



## 28000 Series Varipak<sup>®</sup> Control Valves

Precise Microflow Valves  
with Compact Design  
and Flexible Capabilities





# Dresser Masoneilan 28000 Series Varipak<sup>®</sup> Control Valves

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## Features

Designed specifically for low flow applications, the Masoneilan 28000 Series Varipak provides excellent throttling control performance with a wide range of options and capabilities. Design optimization has also resulted in an extremely integrated and compact assembly. Key design features include:

### Heavy Top-Guiding

Rugged valve plug support is provided along the entire stroke length using an integrated plug guide and seat ring. This ensures excellent plug stability and control even under high pressure drop conditions. Heavy guiding is critical for controlling vibration damage, providing dependable control and seating performance, and minimizing trim mechanical wear.

### Application Flexibility

Ten standard contoured trim designs are available providing flexible application using the same body platform. This helps to eliminate the effects of valve oversizing and improves control loop performance resulting in higher process efficiency.

### Adjustable $C_v$

In addition to multiple standard trim sets, the Varipak is also available with an adjustable  $C_v$  option. This feature allows users to easily increase or decrease the  $C_v$  setting in order to accommodate changing operating conditions. Adjustment is achieved by simply setting a knob within the actuator assembly (see page 5 for details).

### Compact Assembly

Maximum space savings is provided by the Varipak assembly through modular design and force amplification actuator technology. The actuator also includes a low profile top-mounted handwheel option.

### Anti-Cavitation Trim

Varipak is also available with an effective high pressure liquid letdown anti-cavitation trim solution – the Varilog® trim. This unique design includes a multi-stage axial flow plug and liner, which provides dirt tolerant operation and high wear resistance.

### Design Flexibility

Other standard configurations include a High Pressure ASME Class 2500 design, a zero emissions Bellows Seal design, and a design for cryogenic applications. The Varipak is also available with an angle body design to accommodate existing piping configurations.

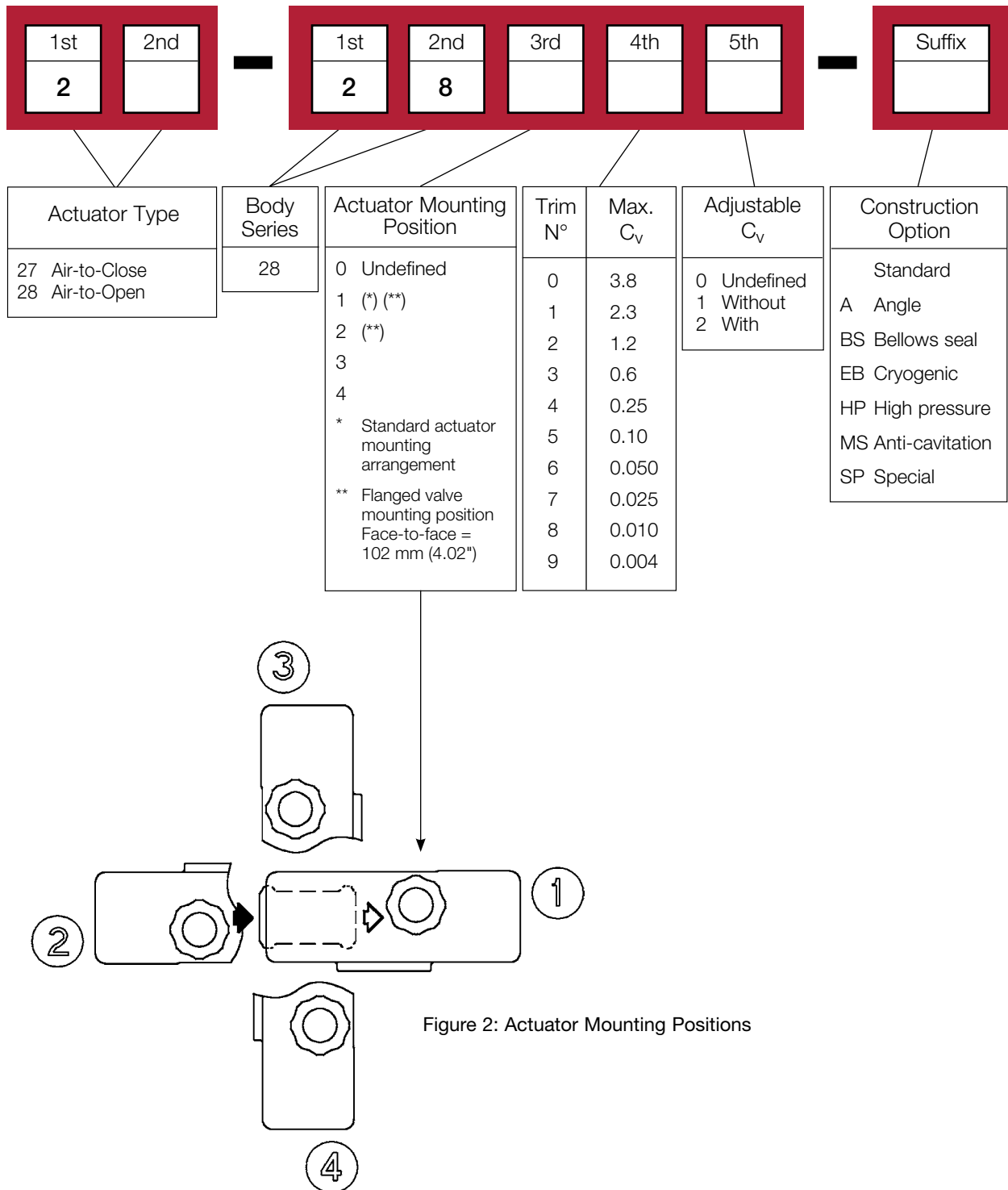
### Ease of Maintenance

Varipak's simple top-entry body construction includes an integrated body and bonnet design, which allows for easy access and removal of the quick change trim. The integral liner and seat ring also reduces components and simplifies assembly and disassembly. Modularity of the actuator design further enhances maintainability of this unique valve assembly.



Figure 1: Varipak Family

# Numbering System



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# Micro-Flow Control Innovation

## Optimized $C_v$ Characteristics

VariPak is far superior to conventional microflow valves in that it provides the user with a very wide range of nominal  $C_v$  ranges from 0.0016 to 3.8, using only eight plugs and five seats.

## Precise $C_v$ Calibration and Selection - $C_v$ and $F_L$

Valve Sizes			Trim No.	Flow Coefficient $C_v$									Critical Flow Factor $F_L$
.5" (15mm)	.75" (20mm)	1" (25mm)		With Adjustable $C_v$ Function							Without Adjustable $C_v$ Function		
				Min.		Risk-Free <sup>(3)</sup>		Max.					
•	•	•	9	0.0016	0.0020	0.0024	0.0028	0.0032	0.0036	<b>0.0040</b>	<b>0.0040</b>	0.85	
•	•	•	8	0.004	0.005	0.006	0.007	0.008	0.009	<b>0.010</b>	<b>0.010</b>	0.85	
•	•	•	7	0.010	0.013	0.016	0.019	0.021	0.023	<b>0.025</b>	<b>0.025</b>	0.85	
•	•	•	6	0.020	0.025	0.030	0.035	0.040	0.045	<b>0.050</b>	<b>0.050</b>	0.85	
•	•	•	5	0.04	0.05	0.06	0.07	0.08	0.09	<b>0.10</b>	<b>0.10</b>	0.85	
•	•	•	4	0.10	0.13	0.16	0.19	0.21	0.23	<b>0.25</b>	<b>0.25</b>	0.90	
•	•	•	3	0.25	0.30	0.35	0.40	0.45	0.50	0.55	<b>0.60</b>	<b>0.60</b>	0.90
•	•	•	2	0.5	0.6	0.7	0.8	0.9	1.0	1.1	<b>1.2</b>	<b>1.2</b>	0.92
•	•	•	1	1.9	1.1	1.3	1.5	1.7	1.9	2.1	<b>2.3</b>	<b>2.3</b>	0.92
	• <sup>(2)</sup>	• <sup>(1)</sup>	0	1.5	1.9	2.3	2.6	2.9	3.2	3.5	<b>3.8</b>	<b>3.8</b>	0.92

(1) Flangeless, flanged or threaded connections.

(2) Flangeless connections.

(3) The "Risk-free" setting allows for easy valve capacity adjustments in the field to meet changing service conditions.



Figure 3: Flow Coefficient Adjustment

# General Data

## ■ Body

Type:	globe style angle style optional
Sizes:	1" (DN 25) standard 1/2" (DN 15) and 3/4" (DN 20) optional
Materials:	Standard: type 316L St. St. Optional: Monel®, Hastelloy® C, Alloy 20, others
Options:	Flanged valve Anti-cavitation Varilog® High pressure Bellows seal Cryogenic Angle valve NACE version

## ■ Trim

Plug type:	contoured, heavy top guided multi-staged anti-cavitation (Varilog) optional
Seat type:	metal seat
C <sub>v</sub> ratio:	500/1 at max. C <sub>v</sub> 200/1 at min. C <sub>v</sub>
Flow characteristics:	linear (trim No. 0 to 5) modified linear (trim No. 6 to 9)
Flow Direction:	flow-to-open flow-to-close optional

## ■ Actuator

Type:	spring-opposed rolling diaphragm
Action:	direct or reverse, easily performed without additional parts
C <sub>v</sub> adjustment:	optional adjustable knob/lever
Handwheel:	optional top mounted
Air connection:	1/8" NPT

## Temperature Range/Seat Leakage

Valve Type	Temperature Range <sup>(1)</sup>	Seat Class <sup>(2)</sup>	
Standard and High Pressure Valves	-320°F to +650°F (-192°C to +343°C)	IV	V
Cryogenic Valves	-455°F to +300°F (-270°C to +150°C)		
Varilog Anit-Cavitation Valves	-20°F to +650°F (-29°C to +343°C)		

(1) Please consult Masoneilan for applications outside the temperature ranges noted.

(2) Class IV seat leakage is standard and Class V is optional. Seat leakage class ratings per IEC 534-4 and ANSI/FCI 70-2.

## Rating/End Connections\*\*

Valve Sizes		Maximum C <sub>v</sub>	ASME Class 150-1500 ISO PN 20-250				ASME Class 150-600 ISO PN 20-100	
inches	mm		Flangeless	Threaded	SW	BW	Flanged Face-to-Face: 6.3" (160mm)	Flanged Face-to-Face: 4" (102mm)
.5	15	2.3	•	•	•		•	•
.75	20	2.3	•(*)	•	•		•	•
1	25	3.8	•	•	•	•	•	•

\* Available with maximum rating of ASME Class 600/ISO PN 100.

\*\* Please consult Masoneilan for applications requiring ASME Class 2500/ISO PN 420 rating.

# Materials of Construction

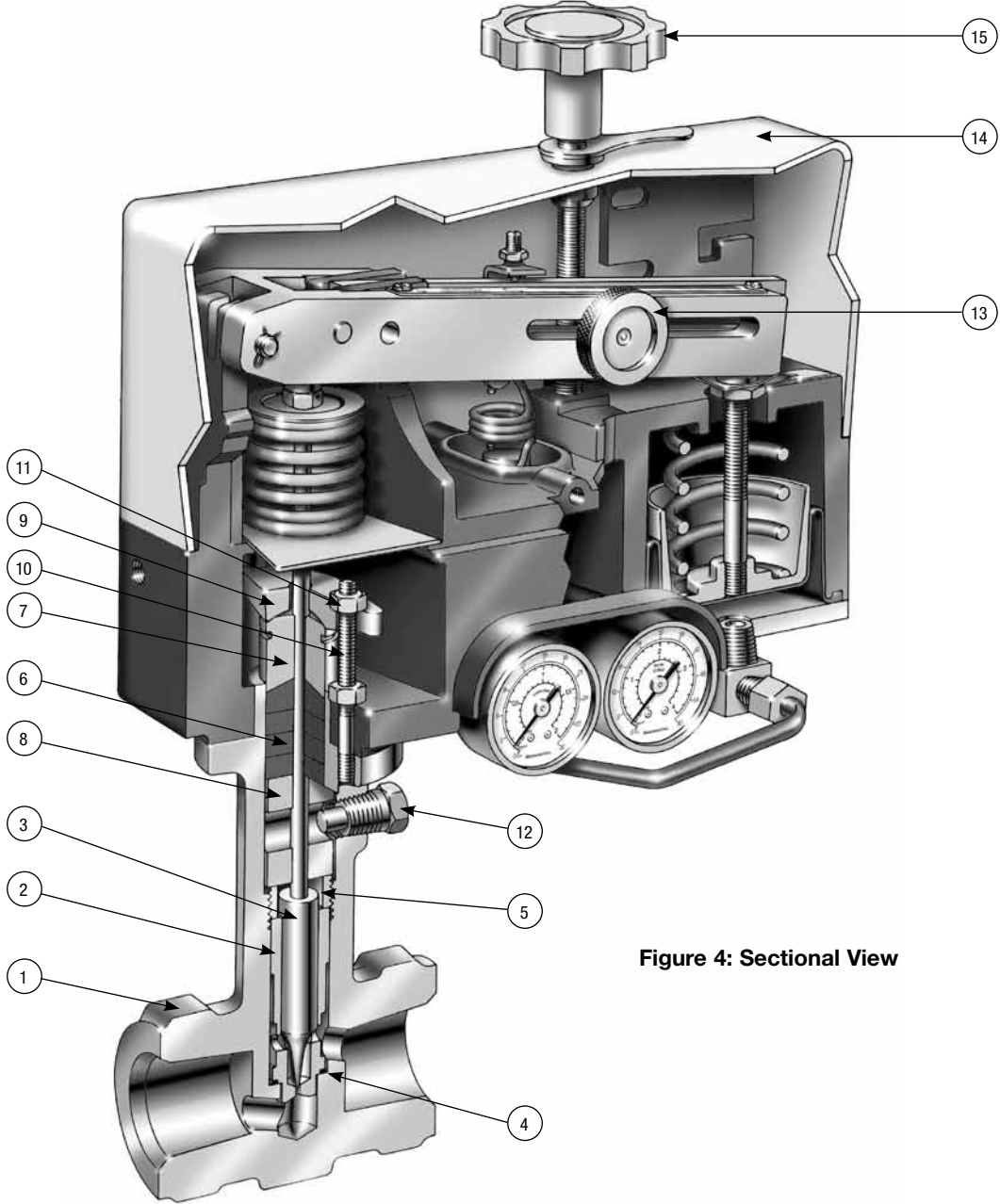


Figure 4: Sectional View

# Materials of Construction

## Materials\* (Standard and NACE Construction) <sup>(1)</sup>

Ref. No.	Temperature Range	-320°F -196°C	+450°F +232°C	+650°F +343°C	-20°F -29°C	+450°F +232°C
		Standard Materials (Optional Materials)			NACE Materials	
1	Body	316L St. St. ASTM A182 Gr. F 316L (forging)			22 HRC Max.	
		316L St. St. ASTM A351 Gr. CF3M (casting)				
		<i>Optional: Monel®, Hastelloy® C, Alloy 20</i>				
2	Seat	17-4 PH St. St. ASTM A564 Gr. 630 Condition H900 (Max CV ≥ 0.10, trims No. 0 to 5)			MONEL K 500 35 HRC Max.	
		Solid Stellite® No. 6 (Max C <sub>V</sub> ≤ 0.05, trims No. 6 to 9)			35 HRC Max.	
		<i>Optional: 440C St. St. Monel®, Hastelloy® C, Alloy 20</i>				
3	Plug and Stem S/A	Plug Solid Stellite® No. 6 (Max C <sub>V</sub> ≥ 0.10, trims No. 0 to 5)			22 HRC Max.	
		Stem 316 St. St. (Max C <sub>V</sub> ≥ 0.10, trims No. 0 to 5)				
		One Piece Solid Stellite® No. 12 (Max C <sub>V</sub> ≥ 0.05, trims No. 6 to 9)				
		<i>Optional: 440C St. St., Monel®, Hastelloy® C, Alloy 20</i>				
4	Seat Ring Gasket	Grafoil® with 316 St. St. inserts			PTFE Fiberglass Reinforced	
5	Seat Ring Retainer	17-4 PH St. St. ASTM A564 Gr. 630 Condition H1075			MONEL K 500 35 HRC Max.	
6	Packing	PTFE (standard up to ASME Class 1500)			PTFE (standard up to ASME Class 1500)	
		Lattyflon® (with optional Viton® O-rings)			Lattyflon® (with optional Viton® O-rings)	
7	Packing Follower	303 St. St. ASTM A582 TY 303			ASTM A479 TY 304 22 HRC Max.	
8	Packing Spacer	316 St. St. ASTM A479 TY 316			22 HRC Max.	
9	Packing Flange	304 St. St. AISI 304			ASTM A743 Gr. CF8 22 HRC Max.	
10	Packing Flange Studs	304 St. St. ASTM A193 Gr. B8			304 St. St. ASTM A193 Gr. B8 (Class III) 304 St. St. ASTM A193 Gr. B8 (Class I or II) 22 HRC Max.	
11	Packing Flange Nuts	304 St. St. ASTM A193 Gr. 8			304 St. St. ASTM A194 Gr. 8 (Class III) 304 St. St. ASTM A194 Gr. 8A (Class I or II) 22 HRC Max.	
12	Safety Pin	316 St. St. ASTM A479 TY 316			22 HRC Max.	
13	C <sub>V</sub> Adjustment Knob	Stainless Steel			Stainless Steel	
14	Actuator Cover	Polycarbonate			Polycarbonate	
		<i>Optional: Stainless Steel</i>			<i>Optional: Stainless Steel</i>	
15	Handwheel (optional)	Lexan® + Austenitic St. St.			Lexan® + Austenitic St. St.	

(1) Materials and processes in accordance with the requirements of NACE specification MR0103. Applications requiring compliance to MR0175, 2003 Rev. or ISO 15156 would require engineering review.  
 (2) Materials designated for these parts conform to NACE Class III bolting requirements.  
 (3) Materials designated for these parts conform to NACE Class I or Class II bolting requirements.  
 (4) Consult Masoneilan for NACE Applications above ASME Class 600 rating.



Material not applicable

\* Materials noted throughout text are for reference only. Masoneilan reserves the right to supply trade name material or equivalent



# Standard Flangeless Varipak

## 28000 Series

The standard flangeless Varipak valve is widely used in all industries. This can be attributed to the overall compactness and simplicity of the flangeless construction, and the wide application range of the stainless steel body design.

- Numbering system: see page 4.
- General data: see page 6.
- Materials: standard construction, see page 8.
- Accessories and options: see page 15.



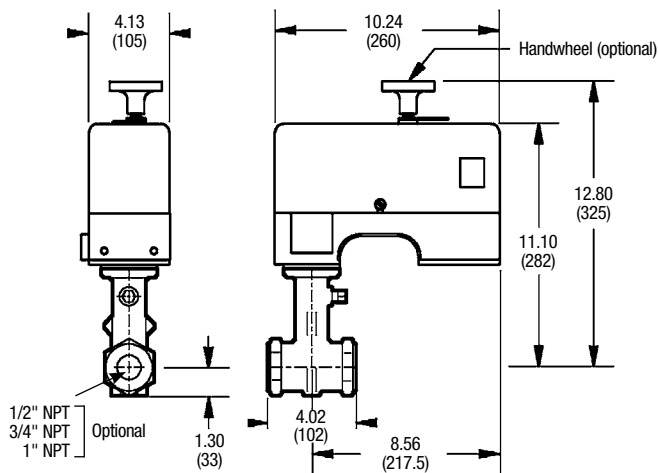
**Figure 5:**  
Standard Flangeless Varipak

## Rated $C_v$ Range/Weight

Body/Actuator Assembly Weight	Rated $C_v$ Range
15.4 lbs (7 kg)	3.8 to 0.0040 (trim No. 0 to 9)

## Dimensions – inches (mm)

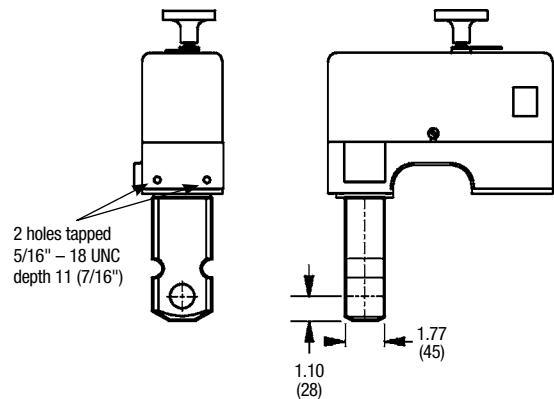
Standard Varipak (Stainless Steel)



Provide a removal clearance of 5.5 inches (140 mm)

Bar Stock Body

(For Non-Castable Material)



# Standard Flanged Varipak

## 28000 Series

The Varipak is also available in flanged configurations with connections and ratings as indicated in the table below.

- Numbering system: see page 4.
- General data: see page 6.
- Materials: standard construction, see page 8.
- Accessories and options: see page 15.



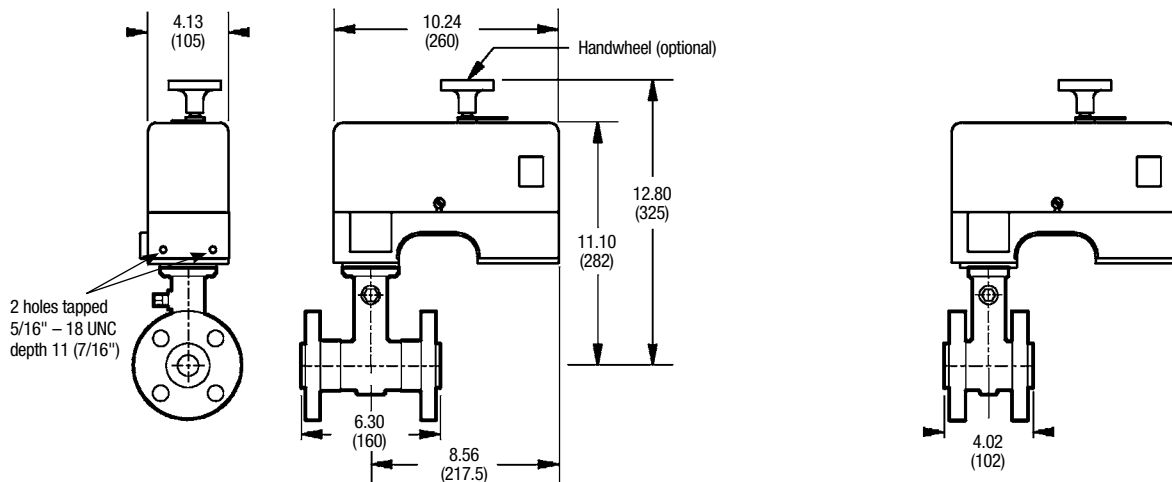
**Figure 6:**  
Standard Flanged  
Varipak

## Flange Ratings/Weight

Face-to-Face Dimensions	Flange Ratings	Body/Actuator S/A Weight*	Rated C <sub>v</sub> Range
4" (102mm)	ASME Class 150-600 ISO PN 20-100 (raised face only)	8 to 10 kg (17.4 to 22 lbs)	3.8 to 0.0040 (trim No. 0 to 9)
6.3" (160mm)	ASME Class 150-1500 ISO PN 20-250 DIN PN 10-250 (RF, FF, RTS, etc...)	10 to 12 kg (22 to 26.5 lbs)	

\* depending on rating.

## Dimensions – inches (mm)



Provide a removal clearance of 5.5 inches (140 mm)

# Varilog® Anti-Cavitation Varipak



## 28000 MS Series

The Varilog multi-stage trim design provides unmatched anticavitation performance in low flow applications.

It minimizes erosion and vibrations, which typically leads to failure in conventional single-seated valves. The Varilog trim is available with the standard Varipak body designs in either the flanged or flangeless configurations.

- Numbering system: see page 4.
- Accessories and options: see page 15.
- General data: see page 6.
- Materials: see chart below.

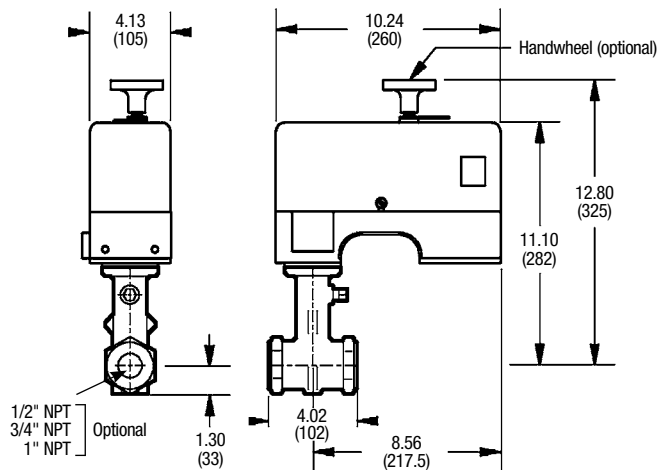
Figure 7: Varilog Trim Subassembly

## Specific Characteristics

Rated $C_v$ Range	Critical Flow Factor $F_L$	Temperature Range	Materials	
0.60 to 0.050 (trim No. 3 to 6)	0.98	-20°F to +660°F (-29°C to +350°C)	Seat	ASTM A 564 Gr. 630 Condition H900 Type 17-4 PH St. St.
			Plug	One part from solid Stellite No. 12 or ASTM A 276 type 440 C St. St.
			Other Parts	Standard Construction: see page 8

## Dimensions – inches (mm)

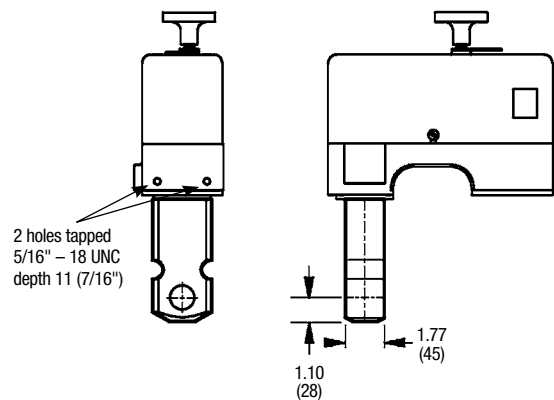
Standard Varipak (Stainless Steel)



Provide a removal clearance of 5.5 inches (140 mm)

Bar Stock Body

(For Non-Castable Material)



# High Pressure Varipak

## 28000 HP Series

Where very high upstream pressure occurs or where the pressure drop exceeds the pressure rating of the standard body (see page 9), a high pressure Varipak is the recommended choice.

- Numbering system: see page 4.
- General data: see page 6.
- Accessories and options: see page 15.
- Materials: see chart below.

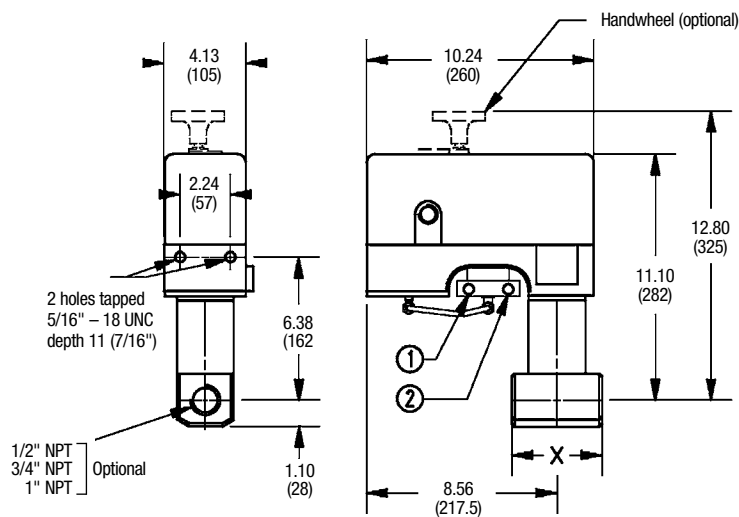


**Figure 8:**  
High Pressure Varipak

## Specific Characteristics

Rated C <sub>v</sub> Range	Body Rating	Seat Leakage	Materials	
0.60 to 0.0040 (trim No. 3 to 9)	ASME Class 2500 ISO PN 420	Class IV	Body	ASME A 182 Gr. F 316L <i>Optional: ASTM A182 Gr. F 316</i>
			Other Parts	Standard Construction: see page 8

## Dimensions – inches (mm)



Valve Sizes		X	
inches	mm	inches	mm
.5	15	3.15	80
.75	20	4.02	102
1	25		

Provide a removal clearance of 5.5 inches (140 mm)

# Bellows Seal Varipak

## 28000 BS Series

A version of the Varipak with bellows seal is available for applications requiring zero leakage at the packing box.

This type of valve is often needed for applications involving the handling of flammable, toxic or explosive fluids.

- Numbering system: see page 4.
- General data: see page 6.
- Accessories and options: see page 15.
- Materials: see chart below.

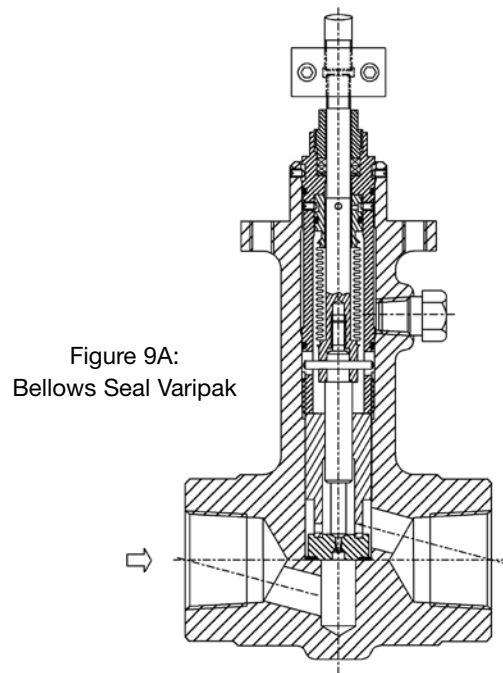
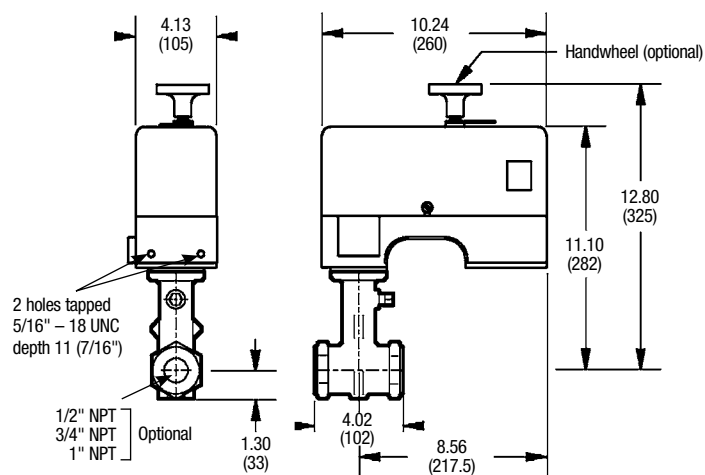


Figure 9A:  
Bellows Seal Varipak

## Specific Characteristics

Rated C <sub>v</sub> Range	Body Rating	Seat Leakage	Operating Pressures	Materials	
2.3 to 0.0040 (trim No. 1 to 9)	ASME Class 150-600 ISO PN 10-100	Class IV	800 psi at +212°F (55 bar at +100°C)  580 psi at +392°F (40 bar at +200°C)	Body	ASTM A 182 Gr. F 316L <i>Optional: A 182 Gr. F 316</i>
				Plug/Bellows Subassembly	Plug and Seat: Standard Materials Bellows Assembly: 316L St. St. Viton® O-rings
				Other Parts	Standard Construction: see page 8

## Dimensions – inches (mm)



Provide a removal clearance of 5.5 inches (140 mm)



Figure 9B:  
Plug and Bellows  
Subassembly

# Cryogenic Varipak

## 28000 EB Series

### Simplified maintenance

The cryogenic Varipak meets the requirements of cryogenic processes requiring thermal insulation. An 'insulating interface' sets up between the valve body ('cold zone') and the body extension located in the higher temperature area ('warm zone'). The valve body assembly and its thermal extension are positioned inside the 'cold box'. The plug can be easily removed and inspected without disturbing the valve body. This precludes any preliminary, complicated dismounting, and more importantly, prevents interfering in any way with the 'cold box'.

### Body

The valve body, manufactured from a material suitable for low temperatures, maintains ductility in service. It can be conveniently mounted to suit any specific piping needs. However, arrangements must be made so that the angle between the valve axis and vertical does not exceed 60°.

The bonnet is located away from the cryogenic fluid, which means that the body gasket is not inside the cold zone. This design prevents any leakage of the cryogen into the insulated zone.

### Body extension

The body extension and coupling sleeve are thin-walled metal tubes so as to minimize the inflow of heat by conduction. The annular space is reduced in order to exclude any convection currents.

### Plug

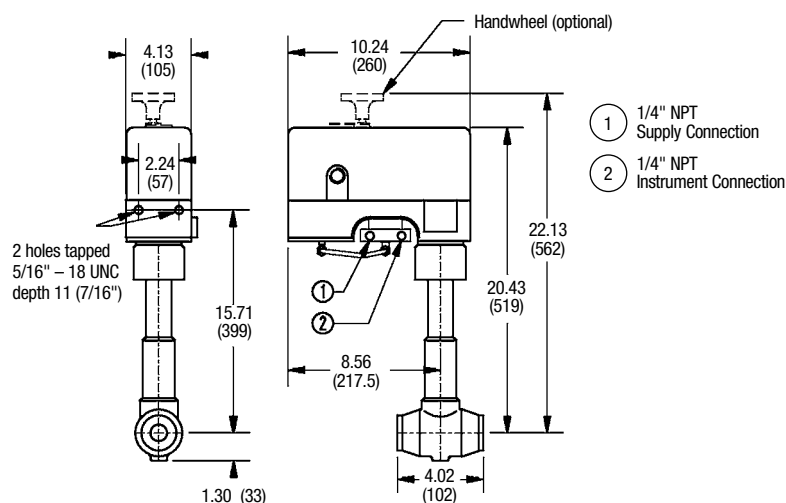
The design of the plug allows the working parts to be perfectly centered in relation to the seat and provides a uniform temperature zone for the guiding.

- Numbering system: see page 4.
- General data: see page 6.
- Accessories and options: see page 15.
- Materials: see chart below.

## Specific Characteristics

Rated C <sub>v</sub> Range	Temperature Range	Body Rating	Seat Leakage	Materials	
3.8 to 0.10 (trim No. 0 to 5)	-455°F to +300°F (-270°C to +150°C)	ASME Class 150-600 ISO PN 20-100 excepted trim No. 0: ASME Class 150-300 ISO PN 20-50	Class IV	Body and Extension	ASTM A 182 Gr. F 316L
				Plug/Stem	Standard Material
				Seat	Trim No. 0: Standard Material Trim No. 1 to 5: ASTM A 564 Gr. 630 Condition H900 Type 17-4 PH. St. St.
				O-ring Seat Gasket	PTFE
				Other Parts	Standard Construction: see page 8

## Dimensions – inches (mm)



Provide a removal clearance of 5.5 inches (140 mm)

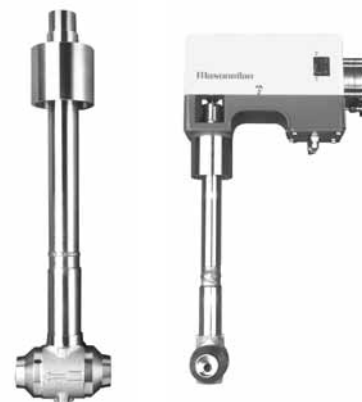
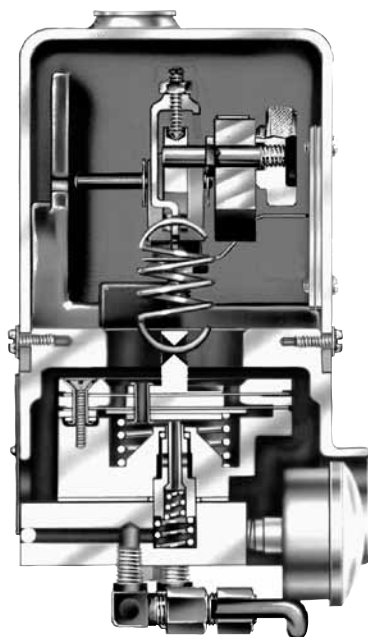


Figure 10: Cryogenic Varipak

# Accessories and Options



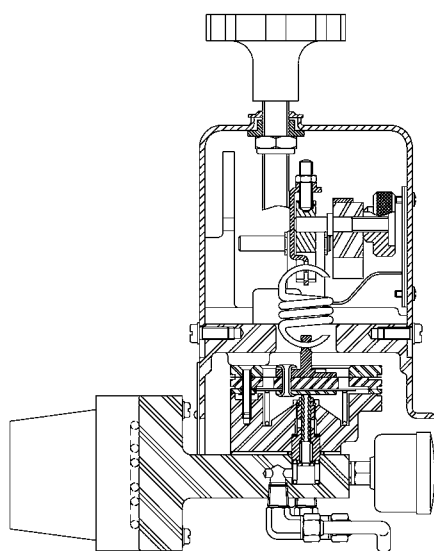
**Figure 11: Model 7700P  
Pneumatic Positioner**

## Pneumatic Positioner (Model 7700P)

- **Type**  
pneumatic, force balance
- **Mounting**  
built-in bracket in actuator
- **Action**  
direct: increasing instrument signal  
increases air output
- **Characteristics**  
linear
- **Instrument signal**  
200 to 1000, 400 to 2050 or  
3 to 15, 6 to 30 or 3 to 27 psi  
(200 to 1850 mbar)  
3 to 9, and 9 to 15 psi  
(200 to 600 and 600 to 1000 mbar)  
split range
- **Connections**  
1/4" NPT instrument and supply –  
1/8" NPT output
- **Average air consumption**  
0.15 scfm at 30 psi supply  
(0.26 Nm<sup>3</sup>/h at 2.1 bar supply)
- **Max. air output**  
4.20 scfm (7 Nm<sup>3</sup>/h)
- **Supply pressure effect**  
0.05% of full stroke variation per  
psi supply pressure change  
(0.07% per 100 mbar)
- **Open loop gain**  
70
- **Linearity**  
± 0.5%
- **Sensitivity**  
0.1%
- **Repeatability**  
0.1%
- **Full stroke time**  
less than one second
- **Weight**  
3.3 lbs (1.5 kg)

### Other Accessories

Proximity sensors and limit switches  
Digital positioners – HART® and  
Fieldbus Foundation  
Handwheel, airsets and solenoid valves



**Figure 12: Model 7700E  
Electropneumatic Positioner**

## Electropneumatic Positioner (Model 7700E)

- **Type**  
electropneumatic, force balance
- **Mounting**  
compact, without external linkage  
to the actuator (see Fig. 15)
- **Action**  
direct: increasing instrument signal  
increases air output
- **Characteristics**  
linear
- **Instrument signal**  
4-20 mA
- **Air Connections**  
1/4" NPT supply – 1/8" NPT output
- **Average air consumption**  
0.24 scfm (0.4 Nm<sup>3</sup>/h)
- **Electrical connections**  
1/2" NPT or M20
- **Weight**  
7.7 lbs (3.5 kg)

### Hazardous Location Protection

ATEX Approvals (94/9/EC Directive)

Explosionproof  
No. SIRA 02 ATEX 1274  
Intrinsic Safety  
No. SIRA 02 ATEX 2277 X

FM (Factory Mutual) Approvals

Explosionproof  
Intrinsic Safety  
Non-incendive and  
Dust-ignitionproof

CSA Approvals

(Canadian Standards Association)

Explosionproof  
Intrinsic Safety  
Non-incendive

# Standard Actuator Options

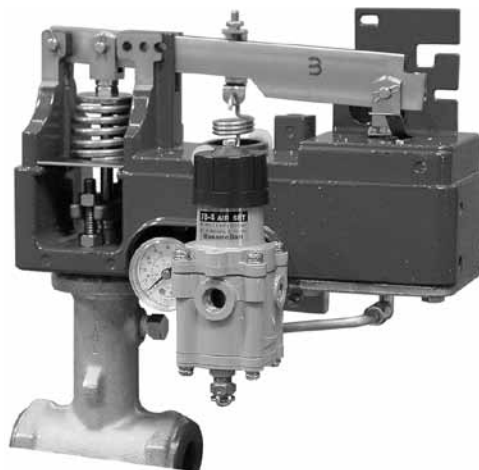
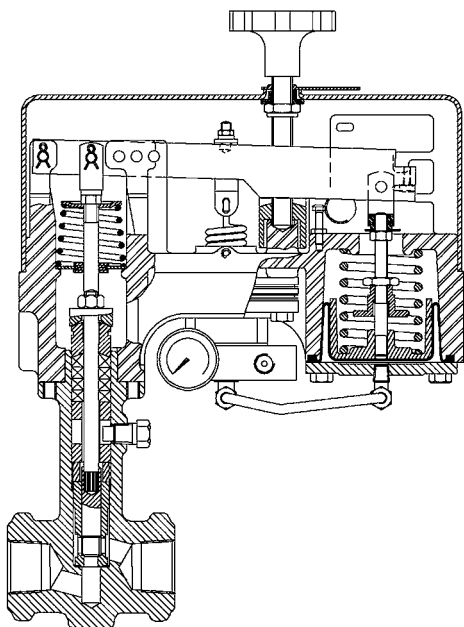


Figure 14: Varipak with Non-Adjustable  $C_v$  Actuator (cover removed)

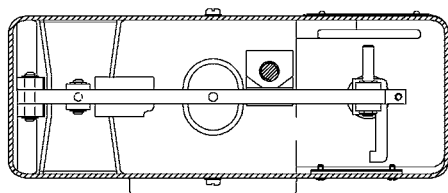


Figure 13: Non-Adjustable  $C_v$  Actuator



Figure 15: Varipak with 7700E Electropneumatic Positioner

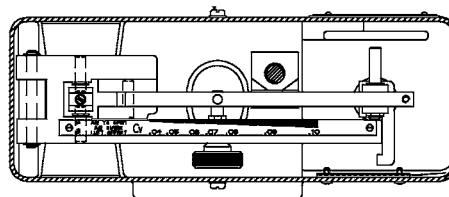
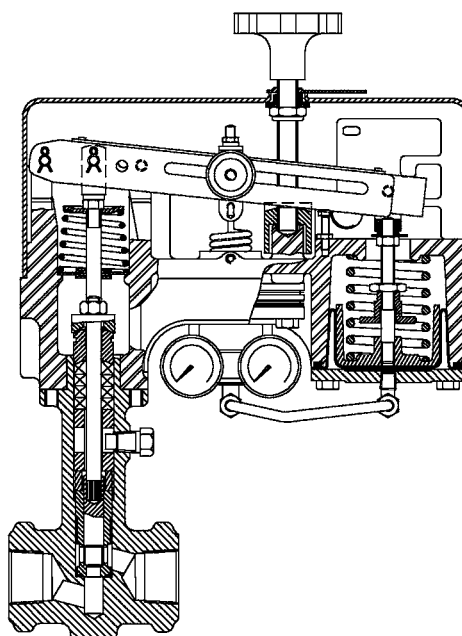


Figure 16: Adjustable  $C_v$  Actuator





# Notes



# Notes



# Notes

# DIRECT SALES OFFICE LOCATIONS

## BELGIUM

Phone: +32-2-344-0970  
Fax: +32-2-344-1123

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## About Dresser Masoneilan

Dresser Masoneilan, headquartered in Houston, Texas, has been the leading global partner in process control valves and solutions for more than 100 years. A business segment of Dresser, Inc., the company delivers customized products, services and diagnostic solutions for oil and gas, process and power generation applications. [www.dresser.com](http://www.dresser.com)



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