General
The presence of trapped air in a pressurized pipeline can have serious effects on system operation and efficiency. As air pockets accumulate at high points, they reduce the effective cross-section of the pipeline in their location, decreasing the water flow, and increasing energy consumption required to pump the water through. Thus reducing the overall system efficiency. A pipeline with many air pockets may impose enough restriction to stop all flow ("airlocks").

The dislodge and movement of the air pockets may change suddenly the fluid velocity and cause pressure surges and pipeline ruptures.

Trapped air pockets may also accelerate corrosion in the pipe material, damage water metering devices and cause erratic operation of control valves.

On the other hand, when a system is being drained there is a necessity to admit atmospheric air into the pipeline in order to occupy the volume of drained water so to prevent dangerous sub-atmospheric pressure in the pipeline that may bring to complete collapse of pipe-sections.

Primary Sources for Air in Water-Charged Pipelines
• Atmospheric air that was trapped within the pipe-system when the pipeline was filled with water. With absence of air discharge devices, this would normally accumulate at local elevated points in the system or vent through customer tapping points.
• Water at normal pressure and temperature can contain approximately 2% (by volume) of dissolved air. The water flow is subjected to varying pressures and temperatures, due to the terrain slopes, variations in flow velocity caused by changing pipe diameters, partially-open valves, etc. and the dissolved air may be released from the water mass, accumulating as large pockets of air in the local peaks.
• Air may be drawn into the pipeline at start-up of deep-well pumps, by the pump suction-vortexes and through leaking joints at zones above the hydraulic gradients (negative-pressure points). Air can also be admitted into the system by air valves under under sub-atmospheric pressure conditions.

After each stoppage of deep-well (borehole) pump, the riser drains from water and should be filled with air. At startup, the water column in the pipe rises rapidly, and in the absence of an air-valve the pressurized air may be forced through the surface check-valve into the main header. Additionally, once the riser is full with water, the sudden increased resistance may cause pressure surges.
The Types and Functions of Air-Valves:

**Kinetic Air / Vacuum Valve:**
- Exhaust large quantities of air from the pipeline when it is filled with water, at low pipeline pressure ("Kinetic" air-release function)
- Admit large quantities of air into the pipe when it is drained, or when the internal pressure drops below atmospheric pressure due to transient conditions in transient conditions ("Kinetic" anti-vacuum function)

**Automatic Air Release Valves:**
- Release small pockets of accumulated air while the pipeline operates under pressure ("Automatic" air-release function)

**Combination Air Valves:**
- A valve that perform the functions of both the "Kinetic" and "Automatic".

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Air Valve locations along a pipeline:

1. High points (relative to hydraulic gradient line).
2. Increase in a downward slope.
3. On uniform, long pipe sections: horizontal run, long descents. Air valves should also be located at even spaces of few hundreds of meters (500 to 1000), as determined by collapse-potential of the pipeline under negative pressure.
4. When the flow velocity is very low, air pockets may accumulate in each local peak, even in small ones, and in steep downhill slopes. It is recommended to eliminate these restrictions by installing air release valves.
5. On the discharge side of deep-well pumps and vertical turbine pumps.
6. Both sides of canal and bridge crossings.
7. Both sides of check-valves, isolating valves and any device that may be closed in the water system, where air may accumulates on one side while vacuum may be created on the other side.
8. Downstream of a pressure reducing device.
9. At any point where the air may accumulate due to local pressure change.
10. At any point where sub-atmospheric conditions may occur during normal or transient conditions.
Overview

- Outlet of reservoir, downstream of the check valve
- Discharge side of pumps, subsequent to a non return valve
- Discharge side of vertical turbine pumps, subsequent to a non return valve
- On uniform, long pipe sections: horizontal run, long descents, and long ascents
- Negative breaks: increase in a downward slope
- Downstream of a pressure reducing device
- Both sides of check-valves, isolating valves or any device that may be closed
- Both sides of canal and bridge crossings
Overview

Sizing principles:
The volumetric air flow through the air valve is equal to the flow rate of the water filling or emptying the system: For each volume of water entering the pipeline, the same volume of air must be expelled, and similarly, for each volume of water drained from the system, the same volume of air should be admitted into the line.

Note: Air is a compressible media, so its density and volume vary with the pressure. The term "volumetric flow" noted above, refers to the volume of air inside the pipeline. It is smaller than the ‘standard’ (atmospheric pressure) air flow when the system is being charged with water, and larger than the ‘standard’ flow when the system is being drained. The tables and charts presented in this catalogue present the standard air flow under atmospheric pressure.
The air flow velocity in the valve depends on three factors:
a. Rate of water flow, at the valve site
b. Orifice Diameter of the valve
c. Geometry of the specific valve
d. Pressure differential between the pipe and the atmosphere
The air flow-velocity through the valve can reach very high values, due to its low density. It is limited only when the velocity reaches the sonic speed, which is practically impossible for the ‘Kinetic’ valve type, but is the normal situation in the case of the ‘Automatic’ valve type. When the system’s internal pressure reaches 0.89 barg, the volumetric air-flow through the orifice becomes constant (critical, sonic-velocity). Increase of the pressure will not result in increased volumetric-flow, though standard air-flow will continue to increase.
As a rule of thumb, the initial design value for air valves should allow maximal ΔH of 0.1 barg across the valve, i.e. pipeline pressure which does not exceed 0.1 bar gauge-pressure while the pipe is filled, or -0.2 barg when it is drained.
However, each system must be inspected to its specific conditions, which the main one is the risk of collapse under sub-atmospheric pressures. Too small orifice results in high air velocity that may cause:
1. Premature closure, before the water reaches the valve
2. A mechanical slam of the float to its seating area when the water has reached the valve, local water-hammer and possible breakage of the valve.
3. Too-small air valve may cause too low sub-atmospheric pressure, which in turn may cause ingress of contaminants into the system and even pipe-collapse.

Ordering guide:

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<td>Note: 2&quot; / 50mm available with K or KA functions only</td>
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*Coming soon

In the example:
Dorot plastic air-valve, size 25mm with BSP threaded connection and with ‘Automatic’ function for line pressure up to 16 bar.