

**Python®  
1500 Series  
Control Valves**  
**Pneumatic and  
Electric Actuators**





# Armstrong® Python® - 1500 Series Control Valves

---

Control valves are a key component in any pressure or temperature control application. With the increasing cost of fuel, delivering media in the most efficient way increases productivity by delivering the required pressure or temperature while avoiding excessive consumption. Precision control also provides repeatability and safety for any process.

## Features

- Series 1500 valves are globe two-way single seated design valves, which deliver accurate and efficient control for most steam and liquid applications
- Body with top entry trim and bolted bonnet facilitates easy access to all internal parts for in-line inspection, maintenance, and trim replacement
- Cast steel material
- 2 Packings: PTFE chevron seals and grafoil
- Parabolic equal percentage trims for accurate control  
\*Additional trims are coming soon. Trims such as perforated unbalanced, multi-hole balanced, soft seat Class VI, and micro trims are a few examples.
- Metal to metal seats rated for Class IV shut off
- 17-4 PH h900 plugs and seat for long service and better resistance
- 50:1 Rangeability
- Two pneumatic actuator sizes
- 6 springs design which allows lower hysteresis and higher performance
- Pneumatic actuators tested to over 4 million cycles
- Reverse and direct acting actuators that are field reversible
- Live spring loaded teflon packing for long service and less maintenance
- Electric actuators
- On/Off and modulating characteristic

## Accessories

### Positioners

- Pneumatic
- Electro-Pneumatic
- Digital

### Controllers

- Pneumatic
- Electric

### Transmitters

### Temperature sensor



Python Series 1500  
Control Valve -  
Flanged Connection

# Python® - 1500 Series Control Valve



List of Materials	
Valve Body	GP240GH (1.0619)
Bonnet	
Valve/Valve Seat	17-4 PH h900
Valve Spindle	ANSI SS 431
Gland Packing	V-Teflon - option 1 (366°F (186°C) Max.) Grafoil - option 2 (800°F (427°C) Max.)
Yoke	Ductile Iron
Actuator Spring	SiCr Spring Steel
Actuator Diaphragm	Nitrile Reinforced with Nylon Fiber

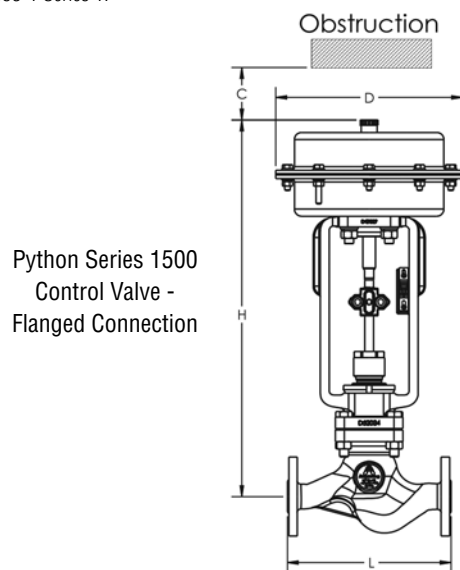
Technical Data		
Flow Characteristic	Equal Percentage	
Leakage	ANSI Class IV	
Rangeability	50:1	
Travel	1/2" to 1-1/2"	20 mm
	2"	30 mm

Dimensions and Weights - 174 cm <sup>2</sup> Actuator and Valve						
Size		Face-to-Face "L"	"C"	"D"	"H"	Weight
in	mm					PN40*
		mm	mm	mm	mm	
1/2	15	130	150	210	431	15
3/4	20	150	150	210	431	16
1	25	160	150	210	433	18
1-1/4	32	180	150	210	458	21
1-1/2	40	200	150	210	458	22

\* Flange to EN1092-1. Face to Face to EN558-1 Series 1.

Dimensions and Weights - 348 cm <sup>2</sup> Actuator and Valve						
Size		Face-to-Face "L"	"C"	"D"	"H"	Weight
in	mm					PN40*
		mm	mm	mm	mm	
1/2	15	130	150	280	481	24
3/4	20	150	150	280	481	24
1	25	160	150	280	483	28
1-1/4	32	180	150	280	508	30
1-1/2	40	200	150	280	508	31
2	50	230	150	280	510	42

\* Flange to EN1092-1. Face to Face to EN558-1 Series 1.



Designs, materials, weights and performance ratings are approximate and subject to change without notice. Visit [armstronginternational.com](http://armstronginternational.com) for up-to-date information.

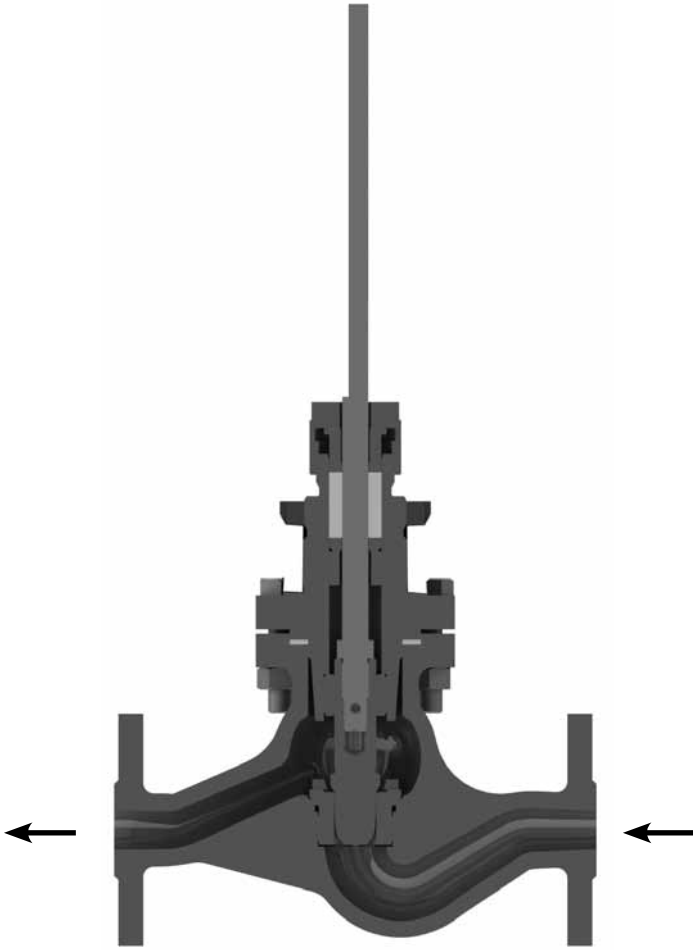


# Armstrong® Python® - 1500 Series Control Valve

## Trim:

### Parabolic Top Guided

The Parabolic Top Guided trim is an ideal choice for many applications. It provides equal percent control with precise accuracy. Top Guided trim also can be used in almost any media type with excellent performance. The plug is guided in the lower part of the bonnet minimizing the effect of side thrust on the valve plug and eliminating trim vibration.



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

Valve Size		Trim Size	CV	KV
in	mm	in		
1/2, 3/4, 1	15 20 25	1/8	0.12	0.104
		5/32	0.3	0.26
		3/16	0.5	0.43
		9/32	1.2	1.04
		7/16	3	2.6
		1/2	5	4.33
		3/4	9	7.79
1-1/4	32	1	13	11.3
		3/4	9	7.79
		1-1/4	21	18.2
1-1/2	40	1	13	11.3
		1-1/4	21	18.2
		1-1/2	30	26
2	50	1-1/4	21	18.2
		1-1/2	30	26
		2	50	43.3

Shade indicates products that are CE Marked according to the PED (97/23/EC). All the other models comply with the Article 3.3 of the same directive.

**Pressure Temperature Rating**

Temp °C	PN40 bar
Ambient Temp	40
100	37.1
150	35.2
200	33.3
250	30.4
300	27.6
350	25.7
400	23.8



# Python® - 1500 Series Control Valve

## Multi-Spring Actuators

Multi-Spring Actuators are diaphragm actuators with pre-compressed multi-spring construction. They are compact, easy to maintain and quickly reversible. The actuators are suitable for modulating and on/off applications. Models are available covering small to large thrust requirements.

## Specifications

- Maximum Diaphragm Pressure:  
4 bar for Model 174 and 348
- Actuator travel:  
174: 20 mm  
348: 20 mm/30 mm
- Diaphragm:  
Nitrile reinforced with Nylon fiber
- Operating Temperature Range:  
-40° to 80°C
- Connections:  
1/4" NPT (F) for Models 174 and 348
- Permissible Linearity and Hysteresis:  
±5% of Signal Pressure Range

## Features:

- 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, rolling diaphragm 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.
- Tested to over 4 million cycles. Full 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.

## 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.

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

Model Number	Cubic meter (feet)/Stroke
174cm <sup>2</sup> 20mm	0.0004 m <sup>3</sup>
348cm <sup>2</sup> 20mm	0.0008 m <sup>3</sup>
348cm <sup>2</sup> 30mm	0.0012 m <sup>3</sup>



# Armstrong® Python® - 1500 Series Control Valve

**Table 6-1. Contoured Top Guided Shut Off Pressure for Reverse Acting Actuator**

Actuator Model No.	Min. Air Supply to Actuator W/ Positioner	Spring Range	Diap. Area	Maximum Differential Pressure bar $\Delta P$ / Shut Off Pressure											
				Trim Size											
				CV	0.12	0.3	0.5	1.2	3	5	9	13	21	30	50
	bar	bar	cm <sup>2</sup>		1/8"	5/32"	3/16"	9/32"	7/16"	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"
174 20mm	1.3	0.2-1	174cm <sup>2</sup>		40	40	40	40	33	15	11	6	3	2	-
	1.5	0.4-1.2			40	40	40	40	40	32	24	14	7	5	-
	2.5	0.6-2.2			40	40	40	40	40	40	37	21	12	8	-
	2.9	1.1-2.6			40	40	40	40	40	40	40	40	40	23	16
348 20mm	1.3	0.2-1	348cm <sup>2</sup>		40	40	40	40	40	32	24	14	7	5	-
	1.5	0.4-1.2			40	40	40	40	40	40	40	29	16	11	-
348 30mm	1.3	0.2-1	348cm <sup>2</sup>		-	-	-	-	-	-	-	-	7*	5*	3*
	1.5	0.4-1.2			-	-	-	-	-	-	-	-	16*	11*	6*
	2.5	0.6-2.2			-	-	-	-	-	-	-	-	25*	17*	10*
	2.9	1.1-2.6			-	-	-	-	-	-	-	-	40*	33*	19*

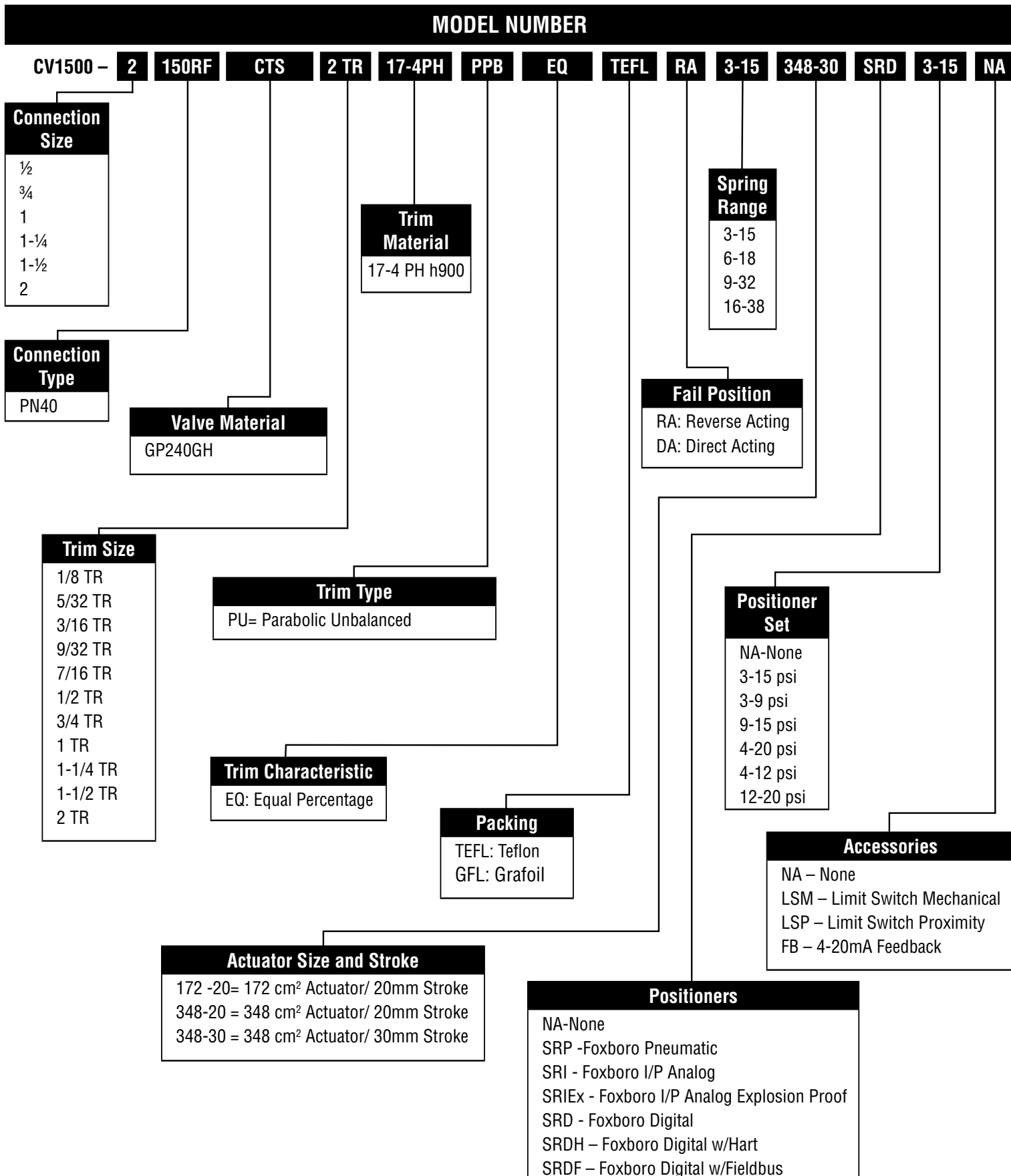
Do not exceed 60 psig (4 barg) air pressure to the actuator  
 \* For 2" valves with reduced port trims only.

**Table 6-2. Contoured Top Guided Shut Off Pressure for Direct Acting Actuator**

Actuator Model No.	Min. Air Supply to Actuator W/ Positioner	Spring Range	Diap. Area	Maximum Differential Pressure bar $\Delta P$ / Shut Off Pressure											
				Trim Size											
				CV	0.12	0.3	0.5	1.2	3	5	9	13	21	30	50
	bar	bar	cm <sup>2</sup>		1/8"	5/32"	3/16"	9/32"	7/16"	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"
174 20mm	1.2	0.2-1	174cm <sup>2</sup>		40	40	40	40	33	15	11	6	3	2	-
	1.5				-	-	-	-	40	40	30	18	10	7	-
	2				-	-	-	-	-	40	40	37	20	14	-
	2.5				-	-	-	-	-	-	-	40	31	22	-
	3				-	-	-	-	-	-	-	-	40	30	-
	3.5				-	-	-	-	-	-	-	-	40	37	-
	4				-	-	-	-	-	-	-	-	-	40	-
348 20mm	1.2	0.2-1	348cm <sup>2</sup>		40	40	40	40	40	32	24	4	7	5	-
	1.5				-	-	-	-	40	40	37	20	14	-	
	2				-	-	-	-	-	-	40	40	30	-	
	2.5				-	-	-	-	-	-	-	40	40	-	
	3				-	-	-	-	-	-	-	-	40	-	
348 30mm	1.2	0.2-1	348cm <sup>2</sup>		-	-	-	-	-	-	-	-	7*	5*	3
	1.5				-	-	-	-	-	-	-	-	20*	14*	8
	2				-	-	-	-	-	-	-	-	40*	30*	17
	2.5				-	-	-	-	-	-	-	-	40*	40*	26
	3				-	-	-	-	-	-	-	-	-	40*	34
	3.5				-	-	-	-	-	-	-	-	-	-	40
	4				-	-	-	-	-	-	-	-	-	-	40

Do not exceed 4 barg air pressure to the actuator  
 \* For 2" valves with reduced port trims only.

# Python® - Pneumatic Actuators



Designs, materials, weights and performance ratings are approximate and subject to change without notice. Visit [armstronginternational.com](http://armstronginternational.com) for up-to-date information.



# Armstrong® Python® - Electric Linear Actuators

When accurate control of your steam or water application is desired and air is not available, the Python AEL Electric Control Valve will deliver precise control. The electric version of the popular 1500 series control valve is built to out perform and deliver accurate control. The AEL Series Electric Control Valve is constructed and equipped with state of the art industrial materials combined with the standard 1500 series main valve.

## Product Features:

- Power: 230 V (24 V AC)
- Frequency 50 Hertz
- Terminal board connection
- Auto/Manual control
- Control signal 4-20 mA, 0-10 volts
- Protection class IP 67
- High thrust capabilities
- Electronic position control
- Metal internal gears
- Compact design
- Mounts to the standard 1500 Series valve body
- Actuators available for valves from 1/2" to 2"



Python Series 1500  
AEL Electric Actuator

## Technical Data

Flow Characteristics	Equal Percentage
Leakage	ANSI Class IV
Rangeability	50:1
Voltage	24V, 230V Power Supply

## List of Materials

Valve Body	GP240GH
Bonnet	
Valve/Valve Seat	Stainless Steel AISI 17-4 PH h900
Valve Stem	Stainless Steel 431
Gland Packing	V-Teflon - Option 1 (366°F (186°C) max)
	Grafoil - Option 2 (800°F (427°C) max)
Yoke	Steel
Actuator Housing	Aluminum

## Pressure Temperature Rating

Temp °C	PN40 bar
Ambient temp	40
100	37.1
150	35.2
200	33.3
250	30.4
300	27.6
350	25.7
400	23.8

Designs, materials, weights and performance ratings are approximate and subject to change without notice. Visit [armstronginternational.com](http://armstronginternational.com) for up-to-date information.



# Python® - Electric Linear Actuators



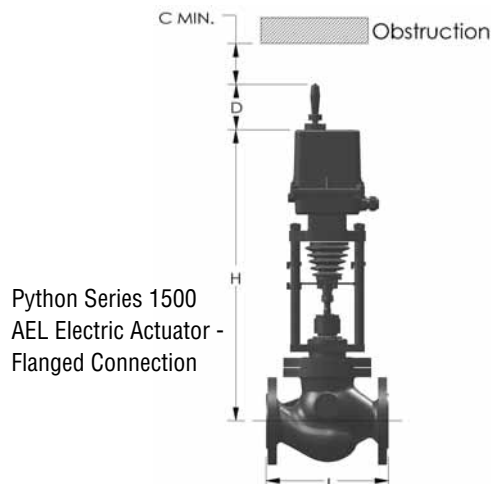
Table 9-1. Top Guided						
Size of Valve		PN40*				
in	mm	Switch-off thrust (N)	Max. load thrust (N) ON/OFF	Speed (mm/min)	Modulating Model	ON/OFF Model
1/2	15	1900	1600	24	AEL1430	AEL1490
3/4	20	1900	1600	24	AEL1430	AEL1490
1	25	1900	1600	24	AEL1430	AEL1490
1-1/4	32	3600	3200	48	AEL1438	AEL1498
1-1/2	40	4600	4000	48	AEL1438	AEL1498
2	50	7200	6300	48	AEL1438	AEL1498

Table 9-2. Contoured Top Guided Shut Off Pressure for Modulating Electric Actuators - bar												
Actuators	Cv Value	0.12	0.3	0.5	1.2	3	5	9	13	21	30	50
	Trim size	1/8	5/32	3/16	9/32	7/16	1/2	3/4	1	1-1/4	1-1/2	2
AEL1430		40	40	40	40	40	40	40	27	-	-	-
AEL1438		-	-	-	-	-	-	-	-	39	-	-
AEL1438		-	-	-	-	-	-	-	-	-	35	-
AEL1438		-	-	-	-	-	-	-	-	-	-	25

Table 9-3. Contoured Top Guided Shut Off Pressure for On/Off Electric Actuators - bar												
Actuators	Cv Value	0.12	0.3	0.5	1.2	3	5	9	13	21	30	50
	Trim size	1/8	5/32	3/16	9/32	7/16	1/2	3/4	1	1-1/4	1-1/2	2
AEL1490		40	40	40	40	40	40	40	40	-	-	-
AEL1498		-	-	-	-	-	-	-	-	40	-	-
AEL1498		-	-	-	-	-	-	-	-	-	40	-
AEL1498		-	-	-	-	-	-	-	-	-	-	36

Dimensions and Weights								
Size		Face-to-Face "L"			"C"	"D"	"H"	Weight
in	mm	PN40*			mm	mm	mm	PN40*
		mm						kg
1/2	15	130			160	87	500	10
3/4	20	150			160	87	500	11
1	25	160			160	87	502	13
1-1/4	32	180			160	87	546	19
1-1/2	40	200			160	87	546	20
2	50	230			160	87	548	29

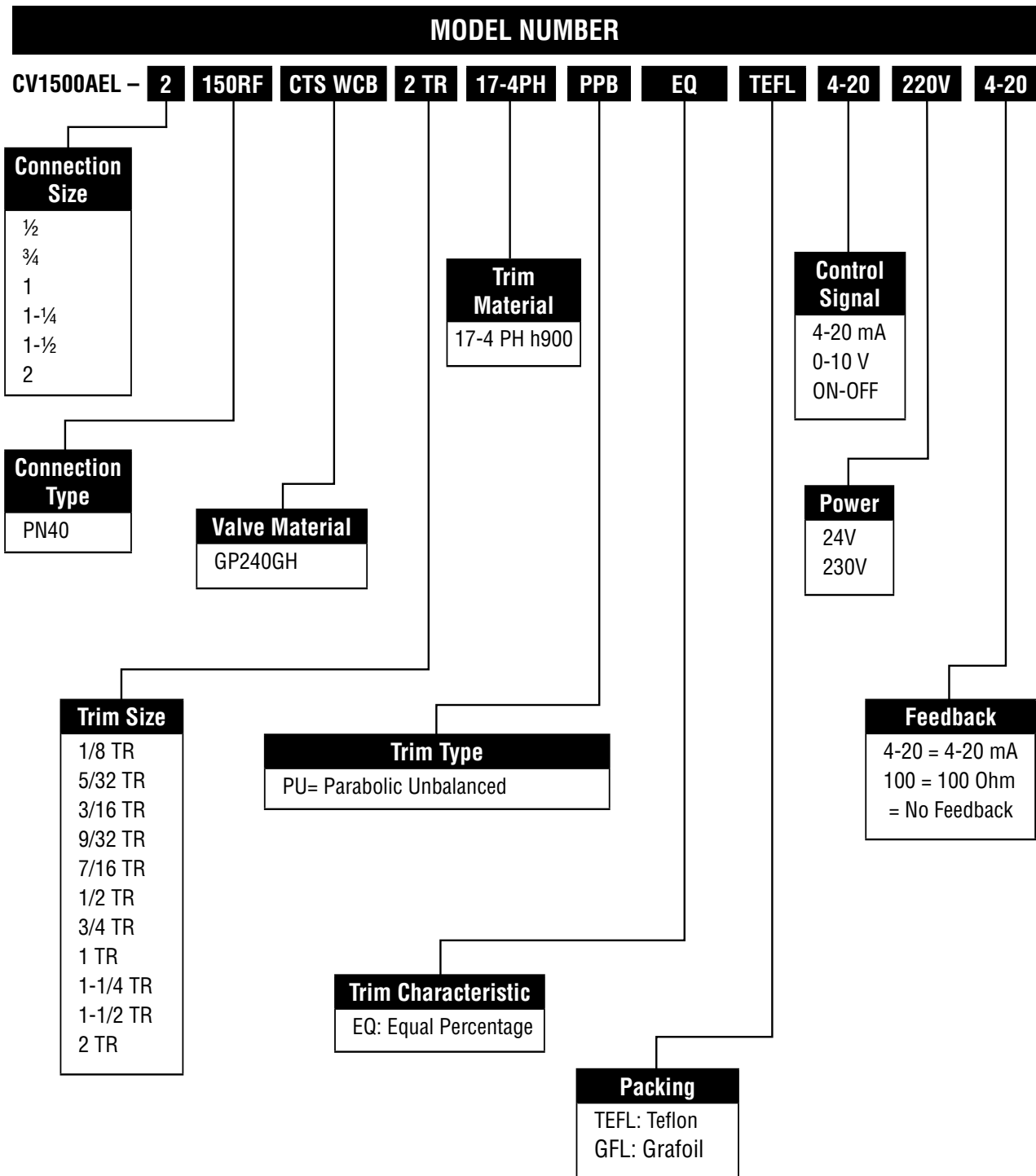
\* Flange to EN1092-1. Face to Face to EN558-1 Series 1.



Designs, materials, weights and performance ratings are approximate and subject to change without notice. Visit [armstronginternational.com](http://armstronginternational.com) for up-to-date information.



# Armstrong® Python® - Electric Linear Actuators



Designs, materials, weights and performance ratings are approximate and subject to change without notice. Visit [armstronginternational.com](http://armstronginternational.com) for up-to-date information.



# Python® - 1500 Series Control Valve

## 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 4 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  $\Delta P < 0.81(P_1/2)$

$$C_v = \frac{0,0724 \cdot Q}{\sqrt{\Delta P(P_{1A} + P_{2A})}}$$

#### Critical Flow

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

$$C_v = \frac{Q}{10,74 \cdot P_{1A}}$$

### For Liquid Service

$$C_v = \frac{Q_L \sqrt{G}}{864,7 \sqrt{\Delta P}}$$

Cv = Valve flow coefficient

Q = Maximum flow capacity of steam, kg/h

P<sub>1A</sub> = Inlet Pressure, bar absolute

P<sub>2A</sub> = Outlet Pressure, bar absolute

ΔP = Pressure drop (P<sub>1</sub> - P<sub>2</sub>) bar

Q<sub>L</sub> = Maximum flow capacity of Liquid, l/h

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

Application: Temperature Control

P<sub>1</sub>: 8,6 bar

Flow: 794 kg/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.

(ΔP = 2,6)

P<sub>2</sub> = 6 bar

$$C_v = \frac{0,0724 \cdot 794}{\sqrt{2,6(9,6 + 7)}} = 8,75$$

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.

These formulas are derived from the ANSI/ISA-75.01.01 standard to allow for easy daily use. These simplified formulas contain assumptions on some parameters and will always give a conservative sizing.

For detailed sizing using the ANSI/ISA-75.01.01 approach, use Armstrong selection software.