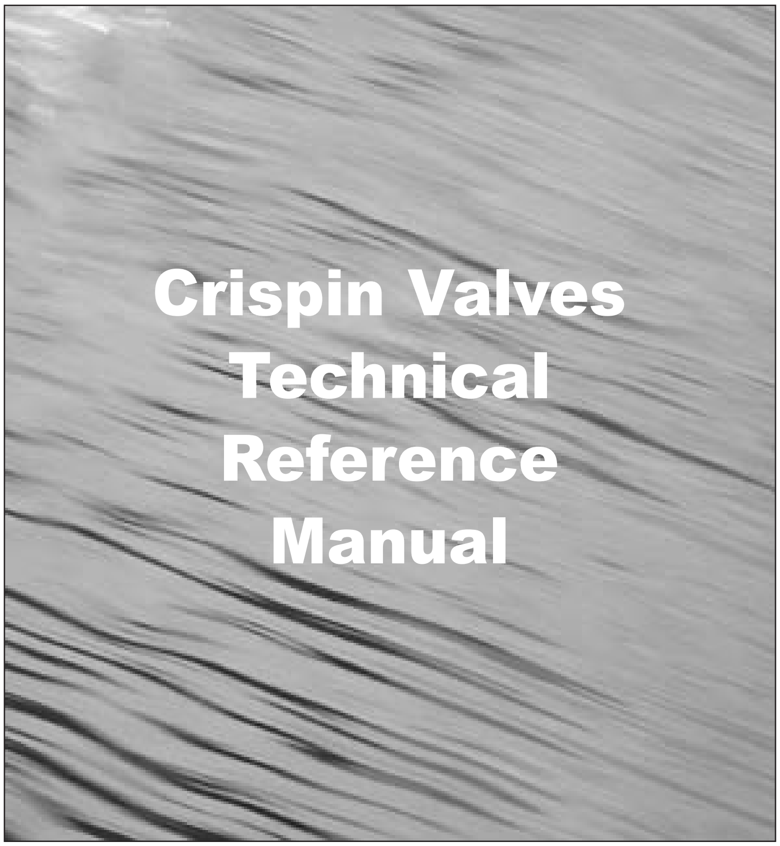

Crispin Valves Technical Reference Manual

Since 1905

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Air Release Valves

DL Series: Deep Well Air Release Valves (ref. #1)

Addressing the air release requirements for well pumps, deep well pumps and certain other centrifugal pump applications often requires special consideration.

Systems with a control or check valve, and with a long vertical rise all on the discharge side of the pump, almost always require a Deep Well Air Release Valve between the pump and control or check valve.

A standard Air and Vacuum Valve would permit the discharge of a large volume of air as the pump starts. However, in most instances, the Air and Vacuum Valve will not function efficiently. That is, as the pump starts, the volume of water being forced up the discharge leg of the pump is directly proportional to the volume of air being forced through the Air Release Valve. Depending upon the slope of the pump curve, the volume of water being pumped initially can be much greater than when the system's operating pressure is reached. This means that when the surge of air and water reaches the Air and Vacuum Valve, one of two things may occur.

1. Either the float may slam into its seat and result in valve or system damage; or
2. The valve may not close at all because the float is held in its cup by a downward force of the vortexing water as it leaves the valve.

The effects of this surge can be overcome by providing a deep well top on the Air and Vacuum Valves through the 6-inch size. Larger sizes may be accommodated with a Surge Check Valve on the inlet.

The deep well top is field adjustable, and can be throttled to restrict the cross sectional area of the valve discharge, which slows down the rising column of air and water as it approaches the valve. Subsequently, the float operates more slowly and provides a positive seat. The increase in differential pressure that is created by the throttling device should never be allowed to be greater than the pressure downstream of the check valve or control valve.

Most large orifice valves that provide the air and vacuum function can be fitted with a deep well top and applied on pump discharges to release air on start up. However, use caution if a Universal Style Combination Valve is being considered for a deep well application. These style valves have not been designed for the greater surges seen in deep well applications, and should not be used in place of a Deep Well Air Release Valve.

The sizing requirements for the Deep Well Valves, provided in the catalog, should be followed so that the valve is not oversized.

Most Air Release Valves can be oversized without harm being done. However, if a Deep Well Valve is oversized, then the ability of the throttling device to exercise control over a specific volume of air is limited, and it may have no effect at all on control.

A & AL Series: Air and Vacuum Valves (ref. #2)

CRISPIN Air & Vacuum Air Release Valves allow large volume air passage upon system start up and shut down. They also have only one moving part—the float.

Each float is sized based on the specific gravity of water, since water is the standard application. If the valves are applied on an alternate liquid system, then our detail sheet entitled "Air Release Valve for Liquids Other Than Water" should be reviewed. (See page 83 of this catalog.)

The float, when buoyant, will seal the outlet orifice to prevent water or air passage. If air should accumulate and completely displace the water in the valve with the system under pressure, the float will remain in its seat. This is because the operating pressure, multiplied by the cross sectional area of the orifice, provides an upward force greater than the weight of the float.

The floats in the l/2'' through 4" Air and Vacuum Valves are spherical and are constructed in two halves. During assembly of the float, one of the two halves is weighted, so that the weld seam is held horizontal and parallel to the orifice. The float will then repeatedly seal the orifice with a smooth surface, uninterrupted by the weld seam.

The 6" through 10" floats are hemispherical on the bottom section and cylindrical on the upper section. The top surface is flat with a machined face to provide a drip tight seal.

All of the CRISPIN Air and Vacuum Valves have guides that direct the float onto the seat upon closure. These guides are peripheral to the float and fixed to the body or the cup and hanger assembly. This peripheral guide system allows unobstructed closure because there are no guide bushings to collect dirt and then bind, and there are no shafts to bend or deform, which would prevent a drip tight seal.

All CRISPIN Air and Vacuum Valves have standard Buna-N seating material with a shore durometer of 70-80. This standard seat allows drip tight closure beyond 10 PSIG. Occasionally, a gravity system operates at pressures less than 10 PSIG. These applications require a soft seating material which will prevent leakage down to 1 PSIG or less. This soft seating material should not be applied to systems with operating pressures greater than 50 PSIG or high pressure leaks may occur around the seat.

The Air and Vacuum Valve sizing information described in the catalog should be used without deviation. This sizing information provides the smallest size that may be applied. It is permissible to oversize the valve and this may even be desired, if a larger valve will enhance system operation and efficiency by decreasing the pressure differential across the valve.

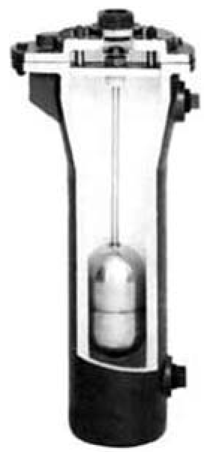
The pressure differential is simply the pressure drop across the valve, and is determined for various flow capacities for each valve size.

Therefore, if the Air and Vacuum Valve is selected at a pressure differential less than 2 PSIG then that valve will simply close at a slower rate. However, this does not imply that a larger Air and Vacuum Valve should be applied as an alternative to using a Surge Check Valve in combination with the Air & Vacuum Valve.

An example of where it may be desirable to use a larger air and vacuum valve would be a location where the liquid in the system is very turbulent, and mixed with a lot of air. The larger Air and Vacuum Valve would provide more cross section for an air/water separation to take place. Also the subsequent increase in the specific gravity of the liquid would raise the float before a great amount of the liquid was discharged. This theory will not apply when selecting the size of Deep Well Air Release Valves. (See technical reference #1).

Air Release Valves

S Series: Sewer Air and Vacuum Valves (ref. #3)



CRISPIN Sewer Air and Vacuum Valves provide an air release function on system start-up, and vacuum relief on shut-down.

The body is elongated to prevent solids from collecting near the top valve mechanism, which could inhibit operation. Solids that settle near the bottom of the valve are flushed out of the lower blow-off valve (1” gate valve).

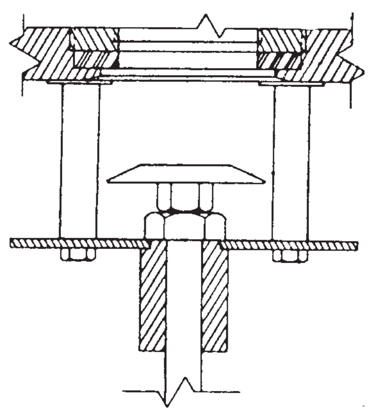
The seating area in an Air and Vacuum Sewer Valve is made up of a stainless steel disc which mates with a BUNA-N seat when the valve is closed. The thickness of the disc is determined by the orifice size, but is no less than 1/4” at its thickest point. The circumference of the disc is chamfered so that the valve can be self seating, and maintain a positive drip tight seal with repeated operating cycles.

Those Sewer Air and Vacuum Valves that have a float at the top of the float rod function the same as a CRISPIN Sewer Air and Vacuum Valve. That is, the top float functions only as a seating surface to seal the valve, and does not offer any buoyant force to close the valve. This is because the water should never be at that level in the valve body. If a section of the top float seating surface is examined, then it is easy to see how the radius of the float duplicates the chamfer of the stainless steel disc.

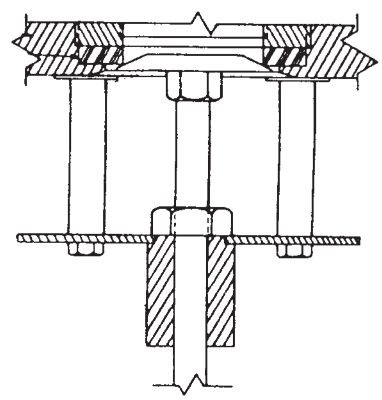
The disc offers additional assurance of operational longevity with its structural rigidity. If the velocity of the liquid entering the valve is great enough to slam the valve closed, then the valve disc is much less likely to be damaged than the float.

The following diagram of the valve seating area shows the valve disc in open and closed positions.

Part No.	Item
1	Top
2	Top Flange
5	Buna-N Seat
6	Valve Disc
7	Baffle Plate
8	Guide Bushing
10	Float Rod
13	Stand Rod



“Open” Position



“Closed” Position

The float rod is supported by a baffle plate that prevents premature closure of the valve. This is because the baffle plate directs a rush of exhaust air away from the underside of the valve disc.

Minimum inlet size for any of the sewer valves is 2” because of the nature of sewage solids. The outlet orifice will control the air flow capacity in this case.

The Sewer Air and Vacuum Valve uses the same sizing parameters and curves as the standard Air and Vacuum Valve.

The CRISPIN Sewer Air and Vacuum Valve is designed to operate at a maximum hydrostatic pressure of 300 PSIG. The standard seating material will provide a positive seal at this pressure. However, at operating pressures below 15 PSIG, the durometer or material hardness is too high to provide a drip tight seal. A soft seat material can be provided as an option for these lower operating pressures.

SL Series: Pressure Sewer Air Release Valves (ref. #4)

Pressure Air Release Valves allow air and/or gas to be continuously and automatically released from a pressurized liquid system. If air or gas pockets collect at the high points in a pumped system, then those pressurized air pockets can begin to displace useable pipe cross-section. As the cross section of the pipe artificially decreases, the pump sees this situation as increased resistance to its ability to force the liquid through the pipe. An increase in resistance to flow tells the pump to work harder and, subsequently, more energy is expended. However, an even worse situation can be created if the pump is selected with system operating conditions near pump shut-off. In this case, an increase in total dynamic head can cause the pump to go into the pump shut-off condition and cease functioning.

CRISPIN Sewer Pressure Air Release Valves release air from a force-main as air and gas collect at the high points of a system under pressure. The body of the valve is elongated with the float suspended near the inlet, so that with normal buoyant reaction time of the float, solids entering the valve will not interfere with the valve linkage. Solids deposited near the bottom over a period of time can be flushed out of the valve through a 1” blow-off valve. (1” gate valve).

CRISPIN offers two models of Pressure Sewer Valves, each with various inlet sizes. The SL series provides a valve capable of air release capacities equal to or exceeding that of our competition. The traditional “high capacity” CRISPIN Pressure Sewer Valves provide much larger orifice sizes to release larger volumes of accumulating air and gas.

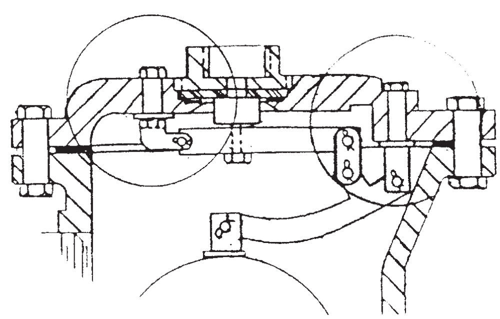
The correct orifice sizing for the valve is determined primarily by pump capacity, and is outlined in this catalog under the Pressure Air Release Valve section. The sizing is based on volumes of air that can typically be expected to accumulate at given pump capacities. This air can enter the system from several sources. Among these are: vortexing in the wet well, leaking joints and flanges, air entrainment in solids passing through the system, etc. In long runs of pipe, sewer gasses can be generated, and will collect at the high points and displace water just the same as accumulating air. These pockets of air and gas must be vented to promote an efficiently operating system.

Figure 1 provides a comparison of air release capabilities between our standard model and our high capacity series.

FIGURE 1

Orifice		Operating	Discharge Capacity CFFAM
SL Series	1/4”	175 PSIG	100
	1/8”	300 PSIG	45
	5/8”	100 PSIG	420
High Capacity Series	1/2”	150 PSIG	390
	7/16”	200 PSIG	390
	3/8”	250 PSIG	350
	1/4”	300 PSIG	185

FIGURE 2



Valve inlet sizing is based on providing an air/water separation of the liquid as it is forced through the pipeline, and passes the inlet to the Air Release Valve. The larger the inlet, the better the air/water separation. In most cases, however, a 2” valve inlet will be large enough.

Backflushing attachments are provided as an option, and are always recommended with the sewer valves to enhance operating efficiency. Each backflush assembly includes a 1” diameter hose, which provides a high capacity flushing capability through the entire valve body.

CRISPIN Pressure Sewer Air Release Valves use all stainless steel trim construction. There are no plastic linkage parts to become brittle and fracture. The linkage is suspended and held stable by bolting to the top flange at two points (Figure 2). This allows any incurred system stresses to be displaced over larger areas of the top flange, which enhances the operational longevity of each unit.

The pressure seat can be easily replaced by removing the threaded top from the top flange, which exposes the seat.

Air Release Valves

PL Series: Pressure Air Release Valves (ref. #5)

Pressure Air Release Valves allow air and/or gas to be continuously and automatically released from a pressurized liquid system. If air or gas pockets collect at the high points in a pumped system, then those pressurized air pockets can begin to displace usable pipe cross section. As the cross section of the pipe artificially decreases, the pump sees this situation as increased resistance to its ability to force the liquid through the pipe. An increase in resistance to flow tells the pump to work harder and, subsequently, more energy is expended. However, an even worse situation can be created if the pump is selected with system operating conditions near pump shut-off. In this case, an increase in total dynamic head can cause the pump to go into the pump shut-off condition and cease functioning.

CRISPIN Pressure Air Release Valves operate by means of a compound lever system. This lever system multiplies the weight of the float, so that the force pulling the rubber valve away from the orifice is greater than the force or system pressure holding it closed. The pressure at which it will operate is determined by the orifice size. The orifice size will vary inversely to the pressure. In other words, as the operating pressure increases, the orifice must be smaller; and as the operating pressure decreases, the orifice can be larger. A valve with an orifice size small enough to permit operation at 300 PSIG will still function at pressures less than 300 PSIG.

The various orifice sizes available for each pressure valve will provide varying volumes of exhaust air. Table 1 indicates the exhaust capability at each operating pressure. Pressure Air Release Valves are normally applied on piping systems that transport liquids with low solid content. Sewer Pressure Air Release Valves are used otherwise. The valves are located at the pump discharge along with Air and Vacuum Valves, and/or along the system at high points or long runs. Suggested locations for the various valves along the pipeline can be found in this catalog.

In some instances, the water in the piping system may be saturated with air or the flow may be extremely turbulent, creating a white water condition. Consequently, effective air release may be very difficult to achieve with an Air Release Valve simply mounted on the pipe. A stilling well may be required to slow down the water flow to provide time for the entrained air to be released. A large section of pipe or a similar device, strategically placed, would decrease the line velocity at that point. It turn, it would provide additional time for the entrained air to be released from the solution, and collect at the high point in order to be discharged. An Air Eliminator Tank may be used for a more compact installation. Where Pressure Air Release Valves are used on systems other than water, the specific gravity of the liquid must be considered (re. catalog sheet: "Air Release Valves For Liquids Other Than Water"). The specific gravity affects the float buoyancy and, subsequently, valve performance. For example, a valve applied on a petroleum application would require a float of lighter weight in order to provide a buoyancy equivalent to that of the float in water.

The standard valve is supplied with a P.V.C. seat and Buna-N plunger. A stainless steel seat is provided as an option with a Buna-N plunger for special applications. Caution should be exercised if the valve is to be used in an environment where the standard materials would not be suitable The internal linkage of the Pressure Air Release Valves, like the Pressure Sewer Air Release Valves, is securely bolted to the top flange at two separate points. This design distributes any incurred linkage stresses more evenly over the surface of the flange.

Table 1: Discharge Capacity in CFM

Operating Pressure	Orifice Size In Inches							
PSIG	1/32	3/64	1/16	5/64	3/32	7/64	1/8	9/64
50	.59	1.37	2.38	3.71	5.34	7.28	9.56	12.09
100	1.05	2.37	4.22	6.58	9.48	12.9	16.9	21.3
150	1.54	3.45	6.14	9.59	13.8	18.6	24.4	30.8
200	2.01	4.5	8.03	12.45	17.9	24.4	31.9	40.3
250	2.47	5.53	9.87	15.3	22.1	30.0	39.2	49.5
300	3.17	7.12	11.75	18.4	26.4	35.8	46.7	58.9

Operating Pressure	Orifice Size In Inches								
PSIG	5/32	3/16	1/4	5/16	3/18	7/16	1/2	5/8	3/4	1
50	14.9	21.4	38.1	59	86	117	153	237	343	610
100	26.3	37.7	68	105	152	205	270	422	607	1080
150	37.9	54.6	98	152	220	298	390	592	855	1520
200	49.5	72	127	198	287	390	510	796	1147	2038
250	61.1	88	157	244	352	480	627	980	1410	2506
300	73	105	187	290	420	572	746	1167	1679	2985

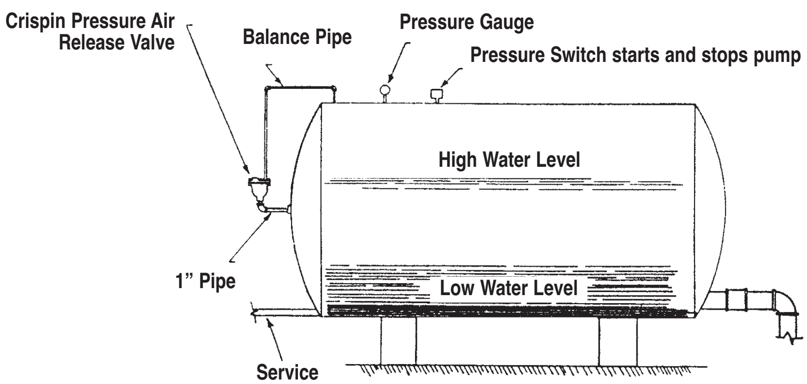
AE Series: Hydropneumatic Tank Air Release Valves (ref. #6)

A Hydropneumatic Storage tank requires the control of the percentage air volume in the tank to permit proper operation, and prevent air binding or water logging the tank.

Water is usually pumped to a hydropneumatic tank via a well pump or vertical turbine. In these cases, air is continuously added to the tank every time the pump begins pumping. The continuous addition of air, if left unchecked, will ultimately air-bind the tank and lower the storage water level.

The Air Release Valve should be located along the side of the tank at a level dictated by the desired water level in the tank. This level can vary but is usually at 50% of tank volume. Figure 1 indicates a typical arrangement, with balancing piping running from the top of the tank to the top of the valve. This piping arrangement allows the water to easily seek the same level in the valve body as in the tank. The valve should be 50% full of water to buoy the float to close the valve. Therefore, the valve should be located adjacent to the operating level in the tank at a point approximately l/2 the height on the valve body.

FIGURE 1



As air begins to accumulate in the tank with each successive pump start, the available water storage capacity decreases. The water level in the valve will control the buoyant level of the float. Subsequently, if the water level decreases because of excess air, the float will drop accordingly and release an amount of air. This will in turn raise the water storage level, and once again close the valve.

A similar arrangement can be made by positioning the air valve pipe on the side of the tank at the minimum desired water level. The valve is mounted in a similar manner as previously mentioned; however, the balancing piping may be omitted. The omission of the balancing piping means that the excess air will have to bubble through the valve inlet piping to the valve. As the air enters the body of the valve, it displaces the water in the valve, which lowers the float and allows the air to escape. Valves used without balancing piping should have a minimum of a 1 inch diameter inlet size, and at least a 1 foot vertical riser pipe to the valve. This will help assure efficient operation of this alternate arrangement by aiding the air/water transfer.

The orifice size of the Pressure Air Release Valve should be precisely selected according to the expected system operating pressure. Occasionally the water supply demand on the hydropneumatic tank can exceed the rate at which the pump can feed the tank. If this should occur, the water level would continue to drop, and allow the Air Release Valve to relieve the pressure in the system. This prevents any water from being forced out of the tank.

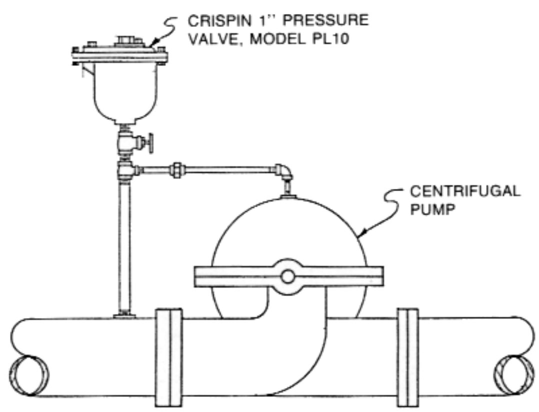
In order to prevent this from occurring, the outlet of the Pressure Air Release Valve can be fitted with a Pressure Relief Valve adjusted to the selected system's low pressure. This will allow air to be released above that pressure, but prevent air from escaping below that pressure. Subsequently, more consistent tank pressures can be maintained at times of high demand.

Air Release Valves

Applications With Vacuum Priming Systems (ref. #7)

A pump which does not have a flooded suction, or which is not capable of priming itself, will require some means of getting the liquid to the pump prior to pump start-up. One of the methods of priming a non-self-priming pump is to lower the pressure in the pump suction piping. This develops a negative pressure in the pump.

Subsequently, atmospheric pressure in the sump will push down the sump liquid level, which will cause the liquid to rise in the suction piping. Once the liquid reaches the pump, and electrical contact is made to start the pump motor, the properly selected pump will sustain the suction lift, and direct the liquid through the system. Automatic Pressure Air Release Valves are used in conjunction with a vacuum source to create a negative pressure in the suction side of a pump. The Pressure Air Release Valve is selected to operate in this capacity, since it can be made to function with pressure on either side of the orifice that is trying to keep the valve closed. (A typical arrangement is illustrated below.)



SEWAGE

In the application, the Pressure Air Release Valve passes the evacuating air from the suction piping and pump volute, then seals the system when the liquid reaches the valve. As any air accumulates in the suction piping and enters the body of the valve, the float drops with the displaced water level, opening the valve. The vacuum removes this air, which raises the water level and float, thus closing the valve.

The Air Release Valve for these applications may not necessarily be a standard valve, but may require a specific orifice size for air volume and vacuum pressures. The valve should be capable of pulling the rubber seal away from the orifice while under maximum vacuum, and still be able to meet the air flow requirement.

The l" Pressure Air Release Valve has a standard orifice size of 1/4" at 0 to 150 PSIG. If, for example, a Vacuum Priming Valve was to pass 30 CFM of air at 20" Hg in a priming time of 60 seconds, then the standard valve orifice would not be sufficient. Referring to the orifice discharge data in this catalog, a 1/4" orifice at 20" Hg or 20" Hg x .49 = 9.8 psi can pass approximately 14.3 cfm when 30 cfm is required. The orifice data indicates that a 3/8" orifice should be specified. Similarly, if the orifice size needs to be much larger, than larger valves should be used accordingly.

The valve inlet is piped from a tap on or near the pump, preferably as close as possible. Horizontal pumps should also have the volute piped to the valve inlet in order to remove trapped air from the pump body. This line should not be larger than the size of the tapped plug in the volute.

Sewage or dirty liquid applications require the use of Sewage Air Release Valves. This is so that solids are kept away from the valve seating area. These valves are applied and installed similar to the standard valves. Standard Pressure Air Release Valves are sometimes used directly on the pump or near the pump suction without the need for a vacuum source. This is only possible when the pump suction is flooded and/or under positive pressure. The valve for this application would be piped similar to the vacuum system piping illustrated above. However, the discharge need only incorporate a Vacuum Check Valve to prevent air from entering the system should a negative pressure occur.

UL Series: Universal Air Release Valves (ref. #8)

Occasionally, there are Air Release Valve applications that require both the air and vacuum function and the pressure air release function at the same location along the pipeline. Where this is required, a CRISPIN Universal, Dual, or Combination Air Release Valve should be applied. The Dual and Combination Valves will be discussed in later Technical References.

The CRISPIN Universal Air Release Valve has a large air and vacuum orifice and a smaller pressure air release office. Each function is performed separate from the other by means of a compound lever system. The air and vacuum function occurs only when the valve is filling or draining, and the pressure air release function is provided anytime between the opening and closing of the air and vacuum orifice. The compound lever system in this type of valve is unique to CRISPIN and provides two distinct advantages:

1. Smaller physical dimensions for a more compact valve are possible in most sizes.
2. The mechanical advantages provided by the compound lever system versus the simple lever system allow CRISPIN to offer larger pressure orifice sizes for improved performance. These orifice sizes are consistent with the recommended orifice sizes described in the CRISPIN Pressure Valve sizing information.

Low Pressure Air Release Valve applications require the use of soft seating materials, as has been previously described in Technical Reference No. 2. When this softer material is required, it should be specifically indicated to the factory at the time the order is placed. Otherwise, low pressure applications may result in water weeping around the seat of a standard valve.

The Universal Air Release Valve is designed for applications along a pipe line, not on a pump discharge. This application would call for the installation of a Deep Well Air Release Valve (Refer to Technical Reference No. 1). The Deep Well Valve is designed to accommodate the surges associated with air release on a pump discharge. If a Universal Valve were applied in this instance, the lever system would multiply the forces on the float created by a surge of water into the valve. Over a period of time, this could have a detrimental effect on the operation of the valve.

The discharge opening of a Universal Air Release Valve should always be covered with either a protectop for free discharge, or piped to some other point to discharge liquid which may blow by. This is to prevent dirt and other debris from falling onto the seating area. The Universal Valve is sized according to standard Air and Vacuum Valve sizing. The Pressure Air Release Valve sizing is used to check whether or not the standard orifice provided with the Universal Valve is adequate for the application.

Dual and Combination Valves

AL/PL & C Series: Dual and Combination Valves (ref. #9)

The CRISPIN Dual and Combination Valve offers the same function as the CRISPIN Universal Air Release Valve. These valves are applied where air and vacuum and pressure air release functions are required along the pipeline.

Any of these three types of valves—with the same size inlet—will provide the same performance with regard to the air and vacuum function. However, the pressure air release performance will vary with each type.

For example, each size of the Universal and Combination Valve has a specific orifice size at each of the operating pressures. Because of this, pressure air release capabilities are restricted to specific volumes for specific size valves. The Dual Valve, on the other hand, has the flexibility to match the system air and vacuum requirements, as well as the system pressure air release requirement. This means that any size Air and Vacuum Valve can be piped to any size Pressure Air Release Valve.

The flexibility of the Dual Valve allows a wide variety of conditions to be addressed. For example: if the system pump capacity were to dictate an air and vacuum sizing of 2” for air release, then that same capacity would normally require a Pressure Air Release Valve of the midget size. However, if a greater amount of air is expected to be entrained in the liquid because of siphoning through leaky joints or packing, or because of turbulence, etc.., then a larger Pressure Valve with a greater orifice size should be provided. Also, if vacuum release is the deciding air and vacuum sizing perimeter because of pipe slope, size, and/or materials of construction, then the corresponding Universal or Combination pressure air release orifice could be larger than actually required for the system. In this case, the flexibility of the Dual Valve would accommodate the system performance requirements.

The Combination Valve offers the same functions of air and vacuum and pressure air release as does the Dual Valve; however, the Combination Valve provides the integrity of two separately functioning valves in one integrally cast body. The Combination does not have interconnecting piping between the Air and Vacuum Valve and the Pressure Air Release Valve. Instead, the body casting provides the necessary inter-valve ducting.

The sizing of a Dual or Combination Valve requires the same data and parameters as used in sizing the standard Air and Vacuum Valve and Pressure Air Release Valve. Subsequently, if the required pressure orifice size varies from the standard pressure orifice provided with each Combination, then a Dual Valve with its flexibility can be applied to accommodate specific orifice requirements.

Both Dual Valves and Combination Valves are constructed with the exclusive CRISPIN peripherally-guided air and vacuum float design (Refer to Technical Reference #2). This design yields the repeatability of drip tight seating over extended periods of time.

The throttling device, which is the deep well top, can be fitted to the outlet of the air and vacuum half of either the Dual Valve or the Combination Valve up to four inches inlet size. This provides some control over the air release surge when the line is filling (see Technical Reference #1). A Surge Check Valve can also be used to provide a similar function of controlling or limiting the effects of surge in the Air and Vacuum Valve. How this is accomplished is discussed in Technical Reference No. 10.

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SC Series: Surge Check Valves (ref. #10)

The Surge Check Valve is a normally open valve used to limit the effects of system surges on the Air Release Valve. This is the only function of the Surge Check Valve. It will not eliminate water hammer or its effects on the system.

The CRISPIN Surge Check Valve will close due to the difference in density between air and water. The air will pass freely through both the Surge Check Valve and the Air Release Valve, since the density of the air against the surge check disc is not great enough to push the disc closed. However, as the air is pushed out of the system by the rising water at a specific velocity, the greater density of the water contacting the disc is enough to push the disc closed. Therefore, with the kinetic energy of the water expended in the Surge Check Valve, the Air Release Valve is free to function without the threat of it being slammed closed by exiting water.

The surge check disc is provided with a few thru holes, the quantity of which is field adjusted by replacing or removing machine screws. This adjustment regulates the rate at which the Air Release Valve will fill with water and close.

The Surge Check Valve's design effectively dampens surge pressure and controls exit velocity. Data that reflects the surge in the Air Release Valve, with and without the Surge Check Valve, is only relative in that it indicates that the Surge Check Valve is closed. The adjustable surge check orifices determine the rate at which the Air Release Valve will fill with water. Subsequently, the same Surge Check Valve can provide different surge readings in the Air Release Valve, depending upon the size and number of holes in the disc through which water is allowed to flow. As the orifice area in the disc increases, the relative time between the closure of the Surge Check and the closure of the Air Release Valve decreases. This will create a greater pressure surge in the Air Release Valve than if the open orifice area and the resulting fill time decreases.

Therefore, the evaluation of a Surge Check Valve should not be restricted to a non-defined pressure reading in the Air Release Valve. Rather, the reliability of the valve to close at and above a specific velocity should be the prime consideration.

Surge Check Valves are normally applied on the inlet of an Air and Vacuum Valve, and on a system with a flow velocity greater than l0 fps. Air and Vacuum Valves that are used on the discharge of deep well or vertical turbine pumps should include either a deep well top on the smaller valves, or a Surge Check Valve on those valves larger than 4 inches.

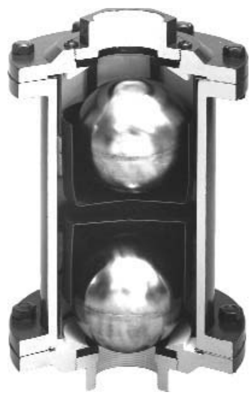
The determination of whether or not a Surge Check Valve is required with the Air Release Valve application can be made by a simple evaluation of the installation.

Cases In Which The Application of a Surge Check Valve is strongly recommended:

—if system line velocities are near or exceed l0 fps.
—if the installation has a Control and/or Check Valve down stream of the air release valve.
—if the potential for surge exists because of piping configurations (valve at the high point in a system with very steep or vertical slopes on either side, and moderate flow velocity).
—if conditions exist for an increase in flow velocity due to the addition of an alternate source.

Negative Pressure Valves

NP Series: Negative Pressure Valves (ref. #11)



The CRISPIN Negative Pressure Valve is similar to an Air and Vacuum Valve; however, the valve does not permit a vacuum to be relieved. The valve is typically used on systems that require a siphon to be maintained for system operation, such as an inverted siphon. Some industrial systems also require that air be released upon system start-up, but not be allowed to re-enter upon shut down.

The Negative Pressure Valve is used at those high points in a system where air is to be released upon filling. After system operation is initiated, those same high points can have the hydraulic gradient below the level of the Air Release Valve, because of system design requirements. This negative pressure will be maintained because the valve design does not permit air to re-enter the system and relieve the vacuum.

The CRISPIN Valve uses a design similar to that used in CRISPIN Air and Vacuum Valves. The floats are peripherally-guided, which allows them to be self-seating at all times. Also, the seats can be easily replaced without removing the flanges.

The Negative Pressure Valves are sized for air release only, and use the same criteria and parameters used for sizing an Air and Vacuum Valve for air release.

Reverse direction of air flow back into the system is stopped immediately upon the formation of a vacuum at the valve location.

It is important to understand that this valve will not release accumulating air from the vacuum line automatically while the system is in operation. In order to release this air through the valve as it accumulates, the hydraulic gradient will have to be raised above the valve. This will allow the air to be forced through the valve by the rising water level as the system pressure, at that point, becomes positive. The hydraulic gradient can sometimes be raised by closing a valve at the end of the system, or by starting a pump to increase pressure. Excess accumulating air can also be removed from the system by applying a Pressure Air Release Valve at the negative pressure location, and connecting the discharge of the valve to a vacuum source. The vacuum source should have a negative pressure greater than the system vacuum. If this accumulating air is not removed, the flow through the siphon will gradually decrease due to a throttling effect.

US Series: Universal Sewer Air Release Valve (ref. #12)

The CRISPIN Universal Sewer Air Release Valve provides two Air Release Valve functions in one valve body, much the same as the CRISPIN Universal Air Release Valve does for clean water systems.

The Universal Sewer Valve is float operated via a compound lever system. A minimum 1/4" thick stainless steel disc seals the air and vacuum orifice as the float is buoyed by the incoming liquid. The valve will continue to function thru the pressure air release orifice as air collects and displaces the liquid level inside the valve.

The stainless steel disc is designed so that solids or other debris which splash onto the seat can roll or fall off, and not interfere with the valve's seating ability. Valves which perform Air Release Valve functions similar to the Universal Sewer Valve usually have an assembly that cradles and guides this disc onto the air and vacuum seat. This cradle can collect and trap solids, which could create leakage at the seating area.

The long body of the Universal Sewer Valve keeps the liquid operating level and subsequent solids deposition away from the valve operating mechanism.

This single body design allows a more compact installation than the Combination Sewer Valve, since the Combination requires two separate valve bodies piped together. However, it does not preclude the use of Combination Valves, since they have more available orifice sizes to accommodate the application requirements.

The discharge opening of a Universal Sewer Air Release Valve should always be covered with either a protectop for free discharge, or with discharge piping to prevent dirt and other debris from falling onto the seating area.

The Universal Sewer Valve is sized according to standard Air and Vacuum Valve sizing. The Pressure Air Release Valve sizing is used to check whether or not the standard orifice provided with the Universal Sewer Valve is adequate for the application. Larger orifice sizes can be accommodated by the application of the custom Crispin Combination Sewer Valve.