

Humidifier control must provide immediate response and precise modulation in order to accurately maintain the required relative humidity. Faulty control can lead to overloading the ducts with moisture and the creation of wet spots or failure to provide the required humidity level.

Two design factors affect the accuracy of humidifier control – the metering valve and the actuator that positions the valve.

Precise flow control can be achieved with a valve designed expressly for the purpose of adding steam to air. All Armstrong modulating humidifiers employ unique parabolic plug type valves. See Figure 50-1.

Armstrong uses an exclusive modified plug for the control valve to accomplish this. The modification of true linear characteristics provides more precise control when capacity requirements are

very low and the valve is just cracked off the seat. Notice in Chart 50-1 that at point A on the curve more than half the valve stroke is devoted to 40% of the unit's capacity. At point B, one-quarter of the stroke is devoted to only 10% of capacity. At point C, 10% of the stroke covers less than 5% of the unit's capacity.

How low can the unit control? Table 50-1 tabulates this function, called rangeability. Rangeability is the ratio between the maximum controllable flow and the minimum controllable flow of steam through the valve. The higher the rangeability of a valve, the more accurately it can control steam flow at low outputs.

To calculate this minimum flow, simply multiply Continuous Discharge Capacity by the percentage shown in Table 50-1. **For example**, a $\frac{1}{2}$ " orifice at 15 psi can discharge 75 lb/hr. The lowest output that can be controlled is 2.5% of 75 or 1 $\frac{1}{4}$ lb/hr.

Table 50-1. Steam Humidifier Valve Rangeabilities			
Humidifier Models	Valve Equivalent Diameter (IN)	Rangeability	
		Ratio of Flow Max.:Min.	Minimum Flow % of Maximum
Model No. 94	1-1/2	63:1	1.6
	1-1/4	69:1	1.4
	1-1/8	61:1	1.6
	1	53:1	1.9
	7/8	44:1	2.3
	3/4	33:1	3.0
Model No. 93	5/8	25:1	4.0
	3/4	118:1	0.8
	5/8	123:1	0.8
	9/16	105:1	0.9
	1/2	97:1	1.0
	15/32	85:1	1.2
Model No. 92	7/16	75:1	1.3
	1/2	97:1	1.0
	7/16	75:1	1.3
	3/8	70:1	1.4
	11/32	59:1	1.7
	5/16	49:1	2.0
Model No. 90, 91 or 92	9/32	40:1	2.5
	1/4	31:1	3.2
	7/32	24:1	4.2
	3/16	18:1	5.6
	5/32	59:1	1.7
	1/8	37:1	2.7
Model No. 90 or 91	7/64	28:1	3.5
	3/32	21:1	4.8
	5/64	15:1	6.9
	1/16	10:1	10.0

Figure 50-1. Parabolic Plug Metering Valve

Parabolic plug valve configuration permits accurate modulation of flow over the complete stroke of the valve.

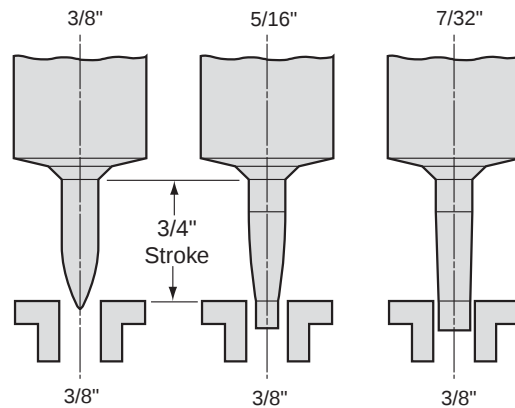
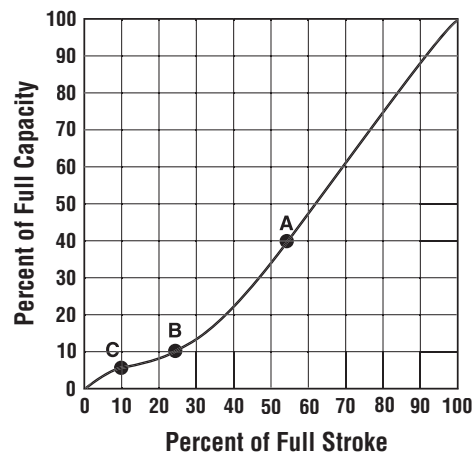


Chart 50-1.

Modified linear characteristic curve for valves used under modulating control. The modification of true linear characteristics provides more precise control when capacity requirements are very low and the valve is just cracked off the seat.



Humidifier operators

The operator for the valve is equally important to humidifier control, and several types are available to provide compatibility with the system in which they are installed. The operator must be able to position the valve in very nearly identical relationship to the seat on both opening and closing strokes. This is essential in order to provide consistent, accurate metering of steam discharged by the humidifier.

By their design, electric motor modulating actuators provide true linear positioning characteristics on both opening and closing cycles. Pneumatic operators may or may not be able to provide the precise positioning and holding characteristics essential to accurate control.

Rolling diaphragm type pneumatic operators are recommended, providing they meet the following criteria:

1. Large diaphragm area – 12 square inches or more – to provide ample lifting force. This permits the use of a spring heavy enough to stabilize both the hysteresis effect and the flow velocity effect on the positioning of the valve stem versus air pressure to the operator.
2. Diaphragm material that is highly resistant to wear or weakening from continuous cycling and high temperatures.
3. Operator stroke long enough, in conjunction with valve plug and seat design, to provide high rangeability ratios.
4. Easy serviceability.

Table 51-1. Operator Spring Ranges for Pneumatically Controlled Humidifiers

Armstrong C-1801		Honeywell MP953D	
Operating Range	Adjustable Start Points	Operating Range	Non-adjustable Start Points
5 lbs.	3 psig minimum	4 lbs.	3 psig
*10 lbs.	3 psig minimum	5 lbs.	8 psig
		*7 lbs.	4 psig

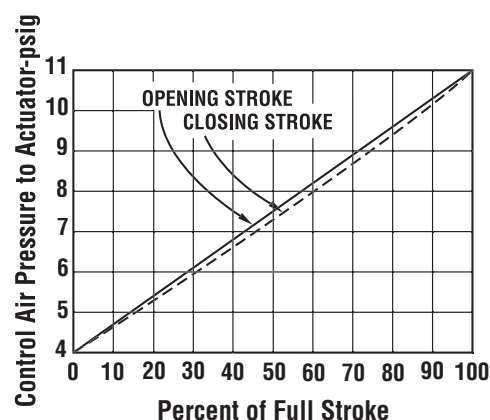
*Standard spring - furnished when no spring range is specified.

All modulating operators, whether electric or pneumatic, should incorporate a spring return. This is necessary to ensure closing of the valve if there is an interruption of power or control air to the unit.

For industrial in-plant operation and for certain very limited duct applications, a solenoid operator may be used to provide simple on/off operation. This type of operator should not be specified for duct applications without a detailed analysis of the system.

Chart 51-2.

Desirable operating characteristic for pneumatic actuators. Position of valve is very nearly identical on both opening and closing strokes at any given air pressure to the actuator.



Temperature switches are recommended.

Temperature switches prevent humidifier operation until start-up condensate is drained and the entire unit is up to steam temperature, thus eliminating the possibility of spitting on cold start-up.

Either pneumatic or electric temperature switches are recommended in any system where the steam supply to the manifold jacket and humidifier body may be interrupted or turned off, such as summer cycles. Cold piping downstream of the on/off valves can generate spitting.

Operator Types



Armstrong C-1801 pneumatic operator for humidifiers under modulating control. Adjustable start points and various air pressure ranges. (See Table 51-1, Page 51.)



Standard Honeywell MP953D pneumatic operator for humidifiers under modulating control. Operating spring ranges and start points are shown in Table 51-1, Page 51. Operational start point adjustment is available in the form of a pilot positioner where required.



Standard electric operator for humidifiers under modulating electrical control. Choice of Honeywell M9182A operator (shown above 24V 60Hz), or Belimo AF24SR (24V 60 Hz), or Belimo NVF24 (shown below, 24V 60Hz standard). Transformers for other voltages available for all electric operators.



Standard ASCO electric solenoid operator for humidifiers under on-off control. **Caution:** On-off operation of humidifiers in air handling systems is advisable only for very limited, specialized applications. Consult your Armstrong Representative.

Humidifier operators in stock

1. Pneumatic Modulating

Armstrong C-1801
Honeywell M953D and F
Invensys. MK4421 and MK4411

2. Electric Modulating

Honeywell M9182A
Belimo AF24SR
NVF24

3. Solenoid

Asco Class H Coil

Humidifier operators that have been installed on Armstrong humidifiers*

1. Pneumatic Modulating

Barber-Colman. MK-4600 Series
Baumann H32
Fisher Governor 513 R
513 R with 3582 positioner
Honeywell 600
Type 9
Johnson PA 20/150
Samson 271/240
271/350
Sauter AV42P10 with XSP31 positioner

2. Electric Modulating

Baelz Type E11
Barber-Colman. MPR-5600, MPR-5700
MP-5210
MP-361, MP-461
Belimo AF24SR, NVF24
Honeywell M7425A
M7285A
Johnson/Penn EVA20 850F
M130XG-A
Landis & Gyr SKD62
Samson Type 5802
Satchwell Type ALES-ALXS-ALZS
Sauter AVN1H12F020
AVN1H12F001
Tour & Andersson. EFM-10

Note: Any operator with a reverse acting (lift to open) $\frac{3}{4}$ " stroke and spring return can usually be adapted. Consult factory for details.

*Request Armstrong Application Guideline APP-505 for details on control signal and power requirements.

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

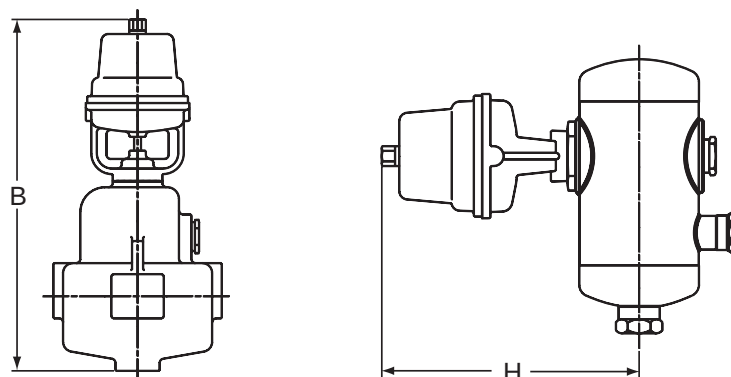


Table 53-1. Dimensions with Operators Installed

Mode of Control	Pneumatic Modulating			Electric Modulating			Electric On-Off
	Armstrong C-1801	Honeywell MP953D	Invensys MK4411 & MK4421	Honeywell M9182A	Belimo AF24SR	Belimo NVF24-MFT-US-E	ASCO
"B" - 90 Size	11-7/8"	10-3/8"	14-7/8"	14-7/8"	18-1/2"	15"	7"
91 Size	16"	14-1/2"	19"	18-7/8"	22-11/16"	18-15/16"	10-7/8"
92 Size	16"	14-1/2"	19"	18-7/8"	22-11/16"	18-15/16"	10-7/8"
93 Size	19-1/2"	17-7/8"	22-3/16"	22-1/8"	26-3/16"	22-1/4"	14-1/2"
94 Size	—	24-1/2"	—	27-7/8"	31-1/16"	27-7/16"	—
"H" - 1100 Size	9-3/8"	8"	12-1/2"	13"	16-1/16"	14-9/16"	4-3/8"
1200 Size	9-9/16"	8-3/16"	12-9/16"	13-3/16"	16-1/4"	14-3/4"	4-9/16"
1300 Size	10-3/4"	9-1/4"	13-3/4"	14-1/4"	17-5/16"	15-13/16"	5-5/8"
1400 Size	—	11-5/16"	15-3/4"	16-5/16"	19-3/8"	—	—
Weight of Operator	7-3/4 lbs.	6 lbs.	6-1/4 lbs.	12 lbs.	13 lbs.	4-1/4 lbs.	3/4 lbs.

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