

## High Pressure, Subplate Mounted Seated Control Valves

**VST SERIES  
10 000 and 15 000 psi  
(700 and 1040 bar)**

VST Series valves provide reliable high pressure venting or directional control operation.

VSTV and VST22 models are two position, two-way valves for venting, unloading, dumping or similar on/off "switching" functions.

VST23 models for three-way directional control are ideal for circuits which require locking of actuators used in clamping systems, presses and load holding applications.

The "T" port on these valves must be connected to tank. For maximum tank port pressures, see "Specifications" on page 2. Also, refer to valve functions in "Typical Model Code" on page 7.

### FLOW AND PRESSURE RATINGS

VSTV models are low flow vent valves rated for 1 gpm (3,8 L/min) nominal with maximum flows to 2 gpm (7,6 L/min). They operate reliably at pressures to 15 000 psi (1040 bar).

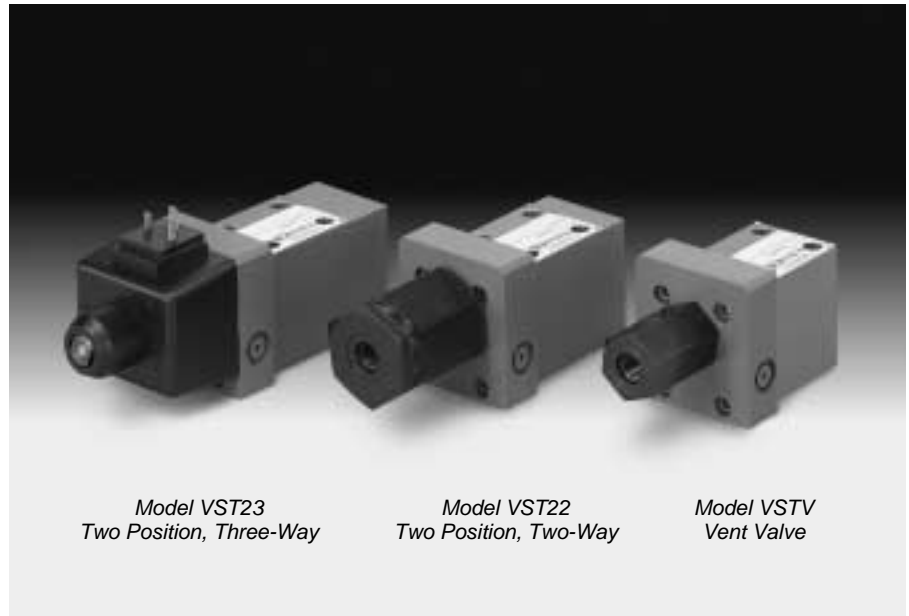
VST22 and VST23 models are rated for 5 gpm (19 L/min) nominal flow at pressures to 10 000 psi (700 bar). Flows to 10 gpm (38 L/min) are possible with some models. See "Typical Valve Performance" on page 3.

### BALL-ON-SEAT DESIGN

VST valves are ideal for systems operating at higher pressures. The ball-on-seat design provides distinct advantages compared to spool valves.

First, with this design silting cannot occur. This provides reliable shifting even when the valve remains unactuated for long periods at high pressure.

Second, these are positive sealing valves, which make them ideal for circuits requiring load holding functions.



### PLUG-IN TERMINAL SOLENOIDS

Standard solenoid plugs simplify electrical connections during installation and servicing. These integral three-terminal, bi-polar plugs fit DIN Connector Standard 43650 (Hirschmann GDM 209).

Solenoid models are quiet and weather-tight for extra-long life. Wet armature design eliminates dynamic

seals and increases the available shifting forces. Static o-rings prevent external leakage.

### EXPLOSION PROOF SOLENOIDS

Solenoids with special enclosures are approved by "UL" and "CSA" for use in hazardous locations. These models are available for A.C. and D.C.

### RELIABLE VALVE SEALING

Tapered o-ring counterbores reduce leakage, by assuring seal retention in rapid cycling operation.

### MANUAL SOLENOID OVERRIDE

Solenoid override pins are made from corrosion-resistant brass for trouble-free operation.

Convenient hand-actuated manual override is available as an option. This provides solenoid override without the use of tools.



*Convenient Hand-Actuated Override*

# Valve Specifications and Application Data

## SPECIFICATIONS

### Special Mounting

VST Series valves, with HP03 mounting interface, require a special mounting pattern. Refer to page 4.

### Operation

VSTV: Vent Valve;  
VST22: Two Position, Two-Way;  
VST23: Two Position, Three-Way

For all models, one port must be connected to tank, with a maximum tank port pressure as shown below. Refer to valve functions in “*Typical Model Code*” on page 7.

### Solenoids

Available with AC or DC, standard Plug-In Terminal Solenoids fit DIN Connector Standard 43650 (Hirschmann GDM 209).

Explosion Proof solenoids (EP option) are available with a special enclosure approved by “UL” and “CSA” for use in hazardous locations. Available A.C. and D.C.

U.L. Classification:  
Class I, Group C,D;  
Class II, Group E,F,G

### Rated Pressure

VSTV Vent Valves:  
15 000 psi (1040 bar);  
VST22, Two Position, Two-Way:  
10 000 psi (700)  
VST23 Two Position, Three-Way:  
10 000 psi (700 bar)

For all models, pressure is limited on the tank port as shown below.

### Tank Port Pressure (Maximum)

Solenoid Actuated Models:

Standard,  
1000 psi (70 bar) dynamic,  
3000 psi (210 bar) static;  
HT Option,  
3000 psi (210 bar) dynamic,  
5000 psi (350 bar) static;  
Explosion Proof Solenoids,  
1000 psi (70 bar) dynamic,  
3000 psi (210 bar) static;

Hydraulic and Air Actuated Models:  
3000 psi (210 bar)

### Rated Flow

VSTV Vent Valves:  
1 gpm (3,8 L/min) nominal;  
2 gpm (7,6 L/min) maximum

VST22 and VST23 Valves:  
5 gpm (19 L/min) nominal;  
10 gpm (38 L/min) maximum for some models.

## ELECTRICAL DATA

Solenoid Code <sup>①</sup>	Input Voltage (Volts)	Frequency (Hz)	Inrush Current (Amps)	Holding Current (Amps)	Holding Power (Watts)	Coil Resistance (Ohms $\pm 10\%$ )
115HA (Dual Frequency)	110 A.C. 115 A.C.	50 60	4.80 4.30	0.88 0.72	37 35	10.2 10.2
230HA (Dual Frequency)	220 A.C. 230 A.C.	50 60	2.40 2.20	0.44 0.36	37 35	40.8 40.8
12HD	12 D.C.	—	4.00	4.00	48	3.0
24HD	24 D.C.	—	2.00	2.00	48	12.0
12EP <sup>②</sup>	12 D.C.	—	4.00	4.00	48	3.0
24EP <sup>②</sup>	24 D.C.	—	2.00	2.00	48	12.0
115EP <sup>②</sup>	115 A.C.	60	3.90	0.83	43	10.5

① Valves are provided with standard “Plug-In-Terminal” solenoids (Hirschmann GDM 209).

② “EP” models are explosion proof solenoids.

## APPLICATION DATA

### Flow Actuating Pattern

Refer to “*Typical Model Code*” on page 7 for valve functions including A.S.A. flow symbols.

These spring offset valves will be spring positioned unless actuated continuously.

### Mounting

Orientation unrestricted for all models.

Valves can be mounted without removing nameplate. Openings in plate provide access to mounting holes in valve body.

### Seals

Standard models use Fluorocarbon (Viton® or Fluorel®) o-rings, providing greater fluid compatibility and improved temperature performance.

Optional seals include Buna-N or EPR for use with some phosphate ester fluids.

### Fluid Recommendations

50 to 1500 SUS (7 to 323 cSt) viscosity;  
-20° to 200° F. (-29° to 93° C.) temperature range.

### Filtration

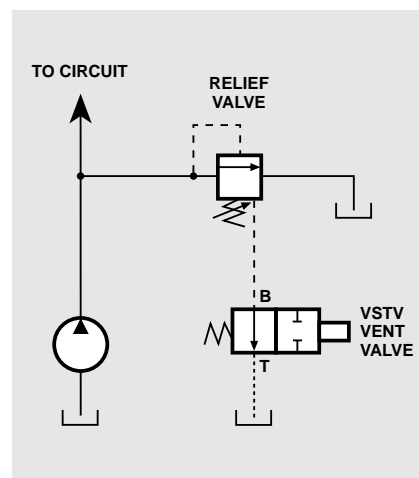
25 micron or better

### Response Time

The table below shows typical response times for solenoid actuated models.

### RESPONSE TIME (MS)

Model	On		Off	
	A.C.	D.C.	A.C.	D.C.
VSTV	10-18	25-30	20	35
VST22	15-20	30-35	20	35-40
VST23	15-20	30-35	20	35-40



### TYPICAL VENTING FUNCTION

VST vent valves can be used to unload pump output in a circuit during idle portions of a machine cycle.

They typically work in conjunction with a relief valve in the circuit. The relief valve opens when pressure is vented by the vent valve, diverting pump output directly to tank with minimum pressure drop.

# Typical Valve Performance

## VENT VALVES

Vent valves are designed for low flow operation. All models have a nominal rating of 1 gpm (3,8 L/min) with maximum capacity of 2 gpm (7,6 L/min). Refer to the pressure drop curves.

For pilot pressure and volume information for hydraulic and air actuated models, see below.

## DIRECTIONAL VALVES WITH SOLENOID ACTUATORS

The curves at right show typical flow capacity for each function. The letters in the “Flow Curve Reference” table identify the appropriate curve.

For example, looking in the table for VST22 models (two position, two-way) with function PT (spring offset open), curve “B” is called out.

Looking at the curves, “B” indicates a maximum capacity of about 9 gpm (34 L/min) at a maximum pressure of 700 bar, to 10 gpm (38 L/min) at a reduced pressure of 7500 psi (520 bar).

## VALVES WITH HYDRAULIC OR AIR ACTUATORS

The flow capacity for these models is dependent on pilot pressure. Generally, the maximum flow for directional control models is 10 gpm (38 L/min).

### Minimum Pilot Pressure

Hydraulic: 350 psi (24,1 bar);  
Air: 40 psi (2,8 bar)

These values are based on zero tank pressure. For hydraulic actuated models, as back pressure increases above zero, the minimum pilot pressure must be increased equally.

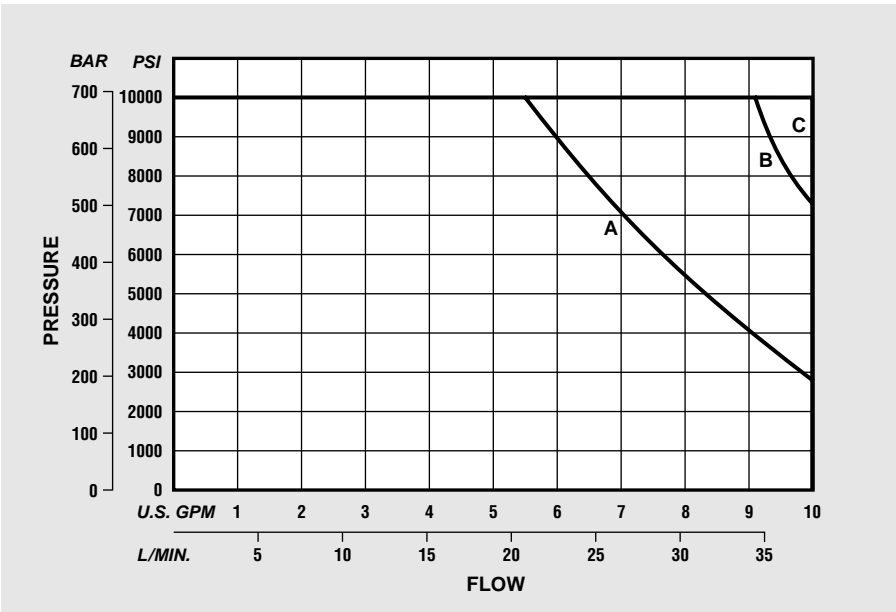
### Maximum Pilot Pressure

Hydraulic: 3000 psi (207 bar);  
Air: 200 psi (13,8 bar)

### Volume

Minimum required to shift valve:  
Hydraulic, 0.018 in³ (0,30 cm³);  
Air, 0.640 in³ (10,49 cm³)

## FLOW CAPACITY — DIRECTIONAL VALVES, SOLENOID MODELS



## FLOW CURVE REFERENCE

Model	Function	Curve
VST22	PT	B
	PC	C
VST23	BT-PC	A
	PB-TC	C

## Determining Valve Efficiency

## PRESSURE DROP

The curves at right indicate pressure drop for all VST valves.

These curves show resistance to flow for specific models, function and flow paths. The “*Flow Curve Reference*” table identifies the proper curve.

Maximum flow capacity depends on valve operation, function and other application factors. Refer to flow capacity curves on page 3.

For example, looking in the table for VST23 models (two position, three-way) with function BT-PC (spring-offset B→T, P closed), curve “C” is called out for flow path B→T.

Looking at the curves, “C” indicates a drop of about 190 psi (13 bar) at 5 gpm (19 L/min).

## Installation And Dimensions

## DIMENSIONS

Dimensions throughout are shown in inches (millimeters in parentheses) and are nominal.

The valve body and overall dimensions vary depending upon the valve operator (i.e., vent; two position, two-way; or two position, three-way).

Refer to the variable dimension tables for dimensions specific to each operator type.

## HP03 VALVE MOUNTING

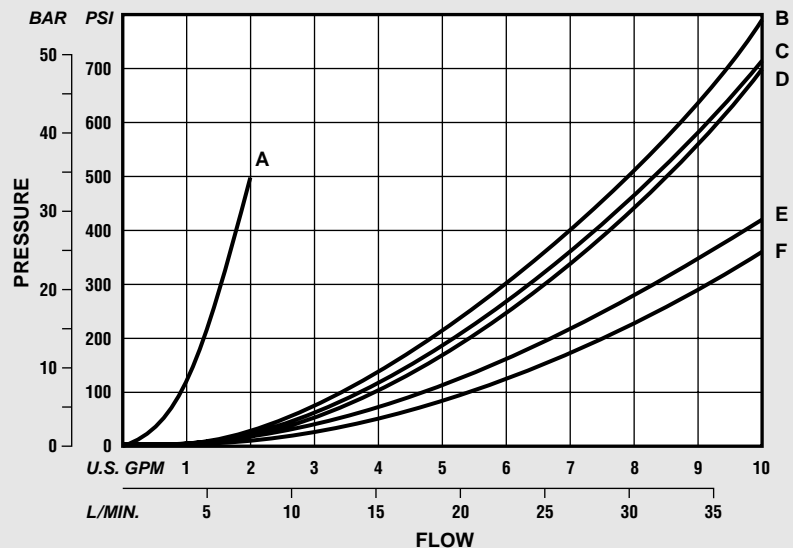
The mounting surface drawing shows the minimum flush or raised surface required for this special pattern.

As indicated, port “B” is required for Models VSTV and VST23; port “P” is required for VST22 and VST23.

Mounting face must be flat within 0.0004 inch/4.0 inches (0,010 mm/102 mm) with a surface finish of 32 microinch (0.80  $\mu$ m) AA.

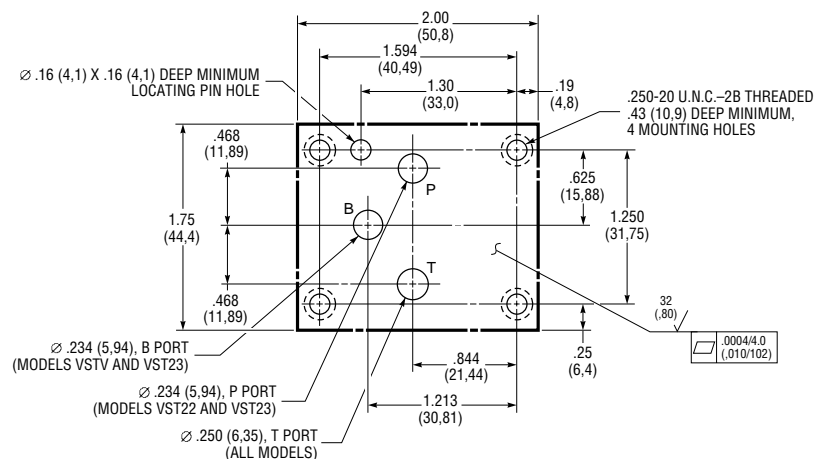
Port o-rings are included with all valves. Mounting bolts must be ordered separately; .250-20 UNC Threaded x 2.00 inch (50,8 mm), Grade 8 or better; four required. Recommended mounting torque is 12 lb·ft (16 N·m) maximum.

### PRESSURE DROP ( $\Delta P$ )



## FLOW CURVE REFERENCE

Model	Function	Curve
VSTV	NO NC	A A
VST22	PT PC	E F
VST23	BT-PC	
	Flow Path B→T:	C
	Flow Path P→B:	B
	PB-TC	
	Flow Path P→B:	D
	Flow Path B→T:	F



*Minimum Mounting Surface, Special HP03 Pattern*

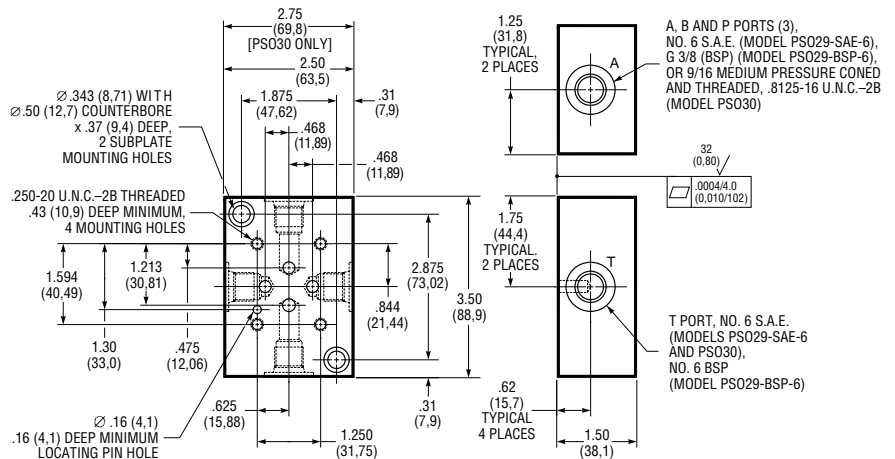
A subplate is available for mounting HP03 pattern valves, with a choice of S.A.E. or British Standard Pipe Parallel (BSP) ports, or ports which fit *Autoclave* or *Butech* fittings.

Mounting bolts are supplied as part of the subplate kit. When ordering valves and subplates together, valves are not mounted on subplates.

## SUBPLATE AND BOLT KITS

<b>Item: Part Number</b>	<b>Description</b>
Subplate: PS032-SAE6	Side Ports, S.A.E. No. 6
Subplate: PS032-BSP6	Side Ports, BSP No. 6
Subplate: PS032-9/16-M/P	Side Ports, .8125-16 U.N.-2B Threaded Medium Pressure Coned and Threaded <sup>①</sup>
Bolt Kit: P11-BK-32	(4) .250-20 U.N.C. Threaded x 2.0 inches (50,8 mm)

① High pressure A, B and P ports fit Autoclave Medium Pressure, Butech M/P or equivalent fitting. T port is No. 6 S.A.E.



*Subplate PS032-SAE6 or PS032-BSP6 or PS032-9/16-M/P*

## SOLENOID MODEL DIMENSIONS

The drawing at right shows dimensions for both AC and DC solenoids; DC configuration shown printed in gray.

### Weight (Mass)

Model VSTV:

A.C.: 7.2 lb (3,3 kg);

D.C.: 8.5 lb (3,9 kg);

Model VST22:

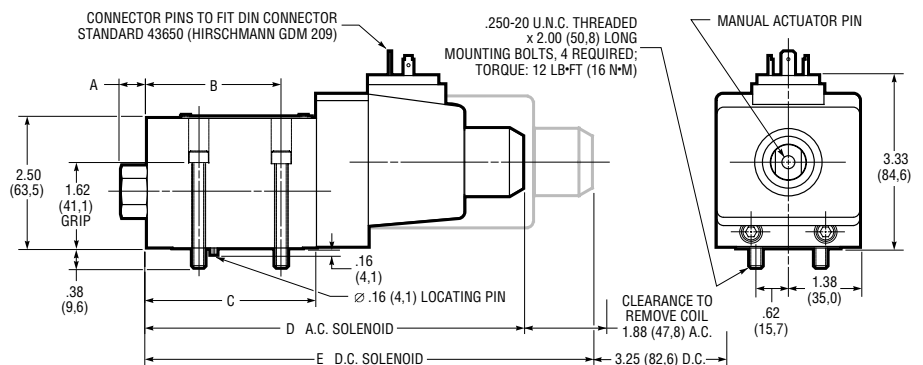
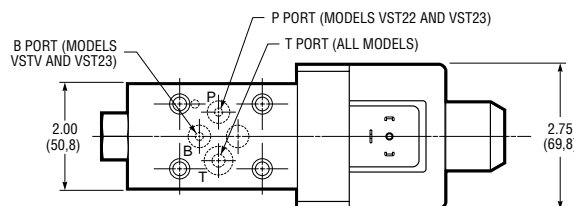
A.C.: 8.1 lb (3,7 kg);

D.C.: 9.5 lb (4,3 kg);

Model VST23:

A.C.: 8.8 lb (4,0 kg);

D.C.: 10.2 lb (4,6 kg)



### Solenoid Actuator Models (Standard Plug-In Terminal)

## VARIABLE DIMENSIONS

Dimension	Valve Model		
	VSTV	VST22	VST23
A	0.31 (7,9)	0.50 (12,7)	0.50 (12,7)
B	1.94 (49,3)	2.59 (65,8)	3.05 (77,5)
C	2.53 (64,3)	3.26 (82,8)	3.73 (94,7)
D	6.52 (165,6)	7.25 (184,2)	7.71 (195,8)
E	7.86 (199,6)	8.59 (218,2)	9.05 (230,0)

## EXPLOSION PROOF SOLENOIDS

### Weight (Mass)

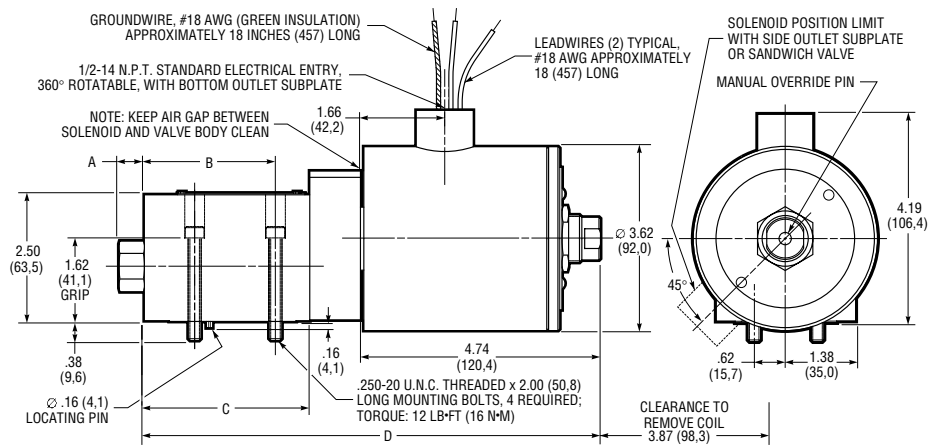
Model VSTV: 14.8 lb (6,7 kg);

Model VST22: 15.7 lb (7,1 kg);

Model VST23: 16.4 lb (7,4 kg)

### VARIABLE DIMENSIONS

Dimension	Valve Model		
	VSTV	VST22	VST23
A	0.31 (7,9)	0.50 (12,7)	0.50 (12,7)
B	1.94 (49,3)	2.59 (65,8)	3.05 (77,5)
C	2.53 (64,3)	3.26 (82,8)	3.73 (94,7)
D	8.27 (210,1)	9.00 (228,6)	9.47 (240,5)



Explosion Proof Solenoid Models (EP Actuator Option)

## HYDRAULIC PILOTED MODELS

### Weight (Mass)

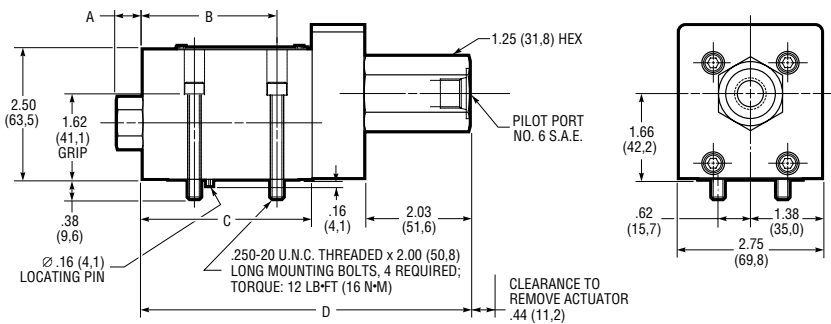
Model VSTV: 6.2 lb (2,8 kg);

Model VST22: 7.1 lb (3,2 kg);

Model VST23: 7.8 lb (3,5 kg)

### VARIABLE DIMENSIONS

Dimension	Valve Model		
	VSTV	VST22	VST23
A	0.31 (7,9)	0.50 (12,7)	0.50 (12,7)
B	1.94 (49,3)	2.59 (65,8)	3.05 (77,5)
C	2.53 (64,3)	3.26 (82,8)	3.73 (94,7)
D	5.56 (141,2)	6.29 (159,8)	6.76 (171,7)



Hydraulic Actuated Models ("H" Actuator Option)

## AIR PILOTED MODELS

### Weight (Mass)

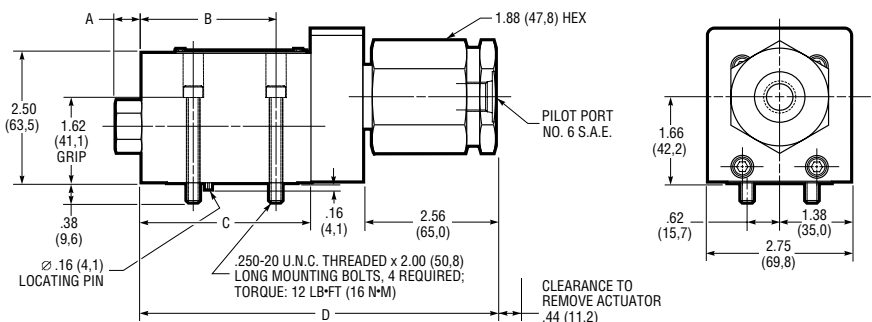
Model VSTV: 7.0 lb (3,2 kg);

Model VST22: 7.9 lb (3,6 kg);

Model VST23: 8.6 lb (3,9 kg)

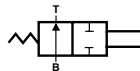
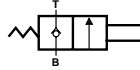
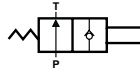
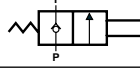
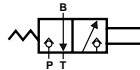
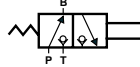
### VARIABLE DIMENSIONS

Dimension	Valve Model		
	VSTV	VST22	VST23
A	0.31 (7,9)	0.50 (12,7)	0.50 (12,7)
B	1.94 (49,3)	2.59 (65,8)	3.05 (77,5)
C	2.53 (64,3)	3.26 (82,8)	3.73 (94,7)
D	6.09 (154,7)	6.82 (173,2)	7.29 (185,2)



Air Actuated Models ("A" Actuator Option)

# Typical Model Code

VST		23	BT-PC	—	HP03	—	115HA	—	HT	—	N	—	1	0
<b>Valve Type</b> Subplate Mounted Seated Valve		<b>Mounting Interface</b> HP03 — High Pressure, Special Mounting Pattern		<b>Electric Options (Plug-In Terminal Only)</b> HT — High Pressure Tank Port, Maximum: 3000 psi (210 bar) dynamic, 5000 psi (350 bar) static M — Hand Actuated Manual Override		<b>Design Number</b>		<b>Modification Number</b>						
<b>Operation</b> V — Vent 22 — Two Position, Two-Way 23 — Two Position, Three-Way		<b>Functions</b>		<b>Actuator</b> PLUG-IN TERMINAL SOLENOIDS: <sup>①</sup> 115HA — Dual Frequency, 115/60, 110/50 230HA — Dual Frequency, 230/60, 220/50 12HD — Direct Current, 12 Volts 24HD — Direct Current, 24 Volts EXPLOSION PROOF: 24EP — Explosion Proof Solenoids, Direct Current, 24 Volts 115EP — Explosion Proof Solenoids, 115/60 110EP — Explosion Proof Solenoids, 110/50 220EP — Explosion Proof Solenoids, 220/50 HYDRAULIC: H — Hydraulic Actuator AIR: A — Air Actuator		<b>Seals</b> No Code — Viton (Standard) N — Buna-N E — EPR								
<b>Vent Valve:</b> <sup>①</sup>		NO — Spring Offset Open												
		NC — Spring Offset Closed												
<b>Two Position, Two-Way:</b> <sup>①</sup>		PT — Spring Offset Open												
		PC — Spring Offset Closed												
<b>Two Position, Three-Way:</b>		BT-PC — Spring Offset B→T, P Closed												
		PB-TC — Spring Offset P→B, T Closed												

<sup>①</sup> As shown in the schematic, one port on these valves must be connected to tank. For maximum tank port pressures, refer to Bulletin VES.VST.

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