By Kris Kline, Technical Assistant

Air Release Valves – The Good, The Bad, and The Ugly

Why Are Air Release Valves Important, Often Forgotten About, and Some in the Most Unusual Places?

I have heard references to air release valves as "the lost and forgotten". On many systems, these valves receive far less attention than any other pumping or distribution system component. Air release valves are typically installed at the highest point of a pipeline to allow the release of undesired air to protect against unwanted surges and maintain system performance. Air release valves should ideally be placed at strategic higher places where trapped air can accumulate. Air release valves protect and maintain the pipeline system's efficiency. They're ideal for fast releasing vast volumes of air during filling or startup. They also allow air to return into the pipeline while emptying to help prevent negative pressure which can cause pipelines to collapse. A properly sized air release valve is essential for an effective, efficient, and safe air control system.

This photo shows a typical valve arrangement and the vent pipe from an air release valve in a rural water system in southeast Kansas.

The Good

Air Release valves are typically the most neglected devices in any water system. Some are located within a water treatment plant or pump station, while others are installed on the distribution system. For the most part, these devices just seem to work and do their job to release air that gets trapped in the piping. Operators rarely hear or see these devices working, and most of these valves are not inspected, nor do they receive maintenance. Air release valves are generally installed during the construction of new water mains and larger transmission lines to allow air to exhaust during startup. The water mains are filled with water pushing air to the tops of hills, where the air gets trapped. The newly installed air release valve goes to work releasing the air. Once all of the air is expelled from the waterline, the water fills the body of the air release valve and then the internal float closes the valve that allows the air to escape. At this point, the air release valve job is finished, and the valve is typically forgotten about. It may not be checked again for years. In some cases, decades. Everyone hopes or assumes that the valves will continue to function even though forgotten about.

Air release valves serve the same purpose in a water treatment plant or pump station. As the piping winds through the plant, air needs to be released to prevent flow restriction and possible damage to filter media. When water is pumped from a clearwell, trapped air is released through the air release valve. Operators can hear the sound of air being released; they know they are working properly. When the air is released from the piping, pumps function more efficiently. Air in pipelines restricts flow and more power is required to pump the water.

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The Bad

As I had mentioned, air release valves are mechanical devices that are rarely inspected or have any maintenance performed. Sometimes, these devices are randomly installed in the distribution systems at various hilltops, sometimes over hundreds of miles of pipeline. The valves continue to work even though brush and grass have grown around them. During the repair of a pipeline, air enters the pipeline – and the air release valve is required to doing its job to release the air. This is why these valves must be checked for proper operation. Without periodic inspection, it is just a chunk of metal attached to the main that serves no valuable purpose.

The air release valve should be in a pit large enough that maintenance or removal of the valve is possible. A main shut-off valve should be accessible to isolate the valve in case the air release valve begins to leak or needs to be disassembled for maintenance. A drain and flush port should be installed to allow the operator to verify the operation of the unit. Refer to the manufacturer's operating manual for your device for proper installation, maintenance, and repair information. I know that many of these units are not properly installed and certainly are not set up to allow for any maintenance.

Some installations of air releases are clearly contamination hazards. This unit is installed in pit, that although covered, allows surface water to enter. Note the lines of debris on the sidewall of the pit, well above the top of the air release vent pipe.

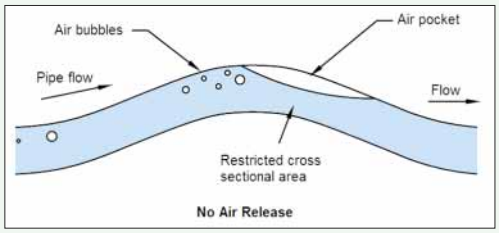
The Ugly

As with any mechanical device that does not receive regular maintenance, at some point, things get ugly and the device is likely to fail. Since I started working for KRWA in 2021 and in previous employment in water systems, I have seen quite a few air release valves being used. When I began as an operator, I will admit that I had no idea what these devices do or that they needed any maintenance. Some of the air release valves that I have encountered at various systems are not correctly installed and many are even a location that makes much sense. If the air release valve is not at the top of a hill or located where it is most beneficial, the operator may consider removing it or relocating it to a place that makes more sense. It begins with how the valve is attached to the main. The main should be tapped at or near the top of the pipeline and not on the side. Sometimes contractors tap them on the side of the main as they would connect a meter setting. That defeats the purpose of the valve. The air release valve can be installed directly above the main or next to a fencline in a pit. The air release valve should be installed at a slightly higher elevation than the waterline pipeline to allow air to make its way to the air release valve.

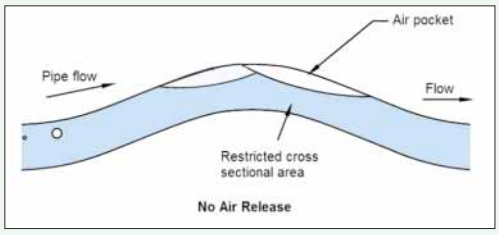
Air release valves can also be a point for contamination. Imagine that if no maintenance or flushing of the air release valve has been done for a decade or more, brush and grass have overtaken the area, and rodents are making nests in the pit where the air release valve is located. The pit may be filled with

The basics of air release valves . . . .

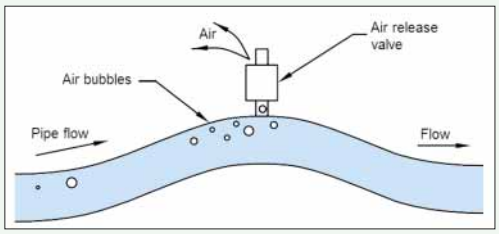
These graphics show installation of an air release valve in a waterline. Problems with air in waterlines is experienced in both rural water and municipal systems.



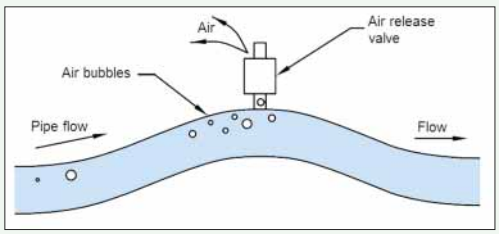
Air in a waterline generally forms on the downhill side of the highest point. This is because of the flow of water in the pipe. Air enters pipelines on startup following installation or shutdowns due to repairs.



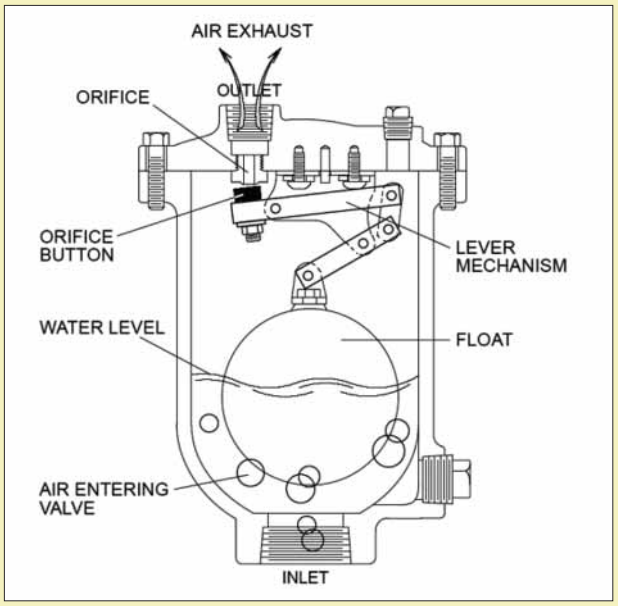
Air in a waterline can result in flow restriction to the point in severe cases of entirely blocking the flow of water. When the air becomes dislodged, water hammer can result as the air may separate and surge forward. causing tremendous pressure differential in the pipeline, resulting in breakage of pipeline or fittings.



This graphic illustrates the proper location of an air release valve.



Air release valves open against internal pressure because the internal lever mechanism multiplies the flow force to be greater than the internal pressure. This results in the orifice opening when air pockets collect in the valve.



The air release valve is designed to automatically remove air pockets at the high points in a piping system. The valve, as shipped, is a normally open valve and will slowly vent air through the top orifice. The float will rise as fluid enters the valve, closing the orifice. As air accumulates in the piping system and enters the valve, the float drops, allowing the venting orifice to open.

The lever mechanism provides a mechanical advantage for the float. The pipeline pressure exerts a strong upward force on the sealing component, the orifice button during system operation. The lever mechanism magnifies the weight of the float so that the orifice will open under high pipeline pressures. Additional ports are provided for flushing, testing and draining purposes.

Graphic and information courtesy of Val-Matic Valve and Manufacturing Corporation, Manual No. ARCL-OM1-2.

stagnant surface water. Sometimes the pipe connected to the top of the air release valve is located in the pit and does not vent above ground. This is as ugly as it gets.

So, if you are a new or veteran operator and not sure what to do with air release valves that the system has, or the system has what seem to be random meters pit in unusual locations with an odd-looking device in it, don't just ignore it. This could be a place for a potential leak or a hazard for the distribution system and water quality. I am pleased to take any question or call concerning the installation, operation and maintenance of air release valves or any other component of a water system. Email me at kris@krwa.net or call my cell at 785/219-1990.

Kris Kline began work with Kansas Rural Water on September 30, 2021 as a Circuit Rider. He obtained his Class IV Water and Class I Wastewater operator certification at Osage City, Kan. and later become the Utilities Director. He also had 12 years of experience as Operation's Manager at Osage Co. RWD 8.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