Valve Concepts, Inc.
ISO Registered Company

TECHNICAL BULLETIN

1049 - TB
3-16

Model 1049

Secure-Gard® Pilot Operated Vent Valve (POVV)

The Model 1049 is a pilot operated vent valve specifically designed for low-pressure storage tanks and piping systems. Designed to meet the requirements of API 2000.

2" Model 1049

BENEFITS

- Set pressure unaffected by backpressure
- Full Lift at only 10% overpressure
- Bubble tight to set pressure
- Inexpensive replacement parts
- Simpler design lowers maintenance costs
- Maximum relieving capacity for valve size
- Designed for easy maintenance

TYPICAL APPLICATIONS

- Normal venting of low pressure storage tanks and overpressure protection of piping systems.

FEATURES

- Pilot operated
- Fail-open design
- Uses standard o-rings
- Full-bore design
- Optional Air or N_2 assist pilot for low settings

GENERAL SPECIFICATIONS

Body Sizes

Inlet x Outlet

2" x 3"	(DN50) x (DN80)
3" x 4"	(DN80) x (DN100)
4" x 6"	(DN100) x (DN150)
6" x 8"	(DN150) x (DN200)
8" x 10"	(DN200) x (DN250)
10" x 12"	(DN250) x (DN300)
12" x 16"	(DN300) x (DN400)

End Connections

ANSI 150# RF flanges (DIN Flanged PN16)

Material of Construction

Body Material:
- CS
- 316 SST

Pilot Diaphragm Case, Spring Bonnet and Cap:
- CS
- 316 SST

Trim Material:
- 316 SST

Diaphragm Material:
- Actuator Diaphragm
  - Buna-N (Nitrile-NBR)
  - EPDM (Ethylenepropylene)
  - FKM (Fluorocarbon Elastomer)
  - Teflon®
- Pilot Sense Diaphragm
  - Teflon®

Soft Seats and Seal:
- Buna-N (Nitrile-NBR)
- EPDM (Ethylenepropylene)
- FKM (Fluorocarbon Elastomer
- FFKM 1 - Similar to Chemraz
- FFKM 2 - Similar to Kalrez

Set Point Pressure Ranges

6 range springs
4.0" WC to 14.0 psig

Settings below 4.0" WC external Air or N_2 assist pilot required.

Temperature Limits

FKM (Fluorocarbon Elastomer):
0° F to 212° F (-17° C to 100° C)
Buna-N (Nitrile-NBR):
-40° F to 180° F (-40° C to 82° C)
EPDM (Ethylenepropylene):
-50° F to 212° F (-45° C to 100° C)
Teflon®:
-40° F to 180° F (-40° C to 82° C)
FFKM 1 (Perfluoroelastomer):
-22° F to 400° F (-30° C to 204° C)
FFKM 2 (Perfluoroelastomer):
-40° F to 400° F (-40° C to 204° C)

Maximum Back Pressure

See sizing section on page 8.

Capacities

See Table 6 and 6A or equations (1).

Painting: Standard: Exterior coating will be a combination of Cashco Paint Specs #S-1777 epoxy and #S-1743 powder coated. Fasteners, seat surfaces and corrosion resistant parts excluded.

TABLE 1					
POVV STANDARD MATERIAL					
ITEM	STANDARD VALVE	STAINLESS VALVE	ITEM	STANDARD VALVE	STAINLESS VALVE
Main Body	CS	316 SST	Pilot Breather Vent	Plastic	SST
Pilot Body	SST	316 SST	Tube Fittings	CS	316 SST
Pilot Diaphragm Case	CS	316 SST	Tubing	SST	316 SST
Pilot Sense Diaphragm	Telflon®	Telflon®	Actuator Case	CS	316 SST
Spring Bonnet & Cap	CS	316 SST	Actuator Diaphragm	Buna-N[1]	Buna-N[1]
Valve Trim	SST	316 SST	Seat & Seals (o-rings)	Buna-N[1]	Buna-N[1]
Set Pressure Spring	SST	316 SST	Nuts & Bolts	SST	316 SST
1. See Table 3.					

TABLE 2	
SET PRESSURE RANGES	
SET PRESSURE RANGES FOR ALL SIZE VALVES	SPRING COLOR
4.0” to 12.0” WC (9.9 – 29.9 mbar)	Yellow
12.1” to 18.0” WC (30.0 – 44.8 mbar)	White
18.1” to 36.0” WC (44.9 – 89.4 mbar)	Black
36.1 to 41.7" WC (89.5– 103.5 mbar)	Red
41.8 to 86.0" WC (103.6 – 214 mbar)	Red
3.2 to 14.0 psig (0.22 – 0.97 bar)	Red
Settings below 4.0” WC require Air or N_2 assist pilot.	

TABLE 3	
ACTUATOR DIAPHRAGMS	SEATS
Buna-N EPDM FKM PTFE	Buna-N FFKM 1, FFKM 2 EPDM FKM

TABLE 4							
POVV ORIFICE AREA							
Valve Size	2” x 3”	3” x 4”	4” x 6”	6” x 8”	8” x 10”	10” x 12”	12” x 16”
Orifice (in^2)	3.354	7.389	12.724	28.890	50.240	80.400	125.00

ADVANTAGES OF POVV vs. WEIGHT LOADED PRESSURE VENT

Discharge Header Backpressure Consideration

A weight loaded pressure vent set pressure varies with back pressure. The positive back pressure acting on the weight-loaded vent would have to be compensated for by increasing internal tank pressure by the exact amount of the positive back pressure. This increase in the internal tank pressure to overcome the back pressure acting on the vent may result in exceeding the tank design pressure.

If the header pressure is variable or not thoroughly identified to an exact amount, then the proper selection of the weight loaded vent set point is difficult to determine.

A POVV's set point is unaffected by static or variable back pressure.

Leakage Criteria

API 2521 set guidelines as to what is acceptable when it comes to weight loaded vent leakage. It states, "The condition of PV vents is considered satisfactory for all practical purposes, if the rate of leakage.... does not exceed ½ SCFH for vents 6 in. size or smaller, or 5 SCFH for vents 8 in. size or larger." It further states, that the leakage should be determined at a test pressure of three-quarters (75%) of the set opening pressure (or vacuum). Some weight loaded vent manufactures improve upon this requirement. For example, several companies state their weight-loaded vents will have a leakage rate of 1 SCFH or less at 90% of set pressure.

API 2000 states the weight loaded vent "is tightest when tank pressures are 75 percent or less of the set point". Therefore, the weight loaded vent normal operating pressure is typically 25% or greater below the set pressure of the unit to minimize the leakage that occurs as set pressure is approached.

POVVs, on the other hand are bubble tight (no leakage) up to set pressure. This would be advantageous in:

a. Reducing environmental emissions and product losses, when operating closer to set point.

b. Reducing product losses while venting to a header system.

Capacity Capabilities

According to API 2000 a direct acting weight loaded vents typically require "70% to 100% overpressure to achieve full lift of a pallet". "For an application in which full lift of the seat pallet is required for capacity reasons but cannot be obtained because of a pressure limit on the storage tank, a larger vent or multiple vents must be used at reduced lift and capacity."

POVVs are at full lift by only 10% overpressure. For sizing applications with 10% to 25% allowable overpressure, a one or two-pipe size smaller POVV could be used (e.g. 2" x 3" in lieu of 4" x 6"). This would have a major advantage by reducing outlet-piping cost on those relief systems discharging into a header.

VALVE OPERATION

Closed Position

Figure B-1 shows the pilot operated vent valve in the closed position. Whenever the pressure sensed in the sense chamber is insufficient to overcome the downward force of the set pressure spring, the pilot will remain closed. This will cause the tank pressure to be applied to the top side of the actuator diaphragm. Since the downward effective area of the actuator diaphragm is larger than the area of the main valve seat, the resulting force is downward and the main valve will remain closed.

Open Position

Figure B-2 shows the pilot operated vent valve in the open position. Whenever the pressure sensed in the sense chamber is sufficient to overcome the downward force of the set pressure spring, the pilot will open. With the pilot open and a restriction at the pilot inlet, the pressure in the actuator pressure chamber will be able to flow out through the pilot exhaust faster than the tank pressure can enter the pilot, thus dropping the pressure in the actuator pressure chamber. The full tank pressure pushing upwards on the main valve seat plate will overcome the reduced actuator force and lift the main valve seat plate open, thus relieving excess tank pressure. When the tank pressure falls below the set pressure the pilot will close and full tank pressure is again applied to the top side of the actuator diaphragm to close the main valve.

Special Design for Set Points Below 4" WC

The principle of operation of this valve is similar to that of the standard pilot operated vent valve. For these low settings, the actuator has an added spring under the diaphragm to push the actuator diaphragm up. An external nitrogen pressure of approximately 5 psig is therefore required to move the actuator diaphragm down.

As long as the tank pressure is below set point, the pilot is closed and the pressure chamber is fully pressurized. The valve main set is pressed closed.

When the tank pressure rises above set point, the pilot opens allowing the actuator pressure to escape through the pilot exhaust. The flow out of the pressure chamber through the pilot will be faster than the flow in through the orifice. The pressure chamber will lose pressure and the spring will open the main valve seat.

NOTE: This is a non-flowing pilot which makes it ideal for wet or solidifying processes. In such applications a purge of the sense connection is recommenced. The pilot comes complete with filter regulator and relief valve to prevent over pressure.

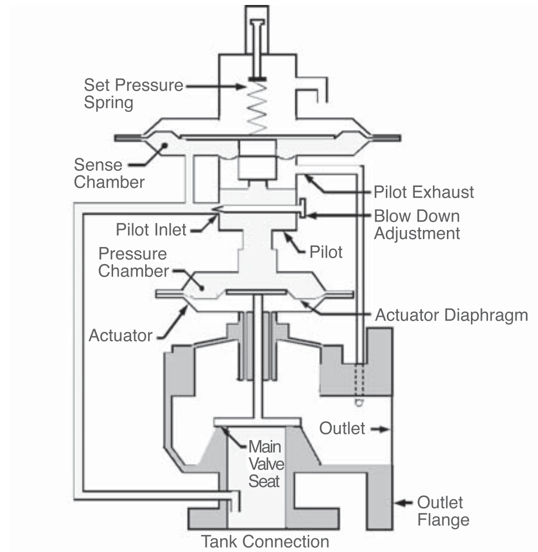


Figure B-1 - Closed Position

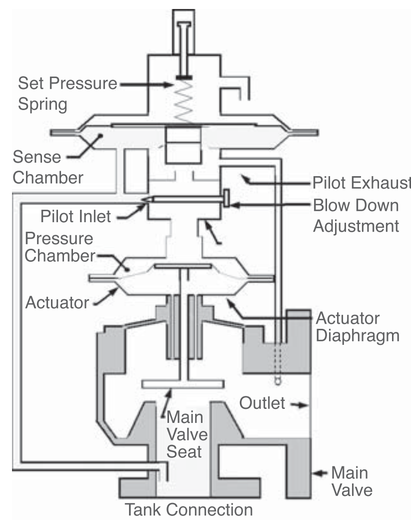


Figure B-2 - Open Position

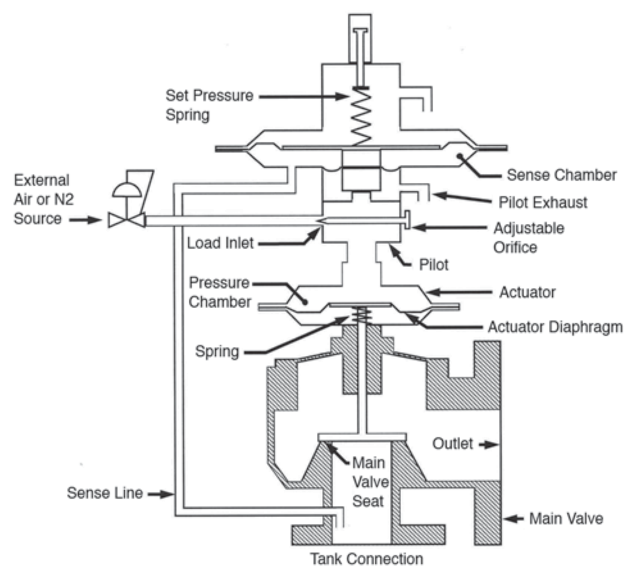


Figure B-3 - Special Design

POVV RELIEVING CAPACITY REQUIREMENTS – STORAGE TANKS

The normal pressure venting requirements for an atmospheric or low-pressure storage tank is made up of three components. The first is outbreathing due to liquid or product movement into the tank. The second is outbreathing due to thermal expansion of the vapors and the vaporization of the product in the tank due to weather changes. The third is outbreathing due to any event such as equipment failures or operator errors that could result in the over pressuring of the tank. The sum of these three components will give the total normal outbreathing requirements.

The first component, outbreathing venting requirements for maximum product movement into the tank for products with a flash point below 100° F is as follows:

$Q_{displacement}$ (SCFH)=Pump In Rate (gpm) x 17.2

The outbreathing venting requirements for maximum product movement into the tank for products with a flash point equal to or greater than 100° F is as follows:

$Q_{displacement}$ (SCFH)=Pump In Rate (gpm) x 8.57

The second component outbreathing due to weather changes is selected from Table 5 or 5A. The tank capacity is found in column labeled "Tank Capacity" and the corresponding outbreathing requirement **($Q_{thermal}$)** is selected from the appropriate column for product flash point below 100° F or product flash point equal to or greater than 100° F.

The third component outbreathing venting requirement for equipment failures or operator errors is beyond the scope of this bulletin but must be considered when calculating the total outbreathing requirements.

Total Outbreathing Requirement:

As a minimum requirement the first two components must be considered:

Q_{total} (SCFH of Air)= $Q_{displacement}$ + $Q_{thermal}$

POVV Selection

The selection of the correct POVV size is not only based on the venting requirement but also on the valve-piping configuration.

Case 1: The main valve and pilot exhaust discharges to the atmosphere. In this case the valve will be able to flow its full rated capacity. The valve would be selected from Table 6 based on set point and required flow.

Case 2: The main valve discharges into a header, and the pilot exhaust discharges to the atmosphere. In this case the valve capacity would need to be calculated using equation (1). The calculated capacity will need to meet or exceed to the total venting requirement.

Case3: The main valve and pilot exhaust discharge into a header. Again the valve capacity would need to be calculated using equation (1). The calculated capacity will need to meet or exceed the total venting requirement. It should be noted, in order for the valve to flow the calculated capacity, the header pressure should not exceed 60% of the set pressure of the valve.

THERMAL VENTING CAPACITY TABLES

TABLE 5							
REQUIREMENTS FOR THERMAL VENTING CAPACITY - ENGLISH UNITS							
TANK CAPACITY		FLASH POINT ≥ 100° F	FLASH POINT < 100° F	TANK CAPACITY		FLASH POINT ≥ 100° F	FLASH POINT < 100° F
Barrels	Gallons	SCFH Air	SCFH Air	Barrels	Gallons	SCFH Air	SCFH Air
60	2,500	40	60	35,000	1,470,000	19,000	31,000
100	4,200	60	100	40,000	1,680,000	21,000	34,000
500	21,000	300	500	45,000	1,890,000	23,000	37,000
1,000	42,000	600	1,000	50,000	2,100,000	24,000	40,000
2,000	84,000	1,200	2,000	60,000	2,520,000	27,000	44,000
3,000	126,000	1,800	3,000	70,000	2,940,000	29,000	48,000
4,000	168,000	2,400	4,000	80,000	3,360,000	31,000	52,000
5,000	210,000	3,000	5,000	90,000	3,780,000	34,000	56,000
10,000	420,000	6,000	10,000	100,000	4,200,000	36,000	60,000
15,000	630,000	9,000	15,000	120,000	5,040,000	41,000	68,000
20,000	840,000	12,000	20,000	140,000	5,880,000	45,000	75,000
25,000	1,050,000	15,000	24,000	160,000	6,720,000	50,000	82,000
30,000	1,260,000	17,000	28,000	180,000	7,560,000	54,000	90,000
NOTE: Table and Sizing Information is from API 2000 Seventh Edition, annex A, March 2014.							

TABLE 5A					
REQUIREMENTS FOR THERMAL VENTING CAPACITY – METRIC UNITS					
TANK CAPACITY	FLASH POINT ≥ 37.8° C	FLASH POINT < 37.8° C	TANK CAPACITY	FLASH POINT ≥ 37.8° C	FLASH POINT < 37.8° C
Cubic Meters	Nm^3/h	Nm^3/h	Cubic Meters	Nm^3/h	Nm^3/h
10	1.01	1.69	5,000	472	787
20	2.02	3.37	6,000	537	896
100	10.1	16.9	7,000	602	1,003
200	20.2	33.7	8,000	646	1,077
300	30.3	50.6	9,000	682	1,136
500	50.6	84.3	10,000	726	1,210
700	70.8	118	12,000	807	1,345
1,500	101	169	14,000	888	1,480
1,000	152	253	16,000	969	1,615
2,000	202	337	18,000	1,047	1,745
3,000	303	506	20,000	1,126	1,877
3,180	322	536	25,000	1,307	2,179
4,000	388	647	30,000	1,497	2,495
NOTE: Table and Sizing Information is from API 2000 Seventh Edition, annex A, March 2014.					

POVV CAPACITY CALCULATION

$$V = \frac{4645 * A * K_d * P_1 * F}{\sqrt{M * T * Z}}$$ Equation (1)

Valve Size	2x3	3x4	4x6	6x8	8 x 10	10 x 12	12 x 16
Orifice (in^2)	3.354	7.389	12.724	28.890	50.240	80.400	125.000

$$K_d = x\left(\frac{P_2}{P_1}\right)^y$$

Size	X	Y
2" x 3" (DN50) x (DN80)	0.7430	-0.1290
3" x 4" (DN80) x (DN100)	0.6360	-0.3059
4" x 6" (DN100) x (DN150)	0.7394	-0.1277
6" x 8" (DN150) x (DN200)	0.6742	-0.2412
8" x 10" (DN200) x (DN250)	0.5968	-0.4839
10" x 12" (DN250) x (DN300)	0.5741	-0.2680
12" x 16" (DN300) x (DN400)	0.5430	-0.2641

$$F = \sqrt{\frac{k}{k-1}\left[\left(\frac{P_2}{P_1}\right)^{\frac{2}{k}} - \left(\frac{P_2}{P_1}\right)^{\frac{k+1}{k}}\right]}$$

A = orifice area (in^2)

k = ratio of specific heat of test medium (for air k = 1.41)

M = molecular weight of flowing gas or vapor (for air M = 28.9644)

P_1 = flowing inlet pressure in psia (set pressure+overpressure+14.696)

P_2 = outlet (or header) pressure during valve discharge in psia (see note below)

T = flowing temperature in degrees Rankin ($^\circ$R = $^\circ$F+459.67°)

V = required capacity in scfm at standard conditions

Z = compressibility factor of the flowing gas. Use Z = 1 if unknown

F = factor based on ratio of specific heats and pressure drop across valve nozzle

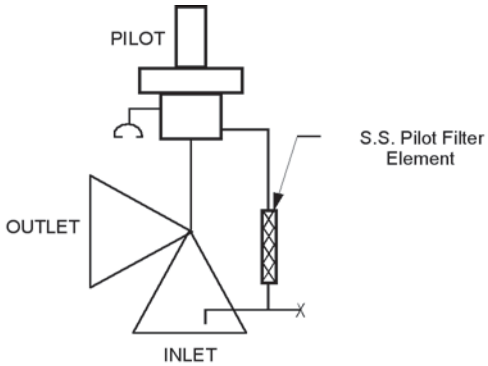
NOTE: Header Back Pressure should not exceed 60% of 1049 set point in order for the valve to flow per the above sizing equation.

Example = If setpoint of 1049 is 14 psig (0.97 Barg), then the maximum back pressure the unit should see is 8.4 psig (0.58 Barg) in order to be able to flow per equation (1).

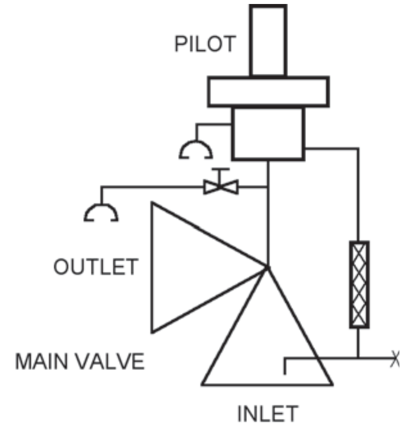
TABLE 6 - ENGLISH UNITS							
POVV CAPACITIES - SCFM AIR AT 10% OVERPRESSURE							
Pressure Setting	Valve Size						
	2” x 3”	3” x 4”	4” x 6”	6” x 8”	8” x 10”	10” x 12”	12” x 16”
4" wc	144	273	545	1129	1743	2676	3936
6" wc	177	334	667	1384	2139	3282	4826
8" wc	204	387	771	1600	2476	3795	5580
10" wc	228	433	863	1791	2775	4248	6246
0.5 psig	269	511	1016	2113	3281	5012	7368
15"wc	280	532	1058	2200	3419	5218	7672
20" wc	324	617	1223	2547	3971	6044	8886
25" wc	363	692	1369	2855	4465	6777	9964
psig							
1	382	730	1442	3010	4715	7146	10506
2	544	1051	2052	4316	6872	10266	15087
3	670	1309	2527	5354	8657	12756	18743
4	777	1535	2933	6256	10262	14929	21931
5	873	1742	3295	7072	11760	16903	24826
6	961	1935	3625	7828	13186	18737	27513
7	1042	2117	3932	8539	14559	20465	30044
8	1118	2291	4219	9213	15893	22109	32452
9	1190	2459	4491	9857	17194	23684	34758
10	1259	2621	4750	10477	18470	25202	36979
11	1325	2778	4997	11075	19724	26671	39128
12	1388	2931	5234	11654	20959	28096	41212
13	1448	3080	5463	12217	22178	29483	43240
14	1507	3226	5684	12764	23383	30836	45217

TABLE 6A - METRIC UNITS							
POVV CAPACITIES - Nm^3/h AIR AT 10% OVERPRESSURE							
Pressure Setting (mbarg)	Valve Size						
	DN50 x DN80	DN80 x DN100	DN100 x DN150	DN150 x DN200	DN200 x DN250	DN250 x DN300	DN300 x DN400
10	236	445	889	1843	2845	4369	6425
15	289	546	1090	2260	3493	5358	7879
20	333	631	1259	2613	4043	6195	9109
25	373	707	1408	2924	4531	6935	10196
40	473	898	1784	3711	5772	8804	12944
50	529	1007	1996	4158	6483	9867	14507
60	580	1106	2189	4564	7135	10835	15929
70	627	1198	2367	4940	7742	11731	17245
100	751	1443	2836	5941	9378	14119	20753
150	924	1790	3489	7348	11733	17484	25695
200	1072	2093	4045	8564	13826	20401	29977
300	1323	2622	4991	10669	17587	25475	37420
400	1537	3090	5801	12512	21023	29939	43964
500	1729	3521	6524	14189	24266	34017	49938
600	1904	3925	7185	15747	27378	37821	55508
700	2067	4308	7798	17214	30396	41417	60770
800	2220	4675	8373	18610	33341	44846	65786
900	2364	5029	8917	19945	36227	48138	70599

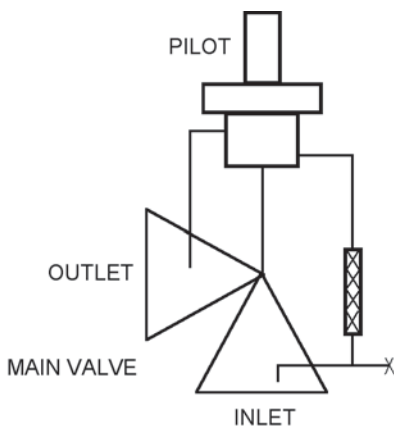
STANDARD ACCESSORIES & CONFIGURATIONS



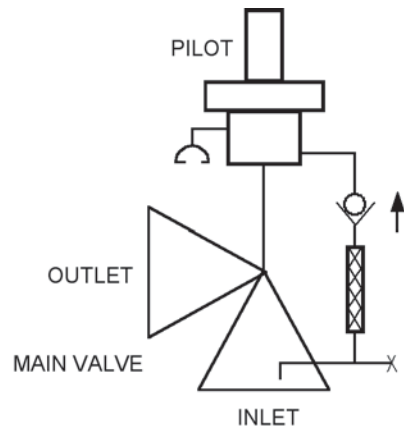
Standard Configuration
Internal Sensing, SS Pilot Filter Element and Pilot Exhaust to Atmosphere



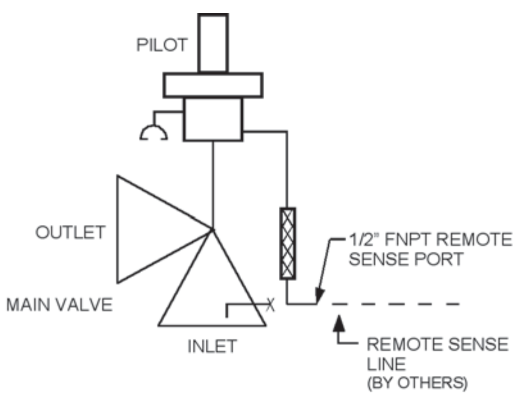
Option 3
With Manual Blowdown Valve



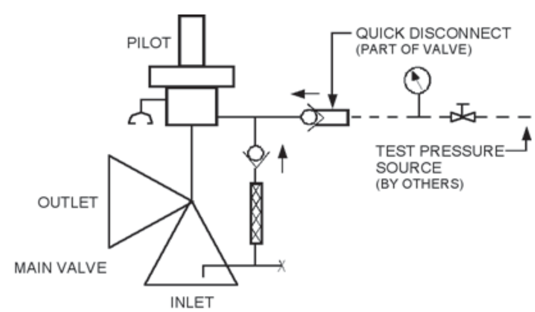
Option 1
With Pilot Exhaust Tubed to Main Valve Outlet



Option 4
With Back Flow Preventer to Prevent Back Flow through Main Valve and Pilot

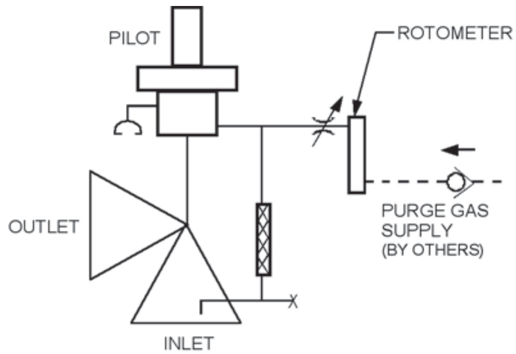


Option 2
With Remote Sensing

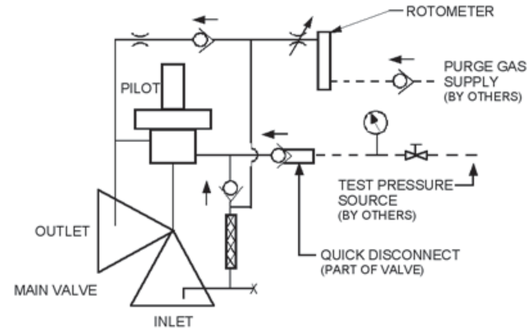


Option 5
With Field Test Connection
(Back Flow Preventer Included)

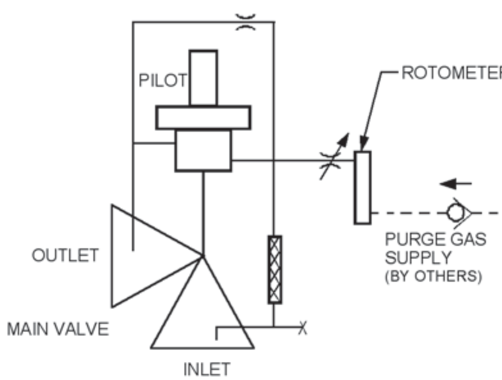
STANDARD ACCESSORIES & CONFIGURATIONS



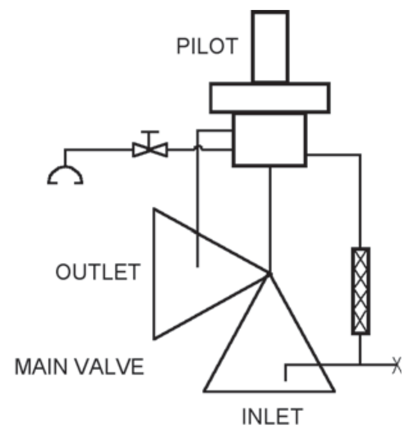
Option 6
With Rotometer to Purge Pilot Sense



Option 8
With Field Test Connection, Back Flow Preventer and Rotometer to Purge Pilot Sense and Discharge Lines



Option 7
With Rotometer to Purge Pilot Sense and Discharge Lines



Option A
Internal Sensing, SS Pilot Filter Element, Pilot Exhaust to Main Valve Outlet with Manual Blowdown Valve

DIMENSIONS AND WEIGHTS

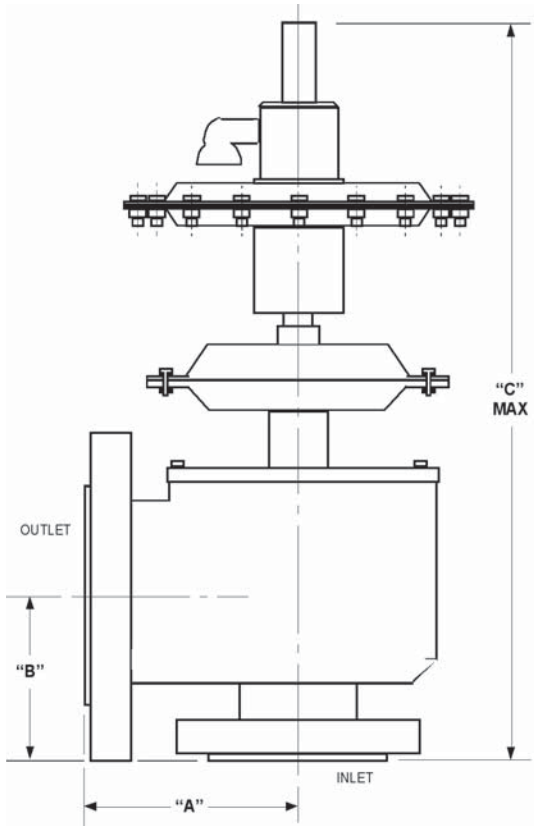


TABLE 7
DIMENSIONS AND WEIGHTS

ENGLISH UNITS (In)

FLANGE STANDARD	VALVE SIZE - in INLET	VALVE SIZE - in OUTLET	A	B	C	APPROX. WEIGHT (lb)
ASME	2	3	5.00	3.75	22.00	50
DIN	2	3	6.50	5.25	22.00	50
ASME	3	4	5.75	4.50	24.00	68
DIN	3	4	7.38	5.94	24.00	68
ASME or DIN	4	6	7.00	5.50	26.00	100
	6	8	9.25	6.69	33.00	170
	8	10	11.00	8.00	35.00	270
	10	12	16.00	10.94	41.00	450
	12	16	18.50	12.57	44.00	700

METRIC UNITS (mm)

FLANGE STANDARD	VALVE SIZE - (DN) INLET	VALVE SIZE - (DN) OUTLET	A	B	C	APPROX. WEIGHT (kg)
ASME	(50)	(80)	127	95	559	23
DIN	(50)	(80)	165.1	133.3	559	23
ASME	(80)	(100)	146	114	610	31
DIN	(80)	(100)	187.5	150.9	610	31
ASME or DIN	(100)	(150)	178	140	660	46
	(150)	(200)	235	170	838	68
	(200)	(250)	279	203	889	123
	(250)	(300)	406	278	1041	205
	(300)	(400)	470	319	1118	320

NOTES

PRODUCT CODE 3/31/16

MODEL 1049 PILOT OPERATED VENT VALVE

PV	Table 1	Table 2	Table 3	Table 4	Table 5	Table 6	A

TABLE 1 - BODY MATERIALS

Body Material	CODE
Carbon Steel	C
Stainless Steel	S

TABLE 2 - SIZE

Inlet/Outlet	CODE
2" Inlet x 3" Outlet	1
3" Inlet x 4" Outlet	2
4" Inlet x 6" Outlet	3
6" Inlet x 8" Outlet	4
8" Inlet x 10" Outlet	5
10" Inlet x 12" Outlet	6
12" Inlet x 16" Outlet	7

TABLE 3 - PILOT & MAIN VALVE SEAT MAT'L.

Pilot & Main Valve Seat Materials	CODE
Buna-N	B
FFKM 1	C
EPDM	E
FFKM 2	K
FKM	V

TABLE 4 - OPTIONS

Sensing Configuration & Accessory Options SST Pilot Filter		CODE
Standard:	Internal Sensing, Pilot Exhaust to Atmosphere	X
Option 1:	Internal Sensing, Pilot Exhaust Tubed to Main Valve Outlet	1
Option 2:	Remote Sensing, Pilot Exhaust to Atmosphere	2
Option 3:	Internal Sensing, Pilot Exhaust to Atmosphere with Manual Blowdown Valve	3
Option 4:	Internal Sensing, Pilot Exhaust to Atmosphere with Backflow Preventer	4
Option 5:	Internal Sensing, Pilot Exhaust to Atmosphere with Backflow Preventer & Field Test Connection	5
Option 6:	Internal Sensing, Pilot Exhaust to Atmosphere with Rotometer to Purge Pilot Sense & Discharge Line	6
Option 7:	Internal Sensing, Pilot Exhaust Tubed to Main Valve Outlet with Rotometer to Purge Pilot Sense & Discharge Line	7
Option 8:	Internal Sensing, Pilot Exhaust Tubed to Main Valve Outlet with Backflow Preventer & Field Test Connection	8
Option A:	Internal Sensing, Pilot Exhaust Tubed to Main Valve Outlet with Manual Blowdown Valve	A
Option 10:	Internal Sensing, Pilot Exhaust Tubed to Main Valve Outlet with Backflow Preventer	D

TABLE 5 -

ACTUATOR DIAPHRAGM MAT'L.	CODE
Buna-N	B
EPDM	E
FKM	V
TFE (1.2"-12" W.C.)	T
Buna-N TFE Cover *	F
FKM TFE Cover *	W

* For FFKM 1 and FFKM 2 seat material

TABLE 6 - SPRING RANGES

Spring Range	CODE
4.0" - 12.0" WC (9.9 - 29.9 mbar)	3
12.1" - 18.0" WC (30.0 - 44.8 mbar)	6
18.1" - 36" WC (44.9 - 89.4 mbar)	7
36.1" - 41.7" WC (89.5 - 103.5 mbar)	8
41.8" - 86.0" WC (103.6 - 214 mbar)	9
3.2 - 14.0 psig (0.22 - 0.97 bar)	H
1.2" - 4.0" WC Air or N_2 Assist	L

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