

ANDERSON GREENWOOD LOW PRESSURE POPRV CATALOG

SERIES 90 AND 9000 PILOT OPERATED PRESSURE RELIEF VALVES

Series 90 and 9000 valves offer a high performance alternative to spring and weight-loaded relief devices for low pressure systems.



Product overview

The Series 90 and 9000 group of products is a very wide range of both pressure and vacuum relief valves, primarily designed for protecting low pressure storage vessels and tanks, as well as low pressure piping systems. They are designed to meet the requirements of ASME VIII and API 2000; many models also satisfy IMO and other marine regulations.

Anderson Greenwood Type 93 was introduced in 1968, this pilot operated pressure relief valve is designed with elastomer seats and seals for gas piping and chemical tank applications.

The Type 9200 design can be used in the pilot operated pressure relief mode and also provide weight loaded or pilot operated vacuum relief. The 9200 vents directly to atmosphere and has no provision to pipe away the discharge.

The Type 9300 design is a full body valve to pipe away the discharge if necessary and is balanced against back pressure. This design can be used in the pilot operated pressure relief mode and also provide pilot operated vacuum relief.

Features and benefits

- **Tight Up to Set Pressure:** Pilot control keeps high seat forces all the way to set point, helping eliminate product losses.
- **Full Open at Set Point:** Snap action opening permits full opening at set pressure, allowing for higher settings and overcoming freezing or sticking problems.
- **Pop or Modulating Action:** Pilot selection allows a choice between rapid snap opening action and proportional modulating action to best suit the process.
- **Resilient Seats and Diaphragms:** Extensive selection of seat and diaphragm materials to meet most conditions and provide long maintenance-free operation.
- **Balanced Against Back Pressure:** Valves can be connected to closed header systems without loss of valve lift or set pressure fluctuations.
- **Remote Sensing:** This option permits the pressure in the protected system to be accurately sensed at the PRV regardless of the inlet piping pressure losses to the PRV.
- **Field Test Connection:** Valve function can be verified in place without removing the valve to a test bench or raising process pressures.
- **Manual Blowdown:** The valve can be actuated manually or remotely to depressurize a system.

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SERIES 90 AND 9000 PILOT OPERATED PRESSURE RELIEF VALVES

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Type 93: The Type 93 is the original workhorse of the product range, providing excellent service since 1968. This pilot operated pressure relief valve is designed with elastomer seats and seals, with construction materials in aluminum, carbon steel (CS) and stainless steel (SS) to satisfy the majority of gas piping and chemical tank applications.

Types 91 and 94: The Types 91 and 94 were designed for specific applications where FEP diaphragms alone were not rugged enough and premium sealing was required for super cryogenic fluids. The Types 91 and 94 employ a bellows coupled with a Teflon® film seat to provide extraordinary performance for hard-to-hold cryogenic fluids such as hydrogen and helium. They also satisfy specific marine applications.

Type 95: The Type 95 is a unique higher pressure protection valve that utilizes a piston in the main valve for ruggedness, and high performance elastomers, making this valve ideal for special applications up to 150 psig [10.34 barg] in marine LPG services.

Type 96A: All of the above valves are pilot operated pressure relief valves. The Type 96A is a weight-loaded vacuum breaker designed to compliment the pressure relief products.

Types 9200 and 9300: The Types 9200 and 9300 were designed in 1986 to expand upon the capabilities of the Series 90 product range. The Types 9200 and 9300 employ the highly successful pressurized Teflon® film seat, as well as protected FEP diaphragms. The designs allow these valves to be used in the pilot operated pressure relief mode and simultaneously provide vacuum relief, either via weight loads of the internals, or with a specific pilot control of the vacuum opening. The Types 9200 and 9300 were designed with a special studded inlet connection to reduce the

inlet profile, and coupled with larger orifice areas, these valves provide flow capacities as much as 45 percent greater than the Series 90 valves. The Type 9300 is a full body valve to pipe away the discharge if required. The 9200 vents directly to atmosphere and has no provision to pipe away the discharge.

NOTE: The application of the 90 and 9000 Series flowing style pilot operated pressure relief valves in condensable gas service (ie: n-Butane, Isobutane or Butadiene) with operating fluid saturation temperatures that fall within the expected ambient temperature extremes require special consideration to assure the valve temperature remains above the operating fluid saturation temperature. Please contact your sales representative to review all applications which fall within this categorization.

Function – Low Pressure POPRV

Low pressure systems can be protected from overpressure by spring-operated valves, weight-loaded valves or pilot operated valves.

Full Open at Set Pressure

Weight-loaded and spring-operated valves begin to open when forces are in equilibrium. As process pressures approach set pressures, there can be significant simmer or leakage and loss of product. Long periods of simmer can lead to valve freeze-up with cryogenic fluids. Very small differential forces don't easily overcome sticky fluids and prevent proper opening. Typical weight-loaded valves require significant overpressure to achieve rated capacities (see Figure 1).

Pilot operated valves use a pilot to control pressure over a large unbalanced member in

the main valve, such as a diaphragm or piston (see Figure 2). The large overbalance means a much larger force on top of the seat compared to process forces pushing up on the seat. At set pressure, the pilot relieves the pressure quickly, permitting the main valve seat to open rapidly. The Anderson Greenwood Series 90 and 9000 designs can provide full opening without any overpressure, a capability unavailable in spring-operated and weight-loaded valves in low pressure systems.

This same feature can be applied to the Anderson Greenwood Series 9000 for vacuum, allowing tight sealing operation in a vacuum mode until such point where the valve must rapidly open to prevent excess vacuum.

Snap Action or Modulating Action Opening

Weight-loaded and spring-operated valves open as process forces overcome downward forces, with little flexibility to overcome problem applications. Anderson Greenwood pilot operated valves can be adjusted to open with a rapid "snap" action or modulating action. Most applications are well served by the snap action mode, with full opening at set pressure and full reseating after a short blowdown. However, some systems might best be served by a proportional opening, whereby the valve opens just enough to satisfy small upsets and maintain constant system pressure, yet still have the capability to reach full capacity within 10 percent overpressure. The Anderson Greenwood Series 90 and 9000 can be set for a snap acting or modulating mode with a simple adjustment of the external blowdown screw. No part changes are necessary to change the operating mode.

Large Selection of Models

The Series 90 and 9000 valves are offered in a wide variety of sizes, materials and configurations to meet most applications for

Function – Low Pressure POPRV (continued)

positive pressure and vacuum protection. Anderson Greenwood has decades of experience in cryogenic, industrial, and chemical applications. Each application benefits from the same features of leak-free operation, balanced against back pressure, as well as precise and repeatable opening.

Leak-Free Operation

Weight-loaded and spring-operated valves have decreasing seating forces as set pressure is approached. This leads to significant leakage of valuable product prior

to set point. With the Anderson Greenwood pilot operated valves, the greater the system pressure, the higher the seating force, until set point is reached and the valve opens.

This provides superior leak-free operation, minimizing product loss. Figure 3 illustrates the relative seating forces of the valve types.

Balanced Against Back Pressure

Low-pressure weight-loaded and spring-operated valves are directly affected by any back pressures, built-up or superimposed. Therefore, any vent piping or closed header

system can adversely affect the opening and capacities of these valves. Such valves should not be used when discharging into closed header systems. Figure 4 illustrates a typical weight-loaded design, where any back pressures will directly increase the opening pressure of such designs, or add to premature closing and instability. Anderson Greenwood pilot operated valves will not increase in set pressure or lose lift due to back pressure, as they are inherently balanced against back pressures.

Figure 1

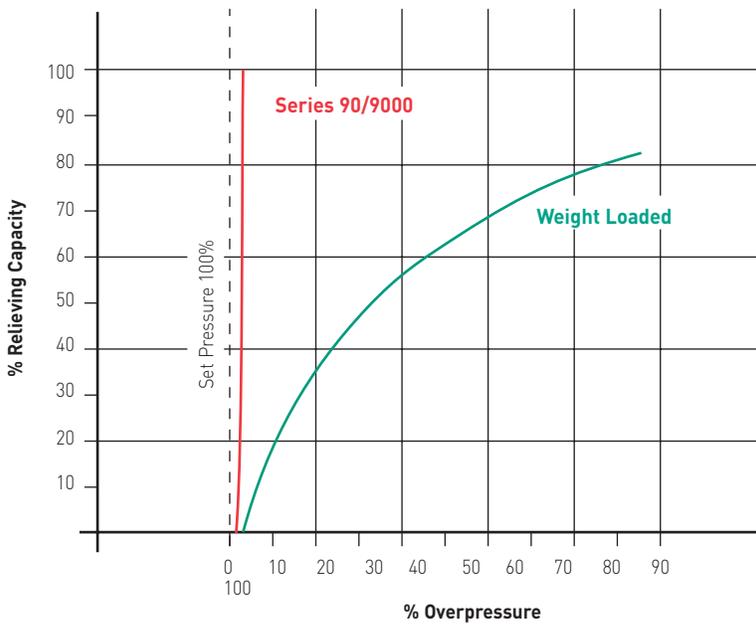


Figure 2

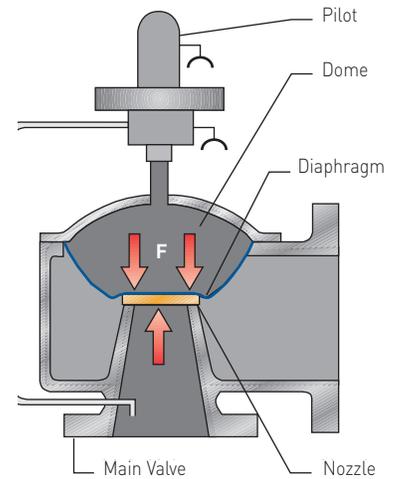


Figure 3

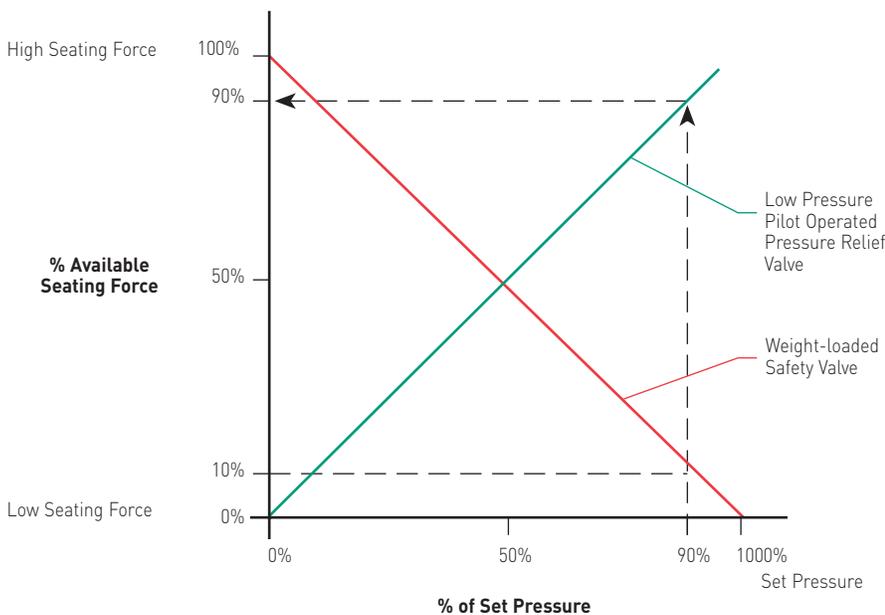
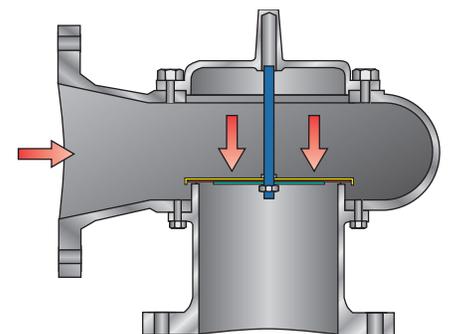
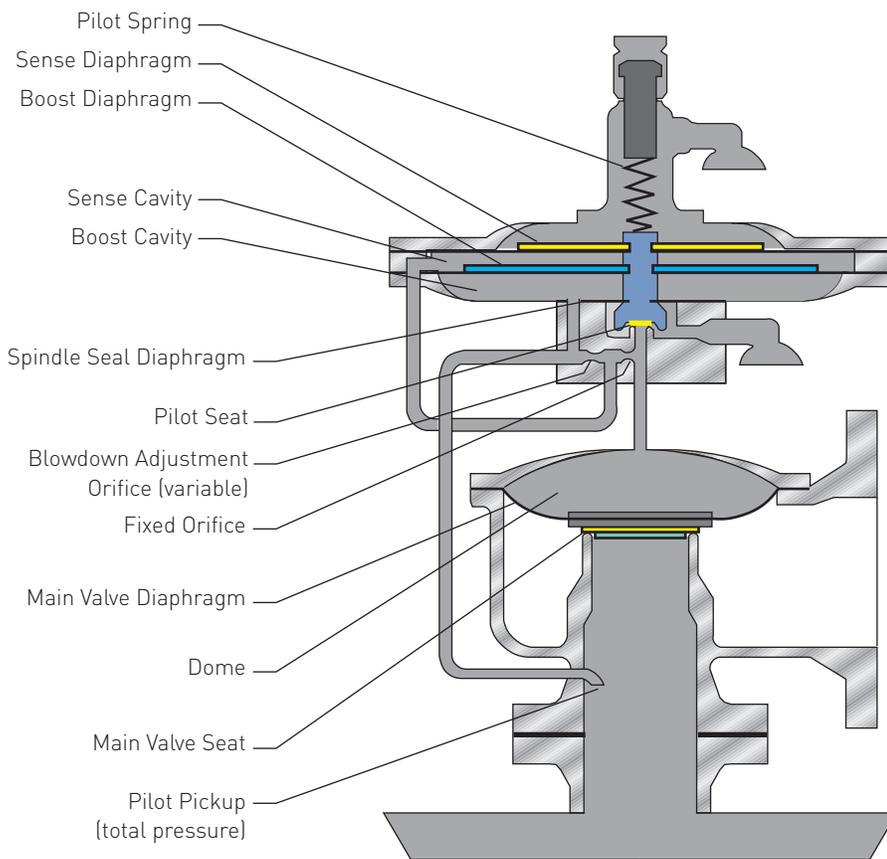


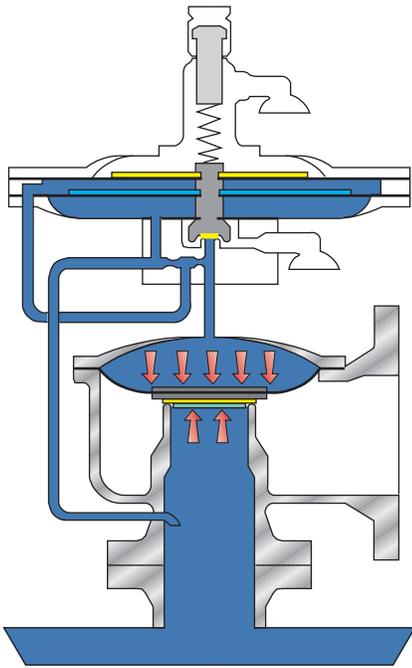
Figure 4



Operation – Series 90



Operation – Series 90

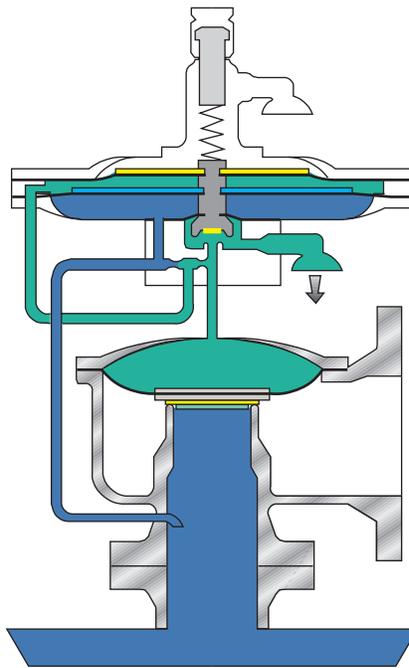


**Figure 5
 (Closed)
 Positive Pressure Relief**

Under normal operating conditions, system pressure acts on the bottom of the main valve seat, on top of the main valve diaphragm, and on the pilot diaphragms. The main valve seat is held tightly closed by a large force equal to the system pressure times the unbalanced area of the main valve diaphragm.

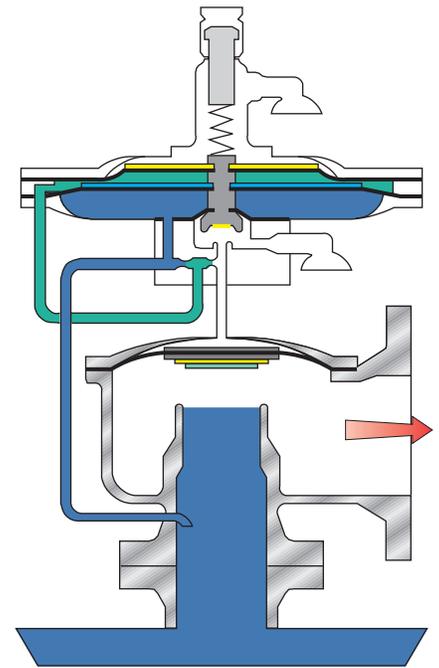
System pressure is also applied to the boost cavity and the sense cavity downstream of the variable orifice.

The soft pilot seat is held closed as the pilot spring load is greater than the upward forces acting on the sense diaphragm.



**Figure 6
 (Pilot Open)
 Positive Pressure Relief**

When process pressure increases to the point where the upward force on the sense diaphragm exceeds the spring load, the pilot seat lifts slightly, setting up a small flow in the pilot sense line. This small flow across the blowdown adjustment orifice causes a reduction in pressure downstream of the orifice and in the sense cavity. Even though this is only a small reduction in pressure, it creates a large net upward force which snaps the pilot full open as shown in Figure 7.



**Figure 7
 (Open and Flowing)
 Positive Pressure Relief**

With the pilot fully open, a large reduction in pressure on top of the main valve diaphragm occurs, resulting in full lift of the main valve seat. Set pressure is where the main valve opens.

Flow through the main valve continues until system pressure has been reduced to the point where the pilot spring is again able to overcome the lifting forces on the boost diaphragm. As the pilot begins to close, the flow and pressure drop across the blowdown adjustment and orifice decreases. The sense cavity pressure now increases to assist in an accelerated closing rate.

With the pilot closed, full line pressure again loads the dome area, the main valve seat closes, and the pressures return to those shown in Figure 5.

The point at which the pilot spring overcomes the net lifting forces on the boost diaphragm may be varied by changing the pressure drop across the variable blowdown adjustment orifice. A smaller orifice adjustment makes the valve close at a lower system pressure (longer blowdown). A larger orifice adjustment makes the valve open and close in a proportional/ modulating mode.



Operation – Series 9000 (Positive Pressure Relief)²

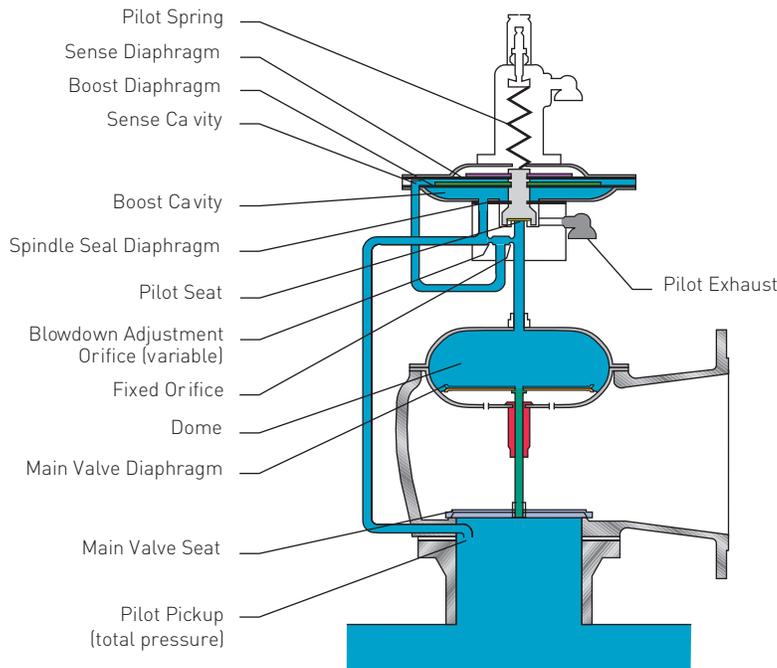


Figure 8 (Closed)



Figure 8 Positive Pressure Relief²

The Series 9000 group of products operates very similarly to the Series 90 group of valves. The Series 90 pilot is widely used with the Series 9000 valves, available in both “snap” and “modulating” actions (see Figures 5 - 7). The main difference is the main valve diaphragms are fully supported by the surrounding cases and diaphragm plates, increasing the pressure ranges of the Teflon® diaphragms and permitting vacuum operations. The main valve seat is a high performance Teflon® film seat which is extended from the main valve diaphragms to a lower profile nozzle, which permits greater flow capacities at set pressure.

Figure 9 Positive Pressure Relief

When process pressure increases to the point at which the upward force on the sense diaphragm exceeds the pilot spring load, the pilot seat lifts and begins the flow through the pilot. The flow across the blowdown adjustment orifice can be set to rapidly reduce the main valve dome pressure for a “snap” action, or slowly reduce the main valve dome pressure for a “modulating” action.¹

Figure 10 Positive Pressure Relief

- With the pilot open, the dome pressure is sufficiently reduced and the forces under the main valve seat lift the seat plate and begin to relieve system pressure.
- Flow through the main valve continues until system pressure has been reduced enough so the pilot spring is again able to overcome the lifting forces on the boost diaphragm.
- As the pilot begins to close, the flow and pressure drop across the blowdown adjustment orifice decreases.
- The sense cavity pressure then increases to assist in an accelerated closing rate.
- With the pilot closed, full line pressure again loads the dome area and the main valve seat closes. Pressures return to those shown in Figure 8.
- A non-flowing modulating pilot, Series 400, is available for special applications.

Figure 11 Weight Loaded Vacuum Relief

Weight loaded vacuum relief is most typical for economical vacuum protection in combination with a pilot operated pressure relief valve.

- The same valve which is held tightly closed on positive pressure opens on vacuum based on the weight of internal components.

Figure 12 Weight Loaded Vacuum Relief

- Vacuum in the protected vessel pulls up on one or two dome areas while external atmosphere pushes upwards on the diaphragms to lift the seat plates.
- Vacuum opening pressures depend on valve internals and number of diaphragm chambers used.

Figure 13 Vacuum Relief Pilot Operated

Pilot operated vacuum relief operation is basically the same as positive pressure relief operation, as follows:

- A seating force is established by loading the large dome area with a pressure greater than the inlet pressure under the seat.
- In the closed condition, atmospheric pressure is present in the dome area of the main valve and a vacuum is present at the inlet. This causes a net force that closes the seat and maintains tightness up to set point.

Operation – Series 9000 (Vacuum Relief)^{2, 3}

- At set point, the vacuum pulls against the spring force, and the pilot valve opens, evacuating the dome pressure through the supply tube into the inlet vacuum.
- When the pilot reseats, the supply line is closed by the pilot seat.
- Atmospheric pressure again fills the dome through the blowdown adjustment and fixed orifice, which closes the main valve.

Figure 14 Vacuum Relief Pilot Operated

- With a partial vacuum established in the dome, atmospheric pressure forces the diaphragm and seat to open and establishes air flow into the valve. This relieves the system vacuum.

Notes:

1. The point at which the pilot spring overcomes the net lifting forces on the boost diaphragm can be varied by changing the pressure drop across the variable blowdown adjustment orifice. A smaller orifice adjustment makes the valve close at a lower system pressure (longer blowdown).
2. With either pressure or vacuum configuration alone, the valve will open and flow when the weight-loaded pressure or vacuum for the opposite condition is exceeded unless a backflow preventer is installed.
3. Remote pressure sense required.

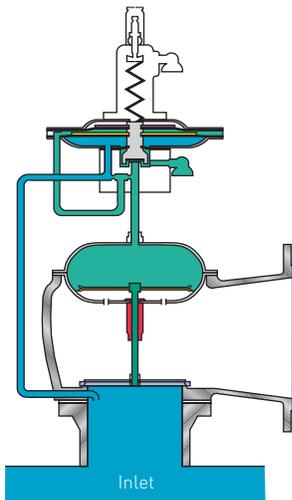


Figure 9 (Pilot Open)

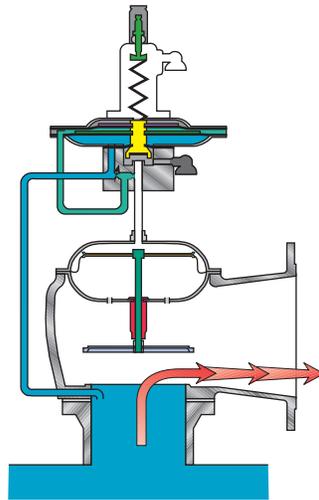


Figure 10 (Open and Flowing)

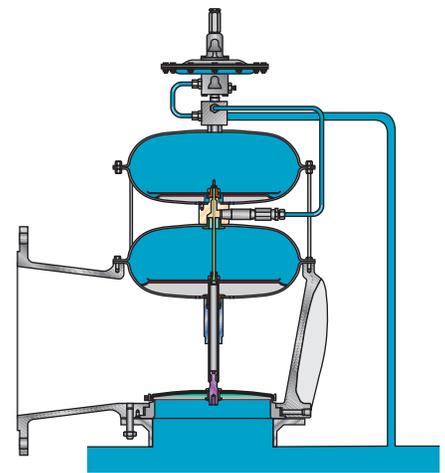


Figure 11 (Closed)

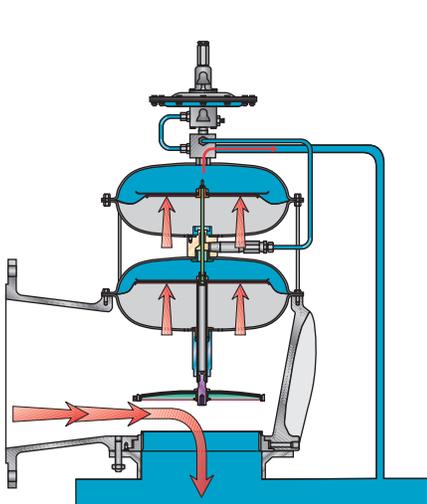


Figure 12 (Open and Flowing)

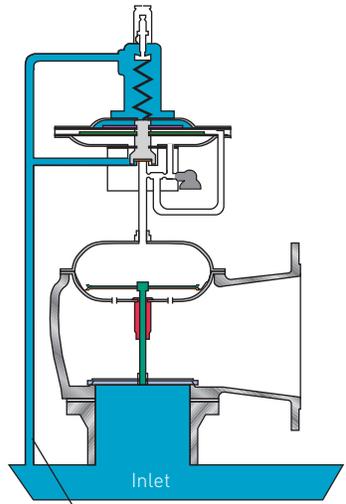


Figure 13 (Closed)

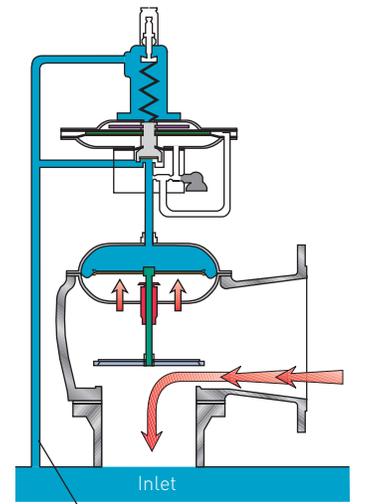
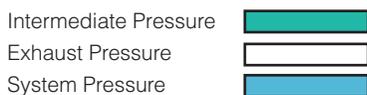
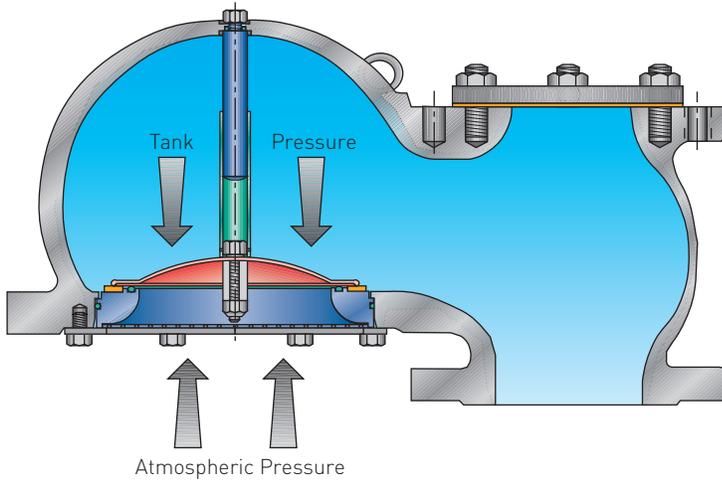
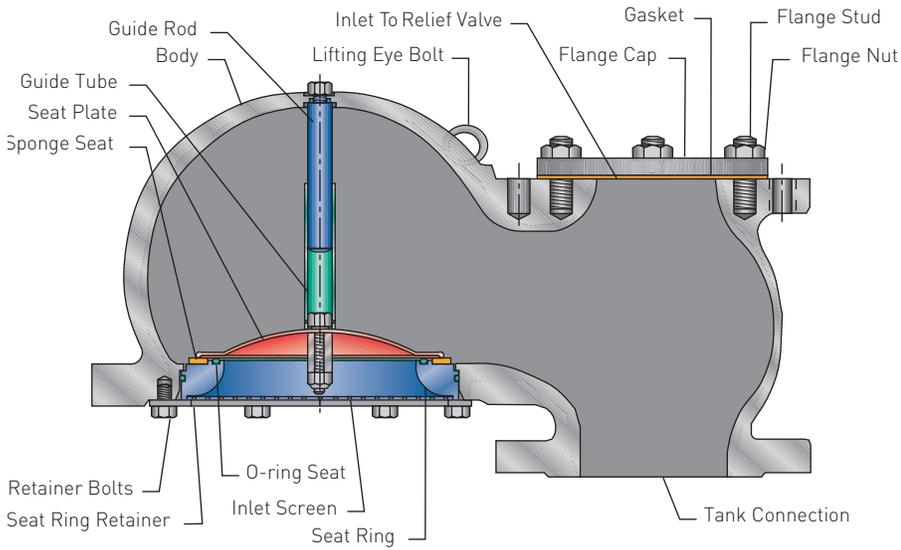


Figure 14 (Open and Flowing)

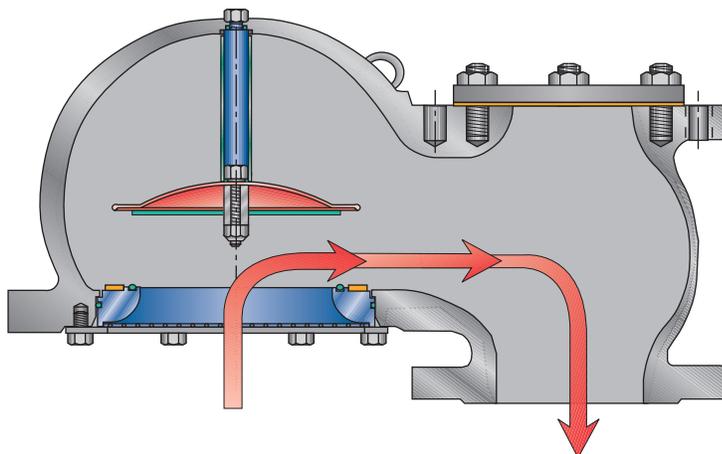


Operation – Type 96A Vacuum Breaker



Valve Closed

The weight of the pallet and any positive internal tank pressure holds the valve closed.



Valve Open and Flowing

The tank vacuum creates a pressure differential great enough to overcome the weight of the pallet and the pallet is lifted to the open position.

ANDERSON GREENWOOD LOW PRESSURE POPRV CATALOG

SERIES 90 AND 9000 PILOT OPERATED PRESSURE RELIEF VALVES

General Technical Data – Refer to Model Selection Tables for Specific Pressure Limitation

Series 90 ¹ ,					
Valve Type	Type 93	Pressure Relief Valves		Type 95	Vacuum Breaker
		Type 91	Type 94		Type 96A
Materials	AL, CS ⁶ , SS	AL or SS	AL or SS	SS	AL, CS ⁶ , SS
Main Valve Soft Goods	Elastomer or Teflon [®] Diaphragm, Rubber Seat and Seals	SS Bellows Teflon [®] Seat and Seals	SS Bellows Teflon [®] Seat and Seals	Kalrez [®] Seat Teflon [®] Seals	Elastomer Seat and Seals
Pilot Soft Goods	Elastomer or Teflon [®] Diaphragm, Elastomer Soft Goods	SS Diaphragms Teflon [®] Soft Goods	Teflon [®] Diaphragm Elastomer Soft Goods	Hastelloy [®] Teflon [®] Kalrez [®] Soft Goods	N/A
Set Pressure Range	3" wc to 50 psig [7.5 mbarg to 3.45 barg]	7" wc to 50 psig [17.4 mbarg to 3.45 barg]	7" wc to 50 psig [17.4 mbarg to 3.45 barg]	5 psig to 150 psig [.345 barg to 10.34 barg]	1/2 oz. or 1 1/2 oz. Vacuum [-2.2 to -6.6 mbarg]
Process Temperature	-260°F to 300°F ² [-162°C to 149°C]	-423°F to 200°F [-253°C to 93°C]	-423°F to 200°F [-253°C to 93°C]	-160°F to 400°F [-107°C to 205°C]	-320°F to 300°F ² [-196°C to 149°C]

Series 90 Temperature Ratings	
BUNA-N ³	-65°F to 250°F [-54°C to 121°C]
Viton [®]	-65°F to 300°F [-54°C to 149°C]
EPR	-65°F to 250°F [-54°C to 121°C]
Teflon [®] Film seat and seals (Types 91 and 94)	-423°F to 200°F [-253°C to 93°C]

Series 9000 ^{1,7}		
Valve Type	Pressure/Vacuum Relief Valves	
	Type 9200	Type 9300
Materials	AL or SS	AL, CS ⁶ , SS
Main Valve Soft Goods	Teflon [®] Diaphragm Seat and Seals	Teflon [®] Diaphragm Seat and Seals
Pilot Soft Goods	Elastomer or All Teflon [®] Soft Goods	Elastomer or All Teflon [®] Soft Goods
Set Pressure Range	4" wc to 5 psig [9.9 mbarg to 0.345 barg]	4" wc to 50 psig [9.9 mbarg to 3.45 barg]
Vacuum Range	-1.73" wc to -5 psig [-4.3 mbarg to -0.345 barg]	-1.73" wc to -5 psig [-4.3 mbarg to -0.35 barg]
Process Temperature	-320°F to 200°F ² [-196°C to 93°C]	-320°F to 200°F ² [-196°C to 93°C]

Notes:

- Not all valve sizes are available for service at extreme limits of both temperature and pressure simultaneously. Please consult your sales representative when "at limits" to confirm suitability of selected valve.
- Maximum temperature ratings for Series 90 Soft Goods: This is only a guide since pressure and fluid compatibility will also affect valve selection. See Series 90 Temperature Ratings table. For ASME code requirements, the maximum temperature for aluminum is 250°F [121°C].
- BUNA-N O-ring main valve seat is rated to -260°F [-162°C] in conjunction with Teflon[®] diaphragm.
- Kalrez[®], Viton[®] and Teflon[®] are registered trademarks of E.I. duPont de Nemours Company.
- Hastelloy[®] is a registered trademark of Haynes International.
- Minimum temperature for CS is -20°F [-29°C].
- Contact your sales representative for 90 or 9000 Series product recommendations when the boiling point of the lading fluid is in between the minimum and maximum expected ambient temperatures.

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SERIES 90 AND 9000 PILOT OPERATED PRESSURE RELIEF VALVES

Model Selection

Model Selection Overview

Valve Size Inlet x Outlet in [mm]		Orifice Area							
		Type 93 in ² [cm ²]		Types 91 and 94 in ² [cm ²]		Type 95 in ² [cm ²]		Types 9200 and 9300 in ² [cm ²]	
2 x 3	[50 x 80]	2.29	[14.77]	2.92	[18.84]	2.93	[18.90]	3.35	[21.61]
3 x 4	[80 x 100]	5.16	[33.29]	6.24	[40.26]	6.25	[40.32]	7.39	[47.68]
4 x 6	[100 x 150]	8.74	[56.39]	10.33	[66.65]	10.32	[66.58]	12.73	[82.13]
6 x 8	[150 x 200]	19.56	[126.19]	22.22	[143.35]	22.15	[142.90]	28.89	[186.39]
8 x 10	[200 x 250]	36.40	[234.84]	39.57	[255.29]			50.00	[322.58]
10 x 12	[250 x 300]	51.00	[329.03]	56.50	[364.52]			78.85	[508.71]
12 x 16	[300 x 400]	84.00	[541.93]	89.87	[579.81]			113.00	[729.03]

Type 93

Main Valve Size Inlet x Outlet in [mm]		Valve Body Material ^{2,3}	Minimum ¹ Set Pressure in wc [mbarg]		Sponge Seat ⁴ O-ring Seat psig [mbarg]		Maximum ¹ Set Pressure psig [barg]	
Orifice Area in ² [cm ²]								
2 x 3 [50 x 80]	2.29 [14.77]	AL	2	[5.0]	2.5	[170]	50.0	[3.45]
		CS	2	[5.0]	2.5	[170]	50.0	[3.45]
		SS	2	[5.0]	2.5	[170]	50.0	[3.45]
3 x 4 [80 x 100]	5.16 [33.29]	AL	2	[5.0]	1.5	[103]	50.0	[3.45]
		CS	2	[5.0]	1.5	[103]	50.0	[3.45]
		SS	2	[5.0]	1.5	[103]	50.0	[3.45]
4 x 6 [100 x 150]	8.74 [56.39]	AL	2	[5.0]	1.0	[69]	50.0	[3.45]
		CS	2	[5.0]	1.0	[69]	50.0	[3.45]
		SS	2	[5.0]	1.0	[69]	50.0	[3.45]
6 x 8 [150 x 200]	19.56 [126.19]	AL	2	[5.0]	1.0	[69]	50.0	[3.45]
		CS	2	[5.0]	1.0	[69]	50.0	[3.45]
		SS	2	[5.0]	1.0	[69]	50.0	[3.45]
8 x 10 [200 x 250]	36.40 [234.84]	AL	2	[5.0]	1.0	[69]	50.0	[3.45]
		CS	2	[5.0]	1.0	[69]	50.0	[3.45]
		SS	2	[5.0]	1.0	[69]	50.0	[3.45]
10 x 12 [250 x 300]	51.00 [329.03]	AL	2	[5.0]	1.0	[69]	30.0	[2.07]
		CS	2	[5.0]	1.0	[69]	30.0	[2.07]
		SS	2	[5.0]	1.0	[69]	30.0	[2.07]
12 x 16 [300 x 400]	84.00 [541.93]	AL	2	[5.0]	1.0	[69]	30.0	[2.07]
		CS	2	[5.0]	1.0	[69]	30.0	[2.07]
		SS	2	[5.0]	1.0	[69]	30.0	[2.07]

Notes:

1. Listed minimum and maximum set pressure may not be available for some material and service temperature combinations. Minimum set pressure with accessories is 5 inches wc [12.4 mbarg] or minimum stated above, whichever is greater. Consult with sales office for verification.
2. Refer to material sections of this catalog for balance of standard materials for the valve model shown.
3. Standard Aluminum valves are manufactured with flat faced flange finish in accordance with commercial practice. The flanges are designated as Class 150 FF, with drilling equal to ANSI Class 150. Standard CS and SS valves are manufactured with ANSI Class 150 RF (spiral serrated, raised face, unless otherwise specified). Special facings, drilling and surface finishes are available upon request.
4. At this pressure and below, a sponge-design seat is utilized in the main valve. Above this pressure, an O-ring design seat is utilized.

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SERIES 90 AND 9000 PILOT OPERATED PRESSURE RELIEF VALVES

Model Selection

Notes:

1. Listed minimum and maximum set pressure may not be available for some material and service temperature combinations. Consult with sales office for verification.
2. Refer to material sections of this catalog for balance of standard materials for the valve model shown.
3. Standard Aluminum valves are manufactured with flat faced flange finish in accordance with commercial practice. The flanges are designated as Class 150 FF, with drilling equal to ANSI Class 150. Standard SS valves are manufactured with ANSI Class 150 RF (spiral serrated, raised face, unless otherwise specified). Special facings, drilling and surface finishes are available upon request.

Types 91 and 94

Main Valve Size		Orifice Area in ² [cm ²]	Valve Body Material ^{2,3}	Minimum ¹ Set Pressure		Maximum ¹ Set Pressure	
Inlet x Outlet in [mm]	psig [mbarg]			psig [barg]			
2 x 3 [50 x 80]	2.92 [18.84]	AL SS	1.50 1.50	[103] [103]	50.0 50.0	[3.45] [3.45]	
3 x 4 [80 x 100]	6.24 [40.26]	AL SS	1.00 1.00	[69] [69]	50.0 50.0	[3.45] [3.45]	
4 x 6 [100 x 150]	10.33 [66.65]	AL SS	1.00 1.00	[69] [69]	50.0 50.0	[3.45] [3.45]	
6 x 8 [150 x 200]	22.22 [143.35]	AL SS	1.00 1.00	[69] [69]	50.0 50.0	[3.45] [3.45]	
8 x 10 [200 x 250]	39.57 [255.29]	AL SS	0.75 0.75	[52] [52]	50.0 50.0	[3.45] [3.45]	
10 x 12 [250 x 300]	56.50 [364.52]	AL SS	0.75 0.75	[52] [52]	50.0 50.0	[3.45] [3.45]	
12 x 16 [300 x 400]	89.87 [579.81]	AL SS	0.50 0.50	[34] [34]	50.0 50.0	[3.45] [3.45]	

Notes:

1. Refer to material sections of this catalog for balance of standard materials for the valve model shown.
2. SS valves are standard with ANSI Class 150 RF (spiral serrated, raised face, unless otherwise specified). Special facings, drilling and surface finishes are available upon request.

Type 95

Main Valve Size		Orifice Area in ² [cm ²]	Valve Body Material ^{1,2}	Minimum Set Pressure		Maximum Set Pressure	
Inlet x Outlet in [mm]	psig [barg]			psig [barg]			
2 x 3 [50 x 80]	2.93 [18.90]	SS	10.00	[0.690]	150	[10.3]	
3 x 4 [80 x 100]	6.25 [40.32]	SS	5.00	[0.345]	150	[10.3]	
4 x 6 [100 x 150]	10.32 [66.58]	SS	5.00	[0.345]	150	[10.3]	
6 x 8 [150 x 200]	22.15 [142.90]	SS	5.00	[0.345]	150	[10.3]	

ANDERSON GREENWOOD LOW PRESSURE POPRV CATALOG
 SERIES 90 AND 9000 PILOT OPERATED PRESSURE RELIEF VALVES

Model Selection

Type 9200, Pressure Only - Pilot Operated (single chamber)

Main Valve Size Inlet in [mm]	Orifice Area in ² [cm ²]	Valve Trim Material ^{2,3}	Minimum ¹ Set Pressure		Maximum ¹ Set Pressure	
			in wc	[mbarg]	psig	[barg]
2 Vent [50]	3.35 [21.61]	AL	6	[14.9]	5	[0.35]
		SS	6	[14.9]	5	[0.35]
3 Vent [80]	7.39 [47.68]	AL	4	[10.0]	5	[0.35]
		SS	4	[10.0]	5	[0.35]
4 Vent [100]	12.73 [82.13]	AL	3	[7.5]	5	[0.35]
		SS	5	[12.4]	5	[0.35]
6 Vent [150]	28.89 [186.39]	AL	3	[7.5]	5	[0.35]
		SS	5	[12.4]	5	[0.35]
8 Vent [200]	50.00 [322.58]	AL	4	[10.0]	5	[0.35]
		SS	7	[17.4]	5	[0.35]
10 Vent [250]	78.85 [508.71]	AL	4	[10.0]	5	[0.35]
		SS	6	[14.9]	2	[0.14]
12 Vent [300]	113.00 [729.03]	AL	4	[10.0]	5	[0.35]
		SS	10	[24.9]	2	[0.14]

Notes:

1. Listed minimum and maximum set pressure may not be available for some material and service temperature combinations. Minimum set pressure with accessories is 5 inches wc [12.4 mbarg] or minimum stated above, whichever is greater. Consult with sales office for verification.
2. Refer to material sections of this catalog for balance of standard materials for the valve model shown.
3. All standard Type 9200 valves are manufactured with ANSI Class 150 RF inlet flanges (smooth, raised face, unless otherwise specified). Special facings, drilling and surface finishes are available upon request.

Type 9300, Pressure Only - Pilot Operated (single chamber)

Main Valve Size Inlet x Outlet in [mm]	Orifice Area in ² [cm ²]	Valve Trim Material ^{2,3,6}	Minimum ¹ Set Pressure		Maximum ¹ Set Pressure	
			in wc	[mbarg]	psig	[barg]
2 x 3 [50 x 80]	3.35 [21.61]	AL	6	[14.9]	5	[0.35]
		SS	6	[14.9]	5	[0.35]
		SS	19	[47.3]	50	[3.45]
3 x 4 [80 x 100]	7.39 [47.68]	AL	4	[10.0]	5	[0.35]
		SS	4	[10.0]	5	[0.35]
		SS	11	[27.4]	50	[3.45]
4 x 6 [100 x 150]	12.73 [82.13]	AL	3	[7.5]	5	[0.35]
		SS	5	[12.4]	5	[0.35]
		SS	8	[19.9]	44 ⁴	[3.03]
6 x 8 [150 x 200]	28.89 [186.39]	AL	3	[7.5]	5	[0.35]
		SS	5	[12.4]	5	[0.35]
		SS	6	[14.9]	25 ⁴	[1.72]
8 x 10 [200 x 250]	50.00 [322.58]	AL	4	[10.0]	5	[0.35]
		SS	7	[17.4]	5	[0.35]
		SS	10	[24.9]	23 ⁴	[1.59]
10 x 12 [250 x 300]	78.85 [508.71]	AL	4	[10.0]	5	[0.35]
		SS	6	[14.9]	2	[0.14]
		SS	11	[27.4]	14 ⁵	[0.97]
12 x 16 [300 x 400]	113.00 [729.03]	AL	4	[10.0]	5	[0.35]
		SS	10	[24.9]	2	[0.14]
		SS	17	[42.3]	14 ⁵	[0.97]

Notes:

1. Listed minimum and maximum set pressure may not be available for some material and service temperature combinations. Minimum set pressure with accessories is 5 inches wc [12.4 mbarg] or minimum stated above, whichever is greater. Consult with sales office for verification.
2. Refer to material sections of this catalog for balance of standard materials for the valve model shown.
3. Standard Aluminum valves are manufactured with flat faced outlet flange finish in accordance with commercial practice. The flanges are designated as Class 150 FF, with drilling equal to ANSI Class 150. Standard CS and SS valves are manufactured with ANSI Class 150 RF (smooth, raised face, unless otherwise specified). Special facings, drilling and surface finishes are available upon request. All inlet flanges must be raised face.
4. 50 psig [3.45 barg] with SS cap.
5. 30 psig [2.07 barg] with SS cap.
6. Valve body available in AL, CS or SS.

ANDERSON GREENWOOD LOW PRESSURE POPRV CATALOG

SERIES 90 AND 9000 PILOT OPERATED PRESSURE RELIEF VALVES

Model Selection

Notes:

1. Listed minimum and maximum set pressure may not be available for some material and service temperature combinations.
2. Refer to material sections of this catalog for balance of standard materials for the valve model shown.
3. All standard Type 9200 valves are manufactured with ANSI Class 150 RF (smooth, raised face, unless otherwise specified). Special facings, drilling and surface finishes are available upon request.
4. Weight loaded vacuum openings are available from -1 oz [-4.3 mbarg] full open. Dual chambers may be required.
5. Valve will open on positive pressure unless equipped with positive pressure block accessory. Minimum vacuum set with this accessory is limited to -5" wc [-12.4 mbarg]. Positive pressure is limited. Please consult your sales representative.
6. Remote pressure sense connection is required for all vacuum configurations.

Type 9200, Vacuum Only - Pilot Operated^{5, 6} (single chamber)

Inlet in [mm]	Main Valve Size		Valve Trim Material ^{2,3}	Minimum ^{1,4} Set Vacuum		Maximum ¹ Set Vacuum	
	Inlet	Orifice Area		in wc	[mbarg]	psig	[barg]
2 Vent [50]	3.35 [21.61]		AL SS	-2 -2	[-5.0] [-5.0]	-5 -5	[-0.35] [-0.35]
3 Vent [80]	7.39 [47.68]		AL SS	-2 -2	[-5.0] [-5.0]	-5 -5	[-0.35] [-0.35]
4 Vent [100]	12.73 [82.13]		AL SS	-2 -2	[-5.0] [-5.0]	-5 -5	[-0.35] [-0.35]
6 Vent [150]	28.89 [186.39]		AL SS	-2 -2	[-5.0] [-5.0]	-5 -5	[-0.35] [-0.35]
8 Vent [200]	50.00 [322.58]		AL SS	-4 -4	[-10.0] [-10.0]	-5 -5	[-0.35] [-0.35]
10 Vent [250]	78.85 [508.71]		AL SS	-2 -2	[-5.0] [-5.0]	-5 -2	[-0.35] [-0.14]
12 Vent [300]	113.00 [729.03]		AL SS	-3 -5	[-7.6] [-12.7]	-5 -2	[-0.35] [-0.14]

Notes:

1. Listed minimum and maximum set pressure may not be available for some material and service temperature combinations.
2. Refer to material sections of this catalog for balance of standard materials for the valve model shown.
3. Standard Aluminum valves are manufactured with flat faced outlet flange finish in accordance with commercial practice. The flanges are designated as Class 150 FF, with drilling equal to ANSI Class 150. Standard CS and SS valves are manufactured with ANSI Class 150 RF (smooth, raised face, unless otherwise specified). Special facings, drilling and surface finishes are available upon request. All inlet flanges must be raised face.
4. Valve body available in AL, CS or SS.
5. Weight loaded vacuum openings are available from -1 oz [-4.3 mbarg] full open. Dual chambers may be required.
6. Valve will open on positive pressure unless equipped with positive pressure block accessory. Minimum vacuum set with this accessory is limited to -5" wc [-12.4 mbarg]. Positive pressure is limited. Please consult your sales representative.
7. Remote pressure sense connection is required for all vacuum configurations.

Type 9300, Vacuum Only - Pilot Operated^{6, 7} (single chamber)

Inlet x Outlet in [mm]	Main Valve Size		Valve Trim Material ^{2,3,4}	Minimum ^{1,5} Set Vacuum		Maximum ¹ Set Vacuum	
	Inlet	Orifice Area		in wc	[mbarg]	psig	[barg]
2 x 3 [50 x 80]	3.35 [21.61]		AL SS	-2 -2	[-5.0] [-5.0]	-5 -5	[-0.35] [-0.35]
3 x 4 [80 x 100]	7.39 [47.68]		AL SS	-2 -2	[-5.0] [-5.0]	-5 -5	[-0.35] [-0.35]
4 x 6 [100 x 150]	12.73 [82.13]		AL SS	-2 -2	[-5.0] [-5.0]	-5 -5	[-0.35] [-0.35]
6 x 8 [150 x 200]	28.89 [186.39]		AL SS	-2 -2	[-5.0] [-5.0]	-5 -5	[-0.35] [-0.35]
8 x 10 [200 x 250]	50.00 [322.58]		AL SS	-4 -4	[-10.0] [-10.0]	-5 -5	[-0.35] [-0.35]
10 x 12 [250 x 300]	78.85 [508.71]		AL SS	-2 -2	[-5.0] [-5.0]	-5 -5	[-0.35] [-0.35]
12 x 16 [300 x 400]	113.00 [729.03]		AL SS	-3 -5	[-7.6] [-12.7]	-5 -5	[-0.35] [-0.35]

ANDERSON GREENWOOD LOW PRESSURE POPRV CATALOG
 SERIES 90 AND 9000 PILOT OPERATED PRESSURE RELIEF VALVES

Model Selection

**Type 9200, Pressure Pilot Weight Loaded Vacuum Combination^{4, 5}
 (dual chamber)**

Main Valve Size		Valve Trim Material ^{2,3}	Pressure ¹ Pilot Range
Inlet in [mm]	Orifice Area in ² [cm ²]		
2 [50]	3.35 [21.61]	AL	6" wc to 5 psig [14.9 mbarg to 0.35 barg]
2 [50]	3.36 [21.68]	SS	6" wc to 5 psig [14.9 mbarg to 0.35 barg]
3 [80]	7.39 [47.68]	AL	4" wc to 5 psig [10 mbarg to 0.35 barg]
3 [80]	7.39 [47.68]	SS	4" wc to 5 psig [10 mbarg to 0.35 barg]
4 [100]	12.73 [82.13]	AL	3" wc to 5 psig [7.5 mbarg to 0.35 barg]
4 [100]	12.73 [82.13]	SS	5" wc to 5 psig [12.4 mbarg to 0.35 barg]
6 [150]	28.89 [186.39]	AL	3" wc to 5 psig [7.5 mbarg to 0.35 barg]
6 [150]	28.89 [186.39]	SS	5" wc to 5 psig [12.4 mbarg to 0.35 barg]
8 [200]	50.00 [322.58]	AL	4" wc to 5 psig [10 mbarg to 0.35 barg]
8 [200]	50.00 [322.58]	SS	7" wc to 5 psig [17.4 mbarg to 0.35 barg]
10 [250]	78.85 [508.71]	AL	4" wc to 5 psig [10 mbarg to 0.35 barg]
10 [250]	78.85 [508.71]	SS	6" wc to 2 psig [14.9 mbarg to 0.14 barg]
12 [300]	113.00 [729.03]	AL	4" wc to 5 psig [10 mbarg to 0.35 barg]
12 [300]	113.00 [729.03]	SS	10" wc to 2 psig [24.9 mbarg to 0.14 barg]

Notes:

1. Listed minimum and maximum set pressure may not be available for some material and service temperature combinations. Consult with sales representative for verification.
2. Refer to material sections of this catalog for balance of standard materials for the valve model shown.
3. Aluminum and SS valves are manufactured with raised faced inlet flange finish in accordance with commercial practice. The flanges are designated as Class 150 RF.
4. With dual diaphragm chambers, valve reaches rated capacity at -1 oz [-4.3 mbarg]. Note that 2-inch valve only requires single diaphragm chamber. Pilot operated control of vacuum setting is available. Please consult your sales representative.
5. Remote pressure sense connection is required for all vacuum configurations.

ANDERSON GREENWOOD LOW PRESSURE POPRV CATALOG

SERIES 90 AND 9000 PILOT OPERATED PRESSURE RELIEF VALVES

Model Selection

Notes:

1. Listed minimum and maximum set pressure may not be available for some material and service temperature combinations. Consult with your sales representative for verification.
2. Refer to material sections of this catalog for balance of standard materials for the valve model shown.
3. Standard Aluminum valves are manufactured with flat faced outlet flange finish in accordance with commercial practice. The flanges are designated as Class 150 FF, with drilling equal to ANSI Class 150. Standard CS and SS valves are manufactured with ANSI Class 150 RF (smooth, raised face, unless otherwise specified). Special facings, drilling and surface finishes are available upon request.
4. 50 psig [3.45 barg] with SS cap.
5. 30 psig [2.07 barg] with SS cap.
6. Valve body available in AL, CS or SS.
7. With dual diaphragm chambers, valve reaches rated capacity at -1 oz [-4.3 mbarg]. Note that 2-inch valve only requires single diaphragm chamber. Pilot operated control of vacuum setting is available. Please consult your sales representative.
8. Remote pressure sense connection is required for all vacuum configurations.

Type 9300, Pressure Pilot Weight Loaded Vacuum Combination^{7, 8} (dual chamber)

Main Valve Size		Valve Internals Material ^{2,3,6}	Pressure ¹ Pilot Range
Inlet in [mm]	Orifice Area in ² [cm ²]		
2 x 3 [50 x 80]	3.35 [21.61]	AL	6" wc to 5 psig [14.9 mbarg to 0.35 barg]
2 x 3 [50 x 80]	3.36 [21.68] 3.36 [21.68]	SS	6" wc to 5 psig [14.9 mbarg to 0.35 barg] 20" wc to 50 psig [48.8 mbarg to 3.45 barg]
3 x 4 [80 x 100]	7.39 [47.68]	AL	4" wc to 5 psig [10 mbarg to 0.35 barg]
3 x 4 [80 x 100]	7.39 [47.68] 7.39 [47.68]	SS	4" wc to 5 psig [10 mbarg to 0.35 barg] 12" wc to 50 psig [29.9 mbarg to 3.45 barg]
4 x 6 [100 x 150]	12.73 [82.13]	AL	3" wc to 5 psig [7.5 mbarg to 0.35 barg]
4 x 6 [100 x 150]	12.73 [82.13] 12.73 [82.13]	SS	5" wc to 5 psig [12.4 mbarg to 0.35 barg] 9" wc to 44 psig ⁴ [22.4 mbarg to 3.03 barg]
6 x 8 [150 x 200]	28.89 [186.39]	AL	3" wc to 5 psig [7.5 mbarg to 0.35 barg]
6 x 8 [150 x 200]	28.89 [186.39] 28.89 [186.39]	SS	5" wc to 5 psig [12.4 mbarg to 0.35 barg] 7" wc to 25 psig ⁴ [17.4 mbarg to 1.72 barg]
8 x 10 [200 x 250]	50.00 [322.58]	AL	4" wc to 5 psig [10 mbarg to 0.35 barg]
8 x 10 [200 x 250]	50.00 [322.58] 50.00 [322.58]	SS	7" wc to 5 psig [17.4 mbarg to 0.35 barg] 11" wc to 23 psig ⁴ [27.4 mbarg to 1.59 barg]
10 x 12 [250 x 300]	78.85 [508.71]	AL	4" wc to 5 psig [10 mbarg to 0.35 barg]
10 x 12 [250 x 300]	78.85 [508.71] 78.85 [508.71]	SS	6" wc to 2 psig [14.9 mbarg to 0.14 barg] 12" wc to 14 psig ⁵ [29.9 mbarg to 0.97 barg]
12 x 16 [300 x 400]	113.00 [729.03]	AL	4" wc to 5 psig [10 mbarg to 0.35 barg]
12 x 16 [300 x 400]	113.00 [729.03] 113.00 [729.03]	SS	10" wc to 2 psig [24.9 mbarg to 0.14 barg] 19" wc to 14 psig ⁵ [47.3 mbarg to 0.97 barg]

ANDERSON GREENWOOD LOW PRESSURE POPRV CATALOG

SERIES 90 AND 9000 PILOT OPERATED PRESSURE RELIEF VALVES

Model Selection

Type 96A Vacuum Breaker¹

Valve Size in [mm]	Tank Connection		Valve Size in [mm]	Safety Valve Connection		Valve Model Number ^{3,4}
	ANSI Flange Class ²	Valve Body Material		ANSI Flange Class ²	Maximum Positive Pressure	
4 [100]	150 FF	AL	Capped	150 FF	85 psig [5.86 barg]	96A04FA
	150 RF	SS		150 FF	85 psig [5.86 barg]	96A04RS
4 [100]	150 FF	AL	4 [100]	150 FF	85 psig [5.86 barg]	96A0404FA
	150 RF	SS		150 FF	85 psig [5.86 barg]	96A0404RS
4 [100]	150 FF	AL	3 [80]	150 FF	85 psig [5.86 barg]	96A0403FA
	150 RF	SS		150 FF	85 psig [5.86 barg]	96A0403RS
6 [150]	150 FF	AL	Capped	150 FF	37 psig [2.55 barg]	96A06FA
	150 RF	SS		150 FF	37 psig [2.55 barg]	96A06RS
6 [150]	150 FF	AL	6 [150]	150 FF	37 psig [2.55 barg]	96A0606FA
	150 RF	SS		150 FF	37 psig [2.55 barg]	96A0606RS
6 [150]	150 FF	AL	4 [100]	150 FF	37 psig [2.55 barg]	96A0604FA
	150 RF	SS		150 FF	37 psig [2.55 barg]	96A0604RS
8 [200]	150 FF	AL	Capped	150 FF	65 psig [4.48 barg]	96A08FA
	150 RF	SS		150 FF	65 psig [4.48 barg]	96A08RS
8 [200]	150 FF	AL	8 [200]	150 FF	65 psig [4.48 barg]	96A0808FA
	150 RF	SS		150 FF	65 psig [4.48 barg]	96A0808RS
8 [200]	150 FF	AL	6 [150]	150 FF	65 psig [4.48 barg]	96A0806FA
	150 RF	SS		150 FF	65 psig [4.48 barg]	96A0806RS
12 [300]	150 FF	AL	Capped	150 FF	44 psig [3.03 barg]	96A12FA
	150 RF	SS		150 FF	44 psig [3.03 barg]	96A12RS
12 [300]	150 FF	AL	12 [300]	150 FF	44 psig [3.03 barg]	96A1212FA
	150 RF	SS		150 FF	44 psig [3.03 barg]	96A1212RS
12 [300]	150 FF	AL	10 [250]	150 FF	44 psig [3.03 barg]	96A1210FA
	150 RF	SS		150 FF	44 psig [3.03 barg]	96A1210RS

Notes:

- All model numbers shown are standard. Some alternative flange facing or drilling is available upon request.
- The pressure relief valve connection is drilled to meet the size and number of bolts for ANSI Class 150 flanges.
- Standard Settings: -1/2 oz [-2.2 mbarg]
-1 1/2 oz [-6.6 mbarg]
Full open at double this setting.
- Seat and seals available in BUNA-N, Viton® and EPR.

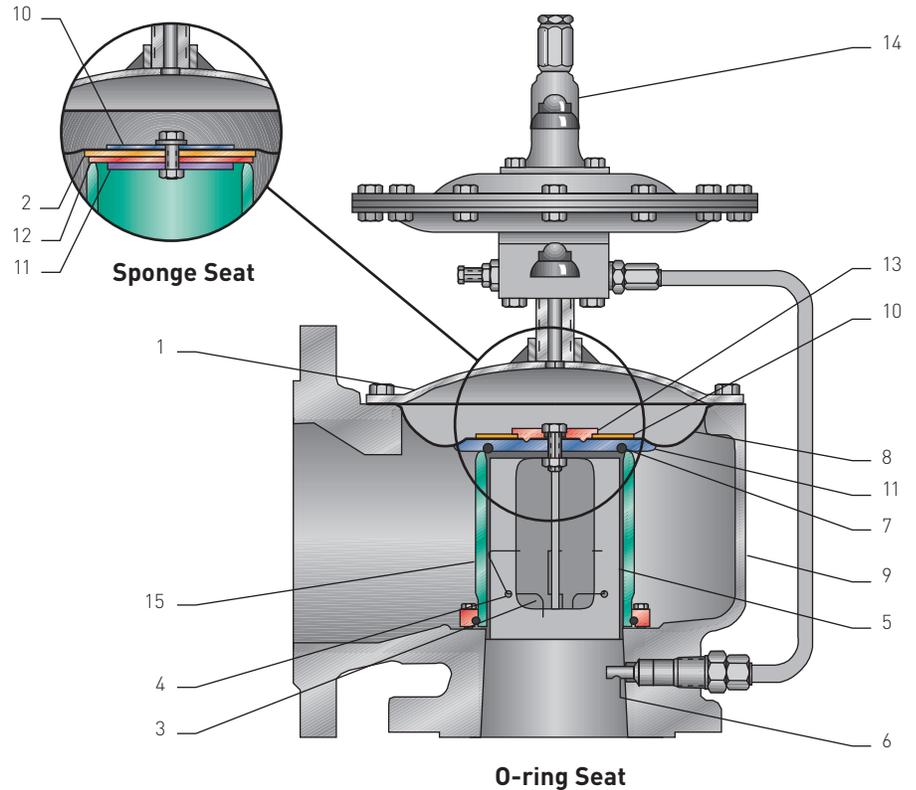
ANDERSON GREENWOOD LOW PRESSURE POPRV CATALOG
 SERIES 90 AND 9000 PILOT OPERATED PRESSURE RELIEF VALVES

Product Detail – Type 93

- ASME UV Code Stamp, NB certified capacity 15 psig and above
- Elastomer or Teflon® Diaphragms
- Replaceable Nozzles
- Elastomer Seat and Seals
- Pressure Range
2-inch wc to 50 psig
[5.0 mbarg to 3.45 barg]
- Sizes 2 to 12-inch [50 to 300 mm]
- Orifices 2.29 to 84.0 in²
[14.78 to 541.97 cm²]

Notes:

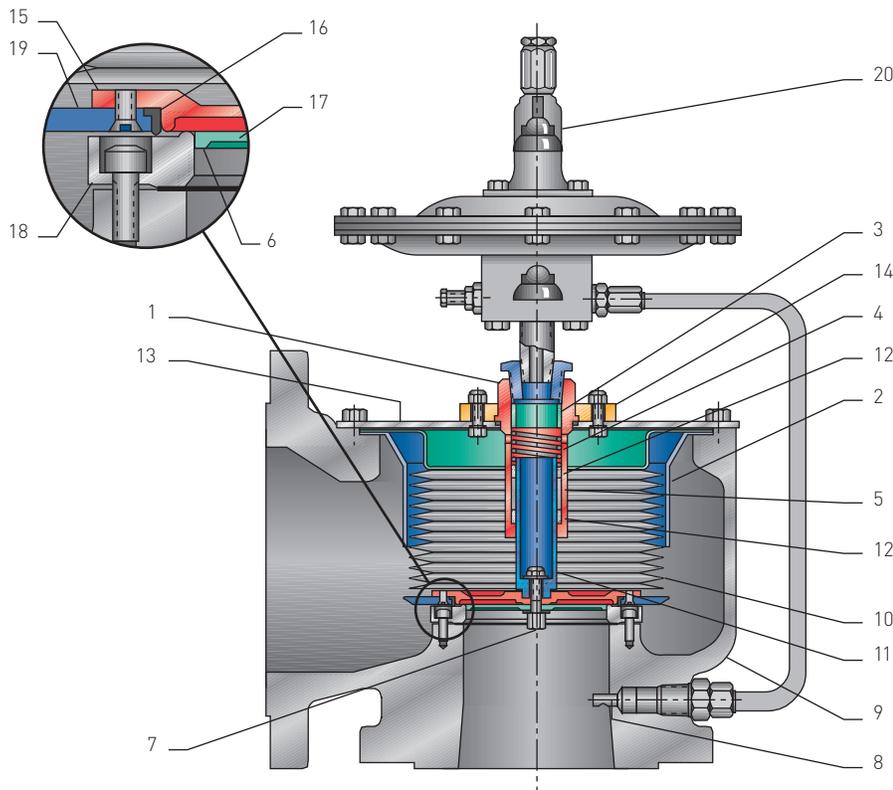
1. SS optional.
2. Used on 6-inch [150 mm] and larger valves only.
3. BUNA-N standard, Viton® or EPR optional.
4. BUNA-N, Dacron reinforced standard; Viton®, EPR, Dacron reinforced optional; non-reinforced Teflon® optional.
5. Electroless Nickel plated.
6. Not required in lowest pressure.
7. 2- to 6-inch [50 to 150 mm]:
A747-CB7CU1H1150.
8- to 12-inch [200 to 300 mm]:
A240-304/A276-304/A312-304W.
8. Used on 6-inch [150 mm] and smaller valves.



Materials of Construction

Part #	Description	Material		
		AL	CS	SS
1	Cap	CS ¹ SA516-70 ¹	CS SA516-70 ¹	SS A240-316
2	Retainer Plate	AL 6061-T6 ¹	AL 6061-T6 ¹	SS A240-304
3	Guide Spring ⁶	316 SS	316 SS	316 SS
4	Spring Pin ²	302 SS	302 SS	302 SS
5	Guide ⁶	AL 6061-T6 ¹	AL 6061-T6 ¹	7
6	Dipper Tube	17-4 SS	17-4 SS	17-4 SS
7	Seat O-ring	3	3	3
8	Diaphragm	4	4	4
9	Body	AL SB26 356-T6	CS A216-WCB	SS A351-CF8M
10	Diaphragm Retainer	AL 6061-T6 ¹	AL 6061-T6 ¹	SS A240-304
11	Seat Retainer	AL 6061-T6 ¹	AL 6061-T6 ¹	SS A240-304
12	Sponge Seat	3	3	3
13	Top Plate ⁸	AL 6061-T6 ¹	AL 6061-T6 ¹	SS A240-304
14	Pilot Valve	AL ¹	CS ¹	SS
15	Nozzle	SS 479-316 or A351-CF8M	CS ^{1,5} A108-1213 or A513-1026	SS 479-316 or A351-CF8M
-	Nuts/Bolts/Tubing	18-8 SS	18-8 SS	18-8 SS

Product Detail – Types 91 and 94



- ASME UV Code Stamp, NB certified capacity 15 psig and above
- Bellows
- Teflon® Seat and Seals
- Film Type Seat
- Pressure Range 4-inch wc to 50 psig [10.0 mbarg to 3.45 barg]
- Sizes 2 to 12-inch [50 to 300 mm]
- Orifices 2.92 to 89.87 in² [18.84 to 579.84 cm²]

Materials of Construction

Part #	Description	Material		Part #	Description	Material	
		AL	SS			AL	SS
1	Guide Tower	AL 6061-T651	SS A582-303	12	Taper Ring ²	AL 6061-T651	SS A582-303
2	Bellows Shield ¹	18-8 SS	18-8 SS	13	Cap	AL 6061-T651	SS A240-316
3	Spacer ²	AL 6061-T651	SS 304	14	Flange	AL 6061-T651	SS A582-303
4	Spring ²	316 SS	316 SS	15	Seat Plate	AL 6061-T651	SS A240-304
5	Wedge Ring ²	Teflon® PTFE	Teflon® PTFE	16	Secondary Seat	Teflon®	Teflon®
6	Retainer Disc	AL 6061-T651	SS A240-304	17	Primary Seat	Teflon®	Teflon®
7	Guide Bolt	17-4 SS	17-4 SS	18	Nozzle	SS ³	SS ³
8	Dipper Tube	17-4 SS	17-4 SS	19	Seat Retainer	AL 6061-T6	SS A240-304
9	Body	AL SB26 356-T6	SS A351-CF8M	20	Pilot Valve	AL	SS
10	Bellows	300 SS	300 SS	-	Seals	Teflon®	Teflon®
11	Guide	SS A479-316	SS A479-316	-	Nuts/Bolts/Tubing	18-8 SS	18-8 SS

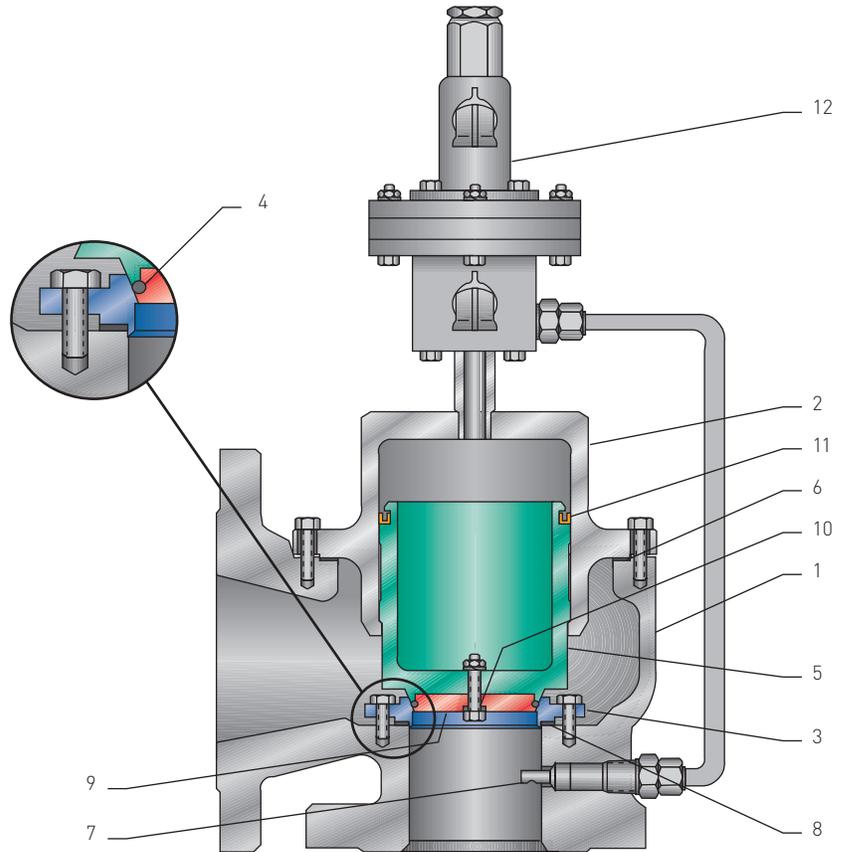
Notes:

1. Used above 15 psig [1.03 barg].
2. Used on 6-inch [150 mm] and larger valves only.
3. 2- to 6-inch [50 to 150 mm]: A240-304.
 8- to 12-inch [200 to 300 mm]: A351-CF8M.

ANDERSON GREENWOOD LOW PRESSURE POPRV CATALOG
 SERIES 90 AND 9000 PILOT OPERATED PRESSURE RELIEF VALVES

Product Detail – Type 95

- ASME UV Code Stamp, NB certified capacity 15 psig and above
- Piston Moving Member
- Kalrez® Elastomer Seat, Teflon® Seals
- Pressure Range 5 to 150 psig [0.345 to 10.34 barg]
- Sizes 2 to 6-inch [50 to 150 mm]
- Orifices 2.93 to 22.15 in² [18.90 to 142.90 cm²]



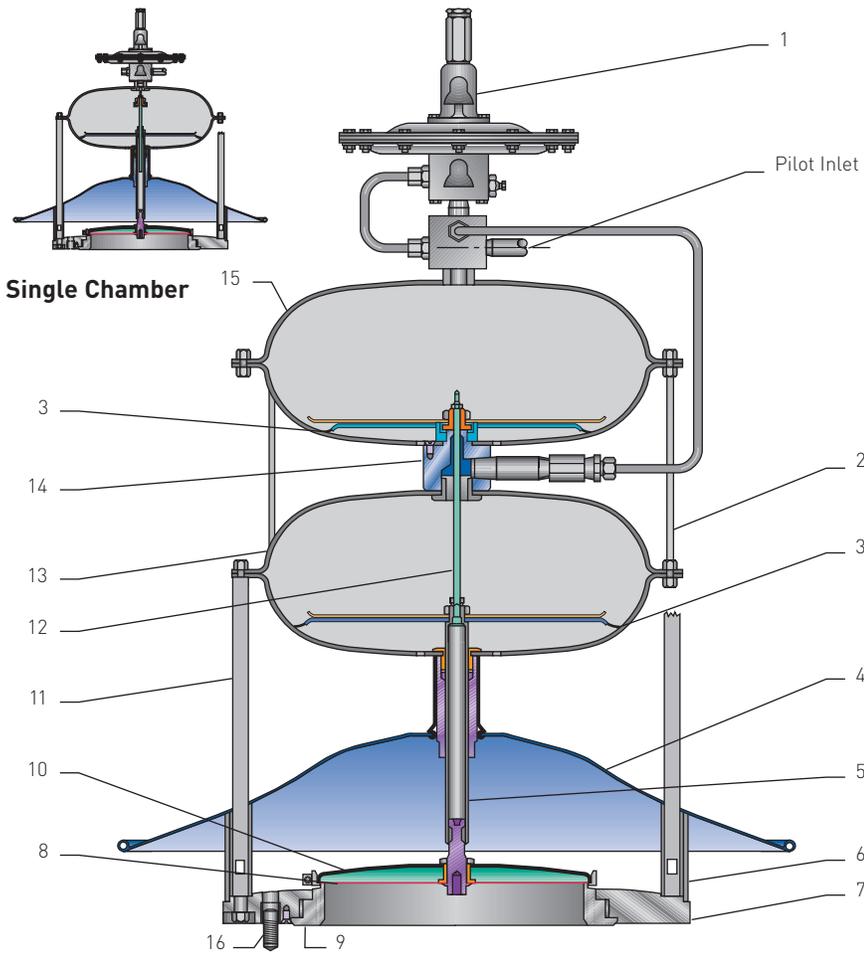
Materials of Construction

Part #	Description	Material SS
1	Body	SS A351-CF8M
2	Cap/Liner	SS A479-316 ¹
3	Nozzle	SS A479-316
4	Seat	Kalrez® ²
5	Piston	SS A479-316 ³
6	Cap Gasket	Teflon® PTFE
7	Dipper Tube	17-7 SS
8	Nozzle Gasket	Teflon® PTFE
9	Seat Retainer	SS A582-303 ⁴
10	Seat Retainer Seal	Teflon® PTFE
11	Piston Seal	Teflon® PTFE
12	Pilot Valve	SS
-	Nuts/Bolts/Tubing	18-8 SS

Notes:

1. Optional SS A351-CF8M.
2. duPont Co. Perfluoroelastomer.
3. 4- and 6-inch [100 and 150 mm]: A351-CF8M.
4. 4- and 6-inch [100 and 150 mm]: A240-316.

Product Detail – Type 9200 Vent



- Protected FEP Teflon® Diaphragms
- Film Type Main Valve Seat
- Elastomer or Teflon® Pilot Seat and Seals Available
- Vents Direct to Atmosphere
- Pressure Range
4-inch wc to 5 psig
[10.0 mbarg to 0.345 barg]
- Vacuum Range
-1 oz [-4.3 mbarg] full open
weight loaded -2-inch wc to
-5 psig pilot operated
[-5.0 mbarg to -0.345 barg]
- Sizes 2 to 12-inch
[50 to 300 mm]
- Orifices 3.35 to 113.00 in²
[21.61 to 729.03 cm²]

Notes:

1. Only supplied for certain vacuum conditions.
2. Also available in SS.

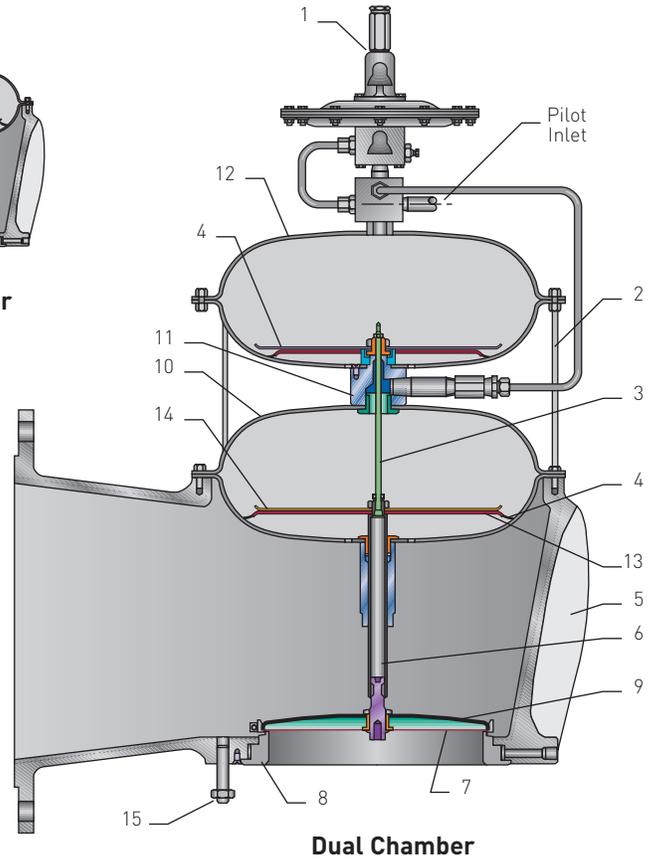
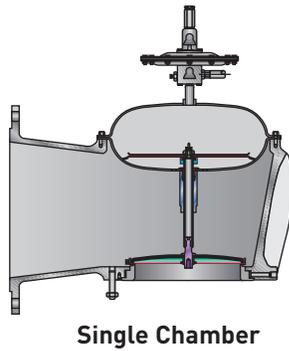
Materials of Construction

Part #	Description	Material	
		AL	SS
1	Pilot	AL	SS
2	Auxiliary Actuator Support	SS 316	SS 316
3	Diaphragms	FEP	FEP
4	Shield	AL B209-6061-0	SS A240-304
5	Shaft	AL B211-6061-T6	SS 316
6	Screen	SS 304	SS 304
7	Base Flange	AL B209-6061-T6	SS A351-CF8M
8	Film Seat	FEP	FEP
9	Nozzle	SS A351-CF8M	SS A351-CF8M
10	Seat Plate	AL B209-6061-T6 ²	SS A240-316
11	Support Column	SS A479-304	SS A479-304
12	Auxiliary Rod	SS A276-316	SS A276-316
13	Primary Actuator Case	AL SB209-6061-T4	SS A240-304/316
14	Adaptor ¹	SS 17-4	SS 17-4
15	Auxiliary Actuator Case ¹	AL SB209-6061-T4	SS A240-304/316
16	Inlet Studs	CS A193-B7	SS A193-B8M

ANDERSON GREENWOOD LOW PRESSURE POPRV CATALOG
 SERIES 90 AND 9000 PILOT OPERATED PRESSURE RELIEF VALVES

Product Detail – Type 9300

- ASME UV Code Stamp, NB certified capacity 15 psig and above
- Protected FEP Teflon® Diaphragms
- Film Type Main Valve Seat
- Elastomer or Teflon® Pilot Seat and Seals Available
- Vents Direct to Atmosphere
- Balanced Against Back Pressure
- Pressure Range
4-inch wc to 50 psig
[10.0 mbarg to 3.45 barg]
- Vacuum Range
-1 oz [-4.3 mbarg] full open weight loaded -2-inch wc to -5 psig pilot operated
[-5.0 mbarg to -0.345 barg]
- Sizes 2 to 12-inch
[50 to 300 mm]
- Orifices 3.35 to 113.00 in²
[21.61 to 729.03 cm²]



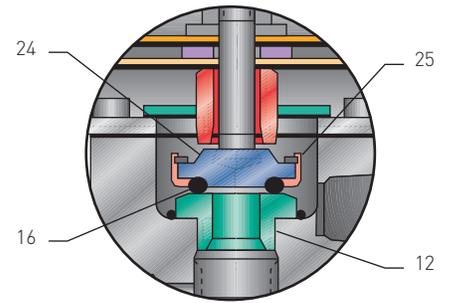
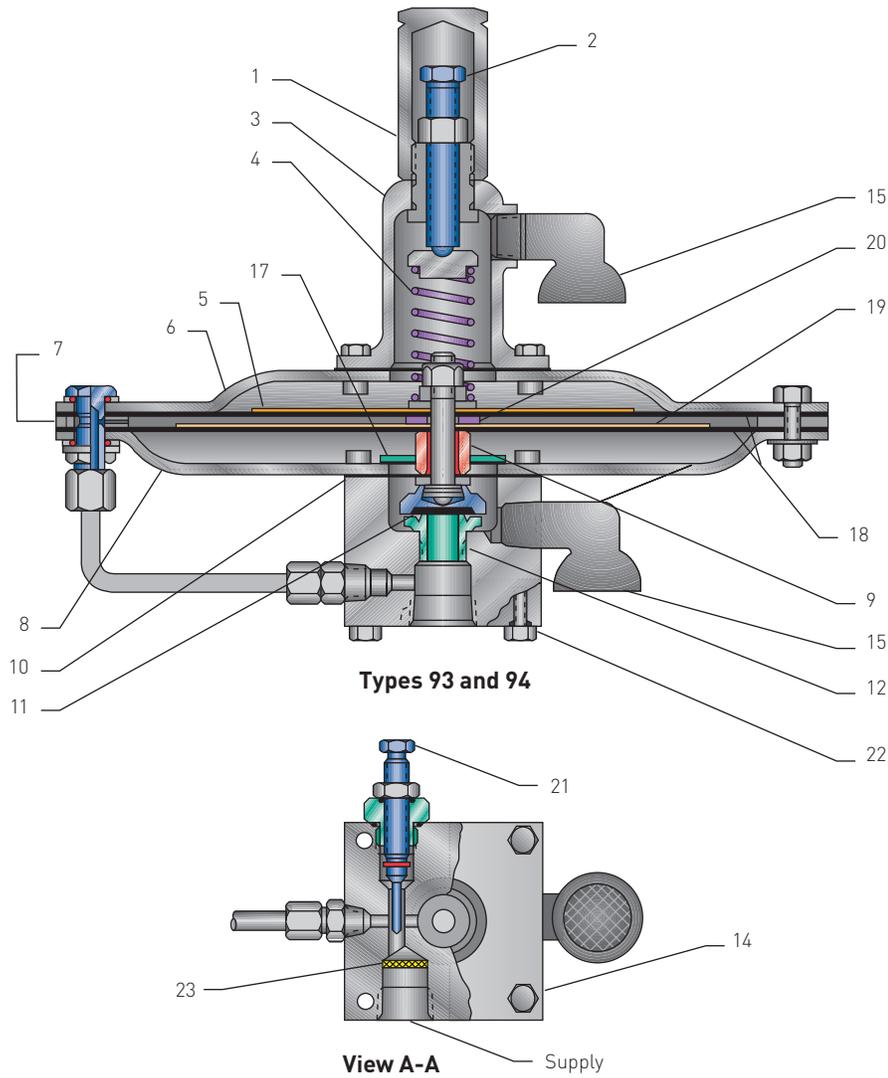
Materials of Construction

Part #	Description	Material		
		AL	CS	SS
1	Pilot	AL	CS	SS
2	Auxiliary Actuator Support	SS 316	SS 316	SS 316
3	Auxiliary Rod	SS A276-316	SS A276-316	SS A276-316
4	Diaphragms	FEP	FEP	FEP
5	Body	AL SB26 356-T6	CS SA216-WCB	SS SA351-CF8M
6	Shaft	AL B211-6061-T6	SS 316	SS 316
7	Film Seat	FEP	FEP	FEP
8	Nozzle	SS A351-CF8M	SS A351-CF8M	SS A351-CF8M
9	Seat Plate	AL B209-6061-T6 ²	SS A240-316	SS A240-316
10	Primary Actuator Case	AL SB209-6061-T4/T451	CS SA516-70	SS A240-304/316
11	Adapter ¹	SS 17-4	SS 17-4	SS 17-4
12	Auxiliary Actuator Case ¹	AL SB209-6061-T4/T451	CS SA516-70	SS A240-304/316
13	Pressure Support Plate	AL B209-6061-T6 ²	SS A240-304	SS A240-304
14	Vacuum Support Plate	AL B209-6061-T6 ²	SS A240-304	SS A240-304
15	Inlet Stud	CS A193-B7	CS A193-B7	SS A193-B8M

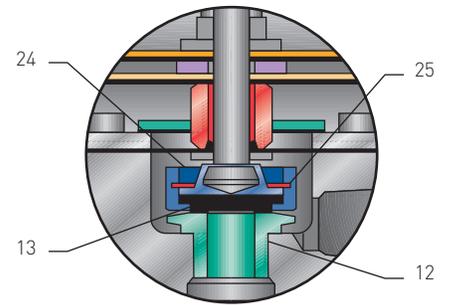
Notes:

1. Only supplied for certain vacuum conditions.
2. Also available in SS.

Product Detail – Series 90 Pilot Construction



Type 95 Seat Kalrez®³ O-ring



Types 91 and 93T Seat Teflon®

ANDERSON GREENWOOD LOW PRESSURE POPRV CATALOG

SERIES 90 AND 9000 PILOT OPERATED PRESSURE RELIEF VALVES

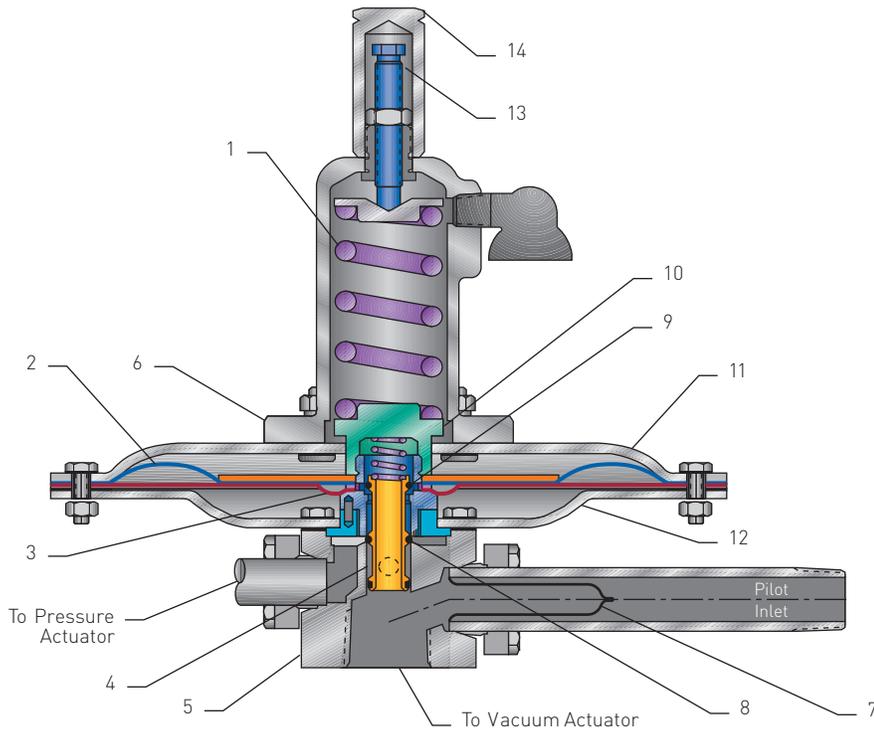
Product Detail – Series 90 Pilot

Materials of Construction				
Part #	Description	Material		
		AL	CS	SS
1	Cap	CS AX/ZN/CO	CS AX/ZN/CO	SS A582-303
2	Pressure Adjustment Bolt	SS A276-316	SS A276-316	SS A276-316
3	Bonnet	SS A351-CF8M	SS A351-CF8M	SS A351-CF8M
4	Spring	316 SS	316 SS	316 SS
5	Sense Plate	AL 6061-T6	CS 1010 ZN/CO	304 SS
6	Upper Case	CS A367	CS A367	304 SS
7	Spacer Ring	CS A367	CS A367	304 SS
8	Lower Case	CS A367	CS A367	304 SS
9	Boost Spacer	AL 2617-T451	304 SS	304 SS
10	Spindle Diaphragm	1	1	1
11	Seat (Types 93 and 94)	2	2	2
12	Nozzle	SS A351-CF8M	SS A351-CF8M	SS A351-CF8M
13	Seat (Type 91)	Teflon®	Teflon®	Teflon®
14	Body	AL 6061-T651	CS 1117 Ni PI	SS A479-316/316L
15	Vent	Zytel	Zytel	Zytel
16	Seat (Type 95)	Kalrez® ³	Kalrez® ³	Kalrez® ³
17	Check Plate	304 SS ⁵	304 SS ⁵	304 SS ⁵
18	Diaphragms	6	6	6
19	Boost Plate	AL 6061-T6	CS 1010 ZN/CO	304 SS
20	Sense Spacer	316 SS	316 SS	316 SS
21	Blowdown Needle	SS A276-316	SS A276-316	SS A276-316
22	Body Bolt Seal	4	4	4
23	Filter Screen	316 SS	316 SS	316 SS
24	Seat Retainer	SS SA479-304	SS SA479-304	SS SA479-304
25	Retainer Ring	SS PH15-7M0	SS PH15-7M0	SS PH15-7M0
	-Nuts/Bolts/Tubing	18-8 SS	18-8 SS	18-8 SS

Notes:

- Types 91 and 95 - SS
Types 93 and 94 - BUNA-N standard; Viton®, EPR or Teflon® optional.
- BUNA-N standard; Viton® or EPR optional.
- duPont Co. Perfluoroelastomer.
- Types 91 and 95 - Teflon®
Type 93 - BUNA-N standard; Viton® or EPR optional.
- Types 91, 94 and 95 - PCTFE
Type 93 - BUNA-N standard; Viton® or EPR optional.
- Type 91 - SS/Teflon®
Type 95 - Hastelloy®/Teflon®
Types 93 and 94 - BUNA-N standard; Viton®, EPR, or Teflon® optional.
- SS optional.

Product Detail – Series 400 No-Flow Modulating Pilot



Materials of Construction

Part #	Description	Material
1	Spring	316 SS
2	Sensing Diaphragm	FEP
3	Feedback Diaphragm	FEP
4	Spool	SS A479-316
5	Body	SS A479-316
6	Bonnet Assembly	SS A351-CF8M
7	Inlet Screen	316 SS
8	Outlet Seat	1
9	Inlet Seat	1
10	Spindle Assembly	SS A276-316
11	Upper Diaphragm Case	304 SS
12	Lower Diaphragm Case	304 SS
13	Pressure Adjusting Screw	SS A276-316
14	Bonnet Cap	SS A582-303

Note:

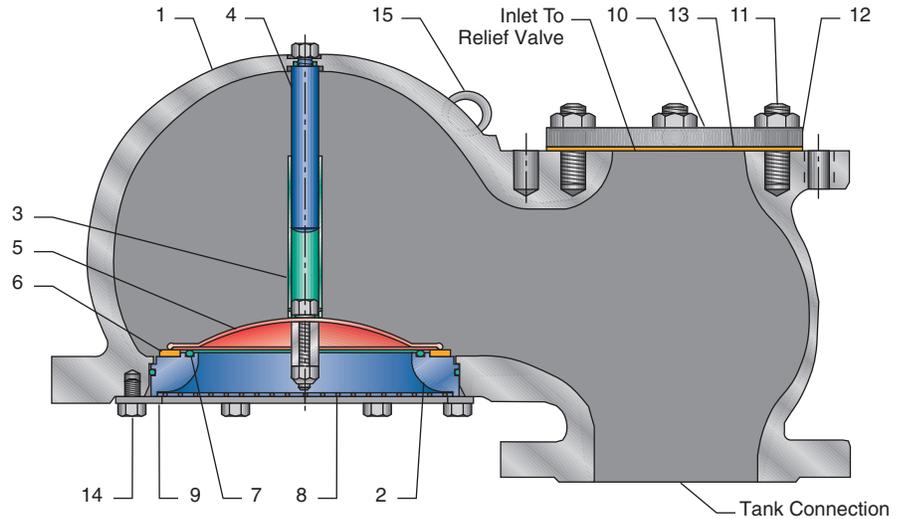
1. BUNA-N standard; Viton® or EPR optional.

ANDERSON GREENWOOD LOW PRESSURE POPRV CATALOG

SERIES 90 AND 9000 PILOT OPERATED PRESSURE RELIEF VALVES

Product Detail – Type 96A

- 1/2 oz. [2.2 mbarg] Standard Vacuum Setting; 1 1/2 oz. [6.6 mbarg] Optional
- Aluminum or SS
- Sizes 4-, 6-, 8-, and 12-inch [100, 150, 200, and 300 mm]



Tank Connection Size	Maximum Allowable Positive Pressure
4-inch [100 mm]	85 psig [5.86 barg]
6-inch [150 mm]	37 psig [2.55 barg]
8-inch [200 mm]	65 psig [4.48 barg]
12-inch [300 mm]	44 psig [3.03 barg]

Materials of Construction

Part #	Description	Material		
		AL	CS	SS
1	Body	AL ASTM-B26 356-T6	CS SA216-WCB	SS A351-CF8M
2	Seat Ring	AL 6061-T6	SS A240-316	SS A240-316
3	Guide Tube	SS A269-316W/D	SS A269-316W/D	SS A269-316W/D
4	Guide Rod	303 SS Teflon® Coated	303 SS Teflon® Coated	303 SS Teflon® Coated
5	Seat Plate	SS A240-316	SS A240-316	SS A240-316
6	Sponge Seat	1	1	1
7	O-ring Seat	1	1	1
8	Inlet Screen	304 SS, 1" Mesh 0.08-inch Wire Diameter	304 SS, 1" Mesh 0.08-inch Wire Diameter	304 SS, 1" Mesh 0.08-inch Wire Diameter
9	Seat Ring Retainer	SS A240-316	SS A240-316	SS A240-316
10	Flange Cap	AL 6061-T6 ²	SS A240-316 ²	SS A240-316 ²
11	Flange Stud	316 SS ²	316 SS ²	316 SS ²
12	Flange Nut	18-8 SS ²	18-8 SS ²	18-8 SS ²
13	Gasket	Teflon ²	Teflon ^{®2}	Teflon ^{®2}
14	Retainer Bolts	SS 18-8	SS 18-8	SS 18-8
15	Lifting Eye Bolt	CS A307	CS A307	CS A307

Notes:

Vacuum breakers and pressure relief valves can be mounted together.

1. BUNA-N standard; Viton®, EPR optional.
2. Furnished on vacuum breakers without relief valve connection.

Options and Accessories

In addition to the beneficial features available through the use of the Series 90 and 9000 pilot operated pressure relief valves, a variety of accessories and options are available to provide additional functions. Some simplify the process of periodic testing, an important safety requirement today. Others assist in the successful operation of the pressure relief valve under adverse or special applications.

Please refer to the options and accessories availability table on page 29. On request, other options may be available for some models for special situations, such as position indicators, purge connections, multiple pilots, differential pressure sensing, etc.

A. Field Test Connection:

- In-service verification of set pressure.
- Simplifies the periodic testing of pressure relief valves.

All Series 90 and 9000 pilot operated pressure relief valves may be readily tested for verification of set pressure during normal operation with this option, using an external pressure source and a test gauge. When the test pressure equipment is initially connected, the test gauge will indicate current system pressure, if any. When test pressure is slowly admitted through a metering valve, the pilot and the main valve dome are pressurized, simulating an increased system pressure.

When set pressure is reached the pilot will actuate. This actuation pressure may then be compared with the nameplate value. Depending upon the current value of system pressure, the main valve may also briefly open and close, or partially open and close, providing verification that the main valve will successfully operate. Special provisions are available to temporarily prevent main valve opening during this test (consult with your representative for details).

The standard Field Test Connection is shown in Figure A1. With this style, any overpressure condition during testing will override the test pressure and open the valve.

A three-way ball valve shown in Figure A2 must be used for the Field Test Connection when any vacuum opening is required of the valves, as the check valve above would prevent a vacuum signal from reaching the pilot. This style of Field Test Connection must also be used with the Type 400 non-flowing modulating pilot.

- A Field Test Connection is recommended when a Backflow Preventer is specified in order to provide a means to evacuate trapped dome pressure before disassembly.

B. Backflow Preventer:

- Prevents accidental reverse flow through pressure relief valve.

This option, sometimes called a "vacuum block," prevents a pilot operated pressure relief valve from reverse flow when sufficient vacuum is present at the inlet flange. The Backflow Preventer also prevents reverse flow when the pressure at the outlet flange (superimposed back pressure) is greater than the current system pressure. Reverse flow will occur with any standard type or design of pilot operated pressure relief valve when sufficient reverse differential pressure exists.

All backflow preventers operate by permitting the introduction of outlet pressure into the dome of the main valve, thereby holding the unbalanced moving element firmly onto the nozzle, overcoming the effect of a reverse differential pressure across the pressure relief valve. The option also includes a provision to prevent reverse flow through the pilot supply line back into the system.

A Backflow Preventer should be specified whenever:

- A vacuum may be present at the inlet connection due to unusual operating conditions or a temporary vacuum condition may occur under startup conditions.
- The discharge of the pressure relief valve is connected to a downstream pressure vessel, where pressure may vary from time to time, in excess of the pressure in the upstream system.

- The discharge of multiple pressure relief valves is combined into a single manifold or vent system, creating superimposed back pressures in excess of the current upstream system pressure.
- A pilot operated vacuum valve is specified and the valve must remain closed on positive pressure.



A1. Field Test Connection



A2. Field Test Connection



B. Backflow Preventer

Options and Accessories



C. Pilot Supply Filter

C. Pilot Supply Filter:

- Protects pilot from excessive particulate matter in flow stream.

This is a mechanical filter available for applications where there is a possibility of large amounts of particulate matter in the fluid stream. The Pilot Supply Filter is mounted to the main valve cap. A filter drain valve is optionally available.

D. Remote Valve Lift Indicator:

- Provides remote signal to allow the plant operator to know when a safety valve has operated.

This feature consists of a differential pressure switch, actuated when the main valve has been operated. The switch is adjusted to sense the difference between the system pressure and the main valve dome pressure. Electrical indication is then available to a remote location. The switch contact style and rating, as well as the type of enclosure and hazard rating, should be furnished. The switch is mounted to the main valve cap.

Please note that this method of indication is indirect, since it only indicates that pilot actuation has occurred and the necessary dome pressure reduction has taken place. Direct mechanical position indication is not available.



D. Remote Valve Lift Indicator

E. Auxiliary Setters:

- Allows the primary pilot to be set easily to a second or third set pressure.

This system is widely used aboard ships where it is desirable to have different set pressures when under different jurisdictions or when a ship is in port.

The accessory consists of additional springs which are fitted to the primary pilot.



E. Auxiliary Setters

Options and Accessories

F. Manual Unloader:

- Permits the pressure relief valve to be opened at pressures below the nameplate setting.
- Acts as manual override to normal pressure setting, but has no effect on the sealed pressure setting.

A Manual Unloader consists of a small hand valve connected to the dome line of the main valve. Opening the hand valve vents the dome pressure faster than it can be recharged by the pilot supply. Sufficient dome pressure reduction results in opening of the main valve, due to unbalanced forces, simulating a pilot actuation. This option is used to allow the pressure relief valve to be used, along with other valves, for the emergency reduction of system pressure due to potential safety hazards. Venting from the unloader valve is to the atmosphere through a weather fitting, unless otherwise specified.

G. Remote Unloader (not pictured):

- Permits the pressure relief valve to be remotely opened to depressurize the system.

This is the same scheme as the Manual Unloader, except that the unloader valve is remotely operated by either solenoid or pneumatic actuator. Please furnish full particulars of the type of unloader valve to be furnished and the desired valve action, whether normally open or closed. For pneumatic operation, indicate the fluid media and available pressure range; for solenoid operation, the voltage and current type (AC or DC). Furnish the frequency in Hertz for alternating current. The type of enclosure, such as explosion proof, splash proof, corrosion resistant, etc., must also be specified for electric operators. Unless otherwise specified, no separate wiring enclosure is furnished. Venting from the unloader valve will be to the atmosphere through a weather fitting.

H. Pilot Exhaust Tubed to Main Valve Outlet (PEMVO):

- Eliminates any local venting of fluid media from pilot.

This option is desirable when the pressure relief valve is within a closed environment and even the small amount of gas discharged from the pilot is to be avoided.

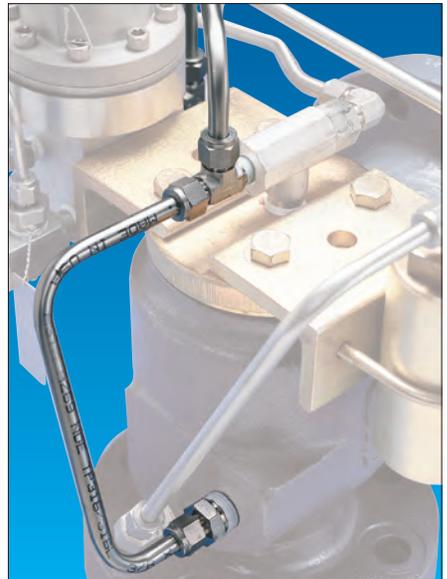
In the majority of applications, where this option is applied, there will be no measurable effect on the set pressure of the pressure relief valve. However the following considerations shall be taken into account:

- The effect of superimposed back pressure on the Series 90 pilot valve will be to slightly reduce the nameplate set pressure. This represents a safe condition, i.e., the pilot is slightly overbalanced to the effect of back pressure. Readjustment of pilot set pressure is rarely necessary (see below).
- For the larger diaphragm case Type 91, 93, or 94 pilot the set pressure will be reduced by 0.0034 psig for each 1 psig [0.034 mbarg for each 1.0 mbarg] of back pressure.
- For the small diaphragm case Type 91, 93, 94 or 95 pilot the set pressure will be reduced by 0.233 psig for each 1 psig [0.233 mbarg for each 1.0 mbarg] of back pressure.
- When this accessory is used, and there is a constant superimposed back pressure of relative significance, no upward adjustment to the factory pilot pressure setting is usually made, unless requested by the customer.

Please consult with your representative for additional assistance.



F. Manual Unloader



H. Pilot Discharge Tubed to Main Valve Outlet

Options and Accessories



I. Remote Pressure Sense Connection

I. Remote Pressure Sense Connection:

- Pressure relief valve will respond to actual system pressure conditions.
- Eliminates undesirable cycling due to excessive inlet pressure losses.
- Improves safety under adverse operating conditions.

This optional feature permits the pilot to sense system pressure at a location that most accurately reflects the actual operating pressure of the protected system. A remote pressure sense connection eliminates the false reading of system pressure that will occur during relieving conditions due to pressure losses in the inlet piping to the pressure relief valve. Remote pressure sense connection is required for any vacuum setting.

Most applicable codes recommend that the inlet piping system be designed for a maximum anticipated pressure loss of 3 percent of set pressure. If this is not possible, the remote pressure sense connection should be specified. Inlet pressure loss can occur during relieving conditions, when one or more of the following conditions are present:

- The length of the inlet piping is substantial, thereby contributing an excessive pressure loss under flowing conditions.
- There are one or more directional changes in the inlet piping, such as elbows, tees, etc., contributing to an excessive pressure loss.

- The geometry of the connection between the pressure vessel and the inlet piping creates an excessive pressure loss.
- Block or isolation valves between the system and the pressure relief valve are overly restrictive to flow.

Please note that the addition of a remote pilot sense line allows the pilot to correctly sense system pressure and to keep the valve from rapid cycling. However, the relieving capacity will be proportionately reduced whenever there is inlet pressure loss to the pressure relief valve. The orifice area sizing calculation should take inlet loss into consideration in arriving at the required area.

The amount of anticipated inlet loss, under actual relieving conditions, should be reviewed with your representative, since valve performance during a relief cycle may be affected by high inlet pressure loss.

The installation of a remote pilot sense line may also reduce the ingestion of particulate matter from 'dirty' systems, whether or not excessive inlet pressure loss is present during the relief cycle.

Pilot operated pressure relief valves furnished originally for remote pilot sense may be converted to integral sense, since the pressure pickup (dipper tube) is installed in all instances at the factory, and then closed off with a removable threaded pipe plug.

Suggested Application Matrix

	Series 90	Series 9000
General Pressure	✓	✓
Vacuum Only	96A	✓
Pressure and Vacuum	1	✓
Cryogenic	91, 94	✓
Marine Service	91, 94, 95	9300
Severe Chloride Service		9300
Marine Vapor Recovery Systems	93	9300

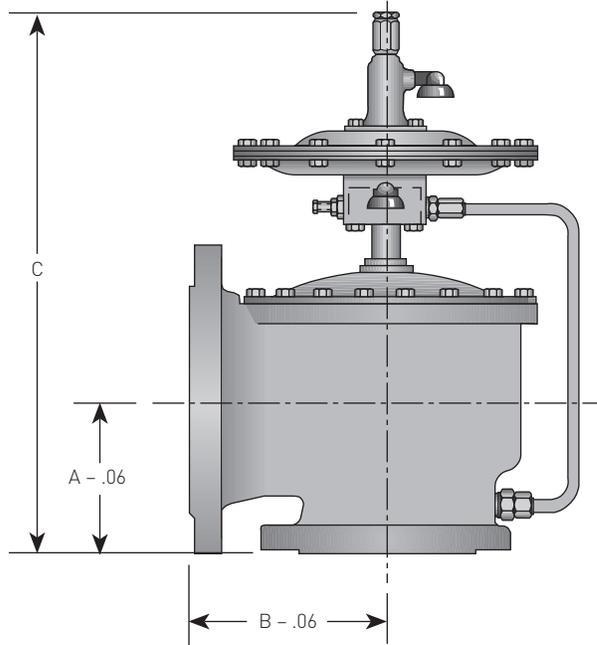
Note:

1. Type 96A in combination with other models.

Options Matrix

	FTC	BFP	Pilot Filter	Aux. Setters	Manual or Remote Blowdown	PEMVO	Remote Sense	Pilot Gag	Lift Lever
91	✓	✓	✓	✓	✓	✓	✓	✓	✓
93	✓	✓	✓	✓	✓	✓	✓	✓	✓
94	✓	✓	✓	✓	✓	✓	✓	✓	✓
95	✓	✓	✓	✓	✓	✓	✓	✓	✓
96A									
9200	✓	✓	✓	✓	✓		✓	✓	✓
9300	✓	✓	✓	✓	✓	✓	✓	✓	✓

Dimensions and Weights – Types 91, 93, 94 and 95



Dimensions and Weights

Valve Size Inlet x Outlet in [mm]	Dimensions, in [mm]			Weight Max., lb [kg] ²	
	A	B	C Max. ¹	AL	CS & SS
2 x 3 [50 x 80]	3.75 [95]	5.00 [127]	16.7 [424]	27 [12.3]	81 [36.7]
3 x 4 [80 x 100]	4.50 [114]	5.75 [146]	18.0 [457]	35 [15.9]	105 [47.6]
4 x 6 [100 x 150]	5.50 [140]	7.00 [178]	20.3 [516]	49 [22.2]	147 [66.7]
6 x 8 [150 x 200]	6.75 [172]	9.31 [237]	22.9 [582]	76 [34.5]	228 [103.4]
8 x 10 [200 x 250]	8.00 [203]	11.00 [279]	25.0 [635]	105 [47.6]	315 [142.9]
10 x 12 [250 x 300]	9.50 [241]	12.50 [318]	31.0 [784]	142 [64.4]	426 [193.2]
12 x 16 [300 x 400]	11.75 [299]	14.25 [362]	34.5 [876]	230 [104.3]	690 [313.0]

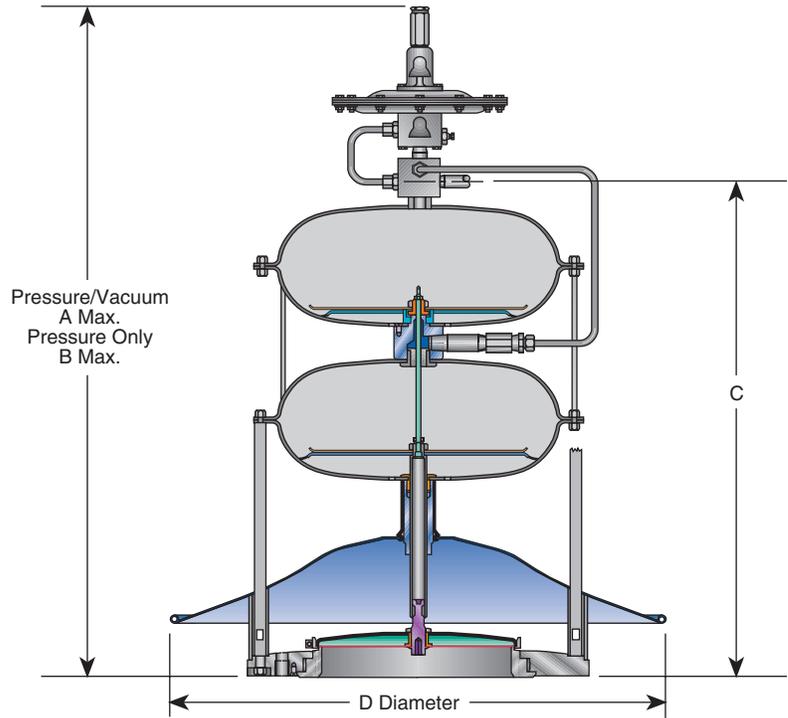
Notes:

1. Will vary with accessories.
2. Weight will vary with accessories.
3. Certified data will be furnished upon request when valves are ordered.

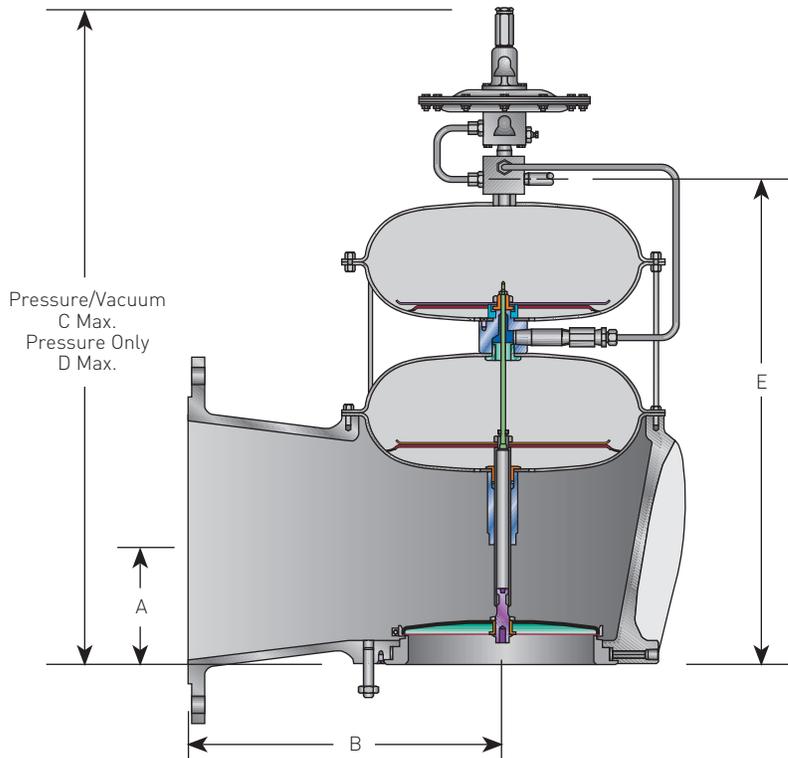
ANDERSON GREENWOOD LOW PRESSURE POPRV CATALOG
 SERIES 90 AND 9000 PILOT OPERATED PRESSURE RELIEF VALVES

Dimensions and Weights – Types 9200 and 9300

Dimensions, in [mm]				
Inlet Size	A	B	C'	D
2 [50]	18.5 [470]	18.5 [470]	12.9 [328]	12.0 [305]
3 [80]	24.8 [630]	18.5 [470]	12.9 [328]	12.0 [305]
4 [100]	27.0 [686]	20.4 [518]	15.1 [384]	14.5 [368]
6 [150]	30.2 [767]	22.8 [579]	18.3 [465]	20.0 [508]
8 [200]	35.4 [899]	26.4 [671]	24.4 [620]	22.0 [559]
10 [250]	39.8 [1011]	29.1 [739]	28.8 [732]	31.0 [787]
12 [300]	42.4 [1077]	31.7 [805]	31.4 [798]	31.0 [787]



Dimensions, in [mm]					
Size	A	B	C'	D	E
2 x 3 [50 x 80]	2.82 [72]	6.00 [152]	18.9 [480]	18.9 [480]	13.2 [335]
3 x 4 [80 x 100]	2.53 [64]	8.00 [203]	24.8 [630]	18.5 [470]	13.3 [338]
4 x 6 [100 x 150]	3.50 [89]	10.00 [254]	27.0 [686]	20.4 [518]	15.5 [394]
6 x 8 [150 x 200]	4.32 [110]	12.00 [305]	30.2 [767]	22.8 [579]	18.2 [462]
8 x 10 [200 x 250]	5.36 [136]	14.00 [356]	35.4 [899]	26.4 [671]	24.6 [625]
10 x 12 [250 x 300]	6.64 [169]	18.00 [457]	39.8 [1011]	29.1 [739]	29.1 [739]
12 x 16 [300 x 400]	8.01 [203]	20.00 [508]	42.4 [1077]	31.7 [805]	31.7 [805]



Notes:

1. Will vary with accessories.
2. Inlet flange drilling conforms to ANSI 16.5, Class 150.

ANDERSON GREENWOOD LOW PRESSURE POPRV CATALOG
 SERIES 90 AND 9000 PILOT OPERATED PRESSURE RELIEF VALVES

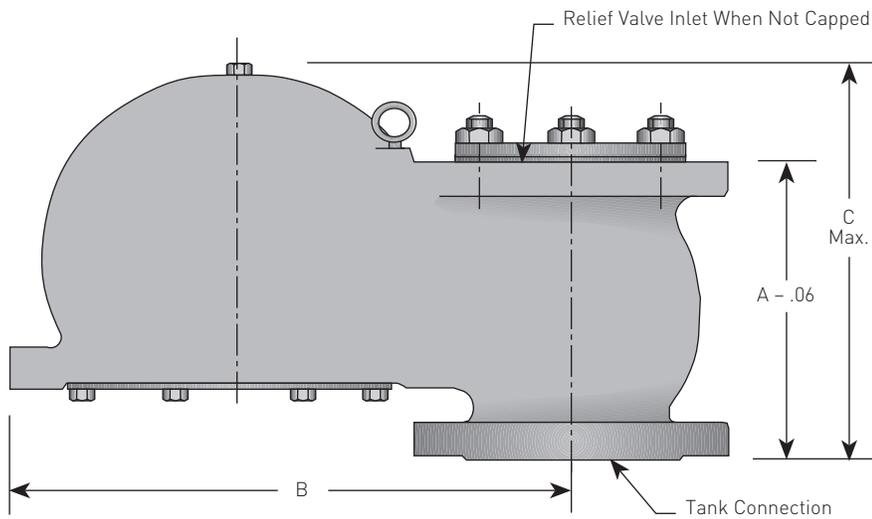
Dimensions and Weights – Types 9200 and 9300

Weights ¹ , lb [kg]				
Size in [mm]	9200 AL	9200 SS	9300 AL	9300 SS
2 [50]	27 [12.3]	72 [32.7]	33 [15.0]	79 [35.9]
3 [80]	29 [13.2]	78 [35.5]	34 [15.5]	86 [39.0]
4 [100]	35 [15.9]	96 [43.6]	38 [17.3]	110 [50.0]
6 [150]	57 [25.9]	162 [73.6]	85 [38.6]	246 [111.8]
8 [200]	77 [35.0]	213 [96.8]	105 [47.7]	306 [139.1]
10 [250]	119 [54.1]	348 [158.2]	177 [80.5]	522 [237.3]
12 [300]	123 [55.9]	370 [168.2]	225 [102.3]	675 [306.8]

Note:

1. Weights will vary with accessories.

Dimensions and Weights – Type 96A



Dimensions and Weights										
Tank Connection Size in [mm]	Relief Valve Connection Dimensions, in [mm]					C Max.	Max.	Weight, Max. lb [kg]		
	3 [80]	4 [100]	A 6 [150]	8 [200]	10 [250]			B 12 [300]	AL	SS
4 [100]	8.56 [217]	8.56 [217]	—	—	—	—	16.5 [419]	11.7 [297]	47.0 [21.4]	133.0 [60.5]
6 [150]	—	11.12 [283]	11.12 [283]	—	—	—	20.7 [526]	14.3 [363]	64.0 [29.1]	182.0 [82.7]
8 [200]	—	—	11.95 [304]	11.95 [304]	—	—	24.8 [630]	17.2 [437]	120.0 [54.5]	339.0 [154.1]
12 [300]	—	—	—	—	16.33 [415]	16.33 [415]	35.0 [889]	21.0 [533]	253.0 [115.0]	734.0 [333.6]

Valve Sizing¹ – Subsonic Flow

Note:

1. A computer sizing program is available. Consult your sales representative.

**Pilot Operated PRV Types 91, 93, 94, 95, 9200 and 9300
 (Set Pressure < 15 psig [1.03 barg])**

**U.S. Weight Flow (lb/h)
 Formula 1**

$$A_{[in^2]} = \frac{W \sqrt{TZ}}{735 K_d P_1 F \sqrt{M}}$$

**U.S. Volumetric Flow (SCFM)
 Formula 11**

$$A_{[in^2]} = \frac{V \sqrt{MTZ}}{4645 K_d P_1 F}$$

**Metric Weight Flow [kg/h]
 Formula 1M**

$$A_{[cm^2]} = \frac{W \sqrt{TZ}}{560 K_d P_1 F \sqrt{M}}$$

**Metric Volumetric Flow [Nm³/h]
 Formula 11M**

$$A_{[cm^2]} = \frac{V \sqrt{MTZ}}{12510 K_d P_1 F}$$

where

$$F = \sqrt{\frac{k}{k-1} \left[\left(\frac{P_2}{P_1} \right)^{\frac{2}{k}} - \left(\frac{P_2}{P_1} \right)^{\frac{k+1}{k}} \right]} \quad \text{[Refer to page 36]}$$

Subsonic Coefficient of Discharge - K_d

Valve Type	Relief	Coefficient of Discharge	Units	Reference
91, 94, 95	Pressure	$K_d = 0.678 (P_2/P_1)^{-0.285}$	all	Figure 16, page 37
93	Pressure	$K_d = 0.700 (P_2/P_1)^{-0.265}$	all	Figure 17, page 38
9200	Pressure	$K_d = 0.756 (P_1 - P_A)^{0.0517}$	in/lb	Figure 14, page 37
9200	Pressure	$K_d = 0.756 [(P_1 - 1.013) \times P_A]^{0.0517}$	metric	Figure 14, page 37
9200	Vacuum	$K_d = 0.667$	all	None
9300	Pressure	$K_d = 0.650 (P_2/P_2)^{-0.349}$	all	Figure 15, page 37
9300	Vacuum	$K_d = 0.55$	all	None

Valve Sizing¹ – Sonic Flow Equations

ASME VIII Gas Flow (Set Pressure ≥ 15 psig [1.03 barg])

**U.S. Weight Flow (lb/h)
Formula 3**

$$A_{[in^2]} = \frac{W}{CK P_1} \sqrt{\frac{TZ}{M}}$$

**U.S. Volumetric Flow (SCFM)
Formula 4**

$$A_{[in^2]} = \frac{V \sqrt{MTZ}}{6.32 CK P_1}$$

**Metric Weight Flow [kg/h]
Formula 3M**

$$A_{[cm^2]} = \frac{1.316 W}{CK P_1} \sqrt{\frac{TZ}{M}}$$

**Metric Volumetric Flow [Nm³/h]
Formula 4M**

$$A_{[cm^2]} = \frac{V \sqrt{MTZ}}{17.02 CK P_1}$$

where

Sonic Coefficient of Discharge - K

Valve Type	ASME Derated Coefficient
91 and 94	0.770
95	0.845
93	0.852
9300	0.629

Valve Sizing – Nomenclature

Gas Flow

Symbol	Description	Inch Pounds	Metric Units
A	Orifice area or equivalent flow area.	square inch (in ²)	square centimeter [cm ²]
C	The gas constant, based on the specific heat ratio, k. If C is unknown, use C = 315, a conservative value. Refer also to Table 1, page 38.	—	—
F	Subsonic flow factor, based on the ratio of specific heats and pressure drop(differential) across the valve.	—	—
k	Ratio of specific heats of gas, where k = C _p /C _v . When the value of k is unknown, use k = 1.001, a conservative value. Refer also to Table 1, page 38.	—	—
K	ASME derated valve coefficient, used where set pressure is 15 psig [1.03 barg] and greater, and the requirements of Section VIII, Division 1 of the ASME Boiler and Pressure Vessel Code apply.	—	—
K _d	Subsonic valve coefficient to be used where set pressure is less than 15 psig.	—	—
M	Molecular weight of the flowing gas. Refer to Physical Properties of Selected Gases, or other resources, for listing of M.	—	—

**Sizing Information
ASME Section VIII**

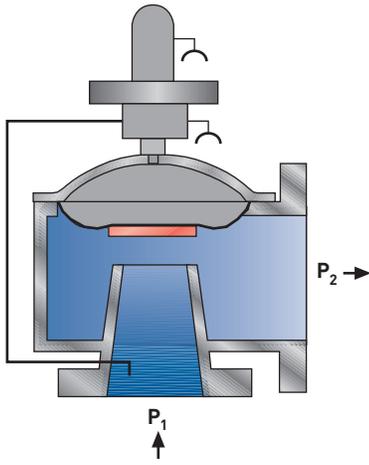
After system capacity has been determined, a properly sized pressure relief valve is determined by the following method.

- A. From the formulas in this section, calculate required orifice area as a function of capacity.
- B. Identify the required orifice size. Always choose an orifice which is equal to, or greater than the required orifice area.
- C. Specifications exceeding Anderson Greenwood standard catalog descriptions should be referred to our sales department.

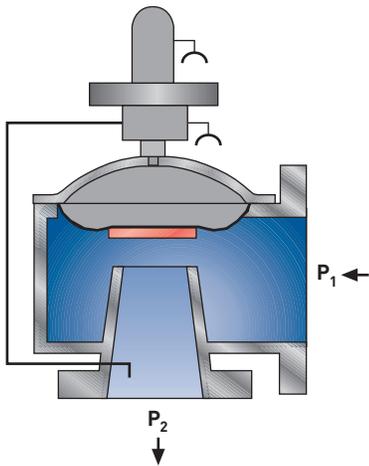
Note:

1. A computer sizing program is available. Consult your sales representative.

Valve Sizing – Nomenclature



Pressure Relief

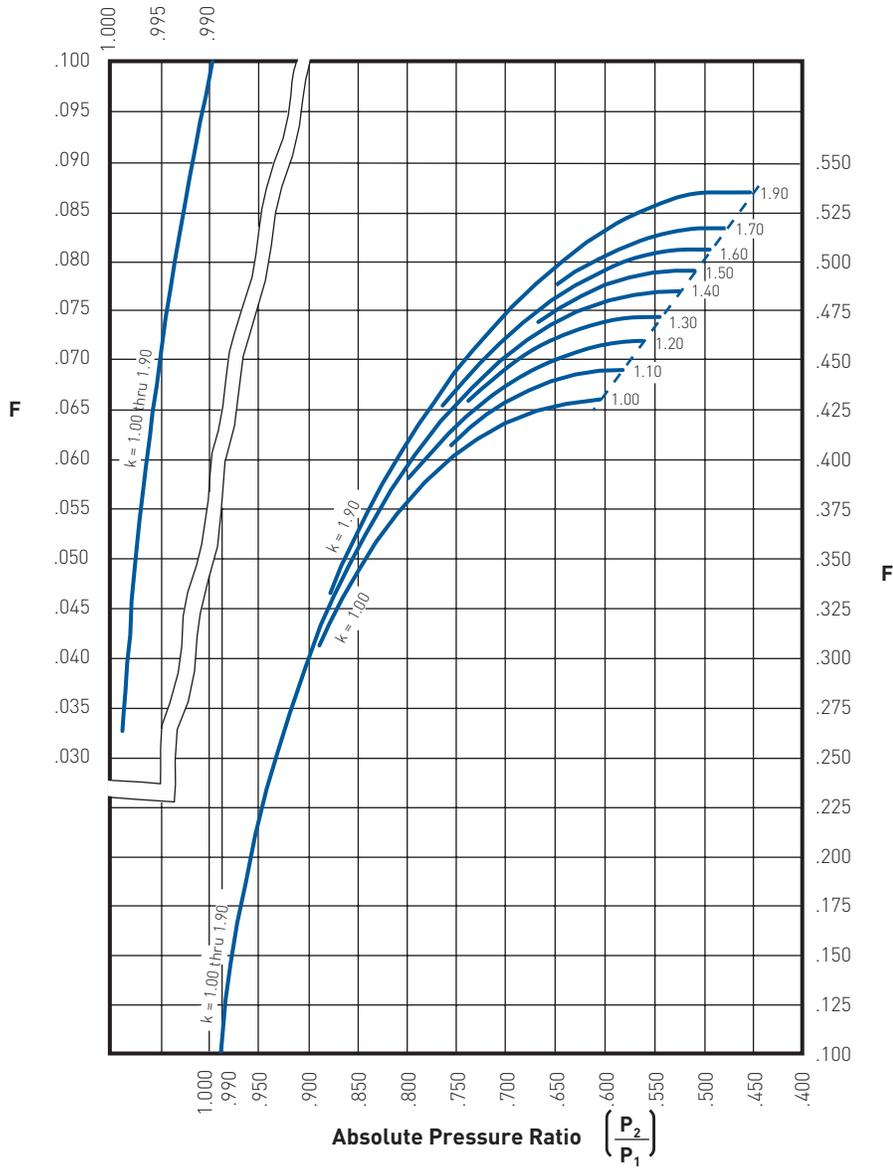


Vacuum Relief

Gas Flow			
Symbol	Description	Inch Pounds	Metric Units
P_1	Pressure at valve inlet during flow. Pressure Relief, $P_1 = \text{set pressure (psig)} + \text{overpressure} + P_A$ Vacuum Relief, $P_1 = P_A$	lb/in ² absolute (psia)	bar absolute [bara]
P_2	Pressure at valve outlet during flow. Pressure Relief, $P_2 = \text{back pressure (psig)} + P_A$ Vacuum Relief, $P_2 = \text{vacuum set (psig)} = \text{overpressure} + P_A$	lb/in ² absolute (psia)	bar absolute [bara]
P_A	Atmospheric pressure – sea level or local atmospheric pressure	Sea Level 14.7 psia	Sea Level 1.013 bara
T	Absolute relieving temperature	degrees Rankin ($^{\circ}\text{R} = ^{\circ}\text{F} + 460$)	degrees Kelvin [$^{\circ}\text{K} = ^{\circ}\text{C} + 273$]
V	Gas flow capacity expressed in volumetric units per time unit at standard conditions. SCFM (14.7 psia and 60°F) Nm ³ /h [1.013 bara and 0°C]	standard cubic feet per minute (SCFM)	normal cubic meters per hour [Nm ³ /h]
W	Gas flow capacity expressed in weight units per time unit. Refer to Gas Flow Conversions for other units of measure.	pounds per hour (lb/h)	kilograms per hour [kg/h]

Sizing - Series 90 and 9000

Figure 13 - Flow Correction Factor F (For use in subsonic sizing page 33)



Sizing

Figure 14 - Type 9200 Subsonic Valve Coefficient (K_d) vs. Relief Pressure

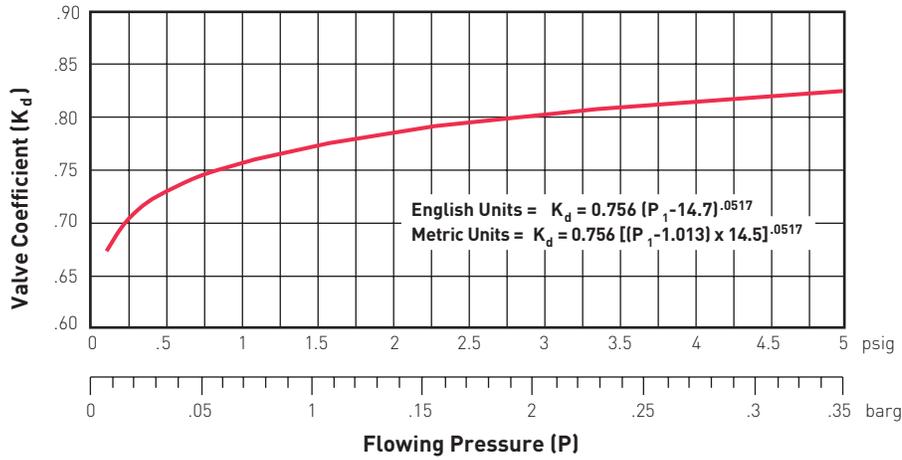
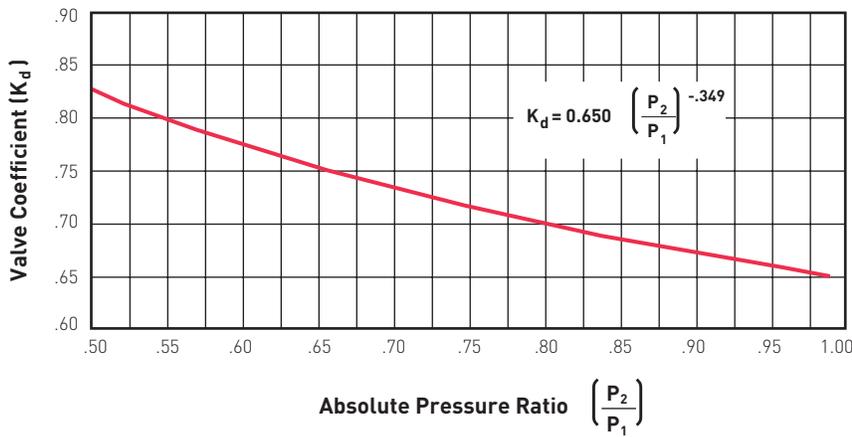
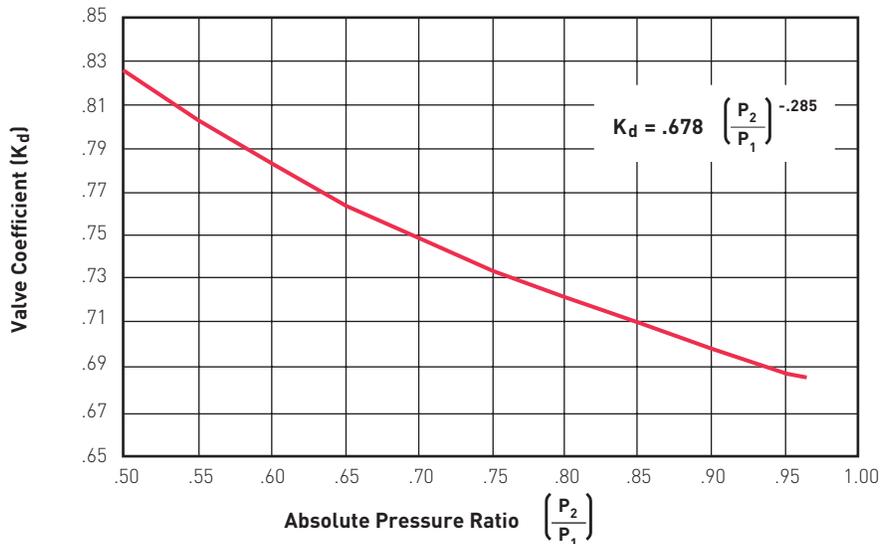


Figure 15 - Type 9300 Subsonic Valve Coefficient (K_d) vs. Absolute Pressure Ratio



For larger capacities, please consult your sales representative. Anderson Greenwood has two Models of the 9300 with increased discharge coefficients for large storage tanks.

Figure 16 - Types 91, 94 and 95 Subsonic Valve Coefficient (K_d) vs. Absolute Pressure Ratio



Sizing

Figure 17 - Type 93 Subsonic Valve Coefficient (K_d) vs. Absolute Pressure Ratio

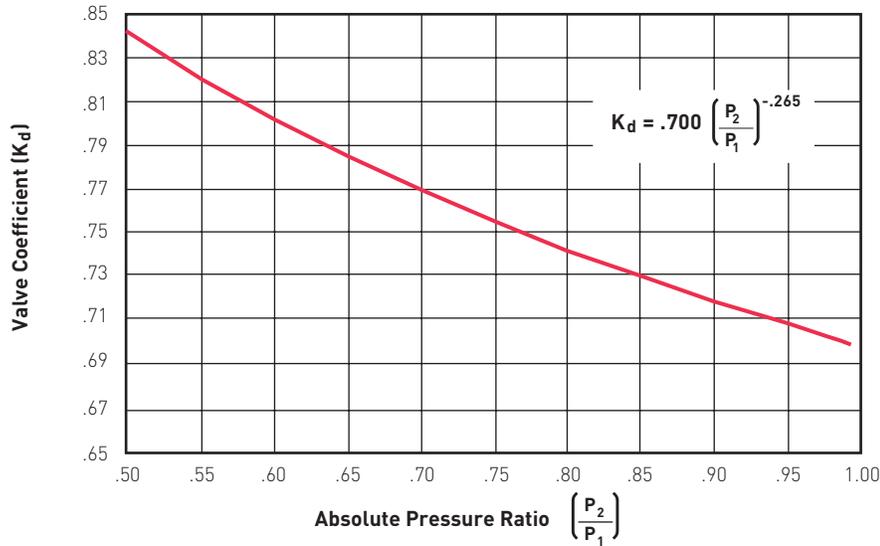


Table 1 - Values of M, k for Representative Gases and Vapors

Gas or Vapor	M Molecular Weight	k Spec. Heat Ratio	C Gas Constant	Boiling Point ¹ (Atm Pressure)
Air	29	1.40	356	-318°F [-194°C]
Ammonia (NH ₃)	17	1.31	348	-28°F [-33°C]
Benzene (C ₆ H ₆)	78	1.12	329	176°F [80°C]
Butadiene (C ₄ H ₆)	54	1.12	329	24°F [-4°C]
Carbon Dioxide (CO ₂)	44	1.28	345	-109°F [-78°C]
Ethane (C ₂ H ₆)	30	1.19	336	-127°F [-88°C]
Ethylene (C ₂ H ₄)	28	1.24	341	-155°F [-104°C]
Helium (He)	4	1.66	377	-454°F [-270°C]
Hexane (C ₆ H ₁₄)	86	1.06	322	156°F [69°C]
Hydrogen (H ₂)	2	1.41	357	-423°F [-253°C]
Hydrogen Sulphide (H ₂ S)	34	1.32	349	-77°F [-61°C]
Methane (CH ₄)	16	1.31	348	-259°F [-162°C]
Methyl Mercaptan (CH ₄ S)	48.1	1.20	337	43°F [6°C]
n-Butane (C ₄ H ₁₀)	58	1.09	326	31°F [-1°C]
Natural Gas (SG = 0.60)	17.4	1.27	344	-260°F [-162°C]
Nitrogen (N ₂)	28	1.40	356	-320°F [-196°C]
Oxygen (O ₂)	32	1.40	356	-297°F [-183°C]
Pentane (C ₅ H ₁₂)	72	1.07	323	97°F [36°C]
Propane (C ₃ H ₈)	44	1.13	330	-44°F [-42°C]
Propylene (C ₃ H ₆)	42	1.15	332	-54°F [-48°C]
Propylene Oxide (C ₃ H ₅ O)	58.1	1.21	338	94°F [34°C]

Note:

1. Contact your sales representative for 90 or 9000 Series product recommendations when the boiling point of the lading fluid is in between the minimum and maximum expected ambient temperatures.

ANDERSON GREENWOOD LOW PRESSURE POPRV CATALOG
 SERIES 90 AND 9000 PILOT OPERATED PRESSURE RELIEF VALVES

Sizing – Type 93 Capacities

National Board Certified, 15 psig and greater

Air Capacities (SCFM, 10 percent overpressure, 60°F, Z = 1.00)								
Set Pressure		2	3	4	Valve Size, in	8	10	12
		2.29	5.16	8.74	6 Orifice Area, in ² 19.56	36.40	51.00	84.00
wc	3.0	80	181	307	687	1280	1720	2950
wc	5.0	104	234	397	888	1650	2310	3810
wc	10.0	147	332	563	1260	2340	3280	5410
wc	15.0	181	408	691	1550	2880	4030	6640
wc	20.0	210	473	801	1790	3330	4670	7690
wc	25.0	235	530	898	2010	3740	5240	8630
psig	1.0	248	559	946	2120	3940	5520	9100
psig	1.5	306	690	1170	2610	4860	6820	11300
psig	2.5	401	903	1530	3420	6370	8930	14700
psig	5.0	586	1320	2230	5000	9310	13000	21500
psig	8.0	765	1720	2920	6530	12200	17000	28100
psig	10.0	872	1960	3330	7440	13800	19400	32000
psig	14.0	1060	2400	4070	9100	16933	23700	39100
psig	15.0	1160	2600	4430	9910	18400	25800	42500
psig	20.0	1340	3010	5100	11400	21300	29900	49000
psig	25.0	1510	3410	5780	12900	24100	33700	55600
psig	30.0	1690	3810	6460	14400	26900	37700	62100
psig	35.0	1890	4250	7200	16100	30000	—	—
psig	40.0	2080	4690	7950	17800	33100	—	—
psig	45.0	2280	5130	8690	19400	36200	—	—
psig	50.0	2470	5570	9440	21100	39300	—	—

Note:

1. Capacities are de-rated per ASME at 15 psig and greater.

ANDERSON GREENWOOD LOW PRESSURE POPRV CATALOG

SERIES 90 AND 9000 PILOT OPERATED PRESSURE RELIEF VALVES

Sizing – Type 93 Capacities

Air Capacities - Metric [Nm³/h, 10 percent overpressure, 0°C, Z = 1.00]

Set Pressure		Metric Valve Size, mm						
		50	80	100	150	200	250	300
		Orifice Area, cm ²						
		14.77	33.29	56.39	126.19	234.84	329.03	541.93
mbarg	7.5	133	300	509	1140	2120	2970	4890
mbarg	10.0	154	347	588	1310	2450	3430	5640
mbarg	15.0	189	425	721	1610	3000	4200	6930
mbarg	20.0	218	492	833	1860	3500	4860	8010
mbarg	50.0	348	783	1330	2970	5530	7740	12700
mbarg	100.0	497	1120	1900	4250	7900	11100	18200
mbarg	250.0	810	1830	3090	6920	12900	18000	29700
barg	0.400	1050	2370	4020	8990	16700	23400	38600
barg	0.600	1330	2990	5070	11300	21100	29600	48700
barg	0.800	1570	3550	6010	13400	25000	35000	57700
barg	1.000	1800	4050	6870	15400	28600	40100	66000
barg	1.200	2060	4640	7860	17600	32800	45800	75500
barg	1.400	2230	5020	8510	19000	35400	49600	81800
barg	1.600	2400	5400	9160	20500	38100	53400	88000
barg	1.800	2570	5790	9810	21900	40800	57200	94200
barg	2.000	2740	6170	10400	23400	43500	61000	100000
barg	2.500	3200	7210	12200	27300	50900	—	—
barg	3.000	3670	8270	14000	31300	58300	—	—
barg	3.448	4090	9210	15600	34900	65000	—	—

Note:

1. Capacities are de-rated per ASME at 1.03 barg and greater.

ANDERSON GREENWOOD LOW PRESSURE POPRV CATALOG
 SERIES 90 AND 9000 PILOT OPERATED PRESSURE RELIEF VALVES

Sizing – Type 93 Capacities

National Board Certified, 15 psig and greater

Natural Gas Capacities (SCFM, 10 percent overpressure, 60°F, Z = 1.00 SG = 0.60)								
	Set Pressure	2	3	4	Valve Size, in	8	10	12
		2.29	5.16	8.74	6	36.40	51.00	84.00
					Orifice Area, in²			
					19.56			
wc	3.0	104	234	396	886	1650	2310	3800
wc	5.0	134	302	511	1140	2130	2890	4920
wc	10.0	190	428	725	1620	3020	4230	6970
wc	15.0	233	525	890	1990	3710	5190	8550
wc	20.0	270	608	1030	2300	4290	6010	9900
wc	25.0	302	681	1150	2580	4810	6730	11100
psig	1.0	319	718	1220	2720	5070	7100	11700
psig	1.5	393	885	1500	3350	6240	8740	14400
psig	2.5	513	1150	1960	4380	8150	11400	18800
psig	5.0	742	1670	2830	6340	11800	16500	27200
psig	8.0	962	2170	3670	8220	15300	21400	35300
psig	10.0	1090	2460	4160	9310	17300	24300	40000
psig	14.0	1320	3000	5040	11300	21000	29400	48500
psig	15.0	1450	3300	5520	12400	22300	32200	53100
psig	20.0	1670	3760	6370	14200	26500	37100	61200
psig	25.0	1890	4260	7210	16100	30000	42100	69300
psig	30.0	2110	4750	8050	18000	33500	47000	77400
psig	35.0	2350	5300	9000	20000	37400	—	—
psig	40.0	2600	5850	9910	22200	41300	—	—
psig	45.0	2840	6400	10800	24300	45100	—	—
psig	50.0	3080	6950	11800	26300	49000	—	—

Note:

1. Capacities are de-rated per ASME at 15 psig and greater.

ANDERSON GREENWOOD LOW PRESSURE POPRV CATALOG

SERIES 90 AND 9000 PILOT OPERATED PRESSURE RELIEF VALVES

Sizing – Type 93 Capacities

Natural Gas Capacities - Metric [Nm³/h, 10 percent overpressure, 0°C, Z = 1.00]

Set Pressure	Metric Valve Size, mm						
	50	80	100	150	200	250	300
	14.77	33.29	56.39	126.19	234.84	329.03	541.93
mbarg 7.5	172	387	656	1470	2730	3830	6300
mbarg 10.0	198	447	758	1700	3160	4420	7280
mbarg 15.0	243	548	929	2080	3870	5420	8930
mbarg 20.0	281	634	1070	2400	4470	6264	10300
mbarg 50.0	447	1010	1710	3820	7110	9960	16400
mbarg 100.0	638	1440	2430	5450	10100	14200	23400
mbarg 250.0	1030	2320	3940	8810	16400	23000	37800
barg 0.400	1330	3000	5080	11400	21200	29600	48800
barg 0.600	1670	3760	6360	14200	26500	37100	61100
barg 0.800	1960	4420	7490	16700	31200	43700	71944
barg 1.000	2230	5020	8510	19000	35400	49400	81700
barg 1.200	2570	5780	9800	21900	40800	57200	94200
barg 1.400	2780	6260	10600	23700	44200	61900	102000
barg 1.600	2990	6740	11400	25500	47500	66600	110000
barg 1.800	3200	7220	12200	27400	50900	71300	117000
barg 2.000	3400	7700	13000	29200	54300	76100	125000
barg 2.500	3990	9000	15200	34100	63500	—	—
barg 3.000	4570	10300	17500	39100	72700	—	—
barg 3.448	5100	11500	19500	43500	81000	—	—

Note:

1. Capacities are de-rated per ASME at 1.03 barg and greater.

ANDERSON GREENWOOD LOW PRESSURE POPRV CATALOG

SERIES 90 AND 9000 PILOT OPERATED PRESSURE RELIEF VALVES

Sizing – Types 91 and 94 Capacities

National Board Certified, 15 psig and greater

Air Capacities (SCFM, 10 percent overpressure, 60°F, Z = 1.00)

Set Pressure		2	3	4	Valve Size, in	8	10	12
		2.92	6.24	10.33	6	39.57	56.50	89.87
					Orifice Area, in ²			
					22.22			
wc	15.0	224	478	792	1700	3030	4330	6890
wc	20.0	259	554	917	1970	3510	5020	7980
wc	25.0	291	622	1030	2210	3940	5630	8950
psig	1.0	307	655	1080	2330	4160	5930	9440
psig	1.5	379	810	1340	2880	5130	7330	11700
psig	2.5	497	1060	1760	3780	6730	9610	15300
psig	5.0	728	1550	2570	5540	9860	14100	22400
psig	8.0	954	2040	3370	7260	12900	18500	29400
psig	10.0	1090	2330	3850	8280	14700	21100	33500
psig	15.0	1350	2880	4770	10300	18300	26100	41500
psig	20.0	1554	3320	5500	11800	21100	30100	47800
psig	25.0	1760	3760	6230	13400	23800	34000	54200
psig	30.0	1970	4200	6950	15000	26600	38000	60500
psig	35.0	2190	4690	7760	16700	29700	42400	67500
psig	40.0	2420	5170	8560	18400	32800	46800	74500
psig	45.0	2650	5650	9360	20100	35900	51200	81400
psig	50.0	2870	6140	10200	21900	38900	55600	88400

Note:

1. Capacities are de-rated per ASME at 15 psig and greater.

ANDERSON GREENWOOD LOW PRESSURE POPRV CATALOG

SERIES 90 AND 9000 PILOT OPERATED PRESSURE RELIEF VALVES

Sizing – Types 91 and 94 Capacities

Air Capacities - Metric [Nm ³ /h, 10 percent overpressure, 0°C, Z = 1.00]								
Set Pressure		50	80	100	Metric Valve Size, mm	200	250	300
		18.84	40.26	66.65	150 Orifice Area, cm ² 143.35	255.29	364.52	579.81
mbarg	7.5	165	352	582	1250	2230	3190	5070
mbarg	35.0	358	766	1270	2730	4850	6930	11000
mbarg	55.0	451	965	1600	3430	6120	8730	13900
mbarg	70.0	511	1090	1810	3890	6920	9890	15700
mbarg	100.0	615	1310	2180	4680	8340	11900	18900
mbarg	250.0	1010	2150	3560	7650	13600	19500	30900
barg	0.400	1310	2800	4630	9960	17700	25300	40300
barg	0.600	1660	3540	5860	12600	22400	32100	51000
barg	0.800	1970	4200	6960	15000	26700	38100	60600
barg	1.000	2250	4820	7980	17200	30600	43600	69400
barg	1.200	2390	5110	8460	18200	32400	46300	73600
barg	1.400	2590	5530	9160	19700	35100	50100	79700
barg	1.600	2790	5960	9860	21200	37800	53900	85800
barg	1.800	2980	6380	10600	22700	40400	57800	91900
barg	2.000	3180	6800	11300	24200	43100	61600	98000
barg	2.500	3720	7950	13200	28300	50400	72000	114000
barg	3.000	4260	9110	15100	32400	57800	82500	131000
barg	3.448	4750	10100	16800	36100	64400	92000	146000

Note:

1. Capacities are de-rated per ASME at 1.03 barg and greater.

ANDERSON GREENWOOD LOW PRESSURE POPRV CATALOG

SERIES 90 AND 9000 PILOT OPERATED PRESSURE RELIEF VALVES

Sizing – Type 95 Capacities

National Board Certified, 15 psig and greater

Air Capacities (SCFM, 10 percent overpressure, 60°F, Z = 1.00)

Set Pressure	Valve Size, in			
	2	3	4	6
	Orifice Area, in ²			
	2.93	6.25	10.32	22.15
psig 5.0	—	1560	2570	5520
psig 10.0	1090	2330	3850	8260
psig 15.0	1500	3190	5270	11300
psig 20.0	1720	3680	6080	13000
psig 40.0	2690	5730	9460	20300
psig 60.0	3690	7880	13000	27900
psig 80.0	4700	10000	16500	35500
psig 100.0	5710	12300	20100	43100
psig 120.0	6710	14300	23600	50700
psig 140.0	7720	16500	27200	58400
psig 150.0	8220	17500	29000	62200

Air Capacities - Metric [Nm³/h, 10 percent overpressure, 0°C, Z = 1.00]

Set Pressure	Metric Valve Size, mm			
	50	80	100	150
	Orifice Area, cm ²			
	18.90	40.32	66.58	142.90
barg 0.250	—	2150	3550	7630
barg 0.400	—	2800	4630	9930
barg 0.600	—	3550	5860	12600
barg 0.800	1970	4210	6960	14900
barg 1.000	2260	4830	7970	17100
barg 1.500	2980	6370	10500	22600
barg 2.000	3520	7520	12400	26700
barg 2.500	4130	8810	14500	31200
barg 3.000	4730	10100	16700	35800
barg 4.000	5940	12700	20900	44900
barg 5.000	7150	15200	25200	54000
barg 7.000	9560	20400	33700	72300
barg 10.000	13200	28100	46400	99600

Note:

1. Capacities are de-rated per ASME at 15 psig and greater (1.03 barg and greater).

ANDERSON GREENWOOD LOW PRESSURE POPRV CATALOG

SERIES 90 AND 9000 PILOT OPERATED PRESSURE RELIEF VALVES

Sizing – 9200 Capacities

Air Capacity (SCFM, 10 percent overpressure at 60°F)

Set Pressure		Valve Size, in						
		2	3	4	6	8	10	12
		Orifice Area, in ²						
		3.35	7.39	12.73	28.89	50.00	78.85	113.00
wc	4	133	294	506	1150	1990	3130	4490
wc	6	167	367	632	1430	2490	3920	5620
wc	8	196	430	741	1680	2910	4590	6580
wc	10	221	486	838	1900	3290	5190	7440
wc	15	277	608	1050	2380	4120	6490	9310
wc	20	324	712	1230	2780	4820	7600	10900
wc	25	366	805	1390	3150	5450	8590	12300
psig	1.0	387	852	1470	3330	5770	9090	13000
psig	1.5	484	1060	1830	4160	7200	11400	16300
psig	2.0	566	1250	2150	4870	8430	13300	19100
psig	2.5	640	1410	2420	5500	9530	15000	21500
psig	3.0	706	1550	2680	6070	10500	16600	23800
psig	4.0	826	1820	3130	7100	12300	19400	27800
psig	5.0	932	2050	3530	8010	13900	21900	31400

Air Capacity - Metric [Nm³/h, 10 percent overpressure at 0°C]

Set Pressure		Metric Valve Size, mm						
		50	80	100	150	200	250	300
		Orifice Area, cm ²						
		21.61	47.68	82.13	186.39	322.58	508.71	729.03
mbarg	10	221	487	838	1900	3290	5190	7450
mbarg	15	277	608	1050	2380	4120	6490	9310
mbarg	20	324	713	1230	2790	4830	7610	10911
mbarg	25	367	806	1390	3150	5460	8600	12300
mbarg	40	475	1040	1800	4080	7070	11100	16000
mbarg	50	537	1180	2030	4610	7990	12600	18100
mbarg	60	593	1300	2250	5100	8830	13900	20000
mbarg	70	646	1420	2450	5550	9610	15100	21700
barg	0.1	785	1730	2970	6750	11700	18400	26400
barg	0.15	980	2160	3710	8430	14600	23000	33000
barg	0.2	1150	2520	4340	9860	17100	26900	38600
barg	0.3	1430	3140	5410	12300	21300	33500	48100
barg	0.35	1550	3410	5880	13300	23100	36400	52300

ANDERSON GREENWOOD LOW PRESSURE POPRV CATALOG

SERIES 90 AND 9000 PILOT OPERATED PRESSURE RELIEF VALVES

Sizing – 9300 Capacities

National Board Certified, 15 psig and greater

Air Capacity (SCFM, 10 percent overpressure at 60°F)								
Set Pressure		2	3	4	Valve Size, in	8	10	12
		3.35	7.39	12.73	6 Orifice Area, in ² 28.89	50.00	78.85	113.00
wc	4	126	279	480	1090	1890	2970	4260
wc	6	155	342	589	1340	2310	3650	5230
wc	8	179	395	681	1550	2680	4220	6050
wc	10	201	443	763	1730	3000	4730	6770
wc	15	247	545	938	2130	3680	5811	8330
wc	20	286	631	1090	2470	4270	6740	9600
wc	25	321	709	1220	2770	4790	7560	10800
psig	1.0	339	748	1290	2920	5060	7980	11400
psig	2.0	489	1080	1860	4220	7300	11500	16500
psig	3.0	611	1350	2320	5270	9120	14400	20600
psig	4.0	718	1580	2730	6200	10700	16900	24200
psig	5.0	817	1800	3100	7050	12200	19200	27600
psig	6.0	909	2000	3450	7840	13600	21400	30700
psig	8.0	1080	2380	4110	9320	16100	25400	36500
psig	10.0	1240	2740	4720	10700	18500	29200	41900
psig	12.0	1390	3070	5290	12000	20800	32800	47000
psig	14.0	1540	3390	5840	13200	22900	36200	51800
psig	15.0	1260	2790	4800	10900	18800	29700	42600
psig	17.0	1340	2960	5090	11600	20000	31500	45200
psig	20.0	1460	3210	5530	12600	21700	34300	49100
psig	22.0	1530	3380	5830	13200	22900	36100	51700
psig	25.0	1650	3640	6270	14200	24600	38800	55600
psig	27.0	1730	3810	6560	14900	25600	40600	58200
psig	30.0	1840	4060	7000	15900	27500	43400	62100
psig	35.0	2050	4530	7810	17700	30700	—	—
psig	40.0	2270	5000	8620	19500	33800	—	—
psig	45.0	2480	5470	9420	21400	37000	—	—
psig	50.0	2690	5940	10200	23200	40200	—	—

Note:

1. Capacities are de-rated per ASME at 15 psig and greater.

ANDERSON GREENWOOD LOW PRESSURE POPRV CATALOG

SERIES 90 AND 9000 PILOT OPERATED PRESSURE RELIEF VALVES

Sizing – 9300 Capacities

Air Capacity - Metric [Nm³/h, 10 percent overpressure at 0°C]

Set Pressure	50	80	100	Metric Valve, mm 150	200	250	300
	21.61	47.68	82.13	Orifice Area, cm ² 186.39	322.58	508.71	729.03
mbarg 10.0	209	462	796	1810	3130	4930	7060
mbarg 15.0	257	567	976	2220	3830	6050	8670
mbarg 20.0	297	656	1130	2560	4430	6990	10000
mbarg 25.0	333	734	1260	2870	4970	7830	11200
mbarg 40.0	423	933	1610	3650	6310	9960	14300
mbarg 50.0	474	1050	1800	4090	7080	11200	16000
mbarg 60.0	521	1150	1980	4490	7780	12300	17600
mbarg 70.0	565	1250	2150	4870	8430	13300	19000
barg 0.1	681	1500	2590	5870	10200	16000	23000
barg 0.2	991	2190	3770	8550	14800	23300	33400
barg 0.3	1250	2750	4740	10700	18600	29300	42000
barg 0.5	1680	3710	6400	14500	25100	39600	56800
barg 1.0	2600	5730	9880	22400	38800	61200	87700
barg 1.200	2200	4940	8520	19300	33400	52800	75600
barg 1.400	2430	5350	9220	20900	36200	57100	81900
barg 1.600	2610	5760	9930	22500	39000	61500	88100
barg 1.800	2800	6170	10600	24100	41700	65800	94300
barg 2.000	2980	6580	11300	25700	44500	70200	101000
barg 2.200	3170	6990	12000	27300	47300	—	—
barg 2.400	3350	7400	12700	28900	50000	—	—
barg 2.600	3540	7810	13400	30500	52800	—	—
barg 2.800	3790	8360	14400	32700	56600	—	—
barg 3.000	3990	8810	15200	34400	59600	—	—
barg 3.200	4200	9260	16000	36200	62700	—	—
barg 3.400	4400	9710	16700	38000	65700	—	—
barg 3.448	4450	9820	16900	38400	66400	—	—

Note:

1. Capacities are de-rated per ASME at 1.03 barg and greater.

ANDERSON GREENWOOD LOW PRESSURE POPRV CATALOG
 SERIES 90 AND 9000 PILOT OPERATED PRESSURE RELIEF VALVES

Sizing – Type 96A Vacuum Capacities

Air Capacities (SCFH, 60°F, Z = 1.00)				
Full Open ¹ Vacuum Relief (oz/in ²)	Valve Size, in			
	4	6	8	12
	Orifice Area, in ²			
	11.70	23.89	38.60	80.93
1.0	19400	43800	84600	199000
3.0	31200	84600	147000	321000

Air Capacities - Metric [Nm ³ /h, 0°C, Z = 1.00]				
Full Open ¹ Vacuum Relief [mbarg]	Metric Valve Size, mm			
	100	150	200	300
	Orifice Area, cm ²			
	75.49	154.13	249.03	522.13
4.3	536	1210	2330	5470
12.9	860	2330	4050	8850

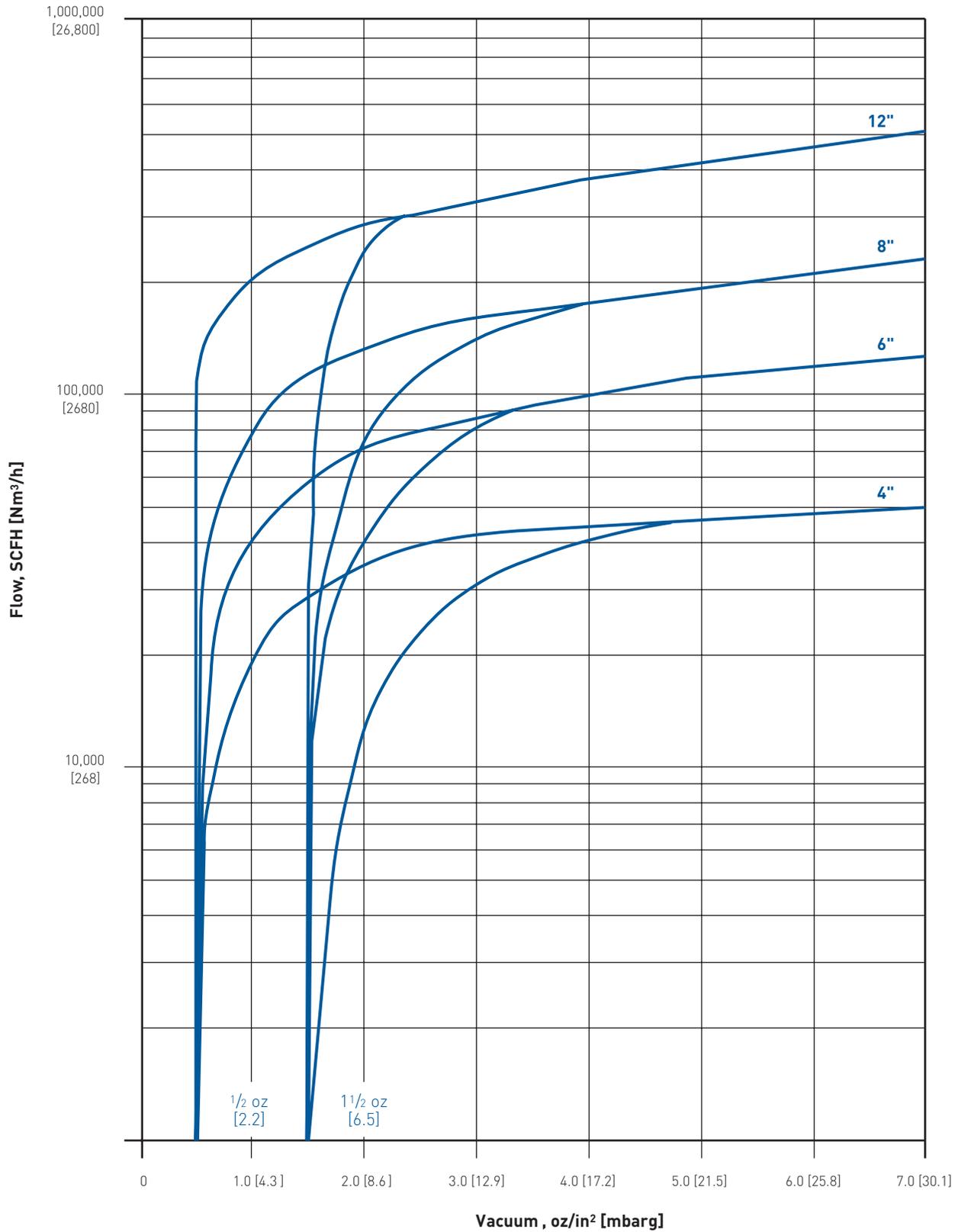
Sizing – Type 9200/9300 Vacuum Capacities

Vacuum Capacity - @ 1 oz. in ² [4.3 mb] - SCFH , 60°F [Nm ³ /h, 0°C] ^{1, 2}					
Valve Size		9200		9300	
2-inch	[50 mm]	4850	[134]	4000	[110]
3-inch	[80 mm]	10700	[295]	8830	[243]
4-inch	[100 mm]	18400	[508]	15200	[419]
6-inch	[150 mm]	41800	[1150]	34500	[951]
8-inch	[200 mm]	72400	[2000]	59700	[1650]
10-inch	[250 mm]	114000	[3150]	94200	[2600]
12-inch	[300 mm]	164000	[4510]	135000	[3720]

Notes:

1. Nameplate vacuum setting 1/2 full open vacuum. Capacities based on flow testing.
2. Remote pressure sense connection is required for all vacuum configurations.

Type 96A Flow Test Results



Note:
 Sizing program not applicable for Type 96A.

ANDERSON GREENWOOD LOW PRESSURE POPRV CATALOG
 SERIES 90 AND 9000 PILOT OPERATED PRESSURE RELIEF VALVES

Series 90 Ordering Information

	93	03	04	F	A
Valve Type	93, 91, 94, 95, 96A				
Inlet Size	02 – 2-inch [50 mm] 08 – 8-inch [200 mm] 03 – 3-inch [80 mm] 10 – 10-inch [250 mm] 04 – 4-inch [100 mm] 12 – 12-inch [300 mm] 06 – 6-inch [150 mm]				
Outlet Size	03 – 3-inch [80 mm] 10 – 10-inch [250 mm] 04 – 4-inch [100 mm] 12 – 12-inch [300 mm] 06 – 6-inch [150 mm] 16 – 16-inch [400 mm] 08 – 8-inch [200 mm] Blank – for capped 96A				
Flange Facing	R – Raised F – Flat				
Main Valve Material	A – Aluminum C – CS S – SS				

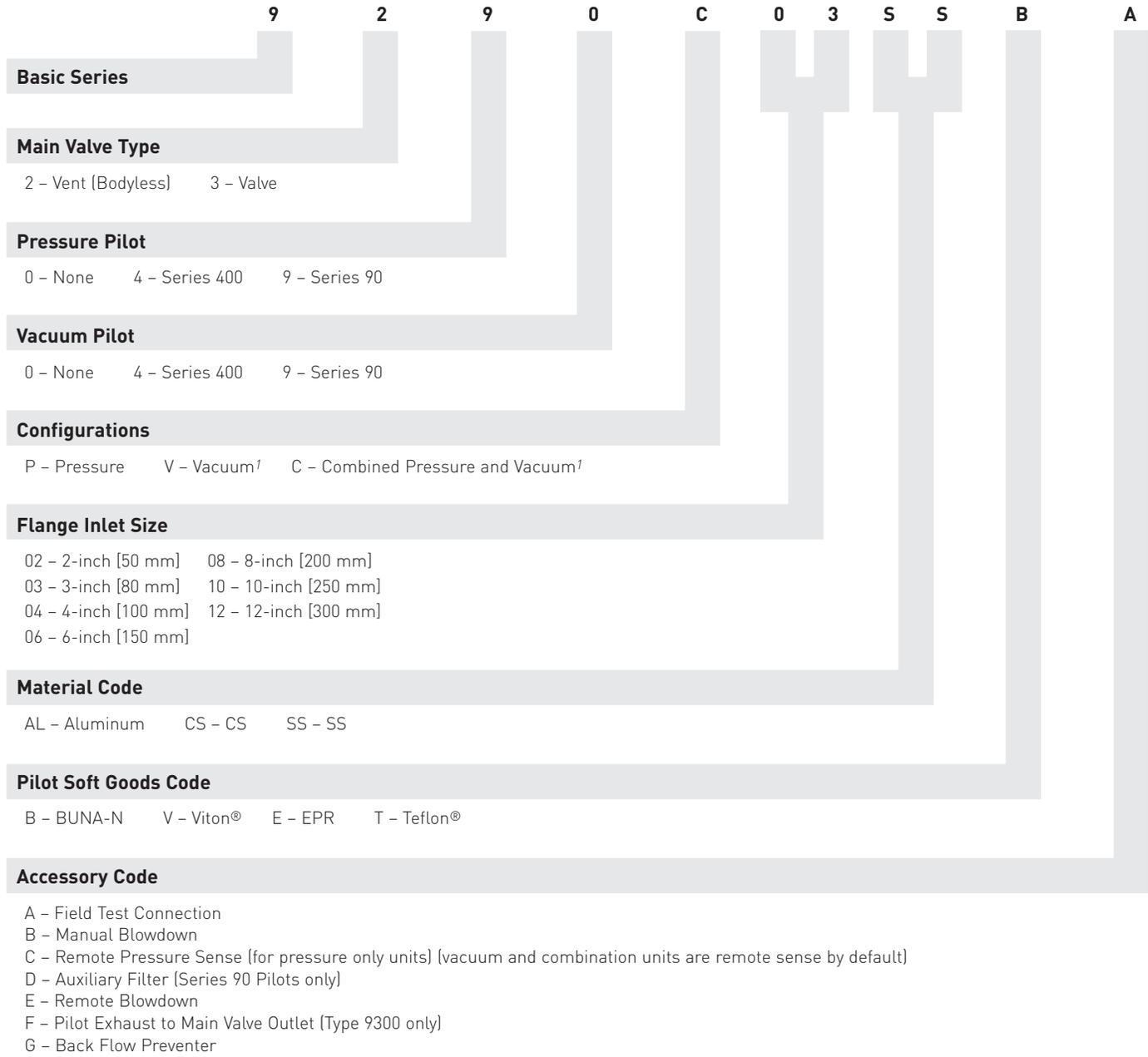
Note:

When ordering or inquiring about the Anderson Greenwood Series 90 and 9000, please include the following:

- Model Number
- Set Pressure
- Accessories
- Required Capacity
- Maximum Inlet Temperature
- Service (specific gravity or molecular weight)
- Detail of any special requirements, including inspection and testing
- Connections

ANDERSON GREENWOOD LOW PRESSURE POPRV CATALOG
 SERIES 90 AND 9000 PILOT OPERATED PRESSURE RELIEF VALVES

Series 9000 Ordering Information



Note:

1. Configurations "V" and "C" require Accessory Code "C" (Remote Pressure Sense)



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