HOW TO CARE FOR YOUR STAINLESS STEEL EQUIPMENT

D. H. JACOBSEN
Technical Adviser, Cherry-Burrell Corporation
Chicago, Illinois

The author points out numerous cases of damage to stainless steel equipment, especially by rough handling, controlled heating of the surfaces, proper cleaning procedures, handling of water deposits and discoloration, detergents and disinfectants, and a code of "don'ts."

Although stainless steel has been used in the manufacture of dairy and food products processing equipment for nearly thirty years, its care is not well understood. Manufacturers of equipment are frequently blamed for the failure or poor performance of equipment, when, as shown by investigation, the equipment has been abused by customer's employees who do not know how to care for and clean it properly. Actually, stainless steel dairy and food processing equipment should give satisfactory service for many years if properly treated and cleaned by approved methods at recommended intervals.

HANDLING STAINLESS STEEL PARTS
Stainless steels are very hard and durable. Nevertheless, stainless steel parts can be damaged by careless, rough handling.

Sanitary lines should not be dropped or dragged on the floor but handled on pipe racks. Parts and fittings should be placed on rubber mats when machines are dismantled.

Many leaky joints and valves can be avoided by reasonably careful handling. In addition, this care means the stainless steel surfaces will remain brighter and be easier to clean.

OPERATING CARE

Milk products processed at high temperatures may, indirectly, affect the life of stainless steel equipment if "burned on" coatings are allowed to accumulate. These deposits are difficult to remove, and vigorous scraping and scouring with metal sponges may mar the finish. These coatings can be more effectively removed by applying acid milkstone remover as a daily cleaning process.

The heating of partially filled vats should also be avoided. Heating should be started after the vat is filled to the normal operating level. When emptying the vat or tank, the heating medium should be stopped and, if possible, the vat should be precooled by turning cold water into the system. When equipment with propeller type agitators is used, it is advisable to stop the agitator when the product begins to splash. These precautions will help prevent "burn on" and make cleaning easier.

Excessive heat used in the sterilizing process can also result in physical damage to the stainless steel equipment. Steam, suddenly turned on a small area of a vat lining will cause excessive strains and may even bulge the sides of the lining.

DAILY CLEANING

A new machine must be cleaned before it is used for the first time to process dairy products in order to remove any residues of oil and dust picked up during shipping and installation. This initial cleaning is best accomplished by brushing the surfaces with hot (120-130°F) solutions of the regular alkaline dairy cleaners, using a solution concentration of about four times that used during routine cleaning procedures. Stainless steel surfaces can then be maintained in a good-as-new state by giving them a thorough cleaning each day. Afterward, they should be allowed to dry and remain dry until used again.

First step in cleaning is to rinse and, when necessary, to cool equipment after use. These preliminary steps make cleaning easier and prevent the drying of product solids on the steel surface. The regular cleaning procedure should then be followed as soon as possible. Because equipment varies in size and use, different cleaning methods must be used. Specific information for individual equipment has been worked out and is usually available from the distributors of cleaning compounds.

Both inside and outside surfaces of the equipment should be cleaned. Dairy products, as well as other food products and foreign materials, which are allowed to adhere to the surfaces for any length of time can cause a change in the finish and even start corrosion of the stainless steel by removing the protective layer of chrome oxide on the surface of the steel.

To maintain and build up this protective layer, the surfaces must have free access to air. Usually, sufficient exposure to air occurs between one day's processing and the next. That stainless steel surfaces are clean is indicated by rinse water draining off completely and no longer forming droplets.

CLEANING METHODS

Equipment such as small vats, freezers, surface coolers and homogenizers is cleaned by brushing with a cleaning solution.

Parts and fittings should be cleaned in the special wash tanks designed for this purpose. Research has shown that cleaning compounds do not generally affect
stainless steels. However, long soaking periods in these cleaning solutions may result in coatings which are difficult to remove. This is especially true where extremely hard water supplies are used. To avoid such an occurrence, it is recommended that the cleaning operations be completed as soon as possible after parts and fittings are placed in the wash tank.

Large tanks and vats may be cleaned by brushing or a combination of brushing and spraying with a cleaning solution. Since an operator must enter the tank or vat for this job, it is very important that he does not track into the equipment any foreign material which may mar or corrode the stainless steel surface. Traces of salt or grit from the operator’s shoes can seriously damage a stainless steel lining.

The brushes used on stainless steel equipment should preferably be fiber or nylon bristle brushes. Metal sponges must be used with caution because they eventually break up, and the metal particles may find their way into moving parts and cause trouble. They may also remain in the equipment and contaminate the product. Ordinary steel brushes or steel wool should never be used on stainless steel because bits of plain steel will become attached to the stainless surface and cause rust spots.

Enclosed systems, such as tubular and plate equipment, sanitary lines, and pumps are cleaned by circulating the cleaning solutions. It is recommended these systems then be dismantled as far as possible, brushed, and rinsed.

The amounts of cleaning compounds required for each job depend on the cleaners and methods of cleaning used as well as the machines to be cleaned. To establish a range of solution concentrations for use on stainless steel equipment would be desirable but is not practical because of the many different and acceptable compounds available.

**Types of Cleaners**

In general, the cleaners used on stainless steel are classified in the following manner: (1) alkaline, (2) neutral, or (3) acid.

Alkaline and neutral cleaners are used for general clean-up. Acid cleaners usually are used on high-temperature heat exchange equipment and for the removal of milkstone; however, they may also be required for machines used for processes at temperatures below 145°F if inefficient cleaning has resulted in milkstone formation. Their function is to dissolve the films of milk salts which form when milk is heated or dried on equipment. The films treated with acid cleaner are then removed more easily with the alkaline detergent.

Acid cleaners are also used as an occasional extra cleaning process for the removal of residues left by the regular cleaning method or from hard water deposits.

The prevention of milkstone in plants having hard water supplies involves good processing control as well as good cleaning. By using cleaners with polyphosphate content in line with the water hardness, the milk film can be removed and the surface rinsed free of all film. The amount of polyphosphate required to meet the water hardness must be carefully considered in each plant, and no general rule can be given. It is essential that the plant operator know the hardness of the water supply and then select cleaning products which contain water-conditioning phosphates in sufficient proportions to prevent precipitation of insoluble salts on the equipment.

The polyphosphate portion of the cleaning compounds may range from 10 to 50 percent to meet the demands of water supplies found in various areas. The polyphosphate not only prevents milkstone deposits but also improves the detergent or cleaning properties of dairy cleaners. By preventing the formation of milkstone, we eliminate the need for the more vigorous cleaning procedures used in removing milkstone. Such methods may involve metal sponges or scouring detergents which scratch the surface of the stainless steel and eventually result in imperfect finish. The practice of removing milkstone by means of acid type cleaners is also a possible source of damage if improper acids or methods are used. It is important that noncorrosive acids be used, and then strictly according to directions regarding concentration time and temperature of application. Strong acids such as muriatic and sulphuric should be avoided. From a standpoint of economy and effectiveness, standard cleaning procedures should be followed. Remember, high concentrations of cleaning agent do not necessarily mean faster and better cleaning. Rather, these concentrations may only serve to make the rinsing operation more difficult.

**Water Deposits**

Water, as ordinarily used in dairy and food processing plants, is a very complex substance. Hard water generally causes trouble. It is advisable, therefore, in many cases to treat the water before use to maintain efficiency in processing machines.

The very common problem of lime scale can be eliminated by using Zeolite softeners. The "Threshold Treatment," employing Micromet, can also be used to prevent scale and rust in water systems.

When hard water is heated, it leaves deposits on the metal surfaces. These deposits often discol the surfaces and, in time, can seriously affect the heating and cooling rates of equipment. According to authorities on boilers, a lime scale layer one-eighth inch thick will reduce the rate of heat transfer by approximately 15 percent.

Hard water coatings can be removed with inhibited muriatic acid and usually without extensive dismantling of the equipment. It should be recognized that muriatic acid will attack stainless steel, and such treatments should be used only when necessary and under close supervision.

Water deposits in the form of red or brown films often are found on the water sides of the plates in plate equipment. Daily washing of both sides of the plates with the same solutions as used on the product side of the plates will prevent these coatings. To remove similar coatings already formed, use a good acid cleaner.

Water supplies with high salt content or other impurities such as acid sulphate, cause more serious corrosion problems with stainless steel equipment. Stainless steels are much more resistant to these effects than other metals, but long use under such conditions can cause corrosion. It is advisable to treat these waters before use. The ordinary Zeolite Water Softeners do not satisfactorily overcome these
problems. Water treatment engineers should be consulted.

**DISCOLORATION**

Discoloration showing up as rainbow colors on vat or tank linings has been found in some cases after vats are in operation in the plant. These areas have been rather easily returned to normal by lightly polishing the area involved. This can be done with a fine abrasive material such as crocus cloth or a 300 to 400 grit paper. The latter should be "manufactured grit" such as "wet or dry" paper, not one using emery. This rainbow discoloration is apparently a surface reaction which may be related to the manufacturing operation on the stainless steel itself, and no solution to the problem has been found. It apparently has no effect on the life of the vat or on the product processed.

In certain machines, such as positive pumps, "straight chrome" stainless steels which have hardening qualities are necessary to prevent seizing or galling of frictional surfaces. These steels discolor and corrode more readily than the 18-8 stainless steels. It is essential that these parts be thoroughly cleaned and dried after use.

**CHLORINE DISINFECTANTS**

There has been extensive research conducted to determine the effects of chlorine disinfectants used on stainless steel equipment. The work shows that the surfaces will not be corroded by the solution concentrations normally used in processing plant. Tests made with 200 parts per million and 100 parts per million solutions gave no indications of corrosion. Stainless steels are much more resistant to corrosion by chlorine compounds than other dairy metals and markedly better than tinned surfaces in this respect.

Careless handling of high concentrations of chlorine compounds may, however, result in damage to stainless steel surfaces. For example, calcium hypochlorite compounds, in powder form, spilled on stainless steel surfaces, will cause corrosion.

Prolonged soaking in chlorine solutions is not recommended. For this reason, chlorine disinfection should be accomplished immediately before the equipment is to be used rather than at cleanup time.

The chlorine disinfection process for stainless steel equipment should always be carefully controlled on concentration and time.

**EFFECT OF BRINE**

The use of brine for cooling in stainless steel equipment should be done with caution. Brine, properly neutralized, may be used when the surfaces may be cleaned daily as in plate type coolers. In vats and other enclosed systems, sweet water or direct expansion refrigeration should be used.

**SUMMARY OF PRECAUTIONS**

The following general precautions in handling stainless steel equipment are recommended by the Alloy Tank Manufacturers Council:

1. Don't use steel wool, particles of which break off and become embedded in the stainless steel and later show up as rust spots.
2. Don't use a water supply having excessive iron, salt, or sulphur content.
3. Don't allow chemical sterilizers, alkalis, or cleaners to remain too long on equipment. Soaking overnight is not recommended.
4. Don't allow particles of foreign matter to adhere to equipment.
5. Don't allow rubber protective items which are fitted over stainless steel surfaces to remain on such surfaces for any length of time, for this would exclude air and prevent the surface from drying.
6. Don't allow wrenches, sanitary fittings, or other metal parts to lie on stainless steel surfaces which remain wet.
7. Don't close the covers of a tank after steaming unless a vent is provided to avoid creating a vacuum which might result in collapse of the tank.
8. Don't apply air or steam pressure unless equipment is specifically designed for such pressures.
9. Don't direct the steam hose on the tank wall so that localized overheating and strains will occur. Rust, discoloration or pitting may result from any one of the first six causes listed here.

**American Dairy Science Association 49th Annual Meeting**

State College, Pa.—The Pennsylvania State University will host this summer the 49th annual meeting of the American Dairy Science Association. Approximately 1600 delegates from the United States and Canada are expected for the national gathering here from June 22 through 24.

Membership in the Association is composed largely of college specialists in the dairy and dairy cattle industries. It also includes scientists and technicians in dairy plants, dairy cattle breeders, and others in the commercial field.

Technical research papers, symposia, and organized discussions on all phases of dairying will be features of the June meeting.

Persons who wish to attend, and who are not members of the Association, are urged to write to the Registration Committee, Dairy Department, State College, Pa., for pre-registration information and to register in advance, if possible.

F. J. Doan, professor of dairy manufacturing at Penn State, is chairman of the general committee planning for the event. Other members are D. V. Josephson, department head, and C. D. Dahle, R. H. Olmstead, C. R. Gearhart, and J. O. Almquist.

**Market Milk and Ice Cream Meetings To Be Held At Purdue**

Two one-day dairy meetings will be held in April, 1954, at Purdue University according to an announcement by Professor H. W. Gregory, Head, Department of Dairy Husbandry. These meetings are as follows: Market Milk Conference, April 13 and Ice Cream Institute, April 14.

The conferences are a continuation of the series held annually in cooperation with the Indiana Dairy Products Association. Specialists from the dairy industry and universities will be on the programs. Ice Cream samples submitted by plants to Purdue for analysis and scoring will be examined and discussed as a part of the ice cream meeting. Foremost problems relating to the processing and distribution of bottled milk and cultured buttermilk will be discussed at the market milk conference. Also, a milk clinic on commercial samples will be a part of the latter meeting.