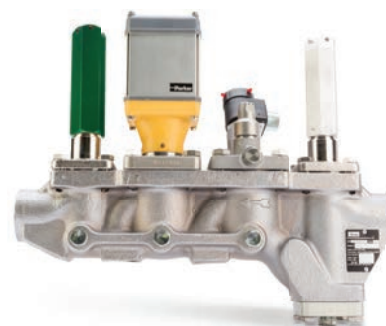


Parker Valve Station

Product Bulletin 10-00 E

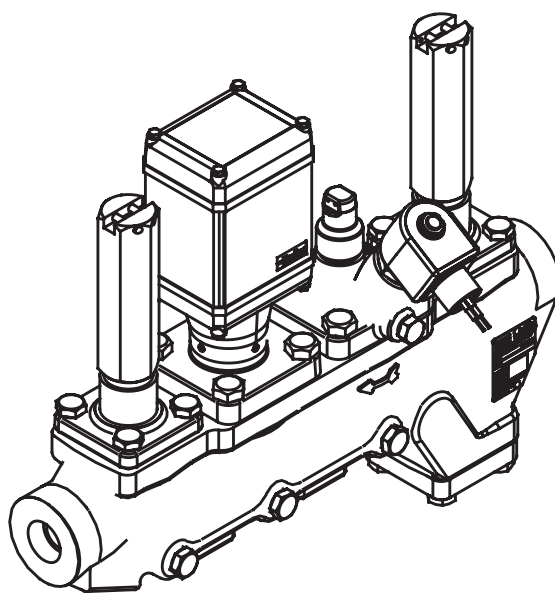
Type: PVS



Purpose:

The PVS weld-in valve stations are designed to simplify valve installation by minimizing the amount of welds required for each valve group. The valve station is also designed to overcome corrosion issues encountered in harsh environments by utilizing plated and stainless steel components. Being weld-in, the valves reduce potential for connection leaks. Since all the shut-off and control valves are top-mounted, the PVS can be easily serviced with standard tools.

(P) (V) (S)
A R K E R
A L V E
T A T I O N



Contact Information: Product Features:

Parker Hannifin Corporation
Sporlan Division -
Refrigeration Business Unit
2445 South 25th Avenue
Broadview, IL 60155-3891

phone (708) 681-6300
fax (708) 681-6306

www.parker.com/rs
rsd_orders@parker.com

- Suitable for Ammonia, CO₂ and other common refrigerants.
- Combines multiple functions in a single housing.
- Plated steel housing increases product life cycle/stainless steel options available.
- Overall weight reduction up to 50% compared to traditional flanged products.
- Interchangeable with other P-Series offerings.
- Coil options to meet various applications.
- Serviceable from the top using standard tools.
- Top-mounted shut-off valves eliminate service issues.
- Lock-out seal caps.
- Complies with ASME B31.5 and PED 2014/68/EU.
- Patented design.



ENGINEERING YOUR SUCCESS.

Table of Contents

Technical Data	2	Suction Stop Bleed Rate Adjustment & Manual Opening	19
Application Example	4	Nameplate Information	19
Function and Design	5	Dimensional Information	20
Control Module Variations	8	Connection Type - Dimensions	23
Material List	11	Service Pointers	24
Installation Instructions	16	Appendix	25
Port Plate Bolt and Torque Recommendations	17	A. Schematic Flow Diagrams	26
Electrical	17	Terms of Sale with Warranty Limitations	30
Manual Opening Operation	18		

Technical Data

Body Material

PVSW	Cast Steel LCC ASTM A352, Zinc Nickel/Chromated Plated
PVSC	Stainless Steel - CF3 ASTM A351

Liquid Temperature Range

Maximum Rated Pressure (MRP)

Ambient Temperature Range

AC Coils

DC Coils

PEV Option

Ambient Temperature Range

Maximum Operating Pressure Differential (M.O.P.D.)

20 to 25 mm (¾ to 1")

32 to 40 mm (1¼ to 1½")

Operating Pressure Range

..... 500 mm Hg to 52 barg (20 in Hg to 754 psig)

Electrical Specification

Enclosure Specification

Rated Seat Leakage

Input Signal

Regulator / Solenoid Option

Ambient Temperature Range

Maximum Operating Pressure Differential (M.O.P.D.)

AC Coils

DC Coils

Minimum Pressure Drop Required to Open Valve

Standard Solenoid

Two Stage Solenoid

0.28 bard (4 psid) min (2nd stage)

Regulators

Suction Stop Option

Ambient Temperature Range

Pressure Drop across the Valve when Bleed Mode Exit Begins:

Maximum

Minimum

Minimum Pressure above Inlet Pressure to Close Valve

.....

Port Size ^[1]		Application	Capacity Plugs	Flow Coefficient ^[2]		Connections				Weight ^[4]	
mm	inch			Kv	Cv	SW		BW ANSI BW Metric (DIN)		kg	lbs
						mm	inch	mm	inch		
20	¾	Relief Regulator	Full 65% 30%	9.1 6.0 3.0	10.5 7.0 3.5	20 25 32	¾ 1 1¼	20 25 32 40	¾ 1 1¼ 1 ½	18.6	41.0
		Suction Regulator									
		Hot Gas & Soft Gas Defrost									
		High Pressure Liquid									
		Pumped Liquid Feed								23.4	53.7
		High Pressure Liquid Feed ^[3]	Full 70%	6.0 4.3	7.0 5.0					26.1	57.6
25	1	Relief Regulator	Full	12.1	14.0	20 25 32	¾ 1 1¼	20 25 32 40	¾ 1 1¼ 1 ½	18.6	41.0
		Suction Regulator									
		Hot Gas & Soft Gas Defrost									
		High Pressure Liquid									
		Pumped Liquid Feed								23.4	53.7
		High Pressure Liquid Feed ^[3]	Full 40%	11.2 4.3	13.0 5.0					26.1	57.6
32	1¼	Relief Regulator	Full 50%	15.7 8.1	18.2 9.4	32 40 50	1¼ 1½ 2	32 40 50	1¼ 1½ 2	28.5	62.8
		Suction Regulator									
		Hot Gas & Soft Gas Defrost									
		High Pressure Liquid									
		Pumped Liquid Feed								36.9	81.4
		High Pressure Liquid Feed ^[3]	Full	16.4	19.0					38.7	85.3
40	1½	Relief Regulator	Full 30%	28.0 8.1	32.4 9.4	32 40 50	1 ¼ 1 ½ 2	32 40 50	1 ¼ 1 ½ 2	28.5	62.8
		Suction Regulator									
		Hot Gas & Soft Gas Defrost									
		High Pressure Liquid									
		Pumped Liquid Feed								36.9	81.4
		High Pressure Liquid Feed ^[3]	Full	29.4	34.0					38.7	85.3
50	2	Relief Regulator	Full 35%	47.6 16.4	55.0 19.0	50 65	2 2½	50 65	2 2½	38.5 to 40.8	85.0 to 90.0
		Suction Regulator									
		Hot Gas & Soft Gas Defrost									
		High Pressure Liquid									
		Pumped Liquid Feed									
		Suction Stop Valve	Full	47.6	55.0						
65	2½	Relief Regulator	Full 45%	65.0 30.3	75.0 35.0	65	2½	65 80	2½ 3	54.0 to 60.0	120.0 to 132.0
		Suction Regulator									
		Hot Gas Defrost									
		High Pressure Liquid									
		Pumped Liquid Feed									
		Suction Stop Valve	Full	83.8	97.0						
80	3	Relief Regulator	Full 35%	86.5 30.3	100.0 35.0	65	2½	65 80	2½ 3	54.0 to 60.0	120.0 to 132.0
		Suction Regulator									
		Hot Gas Defrost									
		High Pressure Liquid									
		Pumped Liquid Feed									
		Suction Stop Valve	Full	83.8	97.0						

1. PVSC Stainless Steel material option is only available on sizes 20 through 40 mm (¾ through 1½").

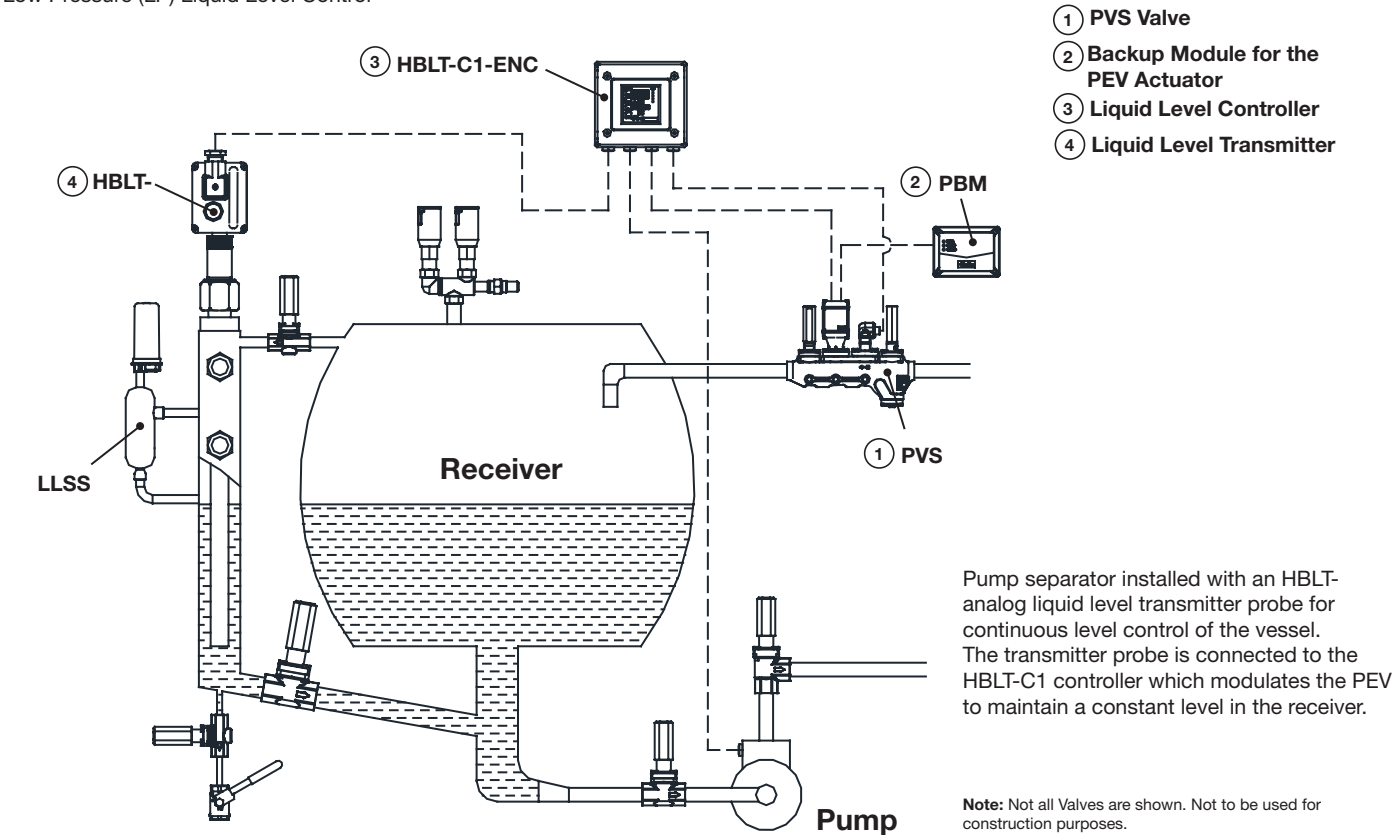
2. The flow coefficient shown is for the control module at the corresponding position, shown in Figure 1.

3. Parker Electronic Valve (PEV) applications.

4. The weight will vary based on the application/valve type.

Application Example

Low Pressure (LP) Liquid Level Control



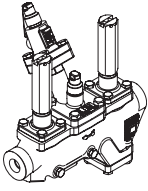
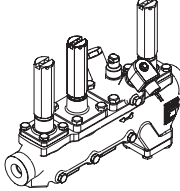
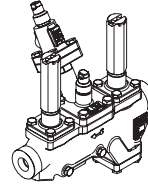
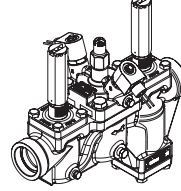
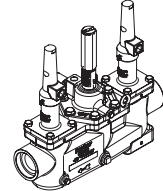
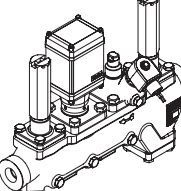
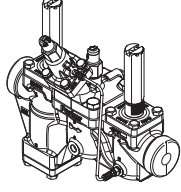
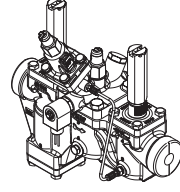
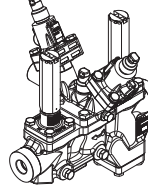
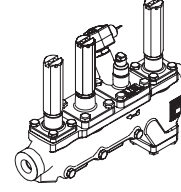
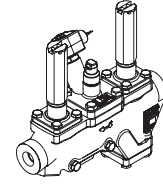
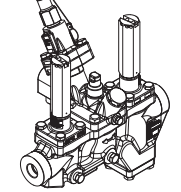
Relief Regulator	Pumped Liquid Feed	Suction Regulator	Soft (Hot) Gas Feed	Suction Stop	Liquid Feed
					
Shut-Off	Shut-Off	Shut-Off	Shut-Off	Shut-Off	Shut-Off
Strainer	Strainer	Strainer	Strainer	Suction Stop (GSS)	Strainer
Reseating Relief Regulator (PA4K)	Solenoid (PS4)	Regulator (PA4)	Dual Solenoid (PS4D)	Shut-Off	Solenoid (PS4)
Shut-Off/Check	HEV	Shut-Off	Shut-Off	—	PEV
—	Shut-Off/Check	—	—	—	Shut-Off
Differential Regulator	Hot Gas Header	Dual Regulator	High Pressure Liquid	Hot Gas Feed	Suction Regulator
					
Shut-Off	Shut-Off	Shut-Off	Shut-Off	Shut-Off	Shut-Off
Strainer	Strainer	Strainer	Strainer	Strainer	Strainer
Differential Regulator (PA4L)	Outlet Regulator with Shut Off Feature (PA4OS)	Dual Regulator (PA4D)	Solenoid (PS4)	Solenoid (PS4)	Regulator with Shut Off Feature (PA4S)
Shut-Off	Shut-Off	Shut-Off	HEV	Shut-Off	Shut-Off
—	—	—	Shut-Off	—	—

Table 1: PVS Common Valve Configurations.

Function and Design

The PVS is an innovative design which combines several different functions into one compact valve station. This multi-module platform is available in three, four or five position housings, as shown in Figure 1, with the capability of interchangeable modules (according to sizes available):

- Isolation Valve (hand shut-off).
- Strainer (100 mesh).
- Solenoid.
- Dual Solenoid .
- Regulator.
- Electronic Valve.
- Electronic Expansion.
- Hand Expansion or Stop/Expansion.
- Gas Powered Suction Stop.
- Stop/Check.

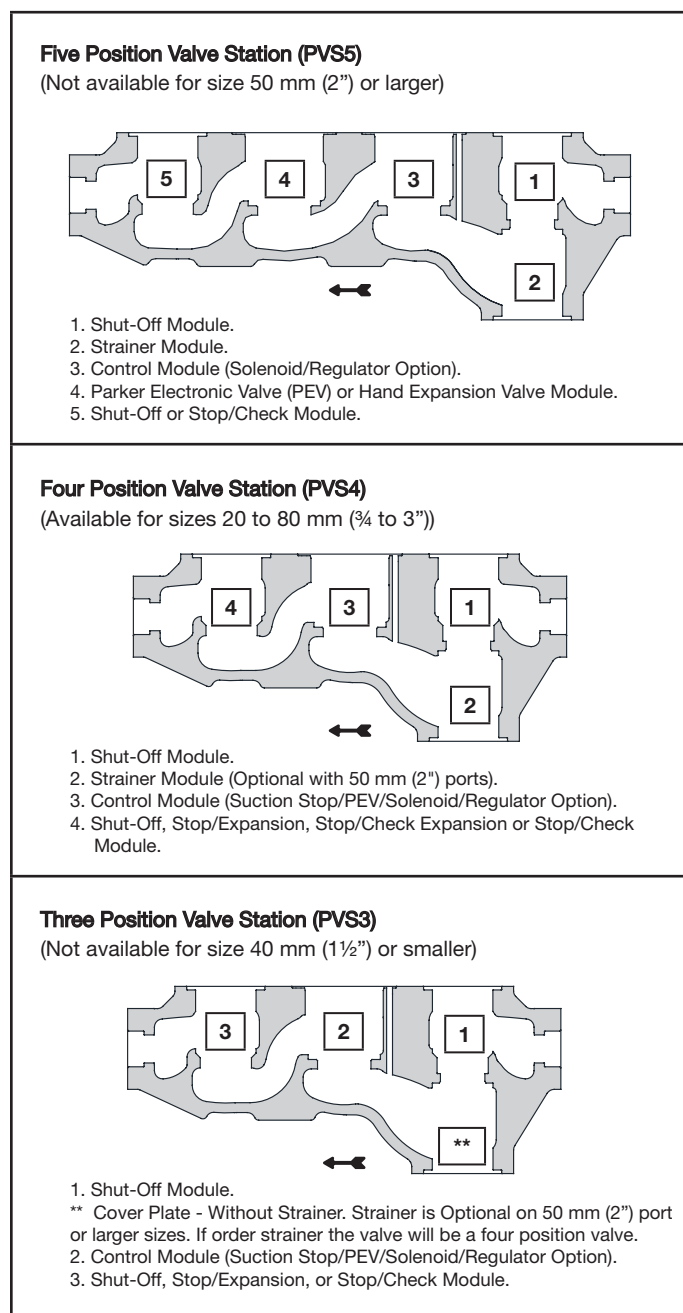


Figure 1: PVS Housings.

The PVS can be configured for many different applications including relief regulation, differential regulation, suction regulation, suction stop, pumped liquid feed, hot gas defrost, hot gas feed, and high pressure liquid solenoid applications as shown in Table 1 on page 4.

The multi-module design reduces the overall length, weight and installation time. The PVS's regulator, solenoid, and electronic modules, including the cartridge assembly for the solenoid and regulator control module, are interchangeable with the P-series valve group.

For additional information on the solenoid, regulator, and electronic P-series valve group, reference the bulletins listed below:

- 24-00 Parker Electronic Valve (PEV).
- 24-05 Pressure Regulators (PA4) & Solenoid (PS4).

Pressure access ports, ⅜" or ¼" NPT, are available at multiple locations on both sides of the valve station, as shown in Figure 2.

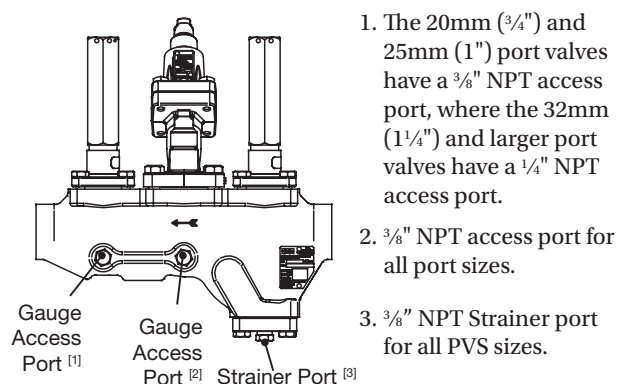


Figure 2: PVS Pressure Access Port Locations (4 Position Valve Station).

The location of the gauge port for inlet and differential pressure regulators in any variant or body type, can be on the port plate, it is shown in Figure 3.

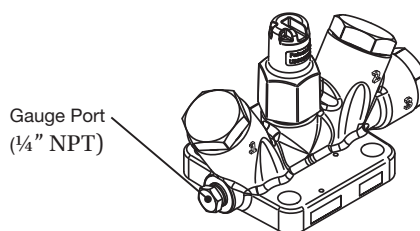


Figure 3: Gauge Port for Inlet and Differential Pressure Regulators.

For outlet pressure regulators in any variant, the gauge's port is shown in Figure 4.

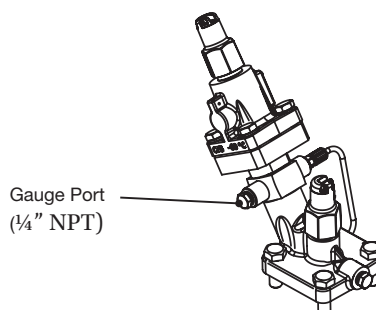


Figure 4: Gauge Port for Outlet Pressure Regulators.

Some regulator variation, such as the differential ('PA4L') or outlet ('PA4O') features, require an outlet sensing line as shown in Figure 5.

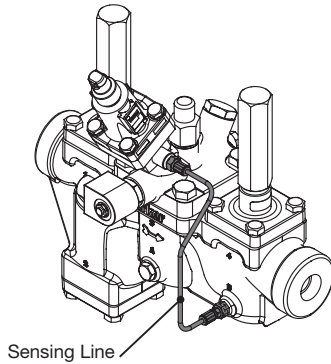


Figure 5: Outlet (Down Stream) Sensing Line.

Solenoid Function

Single Solenoid (PS4)

When the solenoid coil is energized the magnetic field created pulls the plunger up. This allows flow to travel to the top of the piston and collect on the top side of the piston. When a pressure differential is met the piston pushes downward forcing the plug to a full open position allowing flow to the valve outlet.

When the coil is de-energized the plunger returns to its normally closed seated position, by using spring force, terminating refrigerant flow to the top of the piston. A bleed hole in the piston allows for the continuous equalization, pushing the high pressure refrigerant, above the piston, through the bleed hole and out the valve. Piston seal ring ensures that this bleed hole is the sole source of equalization. The top and bottom pressure on the piston equalizes and the weight of the piston along with the closing spring forces the valve to close.

Dual Solenoid Valve or Two Stage Solenoid (PS4D)

The valve will work in the same manner previously explained for a single solenoid; the difference is that it has 2 coils to operate. The solenoid will be opened 10% only when coil in position #2 is energized, and then 100% open when coil in position #1 is energized (both coils). The valve will be closed if both coils are de-energized. See Figure 6.

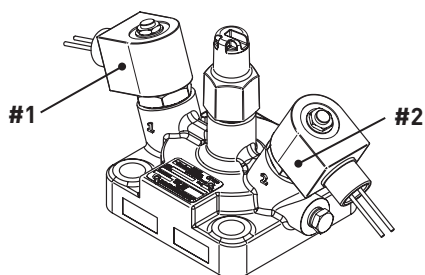


Figure 6: Dual Solenoid Coils Position.

Electronic Module Function (PEV)

The Parker Electronic Valve (PEV) will modulate the flow of the refrigerant by opening and closing based on the control signal input. The actuator is automatically calibrated when power is established.

The electronic valve is powered by 24 VDC and accepts a 4-20mA control signal. When the 4-20 mA signal comes back in range after being out of range, or when manually requested by user. At 4 mA the valve will be closed, and at 20 mA the valve will be 100% open, unless the direction has been reversed at the time of set up. The PEV valve modulates by means of a magnetic coupling and drives a screw mechanism which opens and closes the valve plug.

Suction Stop Function (GSS)

The valve function is normally open to minimize the pressure drop during refrigeration for suction applications. It remains open using a spring. An integrated coil allows the valve to close.

When the coil is energized, pressurized hot gas flows to close the valve to flow from the inlet (the minimum pressure above inlet pressure should be 1.38 bard (20 psid)), to keep the valve closed, the coil should remain energized (see Figure 7).

To equalize pressure across the GSS module, the coil is de-energized and the valve bleeds pressure through an externally adjustable orifice until the pressure difference reaches 0.62 to 1.17 bar (9 to 17 psi). The adjustable bleed rate is 10% to 30% of full capacity without opening the valve. The bleed rate adjustment and manual opening procedures are explained on page 19.

This valve easily optimizes how quickly the evaporators can safely return to refrigeration without opening the valve when the bleed rate is changed.

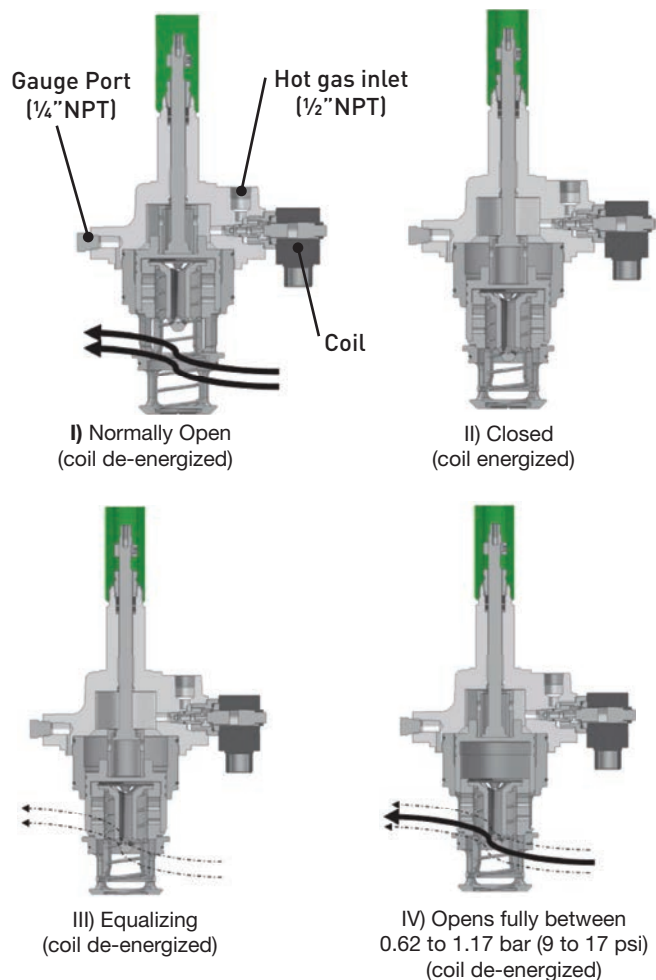


Figure 7: Gas Powered Suction Stop Valve Function.

Regulators Function (PA4)

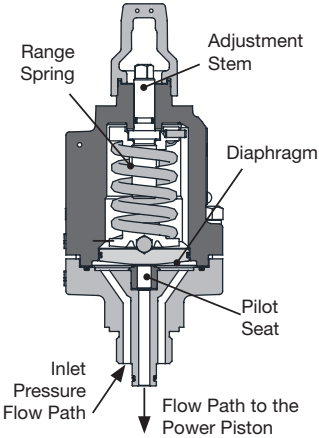
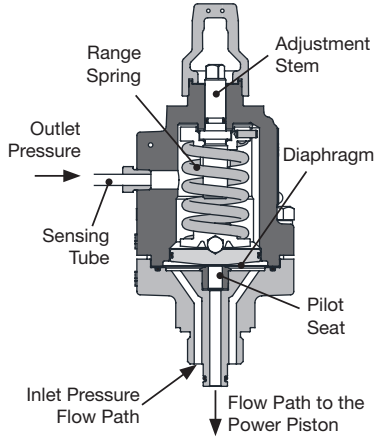
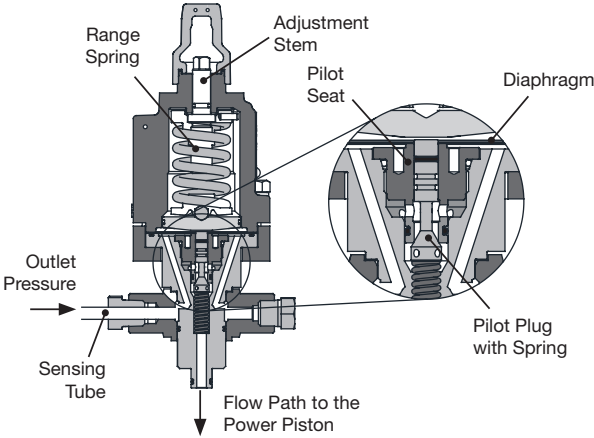
The valve will modulate to maintain a pressure set in the field using a combination of spring pressure and a diaphragm to seat or unseat the path to the piston. Depending on the valve variation the regulator will control upstream, downstream or differential pressure.

When pressure range of the regulator is beyond the field setting, the valve will stop modulating and the piston/plug cartridge assembly will equalize in the same manner as described in the solenoid function. For example, if an “A” range pilot 0.35 to 10.3 bar (5 to 150 psig) is selected, and the pressure in the system exceeds the range of the pilot (example 11.7 bar (170 psig)), the valve will just be wide open and not regulate pressure.

Is highly recommended to consider the options with upstream strainer in order to minimize damage to or prevent malfunction of the valve and the rest of the system.

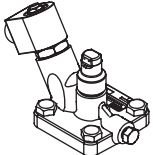
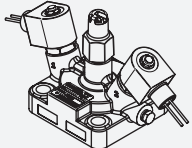
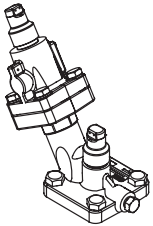
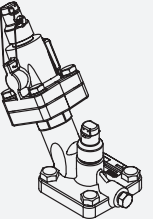
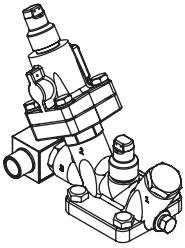
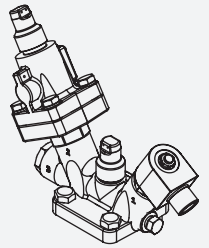
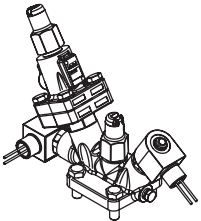
Pressure Regulator Range	Set Point Range	Pressure Change per Turn of the Adjustment Screw	Factory Set Point ^[1]
V ^[2]	254mm Hg to 8.3 bar (10in Hg to 120 psig)	Approximate 1.5 bar (22 psig)	2.8 bar (40 psig)
A	0.35 to 10.3 bar (5 to 150 psig)	Approximate 1.2 bar (17 psig)	2.8 bar (40 psig)
D	5.2 to 19.3 bar (75 to 280 psig)	Approximate 2.9 bar (42 psig)	9.7 bar (140 psig)
E	6.9 to 51.7 bar (100 to 750 psig)	Approximate 3.8 bar (55 psig)	20.7 bar (300 psig)

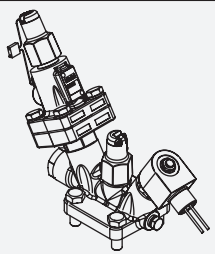
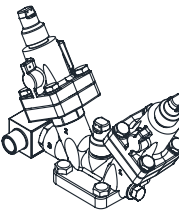
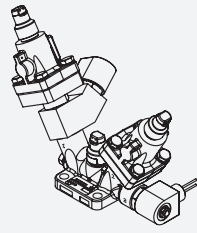
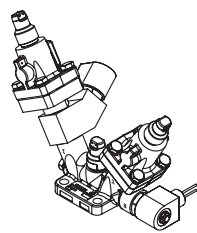
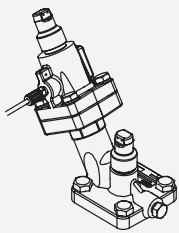
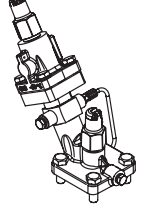
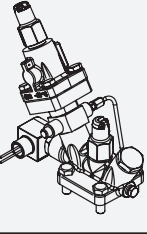
1. The factory set point changes base on regulator type or variation. Example “K” feature for range A is 4.8 bar (70 psig).
2. Range V: Only applicable for outlet regulators.

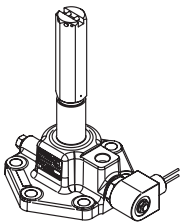
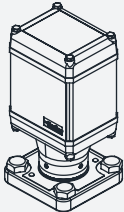
Pressure Pilot Regulator Assemblies - Function		
PA4, PA4_ (B, S, D), PA4K (Inlet Pressure)	PA4L (Differential Pressure)	PA4O (Outlet Pressure)
		
The inlet pressure enters the space under the diaphragm through the inlet flow path. When the force created by the pressure exceeds the force of the range spring, the diaphragm is lifted off the pilot seat allowing pressure to enter on top of the power piston. This causes the power piston to move downward forcing the modulating plug to open and modulate to maintain constant inlet pressure. An increase in inlet pressure lifts the diaphragm further, allowing more pressure on top of the power piston and opening the valve wider. A decrease in inlet pressure causes the diaphragm to move closer to the pilot seat reducing the pressure on the top of the power piston and causing the closing spring to reduce the valve opening. The pressure on top of the power piston is controlled by the flow through the pilot seat and the bleed off through the bleed hole in the power piston and through the clearance between the piston and cylinder.	This is a pilot operated regulator whose main valve is opened by a power piston in response to the inlet pressure received from below the regulator diaphragm. The outlet pressure is introduced through a sensing tube from the outlet of the valve into the bonnet and to the top of the diaphragm, thus allowing the regulator to maintain a differential pressure between the inlet and outlet equivalent to the spring pressure. After the regulator is set for the desired pressure differential, the pressure at the inlet of the regulator will rise and fall, pound for pound, with the rise and fall of pressure at the regulator outlet, always maintaining the set-for differential pressure across the regulator. If the difference between inlet pressure and outlet pressure of the regulator is less than the set-for pressure, the regulator will remain tightly closed.	The outlet pressure is sensed under the diaphragm through the sensing tube. When the force created by the outlet pressure acting under the diaphragm is less than the force of the range spring, the pilot is open, allowing pressure to enter on top of the power piston. This causes the power piston to force the modulating plug to open to maintain to constant outlet pressure. An increase in the outlet pressure will lift the diaphragm against the force of the range spring, allowing the pilot plug to start closing. The pressure on top of the power piston is decreased and the closing spring acts to reduce the opening of the modulating plug and the flow of fluid through the regulator. The pressure on top of the power piston is controlled by the flow through the pilot seat and the bleed through a bleed hole in the power piston and through the clearance between the piston and cylinder.

Control Module Variations

There are many possible options for the control module position (see Figure 1), such as: solenoid ('PS4'), dual solenoid ('PS4D'), electronic ('PEV'), suction stop ('GSS'), inlet pressure regulator ('PA4'), outlet pressure regulator ('PA4O') or differential pressure regulator ('PA4L') and these regulators may be used in combination with other variations; e.g. electric shut-off ('PA4S'), electric wide-opening ('PA4B') and dual pressure ('PA4D'), etc. Reference Schematic Flow Diagrams in **Appendix "A"** for a better understanding of each variation.

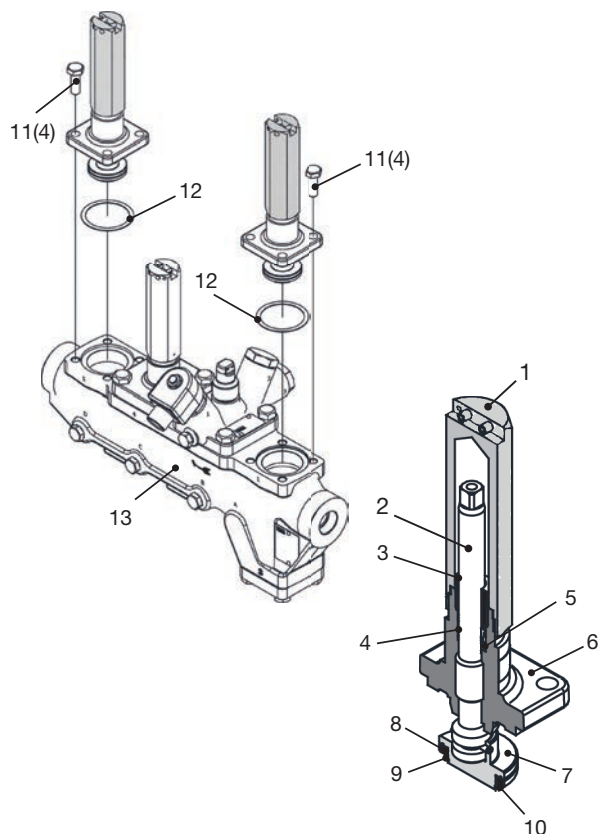
Variation	Model	Port Plate Setup	Function	Operation	Typical Applications
Solenoid	PS4		Shut-Off	Opens when coil is energized; closes when not energized.	1. Pumped liquid feed. 2. High pressure liquid (Make-Up). 3. Hot gas defrost. 4. Evaporator suction stop. 5. Equalizing lines.
Two-Stage Solenoid	PS4D		Opens or closes in two steps electrically	Opens 10% when #2 coil is energized, opens 100% when both coils are energized. Closes when both coils are de-energized. Closes 90% when coil #1 is de-energized and coil #2 is energized.	1. Combined soft gas/hot gas feed for hot gas defrost applications. 2. High pressure liquid make up line to prevent liquid hammer. 3. Suction stop with equalization.
Inlet Pressure Regulator	PA4		Controls inlet pressure	Operates at preset inlet pressure. Can be field adjusted. Opens on rising inlet pressure.	1. Evaporator pressure control. 2. Condenser pressure regulation. 3. Receiver pressure control. 4. Any inlet pressure regulation in the system.
Re-Seating Relief Inlet Pressure Regulator	PA4K		Re-seating relief regulator	Repeatedly re-seats after operation at calibrated pressure (sealed).	1. Defrost relief. 2. Relief to other parts of the system, Non-atmospheric. 3. Relief from high to low pressure side.
Inlet Pressure Regulator with Electric Shut-Off	PA4S		Controls inlet pressure or shut-off regulator	Regulates when electrically energized; closed when not energized.	1. Open for temperature control. 2. Closed for defrosting. 3. Whenever it is required to stop all flow (in the normal fluid flow direction) through the regulator.
Inlet Pressure Regulator with Electric Wide Opening	PA4B		Controls inlet pressure or wide open/bypass regulator	Regulates when not electrically energized; wide open when energized.	1. Wide open for maximum cooling. 2. Regulating for defrost. 3. Regulating for temperature control.
Inlet Pressure Regulator with Electric Wide Opening and Shut-Off	PA4BS		Controls inlet pressure or wide open/bypass regulator and shut-off	Completely closed when both coils are de-energized. Regulates when the coil in position 3 (S2) is electrically energized and the coil in position 1 (S1) is de-energized. Wide open when coil in position 1 (S1) or both coils are energized.	1. Wide open for maximum cooling. 2. Regulating for defrost. 3. Regulating for temperature control. 4. Can close suction line for defrost cycle.

Variation	Model	Port Plate Setup	Function	Operation	Typical Applications
Re-Seating Relief Inlet Pressure Regulator with Electric Wide Opening	PA4BK		Controls a re-seating inlet pressure or wide open/bypass regulator	Regulates when not electrically energized: open wide above set point (sealed calibration); repeatedly re-seats after operation. Wide open when energized.	1. Wide open for maximum cooling. 2. Regulating for defrost. 3. Regulating for temperature control.
Inlet Dual Pressure Regulator	PA4D		Dual pressure control Position 1 (P2): High pressure pilot Position 2 (P1): Low pressure pilot	Regulates at lower pressure when electrically energized; at higher pressure when not energized.	1. Control pressure for defrost. 2. Pressure regulation for temperature control. 3. Internal pressure relief.
Inlet Dual Pressure Regulator with Electric Shut-Off	PA4DS		Dual pressure control with electric shut-off Position 1: - High pressure pilot (P2) - Solenoid pilot (S2) Position 2: Low pressure pilot (P1) Position 3: Solenoid pilot for low pressure (S1)	Shut-off when both coils are de-energized. Regulates at low pressure when only solenoid in position 3 (S1) is energized. Regulates at high pressure when only solenoid in position 1 (S2) is energized.	1. Open for: a) Control pressure for defrost. b) Pressure regulation for temperature control. 2. Closed for defrosting.
Inlet Dual Pressure Regulator with Electric Wide Opening	PA4DB		Dual pressure control or wide open (bypass) Position 1: - High pressure pilot (P2) - Bypass or wide open solenoid pilot (S2) Position 2: Low pressure pilot (P1) Position 3: Solenoid pilot for low pressure (S1)	Regulates at high pressure when both solenoids are de-energized. Regulates at low pressure when only solenoid (S1) in position 3 is energized. Control valve is wide open when solenoid (S2) in position 1 is energized.	1. Wide open for maximum cooling. 2. Regulates evaporator pressure for defrost, temperature control or internal pressure relief. 3. Pressure equalization after defrost.
Differential Pressure Regulator	PA4L		Controls differential pressure between the inlet and outlet across control module.	Regulates pressure difference at or below a pre-set amount.	1. Liquid pump relief regulator. 2. Reduce liquid or vapor line pressure. 3. Condenser-receiver pressure difference regulation. 4. Differential regulation for oil control in the compressor crankcase. 5. Discharge pressure boosting for defrosting or heat recovery.
Outlet Pressure Regulator	PA4O		Controls outlet pressure	Regulates at preset outlet pressure. Can be field adjusted. Opens on a drop in outlet pressure.	1. Crankcase pressure regulation. 2. Hot gas bypass; booster loading. 3. Condenser and receiver pressure control through hot gas bypass. 4. Hot gas supply for artificial refrigeration load. 5. Compressor suction pressure limitation.
Outlet Pressure Regulator with Electric Shut-Off	PA4OS		Controls outlet pressure or shut-off regulator	Regulates when electrically energized at preset outlet pressure. Can be field adjusted. Opens on a drop in outlet pressure. Closed when not energized.	1. Crankcase pressure regulation. 2. Hot gas bypass; booster loading. 3. Hot gas feeding. 4. Pressure of hot gas header.

Variation	Model	Port Plate Setup	Function	Operation	Typical Applications
Suction Stop	GSS		Gas powered suction stop	Normally open; gas powered valve that is closed when coil is electrically energized; enters bleed mode (10 - 30%) with high ΔP .	1. Low temperature applications. 2. Wet return lines. 3. Liquid recirculation system. 4. Liquid and gas return legs of flooded (gravity) evaporators.
Electronic Actuator	PEV		Electronic flow control	Modulates the flow of the refrigerant responding to an electrical signal, giving precise control.	1. High pressure liquid (Make-Up). 2. Liquid feed or expansion for heat exchangers. 3. Liquid Injection for oil cooling to compressors. 4. Hot gas/soft gas supply. 5. Control pressure or temperature in suction lines.

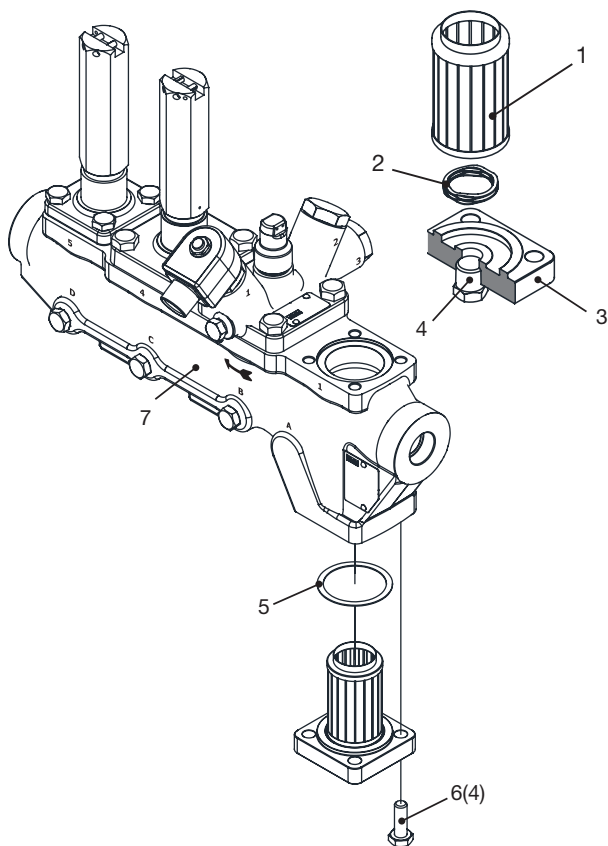
Material List: Shut-Off Module

(Aluminum or Grey Seal Cap, without Grooves or Marks on Stem)



Item	Description	Material	
		PVSW	PVSC ^[1]
1	Seal Cap (Aluminum or Grey)	Aluminum, ADC12 per ASTM B211	Aluminum, ADC12 per ASTM B211
2	Stem, Hand Shut-Off Module (No Grooves or Marks)	303 Stainless Steel	303 Stainless Steel
3	Nut, Packing	303 Stainless Steel	303 Stainless Steel
4	Packing Gland	PTFE, Carbon Filled	PTFE, Carbon Filled
5	Packing Gland	Style 235A Crane Foil	Style 235A Crane Foil
6	Bonnet, Hand Shut-Off Module	Forged Steel, ASTM A350 - LF2, Zinc Nickel/Chromate Plated	Stainless Steel - CF3 ASTM A351
7	Disc Carrier, Hand Shut-Off Module	1117 Stainless Steel	1117 Stainless Steel
8	Seat Disc, Hand Shut-Off Module	PTFE, Carbon Filled	PTFE, Carbon Filled
9	Washer, Retaining Ring	Low Carbon Steel, Zinc with Clear Chromate Plated	Low Carbon Steel, Zinc with Clear Chromate Plated
10	Retaining Ring	Carbon Spring, Temper Steel	Carbon Spring, Temper Steel
11	Bolts, Bonnet	Steel Grade A2, DIN-ISO 3506-1	Steel Grade A2, DIN-ISO 3506-1
12	Gasket, Bonnet	Gylon 3500	Gylon 3500
13	Body ^[2]	Cast Steel - LCC ASTM A352, Zinc Nickel/Chromate Plated	Stainless Steel - CF3 ASTM A351
—	O-Rings	Neoprene	Neoprene

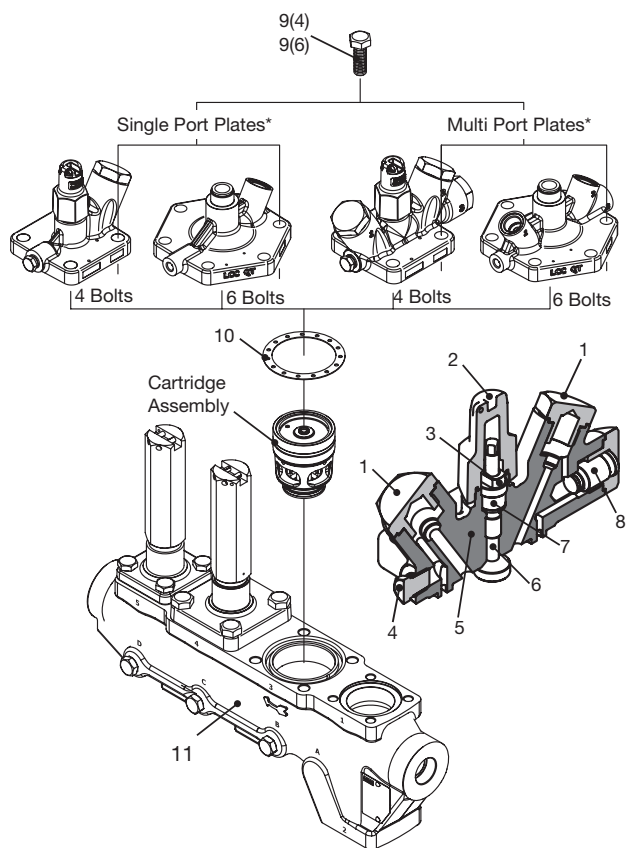
1. PVSC Stainless Steel material option is only available on sizes 20 through 40 mm (¾ through 1-½").
 2. It refers to PVS5, PVS4 and PVS3 bodies (shown PVS5 body only).

Material List: Strainer Module

Item	Description	Material	
		PVSW	PVSC ^[1]
1	Strainer, Basket	100 Mesh, 304 Stainless Steel	100 Mesh, 304 Stainless Steel
2	Wave Spring	Carbon Spring, Temper Steel	Carbon Spring, Temper Steel
3	Cover Plate, Strainer	ASTM A350, LF2 Class 1 Zinc with Clear Chromate Plated	Stainless Steel - CF3 ASTM A351
4	Pipe Plug ^[3]	Zinc Plated Steel	Zinc Plated Steel
5	Gasket, Strainer	Gylon 3500	Gylon 3500
6	Bolts, Strainer Cover	Steel Grade A2, DIN-ISO 3506-1	Steel Grade A2, DIN-ISO 3506-1
7	Body ^[2]	Cast Steel - LCC ASTM A352, Zinc Nickel/Chromate Plated	Stainless Steel - CF3 ASTM A351

1. PVSC Stainless Steel material option is only available on sizes 20 through 40 mm (¾ through 1-½").
 2. It refers to PVS5, PVS4 and PVS3 bodies (shown PVS5 body only).
 3. For all PVS variants and port sizes, the pipe plug size for Strainer is ¾" NPT.

Material List: Control Module (Solenoid/Regulator Options)



Item	Description	Material	
		PVSW	PVSC ^[1]
1	Cap, Port Plate	303 Stainless Steel	304 Stainless Steel
2	Seal Cap	304 Stainless Steel	304 Stainless Steel
3	Packing Nut	303 Stainless Steel	304 Stainless Steel
4	Plug, Gauge Port	304 Stainless Steel	304 Stainless Steel
5	Port Plate	Cast Steel - LCC ASTM A352, Zinc Nickel/Chromate Plated	Stainless Steel - CF3 ASTM A351
6	Stem, Manual Opening	303 Stainless Steel	303 Stainless Steel
7	Packing	Graphitic - ASTM F2168	Graphitic Steel, DIN- ISO 3506-1 Grade A2
8	Plug, Pilot	303 Stainless Steel	303 Stainless Steel
9	Bolts, Port Plate	Steel Grade A2, DIN- ISO 3506-1	Steel Grade A2, DIN- ISO 3506-1
10	Gasket, Port Plate	Gylon 3500	Gylon 3500
11	Body ^[2]	Cast Steel - LCC ASTM A352, Zinc Nickel/ Chromate Plated	Stainless Steel - CF3 ASTM A351
—	Washer, Packing	Steel	Steel
—	Gasket, Seal Cap	Wolverine MS-18020	Wolverine MS-18020
—	Gasket, Port Plate Cap	Wolverine MS-18020	Wolverine MS-18020
—	Gasket, Control Port	Wolverine MS-18020	Wolverine MS-18020

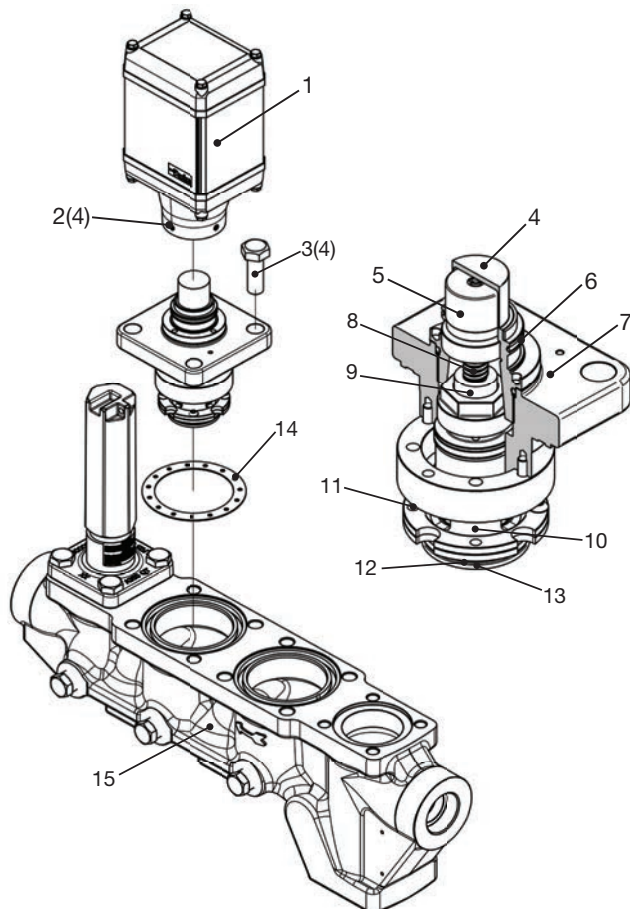
Note: The description and material information for the cartridge assembly and control port options can be found on page 15.

1. PVSC Stainless Steel material option is only available on sizes 20 through 40 mm (¾ through 1-½").

2. It refers to PVS5, PVS4 and PVS3 bodies (shown PVS5 body only).

* 6 Bolts Port Plate is used for PVS3 and PVS4 bodies with 50 mm (2") port or larger sizes only.

Material List: Parker Electronic Valve (PEV) Module

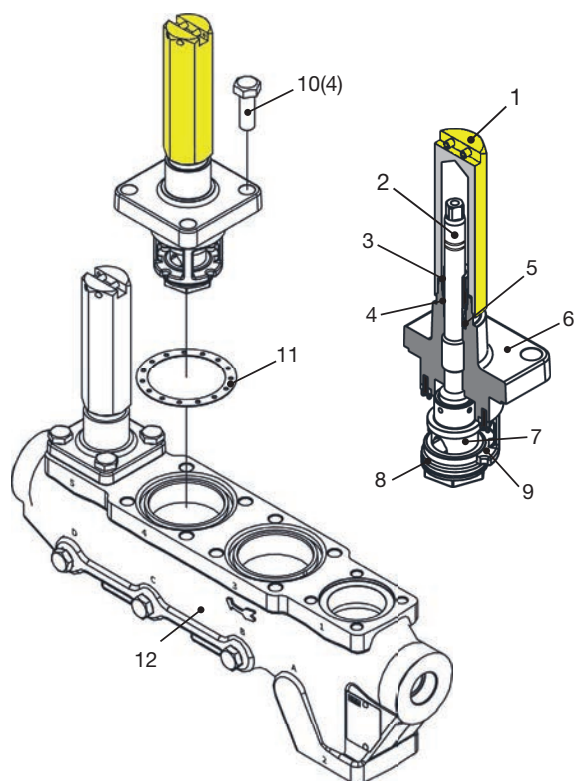


Item	Description	Material	
		PVSW	PVSC ^[1]
1	PEV Actuator	Aluminum, Resin, Silicone	Aluminum, Resin, Silicone
2	Screws, Actuator	Stainless Steel	Stainless Steel
3	Bolts, Port Plate	Stainless Steel Grade A2, DIN-ISO 3506-1	Stainless Steel Grade A2, DIN-ISO 3506-1
4	Cap, Plug	303 Stainless Steel	303 Stainless Steel
5	Magnet Assembly	Stainless Steel	Stainless Steel
6	O-Ring, Cap - Actuator	Neoprene	Neoprene
7	Port Plate, PEV	Stainless Steel - CF3 (ASTM A351)	Stainless Steel - CF3 (ASTM A351)
8	Large Screw	Stainless Steel	Stainless Steel
9	Retainer, Screw Nut	Carbon Steel	Carbon Steel
10	Capacity Plug, Assembly	Stainless Steel, PTFE	Stainless Steel, PTFE
11	Screws, Plug	Zinc Plated Alloy Steel	Zinc Plated Alloy Steel
12	O-Ring, Seat - Plug	Neoprene	Neoprene
13	Seat	Stainless Steel	Stainless Steel
14	Gasket, Port Plate	Gylon 3500	Gylon 3500
15	Body ^[2]	Cast Steel - LCC ASTM A352, Zinc Nickel/ Chromate Plated	Stainless Steel - CF3 ASTM A351

1. PVSC Stainless Steel material option is only available on sizes 20 through 40 mm (¾ through 1-½").

2. It refers to PVS5, and PVS4 bodies (shown PVS5 body only).

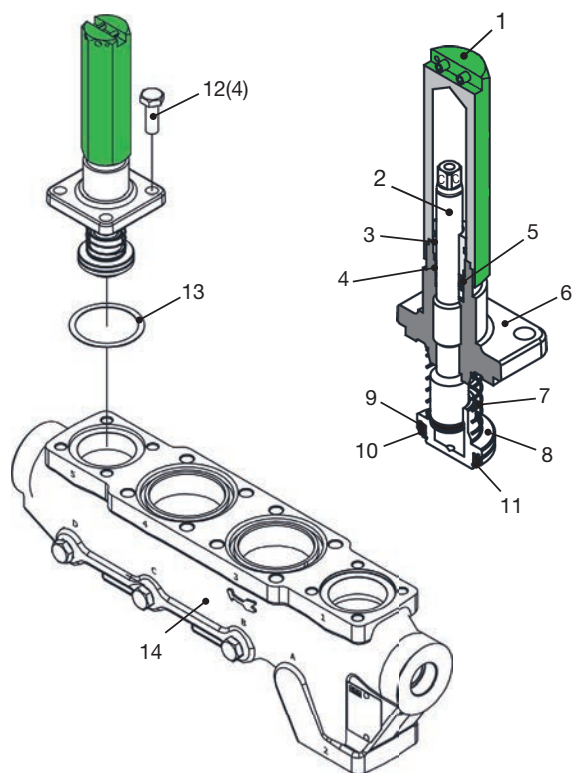
Material List: Hand Expansion Module (Yellow Seal Cap, 2 Grooves on Stem)



Item	Description	Material	
		PVSW	PVSC ^[1]
1	Seal Cap (Yellow)	Aluminum, ADC12 Per ASTM B211	Aluminum, ADC12 Per ASTM B211
2	Stem, Hand Expansion Module (2 Grooves)	303 Stainless Steel	303 Stainless Steel
3	Nut, Packing	303 Stainless Steel	303 Stainless Steel
4	Packing Gland	PTFE, Carbon Filled	PTFE, Carbon Filled
5	Packing	Style 235A Crane Foil	Style 235A Crane Foil
6	Bonnet, Hand Expansion Module	Forged Steel, ASTM A350 - LF2, Zinc Nickel/Chromate Plated	Stainless Steel - CF3 ASTM A351
7	Plug, Regulating/Expansion	303 Stainless Steel	303 Stainless Steel
8	Disc Holder	303 Stainless Steel	303 Stainless Steel
9	Seat	Stainless Steel	Stainless Steel
10	Bolts, Bonnet	Steel Grade A2, DIN-ISO 3506-1	Steel Grade A2, DIN-ISO 3506-1
11	Gasket, Bonnet	Gylon 3500	Gylon 3500
12	Body ^[2]	Cast Steel - LCC ASTM A352, Zinc Nickel/Chromate Plated	Stainless Steel - CF3 ASTM A351
—	O-Rings	Neoprene	Neoprene

1. PVSC Stainless Steel material option is only available on sizes 20 through 40 mm (¾ through 1½").
2. It refers to PVS5, and PVS4 bodies (shown PVS5 body only).

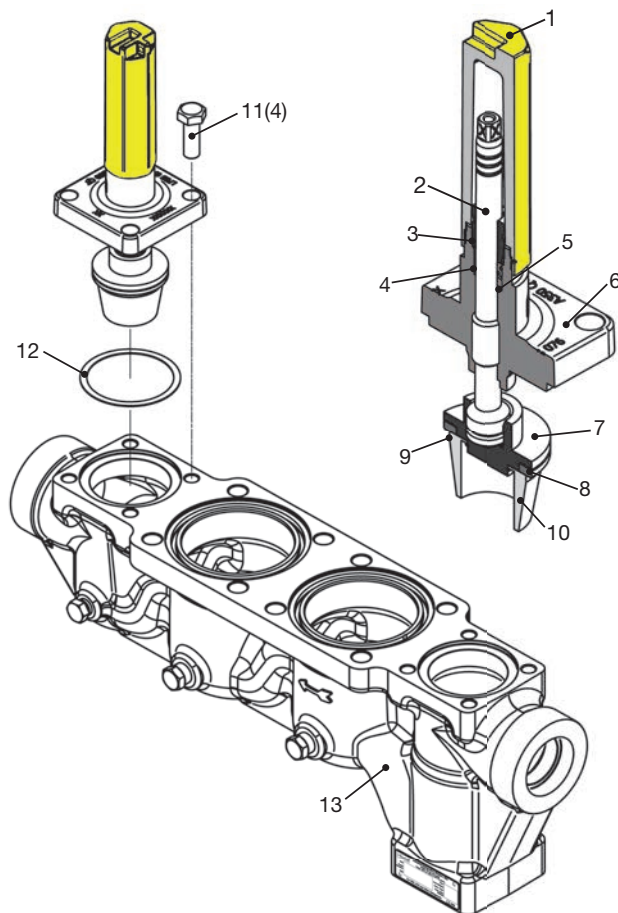
Material List: Stop/Check Module (Green Seal Cap, 1 Groove and "C" Mark on Stem)



Item	Description	Material	
		PVSW	PVSC ^[1]
1	Seal Cap (Green)	Aluminum, ADC12 per ASTM B211	Aluminum, ADC12 per ASTM B211
2	Stem, Stop/Check Module (1 Groove and "C" mark on the top)	303 Stainless Steel	303 Stainless Steel
3	Nut, Packing	303 Stainless Steel	303 Stainless Steel
4	Packing Gland	PTFE, Carbon Filled	PTFE, Carbon Filled
5	Packing	Style 235A Crane Foil	Style 235A Crane Foil
6	Bonnet, Stop/Check Module	Forged Steel, ASTM 350 - LF2, Zinc Nickel/Chromate Plated	Stainless Steel - CF3 ASTM A351
7	Spring	Music Wire, ASTM A-228	Music Wire, ASTM A-228
8	Disc Carrier, Stop/Check Module	1117 Stainless Steel	1117 Stainless Steel
9	Seat Disc, Stop/Check Module	PTFE, Carbon Filled	PTFE, Carbon Filled
10	Washer, Retaining Ring	Low Carbon Steel, Zinc with Clear Chromate Plated	Low Carbon Steel, Zinc with Clear Chromate Plated
11	Retaining Ring	Carbon Spring, Temper Steel	Carbon Spring, Temper Steel
12	Bolts, Bonnet	Steel Grade A2, DIN-ISO 3506-1	Steel Grade A2, DIN-ISO 3506-1
13	Gasket, Bonnet	Gylon 3500	Gylon 3500
14	Body ^[2]	Cast Steel - LCC ASTM A352, Zinc Nickel/Chromate Plated	Stainless Steel - CF3 ASTM A351
-	O-rings	Neoprene	Neoprene

1. PVSC Stainless Steel material option is only available on sizes 20 through 40 mm (¾ through 1½").
2. It refers to PVS5, and PVS4 bodies (shown PVS5 body only).

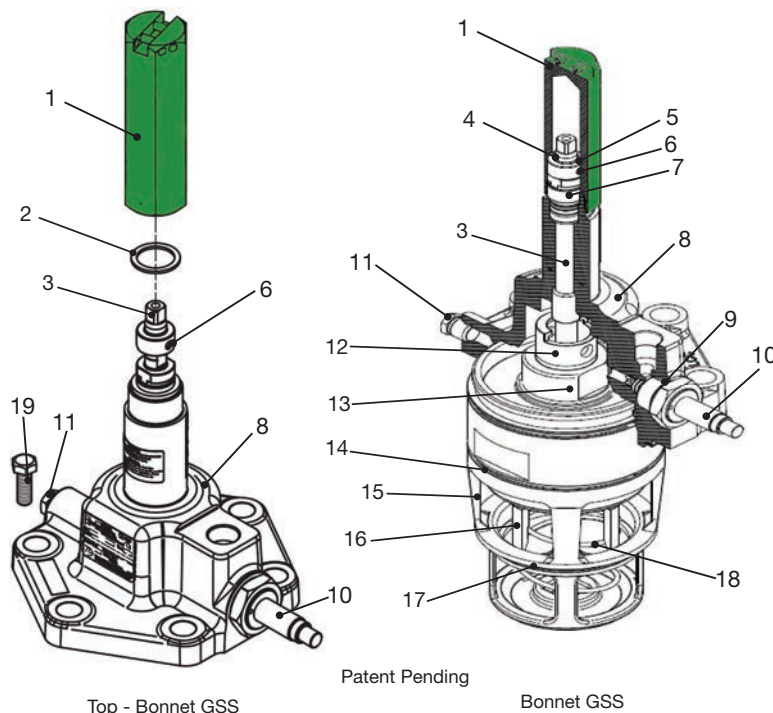
Material List: Stop/Expansion Module (Yellow Seal Cap, 3 Grooves and "X" Mark on Stem)



Item	Description	Material	
		PVSW	PVSC ^[1]
1	Seal Cap (Yellow)	Aluminum, ADC12 per ASTM B211	Aluminum, ADC12 per ASTM B211
2	Stem, Stop/Expansion Module (3 Grooves and "X" mark on the top)	303 Stainless Steel	303 Stainless Steel
3	Nut, Packing	303 Stainless Steel	303 Stainless Steel
4	Packing Gland	PTFE, Carbon Filled	PTFE, Carbon Filled
5	Packing	Style 235A Crane Foil	Style 235A Crane Foil
6	Bonnet, Stop/Expansion Module	Forged Steel, ASTM A350 - LF2, Zinc Nickel/Chromate Plated	Stainless Steel - CF3 ASTM A351
7	Disc Carrier, Stop/Expansion Module	1117 or 1018, Round Steel	1117 or 1018, Round Steel
8	Seat Disc, Stop/Expansion Module	PTFE, Carbon Filled	PTFE, Carbon Filled
9	Retaining Ring	Carbon Spring, Temper Steel	Carbon Spring, Temper Steel
10	Plug, Stop/Expansion Module	303 Stainless Steel, Cold Finished & Annealed	303 Stainless Steel, Cold Finished & Annealed
11	Bolts, Bonnet	Steel Grade A2, DIN-ISO 3506-1	Steel Grade A2, DIN-ISO 3506-1
12	Gasket, Bonnet	Gylon 3500	Gylon 3500
13	Body ^[2]	Cast Steel - LCC ASTM A352, Zinc Nickel/Chromate Plated	Stainless Steel - CF3 ASTM A351
-	O-rings	Neoprene	Neoprene

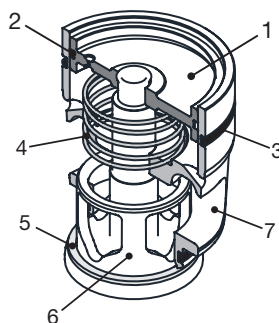
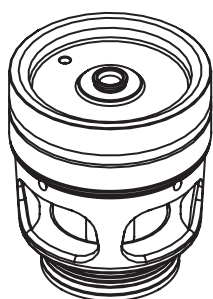
1. PVSC Stainless Steel material option is only available on sizes 20 through 40 mm (¾ through 1-½").
2. It refers to PVS5, and PVS4 bodies (shown PVS5 body only).

Material List: Suction Stop Module (GSS) (Green Seal Cap, without Groove or Marks on Stem)

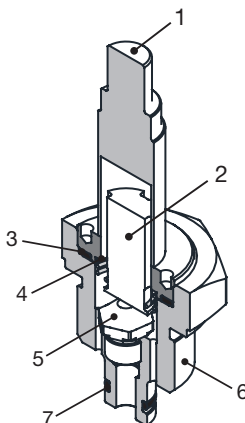
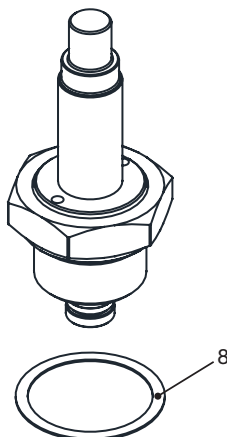


Item	Description	Material
1	Seal Cap (Green)	Aluminum, ADC12 per ASTM B211
2	Gasket, Seal Cap	Wolverine MS-18020
3	Stem, Manual Opening	303 Stainless Steel
4	Retaining Ring	15-7 PH Stainless Steel
5	Collar	303 Stainless Steel
6	Screw	303 Stainless Steel
7	Packing Nut	Graphitic - ASTM F2168
8	Bonnet	Cast steel, LCC ASTM A352 (3"), ASTM A350 LF3 CL2 QT (2")
9	Gasket, Solenoid	Wolverine MS-18020
10	Solenoid, Operator Assy	303 Stainless Steel
11	Plug 1/4" NPT	304 Stainless Steel
12	Tube, Stem Lift	303 Stainless Steel
13	Piston, Outer	Steel - AISI 1215
14	Top O-Ring, Cartridge	Neoprene
15	Cartridge, Body	Steel - AISI 1215
16	Piston, Inner	Steel - AISI 1215
17	Bottom O-Ring, Cartridge	Neoprene
18	Spring	Music Wire - ASTM A-228
19	Bolts, Bonnet	Stainless Steel Grade A2, DIN-ISO 3506-1

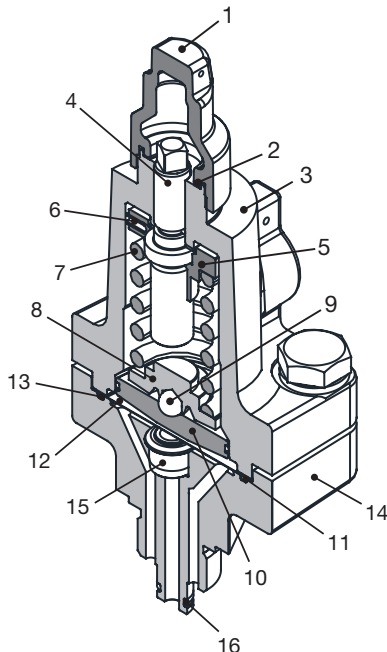
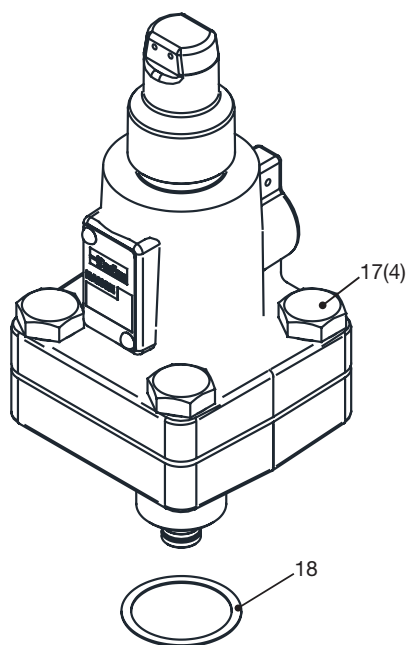
Note: The GSS Module is used for PVS3 and PVS4 bodies with 50 mm (2") port or larger sizes only.

Material List: Control Module - Cartridge Assembly

Item	Description	Material
1	Piston	303 Stainless Steel
2	Ring, Piston	Ductile Iron
3	O-Ring	Neoprene
4	Spring	Music Wire, ASTM A-228
5	Seat	PTFE
6	Plug/Stem	CF3 (ASTM A351)
7	Cartridge, Housing	CF3 (ASTM A351)

Material List: Control Module - Solenoid Pilot Assembly

Item	Description	Material
1	Sleeve	304 Stainless Steel
2	Plunger	430FR Stainless Steel
3	O-Ring	Neoprene
4	Spring, Plunger	18-8 Stainless Steel
5	Seat, Solenoid	PTFE
6	Adaptor	303 Stainless Steel
7	O-Ring, Adaptor	Neoprene
8	Gasket, Adaptor Assembly	Wolverine MS-18020

Material List: Control Module - Regulator Pilot Assembly

Item	Description	Material
1	Seal Cap	304 Stainless Steel
2	Gasket, Seal Cap	Wolverine MS-18020
3	Bonnet	CF3 (ASTM A351)
4	Adjustment Stem	303 Stainless Steel
5	Spring Plate, Top	Steel, AISI 1215 CD
6	Pin	420 Stainless Steel
7	Spring	Music Wire, ASTM A-228
8	Spring Plate, Bottom	Steel, AISI 1215 CD
9	Ball	440C Stainless Steel
10	Follower, Diaphragm	Steel, AISI 1215 CD
11	Gasket, Bonnet	Klingsil, C-4401
12	Diaphragm	301/302 Stainless Steel
13	O-Ring, Diaphragm	Neoprene
14	Plate, Bonnet	CF3 (ASTM A351)
15	Seat, Pilot	416 Stainless Steel
16	O-Ring, Bonnet Assembly	Neoprene
17	Bolts, Bonnet	Steel Grade A2, DIN-ISO 3506-1
18	Gasket, Bonnet Assembly	Wolverine MS-18020
—	Washer, Adjustment Stem	18-8 Stainless Steel
—	O-Ring, Adjustment Stem	Neoprene

Installation Instructions

All personnel working on valves must be qualified to work on refrigeration systems. If there are any questions contact Refrigerating Specialties before proceeding with the installation.

All valves are packed for maximum protection. Unpack carefully, checking to make sure all items are unpacked. If purchased a PVS with the electronic option, the actuator comes with its own packed. Save the enclosed instructions for the installer and eventual user.

⚠ Do not remove the protective coverings from the inlet and outlet of the valve until the valve is ready to be installed.

The valve should be installed in a location where it is easily accessible for adjustment and maintenance. The location should be such that the valve can not be easily damaged by material handling equipment. When it is necessary to insulate the valve the insulation should be installed to provide access for adjustment and maintenance. Do not insulate solenoid coils, this also applies to pressure regulators with pilot solenoid options. Pressure gauges should be installed to be easily visible to the operating engineer for system checks and adjustment purposes.

The PVS series valves must be mounted in the upright horizontal position with the manual opening stems on the top. The valve must be installed with the arrow pointing in the direction of flow for the valve to function properly.

It is not necessary to disassemble the PVS before welding. The hand shut-off and hand expansion modules should be positioned in the mid position, off the seat. To gain access to the adjustments stems for the hand shut-off and expansion modules remove the seal caps, as shown in Figure 8, prior to welding.

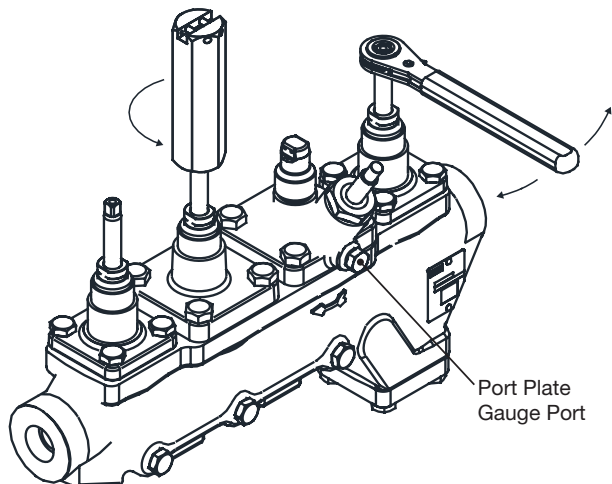


Figure 8: Hand Valves Modules Stem/Disc Position.

Note: The stop/check module can not be back seated, so a wet rag around the valve near the weld location is recommended, shown in Figure 9.

Contractors need to follow a WPS (Welding Procedure Specification) for all welding. The procedure must be qualified and the welder doing the weld must be qualified to perform that procedure.

The codes applicable to the welding of socket weld valves require that the pipe be inserted into the socket until bottomed against the stop. The pipe is then to be backed out approximately $\frac{1}{16}$

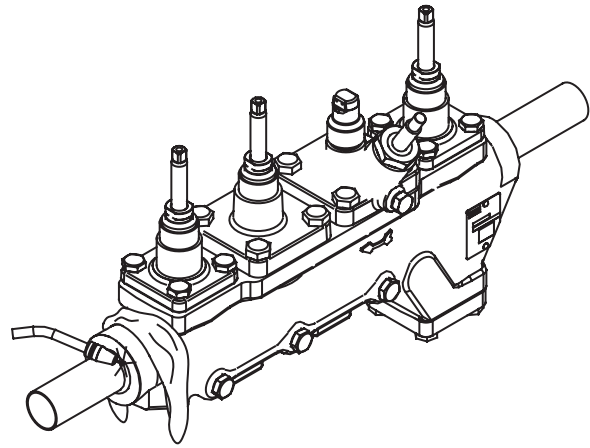


Figure 9: Welding with a Wet Rag.

of an inch before welding. Use of welding rings is optional, but recommended for butt weld valves. They help align, control the width of the gap for full penetration welding and reduce welding debris entry.

After welding the valve in place, back seat the hand shut-off modules and put the seal caps back to the correct location. The expansion and electronic modules can be adjusted at a later time. Seal caps are color coded: green for the stop/check module, yellow for the hand expansion and stop/expansion modules, and non-painted for the hand shut-off module. Reference the module identifying sections in this literature for correct seal cap locations.

If you choose to disassemble the valve station prior to welding protect the inside of the valve station body, bonnet assemblies, cartridge port plate and strainer from welding debris and dirt. Place the components in a plastic bag, plastic container or use a rust protection agent, such as refrigerant oil, and store them in an area where they will not be damaged.

Remove welding debris and any dirt from the valve body before reassembling the valve. Check all contact surfaces, teflon seats, and cartridge o-rings for damage. Apply some silicon grease on the o-rings for protection and for easy installation.

Note: Refrigerating Specialties has new bonnet gaskets for each module to be used as a replacement if valve is disassembled for welding, see Figure 10 for gasket location.

Insert the control module cartridge into station 3, for the 5, 4 position valve and into station 2, for the 3 position valve; prior to inserting all other modules. Next place the larger diameter gaskets with multiple holes in stations 3 and 4 in the 5 position valve; station 3 in the 4 position valve; and the larger diameter gaskets (without holes) in station 2 in the 3 position valve. Smaller diameter gaskets, with no holes, are used in stations 1, 2 and 5 for the 5 position valve; stations 1, 2 and 4 for the 4 position valve; and stations 1 and 3 for the 3 position valve. See Figure 1 for valve module positions and Figure 10 for gasket location.

When installing the control module port plate assembly, the gauge port should always be on the side of the valve as shown in Figure 2. Tighten the port plate bolts with a torque wrench, evenly in a X configuration, to provide proper seating. Refer to Table 2 for the port plate bolt torque specifications.

Before putting valves into service, all pipe connections, valve seats, bonnet seals, and stem seals should be tested for leaks at pressure levels called for in appropriate codes.

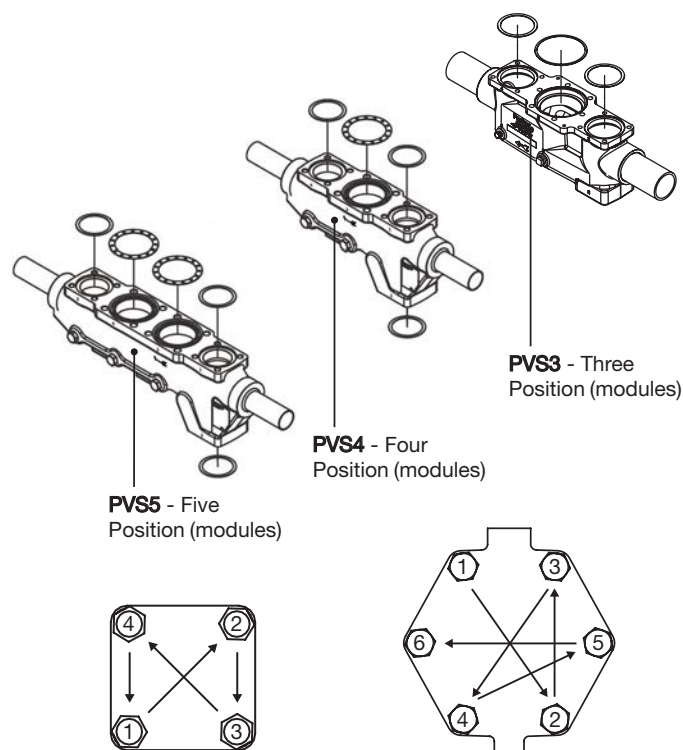


Figure 10: Gasket Location and Port Plate Torque Pattern.

Valve Body	Port Size		Bolt Size	Module Position	Torque	
	mm	inch			Nm	ft. lb.
PVS3	50	2	M12 x 1.75	1, 3	90	66
			M14 x 2	2	104	77
	65	2½	M12 x 1.75	1, 3	90	66
			M16 x 2	2	149	110
	80	3	M12 x 1.75	1, 3	90	66
			M16 x 2	2	149	110
PVS4	20, 25	¾, 1	M10 x 1.5	1, 2 & 4	41	30
			M12 x 1.75	3	61	45
	32, 40	1¼, 1½	M12 x 1.75	1, 2 & 4	61	45
			M16 x 2	3	149	110
	50	2	M12 x 1.75	1, 2 & 4	90	66
			M14 x 2	3	104	77
	65	2½	M12 x 1.75	1, 2, & 4	90	66
			M16 x 2	3	149	110
	80	3	M12 x 1.75	1, 2, & 4	90	66
			M16 x 2	3	149	110
PVS5	20, 25	¾, 1	M10 x 1.5	1, 2 & 5	41	30
			M12 x 1.75	3 & 4	61	45
	32, 40	1¼, 1½	M12 x 1.75	1, 2 & 5	61	45
			M16 x 2	3 & 4	149	110

Table 2: Port Plate Bolt Torque Recommendations.

Electrical

The Refrigerating Specialties Division molded water resistant solenoid coil is designed for long life and powerful opening force. The standard coil housing meets NEMA 4 requirements. This sealed construction can withstand direct contact with moisture and ice. Coil construction will permit coil temperatures as high as 180°C (356°F). A solenoid coil should never be energized except when mounted on its corresponding solenoid tube.

The solenoid coil must be connected to electrical lines with voltage and frequency, same as marked on coil.

The supply circuits must be properly sized to give adequate voltage at the coil leads even when other electrical equipment is operating. The coil is designed to operate with line voltage from 85% to 110% of rated coil voltage. Operating with a line voltage above these limits may result in coil burn-out. Also, operating with line voltage below the limit will definitely result in lowering the valve's maximum opening pressure differential. Power consumption during normal operation will be 22 watts or less.

Type	Image	Terminal Diagram	Classification	Voltages/Frequencies	Wattage	Temp.	Cert.
Leaded		 Start Winding: White Wire End Winding: Black Wire	18" Leaded Wires NEMA 1, 2, 3, 4, 4x IP67	110-120 VAC/60 Hz 110-120 VAC/50 Hz 200-230 VAC/50 Hz 200-240 VAC/60 Hz 24 VAC/60 Hz 24 VAC/50 Hz 24 VDC ^[1] (consult factory for other voltages/frequencies)	22 W	180°C (356°F)	CE
DIN QD		 GROUND 2 N.C. 1 COM	NEMA 1, 2, 3, 4, 4x IP65				
Leaded		 Start Winding: White Wire End Winding: Black Wire	18" Leaded Wires NEMA 7 & 9 IP67	110 VAC/50 Hz 120 VAC/60 Hz			UL Hazardous Locations ^[2]

1. DC coils are limited to an ambient temperature of -25°C to 60°C (-13°F to 140°F) and an M.O.P.D. of 10.0 barg (145 psid). Only available in QD connection.

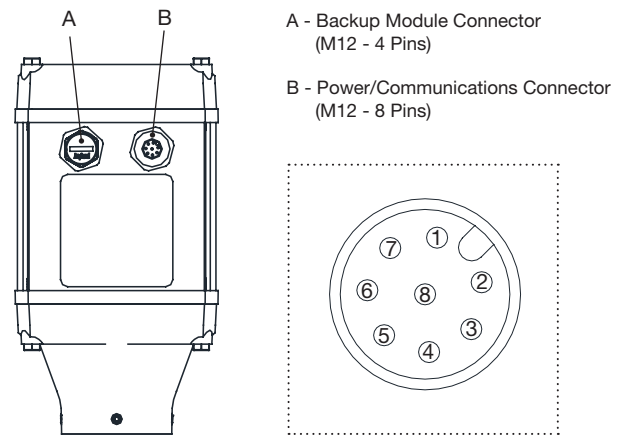
2. Hazardous location coil approvals: Class II, Division 1 & 2, Groups E, F, G; Class IV, Division 1.

Table 3: General Coil Information.

PEV Actuator

The PEV actuator requires 24 VDC power and a 4-20 mA input signal. The acceptable voltage range is 24 ± 2 for the power supply. The power supply should be sized to provide a minimum of 1.3 Amp of current to the PEV actuator. The PEV can be connected to a capacitive Parker Backup Module (PBM) via the four pin quick disconnect cable. The PBM is designed to position the PEV to a pre-determined user-identified position in the event of a power loss. The PEV can also be connected to a user-supplied Uninterruptible Power Supply (UPS) via pin 2 on the eight pin communication cable. The UPS should be sized to supply the necessary voltage and current to the PEV. For system wiring, the PEV comes with a 3 meters (9.8 feet) power cable. If needed the communication cable can be extended to a maximum of 60 meters (196.9 feet) with an 18 AWG 8 pins cable.

At a minimum, the PEV actuator needs to be connected to a 24 VDC power supply (pins 1 & 8) and be provided with a 4-20 mA control signal (pins 5 & 6).



Manual Opening Operation

Solenoid/Regulator Control Module

The solenoid and regulator control modules, position three of both the four and five valve stations; and position two of a three valve station are equipped with a manual driven opening stem located in the center on the top side of the port plate. To manually bypass or open the pressure regulator or solenoid, turn the stem in (clockwise) until it stops. To put the solenoid or pressure regulator back in automatic operation, turn the stem out (counter-clockwise) until it back seats, see Figure 12.

The dual or two stage solenoid valve will open manually in the same manner previously explained for a single solenoid/regulator; the difference is that it will be opened 10%.

Electronic Control Module

The PEV manual opening tool is for the purpose of opening or closing the valve without the use of the actuator. Prior to using the opening tool, turn off the main power to the PEV and disconnect all cords from the actuator. Loosen the four M4 set screws around the base of the actuator and lift the actuator off the valve body.

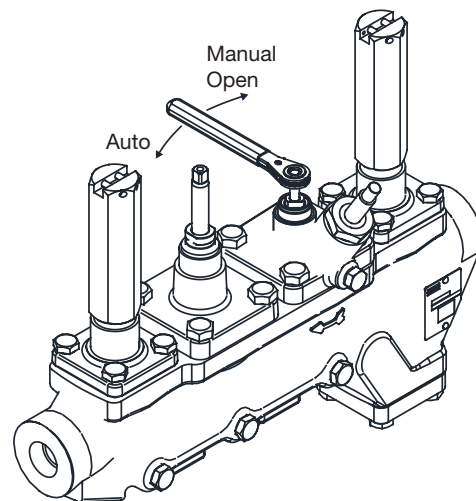


Figure 12: Solenoid/Regulator Control Module Manual Opening Stem.

Once the actuator has been removed, the manual opening tool can be placed on the magnet assembly and manually rotated to open or close the valve, as shown in Figure 11. Clockwise motion will result in the valve opening and counter-clockwise motion will result in the valve closing. The manual opening tool is designed so that no external tools, wrenches, or levers are required to manually operate the valve.

Note: Manual opening tool is ordered separately.

Apply o-ring grease to the actuator's o-ring before reattaching the PEV actuator to the valve. Before attaching the actuator to the valve body check to see that the set screws are not going to cause any interference. If the set screws are protruding into the bore, use the hex wrench (Allen key) to back out the set screws. Then slide the actuator onto the valve and press down until the flat surface of the actuator touches the valve. Once the actuator is in position, use the hex wrench to tighten the set screws.

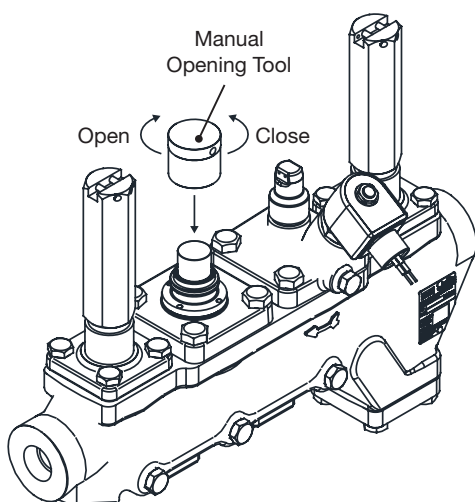
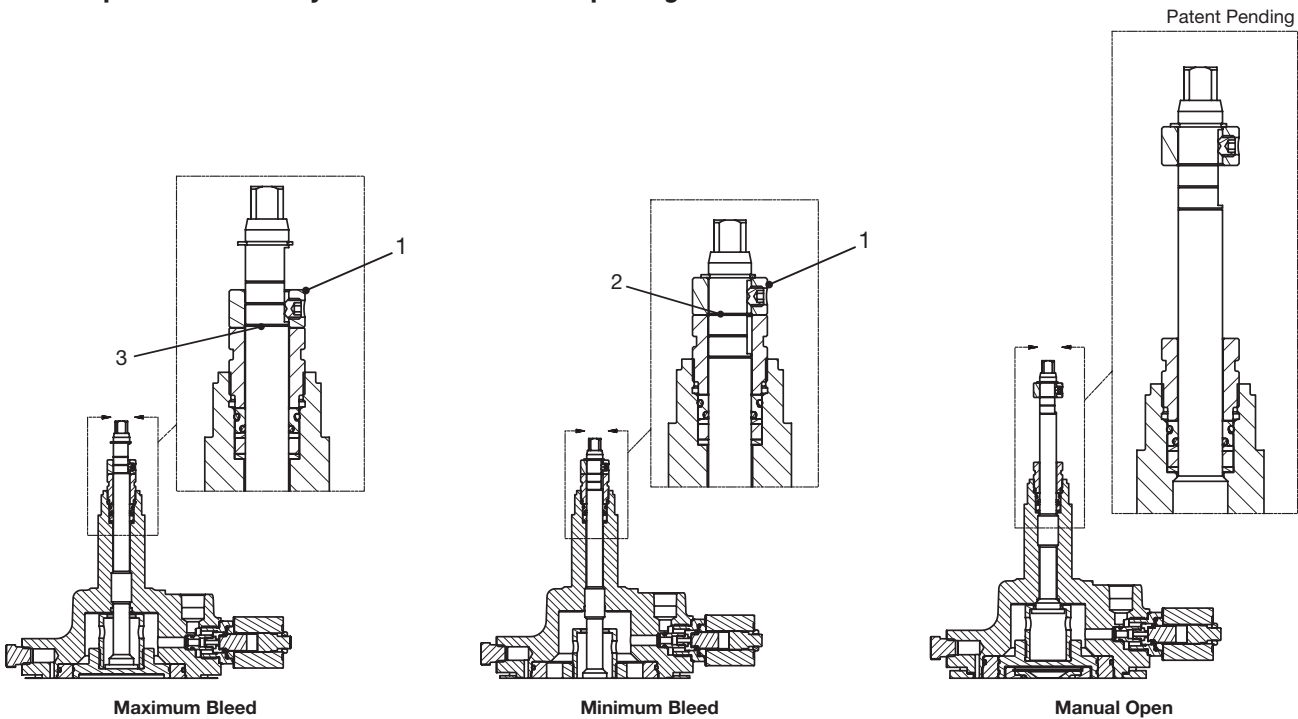


Figure 11: Electronic Module Manual Opening Tool.

Suction Stop Bleed Rate Adjustment & Manual Opening



Variable Bleed: To adjust the bleed rate, first loosen the setpoint collar (1). Using a 1/4" wrench, turn the adjustment stem between the maximum (2) and minimum (3) bleed rate lines. Slide the setpoint collar down and lock it in place using a 1/8" Allen wrench.

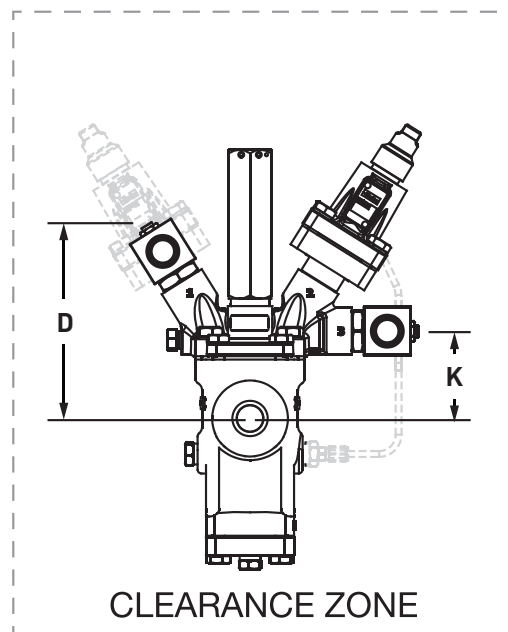
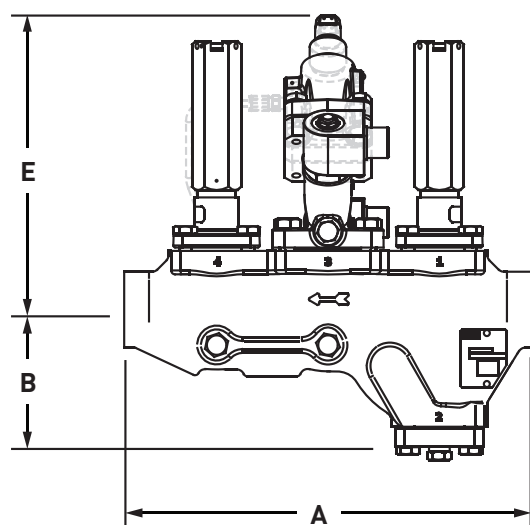
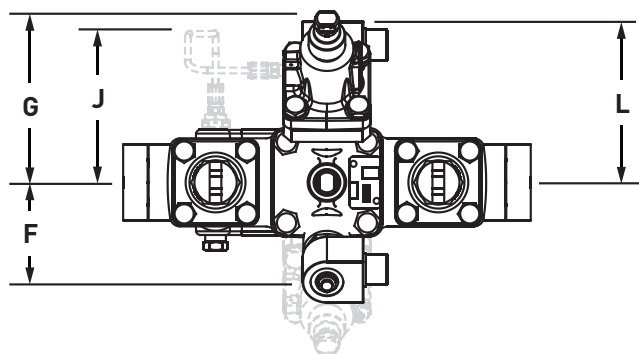
Manual Open: To put the normally open valve into manual open mode, turn the adjustment stem counter-clockwise until it is in the full out position. To put the valve back into automatic mode, turn the stem in until it reaches the set point previously established with the setpoint collar.

Nameplate Information

Port Size	Name Plate Image	Name Plate
20 mm, 25 mm (3/4", 1")		1. Serial Number (S/N) 2. Year Manufactured 3. Valve Model Number (Smart Part Number) 4. Port Size 5. Connection Type 6. Connection Size
32 mm, 40 mm, 50 mm, 65 mm, 80 mm (1 1/4", 1 1/2", 2", 2 1/2", 3")		

Dimensional Information

Three and Four Position Valve - Solenoids and Regulators



Port Size		A		B		D		F		L		K		J	
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
20, 25	¾, 1	335	13.2	112	4.4	157	6.2	85	3.4	138	5.4	71	2.8	124	4.9
32, 40	1¼, 1½	404	15.9	161	6.3	175	6.9	83	3.3	138	5.4	81	3.2	165	6.5
50	2	476	18.8	*164/112	*6.4/4.4	182	7.2	89	3.5	148	5.8	94	3.7	137	5.4
65, 80	2½, 3	572	20.1	*202/142	*8.0/5.6	183	7.2	99	3.9	152	6.0	92	3.6	132	5.2

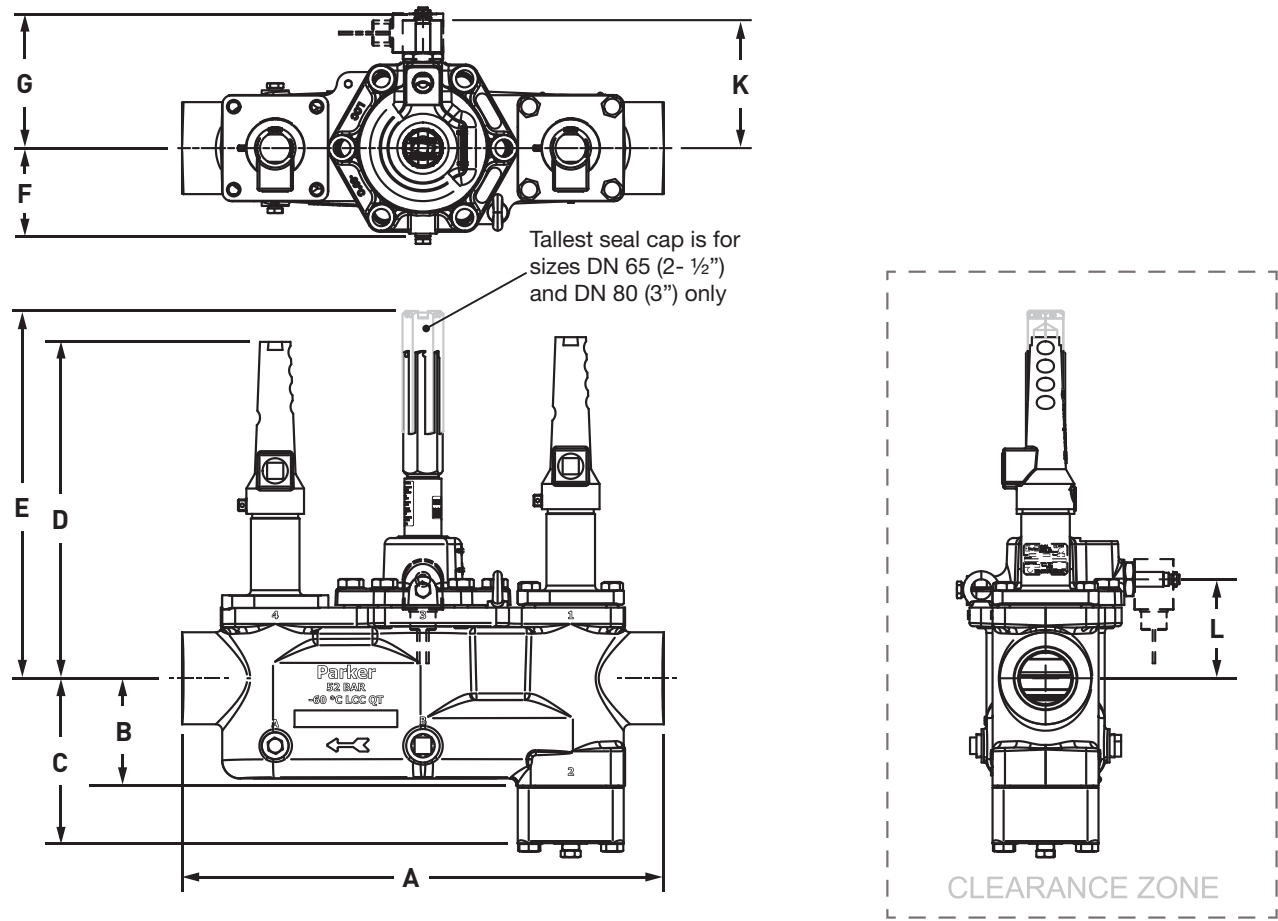
* Smaller dimension is without strainer.

Port Size		E										G									
		Inlet Regulators				Outlet Regulators		Differential Regulators				Inlet Regulators				Outlet Regulators		Differential Regulators			
		Range A, D		Range E		Range V, D		Range A, D		Range E		Range A, D		Range E		Range V, D		Range A, D		Range E	
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
20, 25	¾, 1	242	9.5	273	10.8	264	10.4	264	10.4	273	10.8	142	5.6	6.1	160	160	6.3	160	6.3	6.1	160
32, 40	1¼, 1½	245	9.7	277	10.9	267	10.5	267	10.5	277	10.9	137	5.4	6.4	156	156	6.1	156	6.1	162	6.4
50	2	267	10.5	299	11.8	290	11.4	290	11.4	299	11.8	143	5.6	6.4	157	157	6.2	157	6.2	162	6.4
65, 80	2½, 3	268	10.5	300	11.8	292	11.5	292	11.5	300	11.8	151	6.0	6.7	166	166	6.6	166	6.6	171	6.7

Clearance Zone:

1. The top of the PVS requires a clearance of 152 mm (6") for the removal of the regulator pilot, solenoid pilot, PEV actuator, and seal caps for hand valve, stop/check or hand expansion valves. Modules varies according to each application.
2. The bottom of the PVS requires a clearance of 102 mm (4") for the removal of the strainer basket.
3. Both the left and right side of the PVS, widest valve setup as shown above, requires a minimum of 76 mm (3") on each side.

Three and Four Position Valve - Suction Stop



Port Size		A		B*		C**		D		E		F		G		K		L	
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
50	2	476	18.8	111	4.4	164	6.4	333	13.1	324	12.8	88	3.5	132	5.2	98	3.9	127	5.0
65,80	2½,3	512	20.1	141	5.5	191	7.5	345	13.6	361	14.2	95	3.7	139	5.5	112	4.4	133	5.2

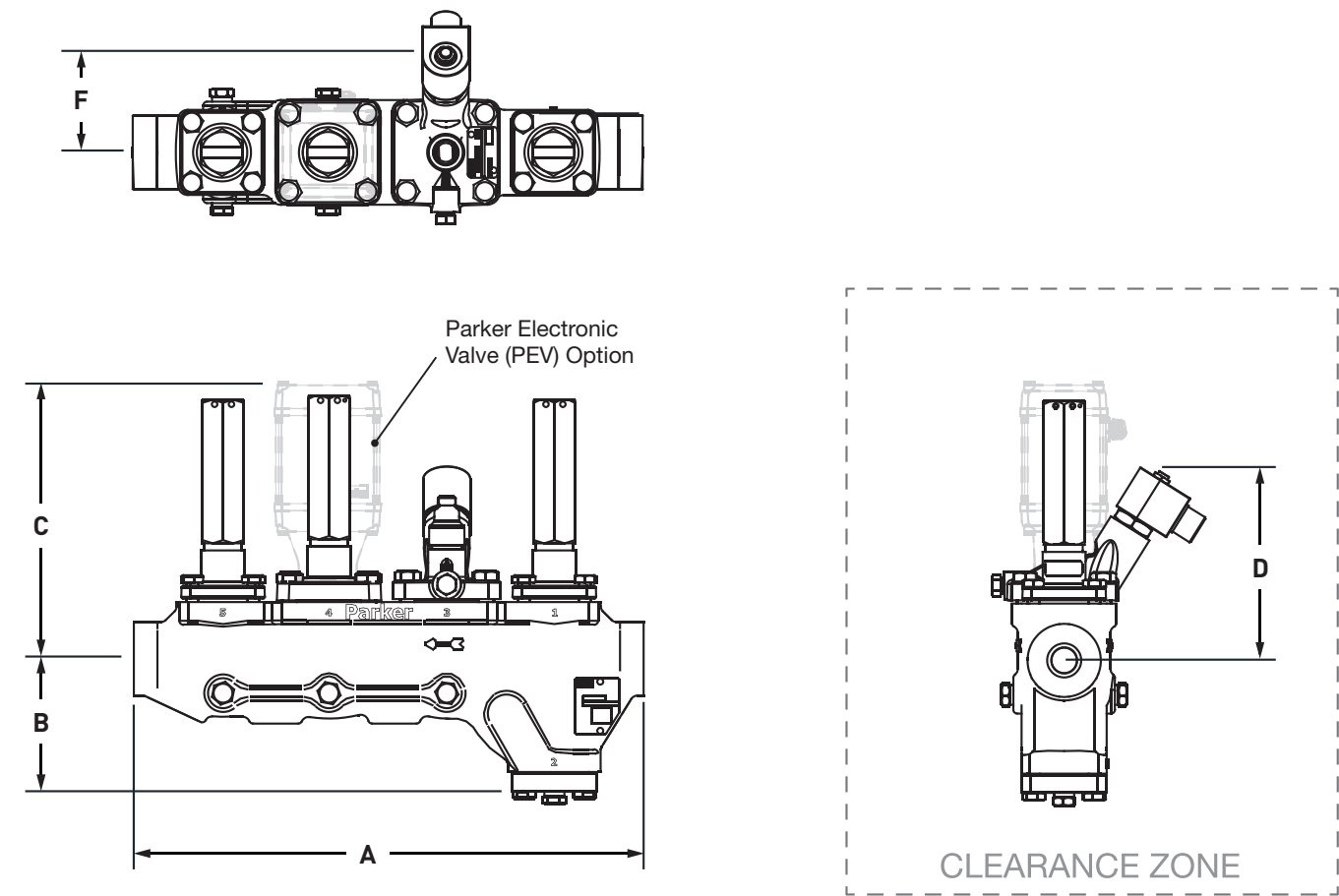
* Valid for PVS3 only (without strainer).

** Valid for PVS4 only (with strainer).

Clearance Zone:

1. The top of the PVS requires a clearance of 178 mm (7") for the removal of the Suction Stop actuator and hand valve seal caps.
2. The bottom of the PVS requires a clearance of 102 mm (4") for the removal of the cover and/or strainer basket.
3. Both the left and right side of the PVS, widest valve setup as shown above, requires a minimum of 76 mm (3") on each side.

Five Position Valve

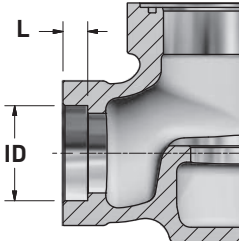
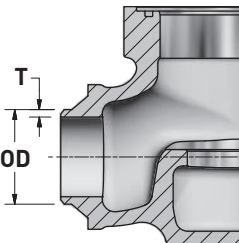
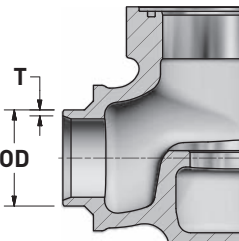


Port Size		A		B		C (PEV)		D		F	
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
20, 25	¾, 1	434	17.1	112	4.4	234	9.2	157	6.2	85	3.4
32, 40	1¼, 1½	535	21.1	161	6.3	252	9.9	175	6.9	83	3.3

Clearance Zone:

1. The top of the PVS requires a clearance of 152 mm (6") for the removal of the PEV actuator and hand valve seal caps.
2. The bottom of the PVS requires a clearance of 102 mm (4") for the removal of the strainer basket.
3. Both the left and right side of the PVS, widest valve setup as shown above, requires a minimum of 76 mm (3") on each side.

Connection Type - Dimensions

Socket Weld (SW) ANSI		<table><tr><th colspan="2">Port Size</th><th rowspan="2">Connection</th><th colspan="2">L</th><th colspan="2">ID</th></tr><tr><th>mm</th><th>inch</th><th>mm</th><th>inch</th><th>mm</th><th>inch</th></tr><tr><td rowspan="3">20 25</td><td rowspan="3">3/4 1</td><td>3/4"</td><td rowspan="3">12.7</td><td rowspan="3">0.50</td><td>27.3</td><td>1.075</td></tr><tr><td>1"</td><td>34.0</td><td>1.340</td></tr><tr><td>1 1/4"</td><td>42.8</td><td>1.685</td></tr><tr><td rowspan="3">32 40</td><td rowspan="3">1 1/4 1 1/2</td><td>1 1/4"</td><td rowspan="3">12.7</td><td rowspan="3">0.50</td><td>42.8</td><td>1.685</td></tr><tr><td>1 1/2"</td><td>48.9</td><td>1.925</td></tr><tr><td>2"</td><td>61.4</td><td>2.416</td></tr><tr><td rowspan="2">50</td><td rowspan="2">2</td><td>2"</td><td rowspan="2">15.9</td><td rowspan="2">0.63</td><td>61.4</td><td>2.416</td></tr><tr><td>2 1/2"</td><td>74.1</td><td>2.919</td></tr><tr><td>65 80</td><td>2 1/2 3</td><td>2 1/2"</td><td>15.9</td><td>0.63</td><td>74.1</td><td>2.919</td></tr></table>	Port Size		Connection	L		ID		mm	inch	mm	inch	mm	inch	20 25	3/4 1	3/4"	12.7	0.50	27.3	1.075	1"	34.0	1.340	1 1/4"	42.8	1.685	32 40	1 1/4 1 1/2	1 1/4"	12.7	0.50	42.8	1.685	1 1/2"	48.9	1.925	2"	61.4	2.416	50	2	2"	15.9	0.63	61.4	2.416	2 1/2"	74.1	2.919	65 80	2 1/2 3	2 1/2"	15.9	0.63	74.1	2.919																																												
		Port Size		Connection		L		ID																																																																																														
mm	inch	mm	inch		mm	inch																																																																																																
20 25	3/4 1	3/4"	12.7	0.50	27.3	1.075																																																																																																
		1"			34.0	1.340																																																																																																
		1 1/4"			42.8	1.685																																																																																																
32 40	1 1/4 1 1/2	1 1/4"	12.7	0.50	42.8	1.685																																																																																																
		1 1/2"			48.9	1.925																																																																																																
		2"			61.4	2.416																																																																																																
50	2	2"	15.9	0.63	61.4	2.416																																																																																																
		2 1/2"			74.1	2.919																																																																																																
65 80	2 1/2 3	2 1/2"	15.9	0.63	74.1	2.919																																																																																																
Butt-Weld (BW) ANSI		<table><tr><th colspan="2">Port Size</th><th rowspan="2">Connection</th><th rowspan="2">Valve Body Material</th><th colspan="2">T</th><th colspan="2">OD</th></tr><tr><th>mm</th><th>inch</th><th>mm</th><th>inch</th><th>mm</th><th>inch</th></tr><tr><td rowspan="6">20 25</td><td rowspan="6">3/4 1</td><td rowspan="2">3/4"</td><td>Steel (PVSW)</td><td>4.06</td><td>0.160</td><td rowspan="2">26.9</td><td rowspan="2">1.06</td></tr><tr><td>Stainless Steel (PVSC)</td><td>3.05</td><td>0.120</td></tr><tr><td rowspan="2">1"</td><td>Steel (PVSW)</td><td>4.57</td><td>0.180</td><td rowspan="2">33.7</td><td rowspan="2">1.33</td></tr><tr><td>Stainless Steel (PVSC)</td><td>3.56</td><td>0.140</td></tr><tr><td rowspan="2">1 1/4"</td><td>Steel (PVSW)</td><td>5.08</td><td>0.200</td><td rowspan="2">42.4</td><td rowspan="2">1.67</td></tr><tr><td>Stainless Steel (PVSC)</td><td>3.81</td><td>0.150</td></tr><tr><td rowspan="6">32 40</td><td rowspan="6">1 1/4 1 1/2</td><td rowspan="2">1 1/4"</td><td>Steel (PVSW)</td><td>5.08</td><td>0.200</td><td rowspan="2">42.4</td><td rowspan="2">1.67</td></tr><tr><td>Stainless Steel (PVSC)</td><td>3.81</td><td>0.150</td></tr><tr><td rowspan="2">1 1/2"</td><td>Steel (PVSW)</td><td>5.33</td><td>0.210</td><td rowspan="2">48.5</td><td rowspan="2">1.91</td></tr><tr><td>Stainless Steel (PVSC)</td><td>3.81</td><td>0.150</td></tr><tr><td rowspan="2">2"</td><td>All</td><td>4.06</td><td>0.160</td><td rowspan="2">60.7</td><td rowspan="2">2.39</td></tr><tr><td>All</td><td>5.33</td><td>0.210</td></tr><tr><td rowspan="2">50</td><td rowspan="2">2</td><td>2"</td><td>All</td><td>4.06</td><td>0.160</td><td>60.7</td><td>2.39</td></tr><tr><td>2 1/2"</td><td>All</td><td>5.33</td><td>0.210</td><td>73.4</td><td>2.89</td></tr><tr><td rowspan="2">65 80</td><td rowspan="2">2 1/2 3</td><td>2 1/2"</td><td>All</td><td>5.33</td><td>0.210</td><td>73.4</td><td>2.89</td></tr><tr><td>3"</td><td>All</td><td>5.61</td><td>0.221</td><td>89.2</td><td>3.51</td></tr></table>	Port Size		Connection	Valve Body Material	T		OD		mm	inch	mm	inch	mm	inch	20 25	3/4 1	3/4"	Steel (PVSW)	4.06	0.160	26.9	1.06	Stainless Steel (PVSC)	3.05	0.120	1"	Steel (PVSW)	4.57	0.180	33.7	1.33	Stainless Steel (PVSC)	3.56	0.140	1 1/4"	Steel (PVSW)	5.08	0.200	42.4	1.67	Stainless Steel (PVSC)	3.81	0.150	32 40	1 1/4 1 1/2	1 1/4"	Steel (PVSW)	5.08	0.200	42.4	1.67	Stainless Steel (PVSC)	3.81	0.150	1 1/2"	Steel (PVSW)	5.33	0.210	48.5	1.91	Stainless Steel (PVSC)	3.81	0.150	2"	All	4.06	0.160	60.7	2.39	All	5.33	0.210	50	2	2"	All	4.06	0.160	60.7	2.39	2 1/2"	All	5.33	0.210	73.4	2.89	65 80	2 1/2 3	2 1/2"	All	5.33	0.210	73.4	2.89	3"	All	5.61	0.221	89.2	3.51
		Port Size		Connection			Valve Body Material	T		OD																																																																																												
mm	inch	mm	inch		mm	inch																																																																																																
20 25	3/4 1	3/4"	Steel (PVSW)	4.06	0.160	26.9	1.06																																																																																															
			Stainless Steel (PVSC)	3.05	0.120																																																																																																	
		1"	Steel (PVSW)	4.57	0.180	33.7	1.33																																																																																															
			Stainless Steel (PVSC)	3.56	0.140																																																																																																	
		1 1/4"	Steel (PVSW)	5.08	0.200	42.4	1.67																																																																																															
			Stainless Steel (PVSC)	3.81	0.150																																																																																																	
32 40	1 1/4 1 1/2	1 1/4"	Steel (PVSW)	5.08	0.200	42.4	1.67																																																																																															
			Stainless Steel (PVSC)	3.81	0.150																																																																																																	
		1 1/2"	Steel (PVSW)	5.33	0.210	48.5	1.91																																																																																															
			Stainless Steel (PVSC)	3.81	0.150																																																																																																	
		2"	All	4.06	0.160	60.7	2.39																																																																																															
			All	5.33	0.210																																																																																																	
50	2	2"	All	4.06	0.160	60.7	2.39																																																																																															
		2 1/2"	All	5.33	0.210	73.4	2.89																																																																																															
65 80	2 1/2 3	2 1/2"	All	5.33	0.210	73.4	2.89																																																																																															
		3"	All	5.61	0.221	89.2	3.51																																																																																															
Butt-Weld (BW DIN) Metric		<table><tr><th colspan="2">Port Size</th><th rowspan="2">Connection</th><th rowspan="2">Valve Body Material</th><th colspan="2">T</th><th colspan="2">OD</th></tr><tr><th>mm</th><th>inch</th><th>mm</th><th>inch</th><th>mm</th><th>inch</th></tr><tr><td rowspan="3">20 25</td><td rowspan="3">3/4 1</td><td>DN20</td><td>All</td><td>2.30</td><td>0.091</td><td>26.9</td><td>1.06</td></tr><tr><td>DN25</td><td>All</td><td>2.60</td><td>0.102</td><td>33.7</td><td>1.33</td></tr><tr><td>DN32</td><td>All</td><td>2.60</td><td>0.102</td><td>42.4</td><td>1.67</td></tr><tr><td rowspan="3">32 40</td><td rowspan="3">1 1/4 1 1/2</td><td>DN32</td><td>All</td><td>2.60</td><td>0.102</td><td>42.4</td><td>1.67</td></tr><tr><td>DN40</td><td>All</td><td>2.60</td><td>0.102</td><td>48.3</td><td>1.90</td></tr><tr><td>DN50</td><td>All</td><td>2.90</td><td>0.114</td><td>60.3</td><td>2.37</td></tr><tr><td rowspan="2">50</td><td rowspan="2">2</td><td>DN50</td><td>All</td><td>2.90</td><td>0.114</td><td>60.3</td><td>2.37</td></tr><tr><td>DN65</td><td>All</td><td>2.90</td><td>0.114</td><td>76.1</td><td>3.00</td></tr><tr><td rowspan="2">65 80</td><td rowspan="2">2 1/2 3</td><td>DN65</td><td>All</td><td>2.90</td><td>0.114</td><td>76.1</td><td>3.00</td></tr><tr><td>DN80</td><td>All</td><td>3.20</td><td>0.126</td><td>88.9</td><td>3.50</td></tr></table>	Port Size		Connection	Valve Body Material	T		OD		mm	inch	mm	inch	mm	inch	20 25	3/4 1	DN20	All	2.30	0.091	26.9	1.06	DN25	All	2.60	0.102	33.7	1.33	DN32	All	2.60	0.102	42.4	1.67	32 40	1 1/4 1 1/2	DN32	All	2.60	0.102	42.4	1.67	DN40	All	2.60	0.102	48.3	1.90	DN50	All	2.90	0.114	60.3	2.37	50	2	DN50	All	2.90	0.114	60.3	2.37	DN65	All	2.90	0.114	76.1	3.00	65 80	2 1/2 3	DN65	All	2.90	0.114	76.1	3.00	DN80	All	3.20	0.126	88.9	3.50																		
		Port Size		Connection			Valve Body Material	T		OD																																																																																												
mm	inch	mm	inch		mm	inch																																																																																																
20 25	3/4 1	DN20	All	2.30	0.091	26.9	1.06																																																																																															
		DN25	All	2.60	0.102	33.7	1.33																																																																																															
		DN32	All	2.60	0.102	42.4	1.67																																																																																															
32 40	1 1/4 1 1/2	DN32	All	2.60	0.102	42.4	1.67																																																																																															
		DN40	All	2.60	0.102	48.3	1.90																																																																																															
		DN50	All	2.90	0.114	60.3	2.37																																																																																															
50	2	DN50	All	2.90	0.114	60.3	2.37																																																																																															
		DN65	All	2.90	0.114	76.1	3.00																																																																																															
65 80	2 1/2 3	DN65	All	2.90	0.114	76.1	3.00																																																																																															
		DN80	All	3.20	0.126	88.9	3.50																																																																																															

Service Pointers

Do not open the valve to atmosphere, strainer, control module or any other device until the refrigerant has been evacuated. All personnel working on valves must be qualified to work on refrigeration systems. Any person intending to service a valve should read the appropriate product and safety bulletin before performing any work on Parker products.

1. Failure to Close: (a) Pilot solenoids are not operating due to low voltage or solenoid coil burnout. (b) Dirt lodged between the cartridge and the cylinder wall (disassemble and remove all dirt and burrs). It is highly recommended to clean thoroughly the strainer module and other modules too. (c) Manual lift stem is turned in, thereby mechanically holding the cartridge in the open position. (d) Dirt in solenoid of the suction stop module (remove and clean). (e) Pilot pressure source for suction stop variant is not high enough; must be at least 1.38 bard (20 psid) above the main valve downstream pressure. (f) Solenoid coils are not being energized in the proper sequence. (g) For the electronic motor and coils review the range of application and M.O.P.D. (h) Main control module spring may be broken/deformed (replace spring). (i) Inspect the quality, integrity, gauge wiring (AWG), electric connection, voltage, and neutral.

2. Failure to Open: (a) Dirt lodged between the cartridge and the cylinder walls (Disassemble and remove dirt and burrs). It is highly recommended to clean thoroughly the strainer module and other modules too. (b) For the suction stop module, the spring may be broken/deformed (replace spring). (c) In the suction stop variant, the pressure between remote pressure source and main valve downstream pressures are not equalizing. (d) Viscous oil can prevent the valve from opening. (e) Inspect the quality, integrity, gauge wiring (AWG), electric connection, voltage, and neutral. (f) For the PEV actuator, check the power supply, it should provide a minimum of 1.3 Amps of current @24 VDC.

3. To properly install and/or remove solenoid coil over the solenoid operator on Parker PVS products:

- Identify the parts, see Figure 13.
- Place the solenoid coil over the solenoid operator.
- Install the wave spring (included with the coil) over the Solenoid Operator on top of the coil.
- Inspect the Solenoid Operator threads for damage. If the threads are damaged, the Solenoid Operator Assembly must be replaced.
- Thread the coil retaining nut (included with the coil) or optional LED knob onto the Solenoid Operator until it contacts the wave spring. Take caution to avoid cross threading.
- Rotate the nut or knob an additional $\frac{1}{4}$ to $\frac{1}{2}$ turn, compressing the wave spring.
- To remove the coil, unthread the coil retaining nut or the LED knob. Torque must not exceed 6.8 Nm (5 ft. lb.).

If cross threading occurred or the threads were damaged, excess torque may be required for removal. This higher torque could unthread the Solenoid Operator from the valve leading to a refrigerant leak. **If the unthreading torque exceeds 6.8 Nm (5 ft. lb.), the refrigerant in the valve must be evacuated before proceeding.**

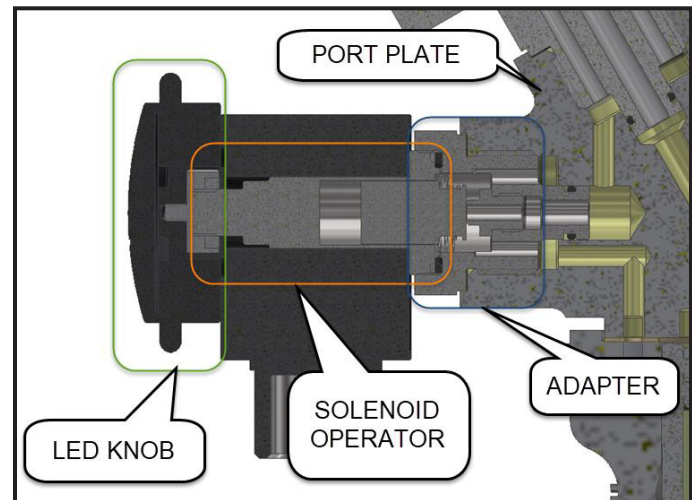


Figure 13: Install and Remove Solenoid Coil over the Solenoid Operator.

A P P E N D I X

Schematic Flow Diagrams

Schematic Flow Diagrams

PS4_
Solenoid

PISTON

S1

VALVE INLET

Control Function	Operation
	S1
Open	Energized
Shut-Off	De-Energized

PS4D
Two-Stage Solenoid

Patent Pending

PISTON

S1

S2

VALVE INLET

Control Function	Operation	
	S1	S2
10% Open	De-Energized	Energized
100% Open	Energized	Energized
Shut-Off	De-Energized	De-Energized

Proper sequencing (energizing and de-energizing) of the solenoid coils is essential for proper operation of the PS4D valve.

PA4_ / PA4_K
Inlet Pressure Regulator

PISTON

P1

VALVE INLET

Control Function	Operation
	P1
Pressure Pilot (P1)	Modulating/Regulation

PA4_S
Inlet Pressure Regulator with Electric Shut-Off

PISTON

P1

S1

VALVE INLET

Control Function	Operation
	S1
Pressure Pilot (P1)	Energized
Shut-Off	De-Energized

Schematic Flow Diagrams

PA4_B

Inlet Pressure Regulator with Electric Wide Open

PISTON

P1

S1

VALVE INLET

Control Function	Operation
	S1
Pressure Pilot (P1)	De-Energized
Wide Open	Energized

PA4_BS

Inlet Pressure Regulator with Electric Shut-Off and Electric Wide Open

PISTON

P1

S1

S2

VALVE INLET

Control Function	Operation	
	S1 (Position 1)	S2 (Position 3)
Pressure Pilot (P1) (Position 2)	De-Energized	Energized
Shut-Off	De-Energized	De-Energized
Wide Open	Energized	Energized/De-Energized

PA4_D

Dual Inlet Pressure Regulator

PISTON

P2

P1

S1

VALVE INLET

Control Function	Operation
	S1 (Position 3)
Low Pressure Pilot (P1) (Position 2)	Energized
High Pressure Pilot (P2) (Position 1)	De-Energized

PA4_DS

Inlet Dual Pressure Regulator with Electric Shut-Off

PISTON

P2

P1

S2

S1

VALVE INLET

Control Function	Operation	
	S1 (Position 3)	S2 (Position 1)
Low Pressure Pilot (P1) (Position 2)	Energized	De-Energized/Energized
High Pressure Pilot (P2) (Position 1)	De-Energized	Energized
Shut-Off	De-Energized	De-Energized

Schematic Flow Diagrams

PA4_DB

Inlet Dual Pressure Regulator with Electric Wide Open

Control Function	Operation	
	S1 (Position 3)	S2 (Position 1)
Low Pressure Pilot (P1) (Position 2)	Energized	De-Energized
High Pressure Pilot (P2) (Position 1)	De-Energized	De-Energized
Wide Open	De-Energized/ Energized	Energized

PA4_L

Differential Pressure Regulator

Control Function	Operation
	P1
Pressure Pilot (P1)	Differential Regulation

PA4_0

Outlet Pressure Regulator

Control Function	Operation
	P1
Pressure Pilot (P1)	Modulating/Regulation

PA4_OS

Outlet Pressure Regulator with Electric Shut-Off

Control Function	Operation
	S1
Pressure Pilot (P1)	Energized
Shut-Off	De-Energized

Patent Pending

GSS Suction Stop

PISTON

S1

VALVE INLET

Control Function	Operation
	S1
100% Open	De-Energized
Bleed Mode	(10 - 30%) De-Energized w/ high ΔP
Shut-Off	Energized

PARKER-HANNIFIN CORPORATION**OFFER OF SALE**

1. Definitions. As used herein, the following terms have the meanings indicated.

Buyer:	means any customer receiving a Quote for Products.
Goods:	means any tangible part, system or component to be supplied by Seller.
Products:	means the Goods, Services and/or Software as described in a Quote.
Quote:	means the offer or proposal made by Seller to Buyer for the supply of Products.
Seller:	means Parker-Hannifin Corporation, including all divisions and businesses thereof.
Services:	means any services to be provided by Seller.
Software:	means any software related to the Goods, whether embedded or separately downloaded.
Terms:	means the terms and conditions of this Offer of Sale.

2. Terms. All sales of Products by Seller are expressly conditioned upon, and will be governed by the acceptance of, these Terms. These Terms are incorporated into any Quote provided by Seller to Buyer. Buyer's order for any Products whether communicated to Seller verbally, in writing, by electronic data interface or other electronic commerce, shall constitute acceptance of these Terms. Seller objects to any contrary or additional terms or conditions of Buyer. Reference in Seller's order acknowledgement to Buyer's purchase order or purchase order number shall in no way constitute an acceptance of any of Buyer's terms or conditions of purchase. No modification to these Terms will be binding on Seller unless agreed to in writing and signed by an authorized representative of Seller.

3. Price; Payment. The Products set forth in the Quote are offered for sale at the prices indicated in the Quote. Unless otherwise specifically stated in the Quote, prices are valid for thirty (30) days and do not include any sales, use, or other taxes or duties. Seller reserves the right to modify prices at any time to adjust for any raw material price fluctuations. Unless otherwise specified by Seller, all prices are EXW Seller's facility (INCOTERMS 2020). All sales are contingent upon credit approval and full payment for all purchases is due thirty (30) days from the date of invoice (or such date as may be specified in the Quote). Unpaid invoices beyond the specified payment date incur interest at the rate of 1.5% per month or the maximum allowable rate under applicable law.

4. Shipment; Delivery; Title and Risk of Loss. All delivery dates are approximate, and Seller is not responsible for damages resulting from any delay. Regardless of the manner of shipment, delivery occurs and title and risk of loss or damage pass to Buyer, upon placement of the Products with the carrier at Seller's facility. Unless otherwise agreed prior to shipment and for domestic delivery locations only, Seller will select and arrange, at Buyer's sole expense, the carrier and means of delivery. When Seller selects and arranges the carrier and means of delivery, freight and insurance costs for shipment to the designated delivery location will be prepaid by Seller and added as a separate line item to the invoice. Buyer shall be responsible for any additional shipping charges incurred by Seller due to Buyer's acts or omis-

sions. Buyer shall not return or repack any Products without the prior written authorization from Seller, and any return shall be at the sole cost and expense of Buyer.

5. Warranty. The warranty for the Products is as follows: (i) Goods are warranted against defects in material or workmanship for a period of twelve (12) months from the date of delivery or 2,000 hours of use, whichever occurs first; (ii) Services shall be performed in accordance with generally accepted practices and using the degree of care and skill that is ordinarily exercised and customary in the field to which the Services pertain and are warranted for a period of six (6) months from the date of completion of the Services; and (iii) Software is only warranted to perform in accordance with applicable specifications provided by Seller to Buyer for ninety (90) days from the date of delivery or, when downloaded by a Buyer or end-user, from the date of the initial download. All prices are based upon the exclusive limited warranty stated above, and upon the following disclaimer: **EXEMPTION CLAUSE; DISCLAIMER OF WARRANTY, CONDITIONS, REPRESENTATIONS: THIS WARRANTY IS THE SOLE AND ENTIRE WARRANTY, CONDITION, AND REPRESENTATION, PERTAINING TO PRODUCTS. SELLER DISCLAIMS ALL OTHER WARRANTIES, CONDITIONS, AND REPRESENTATIONS, WHETHER STATUTORY, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THOSE RELATING TO DESIGN, NONINFRINGEMENT, MERCHANTABILITY, AND FITNESS FOR A PARTICULAR PURPOSE. SELLER DOES NOT WARRANT THAT THE SOFTWARE IS ERROR-FREE OR FAULT-TOLERANT, OR THAT BUYER'S USE THEREOF WILL BE SECURE OR UNINTERRUPTED. UNLESS OTHERWISE AUTHORIZED IN WRITING BY SELLER, THE SOFTWARE SHALL NOT BE USED IN CONNECTION WITH HAZARDOUS OR HIGH RISK ACTIVITIES OR ENVIRONMENTS. EXCEPT AS EXPRESSLY STATED HEREIN, ALL PRODUCTS ARE PROVIDED "AS IS".**

6. Claims; Commencement of Actions. Buyer shall promptly inspect all Products upon receipt. No claims for shortages will be allowed unless reported to Seller within ten (10) days of delivery. Buyer shall notify Seller of any alleged breach of warranty within thirty (30) days after the date the non-conformance is or should have been discovered by Buyer. Any claim or action against Seller based upon breach of contract or any other theory, including tort, negligence, or otherwise must be commenced within twelve (12) months from the date of the alleged breach or other alleged event, without regard to the date of discovery.

7. LIMITATION OF LIABILITY. IN THE EVENT OF A BREACH OF WARRANTY, SELLER WILL, AT ITS OPTION, REPAIR OR REPLACE THE NON-CONFORMING PRODUCT, RE-PERFORM THE SERVICES, OR REFUND THE PURCHASE PRICE PAID WITHIN A REASONABLE PERIOD OF TIME. **IN NO EVENT IS SELLER LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES INCLUDING ANY LOSS OF REVENUE OR PROFITS, WHETHER BASED IN CONTRACT, TORT OR OTHER LEGAL THEORY. IN NO EVENT SHALL SELLER'S LIABILITY UNDER ANY CLAIM MADE BY BUYER EXCEED THE PURCHASE PRICE PAID FOR THE PRODUCTS.**

8. Confidential Information. Buyer acknowledges and agrees that any technical, commercial, or other confidential information of Seller, including, without limitation, pricing, technical drawings or prints and/or part lists, which has been or will be disclosed, delivered or made available, whether

directly or indirectly, to Buyer ("Confidential Information"), has been and will be received in confidence and will remain the property of Seller. Buyer further agrees that it will not use Seller's Confidential Information for any purpose other than for the benefit of Seller.

9. Loss to Buyer's Property. Any tools, patterns, materials, equipment or information furnished by Buyer or which are or become Buyer's property ("Buyer's Property"), will be considered obsolete and may be destroyed by Seller after two (2) consecutive years have elapsed without Buyer ordering the Products manufactured using Buyer's Property. Furthermore, Seller shall not be responsible for any loss or damage to Buyer's Property while it is in Seller's possession or control.

10. Special Tooling. "Special Tooling" includes but is not limited to tools, jigs, fixtures and associated manufacturing equipment acquired or necessary to manufacture Goods. Seller may impose a tooling charge for any Special Tooling. Such Special Tooling shall be and remain Seller's property notwithstanding payment of any charges by Buyer. In no event will Buyer acquire any interest in the Special Tooling, even if such Special Tooling has been specially converted or adapted for manufacture of Goods for Buyer and notwithstanding any charges paid by Buyer. Unless otherwise agreed, Seller has the right to alter, discard or otherwise dispose of any Special Tooling or other property owned by Seller in its sole discretion at any time.

11. Security Interest. To secure payment of all sums due from Buyer, Seller retains a security interest in all Products delivered to Buyer and, Buyer's acceptance of these Terms is deemed to be a Security Agreement under the Uniform Commercial Code. Buyer authorizes Seller as its attorney to execute and file on Buyer's behalf all documents Seller deems necessary to perfect Seller's security interest.

12. User Responsibility. Buyer, through its own analysis and testing, is solely responsible for making the final selection of the Products and assuring that all performance, endurance, maintenance, safety and warning requirements of the application of the Products are met. Buyer must analyze all aspects of the application and follow applicable industry standards, specifications, and any technical information provided with the Quote or the Products, such as Seller's instructions, guides and specifications. If Seller provides options of or for Products based upon data or specifications provided by Buyer, Buyer is responsible for determining that such data and specifications are suitable and sufficient for all applications and reasonably foreseeable uses of the Products. In the event Buyer is not the end-user of the Products, Buyer will ensure such end-user complies with this paragraph.

13. Use of Products, Indemnity by Buyer. Buyer shall comply with all instructions, guides and specifications provided by Seller with the Quote or the Products. **Unauthorized Uses.** If Buyer uses or resells the Products in any way prohibited by Seller's instructions, guides or specifications, or Buyer otherwise fails to comply with Seller's instructions, guides and specifications, Buyer acknowledges that any such use, resale, or non-compliance is at Buyer's sole risk. Further, Buyer shall indemnify, defend, and hold Seller harmless from any losses, claims, liabilities, damages, lawsuits, judgments and costs (including attorney fees and defense costs), whether for personal injury, property damage, intellectual property

infringement or any other claim, arising out of or in connection with: (a) improper selection, design, specification, application, or any misuse of Products; (b) any act or omission, negligent or otherwise, of Buyer; (c) Seller's use of patterns, tools, equipment, plans, drawings, designs, specifications or other information or things furnished by Buyer; (d) damage to the Products from an external cause, repair or attempted repair by anyone other than Seller, failure to follow instructions, guides and specifications provided by Seller, use with goods not provided by Seller, or opening, modifying, deconstructing, tampering with or repackaging the Products; or (e) Buyer's failure to comply with these Terms. Seller shall not indemnify Buyer under any circumstance except as otherwise provided in these Terms.

14. Cancellations and Changes. Buyer may not cancel or modify, including but not limited to movement of delivery dates for the Products, any order for any reason except with Seller's written consent and upon terms that will indemnify, defend and hold Seller harmless against all direct, incidental and consequential loss or damage and any additional expense. Seller, at any time, may change features, specifications, designs and availability of Products.

15. Limitation on Assignment. Buyer may not assign its rights or obligations without the prior written consent of Seller. **16. Force Majeure.** Seller is not liable for delay or failure to perform any of its obligations by reason of events or circumstances beyond its reasonable control. Such circumstances include without limitation: accidents, labor disputes or stoppages, government acts or orders, acts of nature, pandemics, epidemics, other widespread illness, or public health emergency, delays or failures in delivery from carriers or suppliers, shortages of materials, war (whether declared or not) or the serious threat of same, riots, rebellions, acts of terrorism, fire or any reason whether similar to the foregoing or otherwise. Seller will resume performance as soon as practicable after the event of force majeure has been removed. All delivery dates affected by force majeure shall be tolled for the duration of such force majeure and rescheduled for mutually agreed dates as soon as practicable after the force majeure condition ceases to exist. Force majeure shall not include financial distress, insolvency, bankruptcy, or other similar conditions affecting one of the parties, affiliates and/or sub-contractors.

17. Waiver and Severability. Failure to enforce any provision of these Terms will not invalidate that provision; nor will any such failure prejudice either party's right to enforce that provision in the future. Invalidation of any provision of these Terms shall not invalidate any other provision herein and, the remaining provisions will remain in full force and effect.

18. Termination. Seller may terminate any agreement governed by or arising from these Terms for any reason and at any time by giving Buyer thirty (30) days prior written notice. Seller may immediately terminate, in writing, if Buyer: (a) breaches any provision of these Terms, (b) becomes or is deemed insolvent, (c) appoints or has appointed a trustee, receiver or custodian for all or any part of Buyer's property, (d) files a petition for relief in bankruptcy on its own behalf, or one is filed against Buyer by a third party, (e) makes an assignment for the benefit of creditors; or (f) dissolves its business or liquidates all or a majority of its assets.

19. Ownership of Software. Seller retains ownership of all Software supplied to Buyer hereunder. In no event shall Buyer obtain any greater right in and to the Software than a right in the nature of a license limited to the use thereof and subject to compliance with any other terms provided with the Software.

20. Indemnity for Infringement of Intellectual Property Rights. Seller is not liable for infringement of any patents, trademarks, copyrights, trade dress, trade secrets or similar rights ("Intellectual Property Rights") except as provided in this Section. Seller will defend at its expense and will pay the cost of any settlement or damages awarded in an action brought against Buyer based on a third party claim that one or more of the Products sold hereunder infringes the Intellectual Property Rights of a third party in the country of delivery of the Products by Seller to Buyer. Seller's obligation to defend and indemnify Buyer is contingent on Buyer notifying Seller within ten (10) days after Buyer becomes aware of any such claim, and Seller having sole control over the defense of the claim including all negotiations for settlement or compromise. If one or more Products sold hereunder is subject to such a claim, Seller may, at its sole expense and option, procure for Buyer the right to continue using the Products, replace or modify the Products so as to render them non-infringing, or offer to accept return of the Products and refund the purchase price less a reasonable allowance for depreciation. Seller has no obligation or liability for any claim of infringement: (i) arising from information provided by Buyer; or (ii) directed to any Products provided hereunder for which the designs are specified in whole or part by Buyer; or (iii) resulting from the modification, combination or use in a system of any Products provided hereunder. The foregoing provisions of this Section constitute Seller's sole and exclusive liability and Buyer's sole and exclusive remedy for claims of infringement of Intellectual Property Rights.

21. Governing Law. These Terms and the sale and delivery of all Products are deemed to have taken place in, and shall be governed and construed in accordance with, the laws of the State

of Ohio, as applicable to contracts executed and wholly performed therein and without regard to conflicts of laws principles. Buyer irrevocably agrees and consents to the exclusive jurisdiction and venue of the courts of Cuyahoga County, Ohio with respect to any dispute, controversy or claim arising out of or relating to the sale and delivery of the Products.

22. Entire Agreement. These Terms, along with the terms set forth in the main body of any Quote, forms the entire agreement between the Buyer and Seller and constitutes the final, complete and exclusive expression of the terms of sale and purchase. In the event of a conflict between any term set forth in the main body of a Quote and these Terms, the terms set forth in the main body of the Quote shall prevail. All prior or contemporaneous written or oral agreements or negotiations with respect to the subject matter shall have no effect. These Terms may not be modified unless in writing and signed by an authorized representative of Seller.

23. Compliance with Laws. Buyer agrees to comply with all applicable laws, regulations, and industry and professional standards, including those of the United States of America, and the country or countries in which Buyer may operate, including without limitation the U.S. Foreign Corrupt Practices Act ("FCPA"), the U.S. Anti-Kickback Act ("Anti-Kickback Act"), U.S. and E.U. export control and sanctions laws ("Export Laws"), the U.S. Food Drug and Cosmetic Act ("FDCA"), and the rules and regulations promulgated by the U.S. Food and Drug Administration ("FDA"), each as currently amended. Buyer agrees to indemnify, defend, and hold harmless Seller from the consequences of any violation of such laws, regulations and standards by Buyer, its employees or agents. Buyer acknowledges that it is familiar with all applicable provisions of the FCPA, the Anti-Kickback Act, Export Laws, the FDCA and the FDA and certifies that Buyer will adhere to the requirements thereof and not take any action that would make Seller violate such requirements. Buyer represents and agrees that Buyer will not make any payment or give anything of value, directly or indirectly, to any governmental official, foreign political party or official thereof, candidate for foreign political office, or commercial entity or person, for any improper purpose, including the purpose of influencing such person to purchase Products or otherwise benefit the business of Seller. Buyer further represents and agrees that it will not receive, use, service, transfer or ship any Products from Seller in a manner or for a purpose that violates Export Laws or would cause Seller to be in violation of Export Laws. Buyer agrees to promptly and reliably provide Seller all requested information or documents, including end-user statements and other written assurances, concerning Buyer's ongoing compliance with Export Laws.

Safe Operation (See Bulletin RSBCV y RSBHV)

People doing any work on a refrigeration system must be qualified and completely familiar with the system and the Refrigerating Specialties Division valves involved, or all other precautions will be meaningless. This includes reading and understanding pertinent Refrigerating Specialties Division Product Bulletins and Safety Bulletin RSB prior to installation or servicing work.

Where cold refrigerant liquid lines are used, it is necessary that certain precautions be taken to avoid damage which could result from liquid expansion. Temperature increase in a piping section full of solid liquid will cause high pressure due to the expanding liquid which can possibly rupture a gasket, pipe or valve. All hand valves isolating such sections should be marked, warning against accidental closing, and must not be closed until the liquid is removed. Check valves must never be installed upstream of solenoid valves, or regulators with electric shut-off, nor should hand valves upstream of solenoid valves or downstream of check valves be closed until the liquid has been removed.

It is advisable to properly install relief devices in any section where liquid expansion could take place. Avoid all piping or control arrangements which might produce thermal or pressure shock.

For the protection of people and products, all refrigerant must be removed from the section to be worked on before a valve, strainer, or other device is opened or removed. Flanges with ODS connections are not suitable for ammonia service.

Warranty

All Refrigerating Specialties products are under warranty against defects in workmanship and materials for a period of one year from date of shipment from factory. This warranty is in force only when products are properly installed, field assembled, maintained, and operated in use and service as specifically stated in Refrigerating Specialties Catalogs or Bulletins for normal refrigeration applications, unless otherwise approved in writing by the Refrigerating Specialties Division. Defective products, or parts thereof returned to the

factory with transportation charges prepaid and found to be defective by factory inspection, will be replaced or repaired at Refrigerating Specialties option, free of charge, F.O.B. factory. Warranty does not cover products which have been altered, or repaired in the field, damaged in transit, or have suffered accidents, misuse, or abuse. Products disabled by dirt or other foreign substances will not be considered defective.

The express warranty set forth above constitutes the only warranty applicable to Refrigerating Specialties products, and is in lieu of all other warranties, expressed or implied, written including any warranty of merchantability, or fitness for a particular purpose. In no event is Refrigerating Specialties responsible for any consequential damages of any nature whatsoever. No employee, agent, dealer or other person is authorized to give any warranties on behalf of Refrigerating Specialties, nor to assume, for Refrigerating Specialties, any other liability in connection with any of its products.

WARNING – USER RESPONSIBILITY

Failure or improper selection or improper use of the products described herein or related items can cause death, personal injury and property damage.

This document and other information from Parker Hannifin Corporation, its subsidiaries and authorized distributors provide product or system options for further investigation by users having technical expertise.

The user, through its own analysis and testing, is solely responsible for making the final selection of the system and components and assuring that all performance, endurance, maintenance, safety and warning requirements of the application are met. The user must analyze all aspects of the application, follow applicable industry standards, and follow the information concerning the product in the current product catalog and in any other materials provided from Parker or its subsidiaries or authorized distributors.

To the extent that Parker or its subsidiaries or authorized distributors provide component or system options based upon data or specifications provided by the user, the user is responsible for determining that such data and specifications are suitable and sufficient for all applications and reasonably foreseeable uses of the components or systems.

For safety information see the Safety Guide at www.parker.com/safety or call 1-800-CParker.

