



## SANITATION OF FILLING MACHINES FOR FOOD AND BEVERAGE APPLICATIONS

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Food safety continues to gain increased focus and is an important part of the food production process. Various factors have raised awareness of food safety including:

- ✓ An increasing number of food pathogens that spread food borne illnesses.
- ✓ Escherichia coli (E coli) and Salmonella enteritidis (Salmonella) pathogens have become more widespread.
- ✓ Bacteria are becoming more resistant to antibiotics.
- ✓ An increased threat of bioterrorism and contamination of the food supply chain.

From raw materials to finished products, meeting food safety standards is critical during food processing. Proper sanitation and operation of filling machines is an important step in the process. Other factors, such as filling machine design, handling and storage of packaging materials and ingredients, general plant practices or Good Manufacturing Practices (GMP), and sanitation/operation of other food processing equipment and transfer systems also play key roles in meeting food safety standards. This paper will focus primarily on sanitation of filling machinery associated with food processing.

### CHEMICAL SAFETY

Plant personnel should always observe general safety instructions, plant safety regulations, and manufacturer's safety instructions and warnings when operating, cleaning, troubleshooting, or maintaining packaging machinery. Failure to observe proper safety precautions can result in equipment damage, personnel injury, or even death.

Chemicals are widely used throughout the food manufacturing process, particularly during sanitation of plant equipment. Sanitation personnel should always observe plant postings and chemical warning labels to ensure the safe handling of all chemicals. As a minimum, the

following general rules should always be observed when handling chemicals:

- ✓ The product label of all chemical containers should always be read, understood, and followed when using chemical products.
- ✓ Always follow the safety precautions outlined in equipment manuals, plant policies and procedures, and material safety data sheets for chemicals and substances used.
- ✓ Store, transport, and dispose of all chemicals according to the chemical manufacturer's instructions.
- ✓ Chemicals should only be used and handled by persons fully trained in the use and handling of chemicals.
- ✓ Always use protective equipment such as, goggles or face shield, rubber gloves, aprons, and boots when handling chemicals.
- ✓ Pant legs should always be worn outside and over protective rubber boots to prevent the boot from catching and holding chemical spills and/or hot water.
- ✓ Do not overfill detergent pails or containers as this can lead to spillage which in turn could cause burns to the feet, damage to the floor, and/or promote slipping.
- ✓ Do not pour chemicals into a tank or vessel over your head or at eye level. Use a stool or ladder when adding chemicals to an overhead vessel to ensure your waist is above the tank level.
- ✓ Use a barrel truck or appropriate lifting equipment when handling heavy chemical containers or barrels.
- ✓ Keep chlorine based chemicals separated from acid based chemicals at all times. These types of chemicals are

incompatible and may result in dangerous reactions when mixed.

- ✓ Properly coil hoses on the storage hose racks after use. Uncoiled hoses lying on the floor increase the possibility of someone tripping and falling.
- ✓ Always close chemical containers tightly when not in use.
- ✓ Ensure workspaces are properly ventilated when handling chemicals. Chemical vapors can be dangerous if inhaled.
- ✓ Some chemicals can cause burns if contacted with the skin or eyes. Use eye wash stations and safety showers if these chemicals contact the skin or eyes. Report chemical burns to a supervisor. See a doctor after flushing the area with generous amounts of water.
- ✓ Some chemicals are flammable in nature. Make sure no flames, sparks, or smoke is in the area of flammable chemicals.
- ✓ Some chemicals can be explosive or toxic when mixed with other chemicals or substances. Always know the dangers associated with the chemicals in use and never mix chemicals except in accordance with the manufacturer's instructions.
- ✓ Always be prepared and know what to do in the event of a chemical emergency. Know the required antidotes and basic first aid for all types of chemical accidents.
- ✓ Many containers and chemicals look alike. Always read the label and know the chemical you are using before using it.
- ✓ Only take as much chemicals as required to the work area. Never store leftover chemicals in the work area and/or in unmarked containers.
- ✓ Add chemicals slowly when mixing with water. Dumping chemicals into water can cause boiling, splashing, or even explosion. Do not allow cleaning solutions to boil unless specifically instructed to do so.
- ✓ Never add water to concentrated chemicals. Powdered caustic or other concentrated chemicals should be added

to a pail, container, or tank of cold water. When water is added to chemicals that are concentrated, flashback can occur.

- ✓ Flashback can also occur if chemicals are added to heated water. Always heat water after adding chemicals.
- ✓ Do not transport liquid chemical products in open containers because of the possibility of splashing and/or spilling.
- ✓ Always check a system for leaks prior to recirculating hot chemicals because leaks in these systems may cause injury.
- ✓ More is not better. Always use chemicals in the concentrations established by written procedure.
- ✓ Always ensure areas are clear of personnel when using chemicals. If this is not possible ensure all personnel in the area are aware that chemicals are in use and the dangers associated with being in the area.

#### TYPES OF CHEMICAL CLEANING AGENTS

Many types and manufacturers of chemical cleaning agents are available. Although Winpak does not endorse any particular chemical manufacturer, supplier, or type of chemical, the following types of chemicals have proven to be effective in cleaning Winpak filling equipment. This information is provided as a guideline when selecting chemical cleaning agents.

Equipment users should consult their chemical supplier for advice on selecting the proper chemical products. In addition, when using any cleaning chemical by any manufacturer, the equipment user should consult with the manufacturer for proper use of the chemical. Most chemical suppliers will assist in the setup of chemical concentrations, chemical uses, chemical storage, and safe use of their chemical products.

#### ***Hand Wash***

A concentrated, germicidal hand wash should be used for hand cleaning and sanitizing. Hand wash stations should be readily available in the production room, lavatories, break, and lunchrooms. This product is intended for the personal hygiene of employees involved in the

production process. This product should be used on the hands and forearms.

#### ***Detergent for Manual Hand Washing of Filling Machine Parts***

An alkaline detergent should be used for manual hand washing of filler parts not cleaned by the Clean-In-Place (CIP) process. Typically, the detergent is mixed in a clean plastic pail at the proper concentration with water at approximately 125° F. Consult with the chemical manufacturer for the best concentration and temperature to use for the detergent. The solution is then used with a nylon bristle brush to hand wash the filler parts that are manually hand washed. Note that rubber gloves and a face shield should be worn when using this product to brush wash equipment.

#### ***Sanitizer for Manual Hand Washing of Filling Machine Parts***

Winpak recommends an iodine-based sanitizer for use after manual hand washing of filling machine parts not cleaned by the CIP process. The sanitizer should be mixed with cold water to the proper concentration specified by the chemical manufacturer. The sanitizer is then sprayed or applied onto the cleaned parts and allowed to contact the surfaces for at least 2 minutes. The sanitizer should **not** be washed off prior to reassembly of the filling machine parts.

#### ***Detergent for CIP Washing Of CIP Capable Filling Machine Parts***

A liquid chlorinated detergent blend should be used during CIP of CIP capable filling machine parts. The detergent is mixed in the CIP tank with water at a temperature and concentration specified by the chemical manufacturer. Hot water (typically about 150° F) is generally used for these chemicals. The detergent solution should always be drained and rinsed with potable water and then followed with a sanitizer solution.

#### ***Sanitizer for CIP Washing Of CIP Capable Filling Machine Parts***

A liquid acid based sanitizer should be used for CIP of CIP capable parts of the

filling machine. The sanitizer is generally mixed with cold water in the CIP tank. The concentration should be determined by the chemical manufacturer. The sanitizer solution is normally recirculated for a period of time and then drained. The sanitizer is generally never followed with a potable water rinse, but rather allowed to coat on the sanitized areas.

#### ***Foaming Detergent for Foam Washing of Filling Machine Parts***

A liquid chlorinated self-foaming detergent for foaming and soaking filling machine parts in place. The foam detergent is mixed with warm water to a concentration and temperature specified by the chemical manufacturer. Winpak considers foaming to be less effective than standard brush washing of hand cleaned parts. In addition, these products can be corrosive to aluminum machine parts, and if not rinsed properly before drying, leave a film and detergent residue behind.

### PERSONAL HYGIENE

Personnel involved in the operation, sanitation, and maintenance of filling machines are a key link in the food safety chain. Personal hygiene should be emphasized to each employee involved in the production of food and beverage products. Failure to observe good personal hygiene practices can result in contamination, spoilage, and/or reduced shelf life of the products. In addition to plant policies and GMP, personnel should always follow the following practices:

- ✓ Hands should be frequently washed up to the elbows. A hand wash detergent and sanitizer should be used for this purpose.
- ✓ Always wash and sanitize hands after contact with soiled surfaces or any other time the hands become soiled.
- ✓ Always wash and sanitize hands after using the restroom.
- ✓ Always wash and sanitize hands when entering the processing room.
- ✓ Always wash and sanitize hands before entering the processing area of any filling machine.

- ✓ Avoid contact with packaging materials and throw away any packaging materials that have been contacted by human hand.
- ✓ Always wear the head coverings and facial hair coverings and other protective clothing required by plant policy.
- ✓ Aprons, lab coats, hairnets, beard nets, and other protective clothing worn in the processing room should not be worn in other non-processing areas, particularly restrooms and lunchrooms.
- ✓ Personnel should never work in the processing area with exposed open wounds.

### GENERAL NOTES ON HAND CLEANING

Certain components and parts of a filling machine require cleaning by hand. These components and parts of the filler should be outlined in the operating manuals provided with the filling machine. In addition, preventive maintenance procedures often require hand cleaning of some filling machine parts on a scheduled basis. The following general guidelines should be used when hand cleaning filling machine parts:

- ✓ Parts being washed should be disassembled to the degree necessary to ensure proper cleaning.
- ✓ Personnel hand washing filling machine parts should go to a hand wash station prior to starting and thoroughly wash their hands.
- ✓ All parts being hand washed that are removed from the filling machine should be washed on a stainless steel wash table using a rubber mat on the wash table to prevent damage to the parts. Do not use the rubber mats on the floors. Make sure the rubber mats have been thoroughly cleaned, sanitized, and dried before use.
- ✓ Prerinse the parts with fresh water to remove excessive soil, built up product, and loose packaging material.
- ✓ Prepare hand wash cleaning detergent at the proper concentration in a clean plastic pail with fresh water at the temperature specified by the chemical manufacturer.
- ✓ Thoroughly wash all parts with a nylon bristle brush.

- ✓ Rinse all hand washed parts thoroughly with cold fresh water until all detergent is removed. The detergent should never be allowed to dry on the parts before rinsing or a caustic residue will remain. The parts should be rinsed, washed, and rinsed again if the detergent is allowed to dry in place.
- ✓ After completing the wash and rinse of the filling machine parts, personnel should again go to a hand wash station and thoroughly clean their hands.
- ✓ Spray each part thoroughly with sanitizer using a spray bottle during reassembly. Alternatively, the parts that are removed from the filling machine can be immersed in a clean plastic pail of prepared sanitizer solution. This step is used to sanitize the parts. The sanitizer solution should be allowed to dry on the parts without rinsing with fresh water.

### GENERAL NOTES ON CIP

Most Winpak filling machines are equipped with the capability for CIP. CIP stands for clean in place and means that the filling machine or a part of the filling machine can be cleaned without disassembly using circulated water and chemical solutions. However, it should be noted some CIP capable parts may require periodic preventive maintenance that requires disassembly, inspection, and cleaning by hand.

CIP is a multi-step process that is designed to remove soil and byproducts of the filling process and to sanitize the filling machine. The first step is a fresh water rinse of the filling machine with warm water. The water is rinsed through the filling machine to the drain. This step is performed to remove gross soil and product.

Removing the gross soil and product prior to chemical cleaning will minimize dilution of the cleaning chemical strength and prevent the gross soil and product from being recirculated back to the CIP tank. Warm water (95-100° F.) should be used because cold water will tend to solidify the fats and oils left behind by the product, and hot water may cook the fats and oils onto the filler surfaces making it more difficult to remove these during the chemical cleaning phase. The rinse should continue until the water being drained is clear.

The next step is recirculation of a hot caustic detergent water solution. The water is generally about 150° F. but the temperature is dependent upon the chemical detergent used. The chemical used is usually a blended alkaline detergent. The detergent cleans inside product surfaces.

Specifically, the detergent does the following:

- ✓ Dislodges organic matter from equipment surfaces.
- ✓ Allows the solution to act more quickly and effectively on the surface walls by penetrating the dirt deposits.
- ✓ Prevents loosened soil deposits from redepositing on the surface walls.
- ✓ Dissolves calcium salt deposits and hold them in solution so that no scale deposit forms on the surface walls.
- ✓ Kills bacteria.
- ✓ Dissolves proteins.

In order to ensure proper cleaning during the caustic wash step, four variables must be controlled. If any of the variables are not controlled within a desired range the cleaning will not be effective. The four variables are concentration of the detergent, temperature of the solution, mechanical cleaning effect, and recirculation time.

Temperature, time, and concentration are all controlled within a specific set band either manually or automatically. Concentration may or may not be monitored automatically depending upon the type of CIP system in use.

Most CIP systems do not automatically monitor the concentration. Proper concentration is maintained by adding a measured amount of caustic chemical to a predetermined quantity of fresh water. Periodic checks of the returning caustic solution are made as part of the preventive maintenance program to ensure that the proper concentration is maintained.

Unlike in manual hand cleaning where the mechanical cleaning effect is by scouring with nylon bristle scrub brushes, during CIP the mechanical cleaning effect comes from the turbulent flow of the detergent itself. CIP supply pumps and piping systems are designed to provide 5-7 times the flow rate as normal product flow rate during production. This makes the flow highly turbulent and produces the desired mechanical cleaning effect. This can generally be considered

constant after initial verification of the design (through tear down and swabbing).

On manual systems the flow rate should be periodically verified to ensure there is no degradation of the CIP pump. Some automatic CIP systems may automatically measure and monitor flow rate and alert the operator when flow rate degradation has occurred.

The next step in the CIP process is a cold water rinse. The purpose of the rinse is to remove and neutralize the caustic solution from the previous step and to flush the soils that are liberated from surface walls during the wash phase. The cold water also helps cool the filling machine and CIP piping down. The cold water is rinsed through the filler to the floor drains.

The last step in the CIP process is usually to wash the filler with an acid/sanitizer. The purpose of this step is to sanitize the filler. This step results in a 99.9% kill of bacteria. Although the bacteria are effectively killed during caustic cleaning, the caustic requires rinsing with potable water. The rinse water contains bacteria that could survive prior to production. Sanitizing the filling machine will kill most of the bacteria that resulted from the potable water rinse.

The sanitizer is usually drained from the filling machine using the CIP pump. This allows the sanitizer residue to coat the surface walls of the filler until production or until sterilization on food products that require sterilization of the filling machine.

### GENERAL CIP PROCEDURE

CIP should always be performed following the end of production. The following general CIP procedure is provided for reference. Specific CIP procedures will vary depending on the filling machine, CIP equipment, and plant processes. Sanitation personnel should refer to specific plant CIP procedures and/or the CIP procedures in the operating manual provided with the filling machine. Also note that not all filling machines have CIP capability.

1. Disassemble the filling machine as required and prepare it for CIP.
2. Hookup the CIP piping.
3. Using the CIP system, rinse the filling machine to the floor with warm water.

4. Stop rinsing the filling machine when the returning rinse water is clear.
5. Using the CIP system, recirculate hot caustic chemical solution at the proper temperature and concentration for the required amount of time.
6. Using the CIP system, drain the chemical solution to the floor.
7. Using the CIP system, rinse the filling machine to the floor with cold water.
8. Using the CIP system, recirculate cold acid sanitizer chemicals at the proper concentration for the required amount of time.
9. Using the CIP system, drain the chemical solution to the floor.
10. Reassemble the filling machine as required and prepare it for production.

#### GENERAL NOTES ON STERILIZATION

Sterilization is required on some filling machines prior to filling products such as cream. Sterilization is also sometimes referred to as SIP (Steam/Sterilize-in-place). Sterilization effectively kills all bacteria when properly performed. However, SIP will only be effective in killing all microorganisms if the filler is properly cleaned prior to sterilization.

Improper cleaning of the filler could result in a bio-film forming on the surface walls which insulates during SIP. As the bio-film builds, it is subject to shear forces, which could cause pieces of the bio-film to break off and enter the product. The result is random high bacteria counts in the product.

Normally hot pressurized sterile steam or sterile hot water is used to sterilize the filling machine. The surface walls of the product pump and piping are heated to a temperature usually in excess of 250° F. This temperature is held for a specified amount of time, typically for a period of at least 45 minutes.

Any time the machine sits for an extended period of time, the machine should be cleaned and sterilized again. The amount of time a machine is allowed to sit after sterilization prior to the introduction of product should be established by plant procedure. Winpak recommends a maximum wait time of 3 hours before product is introduced

into the machine. After product is introduced the machine should not sit idle for more than 45 minutes maximum. Specific allowable idle time should be established by plant procedure.

It is important to note that not all products and applications require filling machine sterilization. However, for some products sterilization is critical, and failure to properly sterilize the filler will result in reduced shelf life and product spoilage.

#### SUMMARY

Establishing and strictly adhering to a sanitation program is a critical part of meeting food safety objectives. Cleaning and sterilization procedures must be established and followed for all filling machines, as well as other plant processing equipment and product transfer systems.

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