BIRKETT SAFESET SERIES PILOT OPERATED SAFETY RELIEF VALVES

Pop action and modulating pilot operated safety valves with a unique full nozzle design and dimensions to API 526.

GENERAL APPLICATION

Safeset valves are self-contained pilot operated safety relief valves available for both gas and liquid duties which use the system pressure to control the valve opening and closing with no other energy source required.

AGENCY APPROVALS

Quality standard:	ISO 9001:2015
Boiler and pressure vessels:	ASME VIII PED 2014/68/EU
Mechanical engineering directive:	ATEX 2014/34/EU
Sizing and selection:	API 520: Part 1 ISO 4126
Dimensions:	API 526
Leakage rates:	API 527
Flange ratings:	ANSI B16.5

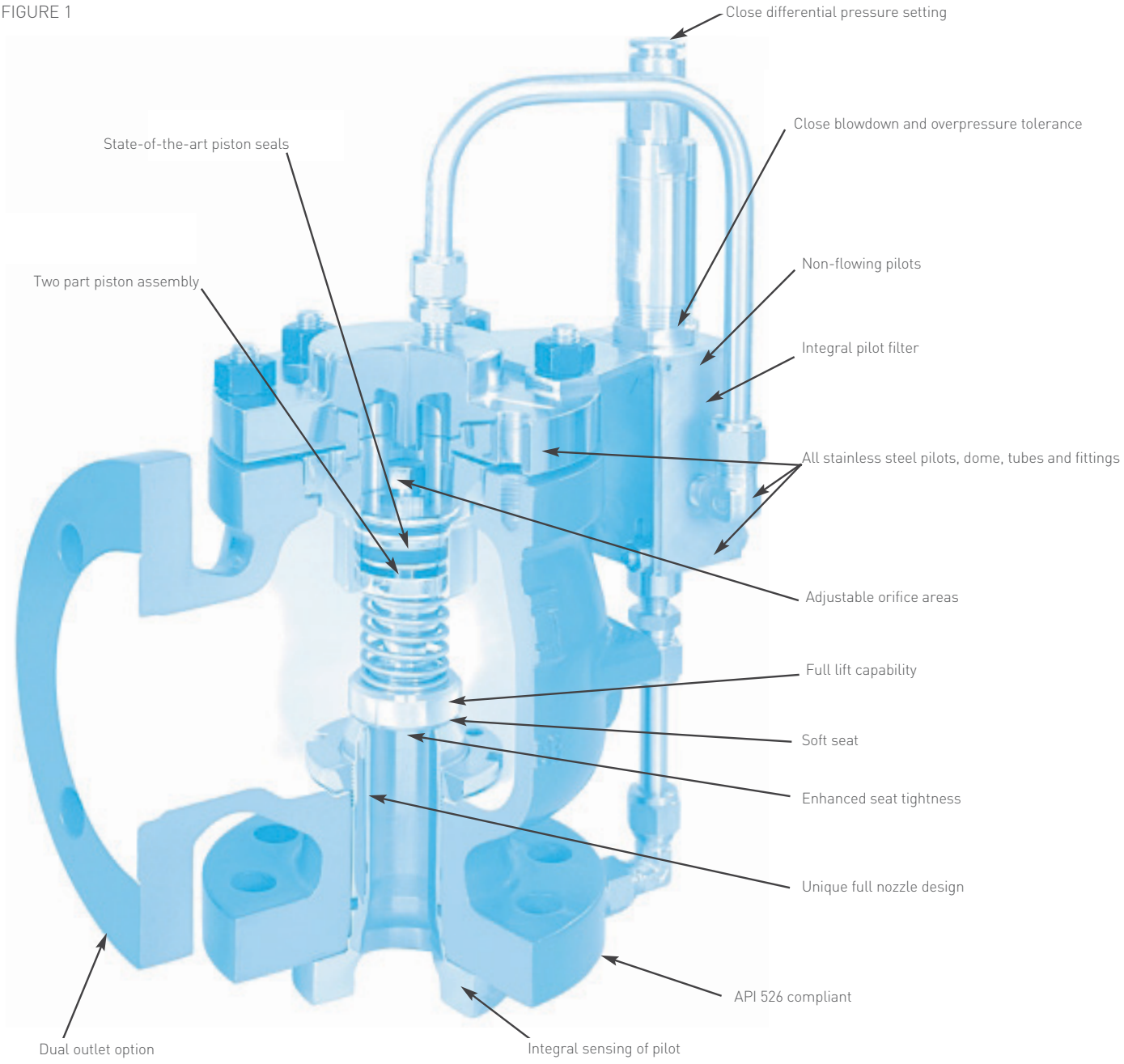
TECHNICAL DATA

Materials:	Carbon steel, stainless steel
Sizes:	1" x 2" to 8" x 10" (DN 25 to DN 200)
Connections:	Flanged
Pressure range:	29 to 6170 psig (2 to 425.5 barg)
Temperature range:	-65 to 500°F (-54 to 260°C)

FEATURES

- Unique full nozzle design reduces seat stresses, inlet pressure losses, increases discharge co-efficient and enables lower specification body materials on corrosive duties.
- All process wetted parts in stainless steel as a minimum, reducing seal contaminations and prolonging service life.
- Non-flowing pilot eliminates freezing risk, improves service life and ensures trouble-free operation.
- System pressures of 95% to 98% of set pressure possible.
- Full lift capability against high levels of back pressure.
- Pop action pilots adjustable for zero overpressure and blowdown equal to 3% of set pressure.
- Soft pilot and main valve seats in a range of material options provide optimum leak tightness and reduce maintenance.
- Adjustable orifice areas within 8 standard body sizes accommodating all 21 standard orifice sizes.
- Integral sensing gives a compact design and accurate pressure sense from within the flow stream.
- Remote pilot sensing option ensures trouble free operation even with high inlet pressure losses.
- Dual outlet, full bore model available for high capacity duties.

FIGURE 1


Close differential pressure setting
Close blowdown and overpressure tolerance
State-of-the-art piston seals
Non-flowing pilots
Two part piston assembly
Integral pilot filter
All stainless steel pilots, dome, tubes and fittings
Adjustable orifice areas
Full lift capability
Soft seat
Enhanced seat tightness
Unique full nozzle design
API 526 compliant
Dual outlet option
Integral sensing of pilot

KEY FEATURES

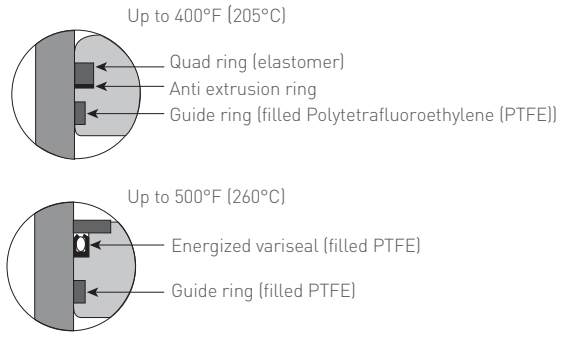
Close differential pressure setting
Pop acting pilot valves are quick acting with no delay between the pilot and the main valve opening pressures. Modulating valves inherently have a nominal 2% delay, which ensures the pilot is not leaking when the system pressure is close to set pressure.

Unique full nozzle design
The nozzle is a patented push-in design, held in position with a locking ring.

API 526 compliant
Fully conforms to the latest edition of API 526 for pressure/temperature ratings and over flange dimensions for pilot valves.

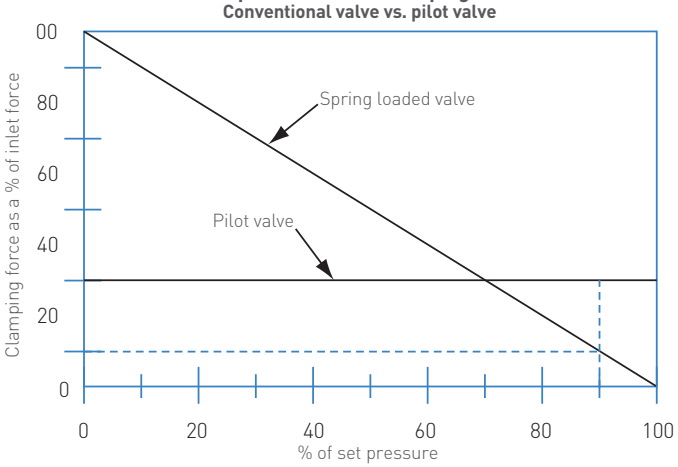
Two part piston-disc assembly
Gives a reduced guiding geometry, keeping the size of the components within the body bowl to a minimum and increasing the effective discharge area through the valve outlet.

State of the art piston seals and bearing rings
Reduce friction and galling of materials at the guide and pistons surfaces - essential for modulating pilots.



Enhanced seat tightness
The main valve is piston operated with a piston area in excess of 30% larger than the seat bore area. This ensures the seat closing force is always at least 30% greater than the seat opening force for all pressures, right up to the set point, producing more effective seat tightness and reducing the possibility of seat leakage.

Comparison of seat clamping force
Conventional valve vs. pilot valve



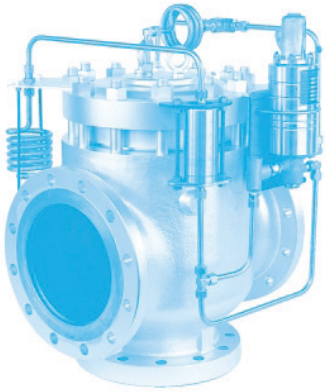
Seat clamping force = Valve closing force – Valve opening force

DUAL OUTLET/FULL BORE PILOT VALVE

This valve is suitable for extremely high capacity duties. It achieves maximum discharge capacities by having a full bore 8" (200 mm) inlet with an available discharge area of 44.178 in^2 (28502 mm^2) and two opposing 10" (DN 250) outlets, which can assist with reaction force problems.

Available with all pilot types 2, 4 and 8.

DUAL OUTLET/FULL BORE PILOT VALVE



MODE OF OPERATION

Safeset valves consist of a separate pilot valve connected to a main valve via a sensing pipe which senses the inlet pressure within the main valve nozzle and provides the pressure signal to the pilot.

Pilot valve
The pilot valve controls the discharge of fluid through the main valve by responding accurately to the system pressure. All pilots are of a non flowing design, meaning there is an absence of system flow through the pilot during the relief cycle.

The benefits of a non flowing design are that freezing of moisture-containing fluid and the carrying of particulate matter into the pilot are minimized, ensuring correct valve performance.

Main valve
The main valve conforms to the latest version of API 526 pressure/temperature ratings and face to face dimensions. It has 21 orifice variants in just 8 inlet x outlet body sizes. It is a differential piston operated design; the opening is controlled by the pilot valve.

PILOT VALVE TYPES

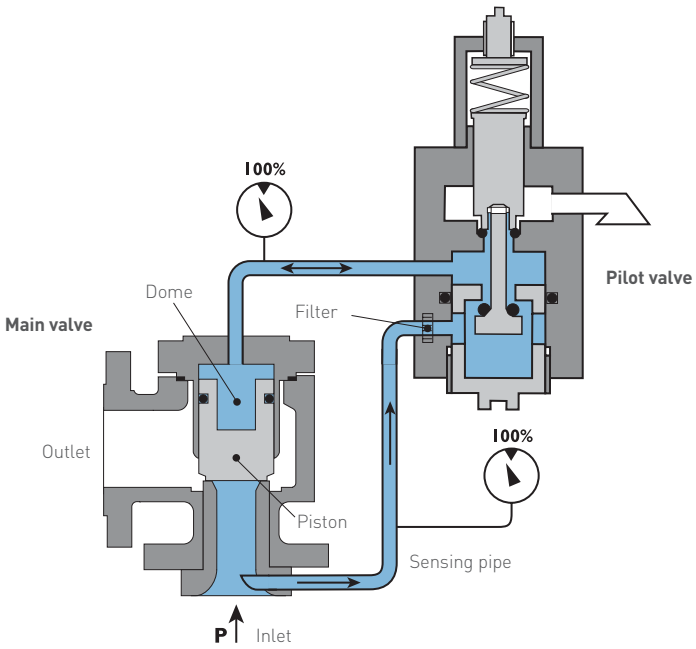
Pop (Type 2) - specifically for gas applications, it controls the main valve in a rapid manner and is either open or closed.

Modulating (Types 4 and 8) - the main valve is opened in a controlled manner, the over pressure is monitored constantly and the opening of the main valve is proportionate to the overpressure.

BASIC OPERATION

The pilot valve is essentially a very accurate spring-loaded safety valve, with two seats. At low system pressures, pressure from the system is fed from the inlet nozzle, through the sense line, past the lower pilot seat and into the main valve dome. The dome area is in excess of 30% larger than the seat bore area. This differential of areas ensures that the main valve remains closed.

When the system pressure reaches the pilot's set point, the lower pilot seat closes and the upper seat opens, releasing the dome pressure to the atmosphere. With no pressure above the piston, the main valve opens. The reverse of this sequence occurs when system pressure falls, feeding the main valve dome with system pressure and closing the main valve.



PILOT CONSTRUCTION

The pilot is essentially a spring loaded safety valve with blowdown adjustment which, during its operation, positions itself on one of two seats. The upper drain seat is used to determine pilot set Pressure; the lower feeding seat determines pilot blowdown.

The valve disc is held on the soft upper drain seat by the setting spring, which also determines the pilot set pressure. This valve disc is connected via a spindle to the lower feeding seat, which controls the system flow into the dome and also controls the pilot blowdown.

The valve disc and lower feeding seat move together; this action opens and closes each respective seat, allowing the pilot to control the operation of the main valve during the relieving cycle.

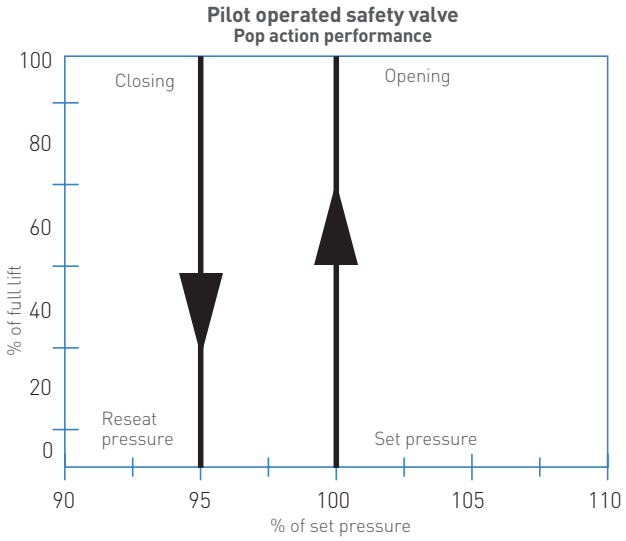
PILOT OPERATION

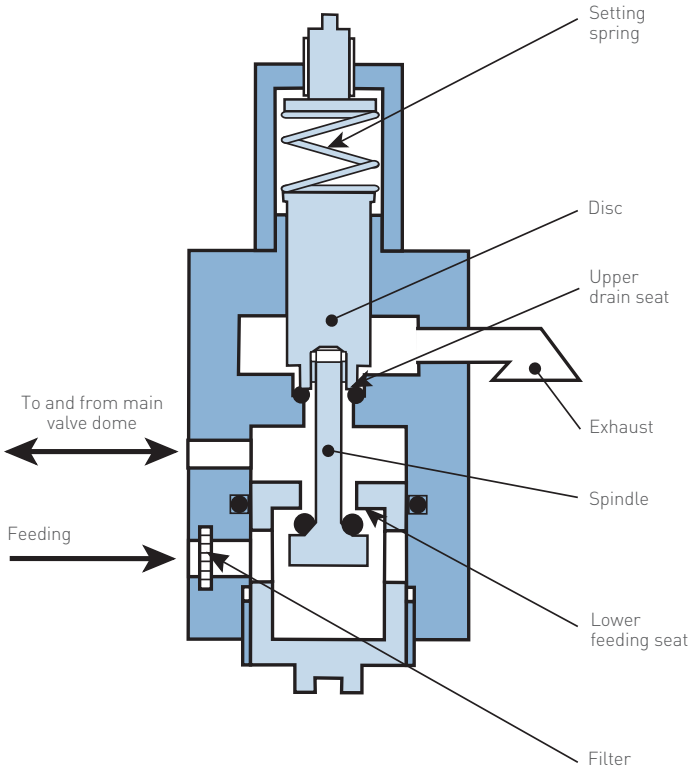
With pop action pilot operation, the main valve is either in the fully open or shut position. The operation is characterized by a distinct rapid 'pop' action, which is evident at the opening of the main valve, followed by a positive re-seat action when the main valve closes.

The graph demonstrates pop action. When set pressure is reached, the pilot valve opens rapidly; this action de-pressurizes the dome volume very quickly and the main valve opens. This is shown by the vertical (rising) line, illustrating that the main valve achieves its design lift at set pressure.

The re-seating characteristic is equally positive: when the system pressure has fallen to the pre-set pilot re-seat pressure, the pilot drain seat closes rapidly. This action allows the dome to be repressurized very quickly, closing the main valve completely. This is shown by the vertical (falling) line.

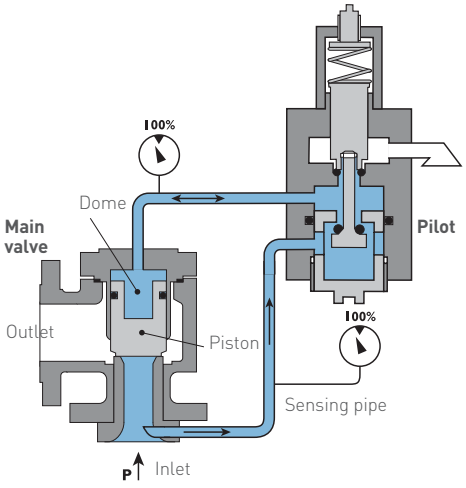
The re-seat pressure of the Type 2 pilot valve is adjustable externally, independently of the set pressure adjustment.



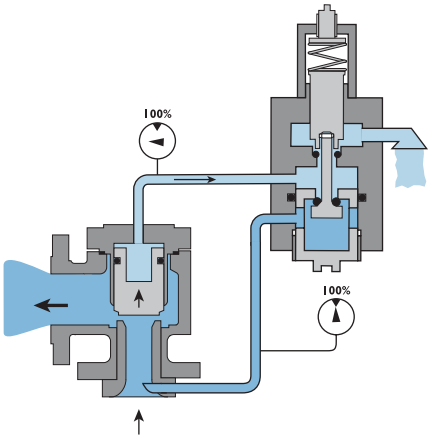


Key points - Type 2 pop action pilot

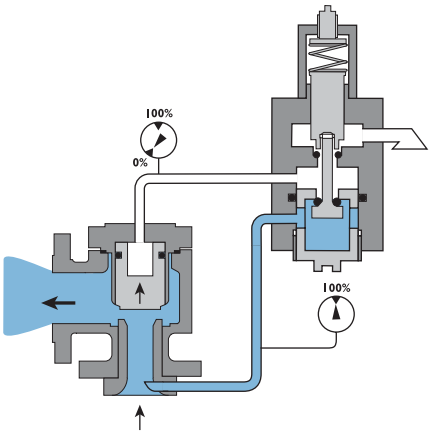
- Pilot set pressure = main valve set pressure.
- Main valve fully open at 0% overpressure.
- The pilot is non-flowing.
- Adjustable blowdown feature.
- Integral filter fitted.
- Gas duty only.



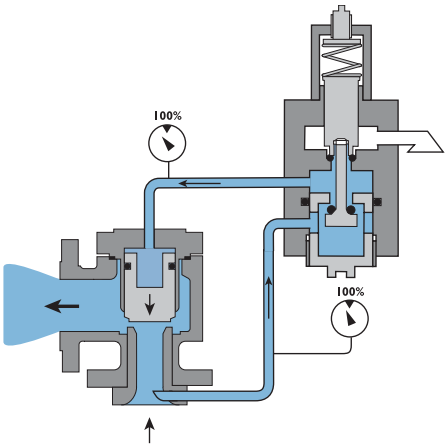
Stage 1
System pressure below the pilot set pressure, dome pressurized, main valve closed.



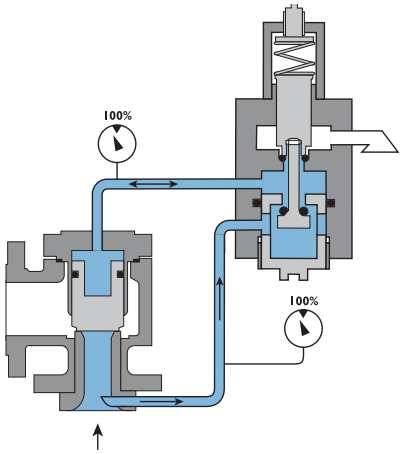
Stage 2
System pressure equal to set pressure, drain seat opens, dome de-pressurizes, main valve lifts fully with no overpressure.



Stage 3
System pressure equal to or greater than set pressure, dome pressure is atmospheric, main valve is fully open.



Stage 4
System pressure falls to equal the re-seat pressure, drain seat closes, feeding seat opens, dome is pressurized, main valve closes.



Stage 5
System pressure below the pilot set pressure, dome pressurized, main valve closed and ready for next upset condition.

PILOT CONSTRUCTION

Modulating pilots are essentially diaphragm or piston operated safety valves with a feedback piston for fine control of the pressure in the dome.

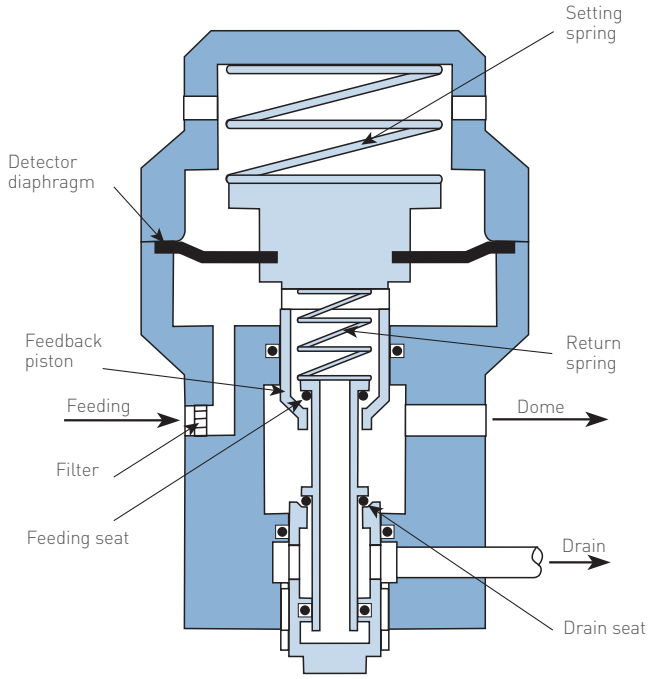
The Type 4 Pilot is used for pressures up to 1480 psig (102 barg).

When the set pressure is reached, the main valve opens in proportion to the system pressure rise. This is achieved by the pilot controlling the dome pressure. The main valve will maintain a lift necessary to discharge the system flow. As the system pressure increases, the main valve lift will change to accommodate the new flow condition. As the system pressure falls, the main valve will begin to close, finally closing at a pressure just below the set pressure.

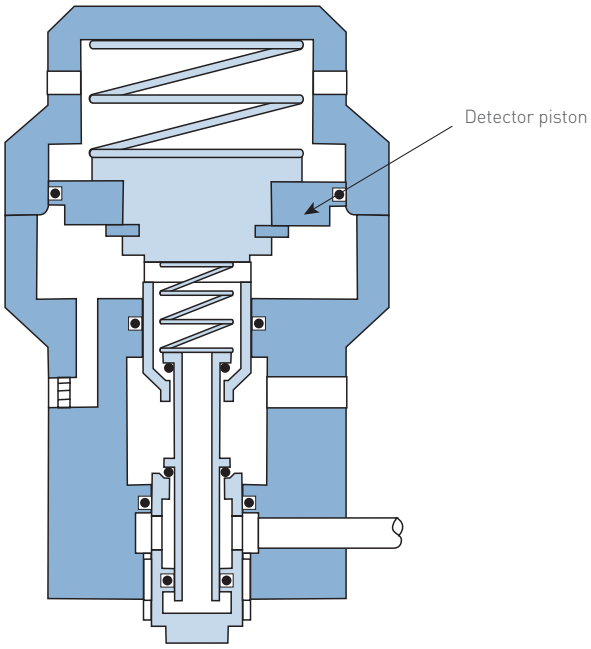
The diaphragm senses the system pressure and the feedback piston senses the dome pressure. The combination of these pressures accurately provides a force balanced with the adjusting spring to open/close the feeding/drain seats. This maintains dome pressure for accurate positioning of the main valve.

NOTE
The Type 4 pilot always drains to the main valve outlet and a back flow preventer should be fitted (see page 17).

TYPE 4/1 PILOT
(29 to 100 Psig)



TYPE 4/2 PILOT
(100 to 1480 Psig)



PILOT CONSTRUCTION

The Type 8 pilot is similar to the Type 4 except that it uses a piston instead of a diaphragm to lift the valve.

The pressure range for the Type 8 Pilot is 1480 to 6170 psig (102 to 425.5 barg).

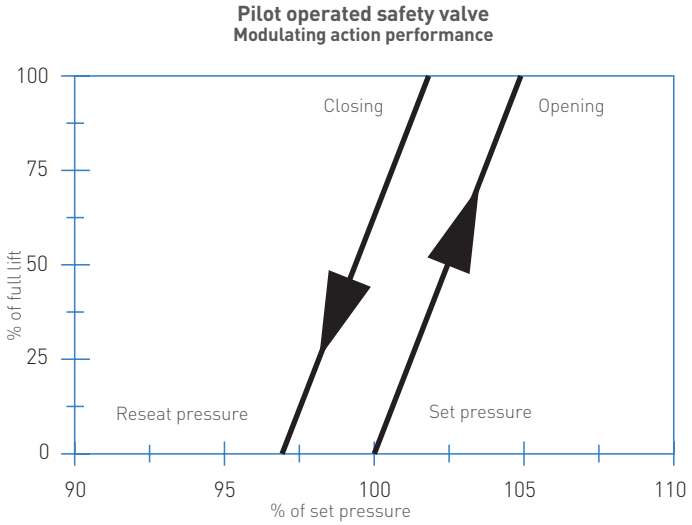
NOTE
The Type 8 pilot always drains to the main valve outlet and a back flow preventer should be fitted (see page 17).

PILOT OPERATION

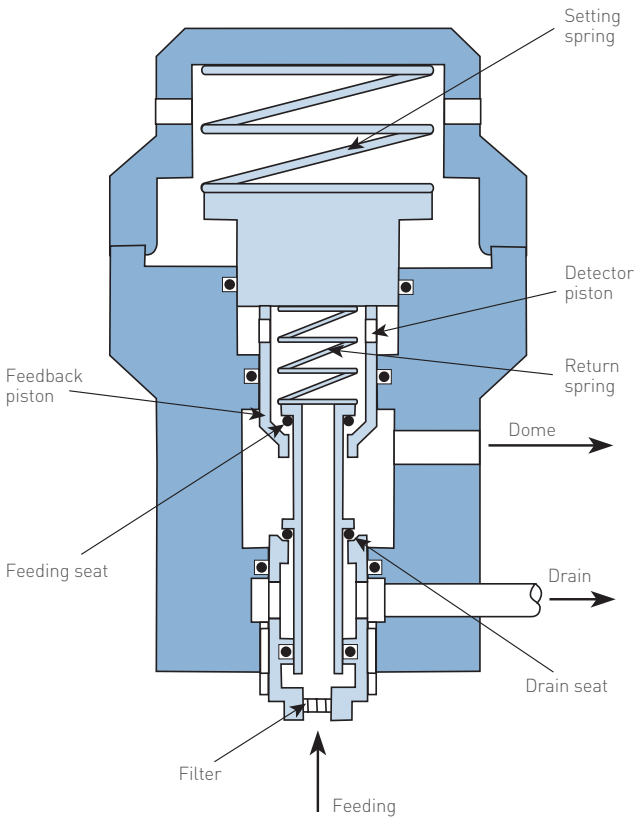
The action of the main valve is characterized as 'modulating'. To achieve this, the pilot accurately controls the pressure in the main valve dome, which positions the main valve disc to match the system upset flow condition, controlling the system pressure.

Effective pilot operation requires a small overpressure above the set pressure, to achieve full design lift of the main valve and a small pressure drop to re-seat the main valve.

A typical modulating performance is shown in the graph. The overpressure, as a percentage of set pressure, will vary with the system flow requirement; this means that an infinite number of relieving cycles can occur within the limits shown. However, the valve lift will always be in proportion to the rise in system pressure, ensuring a safe stable relief cycle.



TYPE 8 PILOT



Key points - Types 4 and 8 modulating action pilots

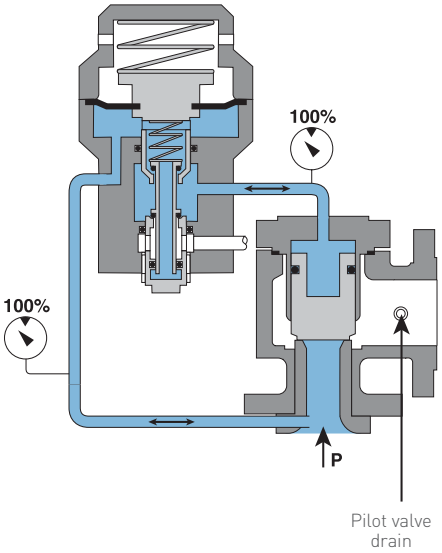
- Pilot set pressure is when the drain seat first opens.
- Main valve discharge maintains the system pressure at its respective flow condition, achieving fully modulating action.
- The pilot valve is firmly closed when the main valve closes.
- Integral filter fitted.

STAGES OF OPERATION - TYPE 4 AND 8 PILOTS

Type 4 and 8 pilots are fully modulating. They are intended for use with gas, liquid and mixed phase fluids. Both types are non flowing designs.

Stage 1
System pressure below set pressure

The feeding seat remains open with the drain seat closed. This maintains equal pressures in the dome and the system. The main valve is closed, held tightly against the nozzle.

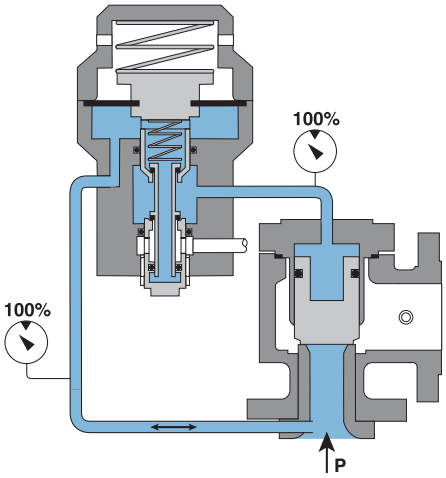


Stage 2
System pressure approaches set pressure

When the system pressure approaches the set pressure, the feeding seat closes. The drain seat remains closed and the main valve is closed.

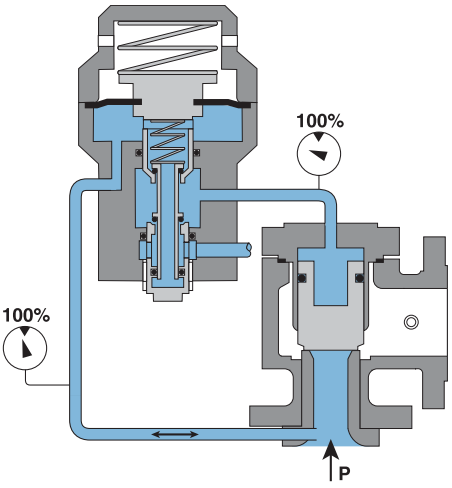
The pressure in the dome is now controlled by the inlet system pressure acting against the pilot diaphragm/piston and the dome pressure acting on the feedback piston. The combination of these two forces controls the opening of the drain seat, thereby controlling the dome pressure and hence the main valve lift.

When the drain seat opens it discharges a small volume of fluid from the dome. At no time is the drain seat flowing continually. It drains in short bursts.



Stage 3
System pressure reaches set pressure

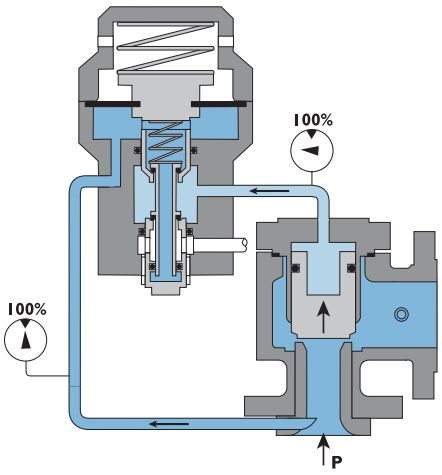
As the system pressure rises gradually to the set pressure, the dome pressure falls gradually approximately 30%. Due to the differential size, top and bottom of the piston, the main valve opening and closing forces are now in equilibrium.



Stage 4
System pressure above set pressure

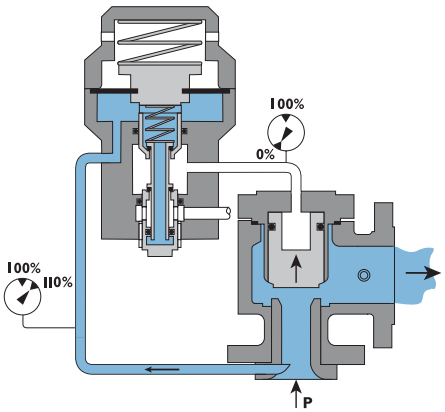
As the system pressure increases above the set pressure, modulation occurs with the main valve opening an amount sufficient to maintain the system flow rate. This is brought about by the increased system pressure acting against the pilot diaphragm/piston to re-open the drain seat. The dome pressure is reduced further, allowing the main valve to open. The reduced dome pressure now acting on the feedback piston produces a lower upward force and the adjusting spring closes the drain seat.

These actions cycle in very small increments and hence give the modulating effect.



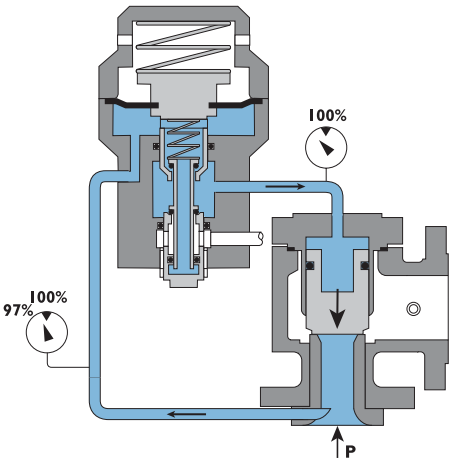
Stage 5
Main valve fully open

The main valve will be fully open before the system pressure reaches 110% of the set pressure.



Stage 6
Main valve closes

When the system upset condition ends, the system pressure will begin to fall. The reduced system pressure acting on the pilot diaphragm/piston will cause the feeding seat to reopen.
This will increase the dome pressure and the main valve will begin to close. The feeding seat will close as the dome pressure increases due to the feedback piston effect. This cycle will repeat as the system pressure is reduced further. The main valve will close with a progressive action. When the system pressure reaches approximately 97% of set pressure, the main valve will be closed.



TECHNICAL SPECIFICATION - PILOT VALVE

Valve type	2	4	8
Pilot action	Pop	Modulating	Modulating
Fluid	Gas	Gas, liquid, dual phase	Gas, liquid, dual phase
Overpressure	0%	<10%	<10%
Blowdown	3-10%[1] / adjustable	<3% / fixed	<3% / fixed
Pilot/main valve set pressure differential	0%	5%	2%
Max back pressure built up and superimposed	70%	70%	70%
Back pressures in excess of these limits can be accommodated - consult factory			
Pressure range Psig (Barg)	29-6170 (2.0-425.5)	29-1480 (2.0-102)	1480-6170 (102-425.5)
High pressure pilots are available - consult factory			
Temp. range °F (°C)	-54 to 260 (-65 to 500)	-54 to 260 (-65 to 500)	-54 to 260 (-65 to 500)
Accessories are available for cryogenic and high temperature applications - consult factory			

1. Unless otherwise required or specified, the type 2 Pilot will be factory set for 5% blowdown.

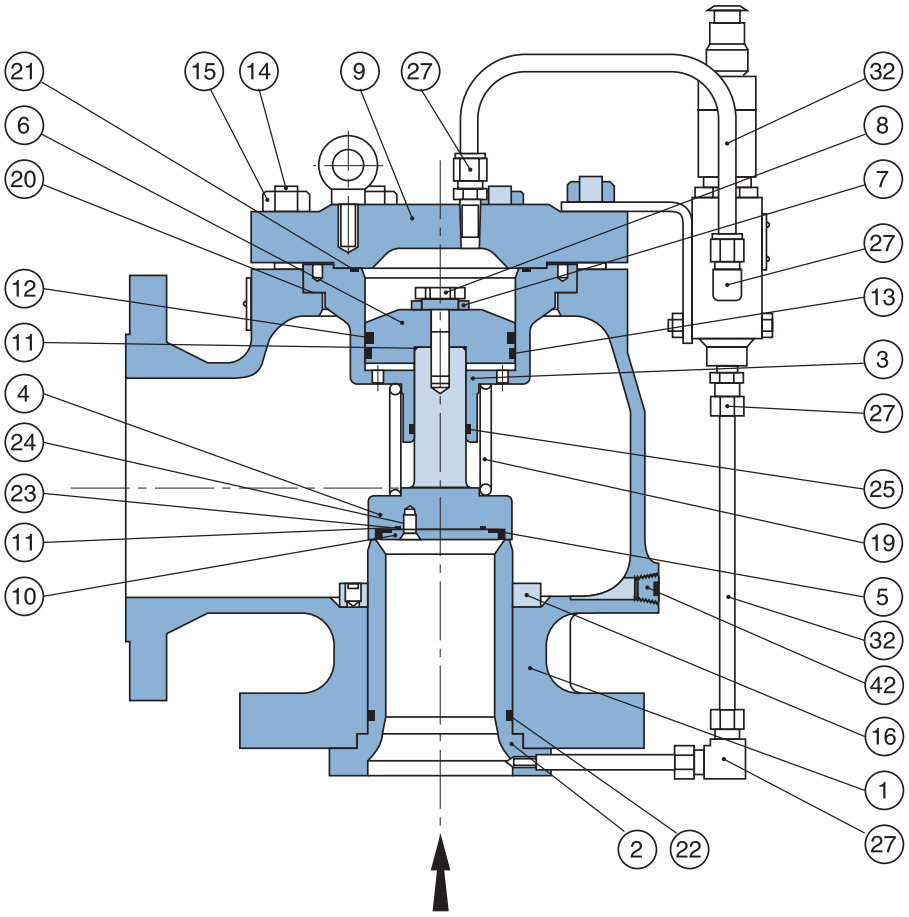
Type 2 Pilot must have the exhaust vent open to atmosphere or piped to a safe area.
Types 4 and 8 Pilots always have their exhaust vents connected into the main valve outlet.

MAIN VALVE - SOFT GOODS

Material	Temperature °F (°C)	Pressure range Psig (Barg)
Main valve seat		
SST filled PTFE	-50/500 (-46/+260)	Up to 1480 (102)
PEEK	-85/500 (-65/+260)	Over 1480 (102)
Fluorocarbon (FKM)	-4/400 (-20/+205)	Up to 1480 (102)
Nitrile (NBR)	-50/248 (-46/+120)	Up to 1480 (102)
Polyurethane	-65/300 (-54/+150)	400/1480 (27.6/102)
Main valve seat (NACE)		
PEEK	-85/500 (-65/+260)	Over 1480 (102)
Fluorocarbon (FKM)	-4/400 (-20/+205)	Up to 1480 (102)
Polyurethane	-65/300 (-54/+150)	400/1480 (27.6/102)
Gaskets		
Carbon fiber	-50/500 (-46/+260)	All pressures
Laminated graphite	-50/500 (-46/+260)	All pressures
Static seals		
Fluorocarbon (FKM)	-4/400 (-20/+205)	Upto 1480 (102)
AED Fluorocarbon (FKM)	-4/400 (-20/+205)	Over 1480 (102)
Options: NBR, Aflas, Chemras, Kalrez		

PILOT VALVE - MATERIALS

Material	Temperature °F (°C)
Body	SST 316 all
Bonnet	SST 316 all
Spring	SST 316 all
Trim	SST 316 all
Pilot seat and seals	
Nitrile (NBR)	-50/248 (-46/+120)
Fluorocarbon (FKM)	-4/400 (-20/+205)
EPR	-65/300 (-54/+150)
Ethylene Propylene Diene (EPDM)	-50/400 (-46/+205)
Aflas	-20/400 (-29/+205)
Heating or cooling coils required above 400°F (205°C) and below -50°F (-46°C)	



PARTS LIST

Body material		Carbon steel		Stainless steel
Item	Description	-20.2 to 500°F (-29 to 260°C)[1]	-50.8 to 500°F (-46 to 260°C)	-50.8 to 500°F (-46 to 260°C)
1	Body	SA 216 WCB	SA 352 LCB	SA 351 CF8M
2	Nozzle	SST 316	SST 316	SST 316
3	Guide	SST 17/4	SST 17/4	SST 17/4
4	Disc holder	SST 316	SST 316	SST 316
5	Disc insert	FKM[2]	FKM[2]	FKM[2]
6	Piston	SST 316	SST 316	SST 316
7	Locknut	SST 316	SST 316	SST 316
8	Lift stop	SST 316	SST 316	SST 316
9	Cover	SST 316	SST 316	SST 316
10	Retaining plate	SST 316	SST 316	SST 316
11	Disc holder seal	FKM[2]	FKM[2]	FKM[2]
12	Piston seal	FKM[2]	FKM[2]	FKM[2]
13 and 25	Guide rings	Carbon/PTFE	Carbon/PTFE	Carbon/PTFE
14	Body stud	A193/B7	A193/B8T	A193/B8T
15	Body nut	A194/2H	A194/8T	A194/8T
16	Lock ring	SST 316	SST 316	SST 316
19	Spring	SST 316	SST 316	SST 316
20	Body gasket	Carbon fiber	Carbon fiber	Carbon fiber *
21	Guide seal	FKM[2]	FKM[2]	FKM[2]
22	Nozzle seal	FKM[2]	FKM[2]	FKM[2]
23	Retaining plate screw	FKM[2]	FKM[2]	FKM[2]
24	Counter sunk screw	SST 316	SST 316	SST 316
27	Fittings	SST 316	SST 316	SST 316
32	Tubes	SST 316	SST 316	SST 316
42	Drain plug	HTS HOLO-KROME	HTS HOLO-KROME	ASTM A479-316L

NOTE

1. Maximum temperature is limited by the seal material.
2. Soft goods materials listed above are standard. For a full listing to cover the temperature ranges of the body materials listed above, it is necessary to refer to the seals, gaskets, selection table on the previous page.

Alternative materials and accessories are available, for NACE, high temperatures and cryogenic applications.

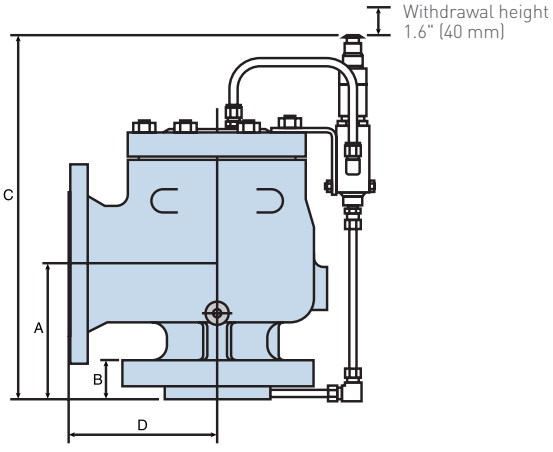
DIMENSIONS

			Dimension, in. (mm)						
						C			
Size, in.	Orifice	Rating	A	D	B	Type 2	Type 4 and 8	Remote pilot	Weight lbs (kg)
1 x 2	D, E, F	150 x 150	4.13 (105)	4.5 (114)	1.69 (43)	14 (356)	19 (483)	9 (229)	42 (19)
		300 x 150	4.38 (111)	4.5 (114)	1.69 (43)	14 (356)	19 (483)	9 (229)	45 (20.5)
		600 x 150	4.38 (111)	4.5 (114)	1.69 (43)	14 (356)	19 (483)	9 (229)	45 (20.5)
		900 x 300	4.94 (125)	4.75 (121)	2.25 (57)	16 (406)	21 (533)	11.5 (292)	53 (24)
		1500 x 300	4.94 (125)	4.75 (121)	2.25 (57)	16 (406)	21 (533)	11.5 (292)	53 (24)
		2500 x 300	4.94 (125)	4.75 (121)	2.25 (57)	16 (406)	21 (533)	11.5 (292)	53 (24)
1.5 x 2	D, E, F	150 x 150	4.88 (124)	4.75 (121)	1.69 (43)	14.5 (368)	19.5 (495)	9.5 (241)	46 (21)
		300 x 150	4.88 (124)	4.75 (121)	1.69 (43)	14.5 (368)	19.5 (495)	9.5 (241)	49 (22)
		600 x 150	4.88 (124)	4.75 (121)	1.69 (43)	14.5 (368)	19.5 (495)	9.5 (241)	49 (22)
		900 x 300	5.88 (149)	5.5 (140)	2.63 (67)	17 (432)	22 (559)	12.5 (318)	57 (26)
		1500 x 300	5.88 (149)	5.5 (140)	2.63 (67)	17 (432)	22 (559)	12.5 (318)	57 (26)
		2500 x 300	5.88 (149)	5.5 (140)	2.63 (67)	17 (432)	22 (559)	12.5 (318)	57 (26)
1.5 x 3	G, H	150 x 150	5.13 (130)	4.88 (124)	1.69 (43)	15 (381)	20 (508)	10.25 (260)	55 (25)
		300 x 150	5.13 (130)	4.88 (124)	1.69 (43)	15 (381)	20 (508)	10.25 (260)	62 (28)
		600 x 150	5.13 (130)	4.88 (124)	1.69 (43)	15 (381)	20 (508)	10.25 (260)	62 (28)
		900 x 300	6.38 (162)	6.75 (171)	2.62 (67)	18.25 (464)	23.25 (591)	13.5 (343)	79 (36)
		1500 x 300	6.38 (162)	6.75 (171)	2.62 (67)	18.25 (464)	23.25 (591)	13.5 (343)	79 (36)
		2500 x 300	6.38 (162)	6.75 (171)	2.62 (67)	18.25 (464)	23.25 (591)	13.5 (343)	79 (36)
2 x 3	G, H, J	150 x 150	5.38 (137)	4.88 (124)	1.81 (46)	15.25 (387)	20.25 (514)	10.5 (267)	55 (25)
		300 x 150	5.38 (137)	4.88 (124)	1.81 (46)	15.25 (387)	20.25 (514)	10.5 (267)	60 (27)
		600 x 150	5.38 (137)	4.88 (124)	1.81 (46)	15.25 (387)	20.25 (514)	10.5 (267)	64 (29)
		900 x 300	6.56 (167)	6.75 (171)	2.44 (62)	19.25 (489)	24.25 (616)	14.5 (368)	93 (42)
		1500 x 300	6.56 (167)	6.75 (171)	2.44 (62)	19.25 (489)	24.25 (616)	14.5 (368)	93 (42)
		1500 x 600	6.56 (167)	6.75 (171)	2.44 (62)	19.25 (489)	24.25 (616)	14.5 (368)	93 (42)
		2500 x 300	7 (178)	6.75 (171)	2.88 (73)	19.25 (489)	24.25 (616)	15 (381)	104 (47)
		2500 x 600	7 (178)	6.75 (171)	2.88 (73)	19.25 (489)	24.25 (616)	15 (381)	104 (47)

NOTES

- Certified dimensions available on request.
- Dimensions A and B are for RF inlet, sensed integrally and remotely.
- Dimensions A and B are for RTJ inlet, sensed remotely.
- Add ½" to dimensions A and B for RTJ inlets 1" to 3" when sensed integrally.
- Add ¾" to dimensions A and B for RTJ inlets 4" to 6" when sensed integrally.
- Add 1" to dimensions A and B for RTJ inlet 8" when sensed integrally.
- Height may vary.
- Weight is approximate for Type 2 Pilot. For Types 4 and 8 Pilots add approx. 11 lbs (5 kg).
- Cap withdrawal 1.6" (40 mm).
- Additional filter 7.7 lbs (3.5 kg).

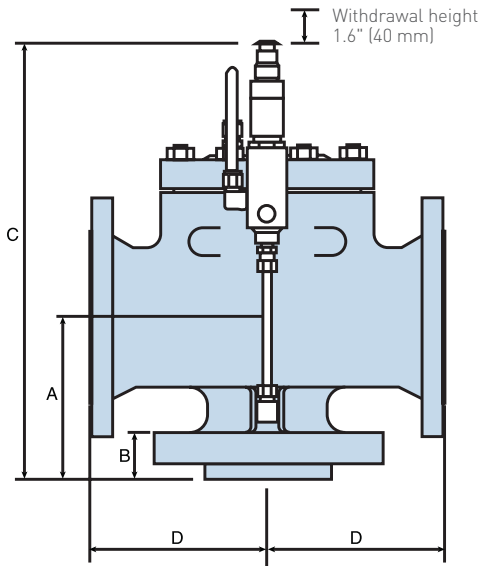
SINGLE OUTLET



DIMENSIONS

			Dimension, in. (mm)						
						C			
Size	Orifice	Rating	A	D	B	Type 2	Type 4 and 8	Remote pilot	Weight lbs (kg)
3 x 4	J, K, L	150 x 150	6.13 (156)	6.38 (162)	2 (51)	17 (432)	22 (559)	12 (305)	137 (62)
		300 x 150	6.13 (156)	6.38 (162)	2 (51)	17 (432)	22 (559)	12 (305)	137 (62)
		600 x 150	6.33 (161)	6.38 (162)	2.25 (57)	17.25 (438)	22.25 (565)	12.25 (311)	154 (70)
		600 x 300	7.5 (191)	7.13 (181)	3 (76)	20.25 (514)	25.25 (641)	15.5 (394)	183 (83)
		900 x 300	7.5 (191)	7.13 (181)	3 (76)	20.25 (514)	25.25 (641)	15.5 (394)	205 (93)
		1500 x 300	7.5 (191)	7.13 (181)	3 (76)	20.25 (514)	25.25 (641)	15.5 (394)	214 (97)
		1500 x 600	7.5 (191)	7.63 (194)	3 (76)	20.25 (514)	25.25 (641)	15.5 (394)	227 (103)
4 x 6	L, M, N, P	150 x 150	7.75 (197)	8.25 (210)	2.31 (59)	20.75 (527)	25.75 (654)	15.5 (394)	225 (102)
		300 x 150	7.75 (197)	8.25 (210)	2.31 (59)	20.75 (527)	25.75 (654)	15.5 (394)	225 (102)
		600 x 150	7.75 (197)	8.25 (210)	2.31 (59)	20.75 (527)	25.75 (654)	15.5 (394)	225 (102)
		600 x 300	9.81 (249)	9.19 (233)	3.38 (86)	25 (635)	30 (762)	19.75 (502)	370 (168)
		900 x 300	9.81 (249)	9.19 (233)	3.38 (86)	25 (635)	30 (762)	19.75 (502)	390 (177)
		1500 x 300	9.81 (249)	9.19 (233)	3.38 (86)	25 (635)	30 (762)	19.75 (502)	401 (182)
		1500 x 600	9.81 (249)	10.38 (264)	3.57 (91)	25.25 (641)	30.25 (768)	20.25 (514)	456 (207)
6 x 8	Q, R	150 x 150	9.44 (240)	9.5 (241)	2.31 (59)	25.5 (648)	30.5 (775)	20.5 (521)	403 (183)
		300 x 150	9.44 (240)	9.5 (241)	2.31 (59)	25.5 (648)	30.5 (775)	20.5 (521)	408 (185)
		600 x 150	9.69 (246)	9.5 (241)	2.75 (70)	25.5 (648)	30.5 (775)	20.75 (527)	419 (190)
		600 x 300	9.69 (246)	10.44 (265)	2.75 (70)	26 (660)	31 (787)	21 (533)	556 (252)
8 x 10	S, T	150 x 150	10.88 (276)	11 (279)	2.69 (68)	29 (737)	34 (864)	24.5 (622)	595 (270)
		300 x 150	10.88 (276)	11 (279)	2.69 (68)	29 (737)	34 (864)	24.5 (622)	661 (300)
		600 x 150	11.69 (296)	11 (279)	3.25 (83)	29.75 (756)	34 (864)	24.25 (616)	728 (330)
		600 x 300	11.69 (296)	12 (305)	3.25 (83)	30.25 (768)	35.25 (895)	25.75 (654)	948 (430)
8 x 10 x10	X	150 x 150	10.88 (276)	11 (279)	1.75 (44)	31.75 (806)	36.75 (933)	31 (787)	959 (435)
		300 x 150	10.88 (276)	11 (279)	1.75 (44)	31.75 (806)	36.75 (933)	31 (787)	959 (435)

DUAL OUTLET



MAXIMUM OPERATING PRESSURES

MAXIMUM OPERATING PRESSURES TO API 526

Size, in. (DN)	Orifice	ANSI flange, psig (bar)		Maximum pressure, psig (bar)	
		Inlet	Outlet	Inlet	Outlet
1 x 2	D, E, F	150 (10.3)	150 (10.3)	285 (19.7)	285 (19.7)
		300 (20.7)	150 (10.3)	740 (51.0)	285 (19.7)
		600 (41.4)	150 (10.3)	1480 (102)	285 (19.7)
		900 (62.1)	300 (20.7)	2220 (153)	740 (51)
		1500 (103)	300 (20.7)	3705 (255)	740 (51)
		2500 (172)	300 (20.7)	6170 (425)	740 (51)
1½ x 2	D, E, F	150 (10.3)	150 (10.3)	285 (19.7)	285 (19.7)
		300 (20.7)	150 (10.3)	740 (51.0)	285 (19.7)
		600 (41.4)	150 (10.3)	1480 (102)	285 (19.7)
		900 (62.1)	300 (20.7)	2220 (153)	740 (51.0)
		1500 (103)	300 (20.7)	3705 (255)	740 (51.)
		2500 (172)	300 (20.7)	6170 (425)	740 (51.0)
1½ x 3	G, H	150 (10.3)	150 (10.3)	285 (19.7)	285 (19.7)
		300 (20.7)	150 (10.3)	740 (51.0)	285 (19.7)
		600 (41.4)	150 (10.3)	1480 (102)	285 (19.7)
		900 (62.1)	300 (20.7)	2220 (153)	740 (51.0)
		1500 (103)	300 (20.7)	3705 (255)	740 (51.0)
		2500 (172)	300 (20.7)	6170 (425)	740 (51.0)
2 x 3	G, H	150 (10.3)	150 (10.3)	285 (19.7)	285 (19.7)
		300 (20.7)	150 (10.3)	740 (51.0)	285 (19.7)
		600 (41.4)	150 (10.3)	1480 (102)	285 (19.7)
		900 (62.1)	300 (20.7)	2220 (153)	740 (51.0)
		1500 (103)	300 (20.7)	3705 (255)	740 (51.0)
		2500 (172)	300 (20.7)	6170 (425)	740 (51.0)
2 x 3	J	150 (10.3)	150 (10.3)	285 (19.7)	285 (19.7)
		300 (20.7)	150 (10.3)	740 (51)	285 (19.7)
		600 (41.4)	150 (10.3)	1480 (102)	285 (19.7)
		900 (62.1)	300 (20.7)	2220 (153)	740 (51.0)
		1500 (103)	300 (20.7)	3650 (251)	740 (51.0)
		2500 (172)	300 (20.7)	3650 (251)	740 (51.0)
3 x 4	J, K	150 (10.3)	150 (10.3)	285 (19.7)	285 (19.7)
		300 (20.7)	150 (10.3)	740 (51.0)	285 (19.7)
		600 (41.4)	150 (10.3)	1480 (102)	285 (19.7)
		900 (62.1)	300 (20.7)	2220 (153)	740 (51.0)
		1500 (103)	300 (20.7)	3705 (255)	740 (51.0)

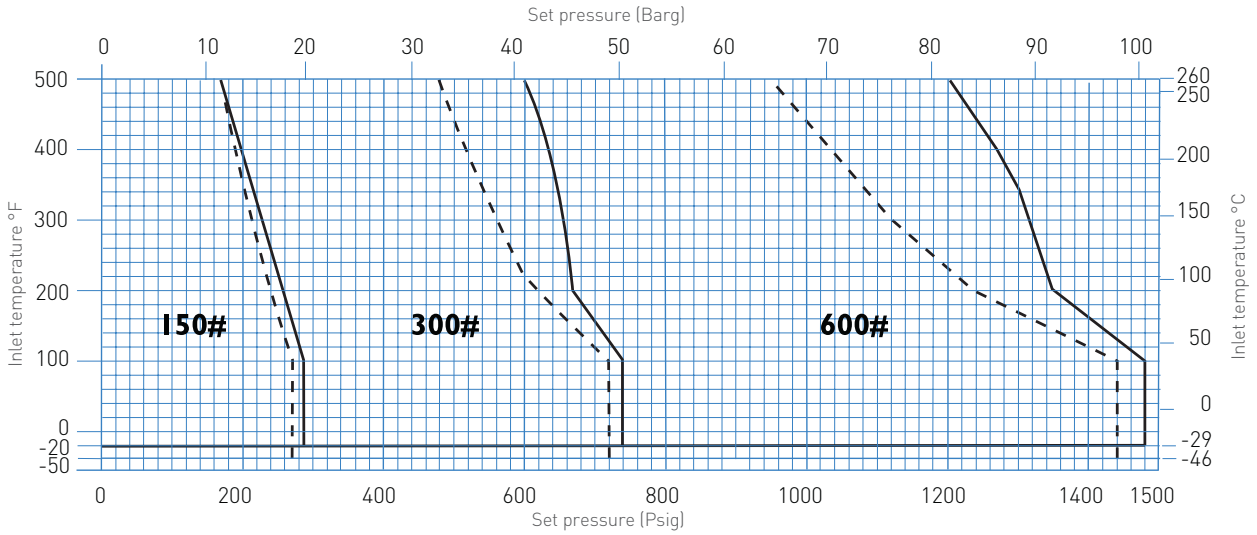
MAXIMUM OPERATING PRESSURES TO API 526

Size (ins)	Orifice	ANSI flange, psig (bar)		Maximum pressure, psig (bar)	
		Inlet	Outlet	Inlet	Outlet
3 x 4	D, E, F	150 (10.3)	150 (10.3)	285 (19.7)	285 (19.7)
		300 (20.7)	150 (10.3)	740 (51)	285 (19.7)
		600 (41.4)	150 (10.3)	1240 (85.5)	285 (19.7)
		600 (41.4)	300 (20.7)	1480 (102)	740 (51)
		900 (62.1)	300 (20.7)	2220 (153)	740 (51)
		1500 (103)	300 (20.7)	2900 (200)	740 (51)
4 x 6	L, M, N	150 (10.3)	150 (10.3)	285 (19.7)	285 (19.7)
		300 (20.7)	150 (10.3)	740 (51)	285 (19.7)
		600 (41.4)	150 (10.3)	1480 (102)	285 (19.7)
		900 (62.1)	300 (20.7)	2220 (153)	740 (51)
		1500 (103)	300 (20.7)	3705 (255.6)	740 (51)
		150 (10.3)	150 (10.3)	285 (19.7)	285 (19.7)
4 x 6	P	300 (20.7)	150 (10.3)	740 (51)	285 (19.7)
		600 (41.4)	150 (10.3)	1305 (90)	285 (19.7)
		600 (41.4)	300 (20.7)	1480 (102)	740 (51)
		900 (62.1)	300 (20.7)	2220 (153)	740 (51)
		1500 (103)	300 (20.7)	3080 (212)	740 (51)
		1500 (103)	600 (41.4)	3705 (255)	1480 (102)
6 x 8	Q	150 (10.3)	150 (10.3)	285 (19.7)	285 (19.7)
		300 (20.7)	150 (10.3)	740 (51)	285 (19.7)
		600 (41.4)	150 (10.3)	1330 (91.7)	285 (19.7)
		600 (41.4)	300 (20.7)	1480 (102)	740 (51)
6 x 8	R	150 (10.3)	150 (10.3)	285 (19.7)	285 (19.7)
		300 (20.7)	150 (10.3)	740 (51)	285 (19.7)
		600 (41.4)	150 (10.3)	915 (63.1)	285 (19.7)
		600 (41.4)	300 (20.7)	1480 (102)	740 (51)
8 x 10	T	150 (10.3)	150 (10.3)	285 (19.7)	285 (19.7)
		300 (20.7)	150 (10.3)	740 (51)	285 (19.7)
		600 (41.4)	150 (10.3)	900 (62.1)	285 (19.7)
		600 (41.4)	300 (20.7)	1480 (102)	740 (51)
8 x 10 x 10	x	150 (10.3)	150 (10.3)	285 (19.7)	285 (19.7)
		300 (20.7)	150 (10.3)	740 (51)	285 (19.7)

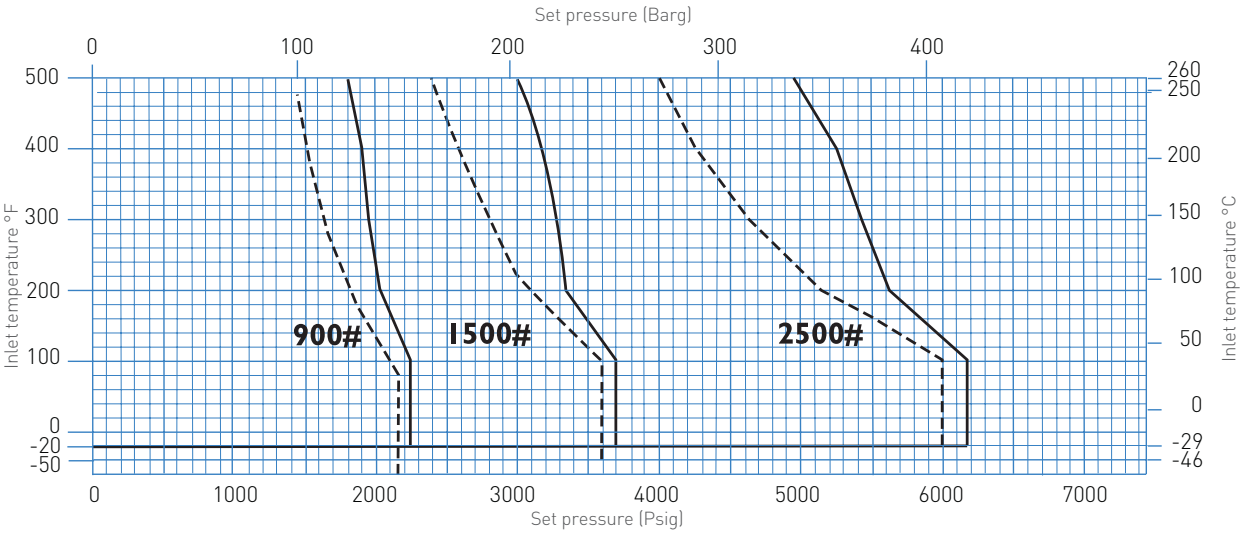
NOTES

- Outlet pressure limits for temperature above 100°F (38°C) to conform to ANSI/ASME B16.34.
- Pressure ratings given are for carbon steel bodies at -20 to 100°F (-29 to 38°C). Austenitic stainless steel and other materials suitable for the service may be used within the code limits for pressure and temperature.
- API Standard 526 specifies lower allowable pressures for service temperatures above and below the ranges given in these charts, for both carbon and stainless steel bodies.

GRAPH 1.0
ANSI Class 150, 300, 600 inlet flange valves



GRAPH 2.0
ANSI Class 900, 1500, 2500 inlet flange valves

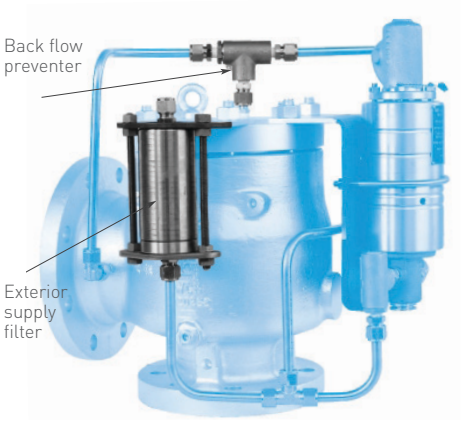


Back flow preventer
High back pressures may exist in the outlet for various reasons such as common disposal systems. If this back pressure can be more than the inlet system operating pressure, the main valve could lift allowing reverse flow from the outlet to inlet system.

A back flow preventer is a two-way check valve which is fitted into the dome line. It allows the highest pressure from either the inlet system or outlet system to enter the dome, ensuring the main valve remains closed and prevents the possibility of reverse flow.

All modulating pilots should be fitted with a back flow preventer and it should always be fitted if a vacuum can exist in the inlet pipework.

When using back flow preventers with back pressure above 50% of the set pressure, the actual service conditions must be reviewed by the factory.



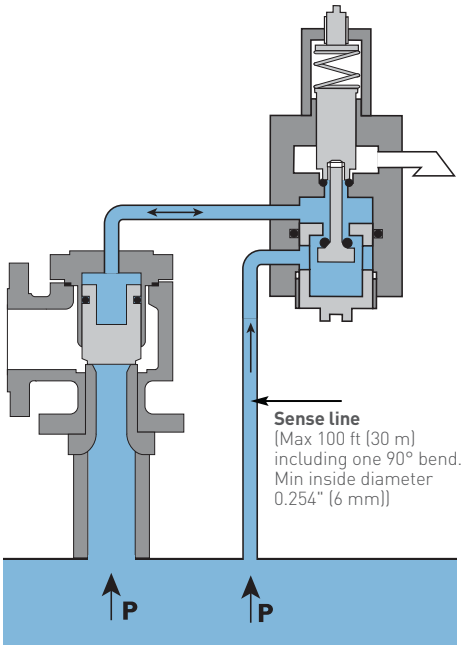
External supply filter
This unit protects the pilot valve when working under 'dirty' flow stream conditions. All Safeset pilots are fitted with integral filters as standard. However, a supply filter should be used under conditions where there are liable to be large amounts of particulate matter in the flow stream. This unit is fitted into the pilot sensing pipe, upstream of the pilot, and is suitable for gas and liquid duty. It is removed easily for maintenance.

Remote pressure sensing
Many codes and standards restrict the inlet pipework pressure loss to 3% of the safety valve set pressure. When the pipework loss is greater than this, the valve should always be connected for remote sensing. The valve is normally supplied with integral sensing, whereby the pilot senses pressure at the main valve nozzle entry. Under flowing conditions, when there is excessive system pressure loss, the valve may cycle open and closed due to the pilot sensing a reduced (artificial) pressure.

Sensing the valve remotely will overcome this problem. In this case the pilot should have its inlet connected directly to the pressure source where the system pressure is stable and not flowing. The main valve nozzle will not contain a sensing tapping.

Excessive system pressure losses will also reduce the flow rate through the valve. This will be in proportion to the absolute system pressure and must be taken into account when sizing the valve.

Remote sensing will ensure that the valve operates without cycling or chatter when high inlet pressure losses are encountered.



Remote pressure sensing

Heating or cooling coils
High or low temperature duties may require the addition of coils to act as heat exchangers to either warm or cool the medium before it enters the pilot valve or main valve dome, ensuring that extremes of temperature do not affect the valve's operation.

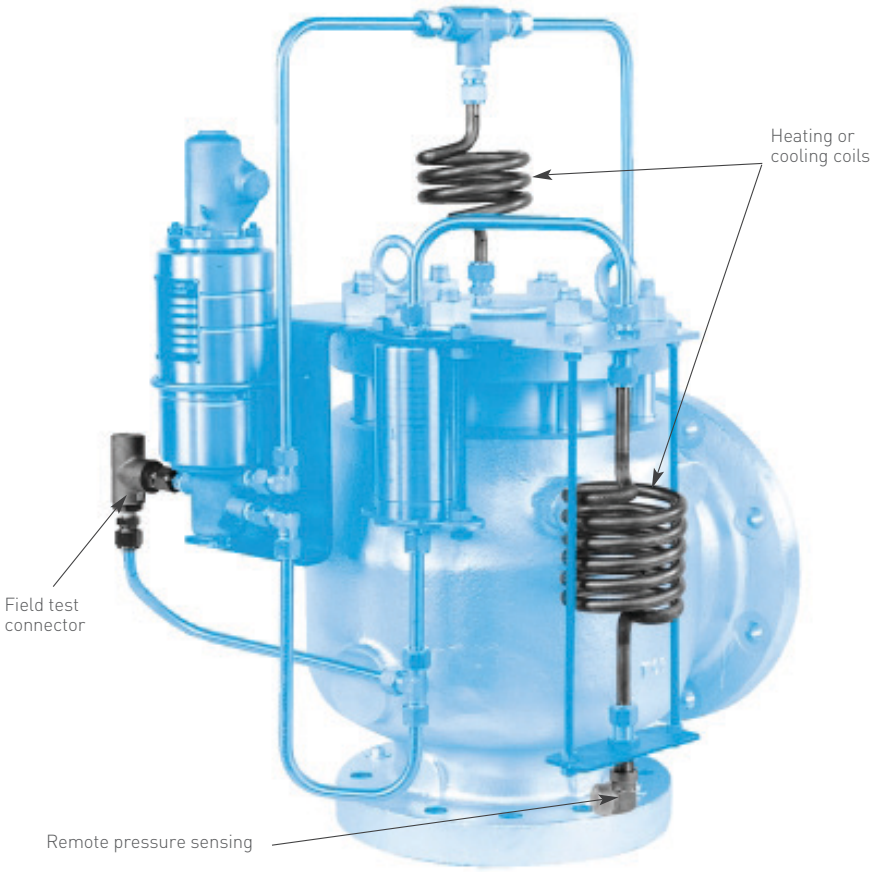
The use of such coils allows standard pilots to be used on valves with inlet temperatures ranging from -320 to 500°F (-196 to 260°C).

Field test connector
This provides verification of set pressure setting during normal system operation. It is a two way check valve which is fitted into the sensing pipe and is an integral part of the pilot operated valve system. If this facility is required, it must be specified on the valve order.

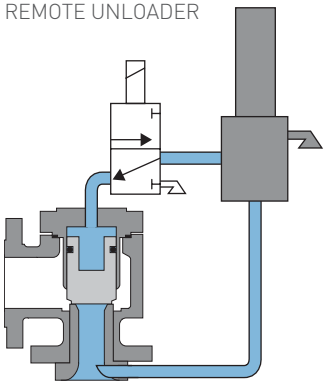
An external pressure supply needs to be connected to the check valve via an isolating valve and pressure gauge. The external pressure should be admitted slowly through the supply isolating valve. When the supply pressure is greater than the system pressure, the check valve delivery seat will open and the system seat will close.

Pressure can now be applied to the pilot and dome. The pilot will open when set pressure is reached. Pop action pilots will 'pop' open; this is the main valve set pressure and the main valve may open briefly.

Modulating pilots will start to vent from their drain seat; this will occur at approximately 2% below the main valve set pressure, details of which can be obtained by referring to the nameplate.



REMOTE UNLOADER

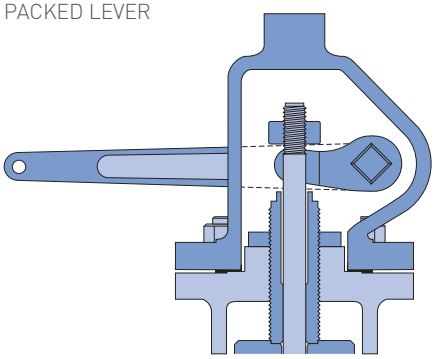


Remote unloader
This device is a three way spool valve which can be operated electronically or pneumatically to enable the main valve to be opened remotely.

The valve is mounted into the dome line and allows a free flow from the pilot into the dome. When remote operation is required, an electrical or pneumatic signal opens the exhaust vent of the spool valve and vents the dome, allowing the main valve to open.

It will normally be supplied mounted onto the main valve with the dome connected directly to the pilot. When the spool valve is energized, the dome will vent directly to atmosphere.

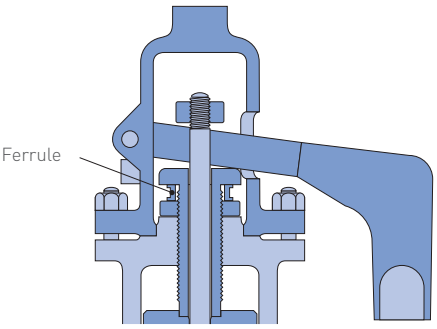
PACKED LEVER



Packed lever
The design of the packed lever assembly ensures that leakage does not occur when the valve is open or when back pressure is present.

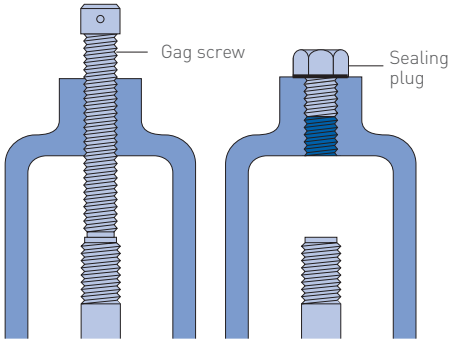
A lift lever can be used to test for correct valve operation where corrosion or deposits could prevent the valve from opening. It can be used to release foreign particles trapped on the seat and must be fitted when codes dictate.

FERRULE



Ferrule (government ring)
A ferrule, or government ring, is a collar fitted beneath the head of the pressure adjusting screw. Some authorities will require a ferrule to be fitted to prevent unauthorized interference with the set pressure.

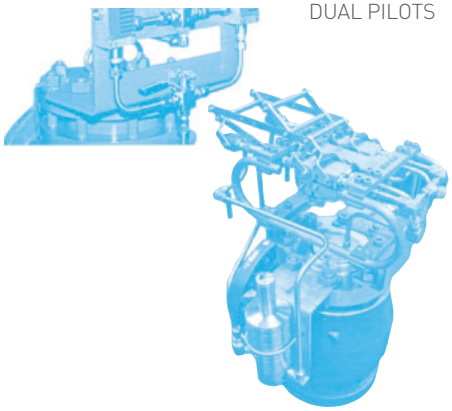
TEST GAG



Test gag (max. pressure 1480 psig (102 barg))
The test gag is used to prevent the safety valve from lifting and is used mainly when carrying out a hydrostatic test on the system, during commissioning.

After testing, the test gag must be removed and replaced with the sealing plug.

DUAL PILOTS



Dual pilots
Traditionally, when a valve required maintenance the plant had to be shut down, resulting in reduced earning time. A solution to this is to install a second pilot on to the main valve with a simple

Available options
- Dual pilot assemblies.
- Dual pilot interlock system.
- Heated or unheated control cabinets.
- Dual outlet/full bore design.
- Differential pressure switch.

SELECTION GUIDE

Example:	4	L	6	4	2	2	1	2	2	1	A

Inlet diameter

1	1"	**4**	4"
1.5	1½"	**6**	6"
2	2"	**8**	8"
3	3"		

Orifice designation

D to T	
X	8" x 10" x 10" full bore

Outlet diameter

2	2"	**6**	6"
3	3"	**8**	8"
4	4"	**10**	10"

Pilot description

2	Pop action, gas
4	Modulating, LP
8	Modulating, HP

ANSI flange rating

1	150 x 150	**7**	1500 x 300	**B**	1500 x 600
2	300 x 150	**8**	2500 x 300	**C**	2500 x 600
3	600 x 150	**A**	600 x 300	**0**	Special
5	900 x 300				

Flange type

1	ANSI RF x RF
2	ANSI RTJ x RF
0	Special

Main valve body

1	Carbon steel SA 216-WCB	**4**	SST SA 351-CF8M
2	Carbon steel SA 216-WCB (NACE)	**0**	Special
3	SST SA 351-CF8M (NACE)		

Main valve spring material

2	SST 316
Z	Inconel® X750 (NACE)
0	Special

Main valve trim

1	SST 316 and PEEK	**8**	SST 316 and Polyurethane
2	SST 316 and Fluorocarbon (FKM)	**9**	SST 316 and PTFE
4	SST 316 and Nitrile (NBR)	**0**	Special

Pressure range, psig (barg)

1	Type 2: 29 to 6170 (2.0 to 425.5)	**2**	Type 4: >100 to 1480 (>6.8 to 102)
	Type 4: 29 to 100 (2.0 to 6.8)		These are min/max pressures of the pilot. Several springs are required to cover these ranges
	Type 8: 1480 to 6170 (102 to 425.5)		

Accessories

A	Remote pressure sensing	**E**	External filter	**T**	Field test connector
B	Back flow preventer	**G**	Test gag[2]	**U**	Remote unloader
C	Cooling/heating coils	**L**	Liquid duty[1]	**S**	Special
D	Screwed cap	**P**	Packed lever		

1. Dual phase duties should use the liquid trim versions of the modulating pilot Types 4 and 8.
2. Test gag available to a max pressure of 1480 psig.