

AIR VALVES: IMPROVING THE PERFORMANCE OF PRESSURE PIPELINES

Air valves automatically release or admit air during the filling, operation, or draining of a pipeline. For all pipe materials, efficient and safe pipeline operation is dependent on continuous removal of air from the line.

THE EFFECTS OF AIR IN PRESSURE PIPELINES

Air exists in all water pipelines and sewer forcemains. According to *AWWA Manual M51*, there are many sources of air. One is the water itself, which contains at least 2% dissolved air by volume in standard pipeline operating conditions. Air collects in pockets at high points along the pipeline and can be detrimental if not controlled.

Air pockets:

- Reduce cross-sectional flow area, affecting pump efficiency and increasing energy costs
- Magnify surge pressures, which can damage the pipe and pipeline components
- Can create unsafe conditions for tapping of pipe
- Will prematurely wear equipment like pumps and may cause other equipment like control valves to operate erratically

There are three main types of air valves installed in pressure piping systems:

- **Air release valves** continuously release small quantities of air from a pressurized line. Also known as “small-orifice air valves” and “pressure air valves.”
- **Air/vacuum valves** discharge large quantities of air from non-pressurized pipes and are used mainly when filling a line. As well, they make it possible to admit large quantities of air when lines are drained or when the internal pressure drops below atmospheric pressure. Also known as “large-orifice air valves,” “low-pressure air valves,” “vacuum breakers,” and “air-relief valves.”
- **Combination air valves** act as both air release and air/vacuum valves by continuously releasing small volumes of air in pressurized lines and by emitting or taking in large volumes of air when filling or emptying a system. Also known as “double-orifice air valves.”

AIR-VALVE PLACEMENT

Air valves are typically used on sewer forcemains and water transmission lines, but may not be needed on smaller water distribution pipelines, where hydrants and service lines provide means for venting entrapped air. They should be installed at locations such as: high points, abrupt increases in downslope, abrupt decreases in upslope, long ascents or descents, and at the beginning and end of long horizontal runs.

DESIGN OF VALVE ORIFICE SIZE

Per *AWWA Manual M51*, the design of orifice size is affected by the pipe’s internal pressure, the shape of the valve orifice, and the difficulty in determining the amount of air that may need to be vented. The *Manual* provides a sizing method, but emphasizes that the valve manufacturer should be consulted to verify the accuracy of assumptions made in the design process.

ADDITIONAL INFORMATION

For additional information on the design of air valves, see Chapters 3 and 4 of *AWWA Manual M51*. For information on the design, operation, and maintenance of a specific product, contact the air valve manufacturer.

References: “Air-Release, Air/Vacuum, and Combination Air Valves,” *AWWA Manual M51*; and “PVC Force Main Design,” *Uni-Bell UNI-TR-6*