CRITICAL PROCESS FILTRATION, INC.

Tank Vent & Process Gas Filters for Bottled Water Production

Most processes for production of spring water, purified water, distilled water, even deionized water, are operated to be "bacteria-free". Keeping a system free of bacteria is not necessarily a regulatory requirement, even pharmaceutical water for injection is not required to be bacteria-free, but bacteria free operation is still the goal of most operators.

Several methods may be used to keep bacteria and other airborne microorganisms from entering the system, including filtration of the air that enters storage tanks as they are emptied. This document looks at how tank vent filters fit into the array of tools used to prevent contamination of bottled water by bacteria and mold.

Prevention AND Remediation

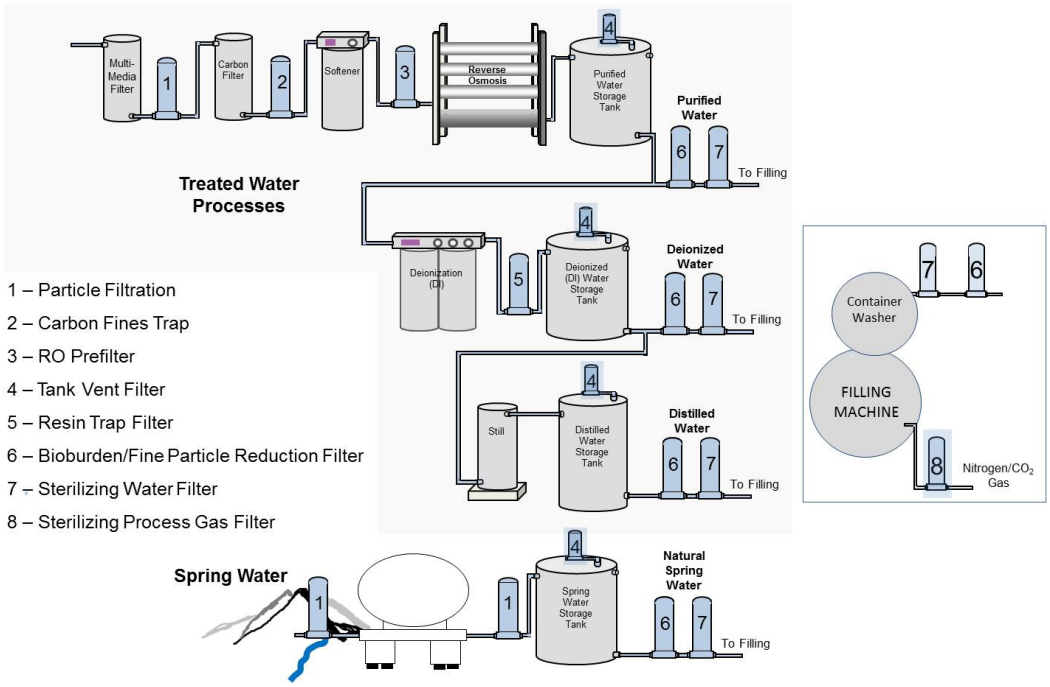
Most of the time, the old saying "an ounce of prevention is worth a pound of cure" is true. Preventing an unwanted event is usually easier than repairing whatever damage is done if the event occurs. However, in virtually all water systems, including bottled water systems, it is safe to assume that BOTH prevention and remediation are needed to control microorganisms.

For our purposes, we will define prevention as not allowing bacteria to enter the system. The best way to do that is to design the system using components that are operated with a minimum of maintenance and create barriers wherever there is the potential for bacteria or other organisms to enter from outside sources. Keeping the system components sealed and barriers in place is usually very effective. Unfortunately, almost any maintenance activity requires opening system components, exposing the interior of the system to the atmosphere and letting bacteria and other airborne organisms enter.

Since it is almost impossible to totally prevent bacteria from entering a system, remediation steps are needed to prevent the growth or microorganisms. Those steps can take three basic forms: 1) inhibiting organism growth with high temperatures or high flows, 2) killing microorganisms using system sanitizing/disinfection with heat or chemicals, and 3) physically removing organisms (liquid filtration).

Using both prevention and remediation places multiple obstacles in the way of bacteria and mold that might affect product quality and potentially harm consumers and your brand.

Figure 1 - Filters in Bottled Water Production and Packaging



Application Summary

Why Tank Vent & Process Gas Filters?

Whenever a tank is emptied, the volume of liquid removed has to be replaced by an equal volume of air or process gas. Otherwise the tank will experience a vacuum condition and implode. As discussed above, outside air contains bacteria and other organisms which have to be removed before the air enters the tank. If used, process gas can also contain particles and microorganisms.

Figure 1 on the previous page shows multiple filters to control particles and bacteria in a process water system. The filters on the tops of tanks (marked 4 in the diagram) are used to filter the air directly in contact with water in the tanks. These filters protect the water from particulates and microorganisms in surrounding air. The housing marked 8 is used to filter process gases that might be used to displace air during filling. This gas, usually nitrogen or carbon dioxide, may be used to limit the oxygen in bottles for product quality reasons.

The tanks used in bottled water systems, even tanks made of stainless steel, do not tolerate excessive pressure or vacuum. Both conditions can cause structural bulging or tank implosion. Therefore, as a tank is filled or emptied, the air inside is allowed to escape or is replaced by outside air or process gas. The vent filter removes possible particle and microorganism contamination.

Filters for Air vs. Liquid

Filters used for liquid applications are made of materials that attract water – are "hydrophilic" – and allow the flow of water with low resistance. For air filtration, it is critical that the media remain dry. If the media becomes wet, and the pores are filled with water, then the air flow is restricted and the pressure or vacuum inside the tank can reach critical levels and cause tank failure. The various media used for air filters are made using materials that repel water – are "hydrophobic" – and resist wetting from water vapor or water droplets.

Choosing the Final Filters

Critical Process Filtration's PTFE membrane and high capacity hydrophobic PVDF membrane-based cartridges and capsules are utilized for ambient temperature storage tanks. If the storage tanks are maintained at elevated temperatures, or frequently sanitized using heat, then the operator should use specially designed PTFE membrane cartridges made for continuous high heat applications (70ºC to 80ºC).

If sterilizing filtration is required for the tank vent and process gas filters, then it is important to remember that sterilizing filtration is defined as removing all bacteria. Filters claiming to be sterilizing must be supplied with proof that they can remove organisms the size of those targeted in the user's system. The pharmaceutical industry has accepted successful removal of surrogate organisms by specific filter membranes as proof that a filter can remove organisms of similar size. The organisms are defined for each pore size rating. The testing is according to an ASTM standard (ASTM F838-05, rev 2013) that requires COMPLETE removal of all test bacteria when a filter is challenged with at least 10^7 organisms per cm^2 of membrane surface area. This level of challenge is extremely unlikely in actual applications.

Critical Process Filtration provides filters tested using the ASTM standard with 0.10µm filters challenged with *Acholeplasma laidlawii*; and 0.22µm challenged with *Brevundimonas diminuta*. The sterilizing filters are supplied with a certificate of compliance stating that the filter has passed the required quality control tests.

Figure 2 – Critical Process Filtration's pleated filters with multiple membrane options are used for bacteria removal.

Filter Options

The filters chosen must be designed to function after whatever disinfection or sterilization process will be used. The organisms targeted for removal also need to be considered.

Critical Process Filtration has several filter options, as shown in the table below. These filters are available as cartridge filters and disposable capsule filters as well is in flat disc form for laboratory scale testing.

Contact Critical Process Filtration for help determining the best filter options for you.

Media Options for Tank Vent and Process Gas Filtration in Bottled Water Production

Process Area	Filter Application	Filtration Function	Critical Process Media*
Bioburden Control and Sterilizing	Tank Vent Filtration	Prevent bacteria from entering tanks when liquid is drawn from them	TM, PVWB
	Process Gas Filtration	Prevent bacteria and particles in process gas from entering packages	TM, PVWB

*Media Codes
PVWB = High Capacity Hydrophobic PVDF Membrane TM – PTFE Membrane

Visit our website or contact us for more information and to access data sheets on all of our products.

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