Australian Standard™

Cleaning and sanitizing dairy factory equipment

Standards Australia

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Australian Chamber of Commerce and Industry

Australian Chemical Specialties Manufacturers Association

Australian Dairy Farmers Federation

Australian Dairy Products Federation

Australian Food and Grocery Council

Dairy Industry Association of Australia

Dairy Industry Authority of Western Australia

Department of Primary Industries, Queensland

Detergent and Sanitiser Manufacturers Co-op Group, New Zealand

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Australian Standard™

Cleaning and sanitizing dairy factory equipment

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee FT/9, Dairy Detergents and Sanitizers to supersede AS 1162—1991.

This Standard is the result of a consensus among Australian and New Zealand representatives on the Joint Committee to produce it as an Australian Standard.

This Standard is one of a number of Standards dealing with dairy detergents and sanitizers. This Standard should be read in conjunction with AS/NZS 2541:1998, *Guide to the cleaning-in-place of dairy factory equipment*, and may also require reference to the product specifications.

The objective of this revision is—

(a) to incorporate guidelines on verification and validation of cleaning programs;

(b) to maintain the present recommended practices for the cleaning and sanitizing of dairy factory equipment; and

(c) to introduce some minor changes.

The term ‘informative’ has been used in this Standard to define the application of the appendix to which it applies. An ‘informative’ appendix is only for information and guidance.

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STANDARDS AUSTRALIA

Australian Standard

Cleaning and sanitizing dairy factory equipment

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard sets out guiding principles and recommended practices for the cleaning and sanitizing of dairy factory equipment. It applies to all dairy factory cleaning operations where the equipment is cleaned by the use of circulating liquids, physically scrubbed by manual exertion or where mechanized cleaning is employed. This Standard is supplemented by AS/NZS 2541 which outlines the principles and practices of circulation cleaning-in-place procedures (CIP) for the cleaning of dairy factory equipment.

1.2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS	
1087	Sodium hypochlorite solutions for use in the dairying industry
1398	Iodophors for use in the dairying industry
1803	General purpose detergents for use in the dairying industry
AS/NZS	
1389	Acidic detergents for use in the dairying industry
1400	Heavy-duty alkaline detergents for ‘in-place’ cleaning in dairy factories
2541	Guide to the cleaning-in-place of dairy factory equipment

1.3 DEFINITIONS

For the purpose of this Standard, the definitions below apply.

1.3.1 Cleaning

An operation designed to remove all foreign deposits or residues from equipment surfaces using physical, chemical or mechanical means.

1.3.2 Clean surface

A surface, free from residual film or soil, and where—

(a) contamination or oxidation is not visible under good lighting conditions with the surface wet or dry;

(b) no objectionable odour is apparent;

(c) the surface does not feel greasy when rubbed with clean fingers;

(d) the surface shows no sign of excessive water-break while water is draining from it;

(e) the surface is free from undesirable residues of cleaning and sanitizing materials;

(f) no sign of fluorescence is detectable when the surface is inspected with a long wavelength (340 nm to 380 nm) ultraviolet light; and

(g) after being sanitized, the surface microbial count is within acceptable levels (see Appendix A).

1.3.3 Cleaning-in-place (CIP)

A method for cleaning equipment, using no direct mechanical aid to remove the soil but depending on solutions flow rate, temperature, time and the chemical properties and concentration of the detergent solution.

1.3.4 Detergents

Formulated blends of chemicals capable of assisting cleaning when added to water.

1.3.5 Detergent cleaning

Detergent cleaning is achieved by circulating detergent solutions at correct use dilution in accordance with the specific recommendations for particular items and in accordance with the chemicals and/or equipment manufacturer's recommendations.

1.3.6 Detergent reclaim

The recovery of a reusable detergent solution.

1.3.7 Manual cleaning

An operation in which the equipment to be cleaned is dismantled, where necessary, and the residues are removed from the equipment by physical effort.

1.3.8 Mechanical cleaning

An operation in which the soiled equipment is cleaned by a cleaning solution assisted by mechanical, pneumatic or ultrasonic agitation.

1.3.9 Post-rinsing

Post-rinsing is the final rinsing with water to remove detergent solutions and soil residues which may adhere to the surfaces.

1.3.10 Potable water

Drinking quality water.

1.3.11 Pre-rinsing

Pre-rinsing is rinsing with water to dislodge easily removable product residues prior to cleaning.

1.3.12 Product contact surfaces

All surfaces which are, or may be, in contact with the product during processing.

1.3.13 Product reclaim

The recovery of a residual product prior to cleaning the equipment.

1.3.14 Sanitizers

Substances that are capable of reducing the number of viable micro-organisms to an acceptable level on product contact surfaces.

1.3.15 Sanitizing

A process which reduces the number of microorganisms in dairy plant and on utensils to an acceptable level (see Appendix A).

1.3.16 Soil

Any materials which have to be removed from product contact surfaces during the cleaning process.

1.3.17 Use dilution

The concentration of the detergent or sanitizer in water which the manufacturer has recommended for use in specified application.

1.4 CLEANING AND SANITIZING MATERIALS

1.4.1 Compliance with Standards

The chemicals used in cleaning and sanitizing should comply with Australian and Australian/New Zealand Standards wherever they exist. For example: AS 1087, AS/NZS 1389, AS 1398, AS/NZS 1400 and AS 1803.

1.4.2 Storage

The cleaning and sanitizing materials should be stored in a secure place protected from sunlight, moisture and excessive heat, and secured from children and animals. Many sanitizers are subject to deterioration with age so large stocks should not be kept. Older stocks should be finished before starting fresh containers.

The cleaning and sanitizing materials should be stored in accordance with regulatory requirements and chemical suppliers' recommendations.

1.4.3 Usage

1.4.3.1 *Manufacturer's recommendations*

All detergents and sanitizers should be used in accordance with the manufacturer's recommendations with particular attention to correct use dilutions, temperatures and contact times. These chemicals should also be used in accordance with equipment suppliers recommendations.

NOTE: This Standard may indicate different usage for a product from that recommended by manufacturers. In such instances consult the manufacturer to ensure that the product is used to best effect.

1.4.3.2 *Safety aspects*

Care should be taken when handling cleaning and sanitizing materials as they can cause damage to eyes and skin and may be toxic. Appropriate clothing, including gloves and full face visor, should be worn. Special attention should be paid to the warnings given by the supplier on labels or in literature about the materials, especially regarding protection of the skin and eyes.

Detergents and sanitizers should not be mixed together nor with any other chemicals, even if being run to waste, unless done in accordance with the manufacturer's recommendations.

1.4.3.3 *Disposal of materials*

Care should be taken to ensure that used solutions of detergents and sanitizers are directed to waste drains since rapid corrosion can occur if they are allowed to remain in contact with floors. Where these liquids are fed into ponds or lagoons for treatment that depends upon biological action, particular care has to be exercised in the selection of detergents and sanitizers to avoid severe disruption of the effluent treatment system. See Appendix B for further details.

1.4.3.4 *Labelling*

All detergents and sanitizers to be clearly labelled as to identify at all times.

1.5 WATER QUALITY

Water used should comply with the standards for potable water set by the relevant regulatory authority. Water hardness may necessitate the use of special detergents and excessive alkalinity may need to be neutralized. (See Appendix C.)

1.6 VERIFICATION AND VALIDATION OF CLEANING PROGRAMS

All Food Safety Program or HACCP based systems should include cleaning checks to verify compliance to the procedures and the effectiveness of the program. This can be achieved through a number of checks and control of systems which are detailed in Appendix A.

SECTION 2 GENERAL RECOMMENDATIONS FOR CLEANING-IN-PLACE (CIP)

2.1 SCOPE OF SECTION

This Section sets out the several steps required for CIP and covers in detail the recommended practices and reasons for each one. Variations to these general recommendations are covered in detail in the appropriate clauses of Section 3.

2.2 GENERAL DESIGN AND OPERATION OF CIP

2.2.1 Efficiency of operation

CIP systems should be designed and operated in accordance with the recommendations given in AS/NZS 2541.

NOTE: Any circuits incorporating spray-balls require a suitable filter, which should be cleared after each use.

2.2.2 Frequency of the operation

Frequency of the operation should be typically after each days production or daily. High temperature product process lines (for e.g. hot dairy products, above 60°C) may require more frequent cleaning.

2.2.3 Joints and gaskets

All joints and gaskets not specifically designed for permanent assembly should be dismantled and cleaned manually.

At least every 6 months, all gasket joints in CIP lines should be dismantled for inspection of the gaskets. Unions and gaskets should be hand-cleaned and reassembled. Damaged gaskets should be replaced.

2.3 STEPS IN CIP CLEANING

2.3.1 General

The operation of a circulation CIP system usually incorporates the following six basic steps:

(a) Preparation.

(b) Pre-rinsing.

(c) Detergent cleaning.

(d) Post-rinsing.

(e) Sanitizing.

(f) Verification and validation of cleaning program.

2.3.2 Preparation

The recommended procedure is as follows:

(a) Remove as much product from the system as possible, either flushing to drain or reclaiming as circumstances demand.

(b) Remove and clean separately those items of equipment which cannot be effectively cleaned by CIP, or which impede the flow of the cleaning solution, e.g. agitators, air distributor pipes, filtration systems, flow controllers, product level indicators, rubber components, thermometers, valves.

NOTE: Instruments, the safe ranges of which do not extend over the range of detergent concentration encountered during cleaning and sanitizing, should be removed from the circuit.

(c) Install connection pieces to complete the CIP system in isolation from production processes still in progress.

NOTE: CIP circuits should be designed to ensure that cleaning solutions are isolated from items of equipment which may still contain product, e.g. a single valve is unsuitable for this purpose.

When using computerized auto CIP systems, select the correct CIP program, and visually check.

(d) Promptly proceed to pre-rinsing to avoid drying of product in the equipment.

2.3.3 Pre-rinsing

Pre-rinsing is rinsing with water to dislodge easily removable product residues prior to cleaning. The recommended procedure is as follows:

(a) Pre-rinse using sufficient quantity of water not more than 40°C to remove product residues. Adequate rinsing is usually indicated by a clear flow at the discharge point. Pre-rinse water should be run to waste.

NOTES:

1 Pre-rinsing may be carried out either by mechanical (pump) or hand (hose) method, and either continuously or in bursts.

2 High temperature may cause products to adhere to the surface and be hard to remove.

2.3.4 Detergent cleaning

Detergent cleaning is achieved by circulating detergent solutions at correct use dilution in accordance with the specific recommendations for particular items and in accordance with the chemicals and/or equipment manufacturers' recommendations.

Where direct steam injection is used as a means of raising temperature, ensure that condensate does not dilute the detergent strength below the stated minimum. Indirect heating is the preferred method (for example, heat exchanger or jacketed vessel) and should be used where practicable.

For some items of equipment, the detergent cleaning cycle may consist of a sequence of detergent treatments in which each detergent solution will be circulated through the system separately, interspersed with appropriate intermediate rinses (a rinse of water used between two detergent treatments in a cleaning operation) to remove traces of earlier detergents. Such intermediate rinses are preferably carried out at the same temperature as the detergent cleaning cycles.

It is important that the chosen detergent be circulated at the required temperature, with sufficient velocity, and for sufficient time to clean the equipment thoroughly.

Milk soil types and detergent ingredients are given in Appendix C of AS/NZS 2541.

In any cleaning system having a long drainage time, it is advisable to avoid temperatures higher than those recommended by the detergent manufacturer otherwise an adherent film may be formed.

If the various detergents used in a sequence of treatments are to be reclaimed, an increased number of CIP tanks will be required. The subject is discussed in more detail in AS/NZS 2541.

NOTE: Reclaimed detergent solutions require microbiological checking and adjustment to recommended use dilution before re-use.

2.3.5 Post-rinsing

Post-rinsing is the final rinsing with water to remove detergent solutions and soil residues which may adhere to the surfaces. The recommended procedure is as follows:

(a) Post-rinse sufficient quantities of water. Do not recirculate post-rinse water. This should be run to waste unless it is to be reclaimed for subsequent re-use as a pre-rinse.

Post-detergent rinsing may be carried out either by mechanical (pump) or hand (hose) method, and either continuously or in bursts.

(b) Replace those items of equipment that were removed and separately hand-cleaned in Clause 2.3.2.

NOTE: Post-detergent rinses, including intermediate rinses, should normally start at temperatures close to that of the detergent that has been circulating but may be allowed to run cooler as the rinse proceeds, i.e. additional water may be cold. This is to stop thermal shock of the equipment, which may cause premature stress cracking failure, or shorten the life of the processing equipment.

2.3.6 Sanitizing

2.3.6.1 *General*

Sanitizing is a process which reduces the number of microorganisms in dairy plant and on utensils to an acceptable level.

The cleaned equipment should be sanitized 30 min before use, by one of the techniques in Clauses 2.3.6.2 and 2.3.6.3.

2.3.6.2 *Moist/heat sterilization*

Either—

(a) circulation of water at a minimum temperature of 82°C at the discharge point for a minimum of 5 min; or

(b) injection of steam into the system until a minimum condensate temperature is attained at the drainage outlet of 82°C for 5 min, or a suitable equivalent.

2.3.6.3 *Chemical*

Application to all product contact surfaces of an aqueous solution of a suitable chemical sanitizer at recommended concentration, temperature and time.

Unless specified by the manufacturer of the sanitizer, do not rinse equipment after sanitizing but ensure proper draining to avoid contamination of the product with sanitizer residues.

Sanitizers complying with AS 1087 and AS 1398 are suitable.

Over-use of chemicals increases costs and the potential for corrosion of equipment.

2.3.7 Verification and validation of cleaning program

All Food Safety Programs or HACCP based systems should include cleaning checks to verify compliance to the procedures and the effectiveness of the program. This can be achieved through a number of checks and control of systems which are detailed in Appendix A.

2.4 MEMBRANE FILTER SYSTEMS

Membrane filter systems have specific requirements to prevent damage to the membranes.

Cleaning and sanitation of membrane filter systems are therefore not included in this Standard and must be isolated and cleaned separately.

Refer to membrane filter manufacturers' specifications for acceptable cleaning and sanitation procedures.

SECTION 3 CLEANING-IN-PLACE OF SPECIFIC ITEMS OF EQUIPMENT

3.1 SCOPE OF SECTION

This Section sets out procedures for the cleaning-in-place of specific items of dairy equipment. The procedures are based on the general recommendations described in Section 2 and should be read in conjunction with those recommendations which are discussed in more detail in AS/NZS 2541.

3.2 COLD MILK VESSELS (INCLUDING VATS, SILOS AND TANKERS)

3.2.1 General

Throughout the operations described, it is assumed that the vessel has adequate provision for draining and venting. Sudden extreme temperature changes are to be avoided throughout the cleaning and sanitizing operations as the resultant pressure and temperature variations may damage the vessel.

NOTE: Heat sanitizing is not recommended as most equipment is refrigerated.

3.2.2 Typical procedure

The typical procedure for cleaning and sanitizing cold milk vessels (including vats, silos and tankers) should be as given in Section 2. Variations to these general recommendations are as follows:

(a) *Pre-rinse* The vessel should be pre-rinsed with water at an inlet temperature of no more than 40°C.

(b) *Detergent cleaning* The detergent cleaning procedure should be as recommended by manufacturer.

3.3 HOT MILK PROCESSING VATS

3.3.1 General

Vats used for pasteurizing at normal pasteurizing temperatures may usually be cleaned by the method for cold milk vessels (see Clause 3.2). However, vats used for extended production periods or for heating milk products to temperatures in excess of normal pasteurizing temperatures, may be difficult to clean. A more severe cleaning regime may be required to remove adherent soils.

A sequence of detergents may be used as appropriate.

NOTE: The initial detergent solution is usually heavily contaminated and should be run to waste.

3.3.2 Procedure

The procedure for cleaning and sanitizing hot milk processing vats should be as given in Section 2.

For post-rinsing, a variation to Clause 2.3.5 is that sufficient rinse solution should be used to completely remove all detergent residues in the post-rinse procedure.

3.4 PLATE HEAT EXCHANGER

3.4.1 General

General cleaning procedures should be as given in Section 2. Variations to these general recommendations are as follows:

(a) *Preparation*

Displace as much product from the system as possible by following the product through with cold to tepid water (no higher than 40°C) or compressed air. Remove filter cloths and clean and sanitize separately.

(b) *Pre-rinse*

(i) If necessary, slacken off the plates when cold, to allow a small flow of solution to atmosphere. This avoids unnecessary pressure on the plate rubbers due to expansion during circulation of hot liquids.

(ii) Arrange the circuit for cleaning. If the balance tank is used as a reservoir, it is necessary to arrange pipework to return the solution to the balance tank.

(c) *Sanitizing*

Re-tighten the plates and rearrange the piping for production and then sanitize all product contact surfaces using one of the procedures described in Clause 2.3.6.2 or 2.3.6.3.

3.5 VACUUM CREAM PASTEURIZERS

3.5.1 General

Vacuum pasteurizers may be cleaned in-place using the procedures recommended in Section 2. Variations to these general recommendations are as follows:

(a) *Preparation*

Preparation should be carried out as given in Section 2. Product reclamation is usually carried out on these units.

(b) *Pre-rinse*

Pre-rinse in accordance with Clause 2.3.3 but at a temperature higher than 60°C to soften and remove fat residues. Set up the circulation circuit by arranging the pipework to run from the discharge pump to a holding vat and then back to the float tank in the pasteurizer.

NOTES:

1 The addition of a small quantity of heavy duty alkaline detergent to the pre-rinse may assist the cleaning operation.

2 High temperature is suitable, as protein component has already been removed from the milk.

(c) *Sanitizing*

The pipework should be rearranged for production and all product contact surfaces sanitized using the technique described in Clause 2.3.6.

During all operations some vacuum should be maintained and should be varied as required, to obtain suitable temperatures during the cleaning cycles. The vacuum should also be reduced momentarily to cause carry-over of solutions into the ejector condenser. However, care should be taken to avoid excessive carry-over.

3.6 PIPELINES

3.6.1 General

Pipeline circuits may be cleaned in-place by the procedure described in Section 2, provided that they have been designed for, or can be modified to be suitable for, this method.

Fittings that cannot be cleaned effectively by CIP should be dismantled daily and cleaned manually.

The layout and design of pipelines should be such that they are completely filled and the capacity of the circulating pump should be sufficient to ensure the minimum flow velocity stipulated in AS/NZS 2541.

NOTE: Product pumps may not be adequate to achieve the required flow velocity.

Variations to general recommendations given in Section 2 are as follows:

(a) *Pre-rinsing*

For high fat milk products the pre-rinse temperature may need to be 60°C to remove residues.

(b) *Detergent cleaning*

Any remotely controlled valves included as part of the circuit should be pulsed a number of times throughout all stages of the cleaning and sanitizing cycles.

3.7 MULTI-FLOW HOMOGENIZERS

3.7.1 General

Homogenizers may be cleaned by CIP procedures described in this Clause, provided that they are not run dry or run for extended periods with solutions having low lubricating properties.

CAUTION: IT IS ESSENTIAL THAT ALL WATER AND CLEANING SOLUTIONS BE FREE OF SUSPENDED OR INSOLUBLE MATERIAL AS PARTICULATE MATTER MAY DAMAGE SUCTION AND DISCHARGE VALVES.

3.7.2 Preparation

The procedure should be as follows:

(a) Reduce the pressure in the homogenizer to between 2800 kPa to 3500 kPa, unless otherwise advised by the manufacturer.

(b) Remove impediments to solution flow, such as non-return (check) valves, prior to in-place cleaning.

(c) Remove inlet strainers, hand clean, rinse, and re-assemble before starting full pre-rinse step.

3.7.3 Pre-rinse

The equipment should be pre-rinsed as described in Clause 2.3.3 but with continuous flow *only*, i.e. no burst rinsing.

CAUTION: BURST RINSING CAN CAUSE DAMAGE TO VALVES.

3.7.4 Detergent cleaning

Owing to the delicate nature of this equipment, it is recommended that the temperature and time of the detergent cleaning cycles are in accordance with recommendations by both the machine and detergent manufacturers. However, the following recommendations are satisfactory for many types of machine:

(a) Circulate the detergent as recommended at the manufacturer’s instructions or at 2800 kPa to 3500 kPa.

(b) An intermediate rinse of warm water until all detergent residues have been removed.

CAUTION: DO NOT ALLOW THE MACHINE TO DRAIN OR RUN DRY.

3.7.5 Post-rinsing

The equipment should be rinsed to drain at a temperature not exceeding that recommended by the equipment manufacturer until all detergent residues have been removed.

CAUTION: DO NOT ALLOW THE MACHINE TO DRAIN OR RUN DRY.

3.7.6 Sanitizing

The homogenizer should be connected for production and sanitized using either of the techniques described in Clause 2.3.6.2.

CAUTION: DO NOT USE A CHEMICAL SANITIZER ON HOMOGENIZER.

3.8 ULTRA-HIGH-TEMPERATURE MILK PROCESSING EQUIPMENT

Ultra-high-temperature treatment of milk (i.e. temperatures exceeding 100°C) is carried out by two main methods, viz.

(a) Direct steam injection.

(b) Indirect steam heating.

Both systems include a pre-warming operation, a flash heating operation, a very short holding time and a rapid cooling treatment.

The types of soils found are similar to those in normal pasteurizing equipment and the same types of detergents should be used to clean the plant.

Due to the temperatures used and the critical nature of processing, most plants have automatic circulation cleaning-in-place provisions included, and the cleaning program is predetermined by the manufacturer. Adequate supplies of the required detergents and rinsing facilities are required.

If cleaning is carried out at temperatures in excess of 100°C, special attention is needed in the selection of the detergent.

For guidance on operating or cleaning the machine, the equipment manufacturer should be consulted.

3.9 EVAPORATORS

3.9.1 General

The CIP methods given below relate to the following types of evaporator:

(a) Batch-pan.

(b) Calandria-tube—single and multiple effect, rising and falling film.

Two methods are described. The first is a vacuum technique, in which the cleaning solutions are caused to boil by reducing the pressure in the system. The other method is conducted at atmospheric pressure. The same principles apply to both procedures:

NOTES:

1 Cleaning materials containing chlorine are not recommended, as free chlorine can be drawn under vacuum into the condensing sections and may cause corrosion.

2 Low-foaming or medium-foaming detergents may be used in these cleaning operations. Medium-foaming detergents may be necessary to provide contact of detergent with upper areas in the chambers.

3 Certain evaporators have spray balls installed in separator sections. These are normally activated by the CIP programmer. In each case, low-foaming detergents are recommended.

3.9.2 Procedure for cleaning under vacuum

3.9.2.1 *Preparation*

The vacuum should be maintained and the pipework connected in accordance with Clause 2.3.2.

3.9.2.2 *Pre-rinse*

The procedure should be as follows:

(a) On the completion of processing, maintain the vacuum and follow the product through with water. When water emerges from the product discharge pump, divert the discharge to drain and complete the pre-rinse.

(b) Arrange the circuit for circulation.

(c) Divert water to a balance tank or hot well until a sufficient quantity is circulating.

(d) Reduce the vacuum to a level just sufficient to achieve 'boil over' and circulation at the highest possible temperature.

(e) Adjust condenser cooling water flow (reduce it), so that temperature of circulating CIP solution can be raised.

(f) Ensure condensate is being returned to balance tank.

3.9.2.3 *Detergent cleaning*

The procedure should be as follows:

(a) Add the recommended quantity of heavy duty alkaline detergent to the balance tank, and circulate for 30 min to 60 min, maintaining the level of the solution in the balance tank.

NOTE: It is advisable to slowly add the alkaline detergent, and rinse the first 5–10 min to drain, this stops large product particulates from blocking distributor holes feeding the tubes, and from blocking sprayballs.

(b) Rinse the cleaning solution from the evaporator by circulating water then discharge to drain.

(c) When this rinse is completed, divert emerging water back to the balance tank, until sufficient is available to continue circulation.

(d) Add the recommended quantity of acidic detergent and circulate for 15 min to 30 min.

NOTES:

1 It is often found desirable to pulse the vacuum for a short period to create a rolling action of the solution as it enters the vapour separators.

2 In some multi-effect evaporators, it may be desirable to introduce some make-up water between the effects, to maintain solution volume to the final effect during the cleaning and rinsing cycle.

3.9.2.4 *Post-rinsing*

The procedure should be as given in Clause 3.9.2.3(b).

3.9.2.5 *Sanitizing*

A sanitizing step is not required, as the start-up heat procedure is adequate for this purpose.

3.9.3 Procedure conducted at or near atmospheric pressure

CIP methods described as 'boil out by steam injection at atmospheric pressure' and 'spray cleaning at atmospheric pressure', are normally used to clean rinsing film calandria-tube and batch-pan types of evaporator.

The procedure for each of these techniques is the same as that described in Section 2 for heavy duty alkaline detergent cleaning, intermediate rinse, acidic detergent cleaning and final rinse.

3.10 DESLUDGING SEPARATORS

3.10.1 General

Desludging centrifuge separators are the only types suitable for cleaning by CIP. All solid bowl machines have to be dismantled and cleaned by manual or mechanical means.

Hermetically-sealed desludgers must have liquid passing through them at all times, but the flow-through paring disc type machines may be momentarily interrupted without damage to the machines. Unless otherwise stated by the manufacturer, the temperature of cleaning and rinsing solutions should not exceed 60°C.

3.10.2 Preparation

The machine should be rinsed as soon as possible after processing is completed and, in the case of hermetic machines, the product should be followed through with rinse water.

3.10.3 Pre-rinse

Pre-rinse should be as given Section 2.

3.10.4 Detergent cleaning

The detergent cleaning procedure should be as given in Section 2, except for the following:

(a) Arrange the balance tank and the feed pump for circulation cleaning-in-place and circulate a detergent under the conditions recommended by the manufacturer. Partially discharge sludge every 5 min to 10 min.

(b) Fully open the cream valve for 5 min, at the same time ensuring that the skim control valve has been shut. This allows a flush out of the cream channels in the separator.

3.10.5 Post-rinsing

The pre-rinse cycle (see Clause 3.10.3) should be repeated using cold water, using the same procedure as for alkali cleaning.

3.10.6 Sanitizing

Sanitizing should be as given in Section 2.

3.11 FILLERS

3.11.1 General

Many details of the cleaning operation are determined by the equipment manufacturer, but the following procedure in conjunction with the general principles of Section 2 may be used. It should be noted that circulation cleaning-in-place can only be carried out on machines designed for CIP.

NOTE: Items such as star wheels, conveyor guides and vacuum assemblies should be removed and manually cleaned.

3.11.2 Preparation

The procedure should be as given in Section 2.

3.11.3 Pre-rinse

The procedure should be as given in Section 2.

3.12 CONTINUOUS BUTTER MAKERS

3.12.1 General

All types of continuous butter makers are cleaned by circulation.

3.12.2 Preparation

The procedure should be as follows:

(a) Follow the cream being fed to the machine with cold water, to displace as much of the butter granules as possible and assist in forcing the last of the churned butter from the machine.

(b) Allow the worker screws to evacuate as much butter from the machine as possible.

(c) Stop the machine and hose out the exposed working surfaces with water at a minimum temperature of 60°C.

(d) Attach all CIP connections according to the machine manufacturer's directions.

(e) Connect up the cream pump, butter milk pump and the butter milk vat for CIP.

3.12.3 Pre-rinse

The equipment should be pre-rinsed as described in Clause 2.3.3 using a minimum solution temperature of 60°C. Additives should not be included in rinse solution when residues are to be recovered.

Butter resides can be collected from the butter milk drain outlet.

3.12.4 Detergent cleaning

An alkaline detergent at 60°C to 70°C should be circulated for at least 20 min.

NOTES:

1 Some early models are equipped with aluminium parts which may be attacked by alkaline detergents and in such cases the equipment manufacturer should be consulted. A general purpose detergent should be satisfactory.

2 Manufacturers recommendations may require you to carry out periodically an additive cleaning to remove milk stone.

3.12.5 Post-rinsing

The equipment should be rinsed with sufficient water at a temperature recommended by the manufacturer to remove all detergent and soil residues.

NOTE: Some additives may be included in the rinse water to prevent the butter sticking.

Butter slips (antistick detergents) are utilized with auto butter makers, these provide a 'non-stick' coating to the machine, to stop butter sticking. Follow the manufacturer's and chemical supplier's instructions carefully.

3.12.6 Sanitizing

The procedure should be as follows:

(a) Assemble the machine for operation.

(b) Sanitize with a chemical sanitizer at the required strength in chilled water using the technique described in Clause 2.3.6.3.

SECTION 4 MANUAL CLEANING OF EQUIPMENT

4.1 SCOPE OF SECTION

This Section sets out recommended procedures for the cleaning of all equipment not suitable or equipped for circulation cleaning-in-place or mechanized cleaning.

4.2 GENERAL PRINCIPLES

Manual cleaning operations are those in which a detergent solution is applied to the equipment and cleaned by physical effort.

Cleaning aids such as brushes or sponges should be maintained in clean and sound condition. Steel wool or similar metallic aids should not be used.

Most accessible items of dairy factory equipment can be manually cleaned. In some instances, other cleaning methods are more efficient.

The following items should be cleaned by hand. This list is not exhaustive:

(a) Plug cocks and dead ends.

(b) Pipe lengths—odd lengths not in the cleaning-in-place circuit.

(c) Gaskets for personnel access openings.

(d) Any rubberware not designed for CIP.

4.3 PROCEDURE

4.3.1 Preparation

As much product as possible should be removed from the system or equipment, either flushing to drain or reclaiming as circumstances demand.

4.3.2 Pre-rinse

The equipment should be pre-rinsed to remove as much of the product residue as possible, using adequate quantities of water at a suitable temperature.

Wherever practicable, the equipment should be pre-rinsed before dismantling for cleaning. The extent of the dismantling should be such that every product contact surface can be reached for cleaning.

NOTES:

1 Rubberware and rubber seats should be regularly cleaned and inspected.

2 Any rubberware showing signs of deterioration or damage should be replaced.

4.3.3 Detergent cleaning

The procedure should be as follows:

(a) Clean dismantled items of equipment with a solution of general purpose detergent at the dilution recommended by chemical supplier.

(b) Thoroughly clean all surfaces of the equipment with detergent solution.

NOTE: The operator should wear gloves and appropriate eye protection gear (see Clause 1.4.3.2).

4.3.4 Post-rinsing

The procedure should be as follows:

(a) Rinse using sufficient quantities of water at a suitable temperature to remove all detergent residues.

(b) Sanitize dismantled equipment during re-assembly.

4.3.5 Sanitizing

The cleaned equipment should be sanitized as described in Section 2.

SECTION 5 MECHANIZED CLEANING OF EQUIPMENT

5.1 SCOPE OF SECTION

This Section sets out procedures for the mechanized cleaning of equipment such as cans, crates, separator discs, bottle-washing machines and cheese hoops.

5.2 GENERAL PRINCIPLES

Mechanical washers should be maintained in an efficient operating condition by ensuring that—

(a) jets, nozzles and strainers are free from blockages and correctly positioned;

(b) washing solutions are not contaminated and are used at the recommended use dilutions and temperatures; and

(c) washers are clean and free of scale.

Other means of mechanical cleaning involve the use of steam guns, pressure guns or jets, or foam guns. These are used for cleaning external surfaces of equipment, walls, floors, conveyor chains and such equipment.

The types of detergents used will depend on the equipment, the cleaning operation and, in the case of guns, the method of application. Safe operating techniques and the possibility of contaminating other surfaces should be taken into consideration when using high pressure guns.

Routine checks should be done to verify that equipment is properly calibrated and maintained.

5.3 CRATES FOR BOTTLES AND CARTONS

5.3.1 General

The mechanized cleaning of bottle and carton crates of wire or plastics construction is usually achieved by passing the crates through a pre-rinse spray, a detergent cleaning spray and a post-rinse spray in a continuous straight-through tunnel by means of a conveyor chain. Crates should be inverted and spaced during transit through the tunnel.

5.3.2 Detergent cleaning spray

A suitable detergent solution at the temperature and concentration recommended by the chemical supplier should be used and maintained throughout the operating period.

5.3.3 Post-rinsing spray

Mains pressure water is used to remove detergent residues.

NOTES:

1 The post-rinse may be collected and used (after heating) as the pre-rinse. This will reduce the amount of water used.

2 It has been found that the plastic crates build up a charge of static electricity which can attract soil while so charged. The charge can be neutralized by occasionally immersing the crates in a solution of a suitable cationic surfactant.

5.4 MECHANICAL WASHERS

5.4.1 General

There are two types of mechanical washers in common use, suitable for discs, hoops, etc. viz.:

(a) Agitator action.

(b) Vibrator, steam injection assisted.

5.4.2 Preparation

The procedure should be as follows:

(a) Remove the separator discs from the separator bowl and rinse away all loose contamination.

(b) Place the discs into the disc-washing machine for cleaning. When loading discs into an agitator-type disc washer, leave a space of about 6 mm between discs.

NOTE: In a vibrator-type disc washer, the discs are close fitting.

5.4.3 Detergent cleaning

The procedure should be as follows:

(a) Add a solution of detergent at the use dilution and clean the discs at 70°C to 80°C for approximately 20 min.

(b) Drain the detergent solution and apply an intermediate rinse.

(c) Add a solution of a suitable acidic detergent at use dilution, and clean the discs at 70°C to 80°C for approximately 20 min.

(d) Drain the detergent solution and apply a final rinse.

(e) Allow to drain and then store until ready for reassembly.

SECTION 6 CLEANING OF SPRAY DRYING EQUIPMENT

6.1 SCOPE OF SECTION

This Section sets out procedures for cleaning and sanitizing spray drying equipment. The same cleaning concepts of wet and dry areas should be applied to other sections of the plant, such as floors, walls and surroundings.

NOTE: The procedures contain elements of CIP, mechanized and manual cleaning, necessitating a separate section for this equipment.

6.2 LIQUID PRODUCT CONTACT SURFACES

All items of equipment coming into contact with liquid product, e.g. pipelines and pumps, should be cleaned in-place with detergent daily or after each production run.

NOTE: Nozzles and atomizers, although coming into contact with liquid product, may generally be considered as part of the drying equipment and should therefore be inspected and cleaned in accordance with Clause 6.3.

6.3 CLEANING PROCEDURES FOR DRYING AND FILTRATION SYSTEM

The cleaning of the spray drying chamber and associated equipment normally consists of a daily dry clean periodical wet clean with detergent as described in Clauses 6.4 and 6.5. Care should be taken to ensure that insulation and hollow bodies are kept dry.

6.4 DRY CLEANING

All surfaces should be dry cleaned using brooms, brushes, scrapers or by vacuum, as required.

Brooms, brushes and such equipment should be sanitized and dried before use. Bristles should be non-absorbent, easily cleaned and firmly secured.

Sanitized equipment should be stored to avoid contamination when not in use.

All cleaning tools and cleaning equipment should be confined to specific areas.

Operators should change into clean, protective clothing (including footwear covers) prior to entering different areas of the plant. Operators entering the drying chamber should change into sanitized protective clothing and footwear.

Filter bags and cyclones should be dry cleaned in place using a suitable brush, or a vacuum cleaner. Filter bags should be turned inside out and brushed or vacuumed. Inlet ducts should be closed during bag cleaning to prevent powder entering the air heating section. After cleaning, the bags should be examined, replaced if necessary, and checked to ensure they are securely located on their collars before restarting plant. Finally, all ducts, rotary valves, cyclones and conveyors should be examined and any deposits of powder removed by brushing.

6.5 WET CLEANING

6.5.1 General

The drying and filtration system should be wet cleaned as described below when dry cleaning is no longer effective.

NOTES:

1 Wet cleaning procedures should always commence at the uppermost level of the plant and proceed towards the bottom level. This will avoid possible recontamination of cleaned surfaces and components.

2 Air filters should be cleaned outside the spray drying area and dried thoroughly before refitting.

6.5.2 Plants without CIP

Plants without CIP should be given a preliminary dry clean as described in Clause 6.4. All parts and surfaces should be washed manually by brushing with a general purpose detergent as described in Section 4. Mechanized cleaning aids may also be used.

6.5.3 Plants with CIP

6.5.3.1 *General*

As the spray systems and water pressures will vary from plant to plant, circulation times for liquids are not stated. The number of passes through the equipment is a more effective measure of rinsing or cleaning. The number of passes required for effective cleaning should be determined for each drying system.

6.5.3.2 *Preliminary dry clean*

The plant should be dry cleaned as described in Clause 6.4 to reduce the amount of product before wet cleaning.

6.5.3.3 *Pre-rinse*

The plant should be flushed thoroughly with water.

6.5.3.4 *Detergent cleaning*

A detergent prepared at the use dilution and at a temperature recommended by the manufacturer should be circulated for a sufficient number of passes to provide adequate cleaning.

6.5.3.5 *Acid rinse*

An acid rinse may be used here if desired.

6.5.3.6 *Post-rinsing*

The plant should be flushed thoroughly with water.

6.6 OTHER OCCASIONS FOR WET CLEANING

Wet cleaning may also be required in the following circumstances:

(a) When closing down the plant for any period for maintenance in the drying chamber.

(b) Prior to starting up the plant after a prolonged shutdown.

(c) When indicated by unsatisfactory bacteriological counts on the powder.

(d) Prior to changing to a non-compatible product.

6.7 FILTER CLOTHS

Filter cloths should be laundered regularly in a mild detergent solution and the temperature controlled to avoid shrinkage. After washing, each cloth should be measured against a standard to ensure the cloth has retained its original dimensions.

6.8 SANITIZING PROCEDURES

All equipment coming into contact with the liquid product should be sanitized in accordance with Clause 2.3.6.

The drying chamber and powder handling equipment should be sanitized and dried by passing air at 100°C to 110°C over them.

APPENDIX A

METHODS OF VERIFICATION AND VALIDATION OF CLEANING PROGRAMS

(Informative)

A1 VERIFICATION

Verification checks ensure that the system is complying with set process specifications. Following is a list of cleaning system verification methods:

(a) *Visual inspection* After cleaning, equipment should be inspected to ensure that the cleaning has been completed satisfactorily. This may detect a number of problems including—

(i) blocked spray balls;

(ii) detergents and sanitizers not fully draining from equipment;

(iii) residue build up can be assessed;

(iv) protein or mineral deposits, such as milk stone;

(v) deposits in hard to get at areas such as pipe joints, behind gaskets or in dead ends of pipes; and

(vi) inappropriateness of the existing cleaning program.

(b) *Temperature of cleaning and sanitation* This is important to the effectiveness of detergents and for sanitation effects. Temperature should be within set ranges. Two factors that should be considered are—

(i) to check that the temperature complies with specifications; and

(ii) to check that thermometers and recorders are calibrated to ensure that temperatures are accurate.

(c) *Detergent concentrations* Detergent concentration should be checked periodically. Underdosing will reduce the effectiveness of chemicals and overdosing wastes chemicals and may lead to residues left in the plant. Chemical suppliers may assist in checking concentrations.

Two factors that should be considered are—

(i) to check that the current usage rates comply with manufacturer's specifications; and

(ii) to ensure that dosing equipment is applying the correct dosage rate and that there are no line blockages.

(d) Time-automated systems should be checked to ensure compliance to the program.

(e) *Recording systems* Some automated programs record cleaning data on graphs.

Two factors that should be considered are—

(i) to check the records against specifications to verify compliance; and

(ii) to check that recorders are calibrated to ensure accurate recording of time, temperature, flow rate and concentration.

A2 VALIDATION

Validation of the system is conducted to ensure that the program, when followed correctly achieves the desired level of cleanliness and sanitation. This may be achieved through:

(a) *Monitoring product test results* Satisfactory tests generally indicate that cleaning programs are adequate, unsatisfactory results may indicate a cleaning problem among other possible problems.

(b) *Testing of equipment surfaces* This testing indicates the effectiveness of cleaning by measuring the level of microorganisms or organic residues remaining on equipment surfaces after cleaning and sanitation. Two methods available to assess viable microbiological residues are through:

(i) *Agar contact method* The solidified nutrient agar is impressed onto the surface to be tested, and then incubated.

(ii) *Swab method* An area of the surface to be tested is defined and sampled by rubbing with a swab. The microorganisms are removed from the swab, plated out and the colonies are counted after incubation.

More information on these procedures may be obtained through commercial or factory microbiological laboratories.

The following surface counts may be used as guidelines to indicate satisfactory cleaning operations:

(A) Agar contact method ..... 15 CFU/cm^2

(B) Swab method ..... 6 CFU/cm^2

NOTE: These counts are for guidance only and may vary in different areas.

(c) *ATP fluorescence test* Measures ATP residues on the equipment. ATP is present in many animal-based soils, not just bacteria and the ATP test will, therefore, detect animal-based soil and bacteria.

This method provides a result as a ‘number’ which is assessed against a standard to assess equipment cleanliness. The calibration of the ATP equipment/method is required to provide a standard set of results which will collelate the obtained ATP ‘number’ to an accepted visual level of cleanliness.

If the ATP ‘number’ obtained after a cleaning program varies significantly from the standard, would indicate a potential problem with the cleaning system (cleaning and/or sanitation) and should be investigated to determine the cause for the deviation.

The ATP test does not differentiate between live (viable) and dead bacteria remaining after sanitation. Therefore, and ATP test should not replace a swab/contact plate micro test which measures number of viable bacteria present on surface.

APPENDIX B

DISPOSAL OF CLEANING SOLUTION EFFLUENTS

(Informative)

B1 EFFLUENT SYSTEM

During plant cleaning, detergents and sanitizers drain away into the same final systems that receive all waste liquids during the working day. Where these liquids are fed into ponds or lagoon systems for treatment that depends on biological action, particular care should be exercised in the selection of both cleaning and sanitizing chemicals. It should be understood that the microorganisms in a pond system, once destroyed, can only be built up again over a period of weeks or even months during which time the odour from the pond will be very unpleasant.

B2 CONSIDERTIONS FOR DETERGENTS AND SANITIZERS

B2.1 pH

Care should be taken when disposing of highly acidic or alkaline compounds. Organisms necessary to digest organic waste will operate only within a comparatively narrow pH range (approximately 4 to 10) while, for optimum efficiency, the pH should preferably be kept between 5 and 8. This can be achieved by mixing acidic and alkaline wastes before disposal or by collecting the wastes and neutralizing before disposal.

B2.2 Foam

Stable foams which float on the surface of ponds will reduce the biological action of the microorganisms. Foams should break down quickly as they are rinsed away.

B2.3 Oils and solvents

Oils and solvents can destroy the organisms in the pond and floating patches will reduce oxygen intake and biological action.

B2.4 Residual activity of sanitizers

The preferred sanitizers for discharge into these systems are those which break down in the presence of large amounts of organic matter and so lose their bactericidal effect. Those based on chlorine or iodine, for instance, are particularly suitable.

Sanitizers having residual action, such as those based on amphoteric or quaternary ammonium compounds, can build up to toxic levels, particularly in anaerobic ponds.

APPENDIX C

WATER QUALITY

(Informative)

C1 GENERAL

If a water supply complying with Clause 1.5 is not readily available, the water may require treatment as discussed below. Before treating a water supply, advice should be obtained from the local dairy officer regarding an analysis of the water and the type of treatment required.

C2 DETERGENT AND SANITIZER SELECTION

Detergents and sanitizers should be selected bearing in mind the following:

(a) *Hard waters* For water exceeding 300 mg/L total hardness, expressed as calcium carbonate ($CaCO_3$), a detergent formulated for use in hard waters should be used. These are described as Type B in AS 1803.

Various treatments may be considered if water supplies have a total hardness, measurable as $CaCO_3$, in excess of 500 mg/L. The most usual treatment is by an ion-exchange softener capable of automatic regeneration.

(b) *Alkaline waters* Water supplies with alkalinity exceeding 100 mg/L, expressed as $CaCO_3$, will affect the proper functioning of iodophors and other acid-based sanitizers and detergents. Waters with excessive alkalinity can be neutralized by the addition of suitable acids or acidic detergents.

C3 CLARIFICATION

Turbid waters may require a chemical treatment with a flocculating agent, followed by settling or filtering, or both, to remove colloidal or other suspended matter. Dosage rates for chemicals will depend on the original condition of the water.

C4 TREATED WATER

Water used to rinse plant before operation should comply with the standards for drinking water set by the relevant regulatory authority. Waters of doubtful bacteriological quality can be made suitable by—

(a) heating the water at 85°C to 90°C for a minimum of 5 min;

(b) chemical treatment with chlorine to breakpoint chlorination; or

(c) by using other equivalent chemical methods.

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