Drinking Water Tech Tips

Sanitary Protection of Reservoirs: Vents

331-250 • Revised June 2021

Stored Water Sanitary Protection: Reservoirs must have adequate sanitary protection to prevent the water supply from being contaminated. Drinking water regulations require reservoirs to prevent entry by birds, animals, insects, excessive dust and other potential sources of contamination. You must correct unprotected reservoir openings as soon as possible.

Finished water storage facilities must have dedicated, screened atmospheric vents designed to allow air in and out to balance internal pressures when water levels change (WAC 246-290-235). An overflow may not serve as an atmospheric vent.

Water storage tanks must be free of any potential pathways for contaminants to enter. Poorly designed or maintained vents and screens are known sanitary defects. These pose unnecessary risks to public health that can lead to illness, unsatisfactory coliform samples, more frequent sanitary surveys, boil water notices, additional sampling or treatment requirements, public notice, and legal liability.

Vents should be constructed and maintained to avoid plugging or air restriction from ice build-up or snow accumulation. The screened vent opening should be at least 24 inches above the roof or ground for buried or partially buried tanks. Elevated tank vents can be 12 inches above the tank top. Vents that are expected to operate in very deep snow or areas with heavy ice buildup may need to take additional precautions such as heating elements, pressure vacuum screened vents, or vacuum relief valves.

Use reasonable security measures to protect the reservoir and stored water from possible damage and compromise by unauthorized persons—WAC 246-290-415(8). Properly anchored vents constructed of more vandal-resistant materials provide better security.

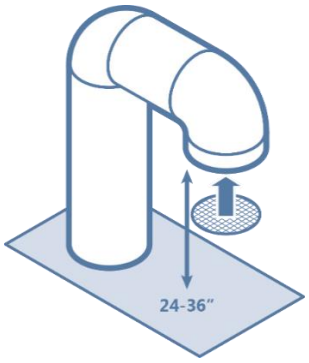
General Principles

- You will need to repair older, improperly designed vents that don't adequately protect stored water or replace them with secure, durable vents. Many common types, such as turbine, vacuum, and attic roof vents, were designed to draw smoke out of a chimney or vent an attic. They were not designed to protect drinking water storage tanks.
- A good vent design must also be properly sealed and anchored to the tank to keep surface water from seeping into the interior. A bolted, flanged base-plate with an approved sealer or epoxy is a good approach with concrete tanks. Steel tanks usually have welded base structures. Many older designs are simply inserted in holes drilled in the storage tank roof and so poorly sealed that they allow surface water to enter.
- Vent design **must** prevent the entry of water that has come into contact with any surface, in the event the surface itself is contaminated; e.g., bird droppings. Unacceptable designs include those that allow animals to nest on the vent screen.

- Screened openings should be observable, to confirm screen integrity. To reduce maintenance, all vent components should be constructed of corrosion-resistant materials.
- Tank tops should be kept clean to prevent build-up of leaves, moss, pine needles, branches, and other debris. These can harbor *E. coli* and pathogens like *Salmonella spp.*, which are found in bird droppings. Surface water is highly contaminated, making a vent sanitary defect a possible threat to public health.
- All systems must have an active Operations and Maintenance Program to document routine self-inspections, the results, and follow-up work. For guidance on routine preventive maintenance, see *Preventive maintenance program: Guide for small public water systems using groundwater* 331-351. Routine inspections can also detect damage from corrosion, vandals, severe weather, or animal activity.

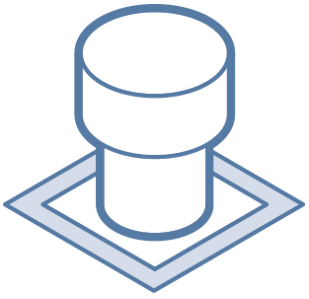
Examples of Good Vent Designs

Vents must have screens to keep insects and animals out of the reservoir. We recommend using durable 24-mesh noncorrodible screen backed with 4-mesh screen. Vent openings must face downward or have shielding to minimize the entrance of insects, rainwater, rain splash, and excessive dust. Modern vent designs protect against icing, vacuum conditions, and tampering. Vent size must be adequate to relieve vacuum during peak-flow conditions. Consult with an engineer when retrofitting vents on larger steel reservoirs to avoid structural damage caused by inadequate vent capacity, especially if vents may experience ice buildup.



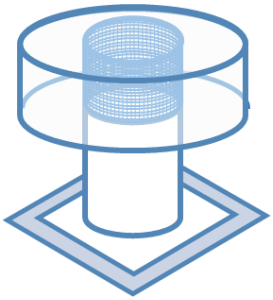
Gooseneck or J-Type Vents

These vents are generally considered to provide adequate sanitary protection. They may be constructed out of PVC, steel, ductile iron, or other material. All vents must be sealed and secured to the roof to keep out contaminated surface water and to deter vandalism. The screened open end should be the recommended minimum height above the roof to extend above snow levels, to keep out water splatter, and prevent pulling in contaminated dust.



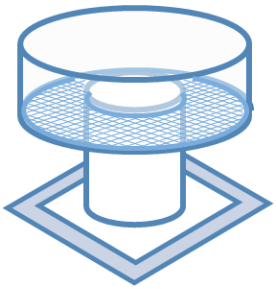
Mushroom-Style Vents

These vents, made of durable noncorrodible steel, have an internal downward or vertical screen with hood shield and are secured or sealed to the reservoir roof to keep out contaminants. If constructed of sturdy material they provide added security from tampering.



Mushroom-Style Vents with Shrouds

These vents have a wrap-around shield to protect from precipitation and splatter from surface water potentially contaminated with disease causing microorganisms such as *Salmonella spp* from bird feces. The shroud may be part of the original vent design or added to improve the sanitary protection of an existing vent.

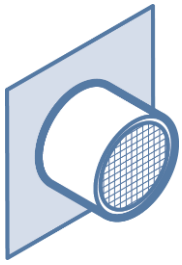


Mushroom-Style Vents with Shrouds

Vents like this have screens facing downward providing excellent protection. Some commercial models may have multiple screens that are designed to relieve vacuum conditions if they become covered in ice.

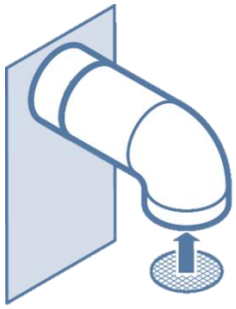
Examples of Poor Vent Designs

Many existing reservoir vents are deteriorating or poorly designed and require upgrades to protect stored water adequately. Replace poorly designed, damaged, or deteriorated vents with vents made of durable material and adequate security to keep contaminants out.



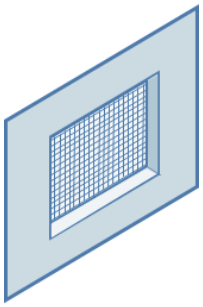
Sidewall Vents—not the Same as Overflows

A screened opening on the side of a tank provides little or no protection from rain, tank run-off, or windblown contaminants. Install a downward facing extension or hood, and screen the downward-facing open end. An overflow is not considered a vent. Overflow outlets must open downward. **You must modify these or install a dedicated vent.**



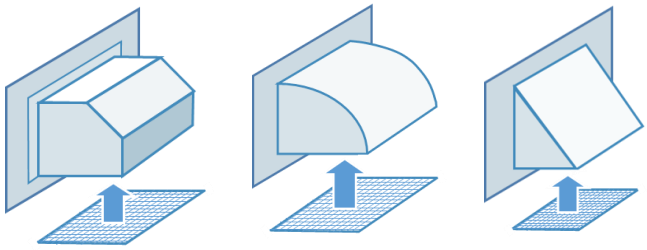
Modified Sidewall Vents

Sidewall vents that are constructed of a length of pipe can usually be modified with a pipe elbow connection and a 24-mesh noncorrodible screen cover. Again, it is important to point out that every finished water storage tanks must have dedicated atmospheric vents; WAC 246-290-235(1). Vents like this, if located at the top of a storage tank, will be very difficult to inspect regularly. If this is not used as an overflow it is a good design that provides adequate sanitary protection.



Sidewall Vents

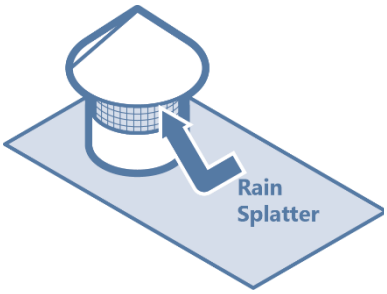
When sidewall vents are not a standard round shape they will have to be modified with a hood that directs the opening downward. Wood stave tanks and storage tanks with top sections constructed of wood framing usually have wide areas of sidewall screen that is not protected from rain, tank run-off, or windblown contaminants. **You must add a shield or replace them with an acceptable design.**



Installed Rain Covers

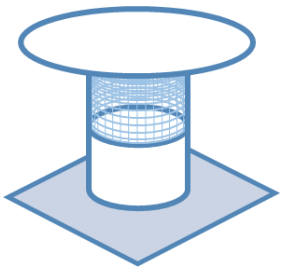
These may be installed over sidewall vents. Ideally, the screens will be on the downward facing opening. Screens that extend over larger areas will be very difficult to shield from contaminants.

Acceptable Vent Design



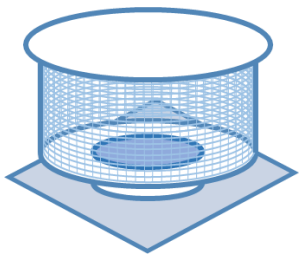
Chimney Vents

The screened area is not adequately hooded. The screen must be high enough off the roof to prevent rain splatter from entering the vent. They are typically not adequately sealed to the roof top to keep out surface runoff. Thin galvanized steel construction is prone to corrosion or structural failure. Check the strength of the connection and the integrity of the seal between vent and reservoir roof. **You must replace them or modify them to provide adequate sanitary protection.**



Vents without Rain or Spatter Protection

This type of vent is common on small or large storage tanks. They can vary widely in shape and size. The sanitary risk is the exposed screen area that is not shielded from rain, splatter or dust. These vents can be modified by installing a protective shield (shroud) over the screened area. **You must add a shield or replace them with an acceptable design.**



Vents without Rain or Spatter Protection

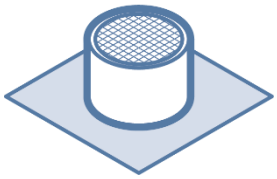
This type of vent has the same sanitary defects as those shown above and pose the same contamination risk. They are commonly found on very large welded steel tanks with capacities of millions of gallons. **You must add a shield or replace them with an acceptable design.**

Turbine Vents

You cannot retrofit these vents to eliminate the potential for contaminants to enter. They are designed to vent smoke from chimneys, not to vent finished water storage tanks. There may not even be a screen installed. Wrapping them entirely in a fragile, easily damaged screen is not an adequate fix. **You must replace them with an acceptable design.**

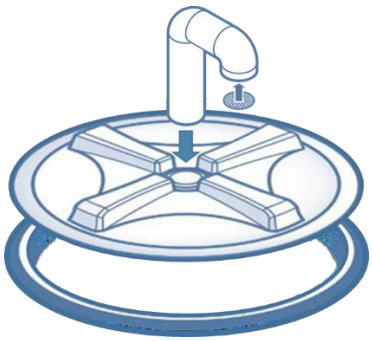
Vacuum Chimney Vents

You cannot retrofit these vents to eliminate the potential for contaminants to enter. They are designed to vent smoke from chimneys not to vent finished water storage tanks. The screen inside allows contaminants to fall directly into the tank. Wrapping them entirely in a fragile, easily damaged screen is not an adequate fix. **You must replace them with an acceptable design.**



Upward Facing Vents

A screened or unscreened upward-facing opening provides no protection from contaminants. Rain can enter and animals can nest on them. **You must replace an upward-facing vent with an acceptable design.**



Plastic Tank Built In Vents

Most plastic tanks have small poorly constructed vents built into the hatch lid. These do not keep out contaminated water or other material that may be present on the top of the lid. These must be sealed and a proper vent installed such as the inverted pipe vent shown here. **You must seal the existing vents and install an acceptable design.**

Other Considerations

- Vent area should be large enough to limit the pressure drop in the tank under all operating conditions, including worst case scenarios (e.g., broken transmission main).
- Inspect storage tank vents at least once per year. You must replace corroded, broken, or missing screens and other unprotected openings as soon as possible.
- Make reservoir vent inspections a routine activity and schedule them as part of an Operations and Maintenance Program. Take photos documenting the condition of screens. Climb tanks under safe conditions and good weather. Don't wait until the lab reports contamination to perform an inspection.
- Inspect reservoir vents after severe weather, storms, or high winds. Falling limbs can damage vents and vent screens. Trimming or removing trees that overhang a storage tank can prevent significant costs from tree falls and reduce or eliminate debris build-up from leaves, branches or needles.

For more information

Our publications are online at doh.wa.gov/drinkingwater.

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