



Applications for Steam in the Food and Beverage Industry



16400 Swash™ Steam Generator

ABOUT ARS/PRESSURE WASHER COMPANY

ARS was established in 1971 to provide sterilizing and washing equipment and field maintenance and repair services to food and beverage firms, hospitals, laboratories and pharmaceutical or medical device manufacturers. Our equipment and service have earned us an outstanding reputation among our customers who have come to rely on ARS.

Our philosophy is to provide dependable equipment incorporating high quality components. The ARS team is dedicated to the highest standards of workmanship. Our pride rests on your satisfaction with the products and service we provide. We believe that with ARS you can achieve many years of reliable performance and an overall low cost of ownership.

STEAM AS A MEANS OF DELIVERING HEAT

Dry saturated steam, generated by an electric steam generator, contains no boiler additives and provides a clean and effective way of delivering heat to surfaces it contacts. In contrast to hot water which gives up its heat by absorption, an inherently slow process, steam delivers heat through the very rapid process of condensation. With sufficient time and temperature, and the moisture derived from the condensation process, heat destroys the proteins which form the cells of the microbes and can result in sterilization of the surfaces in contact with the steam or, in the case of porous materials, the material itself.

The heat required to cause a volume of water to be converted into steam at the same temperature is called the latent heat of vaporization. When steam comes into contact with a surface having a lower temperature, it virtually instantly condenses and all the latent heat is absorbed into the material it touches. As a result, a surface can be heated far more efficiently with 212° F steam than with 212° F water. The pressurized chamber of an electric steam generator efficiently produces 97% dry saturated steam and delivers significantly greater amounts of heat than can be achieved with hot water heaters in far less time and with significantly lower water consumption.

The amount of heat delivered by a steam generator is expressed as BTUs in thousands per hour which is directly derived from the number of pounds of dry saturated steam produced by the steam generator in one hour. With an electric steam

generator, the number of BTUs per hour directly equates to the number of kilowatts consumed. This in turn directly equates to the "boiler horsepower." As an example, a 10kw steam generator is rated at 1.0 B.H.P. or boiler horsepower. It is rated to produce 34.5 lbs. per hr. of steam which equates to 33,500 BTUs per hour. The water consumption necessary to produce this amount of steam is only 3.1 gal. per hr. (Note: boilers and steam generators are rated on the basis of using 212° F feed water. Lower feed water temperatures reduce the steam output accordingly. It is not recommended that feed water be greater than 140° F unless the feed water pump is designed for hot water use.) These calculations are directly proportional, so a 20kw steam generator puts out exactly twice the amount of steam and heat as a 10kw unit and consumes exactly twice the gallons of water per hour. Furthermore, at a given voltage, the amperage draw of a 20kw steam generator is exactly double that of a 10kw unit.

Electric steam generators are extremely efficient and safe. Approximately 98% of the energy from the heating elements is converted to steam with very little heat loss into the room. Heat up time is typically not more than 10 minutes. These units are completely safe for indoor use because there is no open flame, no fumes, no combustible fuel and no fuel storage as is the case with natural gas or diesel fired boilers or pressure washers. Various configurations are available for fixed, centralized installations or with wheels for portable use.

BOTTLING LINE STERILIZATION WITH STEAM

Steam is the most effective means of achieving sterilization of a bottling line. Taking advantage of the latent heat of vaporization, steam, because it is a gas, distributes heat everywhere in the bottling line. As it contacts the colder surfaces, it condenses and gives up its heat. When sufficient heat is delivered, sterilization can be accomplished. In addition to the much greater efficiency in delivering heat compared to hot water, steam can effectively deliver heat into nooks and crannies where it is difficult to get liquid water, ozonated or not, to go. Most in-line filters are also rated for steam sterilization. (Check with the supplier.) As a result, the entire bottling line from filter to filler spout, can be sterilized with steam.

When sterilizing a bottling line, especially with in-line filters, it is very important to lower the output pressure of the steam generator to not more than 25 psi. An FDA and NSF-approved steam hose rated at 100 psi and 300° F is recommended with suitable fittings to attach one end to the steam generator and the other to the sanitary input of the filter housing or bottling line. All the filler spouts should be open. It is recommended that the steam output valve be opened part way until it is evident from dripping condensate, that steam has passed through the filters. Once flow has been established, the valve can be opened all the way. This increases the flow but the pressure is never higher than 25 psi.

The inside surfaces of the bottling line will gradually heat up and liquid condensate will be pushed out of the filter spouts. When the inside surfaces of the bottling line are at approximately 212° F, very little condensate and mostly steam will emerge from the spouts. To better assure sterilization, it is recommended

that the process be continued for at least 15 minutes after achieving approximately 212° F. If the bottling line is to be used immediately, it is recommended that it be cooled with clean tap water.

USE OF STEAM WITH OAK BARRELS

Tartrates which deposit on the inside surface of wine barrels are typically removed by melting and rinsing. When hot water is used, the typical temperature delivered to the barrel is rarely above 180° F. In comparison, when steam is utilized, the temperature inside the barrel reaches 212° F. As a result, substantially more heat is available to melt the tartrates. In addition, the latent heat of vaporization delivers additional heat making the process even more effective.



Bordeaux Style Wine Barrel Steam Wand

Because steam is a gas, it can also penetrate the pores of the wood more effectively than water. In the process of penetrating the wood, it is thought that wine absorbed in the wood during aging is displaced and can be rinsed out of the barrel.

Finally, in the process of cleaning a barrel with steam, the steam is permitted to flow for a recommended period of 3 to 5 minutes after which the steam wand is removed and the bung is replaced while steam remains in the barrel. As the steam condenses back into water, the water occupies less volume and a vacuum is created. By pulling a vacuum, it is believed that

residual wine in the pores of the wood is extracted. The flow of residual wine from the pores of the wood into the inner space of the barrel is thought to help pull or loosen the tartrate crystals from the surface of the wood. In the event there is a leak in the barrel, this vacuum will not form. By removing the bung after a few minutes, it is easy to determine if a vacuum is present or not. As a result, cleaning a barrel with steam provides a built-in, convenient leak test. Since this leak test is conducted with a gas versus a liquid, it is more effective in detecting leaks.

Critics of steam in barrels often say that the heat will volatilize certain compounds in the oak which impart flavor to the wine. In an unpublished study conducted at ARS/Pressure Washer Company, thermocouples were embedded at varying depths in the staves and at locations around the barrel. A thermocouple was also placed in the steam wand and one was suspended in the barrel. The temperature inside the steam wand was slightly higher than 212° F due to back pressure in the wand. In the open space of the barrel, the temperature was the expected 212° F of atmospheric steam. However, oak is such an effective insulator that at a depth of only 1/8" into the wood from the inside of the barrel, after 20 minutes of steaming, the temperature was only 90° F. At this temperature or less, it is unlikely that flavor enhancing compounds would be volatilized.

When steaming barrels, it is critically important to insure that too much pressure does not build up inside the barrel. Special steam wands are available that have built-in pressure relief features to protect the barrel. Failure to take such precaution can result in damage to the barrel and potentially consequential damage from failure of the barrel to contain the pressure. The steam generator should be set at an output operating pressure of no greater than 25 psi.

STEAM CLEANING AND STERILIZING TANKS

Various substances, including tartrates in the case of wine storage tanks, will cling to the interior walls of the tanks. Typical practice is to use a pressure washer, usually with hot water, to blast the inside surface of the tank. To accomplish this, it is not uncommon for a person to enter the tank through the manhole to direct the flow from the pressure washer gun. At best, the process is wet and messy. At worst, it is dangerous.

Steam offers a safe alternative that not only is effective in cleaning the tank, but also can be effective in sanitizing or even sterilizing the inside of the tank, all without the use of any chemicals. An FDA and NSF approved steam hose rated at 100 psi and 300° F is recommended with suitable fittings to attach one end to the steam generator and the other to the sanitary port on or near the bottom of the tank from which the contents is typically pumped out. A port or manhole at or near the top of the tank should be opened or left ajar to insure that the steam cannot pressurize the tank. The steam generator can be operated at a higher pressure of up to 80 psi as long as a valve or manhole on top is open to insure that the tank is not pressurized. The higher the output pressure of the steam generator, the faster the tank will be heated due to the increased flow of steam. Depending on the size of the tank, the output rating of the steam generator, and the ambient temperature, the process of cleaning, sanitizing or sterilizing a tank can take anywhere from an hour to as much as several hours.

Due to the efficiency of electric steam generators, very little water will be consumed in the process. With a typical 20kw steam generator, only 6.2 gallons of water will be used per hour. With a typical pressure washer rated at

3 gallons per minute, the same amount of water is consumed in only two minutes. After a suitable amount of time, the exact amount of which will need to be empirically determined in each facility, the steam supply is shut off and the bottom of the tank is cleaned out through the manhole.

STEAM CLEANING AND STERILIZING PIPING

The same principles for cleaning, sanitizing, or sterilizing the bottling lines and tanks, applies to stainless steel piping. With a suitable arrangement, steam can be directed to flow through the piping to affect sanitization or sterilization. Some assurance that the inside surface has achieved 212° F is desirable after which it is recommended that the steam continue to flow for at least 15 minutes. In some facilities, the piping can be sanitized or sterilized at the same time as the bottling line or tanks. If the steam generator is not of sufficient size, the added time as a result of heat loss through the piping could prohibitively lengthen the cycle for the bottling line or tank. It is also important that piping be self draining when using steam. If liquid water is allowed to "trap" in the piping, it will block the flow of steam and prohibit effective sanitization or sterilization.

While the piping itself can withstand the maximum 80 psi output of most steam generators, if the piping is being sterilized in place (SIP) with the bottling line, the lower pressure required for safety on the bottling line will dictate the appropriate output pressure setting for the steam generator.



Steam rated hose with sanitary fittings.

STEAM CLEANING AND SANITIZING FACILITY SURFACES AND EQUIPMENT

Most, if not all, bacteria typically found in and around food and beverage facilities are killed on contact with atmospheric steam. As a result, steam is a very effective way to reduce the bacteria count in any process area.



Steam gun for facility cleaning.

One accessory to a steam generator is a steam gun especially designed for safe application of steam. It is hooked to the steam generator with a steam rated hose, and steam is directed to the walls, floors and outside surfaces of equipment to kill bacteria or substantially reduce the bioburden on contact. With atmospheric steam, very little water is left behind as most evaporates quickly into the room air. Certain steam guns are outfitted with a second smaller hose through which water is drawn by venturi action into the steam flow. Using a bucket as the water source, with optional soap, detergent or chemicals added, the surfaces can be cleaned prior to sanitizing with steam alone.

Another application for steam is for cleaning vehicle motors. Care must be taken to insure that damage to plastic or other parts of the engine do not occur when using steam.

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PRODUCT LINES REPRESENTED

ARS/PWC

- Swash™ steam generators
- Swash™ winery cleaning system
- Swash™ manual rotating barrel washer
- Swash™ barrel steam wand

Electro-Steam Generator Corp.

- Steam Generators
- Cleaner/Sanitizers
- Spa Steamers

Hydro Tek Systems

- Pressure Washers
- Wash Water Recovery Systems

Moog Cleaning Systems

- Bung-hole Up Barrel Washers
- Semi-automatic Barrel Washers

Bitard

- Original French Barrel Rinsers

Fogmaster Corporation

- Barrel Room Humidification System
- Sprayers

Miele Appliances, Inc.

- Glassware Washers

Hygienic Pigging Systems

- Piping Recovery and Cleaning Systems

Athena Controls

- Fermentation Tank Temperature Controllers

For more information on ARS/PWC products or services, or for the name of the ARS/PWC representative in your area, please call us at **(800) RELY-ARS (800-735-9277)** or visit us at our website: www.cleanwinery.com

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