JAIN Irrigation Inc

world leader in micro irrigation

API

Air Vents

www.jainsusa.com

Air Release / Vacuum Relief Valves

Air Release / Vacuum Relief Valves provide vital protection to pipeline systems. They allow air to escape during system startup by preventing air restrictions, water hammer caused by large air masses, inaccurate flow meter readings, and explosive conditions from air being compressed by water.

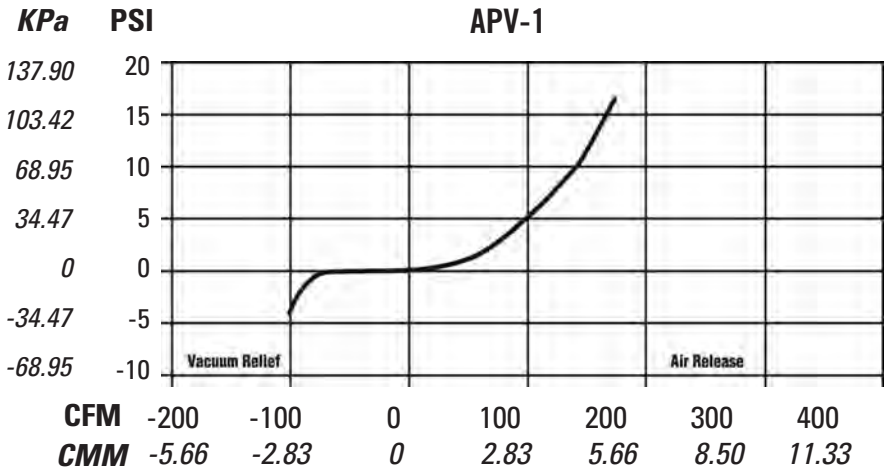
They also allow air to enter the pipeline during valve closure or system shutdown. This minimizes the collapse of mainline and submain pipes, back siphonage of dirt into emitters, and water hammer caused by sudden reversal of flows.

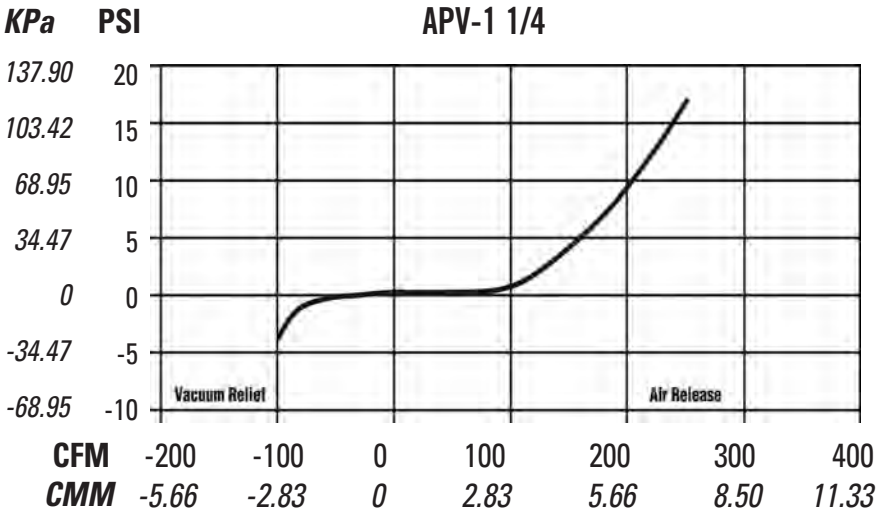
Product Features

- Available in dual acting, continuous and combination models
- Durable, weather resistant and non-corrosive material
- Removable top for seal maintenance
- Protects irrigation system and components
- Bright color allows easy visibility
- Slam resistant models available
- Easy to install
- Performance data tested and verified at C.I.T.
- Used in Agricultural, Nursery and Landscape applications
- Available in models that seal as low as 1 PSI
- Working pressures as high as 200 PSI on some models
- Optional Schrader Valve to check system pressure
- Inlet available in NPT or BSP

APV-1", 1 1/4" & APVV-1", 1 1/4"

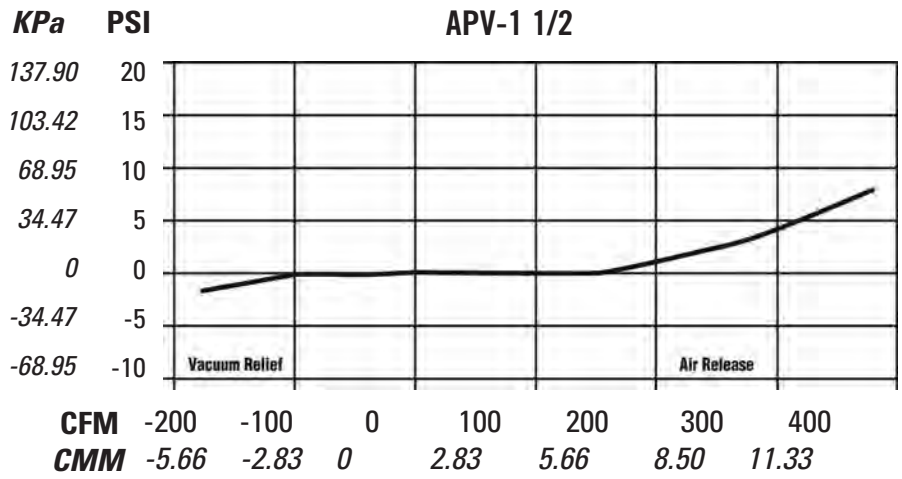
- Dual acting air release/vacuum relief valve
- Innovative and slam resistant design allows only water to close valve
- 150 PSI working pressure
- Inlet 1" and 1 1/4" NPT or BSP
- Seals at 1 PSI
- Clear open diameter is 0.775"
- Optional Schrader Valve to check system pressure

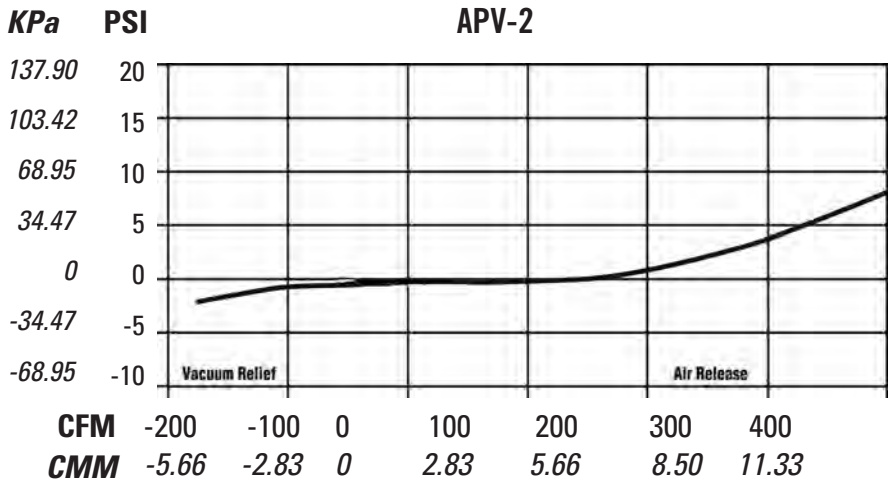




APV- 1 1/2", 2" & APVV-1 1/2", 2"

- Dual acting air release/vacuum relief valve
- Innovative and slam resistant design allows only water to close valve
- 150 PSI working pressure
- Inlet 1 1/2" and 2" NPT or BSP
- Seals at 1 PSI
- Clear open diameter is 1.140"
- Optional Schrader Valve to check system pressure



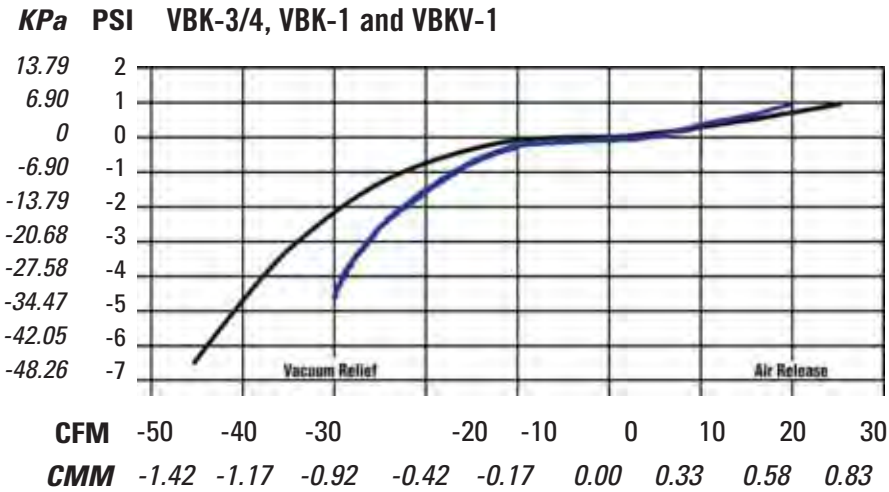


How to Specify APV Series

The air release/vacuum relief valve shall have a maximum working pressure to 150 PSI rated at standard temperature of 73 degrees F and have a (**1" 1 1/4" 1 1/2" 2"**) MPT inlet. Valve shall incorporate an innovative and unique slam resistant design that allows only water to close the valve, which will operate as a dual acting air release and vacuum relief. Valve shall achieve minimum positive sealing at a pressure of 1 PSI with a clear open diameter of (**0.775 1.140**). Valve shall provide vacuum relief of (**100 175**) CFM @ (**-4 -1.9 -1.6**) PSI and air release of (**175 250 375 400**) CFM @ (**16.25 16.6 8**) PSI. Valve will be manufactured with UV stabilized, durable, weather resistant and non-corrosive engineered plastics of bright colors for easy visibility. Valve will have a removable top for easy seal maintenance. Air release/vacuum relief valve shall be manufactured by Jain Irrigation, Inc., Fresno, CA.

VBK-3/4", 1" & VBKV-1"

- Dual acting air release/vacuum relief valve
- 80 PSI working pressure
- Inlet 3/4" and 1" NPT
- Seals at 5 PSI
- Clear open diameter is 0.610"
- Optional Schrader Valve to check system pressure

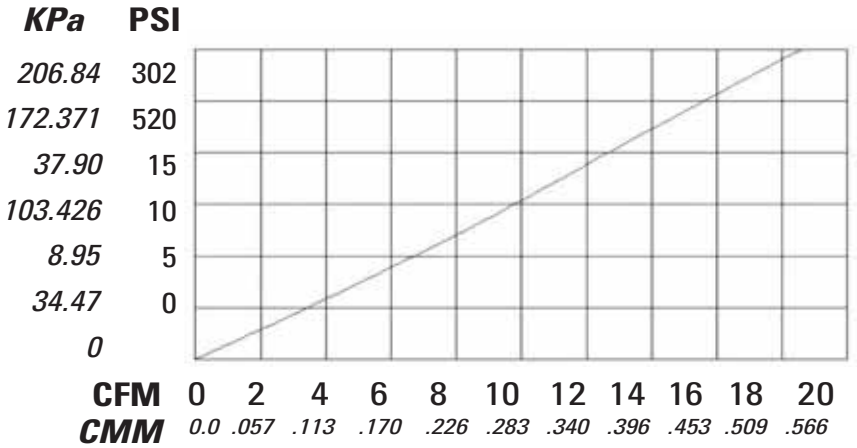


How to Specify VBK Series

The air release/vacuum relief valve shall have a maximum working pressure to 80 PSI rated at standard temperature of 73 F and have a (**3/4" 1"**) MPT inlet. Valve shall operate as a dual acting air release and vacuum relief. Valve shall achieve minimum positive sealing at a pressure of 5 PSI with a clear open diameter of 0.610". Valve shall provide vacuum relief of (**-30 -45**) CFM @ (**-4.5 -6.5**) PSI and air release of (**20 25**) CFM @ 1 PSI. Valve will be manufactured with UV stabilized, durable, weather resistant and non-corrosive engineered plastics of bright colors for easy visibility. Valve will have a removable top for easy seal maintenance (and will have a Schrader valve incorporated into the side of the body to conveniently check system pressure). Air release/vacuum relief valve shall be manufactured by Jain Irrigation, Inc., Fresno, CA.

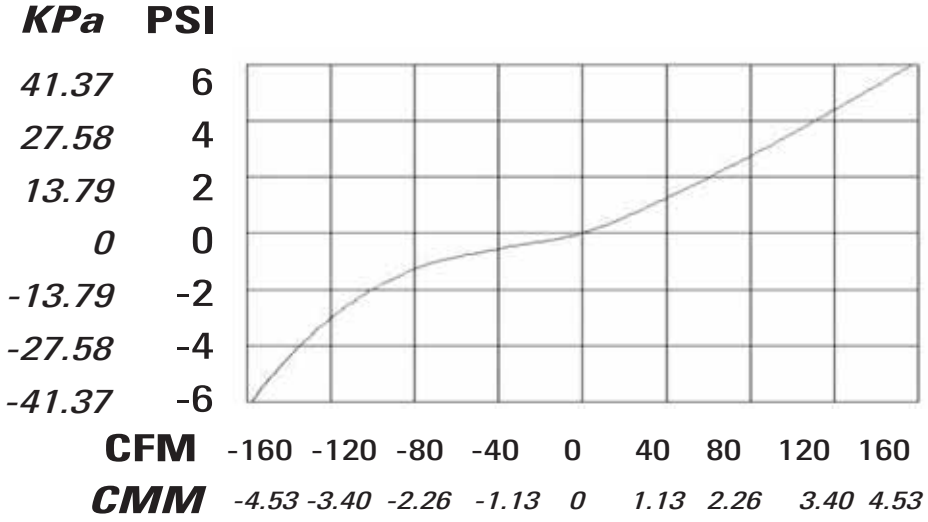
ARV-1

- Continuous air release
- 170 PSI working pressure
- Inlet 1" NPT or BSP
- Simple design
- Easy maintenance



ARV-2

- Combination (dual acting air release/ vacuum relief and continuous air release)
- 200 PSI working pressure
- Inlet 2" NPT or 2" BSP
- Outlet 1 1/4" FPT
- Seals at 1 PSI
- Clear open diameter is 1.290"



Dimensions & Weigths

APV-1*

ARV-1

VBK-1*

ARV-2

Model	Nominal / Metric		Height (A)		Width (B)		Weight	
	in.	cm	in.	cm	in.	cm	lbs.	gr.
APV - 1" & 1 1/4"	1 & 1 1/4	2.54 & 3.18	9	22.86	3.43	8.71	0.67	304.18
APV - 1 1/2" & 2"	1 1/2 & 2	3.81 & 5.08	9	22.86	3.43	8.71	1.80	817.20
ARV - 1	1	2.54	5.25	13.34	3.18	8.07	.63	286.02
ARV - 2	2	5.08	10.75	27.31	3.98	10.10	1.64	744.56
VBK - 3/4	3/4	1.91	5.01	12.73	1.81	4.60	.21	95.34
VBK - 1	1	2.54	5.50	13.97	1.81	4.60	0.24	108.96

**Shown with optional Schrader Valve.*

Guide to the Use of Air Release / Vacuum Relief and Continuous Acting Air Vents

Jain Irrigation, Inc. has realized the need for a basic, yet comprehensive guide for using dual acting (air release/vacuum relief) and continuous acting (continuous air release during system operation) air valves. This information would be helpful for designing complete and trouble-free systems.
Air is commonly introduced into system pipelines. This could eventually cause blockages, water hammer, and other undesirable effects. These problems, including a vacuum within the lines, hinder the system's functionality as well as create possible damage.

With these considerations in mind, Jain Irrigation has asked Dr. Charles Burt to compile the information on the following pages to assist your sales organization, designers, installers, and system troubleshooters with data to assist in recognizing and reducing these hazards.

Why air release / vacuum relief valves are needed on all sprinkler and drip / micro systems

The air release feature allows air to escape the pipeline during system startup. This prevents:

a. Air restrictions (air locks) in pipelines, which can partially or completely block waterflow.
b. Water hammer caused by large air masses which would otherwise remain in the pipe during and after startup.
c. Inaccurate flow meter readings
d. Explosive condition from air being compressed by water

The vacuum relief feature allows air to enter the pipeline during valve closure or system shutdown. This minimizes:

a. Collapse of mainline and submain pipes due to a vacuum.
b. Back siphonage of dirt into emitters. Vacuum relief valves can reduce this problem, but in some configurations will not eliminate it. See special notes on this subject.
c. Water hammer caused by a sudden reversal of flows which can occur if a negative pressure (vacuum) exists downstream of a valve that was just closed.

Why continuous air release valves are also needed on all sprinkler and drip / micro systems

Standard air release/vacuum relief valves are either fully open or fully closed, and they are always closed once the line is under pressure. A continuous air release valve will allow air which remains in the pipeline, or which enters the pipeline after startup, to escape. Standard air release valves are incapable of removing all of the air in a pipeline at startup.
Air can also enter the pipeline after startup via:

a. Fertilizer injectors that continue to operate after all the fertilizer has been injected.
b. Leaky pump suction fittings.
c. Falling water in wells.
d. Air vortexing in reservoirs or canals at the pump suction.

Regardless of the source, air in the pipeline can cause both water hammer problems and flow blockage.

Choosing an air vent

Tests by Jain Irrigation, the US Bureau of Reclamation Hydraulic Branch at Denver, and others show that there are very large differences in the discharge and intake characteristics of various vents of the same nominal diameter.

There can also be serious discrepancies between actual performance and published performance. Tables that show a required nominal diameter of air vent for a diameter of pipeline must therefore be used with caution.

Beyond the questions of leakage and durability of air vents, there are three primary questions that should be considered when sizing an air vent:

What is the air flow?
What is the pressure at that flow?
Does a standard vent slam closed before the specified discharge air flow and pressure are reached? If so, it should not be used.

The Tables below give minimum requirements for air flows and the corresponding pressures pertaining to irrigation systems.

Table 1a. Standard air flow rating pressure for valve type

	Valve Type					
	Air Release		Vacuum Relief		Continuous Air Release	
	PSI	kPa	PSI	kPa	PSI	kPa
Pressure at rated flow	2	14	-1	-7	15	103

Table 1b. Minimum air rate capacities required for a particular pipe size

PVC Nominal Diameter		Air Release		Vacuum Relief		Continuous Air Release	
in.	mm	CFM	LPS	CFM	LPS	CFM	LPS
1	25	5	2	2	1	0.2	0
2	51	16	8	8	4	1	0
3	76	35	17	18	8	2	1
4	102	60	28	30	14	3	1
5	127	90	42	45	21	5	2
6	152	130	61	65	31	6	3
8	203	220	104	110	52	11	5
10	254	340	160	170	80	17	8
12	305	480	227	240	113	24	11
15	381	690	326	345	163	35	16
18	457	1030	486	515	243	51	24
21	533	1430	675	715	337	71	34
24	610	1800	850	900	425	90	43

NOTE: When an air release/ vacuum relief valve is installed at the peak of a hill, water has the potential of flowing downhill both ways upon system depressurization. In this situation, an air release/vacuum relief valve must be sized for twice the actual pipe line size to relieve the increased vacuum created.

Air vent selection example

The working chart below gives an example of how to use the Air Flow Rate Capacities tables. Using theTable and the APV-2 Flow Characteristics graph (below), determine whether the given air vent and pipe size meet the minimum requirements.

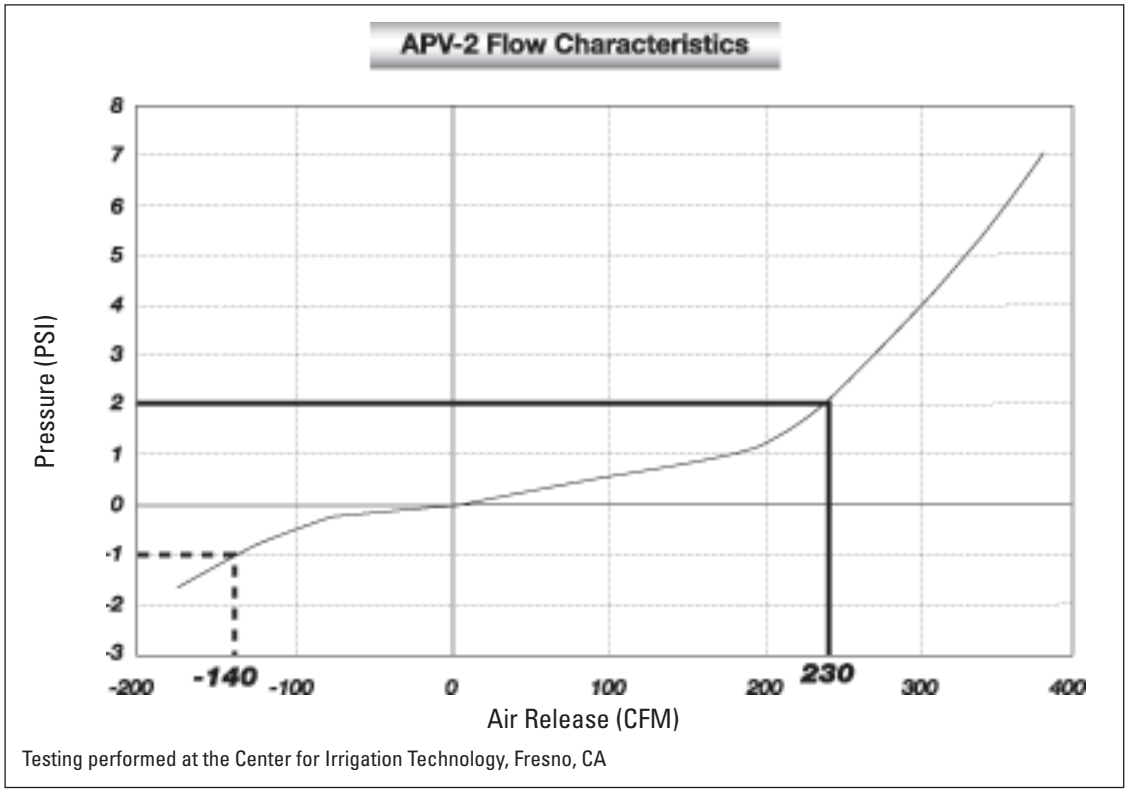
Given:
Pipe: 8" diameter PVC
Valve: APV-2 Air Release/Vacuum Relief Valve
Questions:

What is the air flow?
What is the pressure at that flow?

Solution: Looking at the air release requirement from Table 1b (page 3) for an 8" pipe, find the required air release and vacuum relief needed. Compare those numbers to the APV-2 Flow Characteristics at the same pressure. If the air release valve performance is equal to or greater than the requirements, then the air release valve is safe to use.

	Requirements*		Valve Performance**	
Valve Type	Air Flow (CFM)	Pressure (PSI)	Air Flow (CFM)	Pressure (PSI)
Air Release	220	2	230	2
Vacuum Release	-110	-1	-140	-1

*From Tables on page 3 **from the graph below



Testing performed at the Center for Irrigation Technology, Fresno, CA

Vacuum Relief Air Release

Locating air vents

Table 2. Recommended Air Vent Location Points

Location	Valve Type	
	Air Release / Vacuum Relief	Continuous Air Release
Every 1,320 feet (400 m)	X	X
At all high points	X	X
Upstream of pump check valves	X	
On filter backflush manifolds (at the downturn)	X	
On filter inflow manifolds (at the downstream end)		X
At all points where a pipe begins to slope downhill	X	X
At the end of all mainlines	X	
Downstream of any entrainment point		X
Immediately downstream of the inlet valve to any pipe supplied by a canal or reservoir (if the pipeline slopes downhill)	X	X
~~Down stream of an on/off control valve~~ Upstream of an on/off control valve	X	
		X

Continuous air release valves cannot remove air unless the air is at the top of the pipeline. This has important implications for irrigation system installations:

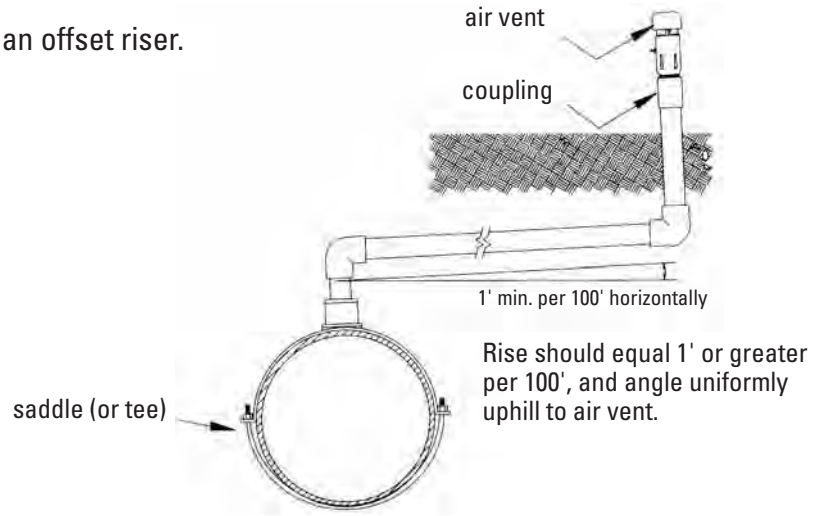
a. Elbows, valves, and propeller meters will cause air to mix throughout the flow stream, so continuous air release valves located close to these points will be ineffective.

The air valves must be located far enough downstream so that the air has had an opportunity to reach the top of the pipeline. See Table 3 on page 7 for minimum distances between points of turbulence and continuous air release valves.

b. The riser pipe which connects the air vents to the pipeline should have a large diameter base where connected to the pipeline. The larger the connection, the better chance an air bubble will have of entering the riser.

c. The riser pipe must be connected to the top of the pipeline. The figure below (See Detail 1) shows how to make the connection if the air vent must be offset from the pipeline.

Detail 1. Proper connection using an offset riser.



Small air vents at the head of drip hose / tape

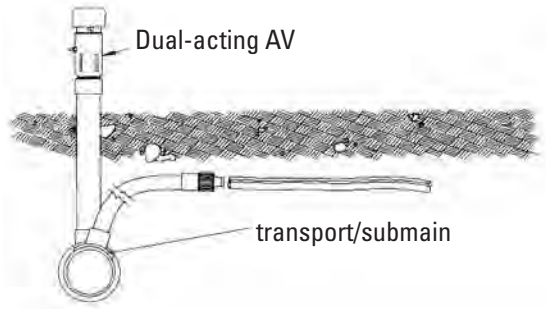
Small vacuum relief vents are sometimes used at the inlets of drip hose/tape which goes down steep hills. These can minimize soil back siphonage into emitters, which can occur at the time the system is shut off.
Care should be taken to orient the small vents so that dirt cannot fall into them, which would contaminate the hose/tape when the vents open. (See Detail 2.)

Above-ground vs. buried manifolds

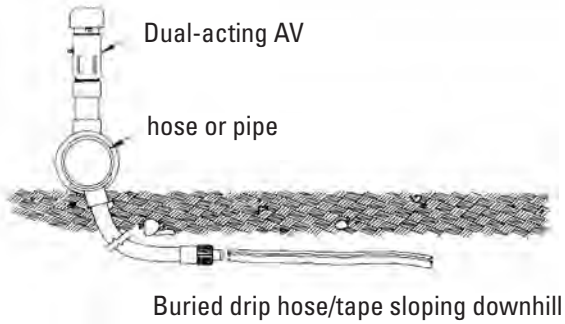
Air vents on buried drip manifolds can reduce the amount of vacuum in hoses at shutoff, but they cannot eliminate it for hoses/tapes that run downhill from the manifold. To move air from the manifold to the hoses/tapes, a vacuum must be at least as large as the vertical distance between the manifold and the hoses/tapes.

Above ground manifolds, due to their height above (rather than below) the hoses/tapes, will not have this problem. This is primarily of concern on steep ground. (See Detail 2.)

Detail 2. Vacuum relief with buried and above-ground manifolds.



Assembly shown here will help to minimize vacuum in drip/hose tape, but it will not eliminate it if the hose/tape goes downhill. Vacuum in the transport/submain is eliminated.



This configuration removes almost all vacuum in both the submain and the hose/tape

Installation details

Air vent placement downstream of turbulence (See Table 3)

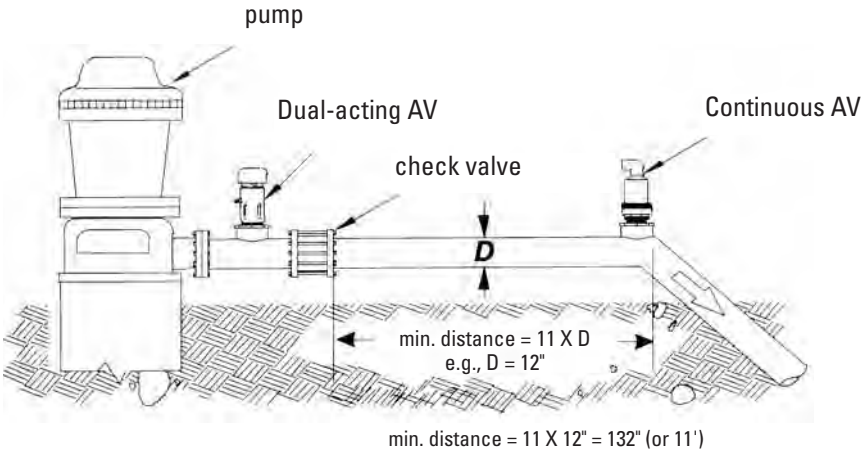
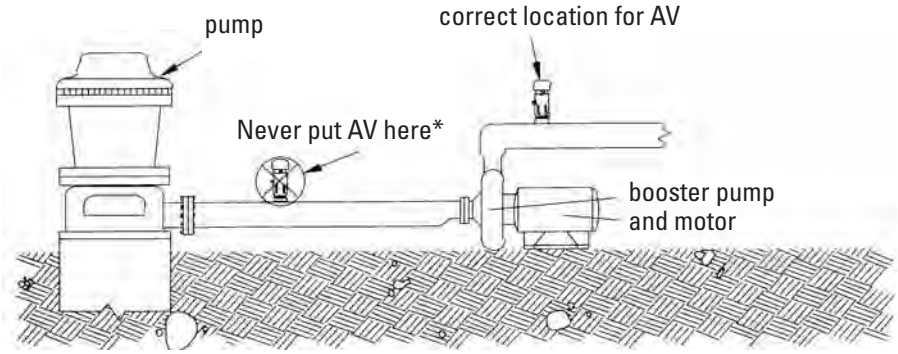


Table 3. Minimum Distance Downstream of Turbulence to Locate Continuous Acting Air Vents

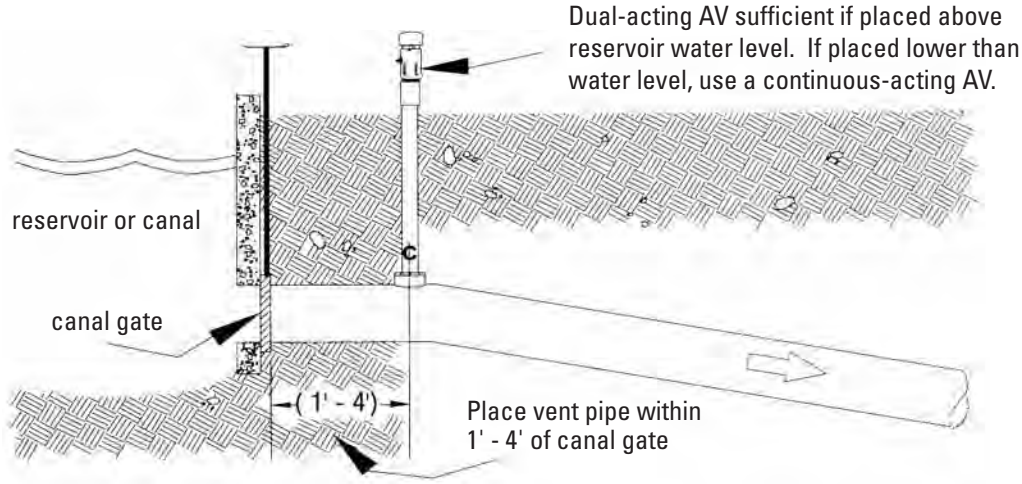
Pipe Diameter		Distance	
in.	mm	ft.	m
1	25	1	0.3
2	51	2	0.6
3	76	3	0.9
4	102	4	1.2
5	127	5	1.5
6	152	6	1.7
8	203	7	2.3
10	254	9	2.8
12	305	11	3.3
15	381	13	4
18	457	16	4.9
21	533	19	5.7
24	610	21	6.4

Air vent placement for pumps in series

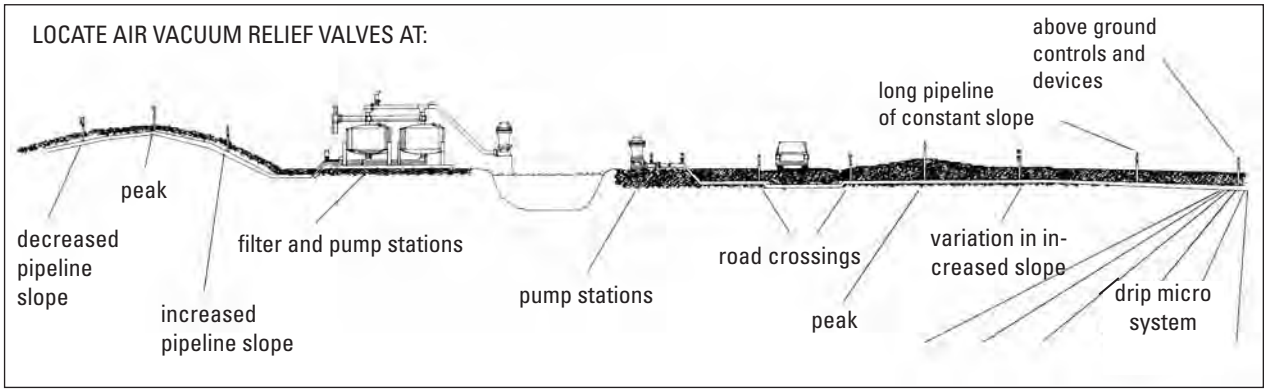


* Never place an air vent between two adjacent pumps in a series, unless the first (source) pump will always exert a positive pressure on the second pump.

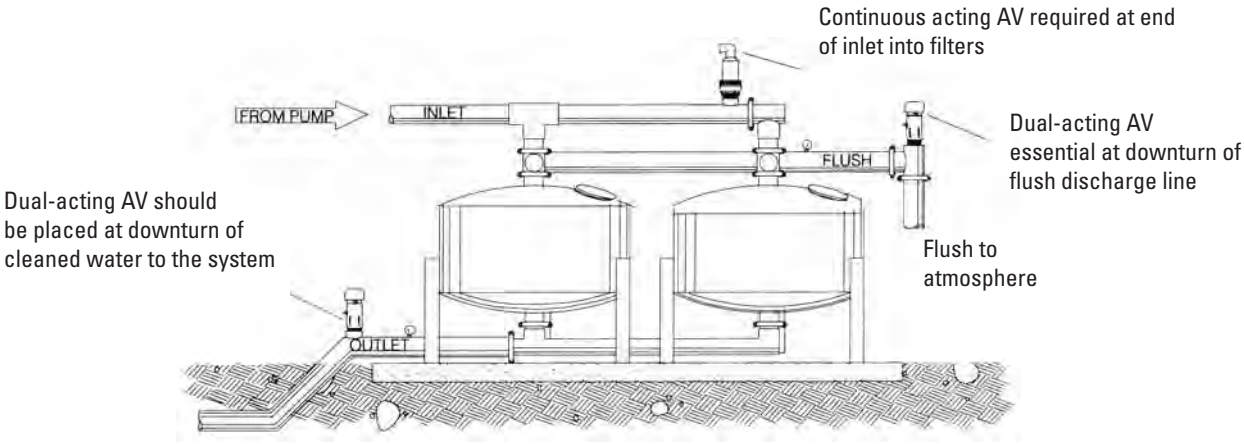
Air release valve downstream of a reservoir or canal



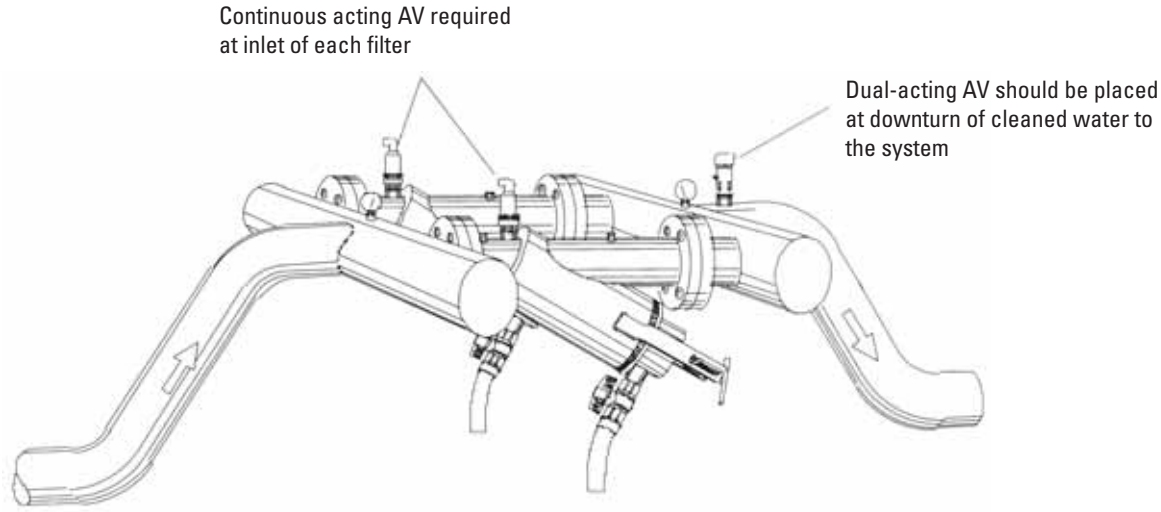
Cross section of air vent placement



Proper placement of air release vents required on a filter station



Proper placement of air vents on a Spin Clean® filter manifold assembly



Spin Clean® Filter Manifold Assembly

Metric Conversion Table for the APV-Series Release Valves										
	Air Action		Pressure							
	CFM	CMM	PSI 2″	KPa 2″	PSI 1 1/2″	KPa 1 1/2″	PSI 1 1/4″	KPa 1 1/4″	PSI 1″	KPa 1″
Vacuum Relief	-175	-4.955	-1.623	--11.192	-1.86	-12.823	-	-	-	-
	-150	-4.248	-1.171	-8.074	-1.330	-9.170	-	-	-	-
	-125	-3.540	-0.778	-5.364	-0.878	-6.054	-	-	-	-
	-100	-2.832	-0.444	-3.061	-0.503	-3.468	-0.397	-2.734	-4.170	-28.751
	-75	-2.124	-0.169	-1.165	-0.205	-1.413	-0.909	-6.267	-0.419	-2.889
	0	0	0	0	0	0	0	0	0	0
Air Release	25	0.708	0.000	0.000	0.000	0.000	0.006	0.041	0.330	2.275
	50	1.416	0.001	0.007	0.000	0.000	0.050	0.345	1.000	6.895
	75	2.124	0.003	0.021	0.001	0.007	0.100	0.689	2.500	17.237
	100	2.832	0.030	0.207	0.005	0.034	0.604	4.164	4.900	33.784
	125	3.540	0.148	1.020	0.009	0.062	2.085	14.373	7.750	53.434
	150	4.248	0.192	1.324	0.035	0.241	4.043	27.876	11.000	75.842
	175	4.955	0.611	4.213	0.562	3.875	6.476	44.650	16.250	112.040
	200	5.663	1.110	7.653	1.178	8.122	9.384	64.700	-	-
	225	6.371	1.689	11.645	1.888	13.017	12.768	88.032	-	-
	250	7.079	2.348	16.189	2.691	18.554	16.628	114.646	-	-
	275	7.787	3.087	21.284	3.586	24.725	-	-	-	-
	300	8.495	3.906	26.931	4.575	31.544	-	-	-	-
	325	9.203	4.804	33.122	5.656	38.997	-	-	-	-
	350	9.911	5.783	39.872	6.831	47.098	-	-	-	-
	375	10.619	6.841	47.167	8.098	55.834	-	-	-	-
	400	11.327	7.979	55.013	-	-	-	-	-	-

Metric Conversion Table for the VBK-Series Release Valves					
Air Action		Pressure			
CFM	CMM	PSI 1″	KPa 1″	PSI 3/4″	KPa 3/4″
-45	-1.274	-6.56	-45.230	-	-
-40	-1.133	-4.81	-33.164	-	-
-35	-0.991	-3.39	-23.373	-	-
-30	-0.850	-2.26	-15.582	-4.8	-33.095
-25	-0.708	-1.40	-9.653	-2.95	-20.340
-20	-0.566	-0.78	-5.378	-1.75	-12.066
-15	-0.425	-0.37	-2.551	-0.80	-5.516
-10	-0.283	-0.13	-0.896	-0.30	-2.068
-5	-0.142	-0.02	-0.138	-0.10	-0.689
0	0	0	0	0	0
5	0.142	0.04	0.276	0.20	1.379
10	0.283	0.18	1.241	0.25	1.724
15	0.425	0.38	2.62	0.50	3.447
20	0.566	0.65	4.482	0.95	6.550
25	0.708	0.88	6.067	-	-

Metric Conversion Table for the ARV-1			
Air Action		Pressure	
CFM	CMM	PSI	KPa
0	0.000	0.000	0.000
2	0.057	2.928	20.191
4	0.113	6.042	41.667
6	0.170	9.284	64.027
8	0.226	12.596	86.868
10	0.283	15.919	109.787
12	0.340	19.195	132.381
14	0.396	22.366	154.247
16	0.453	25.372	174.983
18	0.509	28.157	194.185
20	0.566	30.661	211.452

Metric Conversion Table for the ARV-2			
Air Action		Pressure	
CFM	CMM	PSI	KPa
-160	-4.528	-6.18	-42.639
-150	-4.248	-5.20	-35.885
-140	-3.962	-4.35	-30.010
-130	-3.679	-3.62	-24.943
-120	-3.396	-2.99	-20.613
-110	-3.113	-2.46	-16.947
-100	-2.832	-2.01	-13.874
-90	-2.547	-1.64	-11.322
-80	-2.264	-1.34	-9.220
-70	-1.981	-1.09	-7.496
-60	-1.698	-0.88	-6.079
-50	-1.416	-0.71	-4.897
-40	-1.132	-0.56	-3.877
-30	-0.849	-0.43	-2.950
-20	-0.566	-0.30	-2.042
-10	-0.283	-0.16	-1.083
0	0.000	0.00	0.000
10	0.283	0.31	2.139
20	0.566	0.63	4.342
30	0.849	0.96	6.609
40	1.132	1.30	8.939
50	1.416	1.64	11.334
60	1.698	2.00	13.794
70	1.981	2.37	16.318
80	2.264	2.74	18.908
90	2.547	3.13	21.563
100	2.832	3.52	24.283
110	3.113	3.93	27.070
120	3.396	4.34	29.923
130	3.679	4.76	32.843
140	3.962	5.20	35.830
150	4.248	5.64	38.884
160	4.528	6.09	42.005

Air / Vacuum Relief Valves

Air / Vacuum Relief Valve
VBK-3/4
VBK-1

Air / Vacuum Relief Valve w/ 1/8" Schrader Valve
VBKV-1

Continuous Air Release Valve
ARV-1

Air / Vacuum Relief Valve
APV-1
APV-1-1/4
APV-1-1/2
APV-2

Air / Vacuum Relief Valve w/ 1/8" Schrader Valve
APVV-1
APVV-1-1/4
APVV-1-1/2
APVV-2

Combination Air Release Valve
ARV-2

2851 E. Florence Ave.
Fresno, CA 93721
Ph 800-695-7171
Fax 888-434-3747

P.O. Box 3760
Ontario, CA 91761
Ph 800-828-9919
Fax 800-777-6162

740 Water St.
Watertown, NY 13601
Ph 800-242-7467
Fax 866-329-2427

P.O. Box 3546 • Haines City, FL 33845
3857 W. Lake Hamilton Dr.
Winter Haven, FL 33881
Ph 800-848-8153 • Fax 800-533-6421

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