P-Series Solenoids and Pressure Regulators

Product Bulletin 24-05 B

Type: PS4, PA4

Purpose:

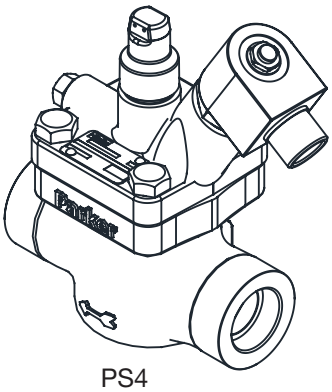
P-Series solenoids and pressure regulators are weld-in, reducing potential for connection leaks and the simple valve design ease for service.

This improved design has a higher working pressure, greater working temperature range and higher flow capacities than our legacy flanged product line.

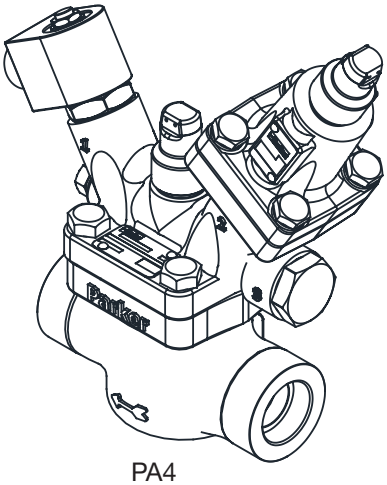
Stainless steel versions (PS4C, PA4C) are corrosion-resistant, suitable for harsh environments.

P-Series valves provide long-term performance with replaceable internal components. Specially designed wear rings eliminate the need for removal of the body from the line (maintenance-free).

P S4 SOLENOID VALVE
A4 PRESSURE REGULATOR
ARKER



PS4



PA4

Contact Information:

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Product Features:

- Suitable for ammonia, CO_2, R-22, R-134a, R-404a, R-410a, R-507 and other common refrigerants
- Cartridge based design simplifies service and eliminates body wear
- Increased flow capacity enables smaller valve sizing
- Integral features prevent contaminates from reaching the pilot section of the valve
- Overall weight reduction up to 50% compared to traditional flanged products
- Coil options to meet various applications

Corrosion-Resistant Valves also:

- Stainless steel construction increases product life cycle

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Table of Contents

Technical Data

Liquid Temperature Range . . . . . -60°C to 120°C (-76°F to 248°F)

Ambient Temperature Range
AC Coils . . . . . -60°C to 60°C (-76°F to 140°F)
DC Coils . . . . . -25°C to 60°C (-13°F to 140°F)

Maximum Rated Pressure (MRP) . . . . . 52 bar (754 psig)

Minimum Pressure Drop . . . . . 0.14 bar (2 psig)

Maximum Operating Pressure Differential (MOPD)
AC Coils . . . . . 20.7 bard (300 psid)
DC Coils . . . . . 10.0 bard (145 psid)

Port Size		Capacity Plugs	Flow Coefficient		Connections		Weight [1]	
mm	inch		Kv	Cv	SW - BW - ANSI	BW - DIN	kg	lbs
20	¾	Full 65% 30%	9.5 7.0 4.3	11 8.0 5.0	¾", 1", 1¼"	20, 25, 32	3.7 - 7.0	8.2 - 15.4
25	1	Full	12	14			3.7 - 7.0	8.2 - 15.4
32	1¼	Full 50%	15.6 7.8	18 9.0	1¼", 1½"	32, 40	10.0 - 12.8	22.0 - 28.2
40	1½	Full 30%	28 7.8	32 9.0	1½", 2"	40, 50	10.0 - 12.8	22.0 - 28.2
50	2	Full 35%	47.6 16.4	55 19	2", 2½"	50, 65	14.5 - 18.1	32 - 40

1. The weight will vary based on the valve function.

Function and Design

P-Series valves are normally closed, requiring a minimum of 0.14 bar (2 psig) pressure drop across the valve to fully open. The valves are an integrated assembly of one, two or three modules:

1. A body, which contains the cartridge assembly, but is ordered to suit a particular connection size. Valve bodies are available with socket weld (SW), ANSI butt weld (BW) or metric butt weld (DIN BW) options. The port size defines the size of the body;

2. A port plate, which defines the valve function. A single port plate provides the option between a solenoid or regulator. For additional control features the multi port plate provides a variety of port plate arrangements; a regulator with pilot solenoids: either an Electric Shut-Off (S) or a Electric Wide Open Bypass (B). For other arrangements see the application guide and variations section of this bulletin.

3. *(Pressure Regulators)* The bonnet assembly, which contains the range set spring and adjustment stem, as shown in Table 1.

Inlet pressure travels from the body to the port plate through a passage located on the inlet side of the valve. The passage is designed to minimize foreign material from entering the pressure pilot and piston area of the valve. Minimizing foreign material to these areas reduces wear and other foreign material issues.

Pressure Regulator Range	Set Point Range	Pressure Change per Turn of the Adjustment Screw	Factory Set Point [1]
V	250mm Hg - 8.3 bar (10in Hg - 120 psig)	*Approximate* 1.5 bar (22 psig)	2.8 bar (40 psig)
A	0.35 - 10.3 bar (5 - 150 psig)	*Approximate* 1.2 bar (17 psig)	2.8 bar (40 psig)
D	5.2 - 19.3 bar (75 - 280 psig)	*Approximate* 2.9 bar (42 psig)	9.7 bar (140 psig)
E	6.9 - 51.7 bar (100 - 750 psig)	*Approximate* 3.8 bar (55 psig)	20.7 bar (300 psig)

1. The factory set point changes based on regulator type. Example "K" feature for range A is 4.8 bar (70 psig).

Table 1: Pressure Pilot Range Settings

Solenoid Function
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.

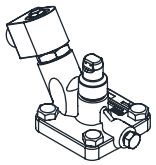
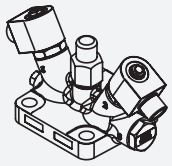
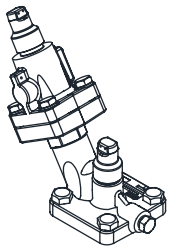
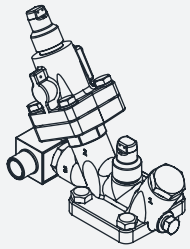
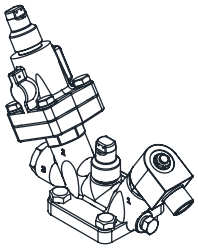
Regulators Function
The valve will modulate to maintain a pressure set in the field using a combination of spring pressure and a diagram to seat or unseat the path to the piston. Depending on the valve variation the regulator will control upstream, downstream or differential pressure. When pressure is beyond the field setting the valve will stop regulating and the piston/plug cartridge assemble with equalize, in the same manner as described in the solenoid function, and the regulator will stop modulating.

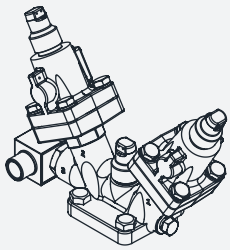
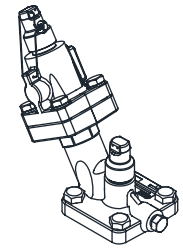
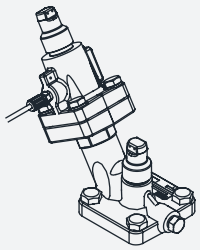
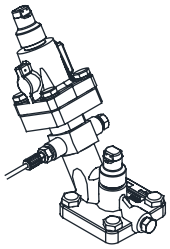
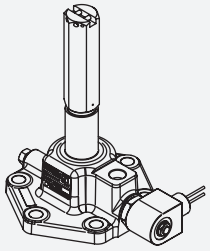
All P-Series valves are to be installed with an upstream strainer in order to minimize damage to or prevent malfuction of the valve and the rest of the system.

Suction Stop Function
The valve function is normally open to minimize the pressure drop for suction applications. When the coil is energized, pressurized hot gas flows to close the valve to flow from the inlet. When de-energized, the valve bleeds pressure through an externally adjustable orifice until the pressure difference reaches 15 psi (1.0 bar).

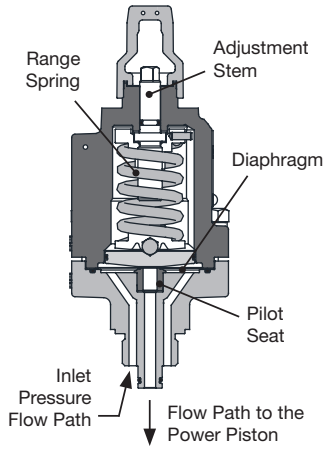
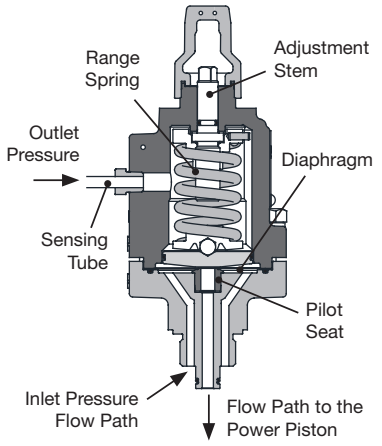
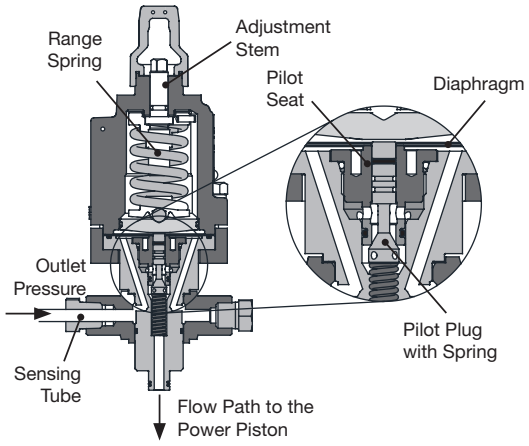
Application Guide and Variations

There are many possible combinations for the P-series valves. These can be used as solenoid (S4), regulator (A4), two stage solenoid (S4D) or gas powered suction stop valve (GSS).

Variation	Type Suffix	Port Plate Setup	Function	Operation	Typical Applications
Solenoid	S4		Shut-off	Open when electrically energized; closed when not energized.	1. Pump liquid feed 2. High pressure liquid 3. Hot gas defrost
Two-Stage Solenoid	S4D		Combined soft gas/hot gas	Open 10% when one coil electrically energized, open 100% when both coils energized; closed when not energized. See Appendix for proper coil sequencing.	1. Combined soft gas/hot gas feed for hot gas defrost applications Patent Pending
Inlet Regulator	A4		Controls inlet pressure	Operates at present inlet pressure. Can be field adjusted. Opens on rising inlet pressure.	1. Evaporator pressure control 2. Condenser pressure control 3. Any inlet pressure control
Regulator with Electric Shut-Off	A4S		Controls inlet pressure or shut-off regulator	Regulates when electrically energized; closed when not energized.	1. Open for temperature control 2. Closed for defrosting
Regulator with Electric Wide Opening	A4B		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

Variation	Type Suffix	Port Plate Setup	Function	Operation	Typical Applications
Dual Regulator	A4D		Dual pressure control Position 1: high pressure pilot Position 2: low pressure pilot	Regulates at lower pressure when electrically energized; at higher pressure when not energized.	1. Higher pressure for defrost 2. Higher pressure for temperature control 3. Internal pressure relief.
Re-Seating Relief Regulator	A4K		Re-seating relief regulator	Open wide above set point. Repeatedly re-seats after operation.	1. Defrost relief 2. Non-atmospheric relief 3. High to low relief
Differential Regulator	A4L		Controls differential pressure 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
Outlet Regulator	A4O		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. Receiver pressure control
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. Gas powered suction stop Patent Pending

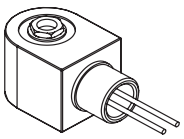
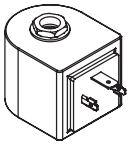
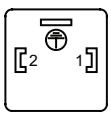
Regulator Pilot Assemblies

Pressure Pilot Regulator Assemblies		
A4_ (B, S, D), A4K	**A4L**	**A4O**
		
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.

Electrical

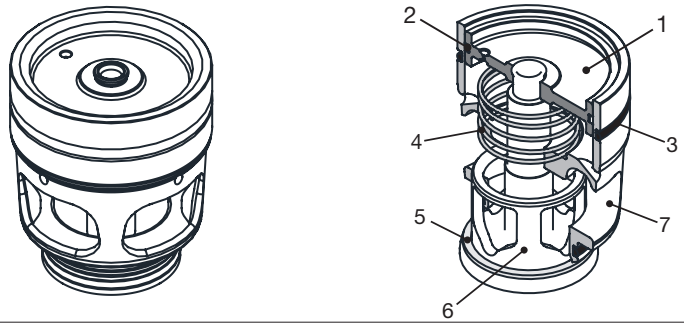
The Refrigerating Specialties Division molded water resistant solenoid coil is designed for long life and powerful opening force. The standard coil housing meets NEMA 4 requirements. This sealed construction can withstand direct contact with moisture and ice. Coil construction will permit coil temperatures 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 or below 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	110-120 VAC/60 Hz 110-120 VAC/50 Hz 220-230 VAC/50 Hz 240 VAC/60 Hz 24 VAC/60 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				

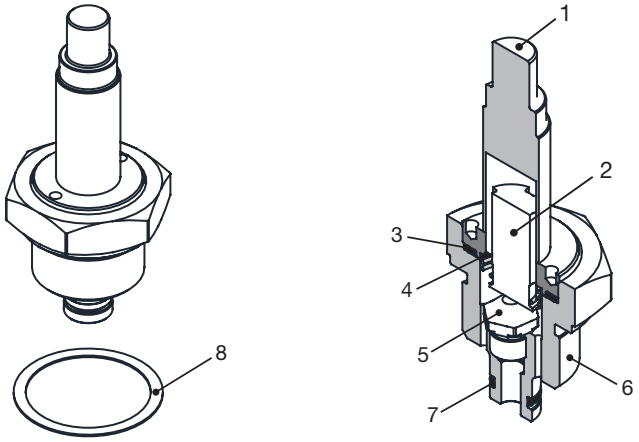
1. DC coils are limited to an ambient temperature of -25°C to 60°C (-13°F to 140°F) and a MOPD of 10.0 bard (145 psid). Only available in QD connection only.

Material List: Control Module 3 - Cartridge Assembly



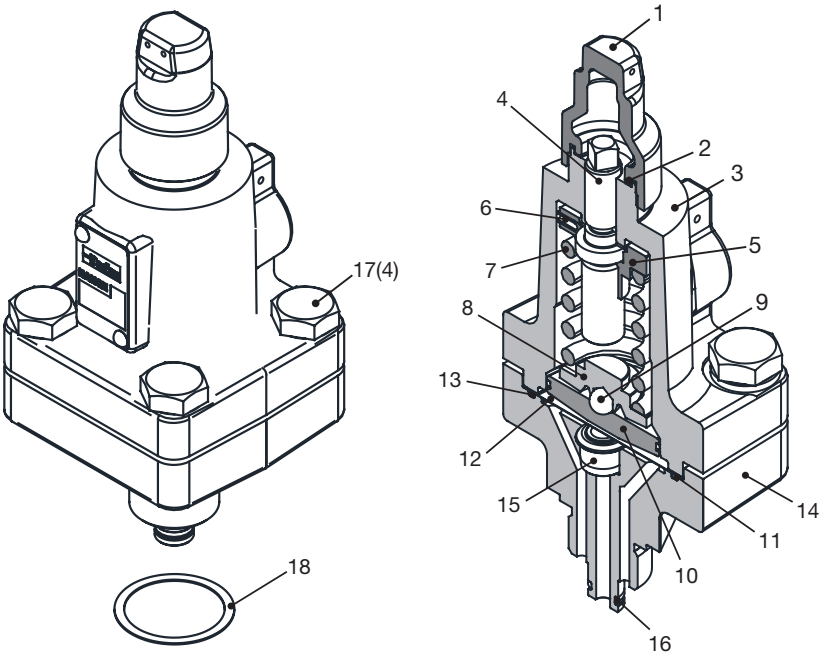
Item	Description	Material
1	Piston	303 Stainless Steel
2	Ring, Piston	Ductile Iron
3	O-Ring	Neoprene
4	Spring	Music Wire, ASTM A-228
5	Seat	PTFE
6	Plug/Stem	CF3 (ASTM A351)
7	Cartridge, Housing	CF3 (ASTM A351)

Material List: Control Module 3 - Solenoid Pilot Assembly



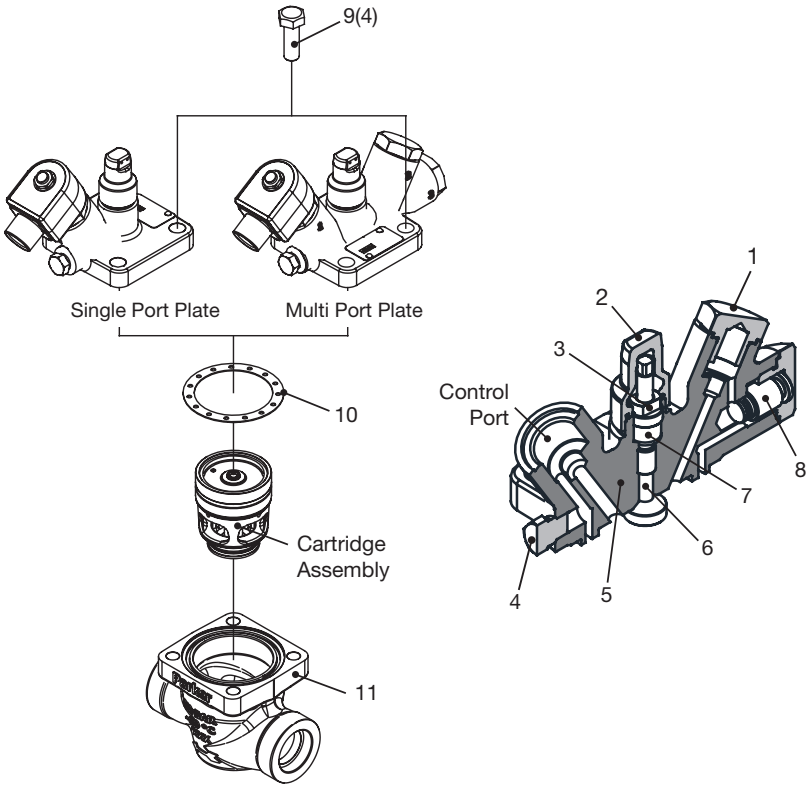
Item	Description	Material
1	Sleeve	304 Stainless Steel
2	Plunger	430FR Stainless Steel
3	O-Ring	Neoprene
4	Spring, Plunger	18-8 Stainless Steel
5	Seat, Solenoid	PTFE
6	Adaptor	303 Stainless Steel
7	O-Ring, Adaptor	Neoprene
8	Gasket, Adaptor Assembly	Wolverine MS-18020

Material List: Control Module 3 - 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	Kingersil, 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	Bolt, Bonnet	Stainless Steel, DIN ISO 3506-1 Grade A2
18	Gasket, Bonnet Assembly	Wolverine MS-18020
—	Washer, Adjustment Stem	18-8 Stainless Steel
—	O-Ring, Adjustment Stem	Neoprene

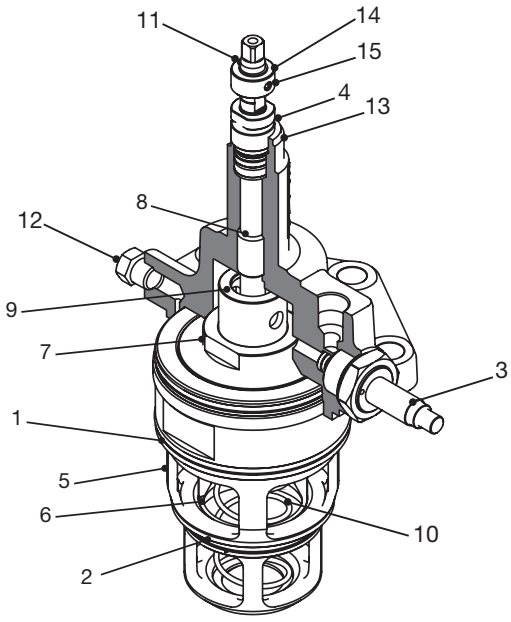
Material List: Control Module and Body (Solenoid/Regulator Options)



Item	Description	P_4C Material	P_4W Material
1	Cap, Port Plate	303 Stainless Steel	303 Stainless Steel
2	Seal Cap	304 Stainless Steel	304 Stainless Steel
3	Packing Nut	303 Stainless Steel	303 Stainless Steel
4	Plug, Gauge Port	304 Stainless Steel	304 Stainless Steel
5	Port Plate	Stainless Steel - CF3 (ASTM A351)	Cast Steel - LCC (ASTM A352)
6	Stem, Manual Opening	303 Stainless Steel	303 Stainless Steel
7	Packing	Graphitic - ASTM F2168	Graphitic - ASTM F2168
8	Plug, Pilot	303 Stainless Steel	303 Stainless Steel
9	Bolts, Port Plate	Stainless Steel, DIN ISO 3506-1 Grade A2	Stainless Steel, DIN ISO 3506-1 Grade A2
10	Gasket, Port Plate	Gylon 3500	Gylon 3500
11	Body, Valve	Stainless Steel - CF3 (ASTM A351)	Cast Steel - LCC (ASTM A352)
—	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 6.

Material List: Suction Stop Module



Patent Pending

Item	Description	Material
1	O-Ring	Neoprene
2	O-Ring	Neoprene
3	Solenoid, Operator Assy	303 Stainless Steel
4	Packing Nut	Graphitic - ASTM F2168
5	Cartridge, Body	Steel - AISI 1215
6	Piston, Inner	Steel - AISI 1215
7	Piston, Outer	Steel - AISI 1215
8	Stem, Manual Opening	303 Stainless Steel
9	Tube, Stem Lift	303 Stainless Steel
10	Spring	Music Wire - ASTM A-228
11	Retaining Ring	15-7 PH Stainless Steel
12	Plug	304 Stainless Steel
13	Bonnet	ASTM A350 LF 3CL2
14	Nut	303 Stainless Steel
15	Screw	303 Stainless Steel

Installation

All valves are packed for a maximum protection. Unpack carefully. Check the carton to make sure all items are unpacked. Save the enclosed instruction for the installer and eventual user.

Do not remove the protective coverings from the inlet and outlet of the regulator until the regulator is ready to be installed. Protect the inside of the regulator from dirt and chips before and during installation.

⚠ Caution

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 work.

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 handing 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 applies to regulators with pilot solenoid options. Proper indicating gauges should be installed to be easily visible to the operating engineer for system checks and adjustment purposes.

The P-Series valves must be mounted in the upright horizontal position with the manual opening stem on the top. The valve must be installed with the arrow in the direction of flow for the regulator to function properly.

The valves should be disassembled before welding to prevent damage to o-rings and teflon (PTFE) components. First remove the port plate by unbolting the bolts. Remove the gasket prior to lifting the cartridge assembly from the body. Located on the top of the cartridge are M5 threads. Screw a M5 bolt in this location and use pliers to pull the cartridge from the valve body, as shown in the Figure 1.

Prior to welding protect the inside of the valve body, cartridge and port plate from welding debris and dirt.

⚠ In the event the valve is left disassembled for any length of time, protecting the components is essential. Place the components in a polyethylene bag or apply a rust protection agent, such as refrigerant oil.

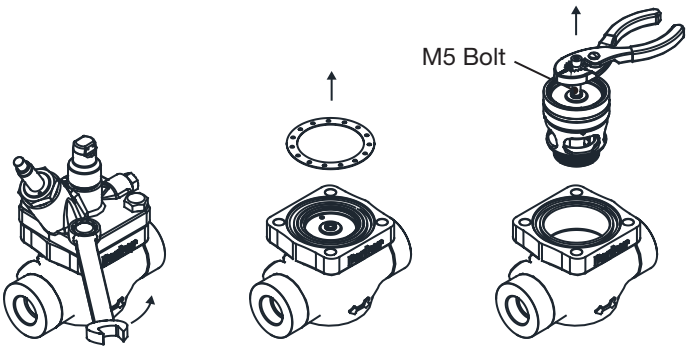


Figure 1: Installation Diagram - Removal of Cartridge

Contractors need to follow a WPS (Welding Procedure Specification) for all welding. The procedure must be qualified and welder doing the weld 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 1/16 of an inch before welding. Use of welding rings is optional, but recommended for butt weld valves. They help alignment, control gap for full penetration welding, and reduce welding debris entry.

Note: When welding carbon steel and stainless steel the welded joint should be painted to prevent galvanic corrosion.

Socket welding, where allowed, is the preferred connection. This connection helps to reduce the amount of welding debris in the piping system.

Remove welding debris and any dirt from the pipes and valve body before reassembling the valve. Check the cartridge o-rings and port plate gasket for damage. If possible, apply some silicon grease on the o-rings to ease installation and protection. After inserting the cartridge place the new port plate gasket in the same position as removed. The small hole located on the port plate gasket must line up with the inlet passage located on the body, as shown parts reference explosion views. If the port plate gasket surface has been damaged or bent, it must be replaced. If it is a multi-hole gasket, no alignment is necessary.

Tighten the port plate bolts, with a torque wrench, evenly in a X configuration to provide proper seating. Torque bolts to a torque found on Table 2.

For more detailed information on how to reassembly the valve see the cartridge maintenance procedures in the maintenance and service section of this bulletin.

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.

Regulator Pilot Adjustment Stem Operation

The P-Series pilot adjustment stem is a non-rising stem. This design prevents foreign material from getting lodged in the threads and has less components than Refrigerating Specialties traditional A4 adjustment stem design.

Adjustment of a regulators' set point requires that the pressure being controlled be monitored by an accurate pressure gauge. Before making any adjustments, the seal cap must be removed. In all cases where the regulator is administering a pressure condition and a solenoid feature is not overriding that function, and the flow is in the normal direction, turning the adjusting stem in the (i.e. clockwise) direction will raise the set point, and turning it (i.e. counterclockwise) direction will lower the set point. See Table 1 for set point range, pressure change per turn of the adjustment stem and the factory set point.

Depending on system responses, the gauge may reflect some delay before change in set point actually results in a change in the pressure being maintained. This can also sometimes be observed following the energization or de-energization of the solenoid features. Regulators with 'B' feature can only be adjusted with the pilot solenoid de-energized. Regulators with the 'S' feature can only be adjusted with the solenoid energized.

For all inlet valve variations the pressure gauge can be connected to the gauge port on the inlet side of the regulator.

Always re-tighten the seal cap once adjustments are complete. See Table 2 for torque specifications.

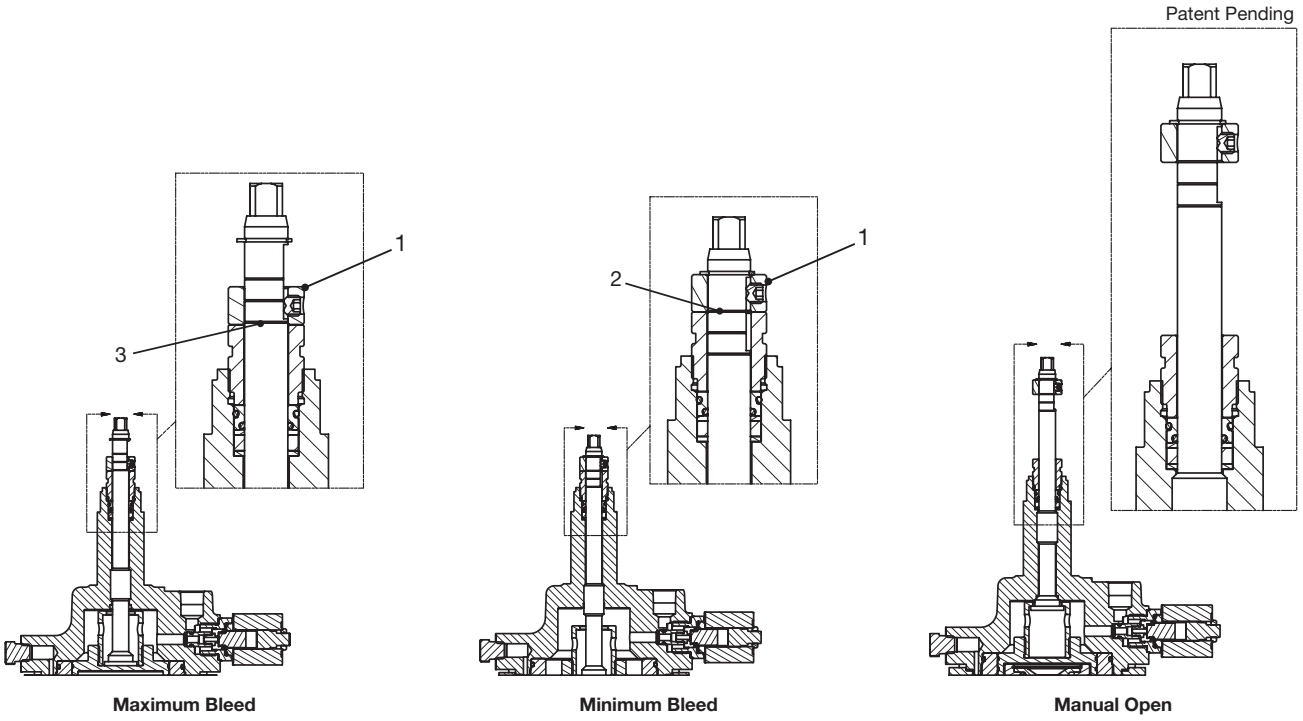
⚠ Caution

When unscrewing the pilot regulator seal cap, check to see if the entire assembly is not coming off the port plate.

Manual Opening Stem Operation

These valves 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 turn the stem in (clockwise) until it stops. To put the pressure regulator back in automatic operation, turn the stem out (counter-clockwise) until it back seats.

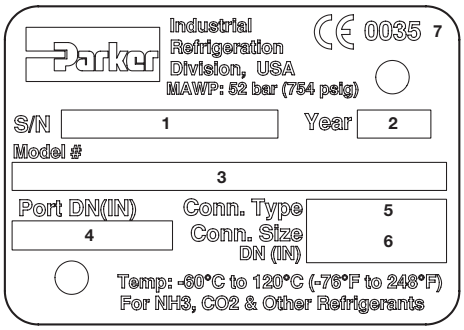
Suction Stop Bleed Rate Adjustment



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 - 50 mm (¾" - 2")		1. Serial Number (S/N) 2. Year 3. Valve Model Number 4. Port Size 5. Connection Size 6. Connection Type 7. CE Mark (1¼" thru 2" only)

Maintenance and Service

⚠ Caution

Before doing any service work, always be sure to disconnect the power and isolate the valve. Failure to do so will result in venting of refrigerant.

All P-series regulators can be serviced without disturbing the piping or the removal of the valve body. The internal components are designed so that they do not cause wear to the welded-in body.

Prior to performing any maintenance on the valve, read the information in this bulletin, safety procedures for refrigeration control valves (bulletin RSBCV) and safety guide on selecting and using Refrigerating Specialties division products and related accessories (bulletin RSBSG)

Before the regulator is disassembled in the line, make sure the valve has been isolated, manually opened and all the refrigerant pumped out.

For instruction on how to operate the manual opening stem, read the manual opening stem operation instructions on the previous page of this document.

Before re-assembly, all parts must be cleaned with a suitable solvent and permitted to dry. For gaskets that are stuck to the surface use a brass scraper or pick to remove the gasket. Using a brass scraper to remove the gasket from the gasket surface prevents from damaging the surface. Do not polish the gasket contact surfaces.

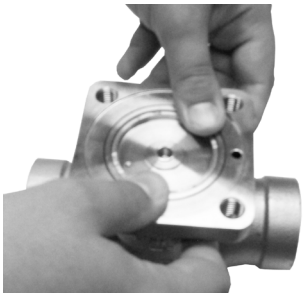
Cartridge Maintenance Procedures

To replace the cartridge assembly, unbolt the port plate from the body. After the port plate has been removed, screw a M5 bolt into the center of the cartridge and pull upwards using pliers to remove the cartridge assembly.

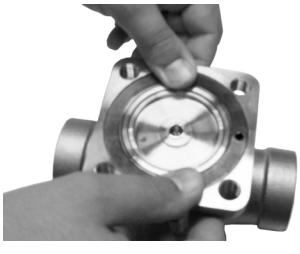
Follow the instructions below to reassemble the new cartridge and valve:

1. Apply silicon grease to the two cartridge o-rings and install the o-rings into the appropriate grove located on the top and bottom of the cartridge assembly. The larger of the two o-rings goes in the top groove.

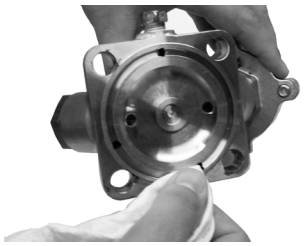
2. Insert the cartridge assembly into the body bore and press down until the cartridge o-rings snap into their seating position.

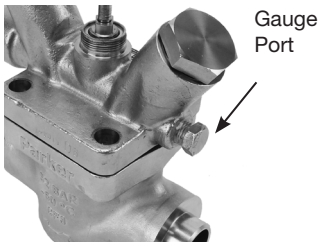


3. Position the port plate gasket into grove aligning the gasket hole with the valve body bleed hole. If it is a multi-hole gasket, alignment is not necessary.



4. Use a paper towel to clean the bottom of the port plate before positioning over the body. Be careful not to misalign the port plate gasket when positioning the port plate. Do not polish the gasket contact surfaces.





5. Apply Never•Seez to the port plate bolt threads and hand thread until snug. Tighten all bolts equally, using the X-pattern sequence, to draw the assembly together evenly, to ensure properly sealing of all joints. Use the same tightening pattern sequence to fully tighten the bolts to the recommended torque specs located in Table 2.

Manual Opening Stem Maintenance Procedures

To replace the manual opening stem the P-Series port plate must be removed. Remove the manual opening stem seal cap and gasket. Unbolt the packing nut prior to removing the port plate from the body. After the port plate has been removed, turn the manual opening stem clockwise until it disengages itself from the threads. From the underside of the port plate, pull the manual open stem to remove it from the port plate. The manual opening stem washer and packing may have to be picked out with a brass pick, so not to damage any surfaces.

Follow the instructions below to reassemble the new manual opening stem and valve:

1. Apply Never•Seez to the new manual opening stem threads, upper stem and thread located on the underside of the port plate.

2. Insert the thread into the bottom of the port plate and turn clockwise to engage the threads. The manual opening stem needs to be back seated prior to installing the washer, packing and packing nut.

3. Install the washer onto the manual opening stem.

4. Install packing onto the manual opening stem with the tapered side end up. Tamp the packing gently using a steel pipe with a outer diameter (OD) of no greater than 13 mm (1/2") and inner diameter (ID) no smaller than 6 mm (1/4").

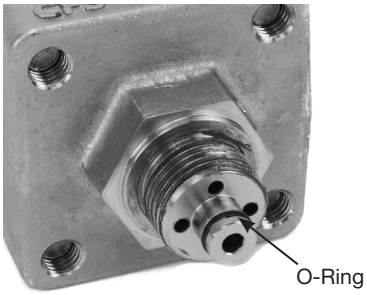
5. Apply Never•Seez to the packing nut threads. Place the packing nut over the stem and thread into the port plate. Tighten the packing nut to the recommended torque specs located in Table 2.

6. For the port plate to body assembly instructions follow steps 3 thru 5 in the cartridge maintenance procedures discussed earlier in this bulletin.

Pressure Regulator Pilot Maintenance Procedures

When replacing the entire pressure pilot, i.e. bonnet assembly, removing the spring tension is not required. Simply unbolt the current bonnet assembly from the port plate, remove the gasket and o-ring.

Before installing the replacement regulator pilot assembly, lubricate the o-ring with silicon grease and install it in the o-ring grove located on the shaft of the regulator pilot base plate. Apply Never•Seez to the mounting plate bottom threads and appropriate port location on the port plate. Torque the bonnet assembly to the port plate using the torque recommendation in Table 2.



When replacing individual components, the spring force on the diaphragm caused by the pressure adjustment stem will need to be reduced. This will prevent the bonnet from projecting off the regulator pilot base plate. To reduce the pilot pressure, remove the regulator seal cap and back out (counter clockwise) the adjustment stem until no further spring compression is felt or when the adjustment stem stops. Now the bonnet bolts can be removed and the internal components replaced.

The removal of the bonnet will expose the diaphragm, diaphragm follower, bottom spring plate and range spring. To remove the adjustment stem rotate the bonnet upside down where the flat of the adjustment stem is rests on a hard flat surface. Push down and the adjustment stem assembly will slide out the bottom of the bonnet. The top spring plate, adjustment stem washer and o-ring will remain intact. To remove the o-ring, washer and top spring plate simply unscrew the spring plate from the bottom of the adjustment stem and pull the o-ring and washer up through the top of the adjustment stem.

If the diagram follower, bottom spring plate and range spring do not fall out from the removal of the bonnet then use the same technique to remove the adjustment stem as described above.

Located on the regulator pilot mounting plate is the diaphragm gasket, diaphragm and diaphragm o-ring. If replacing these components they will have to be removed. The diaphragm o-ring is located in a grove underneath the diaphragm.

Follow the instructions below to reassemble the new pressure pilot components and pilot assembly:

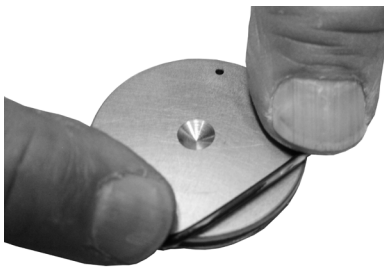
1. Slide the adjustment stem washer onto the adjustment stem from the top.

2. Apply silicon grease to the adjustment stem o-ring and slide onto the adjustment stem from the top. Make sure the o-ring slides into the grove located on the stem.

3. Apply Never•Seez to the adjustment stem threads and thread top spring plate onto stem. After threading spring plate onto stem re-apply Never•Seez to the exposed stem threads.

4. Place the adjustment stem assembly over the range spring. Make sure the top spring plate is threaded to the full length of the adjustment stem.

5. Lubricate the diaphragm follower o-ring with silicon grease and install it in the o-ring groove located on the diaphragm follower.

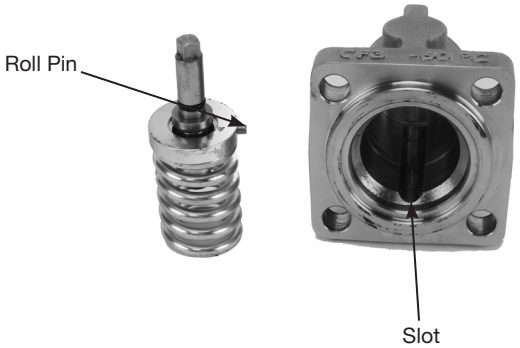


6. Apply bearing grease to the bearing on the lower spring plate and receiving dimple in the diaphragm follower.

7. Place the lower spring plate over the diaphragm follower so that the ball is engaged in the dimple of the diaphragm follower. Place the adjustment stem assembly and range spring onto the lower spring plate.

8. Apply bearing grease to the diaphragm follower seat area of the bonnet and to the top of the adjustment stem assembly.

9. Place bonnet over the assembly, shown in step 7, making sure the upper spring plate roll pin aligns with the slot relief on the inside of the bonnet.



10. Press the bonnet over the assembly until the diaphragm follower is seated flush with a bottom of the bonnet. Use a hard flat surface for this step.

11. Lubricate the bonnet mounting plate o-ring with silicon grease and install it in the mounting plate groove. If the seat is damaged, the entire bonnet will need to be replaced.

12. Clean the diaphragm and place in the bonnet mounting plate pocket. Make sure there are no scratches or dents in the center area of the diaphragm and the side stamped with “this side up” is legible (concave up).

13. Install the gasket over the diaphragm and apply a small amount of refrigeration oil on the center of the diaphragm.

14. Place bonnet assembly over mounting plate, aligning the bolt holes to the bonnet mounting plate. Apply Never•Seez to the bolt threads and hand thread until snug. Tighten all bolts equally, using the X-pattern sequence, to draw the assembly together evenly, to ensure properly sealing of all joints. Use the same tightening pattern sequence to fully tighten the bolts to the recommended torque specs located in Table 2.

15. Apply the seal cap gasket and screw the seal cap on using the recommended torque specs located in Table 2.

16. Apply Never•Seez to the mounting plate bottom threads and appropriate port location on the port plate. Torque the bonnet assembly to the port plate using the torque recommendation in Table 2.

Solenoid Pilot Maintenance Procedures
To replace the solenoid pilot assembly, first remove the coil and unbolt the solenoid pilot assembly from the port plate assembly and remove the gasket.

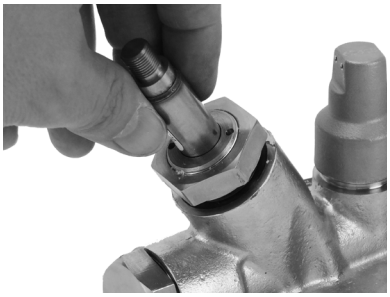
Follow the instructions below to reassemble the new solenoid pilot assembly:

1. Lubricate the o-ring with silicon grease and install it in the o-ring groove located on the bottom end of the solenoid pilot assembly.

2. Install the new gasket into the correct port on the port plate assembly.

3. Apply Never•Seez to the pilot solenoid assembly threads and appropriate port location on the port plate.

4. Insert the new pilot solenoid assembly into same port as the gasket and make sure it is correctly aligned. Screw the assembly with hand until snug and then torque the assembly to the port plate using the torque recommendation in Table 2.



Port Plate Plug Maintenance Procedures
To replace the port plate plug/plugs, unbolt it from the port plate and remove the plug and gasket.

Follow the instructions below to reassemble the new pilot plug and cap:

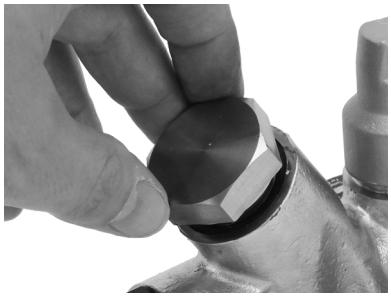
1. Lubricate the o-ring with silicon grease and install it in the o-ring groove located on the bottom end of the port plate plug.

2. Insert the new plug with o-ring into the correct port on the port plate and press down until it snaps into place. Make sure the o-ring end of the plug is inserted first and properly aligned to the orifice located at the bottom of the port.

3. Install the new gasket into the same port as the plug.

4. Apply Never•Seez to the port plate plug cap threads and the appropriate port location on the port plate.

5. Screw the plug cap with hand until snug and then torque to the port plate using the torque recommendation in Table 2.



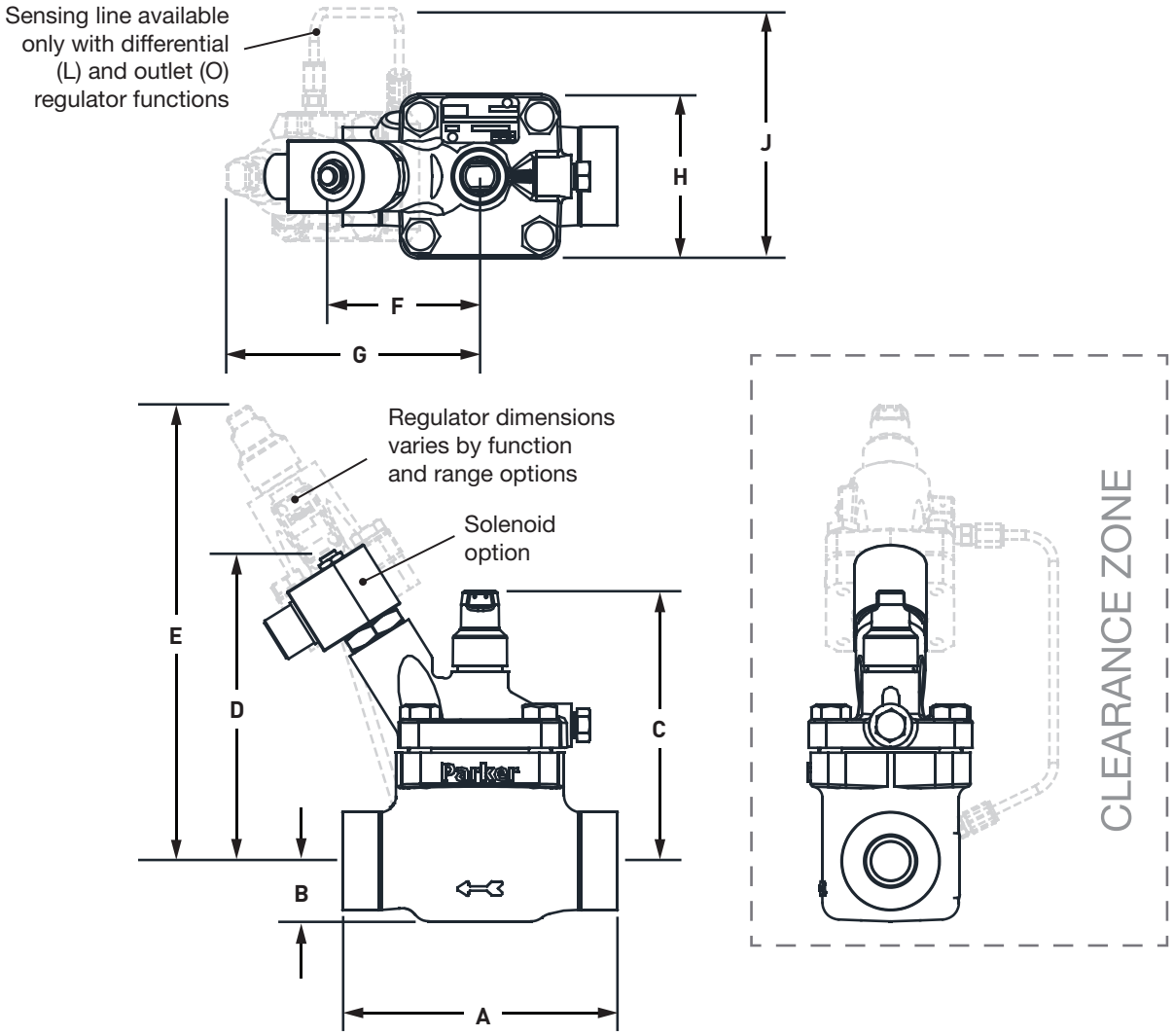
Port Size		Bolt Size	Item Description	Torque	
mm	inch			Nm	ft. lb.
20, 25	¾, 1	M12 x 1.5	Port Plate	61 - 68	45 - 50
32, 40	1¼, 1½	M16 x 2.0	Port Plate	149 - 156	110 - 115
50	2	M14 x 2.0	Port Plate	102 - 109	75 - 80
All	All	M10 x 1.5	Bonnet Assembly	41	30
All	All	¼-18 NPT	Gauge Port Plug	14	10
All	All	1-12 UNF	Solenoid Tube Assembly	54 - 61	40 - 45
All	All	1-12 UNF	Cap, Port Plate	54 - 61	40 - 45
All	All	1-20 UNF	Seal Cap (Reg. & Man. Open Stem)	Snug	
All	All	⅝-18 UNF	Packing Nut	27	20

Table 2: Valve Torque Recommendations

Service Pointers

P-Series Service Pointers		
Symptom	**Probable Cause**	**Correction**
Failure to open or close	Piston jammed due to excessive dirt	Flush clearance space between piston and cartridge bore with refrigeration oil solvent
	Valve Manually Open	Close manual bypass stem by turning counter-clockwise
	Solenoid seat dirty or eroded	Clean and smooth pilot seat
	Installed backwards	Re-install regulator in proper position
System Control cannot be maintained - unstable valve operation	Improper solenoid selection: a. Actual load is lower than regulator capacity b. Actual pressure drop across valve is higher than originally intended c. Combination of a and b	Replace cartridge with one of suitable size

Dimensional Information: Single Port Plate



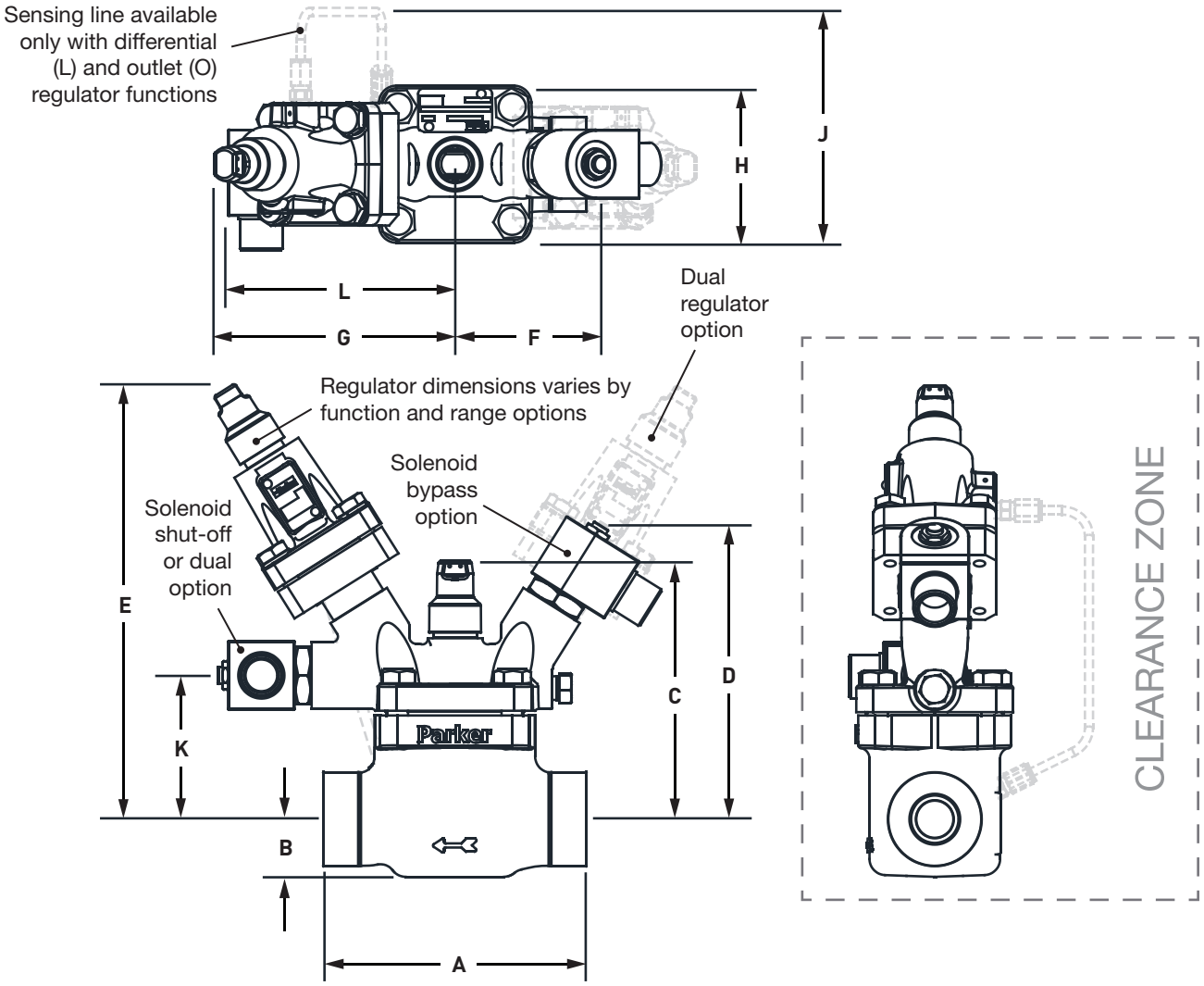
Port Size		A		B		C		D		F		H		J	
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
20, 25	¾, 1	153	6.0	34	1.3	150	5.9	171	6.7	85	3.4	91	3.6	94	3.7
32, 40	1¼, 1½	188	7.4	48	1.9	187	7.4	191	7.6	83	3.3	121	4.8	139	5.5
50	2	227	8.9	75	2.9	187	7.4	187	7.4	89	3.5	170	6.7	183	7.2

Port Size		E						G					
		Inlet Regulators				Outlet Regulators		Inlet Regulators				Outlet Regulators	
		Range A, D		Range E		Range V, D		Range A, D		Range E		Range V, D	
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
20, 25	¾, 1	254	10.0	281	11.1	276	10.8	142	5.6	156	6.1	160	6.3
32, 40	1¼, 1½	274	10.8	306	12.0	297	11.7	137	5.4	162	6.4	156	6.1
50	2	268	10.5	300	11.8	291	11.5	136	5.3	154	6.0	149	5.9

Clearance Zone:

1. The top of the P-series valves requires a clearance of 50 mm (2") for the removal the solenoid or regulator.
2. The bottom of the P-series valves requires a clearance of 13 mm (½").
3. Both the left and right side of the P-series, widest valve setup as shown above, requires a minimum of 25 mm (1") on each side. If the valve has a sensing line add 25 mm (1") to the overall width.

Dimensional Information: Multi Port Plate



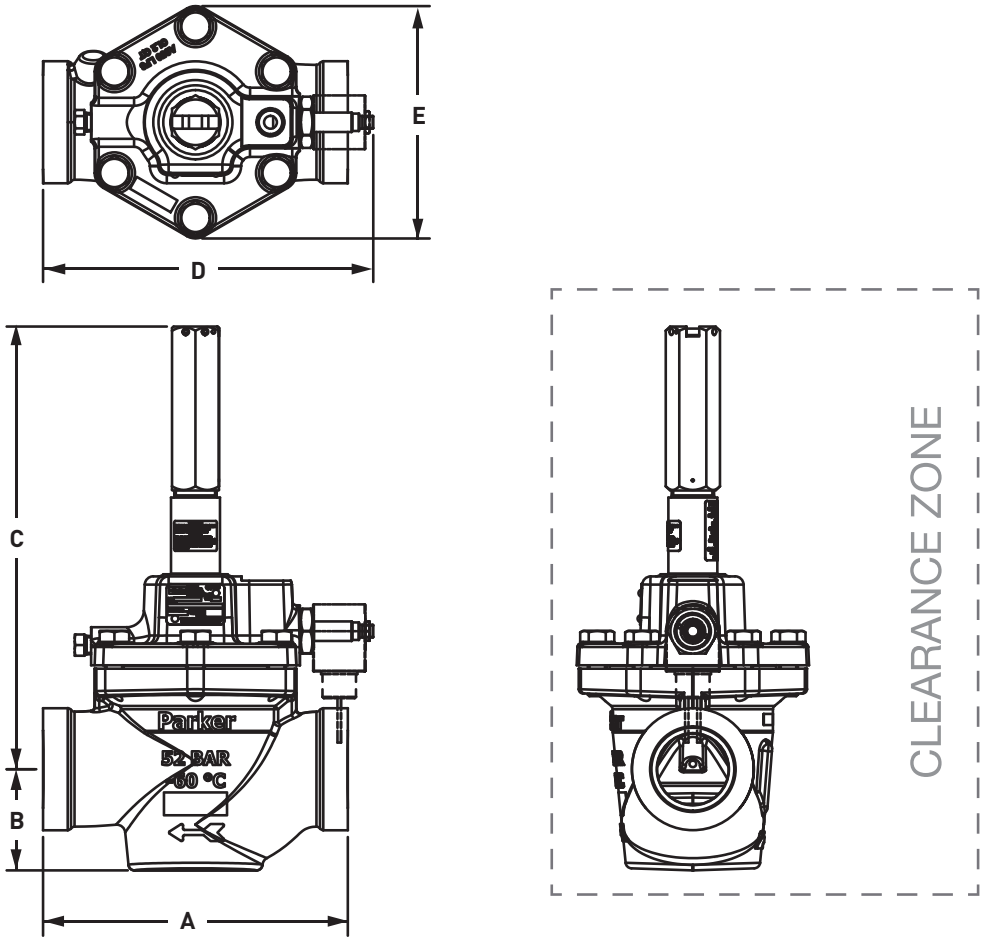
Port Size		A		B		C		D		F		H		J		K		L	
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
20, 25	¾, 1	153	6.0	34	1.3	150	5.9	171	6.7	85	3.4	91	3.6	94	3.7	84	3.3	138	5.4
32, 40	1¼, 1½	188	7.4	48	1.9	187	7.4	191	7.6	83	3.3	121	4.8	139	5.5	101	4.0	138	5.4
50	2	227	8.9	75	2.9	187	7.4	187	7.4	89	3.5	170	6.7	183	7.2	99	3.9	148	5.8

Port Size		E						G					
		Inlet Regulators				Outlet Regulators		Inlet Regulators				Outlet Regulators	
		Range A, D		Range E		Range V, D		Range A, D		Range E		Range V, D	
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
20, 25	¾, 1	254	10.0	281	11.1	276	10.8	142	5.6	156	6.1	160	6.3
32, 40	1¼, 1½	274	10.8	306	12.0	297	11.7	137	5.4	162	6.4	156	6.1
50	2	268	10.5	300	11.8	291	11.5	136	5.3	154	6.0	149	5.9

Clearance Zone:

1. The top of the P-series valves requires a clearance of 50 mm (2") for the removal the solenoid or regulator.
2. The bottom of the P-series valves requires a clearance of 13 mm (½").
3. Both the left and right side of the P-series, widest valve setup as shown above, requires a minimum of 25 mm (1") on each side. If the valve has a sensing line add 25 mm (1") to the overall width.

Dimensional Information: Suction Stop Module



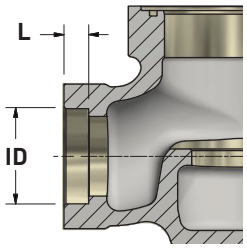
Port Size		A		B		C		D		E	
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
50	2	227	8.9	75	2.9	330	13.0	246	9.7	173	6.8

Clearance Zone:

1. The top of the P-series valves requires a clearance of 200 mm (8") for the removal the regulator.
2. The bottom of the P-series valves requires a clearance of 13 mm (½").
3. Both the left and right side of the P-series, widest valve setup as shown above, requires a minimum of 25 mm (1") on each side.

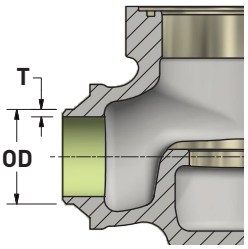
Dimensional Information: Connections

Socket Weld (SW) ANSI



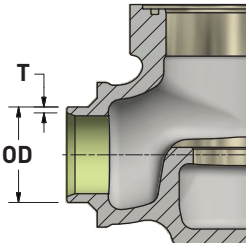
Port Size		Connection	L		ID	
mm	inch		mm	inch	mm	inch
20, 25	¾, 1	¾"	12.7	0.50	27	1.08
		1"			34	1.34
		1¼"			43	1.69
32, 40	1¼, 1½	1¼"	12.7	0.50	43	1.69
		1½"			49	1.93
		2	15.9	0.63	61	2.42
50	2	2"	15.9	0.63	61	2.42
		2½"			74	2.92

Butt-Weld (BW) ANSI



Port Size		Connection	Valve Body Material	T		OD	
mm	inch			mm	inch	mm	inch
20, 25	¾, 1	¾"	Steel (PA4W, PVS)	4.1	0.16	27	1.06
			Stainless Steel (PA4C, PEV)	3.1	0.12		
		1"	Steel (PA4W, PVS)	4.6	0.18	34	1.33
			Stainless Steel (PA4C, PEV)	3.6	0.14		
		1¼"	Steel (PA4W, PVS)	5.1	0.20	42	1.67
			Stainless Steel (PA4C, PEV)	3.8	0.15		
32, 40	1¼, 1½	1¼"	Steel (PA4W, PVS)	5.1	0.20	42	1.67
			Stainless Steel (PA4C, PEV)	3.8	0.15		
		1½"	Steel (PA4W, PVS)	5.3	0.21	49	1.91
			Stainless Steel (PA4C, PEV)	3.8	0.15		
		2	All	4.1	0.16	61	2.39
50	2	2"	All	4.1	0.16	61	2.39
		2½"	All	5.3	0.21	73	2.89

Butt-Weld (BW DN) Metric



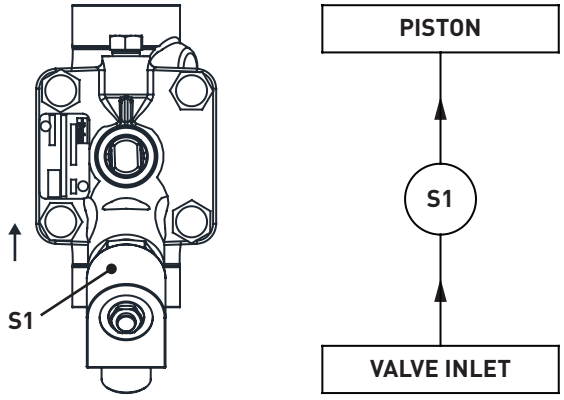
Port Size		Connection	Valve Body Material	T		OD	
mm	inch			mm	inch	mm	inch
20, 25	¾, 1	DN20	All	2.3	0.09	27	1.06
		DN25	All	2.6	0.10	34	1.33
		DN32	All	2.6	0.10	42	1.67
32, 40	1¼, 1½	DN32	All	2.6	0.10	42	1.67
		DN40	All	2.6	0.10	48	1.90
		DN50	All	2.9	0.11	60	2.37
50	2	DN50	All	2.9	0.11	60	2.37
		DN65	All	2.9	0.11	76	3.00

APPENDIX A

Schematic Flow Diagrams

Schematic Flow Diagrams

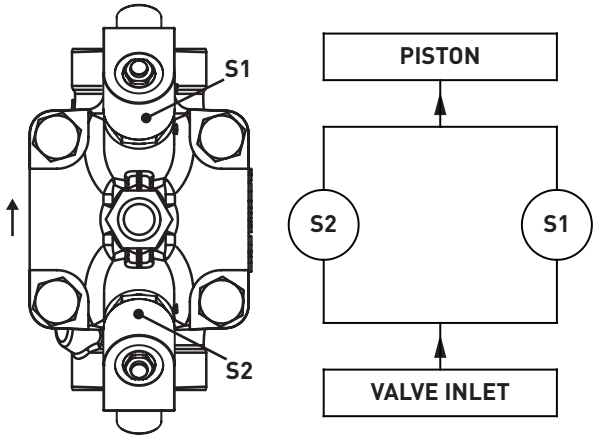
PS4_
Solenoid



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

Patent Pending

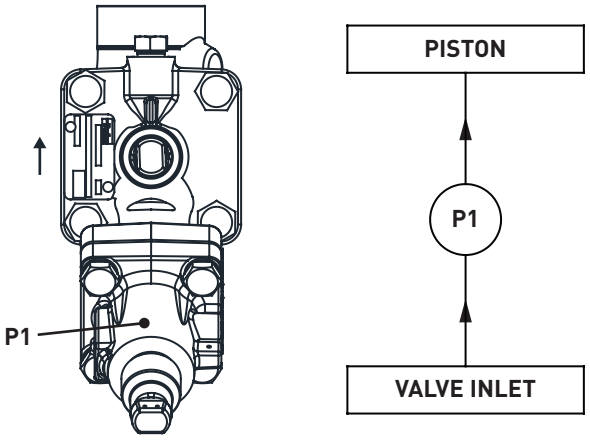
PS4D
Two-Stage Solenoid



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

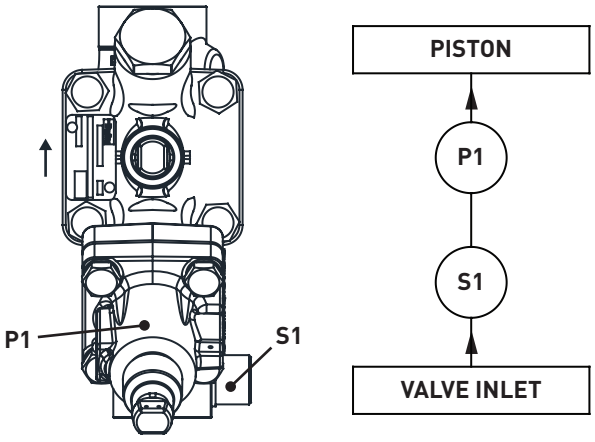
Proper sequencing (energizing and de-energizing) of the solenoid coils is essential for proper operation of the PS4D valve.

PA4_ / PA4_K
Inlet Pressure Regulator



Control Function	Operation
	P1
Pressure Pilot (P1)	Modulating

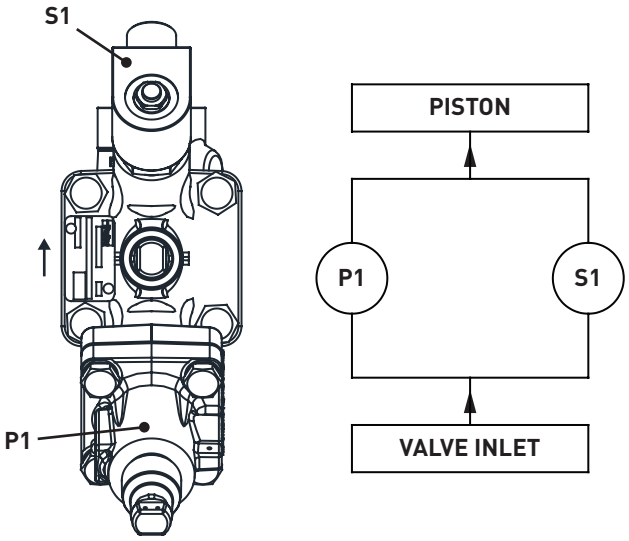
PA4_S
Inlet Pressure Regulator w/ Electric Shut-Off



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

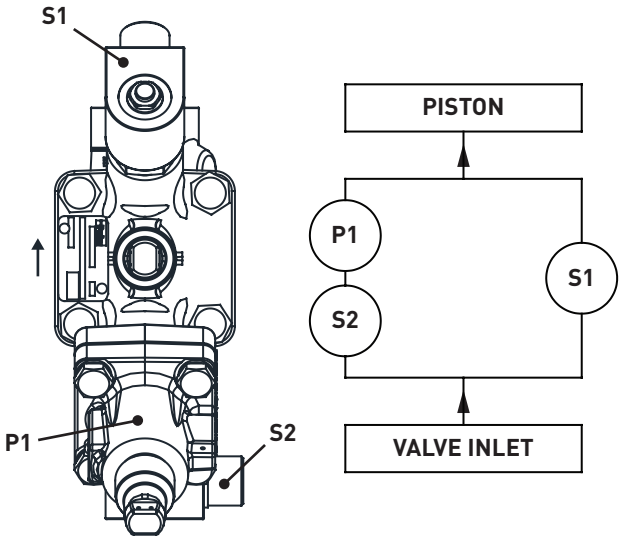
Schematic Flow Diagrams

PA4_B
Inlet Pressure Regulator w/ Electric Wide Open



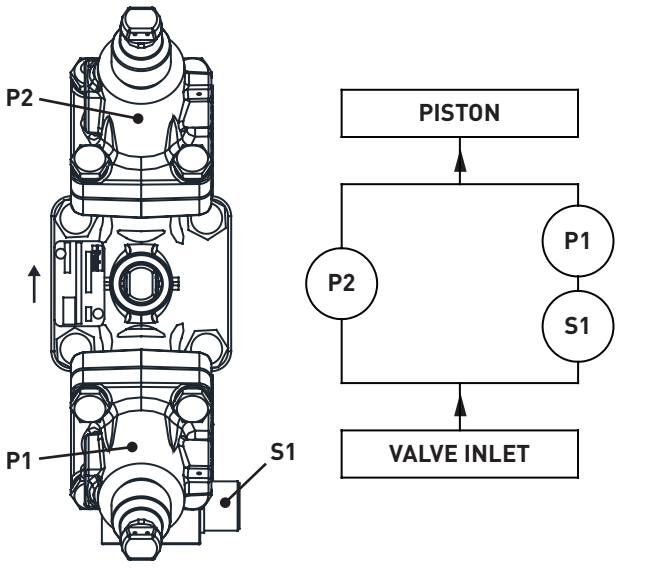
Control Function	Operation
	S1
Pressure Pilot (P1)	De-Energized
Wide Open	Energized

PA4_BS
Inlet Pressure Regulator w/ Electric Shut-Off and Electric Wide Open



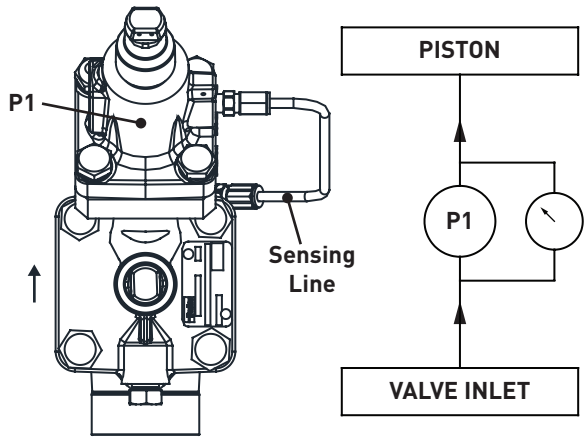
Control Function	Operation	
	S1	S2
Pressure Pilot (P1)	Energized	De-Energized
Shut-Off	De-Energized	De-Energized
Wide Open	Energized or De-Energized	Energized

PS4_D
Dual Inlet Pressure Regulator



Control Function	Operation
	S1
Low Pressure Pilot (P1)	Energized
High Pressure Pilot (P2)	De-Energized

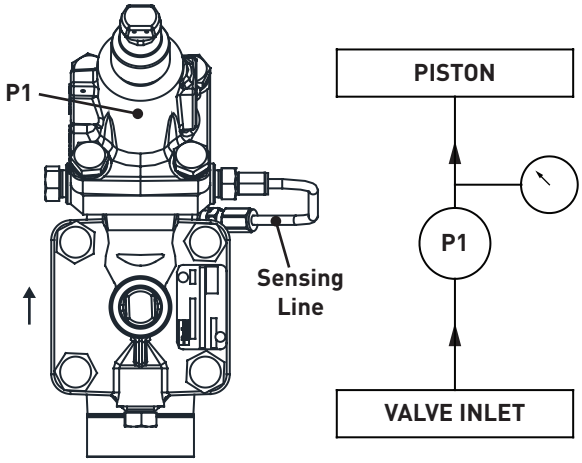
PA4_ L
Differential Pressure Regulator



Control Function	Operation
	P1
Pressure Pilot (P1)	Differential

Schematic Flow Diagrams

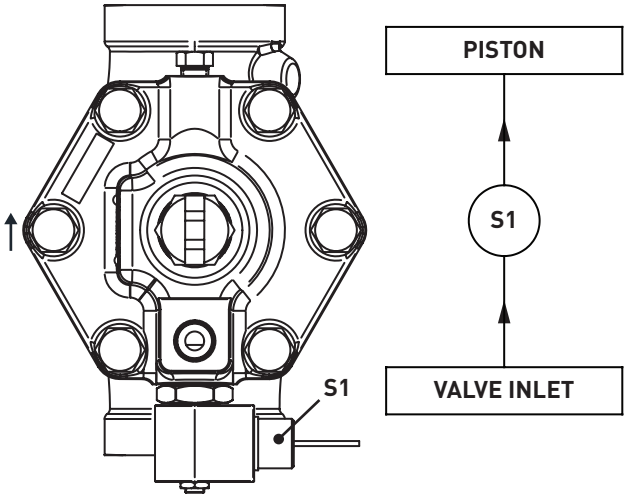
PA4_ 0
Outlet Pressure Regulator



Control Function	Operation
	P1
Pressure Pilot (P1)	Modulating

Patent Pending

PA4_GSS
Suction Stop



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

Safe Operation (See Bulletin RSBCV)
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.

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