
**Code of practice - Food hygiene
management**

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Foreword

This Ethiopian Standard has been prepared under the direction of the Technical Committee for Food products in general (TC 13) and published by the Ethiopian Standards Agency (ESA).

This Ethiopian Standard cancels and replaces ES 929:2015, *Code of practice - Food hygiene management*.

In preparation of this standard references have been made to the following:

- South African Standard, SABS 049:2001, Code of practice food hygiene management.

Acknowledgement is made for the use of information from the above publications.

Code of practice - Food hygiene management

1 Scope

1.1 This Ethiopian Standard specifies provisions for the hygienic handling of food for human consumption, in order to ensure a safe, sound and wholesome product.

1.2 This Ethiopian Standard is applicable to the preparation, processing, packaging, storage, transportation, distribution and sale of food for human consumption.

2 Normative references

The following Ethiopian Standards contain provisions, which, through reference to this text, constitute provisions of this Ethiopian Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this Ethiopian Standard are encouraged to investigate the possibility of applying the most recent editions of the Ethiopian Standard indicated below. Registers of currently valid standards are maintained in the Ethiopian Standards Agency (ESA).

ES 261, *Drinking water- Specification*.

ES 693, *Pesticides - Terminology*.

ES 930, *Code of practice for the application of pesticides in food-handling, food-processing, and catering establishments*.

3 Definitions

For the purposes of this standard, the following definitions apply:

3.1

adequate

suffice to accomplish the intended purpose of this Ethiopian Standard

3.2

administering authority

official agency that has jurisdiction, for example, a central government department, local authority

3.3

appropriate

acceptable to, or required by, the administering authority

3.4

approved

approved by the administering authority

3.5

cleaning

removal of soil, food and fat residues, or other objectionable matter

**3.6
contamination**

occurrence of any undesirable matter such as chemical, biological, physical in the product affecting the health

**3.7
disinfection**

use of approved chemical agents, or physical methods (or both) to reduce, without adversely affecting the food, the number of micro-organisms to a level that will not lead to harmful contamination food

**3.8
establishment**

any buildings) or areas) in which food is handled and the surroundings under the control of the same management

**3.9
food**

any substance, whether processed, semi-processed or raw, which is intended for human consumption, and includes drink, chewing gum and any substance which has been used in the manufacture, preparation or treatment of 'food' but does not include cosmetics or tobacco or substances used only as drugs

**3.10
food handling**

any operation in the ground, harvesting, preparation, processing, packaging, storage, transportation, distribution and sale of food

**3.11
food hygiene**

all measures necessary to ensure the safety, soundness and wholesomeness of food at all stages, and from its production or manufacture until its final consumption

**3.12
food spoilage**

any microbiological food deterioration

**3.13
packaging material**

any containers, such as cans, bottles, cartons, boxes, cases, bags and sacks, or wrapping and covering material, such as foil, film, metal, paper, wax Paper' Plastics and cloth

**3.14
pest**

any organism capable of contaminating food directly or indirectly, distracting, and spoiling the food that may cause health risk

**3.15
policy**

written document that management of a food manufacturing company shall define its objectives, procedures and commitment concerning food hygiene and good manufacturing practice

**3.16
potable water**

water that complies with the requirements of ES 261

**3.17
safe**

containing no substances likely to cause harm to the consumer health

3.18**sensitive production areas**

areas where the product is particularly susceptible to contamination

3.19**suitable**

deemed by the administering authority to be suitable for the purpose

3.20**toxic**

harmful to human, animal or plant health

3.21**waste materials**

unused materials, or used materials subsequently disposed of, including cleaning materials, disinfectants and hazardous materials

3.22**wholesome**

conducive to physical health.

4 General provisions for facilities, materials and processes employed and for employees engaged in the handling of food

The applicable laws, by-laws, regulations and compulsory specifications shall be complied with.

5 Food hygiene policy

The responsibility for, and commitment to, a hygiene policy belong with the highest level of management. Hygiene management is that aspect of the overall management function that determines and implements hygiene policy.

All food manufacturing companies shall maintain hygiene at an appropriate level. This level will vary depending on the type of product or products produced, but shall be such as to ensure that the food produced is safe to eat. This is a legal requirement. The requirements contained in this standard are ancillary to this obligation and are included as a means of eliminating, as far as possible, possible sources of contamination to food. Since contaminated food can be a serious hazard to health, manufacturing companies should have a defined policy for hygiene and should comply with manufacturing practice.

Where a food manufacturer requires listing or registration in terms of ES ISO 9001 and ES 588 HACCP; see clause 6.1), the registering body is advised to use this Ethiopian Standard in conjunction with ES ISO 9001 and ES 588 and to determine if good food manufacturing practice is applied by company.

5 1 General requirements

Management shall define and document its policy, objectives and commitment concerning hygiene. Management shall ensure that its corporate hygiene policy is understood, implemented, maintained at all levels in the organization.

5.2 Specific requirements

5.2.1 Food manufacturing companies shall have written policies and procedures for hygiene and good manufacturing practice, compiled and collated by a person professionally qualified to do so. (This could form part of the total policy statement.) Policy and procedures shall be collated in a hygiene manual.

5.2.2 The policy statement shall contain a commitment to maintain hygiene at a level that is at least in accordance with the minimum standards set out in this standard, to ensure the safety of the produced and to devote adequate resources to achieve this.

5.2.3 A suitably qualified and experienced hygiene officer shall be appointed to take for the implementation and maintenance of the food hygiene management system.

5.2.4 The policy statement shall be signed by the person or persons who have the ultimate responsibility and authority for defining the company's policy.

5.2.5 Activities associated with hygiene shall be reviewed at least annually and as frequently as deemed necessary to rectify shortcomings highlighted by the implementation of a proper hygiene verification programme or by changes in legislation.

6 Food safety

Food contamination is caused by the presence of any undesirable matter or of food spoilage and pathogenic (disease-causing) micro-organisms in food. The most commonly known pathogenic micro-organisms are species of bacteria, but certain moulds, viruses and protozoa are also harmful or pathogenic.

It is the responsibility of all food manufacturers to take all reasonable precautions to prevent and control the risk of food contamination in locations or premises under their direct control. The most effective way to do this is to install documented system procedures for preventing and controlling risk of food contamination. Inspection and testing of food products will not suffice to ensure that food is free from contamination.

HACCP (Hazard Analysis and Critical Control Points) system of evaluation shall be used to assess what is required to ensure the safety of food.

The HACCP system entails the intelligent application of the principles of hazard analysis and the identification and control of critical control points. Critical control points in food-processing operations are the key points in the process that shall be controlled to safeguard the health of the consumer. Such points could include handling, storage, processing (including pasteurization and cooking) and the exclusion of foreign bodies. The maintenance of the cold chain is also critical to ensure the safety of chilled and frozen foods.

For a food manufacturer, hazard analysis is the rational process of estimating the risks associated with the process and marketing of foodstuffs. Risks associated with processing include contamination by micro-organisms and foreign bodies. The risk of microbiological contamination of food is generally greatest after the food has been processed and before it is packaged. In respect of marketing of foodstuffs, foods that shall be maintained at temperatures other than ambient temperature are the most susceptible to abuse during distribution and retailing.

In determining the level of prevention and control that is required to protect the consumer from food borne illness, food, including food ingredients, can be categorized as follows:

- a) **High care:** Foods that are a potential source of pathogenic micro-organisms, that are intended for consumption and that do not have, immediately before consumption, a cooking step that is adequate to kill pathogenic micro-organisms or destroy their toxins; for example perishable foods such as meat, milk, fish, egg, cake, etc.
- b) **Critically risky area under high care:** Foods as for "High care" (see (a)) intended for consumption by people with low immunity, infants, geriatrics and hospital patients or intended for use as an ingredient in the pharmaceutical industry or the medical industry.
- c) **Medium care:** Foods that are a potential source of pathogenic micro-organisms, that are intended for consumption and that do have, immediately before consumption, a cooking step that is adequate to kill pathogenic micro-organisms, or foods that do not belong to the other two categories, or foods that are required to have an extended shelf life before heating or cooking, for example, prepared meals for retail; for example food such as bread, fruit, etc.
- d) **Low care:** Foods not previously known to be a source of pathogenic micro-organisms and in which harmful residues or chemicals have rarely been found, and where limited shelf life is required or the foods are to be further preserved by means of deep-freezing; for example food such as cereals and grains, flour, etc.

6.1 General requirements

The manufacturer shall identify and list the chemical, functional, organoleptic and microbiological tests, the procedures used and the frequencies required to identify cleaning and disinfection failures or food contamination. The manufacturer shall establish specifications for raw materials, in-process materials and the finished product and shall take adequate precautions to ensure that food is free from foreign bodies. Special precautions shall be taken in processing high-risk foods. All expired or irretrievably spoiled food shall be rejected. Contaminated food may be treated or reprocessed to eliminate the contamination where this can be achieved.

NOTE Recommendations on food safety are given in A.1.

6.2 Specific requirements - Food safety

6.2.1 The manufacturer shall make use of a suitably qualified person to identify, list and establish appropriate chemical, functional, microbiological and organoleptic specifications for all raw materials (including additives, ingredients and processing aids) and in-process materials. Raw materials which could affect the safety of the finished product shall only be purchased from approved suppliers. A list shall be kept of such suppliers and their performance records shall be monitored.

6.2.2 The manufacturer should follow the appropriate national standards and establish chemical, functional, microbiological and organoleptic specifications for the raw materials and finished product.

6.2.3 The manufacturer shall test, or have tested, raw materials, in-process materials and the finished product at a frequency commensurate with the risk to the safety of the finished product. These tests shall be carried out in accordance with defined procedures by a competent laboratory. Supplier guarantees shall be adequate to eliminate or reduce the testing requirement for raw materials, but this does not absolve the manufacturer from his responsibilities.

6.2.4 Environmental sampling shall be carried out by the manufacturer following appropriate test methods, and a microbiological analysis of these samples (samples include raw materials, finished products, water, effluents) shall be done at a level commensurate with identifying the risk to the safety of the finished product.

6.2.5 The manufacturer shall identify, monitor and record all critical parameters in the process to ensure that the finished product is microbiologically safe. Critical parameters shall include any heat processing required to pasteurize or sterilize the product, hygiene and cleaning procedures, the strength of cleaning and disinfecting active ingredients and the temperature for each washing cycle and the temperature for post-heat-treatment.

Measuring instruments used to monitor critical parameters shall be calibrated at appropriate intervals to ensure that their accuracy is within defined limits.

6.2.6 Records of all processes required to ensure the safety of food shall be inspected at least daily by a suitably qualified and experienced person, who shall sign the records to show that the inspection has taken place. The purpose of this is to demonstrate that the process has been carried out under the required conditions.

6.2.7 In the event of microbiological results being outside the defined microbiological criteria for raw materials, in-process materials, the finished product or the environment, timely action shall be taken by the manufacturer to identify and rectify the cause so as to preclude the manufacture of product outside the established microbiological specification. Should such product nonetheless be distributed for sale, a recall procedure shall be in place.

6.2.8 There shall be a written procedure defining the action to be taken to ensure that the finished product produced during or after failure in the control of a critical parameter, is not released for sale or consumption until it has been established that the product is safe. The only exception permitted to this requirement is where the product is sold for further treatment or processing which will eliminate the contamination.

6.2.9 Food which shall not comply with clause 6.2.2 shall be rejected, or treated, or processed to eliminate the contamination where this is possible. It shall not be blended with uncontaminated product as a means of bringing the food within specification.

6.2.10 Packaging material used in contact with food shall be free from contamination, shall not transmit to the food substances injurious to the health of the consumer, shall not taint the food, shall not impart off-flavours or off-odours to the product, and shall be able to render the protection required by the particular food product.

6.3 Specific requirements - Foreign matter

6.3.1 The manufacturer shall take all the necessary precautions to ensure that the food is free from foreign matter. Precautions shall include inspection of raw materials, keeping the production area free from extraneous material, and proper control of micro-organisms, insects, rodents or birds.

6.3.2 Where glass containers are used for packaging, the manufacturer shall establish suitable handling procedures to eliminate possible contamination of the food by glass fragments or splinters. X-rays and other suitable means shall be used, where possible, to identify foreign materials, including glass.

6.3.3 No glass containers, other than glass containers to be used for the packaging of the finished product, and glass sampling bottles, shall be brought into the production area.

6.3.4 Glass pipes, flow meters and glass equipment should be avoided but, if used, a documented procedure for routine inspection for cracks and splinters shall be in place.

6.3.5 Broken glass windows shall be reported immediately to the designated person whose responsibility it is to identify and have destroyed any food that could have been contaminated by glass. These windows shall be replaced as soon as possible but not during production, unless adequate screens have been installed.

6.3.6 A metal detector shall be installed, where appropriate, on all consumer lines, and shall be located so as to inspect the finished consumer pack or packs, where this is technically possible. The detector shall be capable of detecting spheres of ferrous material of diameter 2 mm and spheres of non-ferrous material of diameter 2.5 mm unless the composition of the food makes this impossible. The sensitivity of the search head shall be checked at predetermined intervals by a designated trained person, who shall record the results of the test either manually or automatically. Test results shall be kept for at least the shelf life of the product.

The response time of the detector shall be checked to ensure that the correct package is rejected.

6.3.7 In case of contamination by foreign matter, all products shall be traceable by means of

- a) a date code, or
- b) a production code (lot code), or
- c) a sell by/best before or use-by date, or
- d) any combination of these, so that all affected product can be removed and destroyed or reprocessed (see clause 6.1).

6.3.8 Recall procedures shall be in place where it is established that contaminated product has released for sale.

6.4 Specific requirements - High-risk areas

6.4.1 High-risk areas shall be physically separated, either by partitioning, or by location, or by effective means, from other areas of the factory, and shall be demarcated as such.

High-risk processing areas are defined as:

- a) areas where high-risk foods are exposed and the subsequent processing does not contain a step that effectively destroys all harmful micro-organisms, or
- b) areas where high-risk foods are exposed after they have undergone a processing effectively destroys harmful micro-organisms.

No cardboard or outer case packaging shall be permitted in high-risk areas. All products (for example raw vegetables) entering this area shall have been suitably disinfected.

6.4.2 Access to high-risk processing areas shall be restricted to designated personnel, wear readily identifiable

protective clothing and footwear.

6.4.3 Access to high-risk areas shall be via a changing room only, where personnel entering the area shall change to readily identifiable protective clothing, including footwear.

6.4.4 The air supply to high-risk areas shall be filtered to 2µm screen and the area shall be kept under positive pressure.

6.4.5 No toilet facilities, other than wash-hand basins, shall be located in high-risk areas.

6.4.6 In cases where employees develop chronic pathogen infection, such employees shall not access to high-risk processing areas. (Employers should seek to place such employees in other of their businesses.)

7 Premises and structures

The establishment shall be so situated as to minimize the possibility of the food's being contaminated during preparation. It shall not be subject to flooding and the air shall be clean and free from excessive levels of bacteria, yeast and moulds, and from odours. It is essential to eliminate or control, both in the grounds and in the factory premises, conditions that would lead to the spreading of air-borne or foot borne soil, or the harbourage or breeding of micro-organisms, insects, rodents or birds.

The factory and structures shall be so designed, sized and constructed to facilitate maintenance cleaning. Adequate working space shall be provided to allow for the satisfactory performance operations. All working space shall be maintained in a clean condition and be adequate for the purpose for which it is used. A well-designed structure can greatly reduce the cost of cleaning.

7.1 General requirements

The grounds and factory premises shall be kept free of conditions that could lead to the contamination of food or the breeding or harbourage of micro-organisms, insects, rodents or birds and the entry of environmental contaminants. The design and construction of buildings and facilities and the building materials used shall be such as to permit easy and adequate cleaning and disinfecting, which will facilitate the maintenance of good hygiene, and also to permit segregation of non-conforming facilities and materials.

NOTE Recommendations on premises and structures are given in A.2

7.2 Specific requirements - Grounds

7.2.1 Engineering materials, other useful materials and equipment shall be stored so as not to provide sites for the harbourage or breeding of micro-organisms, insects, rodents or birds. Materials and equipment shall be stored in an orderly manner on elevated racks or pallets in clearly defined areas.

7.2.2 Litter, waste and refuse shall be stored in suitable containers that can be thoroughly cleaned. If containers are not stored in an enclosed waste room, they shall be fitted with tight-fitting lids.

7.2.3 To avoid excessive dust, roadways and areas that serve the establishment and that are within its boundaries or in its immediate vicinity shall have a hard, paved surface suitable for wheeled traffic. There shall be adequate drainage, and provision shall be made for cleaning.

7.2.4 Stagnant water shall be eliminated, and particular attention shall be paid to gutters, open drains, potholes and pools. Inadequate drainage or incorrectly sloped surfaces can cause water to become stagnant.

7.2.5 Unused buildings, outhouses, service buildings, etc. shall be kept clean and tidy to preclude the establishment of sites for harbourage and breeding of micro-organisms, insects, rodents or birds.

7.2.6 Precautions shall be taken to ensure that contamination from trucks and other vehicles is not brought into the factory either by fork truck or by foot.

7.2.7 Cattle grids or other appropriate systems shall be used to prevent cattle from entering the factory grounds.

7.2.8 No animal shall be permitted on the factory grounds, other than when it is to be used as raw material, or when it is a guide dog accompanying a blind person in the sales or serving area of the establishment, or when it is used for securing the premises. Security dogs may not come into contact with or enter areas where food is handled.

7.2.9 Access to the factory grounds shall be protected by a perimeter fence or wall to keep out animals, or unauthorized persons (or both).

7.2.10 The grounds shall be kept free from uncut weeds and grass, litter, waste and miscellaneous materials.

7.2.11 Precautions shall be taken to preclude, as far as possible birds from nesting or perching in the grounds of the plant, while complying with the regulations on the conservation of wildlife.

7.2.12 Yards, outside structures and pathways shall be maintained in a clean condition and shall, in particular, be kept free from excreta from birds and animals, to avoid foot-borne soil and harmful micro-organisms, such as *Salmonella*, being carried into the plant.

7.3 Specific requirements - Roofs and outside structures

7.3.1 Roofs, valleys and gutters shall be so maintained as to prevent the contamination of food, or materials used in the preparation or presentation of food, by rain water and to prevent walls and floors from becoming damp or wet due to rain.

7.3.2 Roofs, valleys and gutters shall be kept clear of debris, including insects and dead birds, and shall be inspected at appropriate defined intervals.

7.3.3 Outside structures shall be kept clear of debris, bird droppings, etc. as these can contaminate food.

7.4 Specific requirements - Walls

7.4.1 Walls shall be kept free from cobwebs, dampness, condensation and mould.

7.4.2 Junctions between walls, floors and ceilings, shall be closed and, ideally, should be coved.

7.4.3 The joints on paneled walls shall be sealed.

7.4.4 The preferred finish of walls is white washable acrylic or epoxy-based paint or "iso-wall". Where tiles are used, only the industrial types that are properly sealed shall be considered and the joints between the tiles shall be sealed with a non-absorbent material(see A.2.2).

7.4.5 Horizontal ledges and sills should be avoided and, if present, shall be kept free from soil and any miscellaneous items.

7.4.6 Openings for conveyors, services, vents, etc shall be smooth and sealed.

7.4.7 Where appropriate, walls shall be protected from damage by moving equipment. Galvanized guard rails or the equivalent shall be used for this purpose.

7.4.8 Walls shall be properly maintained. Proper maintenance includes getting rid of flaking paint, replacing damaged tiles, proper grouting of tiles and sealing of cracks and joints on internal wall surfaces.

7.4.9 The placing of fixtures, signs, switch boxes, etc. on internal wall surfaces should be avoided, but, where these are present in processing areas, they shall be sealed to avoid creating sites where soil can accumulate.

7.4.10 Walls shall be maintained in a clean condition.

7.5 Specific requirements

7.5.1 Floors shall be constructed of durable, water-resistant material, for example, concrete or approved synthetic

material. Where floor tiles are used, only industrial type tiles that are properly sealed and will allow floor drainage shall be considered. The entire floor surface shall be nonabsorbent to allow for the frequent use of high-pressure steam washing.

7.5.2 Floors shall be resistant to attack by product spillage, cleaning agents and cleaning solutions.

7.5.3 Floors maintained in good condition, i.e. free from cracks, holes or corrosion.

7.5.4 Floors shall be smooth to facilitate cleaning, subject to the requirement of being safe to walk on when wet, dry or greasy.

7.5.5 Wet areas shall be provided with adequate facilities for provided for drainage and the floors of such areas shall be adequately sloped to drains, so as to prevent pools of liquid from forming.

7.5.6 Channels, if used, shall be easily accessible for cleaning and shall be cleaned daily. Where appropriate for safety or other reasons, channels shall be covered with removable grids that shall be removed and cleaned daily.

7.5.7 Concrete floors shall be suitably construct or sealed to prevent the build up of soil or the release of dust.

7.5.8 Duckboards should be avoided, but if essential, they shall be easy to clean and made of metal or suitable plastics. Wooden duckboards shall not be used.

7.5.9 Mezzanine floors, bridges to mezzanine floors and bridges over equipment shall be completely sealed, shall include side walls and walls around openings in all instances where the absence of these could lead to the contamination of the area below. Adequate provision shall be made for cleaning.

7.5.10 Floors shall be kept clean, free from litter, accumulated water, oil, etc. The floors of processing areas shall be cleaned at least daily. In sensitive production areas, the floors shall be cleaned with a disinfectant.

7.5.11 Stairways in production area and gangways over production lines shall be completely sealed and shall have adequate side walls to preclude contamination of the area below. Metal stairways shall either be constructed from non-corrosive material or be suitably protected from corrosion.

7.6 Specific requirements - Ceilings and overheads

7.6.1 Ceilings shall be smooth, impervious to water and dust, and easy to clean(see A.2.2).

7.6.2 Girders, overhead pipework services and structures should be kept to a minimum to facilitate cleaning, but, if present, shall be free from dust, rust, mould, flaking paint, cobwebs and other extraneous material.

7.6.3 False ceilings are ideal for enclosing services, roof structures, etc. If present, they shall be smooth and impervious to water and dust, adequately supported, and, if appropriate, provided with catwalks or other means to facilitate cleaning enable maintenance of the space above the ceiling.

7.6.4 Where there is no access to the space above the ceiling, the ceiling shall be totally sealed.

7.6.5 Skylights, if present, shall be clean, free from condensation, and shall not open.

7.6.6 False ceilings shall not contain asbestos or be made of material likely to disintegrate.

7.6.7 openings in ceilings for conveyors, vents, piping, etc. shall be properly sealed and the edges shall be smooth.

7.6.8 Canopies that cover equipment, air vents and air vent covers and screens shall be kept clean and dust free.

7.6.9 Ceilings shall be kept free from condensation to prevent mould from growing and water from dropping onto the food. This can be achieved by correct air circulation, insulation and the venting of moist air.

7.6.10 Any internal point of access to outside roofs and structures shall be controlled to preclude foot borne soil from being brought into the plant. The access door shall be locked, unless fire regulations require otherwise, and personnel exiting onto roofs shall change their footwear on re-entering the plant.

7.7 Specific requirements - Doors and windows

7.7.1 Doors, windows and window frames shall be kept clean, in good condition and free from mould, flaking paint, etc.

7.7.2 Windows that can be opened shall be fitted with a fly screen (see A.2.4).

7.7.3 Doors that lead into production areas and that are used other than as emergency exits shall be fitted with self-closing devices, air curtains or plastic strips.

7.7.4 Doors, windows and window frames shall be tight fitting.

7.7.5 External doors shall be kept closed. If this is impracticable because of frequent use, then overlapping plastic strip curtains, rubber swing doors or an appropriate alternative shall be used.

7.7.6 Internal window sills, if newly built, shall have a slope of 45°. In the case of existing premises, windowsills, if horizontal, shall be kept free from dust and extraneous material.

7.7.7 External doors shall be so constructed as to prevent the entry of rain water into the factory.

7.7.8 Wooden doors should be avoided but, if used, should be flush doors to prevent the accumulation of soil, and shall be coated with a non-toxic, easily cleanable material.

7.8 Specific requirements - Furnishings

7.8.1 Furnishings shall be of solid construction and in good repair.

7.8.2 Both inner and outer surfaces of furnishings shall be kept clean.

7.8.3 Furnishings shall ideally be constructed of metal or plastic. If constructed of wood or a woodbased product, the furnishings shall have a finish that is non-toxic and easy to clean.

7.8.4 Furnishings shall be ventilated, where necessary.

7.8.5 The tops of furnishings shall be kept free from dust and extraneous material and, where appropriate, should be sloped.

7.9 Specific requirements - Lifts

Lifts shall be kept clean. Precautions shall be taken to ensure that the wall of the lift is kept free from any condition that could present a risk of contamination to the food.

8 Services

In a food factory, contamination of food can be caused by services that are inadequate, poorly designed, or poorly maintained. Micro-organisms can be carried on dust particles in the air, or in water. Steam, too, can be a source of chemical contamination and condensation. Service ducting can provide rodents and insects with access to the plant and inadequate control of waste and effluent can lead to the establishment of breeding sites for micro-organisms, insects, rodents or birds.

8.1 General requirements

Adequate services shall be provided by the manufacturer. Services shall be so designed, maintained, controlled

and monitored as to avoid the risk of contamination of the food, at all stages of production.

NOTE Recommendations on services are given in A.3.

8.2 Specific requirements -Construction

8.2.1 Electrical equipment shall be appropriate, for example, electrical equipment used in a wet area shall comply with the requirements for this type of use.

8.2.2 The cladding used for pipework shall be suitable for use in a food area and shall be covered with aluminium or a suitable alternative.

8.2.3 Appropriate materials shall be used for services and service lines. The materials shall not contaminate the services they carry and shall be inert to attack by cleaning agents, where appropriate.

8.2.4 Exhaust fan shall be provided for equipment that gives off fumes or steam. These units shall be adequate to prevent the build-up of condensation or fumes in the processing areas, and shall exhaust into the atmosphere at such a point and height as not to constitute an environmental nuisance.

8.2.5 Equipment that requires drainage shall be piped to drain direct.

8.2.6 All drains shall have a water seal, and shall discharge direct into a piped sewer that is water sealed.

8.2.7 Service entry and exit points shall be adequately sealed. The sealing shall be smooth and special precautions shall be taken to ensure that service entry and exit points do not provide access for rodents.

8.3 Specific requirements - Ventilation and air quality

8.3.1 Exhaust ventilation, if present, shall be so designed that the air flow is in the opposite direction to that of the product flow. Where possible, air shall flow from a more hygienic area to a less hygienic area. Air-intake points shall be at least 1 m above the internal floor levels and 1 m above outside surfaces.

8.3.2 Ventilation throughout the factory shall be sufficient to prevent condensation on walls, ceilings and overhead structures under normal operating conditions.

8.3.3 Air-intake points shall be fitted with at least a fly screen and should be fitted with dust filters. Air-intake points shall be located so as to avoid the intake of air contaminated by micro-organisms, dust, aerosols, chemicals, smoke, etc. Where appropriate, air shall be filtered to an acceptable class.

8.3.4 The temperature in various sections of the factory shall comply with the relevant legislation and shall be controlled, where necessary, to protect the quality of the food. Depending on the nature of the operations undertaken, adequate facilities shall be available for heating, cooling, cooking, refrigerating and freezing food, for storing refrigerated or frozen foods, for monitoring food temperature and, when necessary, for controlling ambient temperatures to ensure the safety and suitability of food.

8.3.5 Relative humidity shall be controlled, where necessary, to protect food quality (see clause 12.3.5).

8.3.6 Where the control of air, temperature, relative humidity or relative pressure is deemed necessary to protect the quality of the food, these parameters shall be measured and recorded. Thermometers that contain mercury shall not be used or brought into processing areas unless they are used on heat-processing vessels for closed products such as canned products, where they do not constitute a health hazard. Critical temperature registration equipment shall be calibrated by a trained person under controlled conditions against a mercury-in-glass thermometer, the accuracy of which has been certified by a competent laboratory. Unwrapped foods shall be handled and processed in an area supplied with appropriately filtered air.

8.3.7 All ventilation and extraction systems shall be designed to allow scrupulous cleaning.

8.3.8 Where appropriate, the microbial quality of the air shall be monitored to control the risk of food contamination.

8.4 Specific requirements - Compressed air and gases

8.4.1 Compressed air that comes into contact with food or food contact surfaces shall be dry to prevent the build-up of micro-organisms in the air lines. Such air shall be free from micro-organisms, chemicals, dust and soil that could contaminate the food or that could be hazardous to health.

8.4.2 Where appropriate, non-return valves shall be fitted in the air lines to preclude the entry of food into the lines.

8.4.3 Compressed air shall not be used for cleaning purposes in processing areas, since this will cause soil to spread around the factory.

8.4.4 Compressed air, carbon dioxide, nitrogen and oxygen shall be filtered through a micron filter located close to the point of use, in case the gas comes into contact with food.

8.5 Specific requirements - Water

8.5.1 An ample supply of potable water that is free from any substance that might be detrimental to human health and that is adequately protected from contamination, shall be available at the point of use. Potable water shall comply with the requirements of ES 261.

8.5.2 Where water is chlorinated on site, a routine checking procedure shall be implemented and the results recorded.

8.5.3 The microbiological and chemical quality of all water used in food factories shall be checked regularly and the results recorded.

8.5.4 Storage tanks and reservoirs for water shall be covered so as to preclude the contamination of water by birds, rodents, organic and inorganic matter, and shall be inspected weekly. The air vents to these tanks and reservoirs shall be insect-proof and rodent-proof.

8.5.5 Vacuum breakers shall be included in the water system in all locations where back-syphoning of contaminated water could occur.

8.5.6 Flexible hoses, if used, shall be suitable for food use, shall not be immersed in liquids unless designed for this purpose and, if immersed, shall be included in the cleaning programme. When not in use, they shall be properly stored on a reel or equivalent.

8.5.7 Where water is used as an ingredient or processing aid, it shall be potable and shall comply with ES 261.

8.5.8 If water is dechlorinated to prevent chlorophenol taints, appropriate precautions shall be taken in handling the water and storage time shall be kept to the minimum.

8.5.9 Ice shall be made from potable water and shall be so manufactured, handled and stored as to protect it from contamination.

8.6 Specific requirements - Steam

8.6.1 Steam that comes into direct contact with food, food contact surfaces or water shall be made from potable water and shall not contain substances that might be hazardous to health or that might contaminate the food. Steam shall only contain additives that are permitted for use by law or good manufacturing practice and the total solids in the boiler shall be so controlled as to avoid boiler solids being carried over.

8.6.2 Boilers shall be properly operated and maintained.

8.6.3 Areas requiring steam extraction shall have sufficient ventilation to minimize condensation, since condensation encourages mould growth and corrosion.

8.7 Specific requirements - Solid waste storage and disposal

8.7.1 Facilities for the storage of waste shall be designed to preclude the entry and harbourage of pests and to avoid the contamination of food, potable water, equipment, buildings roadways on the premises and the environment in general.

8.7.2 Skips or containers that contain food waste, offal and other waste material shall be covered and emptied at least once a week, or more frequently as is consistent with minimizing the risk of infestation.

8.7.3 Skips or containers for waste shall be located as far as practicable from processing areas.

8.7.4 Combustible waste, if incinerated, shall be burned in an incinerator of approved design, and that is located at an adequate distance from the factory, so as to avoid a fire hazard and contamination of the factory air supply.

8.7.5 Waste containers shall be provided in appropriate locations in the factory. Only bona fide waste containers shall be used for the disposal of waste. The containers shall be such that they cannot be mistaken for food containers and shall be emptied daily. Packaging material, whether damaged or not shall not be used as a receptacle for waste.

8.8 Specific requirements - Liquid waste disposal

8.8.1 All floor drains shall be fitted with effective traps and shall be covered with a suitable grid. The floor drains shall be kept clean and shall be cleaned, or disinfected (or both) at appropriate interval to prevent the risk of contamination of the food.

8.8.2 Sewerage lines shall be of adequate size and shall be cleaned when necessary using rods or other appropriate means. Ideally, cleaning should be done using manholes located outside the factory.

8.8.3 Manholes in the factory should be avoided but, if essential, shall be doubly sealed.

8.8.4 If effluent is being treated on site or close to the site, the effluent plant should be located as far downwind from the air-intake points of the factory as practicable.

8.8.5 The effluent plant shall be of adequate size to handle the maximum anticipated loading (peak load) and shall be adequately controlled to meet the specified requirements for treated effluent to avoid the risk of pollution.

8.8.6 Effluent lines shall be so constructed as to avoid contamination of potable water supplies meet the specified requirements for treated effluent and the environment.

8.8.7 Hazardous substances shall be disposed of in an environmentally acceptable way. Cooking oil shall only be disposed of after consultation with municipal health authorities, and in accordance with the relevant requirements of responsible authority).

8.9 Specific requirements - Illumination

8.9.1 Adequate natural or artificial lighting of intensity at least 220 lux in general product-handling areas, and artificial lighting of intensity at least 540 lux at inspection points shall be provided throughout the product-handling area. The light source fixtures should avoid glare. Where appropriate, the artificial lighting shall not significantly alter colours. White light shall be used where the colour of the food is a critical quality parameter that has to be monitored.

8.9.2 Light bulbs and lighting fixtures suspended over food materials in any stage of production shall be of a safety type and shall be protected to prevent contamination of food in case of breakage. Fixtures shall be so constructed and situated that the suspended fixtures are easy to clean and maintain.

8.10 Specific requirements - Change-rooms, toilets and ablution facilities

8.10.1 Adequate, suitable and conveniently located change-rooms, toilets and ablution facilities shall be provided at all establishments. Such areas shall be well lit, well ventilated and heated where appropriate. These areas shall also be completely separated from, and shall not open onto, food handling areas direct. The number of toilets and

wash-hand basins provided by the organization shall be adequate and in accordance with the requirements of the administering authority.

8.10.2 Hand-washing facilities with warm or hot and cold running water and hand-cleaning and disinfecting preparations shall be provided at each hand-washing point adjacent to toilets and shall be in such a position that the employee has to pass them when he leaves the toilet area. Suitable hygienic means of drying hands shall also be provided.

8.10.3 Notices directing employees to wash their hands after using the toilet shall be posted.

8.10.4 An adequate number of suitable refuse containers shall be provided in or near each changeroom, hand-washing facility and toilet area.

8.11 Specific requirements- Hand-washing facilities and disinfecting facilities in processing areas

8.11.1 Wash-hand basins, troughs or washing fountains shall be provided in all production areas convenient to personnel access points and adjacent to work stations, where their absence would present a risk to the safety of the food. Access to hand-washing facilities shall at all times be unobstructed.

8.11.2 Wash-hand basins, troughs or washing fountains shall be supplied either with warm or hot and cold running water and the taps shall be knee, foot or automatically operated.

8.11.3 A disinfectant preparation, or a preparation for hand cleaning (or both) shall be provided at each hand-washing disposable towels).

8.11.4 Knife sterilizers, if used or if required by law, shall be kept at a temperature of at least 82 °C when in use. Where appropriate, adequate facilities for cleaning and disinfecting equipment and utensils shall be provided. Such facilities shall have adequate drainage.

8.11.5 Footbaths, where appropriate, shall be installed at all access points to processing areas and shall be charged with fresh bactericidal solution that shall be renewed as frequently as is practicable during processing. Used bactericidal solution shall be so disposed of as to prevent contamination of the environment, either direct or through inadvertent leakage or spillage.

Proper facilities for the cleaning and disinfecting of boots shall be installed at a suitable locality before the entrance to the processing area. Such facilities normally combine a boot-cleaning trough, handheld water spray nozzles, plastics cleaning brushes on chains and boot-cleaning soap (liquid or powder). The boot-cleaning operation shall be conducted before the hands are finally washed before entering the processing area.

8.12 Specific requirements - Storage of hazardous substances

8.12.1 Pesticides or other substances that might present a hazard to health shall be suitably labelled with directions for use and a warning about their toxicity. The substances shall be stored in locked rooms or cabinets used only for that purpose, and shall be dispensed and handled only by authorized and properly trained personnel or by persons under strict supervision of trained personnel. Extreme care shall be taken to avoid contamination of food or the environment. Emergency procedures shall be in place in case of spillage or accidents.

8.12.2 Except when necessary for hygiene or processing purposes, no substance that could contaminate food shall be used or stored in food-handling areas. No hazardous substance may be used or stored in areas where food or food ingredients are stored or processed or otherwise handled.

9 Plant, equipment and utensils

Plant and equipment shall be easy to clean and ideally, new plant and equipment should be so designed that all parts are accessible for cleaning and inspection. Poorly designed plant and equipment can increase the cost of cleaning. Plant and equipment shall be inert to attack by the foodstuffs, water and cleaning agents.

9.1 General requirements

All processing equipment shall be so designed, constructed, installed and maintained as not to be a source of food contamination.

NOTE Recommendations on plant, equipment and utensils are given in A.4.

9.2 Specific requirements

9.2.1 All equipment and utensils used in food-handling areas, and that might come into contact with food, shall be made of material that is non-absorbent, corrosion resistant and capable of withstanding repeated cleaning and disinfection. The material shall not transmit toxic substances, odour or taste, or cause colour changes. Surfaces shall be smooth and free from pits and crevices. The use of wood and other materials that cannot be adequately cleaned and disinfected shall be avoided, except when their use would not be a source of contamination.

9.2.2 Dissimilar metals shall not be used where electrolytic corrosion can take place.

9.2.3 Dead ends in pipework shall not be present as these cannot be adequately cleaned.

9.3.4 Storage and blending vessels shall be fitted with suitable, close-fitting covers that shall be kept in place at all times.

9.2.5 Plant and equipment shall be inspected at appropriate intervals for the presence of cracks and, if found they shall be repaired. Micro-organisms can grow in cracks and might not be killed by normal, cleaning procedures.

9.2.6 Bearings inside and outside the product zones shall not be excessively lubricated and leaking oil seals shall be repaired. Only lubricants approved for use in food production areas may be used.

9.2.7 Where required, motors shall be fitted with oil catch trays. This applies to all motors where leaked oil could come into contact with the food. No oil of any kind may leak onto the product.

9.2.8 Sieves and filters shall be checked regularly and shall be included in the cleaning programme, where applicable.

9.2.9 Pumps used for food shall be stripped down regularly. The frequency of stripping down shall be stated in the cleaning programme.

9.2.10 Where appropriate, pipework shall be of sterilizable quality and open-ended pipes shall be fitted with caps or other means to prevent contamination. Where appropriate, open-ended pipes shall be self-raining.

9.2.11 Where appropriate, food conveyors to and from filling machines and closing machines shall have suitable covers to protect the open food containers and product from overhead contamination.

9.2.12 Food conveyors lubricated with water, soap solutions or food grade lubricants shall be fitted with a catch tray.

9.2.13 Reasonable access under, inside and around plant and equipment shall be provided for servicing and cleaning. Plant and equipment may be mounted direct on walls or floors provided they are adequately sealed to preclude the establishment of sites for the breeding and harbourage of micro-organisms, insects, rodents or birds.

9.2.14 Containers used for transporting unpacked food within the factory shall be controlled to preclude their being used for transporting raw product and then being used for processed product, without adequate cleaning, which would result in cross-contamination.

9.2.15 Containers used for inedible material and waste shall be leakproof, constructed of suitable impermeable material that is either easy to clean or disposable, and shall be such that they can be closed securely.

9.2.16 Equipment and utensils used for inedible materials or waste shall be identified as such and shall not be used for edible products.

9.2.17 Equipment used to cook, heat-treat, cool, store or freeze food shall be designed to achieve the required food temperatures as rapidly as necessary in the interests of food safety and suitability, and to maintain these temperatures effectively. Such equipment shall also be designed to allow temperatures to be monitored and controlled. Where necessary, such equipment shall have effective means of controlling and monitoring humidity, air-flow and any other micro-environmental characteristics likely to have a detrimental effect on the safety or suitability of food. These requirements are intended to ensure that, where appropriate,

a) harmful or undesirable micro-organisms or their toxins are eliminated or reduced to safe levels, or their survival and growth are effectively controlled, and

b) temperatures and other micro-environmental conditions necessary to ensure suitability can be rapidly achieved and maintained.

NOTE Surface materials for equipment used in the food industry are discussed in annex B.

10 Cleaning and disinfecting of facilities

Food can be contaminated by soiled plant and equipment and by an unhygienic environment. To prevent contamination, cleaning is required. Wet cleaning involves the removal of soil, followed by cleaning and disinfection using a detergent-disinfectant solution. Great care shall be exercised if steam or hot water is used for cleaning and disinfection, since their use can cause condensation on overhead structures, leading to re-contamination of cleaned surfaces. It shall be noted that wet surfaces can afford ideal conditions for microbial growth.

Care shall be taken with dry cleaning to ensure that dust particles are not released into the plant environment since they carry micro-organisms. In the case of vacuum cleaners, this might mean efficient filtration of the air.

It is the responsibility of the manufacturer to identify, document, establish and monitor an appropriate cleaning programme for all food contact surfaces and for the environment in which the food is manufactured.

10.1 General requirements

The buildings, equipment, utensils, all other physical facilities of the establishment and the surroundings shall be maintained in good repair and in an orderly condition, and shall be cleaned at regular intervals to prevent them from becoming a source of contamination of the food. The materials and equipment used for cleaning shall be suitable for use in a food plant, and the cleaning equipment shall not in itself be a source of contamination. Cleaning and disinfecting shall meet the requirement of this standard.

NOTE See A.5 for recommendations on the cleaning and disinfecting of facilities, see annex C for more information on cleaning and disinfecting procedures; and see annex D for advantages and disadvantages of various types of disinfecting agents

10.2 Specific requirements

10.2.1 There shall be an established, documented cleaning procedure for cleaning all food contact surfaces, including plant and equipment, walls, floors, windows, gullies and ancillary structures. The cleaning programme shall include dry cleaning, wet cleaning, disinfection and sterilization, as appropriate. The programme shall also include cleaning at a high level and the cleaning of overhead surfaces.

10.2.2 There shall be a cleaning programme for each room, or group of rooms, or each production area and for the exterior of the plant and outside structures. The programme shall state the frequency with which each item (or group of items) of equipment shall be cleaned, and the contact time, temperature and strength of cleaning solutions. It shall also state the method and frequency of cleaning of walls, floors, windows and drains. Records of cleaning shall be kept and evidence that the cleaning programme has been adhered to.

10.2.3 A documented procedure shall be in place to check, where appropriate, the efficiency of cleaning by microbiological analysis of rinse water, swabbing of surfaces, or other appropriate means.

10.2.4 Plant and equipment shall be cleaned at least daily or more often, if required, to control the level of soil and the bacteriological load in the food. This is not applicable in the case of food processes where it can be

demonstrated that daily cleaning is not required. The manufacturer shall be responsible for establishing a procedure for monitoring that all cleaning has been done at the appropriate defined intervals.

10.2.5 Sufficient tanks, suitable for the immersion of loose pieces of equipment, shall be available for cleaning purposes. Where these are used for washing during the production cycle, they shall either be located in an area separated from the production area or the tanks shall be totally enclosed and so designed that there is no risk of contamination of the food by detergents. The tanks shall be fitted with an outlet pipe to facilitate draining.

10.2.6 Detergents and disinfectants shall be stored in an area that is separate from food and shall be clearly labelled or marked.

10.2.7 Since most detergents and disinfectants are hazardous, personnel handling these materials shall be informed of this fact and of the appropriate treatment in the event of an accident. Where required to ensure safety, safety goggles or face shields and gloves shall be available and used when handling hazardous detergents and disinfectants.

10.2.8 Household cleaning chemicals and chemicals from non-reputable suppliers shall be avoided.

10.2.9 Where hazardous materials are mixed or dispensed, an eye-washing and shower facility shall be located close to the point of mixing or dispensing.

10.2.10 All brooms and hand brushes used to clean in the production area shall be made of material other than wood, shall have nylon bristles, which should, ideally, be coloured to enable detection of detached bristles, shall be kept clean and in good condition and, when not in use, shall be hung up with bristles facing downwards, to aid drying. Brushes used for floors shall not be used on equipment surfaces.

10.2.11 When using cleaning cloths and scouring pads, care shall be taken to ensure that they are not a source of contamination, i.e. by being contaminated themselves or by being a source of foreign materials. Cleaning cloths of a woven fabric shall be used only if they are laundered and disinfected or sterilized according to a documented schedule. Alternatively, disposable or "one-day use" cloths can be used.

10.2.12 Equipment, such as sampling utensils and manual agitators, shall be cleaned before or after use, as appropriate.

10.2.13 During the cleaning process, those parts of the plant that operate under dry conditions shall be physically isolated from those parts of the plant that are wet cleaned.

10.2.14 Where dampness could contaminate the product, for example, powder-conveying lines, equipment that has been wet cleaned shall not be used until it is dry.

10.2.15 Where hot solutions are used for cleaning the plant or equipment, there shall be adequate and suitable venting to prevent, as far as possible, condensation on overhead structures.

10.2.16 Vacuum cleaners shall be emptied outside the processing areas.

10.2.17 Adequate precautions shall be taken to prevent food from being contaminated during, cleaning or disinfecting. Cleaning of floors and equipment with water under force may not take place during production as soil might be sprayed onto the food. Cleaning agents and disinfectants shall be approved and adequate. Any residues of these agents left on a surface that might come into contact with food shall be removed by thorough rinsing with potable water before the surface is used again in the handling of food.

10.2.18 Immediately after cessation of the day's work, or during a change of shift, or at such other times as might be appropriate, floors drains, auxiliary structures and walls of food-handling areas shall be thoroughly cleaned.

10.2.19 Change-rooms and toilets shall be kept clean at all times.

10.2.20 Roadways and yards in the immediate vicinity of and serving the premises shall be kept clean.

10.2.21 Cleaning equipment shall be so marked, by colour-coding or other means, that equipment used for specific purposes can be easily identified, for example, cleaning equipment toilet and ablution facilities shall bear different identification marking from appliances.

10.2.22 Waste material shall be so stored and disposed of as to avoid contamination of food, potable water and the environment. Care shall be taken to preclude the entry and harbourage of pests. Waste shall be removed from the food-handling areas and other work areas as often as necessary and least once daily and, in the case of hazardous waste, it shall be disposed of in accordance with the relevant requirements of the hazardous regulation. Immediately after the waste has been disposed of, receptacles used for storage of waste and any contact with the waste shall be cleaned and disinfected.

10.2.23 The use of construction materials that cannot be adequately cleaned disinfected shall be avoided unless their use will clearly not be a source of contamination.

10.2.24 All cleaning operatives shall be trained and retrained to continually meet the require upgraded standards.

11 Pest control

Rodents, insects and birds carry micro-organisms that can cause disease and can therefore be major source of food contamination. For pest infestation to occur, sites for breeding and a supply food are necessary. Both conditions can exist in food factories and grounds, if proper controls are not exercised. Specific requirements to help control pest infestation are dealt with in clause 7 and other various clauses throughout the document. In these clauses, the additional requirements that shall be met to control pests are outlined.

11.1 General requirements

Rodents, birds, domestic and other animals, and insects shall be excluded, as far as practicable, from the factory. Buildings shall be kept in good repair and condition so as not to give access to pests. The factory grounds shall be so protected and maintained as to avoid the establishment of breeding sites for micro-organisms, insects, rodents or birds. Domestic and other animals (except if used for security reasons) shall be excluded from the factory grounds, other than in the case of abattoirs or slaughter houses where they shall be adequately penned. There shall be an effective and continuous programme for pest control. Establishments and their surrounding areas shall be examined regularly for evidence of infestation.

NOTE Recommendations on pest control are given in A.6.

11.2 Specific requirements

11.2.1 Fixed plant equipment on floors shall be either 0.3 m from the ground and 0.5 m from walls, or shall be adequately sealed to prevent the build-up of soil behind or under the equipment.

11.2.2 Air-intake points and windows that open shall at least be fitted with a fly screen.

11.2.3 Insect electrocuters shall be placed in all processing areas where food is exposed, ideally not more than 2.4 m from the floor, in a draught-free area. Electrocuters shall not be installed over areas where food could be exposed. They shall be placed away from natural light and shall be fitted with a catch tray, which shall be cleaned at appropriate, defined intervals. These requirements are not applicable if there is a sound technical reason for not having insect electrocuters, for example, a fire risk or risk of a dust explosion.

11.2.4 The ultraviolet tubes on insect electrocuters shall be replaced at least every year and shall be left on permanently, except when the plant is closed for a period of more than seven days. Records shall be kept of the replacement of ultraviolet tubes.

11.2.5 External doors shall be rodent-proof (i.e. gaps not exceeding 6 mm) and shall either be fitted with self-closers or be protected by an internal lobby with a self-closing door. Plastic curtains or air curtains may be used as an alternative to secondary doors.

11.2.6 The factory shall be inspected at least every month for evidence of infestation by insects and rodents, and for the presence of birds and wild and domestic animals. The inspection shall be carried out by trained personnel.

11.2.7 Raw material deliveries shall be inspected, where appropriate, for the presence of infestation in accordance

with defined written procedures.

11.2.8 If evidence of infestation is found in or around the factory premises, action shall be taken to remove or control the infestation. Control measures involving treatment with chemical, physical or biological agents shall only be undertaken by, or under direct supervision of, personnel who have a thorough understanding of the potential health hazards posed by these agents, including hazards that might arise from residues retained in the product. Control measures shall be carried out in accordance with the recommendations of the administering authority. Pesticides shall be applied in accordance with the provisions of ES 930 Pesticides and pest-control agents shall be environmentally acceptable and registered for use in Ethiopia.

11.2.9 Insecticides and rodenticides that look similar to the food being manufactured, or are in similar containers to those used for packaging, shall not be used. Approved pesticides shall only be used if other preventive measures cannot be used effectively. Before pesticides are applied, care shall be taken to safeguard all food, equipment and utensils against contamination. After pesticide application contaminated equipment and utensils shall be cleaned thoroughly to remove any residue be re-used.

11.2.10 Birds shall be excluded from all production and storage areas (including sales area or wholesale food outlets) and adequate steps shall be taken to ensure that this exclusion is subject to the legal requirements for the conservation of wildlife. To ascertain the degree and effectiveness of such control measures, the administering authority might request a specialist report to substantiate the results of the control measures.

11.2.11 A site drawing and register of all bait stations shall be kept up-to-date. Open bait be used in processing areas, ingredient storage areas or packaging stores, unless the bait station suitably demarcated and there is no possibility of affecting the product.

11.2.12 Potential food sources shall be stored in pest-proof containers or stacked above the ground and away from walls. The areas both inside and outside food premises shall be kept clean.

12 Storage, distribution and transportation

The storage, distribution and transportation of foodstuffs shall be such as to prevent damage, contamination or deterioration of the foodstuffs or of materials that come into contact with it.

12.1 General requirements

All steps in the production process including packaging, storage and delivery, shall be performed no unnecessary delay and under conditions that preclude the possibility of contamination, deterioration, or development of pathogenic and spoilage micro-organisms. Methods of preservation and necessary controls shall, within the limits of good commercial practice, be such as to protect the product from deterioration and contamination, and from becoming a public health hazard.

The manufacturer shall provide adequate storage facilities to prevent damage to or deterioration of the food. Stores and storage vessels shall be kept in a hygienic condition and where controlled conditions are required, these shall be provided and the conditions continuously monitored. The manufacturer shall provide adequate unloading facilities and all incoming material shall be inspected to ensure that contaminated goods or damaged goods that could result in spillage are not brought in to the plant or factory, without taking precautions against this contamination. Adequate loading facilities shall also be provided.

Vehicles used for the transportation or distribution of food shall be clean, free from any odours weatherproof, easy to clean and in the case of vehicles with refrigeration, the refrigeration unit shall be adequate to maintain the food at the required temperature.

NOTE Recommendations on storage, distribution and transportation are given in A.7.

12.2 Specific requirements - Storage

12.2.1 There shall be adequate storage facilities for raw materials, in-process materials, where applicable, and finished product.

12.2.2 No raw material or ingredient shall be accepted by an establishment if it is known to contain parasites, undesirable micro-organisms pesticides, veterinary drugs, or toxic, decomposed or extraneous substances that will not be reduced to an acceptable level by normal sorting, or processing (or both). Where appropriate, specifications for raw materials shall be identified.

Decomposing raw food materials or food products, or any food product or raw food material that contains an unacceptably high number of micro-organisms or pathogenic organisms, shall not be improved in quality or rendered fit for human consumption by gamma-irradiation or heat processing.

12.2.3 Unprocessed food shall not be stored in the same store as processed food, unless it can be shown that there is no risk of cross-contamination. Raw, unprocessed food shall be effectively separated from processed food, either physically or by time.

12.2.4 By-products shall be so stored as to avoid contamination of food or the environment. They shall be removed from the food-handling areas and other work areas as often as necessary and at least once daily.

12.2.5 Food that requires special storage conditions, such as controlled atmosphere, temperature or relative humidity, shall be stored under appropriate conditions and records shall be kept of the storage conditions.

12.2.6 Stores shall be proofed against rodents, insects, and birds, and shall be kept in a hygienic condition.

12.2.7 There shall be a passageway of width at least 0.5 m around the walls or partitions of all stores, to preclude the establishment of breeding sites for rodents, to enable cleaning (for example, vacuum cleaning) and to aid hygienic inspections. Where racks are used against walls there shall be a clearance of at least 0.3 m between the floor and the bottom of the rack.

12.2.8 The height of stacking shall be limited so that crushing or distortion sufficient to damage the product or packaging does not occur on the lower layers. The top layer of stored product shall not make contact with the overhead structures, as this could facilitate access by crawling insects.

12.2.9 Conveyances and containers shall be so designed and constructed that they

- a) do not contaminate foods,
- b) can be effectively cleaned and, where necessary, disinfected,
- c) permit effective separation of different foods, or of foods from non-food items, where necessary during transportation,
- d) can effectively maintain any temperature, humidity, atmosphere and other conditions necessary to protect food from harmful or undesirable microbial growth and deterioration likely to render it unsuitable for consumption, and
- e) allow any necessary conditions of temperature and humidity to be monitored.

12.2.10 Storage tanks, bins and silos used for the storage of food shall be constructed of suitable materials. They shall be fitted with suitable, close-fitting covers that shall be kept in place at all times, and, if vented, the venting shall be so designed and maintained as not to contaminate the contents. The inlet valves and pipework shall be kept in a hygienic condition and precautions shall be taken to preclude access to the pipework by rodents, birds and insects.

12.2.11 Rough treatment of containers shall be avoided to preclude the possibility of contamination of the processed product.

12.2.12 All goods received shall be inspected in accordance with documented procedures, to ensure that damaged goods that could cause spillage are not brought into the warehouse without taking appropriate action to preclude spillage. Damaged goods shall be inspected for evidence of rodent or insect infestation and, if present, shall not be taken into the store until appropriate defined action has been taken.

12.2.13 Re-usable containers shall be of a material and construction that allows easy and thorough cleaning. The containers shall be kept clean and, where necessary, disinfected.

12.2.14 Stackable containers that are used for food, shall not be placed on the floor direct. Pallets, "dummy crates", or trolleys that are clearly identified for this purpose shall be used.

12.3 Specific requirements - Transportation and distribution

12.3.1 All vehicles used for the transportation of food shall be inspected before loading to ensure that they are clean and weatherproof. Where relevant, the refrigeration unit shall be inspected daily to ensure that it is in working condition and that there is adequate fuel in the unit's fuel tank. Regular maintenance shall be carried out. Records shall be kept of daily checks and of maintenance.

12.3.2 Where the same refrigerated transport is used for deliveries to several points, care shall be taken to ensure that the temperature in the food section is maintained at the correct level(see clause A.7.3).

12.3.3 Refrigerated transport shall be fitted with a recording thermometer. The accuracy of the thermometer shall be verified at prescribed intervals.

12.3.4 The internal surfaces of the vehicle body shall be impervious to water and easy to clean where appropriate, and the vehicle body shall be sealed to preclude the entry of pests, exhaust fumes and other sources of contamination.

12.3.5 In the case of an insulated container or vehicle body, the outside cladding shall be weatherproof, so as to prevent loss of insulation properties owing to the ingress of moisture.

12.3.6 When loading food into refrigerated transport, care shall be taken to ensure that there is adequate circulation of air around the food and that the food, on loading, is at the correct temperature, since refrigeration units on transport vehicles do not have the capacity to cool product.

12.3.7 Food shall not be transported in the same container or unit as non-food items unless it can be demonstrated that the non-food items present no risk of contamination to the food.

12.3.8 Tankers and bulk units used for the transportation of food, where the food comes into direct contact with the internal surfaces, shall be cleaned at appropriate intervals. These tankers and bulk units shall not be used for the transportation of non-food items, unless it can be demonstrated that such items do not present a potential hazard to the food.

12.3.9 CIP (cleaning in place) washing units or washing units that contain a re-circulation system for washing food tankers or bulk units shall not be used to wash tankers or bulk units that contained nonfood products.

12.3.10 Loading or unloading of food or materials that will come into contact with food shall not take place under conditions that could cause deterioration, contamination or damage to the food or materials.

12.3.11 Conveyances and containers for transporting food shall be kept in an appropriate state of cleanliness, repair and condition. Where the same conveyance or container is used for transporting different foods or non-foods, effective cleaning and, where necessary, disinfection shall take place between loads. Where appropriate, particularly in the case of bulk transport, containers and conveyances shall be designated and marked for food-use only and be used only for that purpose.

13 Personnel hygiene

People are a potential source of disease-producing micro-organisms, since these micro-organisms live in certain parts of the body, mainly the hair, skin, nose, mouth, throat, bowels and in sores. The microorganisms can easily be transferred to the hands since the hands are in contact with all parts of the body during the course of the day. Even blowing of the nose into a handkerchief can contaminate the hands.

Prevention of contamination of food by personnel depends on their being aware of the potential risks associated with bad hygiene practices and behaving so as to preclude these risks. Management has the specific responsibility for developing a good hygiene ethos among the workforce, which can only be achieved by providing adequate personnel facilities and constant vigilance.

It is now generally accepted that medical screening and stool testing are not a reliable means of identifying potential carriers of pathogenic micro-organisms. Hence all food handlers shall be considered potential sources of pathogenic micro-organisms, and shall be adequately trained in good hygiene practices.

13.1 General requirements

Management shall ensure that all staff are medically fit, are adequately trained in good hygiene practices, behave in such a manner as not to contaminate the food, and wear clean, protective clothing when entering or working in the production area. Adequate personnel facilities shall be provided, and there shall be adequate supervision to ensure compliance with this requirement.

These requirements are applicable to all employees, particularly those entering the production area, and include management staff and service personnel, in addition to production workers.

NOTE Recommendations on hygiene of personnel are given in A.8.

13.2 Specific requirements - Medical

13.2.1 Persons who come into contact with food in the course of their work shall undergo a medical examination before being employed, if the administering authority considers this to be necessary, whether because of epidemiological considerations, the nature of the food prepared in a particular establishment or the medical history of the prospective food handler. Subsequently, any food handler shall be medically examined whenever this is clinically or epidemiologically indicated, and records of such examinations shall be kept in confidential files.

13.2.2 Management shall ensure that no person who is known to be or who is suspected of being

a) infected with a disease capable of being transmitted through food, or

b) a carrier of such a disease, or

c) afflicted with infected wounds, skin infections, sores or diarrhoea, is permitted to work in any food-handling area in any capacity in which there is any likelihood of such a person contaminating the food with pathogenic organisms, direct or indirect. Any person so affected shall immediately report to management that he is ill.

13.3.3 All staff, including supervisory staff, shall be made aware of and shall be responsible for ensuring that the requirements of clause 13.2.2 are met.

13.3.4 Any person who is suffering from any cut or wound shall not be allowed to handle food or food contact surfaces until the injury has been so treated and dressed as to preclude any possible contamination of the food. Adequate first-aid facilities shall be provided.

13.2.5 Cuts, sores and grazes shall be covered after treatment with a conspicuously coloured, waterproof dressing that contains a metal strip. The colour of the dressing should be different, where possible, from the colour of the food produced.

13.3 Specific requirements - Training

13.3.1 Management shall arrange for all food handlers to receive adequate and continued training in the hygienic handling of food and in personal hygiene so that they know which precautions to take to preclude contamination of food. During training, which shall be presented by personnel who are competent in this field, reference shall be made to relevant parts of this standard.

13.3.2 Records shall be kept of all training.

13.4 Specific requirements - Protective clothing

13.4.1 All persons who handle unpacked food shall be provided with clean protective clothing in sound condition. Management shall be responsible for the cleaning and issuing of protective clothing and shall ensure that protective clothing is not removed from the premises for cleaning, repair or other purposes without authorization, and that such clothing, when not in use, is kept in a change-room, central store or locker. Gloves and aprons worn in a food-processing area shall not be removed from such area except for cleaning or repair and, when not in use, shall be so hung up or stored that contamination by pests or chemicals is precluded.

13.4.2 All persons entering food-processing areas, including visitors and subcontractors, shall don clean protective clothing.

13.4.3 Particular attention shall be paid to ensure that maintenance staff and subcontractors do not carry soil on their clothing into production areas, particularly where the product is sensitive to contamination.

13.4.4 Personal garments shall not be worn over protective clothing, and no part of any personal garment may protrude from protective clothing above the knee.

13.4.5 Clean overalls and coats, and covering that covers all hair, including beards, shall be worn by all personnel who enter or work in the production area. Coats and overalls shall have no external pockets above the waistline, and shall be securely fastened; studs or a hook-and-loop (touch-and-close) fastener should, ideally, be used for this purpose.

13.4.6 Footwear shall be clean, and workers shall have separate footwear for use in the factory, to preclude the introduction of pathogenic micro-organisms, such as *Salmonella* and *Listeria*.

13.4.7 Protective clothing shall be kept in a clean condition, consistent with the nature of the work, and shall be cleanable unless designed to be disposed of. Protective clothing shall not be used outside the factory or the factory grounds or worn to or from work.

13.4.8 The use of gloves in the handling of foodstuffs shall be limited to cases where the workers' hands need to be protected against physical, chemical or temperature harm, or where foodstuffs are to be protected from possible contamination by the worker. If the use of gloves is unavoidable, a written glove policy shall be established, implemented and enforced by the manufacturer to prevent misuse of the gloves, or the gloved hand turning into a possible source of contamination of the product. The glove policy shall stipulate the frequency with which gloves shall be changed, and of the washing and disinfection of the gloved hand, as well as changing procedures to be followed when a tear or crack is detected in the gloves. Where possible, disposable gloves shall be used and replaced regularly during each shift. Non-disposable gloves shall be thoroughly cleaned and disinfected as stipulated in the glove policy.

The wearing of gloves shall not exempt the operator from having thoroughly washed hands. Gloves shall be made of an impermeable material except where gloves manufactured from such material would be inappropriate.

13.4.9 Personal effects and clothing shall not be stored in food-handling areas.

13.5 Specific requirements - Miscellaneous

13.5.1 No jewellery shall be worn. Where unprotected food, or raw food materials or components are manipulated by hand, personnel shall remove jewellery from their hands and fingernails shall be short, clean and free from varnish and lacquer. There shall be adequate supervision to ensure compliance with this provision.

13.5.2 Any behaviour that could result in the contamination of food, such as eating, use of tobacco, chewing (of gum, sticks, sweets, etc.) or unhygienic practices, such as spitting, shall be prohibited in food-handling areas.

13.5.3 Every person, while on duty in a food-handling area, shall keep his hands clean by washing them as frequently as is necessary, using a suitable hand-cleaning preparation (preferably a disinfectant) and running water. Hands shall be washed before work is started, and immediately after the toilet has been used. Hands shall also be washed and disinfected, and dried with a disposable towel immediately after handling any material that might be capable of transmitting disease. A hot-air dryer may be used only in non-sensitive production areas. Requirements in respect of the washing of hands shall be displayed on notices. There shall be adequate supervision to ensure compliance with this provision.

13.6 Specific requirements - Facilities

13.6.1 Personnel facilities shall be maintained in good condition and shall be kept clean and odourfree, so as to establish the correct hygiene ethos among all factory workers and also to preclude the establishment of sites for the harbourage or breeding of micro-organisms, insects, rodents or birds.

13.6.2 A suitable canteen or rest-room shall be provided and shall not lead into the processing area direct. In rest rooms, provision shall be made for facilities where staff can lock away their food, eating and drinking utensils and valuable possessions that may not be stored with their daily change of clothing in the cloakroom.

13.6.3 Adequate toilet facilities and associated hand-washing facilities shall be provided. The toilets shall not lead into rest rooms, change rooms or into the processing area direct and there shall be at least a lobby furnished with wash-hand basins between toilets and the above areas. The door between such a lobby and the areas indicated shall be equipped with a self-closing device. Suitable hanging space shall be provided in the lobby for protective clothing that may not be taken into toilets.

Separate, spacious cloakroom facilities shall be provided for males and females, and shall be furnished with sufficient benches and storage facilities for boots and a daily change of clothing. A system of clothes baskets that can be hung over bars, and shelves for cleaned boots may be used instead of lockers.

13.6.4 The toilet facilities and external lobby shall be separately ventilated to the external air in such a way as not to contaminate the factory air. The doors to the toilet and the lobby shall be self-closing, and shall not require the use of the hands to open.

13.6.5 Wash-hand basins in toilet areas shall be supplied with either warm or hot and cold water. The taps shall be operated either by foot, or by knee, or automatically to preclude recontamination of the hands after washing.

13.6.6 Hand-cleaning and disinfectant preparations shall be provided in appropriate dispensers at each hand-washing point.

13.6.7 To dry hands, paper towels with easily cleanable waste receptacles for used towels (or air hand-dryers in non-sensitive production areas) shall be provided adjacent to all wash-hand basins, or hand-washing troughs, or fountains. However, air hand-dryers shall not be used in sensitive production areas, to preclude the possible spread of aerosolized bacteria.

13.7 Personal behaviour

People engaged in food handling activities should refrain from behaviour which could result in contamination of food, for example: smoking, spitting, chewing or eating; sneezing or coughing over unprotected food.

Personal effects such as jewellery, watches, pins or other items should not be worn or brought into food handling areas if they pose a threat to the safety and suitability of food.

13.8 Visitors and contractors requirement

Visitors to food manufacturing, processing or handling areas should, where appropriate, wear protective clothing and adhere to the other personal hygiene provisions in this section.

Visitors and contractors shall be required to wear suitable protective devices such as clothing, goggles, gloves, hair cover, etc. When entering production areas and shall be effectively managed to prevent from being source of contamination to the food.

14 Zoning

Unprocessed food can cause contamination of processed food, either by direct contact, or by micro-organisms that are carried from the unprocessed food to the processed food by air, water or personnel. Food can also be contaminated by the same means from areas such as microbiological laboratories and effluent plants. Chemical contamination can occur from steam boilers, refrigeration plants, detergents, etc. It is necessary to physically separate areas within a food factory in order to prevent potential contamination of the food, and to adequately control the access of personnel to production and laboratory areas.

14.1 General requirements

The manufacturer shall take effective action to protect the food produced from those operations that might cause contamination with undesirable micro-organisms, chemicals, soil or other extraneous material. The manufacturer shall control access to areas where food is sensitive to contamination and shall take adequate precautions to ensure that personnel entering food-processing areas are not a source of contamination from other areas.

NOTE Recommendations on zoning are given in A.9.

14.2 Specific requirements

14.2.1 Production areas where processed foods are exposed shall be physically separated, where possible, from areas where unprocessed or partially processed food is stored, prepared or handled. Where this is not possible, due care shall be taken to ensure that the final product is not contaminated by food that has not been fully

processed.

14.2.2 Separate storage areas shall be provided for processed and unprocessed foods, unless it can be proved that contamination of the processed food cannot occur.

14.2.3 Access to processing areas and particularly to areas where food is exposed, shall be restricted. The level of restriction required will depend on the risk of contamination.

14.2.4 Microbiological laboratories shall be physically separated from production areas and the protective clothing used in the microbiological laboratories shall not be worn in the food-processing areas.

15 Records

It is essential to record all actions taken to ensure the safety of food and to keep these records up to date. These records can be used to prove that appropriate action has been taken to ensure the safety of the food and as an aid to the effective management of product safety.

15.1 General requirements

The manufacturer shall establish and maintain procedures for the identification, collection, indexing, filing, storage, maintenance and disposition of hygiene records.

15.2 Specific requirements

15.2.1 Records shall be kept of all actions, test results and other relevant information required to ensure that hygiene is maintained at a level appropriate to ensure the safety of the food produced.

15.2.2 These records shall be indexed, filed, stored and kept for a suitable period, and procedures for the disposal of obsolete records shall exist.

15.2.3 The records shall include the following:

- a) Records of all the critical parameters and of the tests carried out to ensure the safety of the finished product, and the results of these tests, including microbiological results (HACCP).
- b) The calibration status and procedures used to calibrate all devices used to ensure the compositional safety of the finished product.
- c) Records showing that all staff members have been appropriately screened by a medical examine as suitable to work in food premises and that they are trained in the principles of hygiene.
- d) Records showing that the cleaning programme has been adhered to and that the strength temperatures and contact time of cleaning solutions comply with the specified requirements.
- e) Records showing all the cleaning chemicals used, their functions, and the recommended antidote in case of accidental ingestion.
- f) Records showing that the factory has been inspected, at least monthly and by a suitably qualified person, for evidence of infestation by micro-organisms, insects, rodents or birds.
- g) Records showing that incoming material, where appropriate, has been inspected for hygiene and for the presence of micro-organisms, insects, rodents or birds, and that the distribution vehicle have also been inspected.
- h) Records showing that water storage vessels are inspected weekly for the presence of micro-organisms, insects, rodents or birds, etc.

Daily records of residual free-chlorine levels and records of other water analyses.

Records showing that a hygiene or housekeeping inspection has been carried out at defined intervals, in accordance with a written checklist.

k) Records showing that the construction and maintenance of the factory and processing equipment have been inspected at defined intervals, in accordance with a written checklist.

15.2.4 The following records shall also be maintained, where appropriate, to ensure the safety c food:

a) chemical, functional, microbiological and organoleptic specifications for raw materials, in-process materials and finished product;

b) records of environmental tests;

c) records showing that the tubes in insect electrocuters are replaced at appropriate intervals;

d) records of controlled conditions, such as temperature, relative humidity, controlled atmosphere and positive and negative air pressures and air quality during production, storage and distribution;

e) appropriate records for the effluent plant to show that treated effluent complies with the specific requirements;

f) records showing that glass pipes, flow meters and glass equipment are inspected routinely for cracks, splinters, etc.;

g) records showing that air filters are inspected and replaced at appropriate intervals; and

h) records of sensitivity checks on metal detectors.

15.2.5 Where it is found that hygiene is not maintained at the defined level, records shall be kept of the corrective action taken to bring it under control.

15.2.6 All records shall be signed by an authorized person or persons and shall be dated.

Annex A

(informative)

A.1 Food safety recommendations

A.1.1 Emphasis should be placed on prevention rather than on detection.

A.1.2 A tracking system for microbiological contamination should be established for each production line in order to track the location of possible sources of contamination. These sources can be established by environmental sampling and testing of the samples for pathogenic and food spoilage micro-organisms, in combination with microbiological analysis of the food at various critical stages in its production. To achieve an effective tracking system, an appropriate minimum level of sampling and testing should be established. This level should be increased, as appropriate, if problems are encountered, until effective action has been taken to address the problems.

A.1.3 When designing a new food plant or replacing glass in an existing plant, it is recommended that transparent PVC or the equivalent be used in those areas where food is exposed or where there is a risk of contamination of the food, in the event of the glass being broken.

A.1.4 Metal detectors should be fitted with an automatic rejection mechanism that rejects product containing metal into a locked, inaccessible container. The rejection mechanism, if present, should be checked when the metal detector is being checked. Where automatic rejection is not feasible, automatic stopping of the line is a suitable alternative.

A.2 Premises and structures (see clause 7)

A.2.1 Kerbs, if used around wet areas, should be coved on both sides and, ideally, should have a rounded top.

A.2.2 Care should be taken in designing ceiling heights, since low ceilings can lead to condensation and high ceilings are difficult to keep clean. Walls and ceilings should be of light colour, possibly white to minimize the contrast between work and surroundings and to give maximum reflection for better lighting and reducing the shadows. The ceiling should be painted with light colour for good illumination, cheerful surroundings and cleanliness.

A.2.3 Access to outside roofs and structures from inside the plant should be avoided, since roofs often contain bird droppings that can be contaminated with Salmonella or other food-poisoning microorganisms.

A.2.4 Windows in processing areas should either be double-glazed or should be double windows to prevent condensation, and they should be mounted flush to the internal wall surface to avoid ledges.

A.2.5 Shatterproof material should be used instead of glass in areas where broken glass could contaminate the food.

A.2.6 Personnel entrances to processing areas should have two doors (that do not require use of the hands to open) with a lobby between the two doors. The lobby should contain hand-washing facilities and storage facilities for clean protective clothing.

A.2.7 The use of wall tiles is not recommended, since the area behind the tiles can serve as a breeding ground for insects if there is a failure of the tile grouting. Tiled walls should only be used where they are specified in the relevant regulations.

A.2.8 There should be a path of width at least 1 m around the factory, so as to reduce the possibility of infestation by rodents. The path should be kept clean and clear of materials.

A.2.9 Care should be taken when landscaping the area around a factory. Trees, particularly deciduous trees, should be avoided since rotting leaves can be a source of mould and the trees can give harbourage to birds.

A.3 Services (see clause 8)

A.3.1 Methods of treatment should be fitted with a visual or audible alarm system that will be activated in the event of failure of the system. The alarm system should be checked at defined intervals and records kept of all checks.

A.3.2 The residual free-chlorine level of potable water should be checked regularly at the points most likely to be low in chlorine, for example, the end of the longest pipe run from the source of supply, water storage tank or chlorination plant. At least one check should be carried out daily.

A.3.3 If ultraviolet light is used to ensure the safety of potable water, the intensity of the light source should be checked at regular intervals and records should be kept of such checks.

A.3.4 Potable water should have a minimum residual free-chlorine level of 0.1 ml to 0.2 ml per litre at the point of use. Chlorinated water should be stored for at least 20 min before use to allow adequate contact time for the chlorine.

A.3.5 The microbiological quality of potable water should be checked monthly or weekly for the presence of coliform bacteria. The results should comply with the relevant legislation and with the requirements of ES 261. All water points should be checked at least once a year by the manufacturer.

A.3.6 Aerosolized water (found in, for example, cooling towers, refrigeration plant cooling units and ventilation systems) can be a source of *Legionella*, and can result in legionnaires' disease in susceptible people. Therefore, precautions should be taken in such systems that operate at between 20 °C and 55 °C to prevent the build-up of *Legionella*. Temperatures in excess of 60 °C or effective biocides can be used as control methods.

A.3.7 Where natural light is used in food-processing areas, the windows or skylights should ideally be north facing.

A.3.8 Plant services should not interrupt the smooth finish of the walls, ceiling or floor.

A.4 Plant, equipment and utensils (see clause 9)

A.4.1 Conveyors that convey food, open food containers, whether full or empty, and caps, lids or closures, should be covered to prevent contamination of the food or materials in contact with the food. The covers and conveyors should be designed to facilitate cleaning.

A.4.2 Covers and the tops of plant and equipment should not be flat. This facilitates cleaning and precludes the possibility of materials being left on top of the plant.

A.4.3 Nuts, screws and bolts, if used, should be of the self-locking type and suitable precautions should be taken to ensure that they do not interrupt the smooth finish of the plant or of equipment.

A.4.4 When plant or equipment is being purchased, care should be taken to ensure that it is of hygienic design.

A.4.5 Containers used for the transportation of unpackaged food inside the factory should be colour coded. Different colours should be used to indicate which containers are used for raw product and which are used for processed product.

A.4.6 A separate set of maintenance tools should be reserved for use in high-risk processing areas.

A.5 Cleaning and disinfecting of facilities (see clause 10)

A.5.1 The risk of contamination of food should be taken into account when deciding on a cleaning programme. The rate of microbial growth depends on the nature of the food, pH, temperature and water activity.

NOTE Under ideal conditions, the number of micro-organisms in food can double every 20 min, which means that one micro-organism can produce over two million micro-organisms in seven hours.

A.5.2 Special attention should be paid when establishing a cleaning programme for powderconveying lines where the powder is hygroscopic, as build-up of damp contaminated powder can occur, which might contaminate the product occasionally. Such contamination can be difficult to detect.

A.5.3 Vacuum cleaners, or dust extraction units can also be a source of contamination and it is recommended that the contents thereof be subjected to regular microbiological analysis. The results from regular analysis can be used to help monitor the level of pathogens in the environment of the factory. The use of centralized vacuum systems is not recommended since the pipework can be a potential source of contamination.

A.5.4 If high pressure hoses are required in a cleaning programme, these should be used at the start of the cleaning process, since they might aerosolize micro-organisms.

A.5.5 Brushes used on equipment should be readily distinguishable from brushes used on floors. Different coloured bristles could be considered. Since listeria tends to be carried into factories on footwear, unless brushes are properly controlled, they are a means of transfer onto the equipment.

A.5.6 Sampling utensils and manual agitators should be stored in a suitable sterilant solution. The utensils and agitators should be rinsed free of organic matter and dried before immersion in the sterilant, and then rinsed again before being re-used. The sterilant solution should be checked for efficacy at least daily if long-lasting, or renewed daily. A chlorous solution is not suitable for aluminium and certain grades of stainless steel, since it causes pitting.

A.5.7 The cleaning of equipment and processing areas should include the following steps:

a) **Pre-cleaning:** This involves the preparation of an area or equipment for cleaning by the removal of raw material or food products, protection of sensitive components and packaging materials from water, and the removal of food waste or scraps.

b) **Pre-rinsing:** This involves rinsing with water to remove any remaining large pieces of loose soil.

c) **Cleaning:** This involves treatment of surfaces with an appropriate detergent to remove soil.

d) **Rinsing:** This involves rinsing with water to remove all soil and detergent.

e) **Disinfection:** This involves the application of chemicals, or heat (or both) to destroy most microorganisms on surfaces.

f) **Post-rinse or final rinse:** This involves a final rinse with clean water to remove disinfectant, where applicable.

A.5.8 Cleaning cloths should not have fraying edges. The use of disposable cloths is recommended. For easy identification, the disposable cloths should be of a contrasting colour to the food produced.

A.6 Pest control (see clause 11)

A.6.1 Bristle strips can be used to render doors rodent-proof.

A.6.2 Six-weekly inspections are recommended.

A.6.3 Fly screens should be of stainless steel or nylon. Fly screens should be of mesh size No. 16 (1.2 mm gap).

A.6.4 Holes, drains and other places where pests are likely to gain access should be kept sealed.

A.7 Storage, distribution and transportation (see clause 12)

A.7.1 Covered facilities should be provided for the loading and unloading of vehicles, so that these operations can be carried out independently of weather conditions.

A.7.2 Refrigerated transport should be fitted with a temperature recorder and records should be kept of the temperature of the container or vehicles during transportation.

A.7.3 The following temperatures are given as a guideline:

- a) Chilled food temperature (ready-to-eat, not frozen): -1 °C to 7 °C.
- b) Environment for assembling and packaging of high-risk and ready-to-eat products: 12 °C ± 3°C.
- c) Chilled transport and storage: -1 °C to 4 °C.
- d) Frozen transport and storage (non-cream-based products): maximum -12 °C.
- e) Frozen transport and storage (cream-based products): maximum -18 °C.

A.8 Hygiene of personnel (see clause 13)

A.8.1 The doors that lead to the toilet lobby and to toilets should be fitted with push plates on the inside and on the outside of each door.

A.8.2 The toilet lobby should be of size adequate to enable personnel using the toilets to hang up their protective clothing before entering the toilet. This will prevent possible contamination of the protective clothing.

A.8.3 Lockers should ideally have sloped tops, or should be built into walls, to facilitate cleaning.

A.8.4 There should be segregated areas for keeping clean and soiled protective clothing.

A.8.5 Precautions should be taken to ensure that clothing does not remain damp in lockers or that stale food is not left in lockers since this can encourage the growth of mould. Food and valuables should not be stored in clothes lockers, but should be stored in separate facilities provided in rest rooms.

A.8.6 Lockers should, with the acquiescence of the employees, be inspected every three months to ensure that they are kept in a clean condition and that they are not a site for the harbourage of micro-organisms, insects, rodents or birds.

A.8.7 A room with adequate first-aid facilities should be provided.

A.8.8 Wash-hand basins should be located close to work stations, or close to personnel entrances to the processing area (or close to both). The recommended number of wash hand basins required is one for every fifteen people in clean processing areas, and one for every ten people in soiled processing areas.

A.8.9 Showers should be provided, but are of little use if they are not used. Hence, the shower area should be heated, if appropriate, and should make provision for personnel to undress and dress in private.

A.8.10 Any fasteners used for protective clothing should be of metal and of extremely secure design. The use of buttons on garments should never be acceptable in food factories.

A.9 Zoning (see clause 14)

A.9.1 The manufacturer should identify areas and operations that could present a risk of contamination of the food with undesirable micro-organisms, odours, chemicals, soil and other extraneous materials. These areas should be physically separated, either by partitioning, location or other effective means, and access to these areas should be adequately controlled to prevent contamination of food.

A.9.2 Personnel working in or entering the processing areas should not enter the microbiological laboratories.

A.9.3 Personnel should not go from areas where raw materials are handled in to areas where finished product is

exposed; if essential, adequate precautions should be taken to ensure that micro-organisms are not carried on their person.

A.9.4 High-care processing areas should be accessed through a changing room, where personnel entering the area are required to change their footwear and protective clothing and to wash their hands; or via an air lock fitted with a foot and boot bath, hand-washing facilities and changing facilities. Personnel should not have free access from areas where raw materials are prepared or where lowcare products are handled, to areas where higher-care products are handled, unless essential and adequate precautions have been taken to ensure that cross-contamination is not carried on their person.

NOTE It is important to note that certain foods are naturally free of certain pathogenic micro-organisms but could become toxic when contaminated with such micro-organisms. Where such products are handled on the same premises as foods that are reasonably expected to carry pathogenic micro-organisms, it is reasonable to consider the first product as being a high-care product. Examples of this are meat of warm-blooded animals handled in the presence of fish, and raw vegetables cleaned in the presence of cooked meats.

Table A1- Minimum number of plumbing fixtures

Type of building	Water closets		Urinals, where more than 10 men are employed		Lavatories		Bathtubs or showers	Drinking fountains
	Number of each sex	Number of fixtures	Number of persons	Number of urinals	Number of persons	Number of urinals		
factories, warehouses, foundries, and similar establishments	1-10	1	11-30	1	1-100	1 per 10 persons	1 shower per 15 persons exposed to excessive heat or to hazard from poisonous infectious, or irritating material	1 per 75 persons
	11-25	2	31-80	2				
	26-50	3	81-160	3				
	51-75	4	161-240	4	over 100	1 per 15 persons		
	76-100	5						
		1 fixture for each additional 30 employees						
Public buildings, offices	1-15	1	Urinals may be provided in men's toilet rooms in lieu of water closets, but for not more than 1/3 of the required number of water closets		1-15	1		
	16-35	2			16-35	2		
	36-55	3			36-60	3		
	56-80	4			61-90	4		
	81-110	5			91-125	5		
	111-150	6				1 fixture for each closets additional 45 persons		
		1 fixture for each additional 40 employees						

Annex B

(informative)

Surface materials for equipment used in the food industry

B.1 Scope

This annex covers the types of food equipment surface materials used in the food industry, their characteristics, and their implications for hygiene.

B.2 Materials

B.2.1 Depending on the type of product being processed, materials that could be suitable for the construction of plant and equipment in the food industry include the following:

- Stainless steel
- Steel
- Aluminium
- Nickel alloys
- Anodized aluminium
- Galvanized steel
- Tinned steel
- Tinned copper
- Waterproof,
abrasionresistant paints
- Concrete
- Mortar
- Ceramic tiles
- Quarry tiles
- Vinyl-coated metals
- Epoxy-coated metals
- Rigid plastics
- Soft plastics
- Rigid rubbers
- Soft rubbers

B.2.2 The following materials are unacceptable for plant and equipment in the food industry:

- Timber
- Wicker (baskets)
- Cadmium
- Copper and its alloys
- Enamel
- Lead
- Porcelain
- Paints that are not waterproof or abrasion resistant

B.3 Surfaces

It is important that surfaces in food plants be clean and smooth. That condition can only be maintained if the surfaces are cleanable and resistant to corrosion and abrasion. Materials used for construction vary greatly in their resistance to abrasion, resistance to corrosion, rate of soil build-up and ease of soil removal. When engineers design food plants and equipment, it is highly desirable for one item or area to be constructed from the same material or from materials that can be cleaned by similar detergents and disinfectants. Otherwise, selection of detergents and disinfectants for the cleaning of the whole item or area is restricted to that which is acceptable for

the least resistant material.

B.4 Selection of detergent and disinfectant

The selection of a detergent or a disinfectant for a particular task will be dictated by

- a) the type of soil,
- b) the solution application conditions, and
- c) the surface.

The corrosion resistance of the surface greatly influences the class of detergent or disinfectant that may be selected. The influence of surface materials on the selection of is detailed in table B.1 and table B.2.

NOTE The suppliers or manufacturers of detergents and disinfectants should be consulted when such products are being selected.

Table B.1: The influence of characteristics of metallic surfaces on the selection of cleaning materials

1	2	3
Surface material	Surface characteristics	Cleaning material considerations
Stainless steel	Hard, non-porous, scratch resistant	All alkalis satisfactory; use acids and chlorine with care
Steel	Hard, non-porous, scratch resistant	All alkalis satisfactory; use only corrosion-inhibited acids
Aluminium	Hard, non-porous, scratch resistant	Use only mild corrosion-inhibited alkalis; acids can also corrode
Nickel alloys	Hard, non-porous, scratch resistant	All alkalis satisfactory; use acids with care
Galvanized steel	Hard, non-porous, moderately scratch resistant	Care is needed with some alkalis; use only corrosion-inhibited acids
Anodized aluminium	Hard, non-porous, moderately scratch resistant	Mild acids and mild alkalis satisfactory
Tinned steel and tinned copper	Hard, non-porous, moderately scratch resistant	Use only mild corrosion-inhibited alkalis; use acids with care

1	2	3	4
Surfaces		Surface characteristics	Cleaning material considerations
Group	Materials		
Aggregates	Concrete	Hard, porous, scratch resistant	Mild alkalis satisfactory, acids unsatisfactory
	Mortar	Moderately hard, porous, scratch resistant	Mild alkalis satisfactory, acids unsatisfactory
Glass	Glass	Very hard, non-porous, scratch resistant	No detergent or disinfectant restrictions
	Fibreglass	Hard, non-porous, scratch resistant	Mild alkalis or mild acids satisfactory
Ceramics	Ceramic tiles	Hard, non-porous, scratch resistant	No detergent or disinfectant restrictions
	Quarry tiles	Hard, non-porous, scratch resistant	No detergent or disinfectant restrictions
Plastics	Vinyl-coated metals	Soft, non-porous, poor scratch resistance	Alkalis and mild acids satisfactory High temperature may affect surfaces
	Epoxy-coated metals	Moderately hard, porous, moderate scratch resistance	No detergent or disinfectant restrictions
	Rigid plastics	Moderately hard, non-porous, poor scratch resistance	Mild alkalis or mild acids satisfactory
	Flexible plastics	Soft, porous, poor scratch resistance	Mild alkalis or mild acids satisfactory High temperature may affect surfaces
Rubbers	Rigid rubbers	Moderately hard, porous, poor scratch resistance	Sensitive to non-ionic detergents and solvent type cleaners
	Flexible rubbers	Soft, porous, poor scratch resistance	Sensitive to non-ionic detergents and solvent type cleaners
Paints	High gloss solvent-based paints	Soft, non-porous, poor scratch resistance	Use only mild alkalis or mild acids High temperature may affect surfaces

Annex C

(informative)

Cleaning and disinfection

C.1 General principles

C.1.1 Good hygiene demands effective and regular cleaning of establishments, equipment and vehicles to remove food residues and soil that might promote the growth of pathogenic and spoilage micro-organisms and act as a source of food contamination. This cleaning process could, where necessary, be followed by, or associated with, disinfection to reduce the number of micro-organisms remaining after cleaning to a level that will not cause harmful contamination of food. The cleaning and disinfecting stages can be combined by the use of a detergent-disinfectant mixture, although this process is generally considered to be less efficient than a two-stage cleaning and disinfecting process.

C.1.2 The methods employed for cleaning and disinfection should be such as to be considered satisfactory by the administering authority.

C.1.3 The procedures for cleaning and disinfection should be properly established by a hygiene specialist after consultation with production management, plant engineers and manufacturers of detergents and disinfectants. The procedure for cleaning and disinfection should be designed to meet the particular needs of the process and product concerned, and should be set out in written schedules that should be made available for the guidance of employees and management. Procedures should be established not only for cleaning and disinfecting the establishment, equipment and vehicles but also for the cleaning and disinfecting of the equipment that is used for cleaning, such as brooms and buckets.

There should be adequate supervision by management to ensure that the procedures set out are carried out in an effective manner at the specified intervals of time.

C.1.4 A single individual who is a permanent member of staff of the organization and whose duties should preferably be independent of production, should be appointed to be responsible for cleaning and disinfection procedures and for supervision.

C.1.5 Industrial detergents and disinfectants require careful handling. Alkaline and acidic products should not be mixed. Hypochlorite solutions should not be mixed with acidic products, as chlorine gas will be released. Operators handling strongly alkaline or acidic products should wear protective clothing and goggles and should be thoroughly instructed in handling techniques. Containers in which such substances are kept should be clearly marked and stored separately from food and packaging materials. Manufacturers' instructions should be carefully observed.

C.2 Cleaning

C.2.1 General

Cleaning is carried out by the separate or combined use of physical methods, for example, scrubbing or turbulent flow, and chemical methods, for example, the use of detergents, alkalis or acids. Heat is an important adjunct to the use of physical and chemical methods. Care should be taken in the selection of the temperatures, which will depend on the detergents and the nature of the soil and working surfaces. Some synthetic organic materials can absorb constituents of food, such as milk fat, and the amount absorbed increases with an increase of temperature. Effective cleaning is achieved by applying the following steps in the order given:

- a) Remove gross debris from surfaces by brushing, vacuuming and scraping or by other methods, followed where necessary, by the application of potable water. The temperature of the water used will depend on the type of soil to be removed, but in general warm (45 °C to 60 °C) or hot (> 75 °C) water is more effective than cold (< 30 °C) water.
- b) Apply detergent solution to loosen soil and bacterial film and hold them in solution or suspension.
- c) Rinse with potable water to remove loosened soil and detergent residues.

NOTE 1 Care should be taken that the use of abrasive material does not alter the character of the food contact surface and that fragments from brushes, scrapers and other cleaning materials do not contaminate the food.

NOTE 2 After cleaning has been carried out in terms of (a), (b) and (c) of C.2.1, it may be followed by a disinfection process as described in C.3.

C.2.2 Cleaning methods

C.2.2.1 Manual cleaning

Removable parts of machinery can be manually cleaned by the removal of soil by scrubbing while using a detergent solution. For small items of equipment, soaking in a detergent solution in a separate receptacle may be necessary to loosen the soil before the scrubbing process.

C.2.2.2 Cleaning in place (CIP)

Equipment and pipe runs can be cleaned in place with water and detergent solution, without dismantling the equipment or pipe runs. The equipment should be properly designed for this cleaning method. A fluid velocity of 1.5 m/s with turbulent flow is required for effective cleaning of pipe runs. As far as possible, parts of equipment, such as pipe dead ends, that cannot be cleaned satisfactorily by this method should be identified and eliminated. If this cannot be done satisfactorily, these parts should be dismantled for cleaning to prevent build-up of soil and resulting contaminants.

C.2.2.3 Low pressure high volume spray

Water or detergent solution can be applied in large volumes at pressures of up to approximately 680 kPa.

C.2.2.4 High pressure low volume spray

Water or detergent solution can be applied in low volumes at pressures of up to approximately 6 800 kPa.

C.2.2.5 Foam or gel cleaning

A detergent in the form of a foam or a gel can be applied and allowed to remain for 15 min to 20 min and then be rinsed off with a water spray.

C.2.2.6 Washing machines

Some containers and equipment used in food processing can be washed by machines. These machines carry out the cleaning procedures set out above (see C.2.2.1 to C.2.2.5) with the added advantage of disinfection by a hot water rinse at the completion of the cleaning cycle. Good results can be obtained with a machine, provided that the effectiveness and efficiency of the machine is maintained by adequate and regular servicing. The strength of detergents or detergent-disinfectants in washing machines for utensils should be controlled.

C. 2 .3 Detergents

Detergents should have a good wetting capacity, and they should also have the ability to remove soil from surfaces and to hold the soil in suspension. They should also have good rinsing properties so that residues of soil and detergent can be easily removed from equipment.

There are many types of detergents and advice should be sought to ensure that the detergent used in any particular circumstance is suitable for removing the type of soil resulting from a particular food process and that it is used at the correct concentration and temperature. The detergent used should be non-corrosive and compatible with other materials, including disinfectants used in the procedure for disinfection. Whilst cold solutions of detergent might be effective in some circumstances, removal of fat residues requires the use of warm or hot solutions.

The deposition of mineral salts on equipment might form a hard scale ("stone"), especially in the presence of fats or proteins. The use of an acidic or alkaline detergent (or both, sequentially) might be necessary to remove such deposits. The "stone" can be a major source of bacterial contamination. It can be easily detected by its fluorescence under ultraviolet light, which will highlight deposits usually missed by ordinary visual inspection.

C. 2 .4 Drying after cleaning

C.2.4.1 If equipment is left wet after cleaning, micro-organisms might grow in the water film. It is important to ensure that equipment is left dry as soon as possible after cleaning and, where possible, to allow equipment to air-dry naturally. Single-use disposable tissue or absorbent materials, if used for drying, should be used once only and then discarded.

C.2.4.2 Adequate drainage points should be provided in equipment that cannot be dismantled and for of drying racks should be provided for small pieces of equipment that are dismantled the purpose cleaning.

C.2.4.3 Any equipment that unavoidably remains wet for a period during which significant microbial growth might occur should be disinfected immediately before use.

C.3 Disinfection

C.3.1 General considerations

While disinfection results in the reduction of numbers of living micro-organisms, it does not usually kill bacterial spores. Effective disinfection does not necessarily kill all micro-organisms present but reduces their numbers to levels at which they can be reasonably assumed to present no risk to human health. No disinfection procedure can exert its full effect unless its use is preceded by thorough cleaning.

Disinfectants should be chosen according to the types of micro-organisms to be killed, the type of food being processed, the material of food contact surfaces and, where appropriate, the criteria mentioned in C.3.4. Selection of a disinfectant is also affected by the character of the water available and the method of cleaning employed. The continued use of certain chemical disinfectants might lead to the selection of resistant micro-organisms. Therefore, the alternating use of different disinfectants should be considered.

The most common and effective disinfecting process is the use of moist heat. Chemical disinfectants should, however, be used if the use of heat would not be practicable. The procedures described in C.2.2 can also be used for the application of disinfectants.

C.3.2 Disinfection by application of heat

C.3.2.1 The application of moist heat to raise the surface temperature to at least 70 °C is one of the most common and most useful forms of disinfection. High temperatures, however, will denature protein residues and bake them onto the surface of food equipment. It is essential that all soil resulting from food residues be removed by thorough cleaning before heat is applied for disinfection.

NOTE 1 Hot water is regarded as water that has a temperature in excess of 75 °C, warm water as having a temperature in the range 45 °C to 60 °C and cold water as not exceeding a temperature of 30 °C.

NOTE 2 Time and temperature are inversely related where disinfection by the application of heat is concerned.

C.3.2.2 Hot water disinfection is the method commonly used throughout the food industry. Removable parts of machinery and smaller items of equipment can be submerged for a suitable time in a sink or tank that contains water at disinfection temperature, for example, for 2 min at 80 °C. The disinfectant rinse in mechanical washing machines should reach the specified disinfection temperature and the period of immersion should be sufficient to allow the equipment surfaces to reach this temperature. Water at disinfection temperature will scald bare hands and therefore, basket racks or some other type of receptacle should be used where the process is manual.

C.3.2.3 Where steam is used, the upper layer of the surface to be disinfected shall be raised to a high disinfection temperature for a suitable time. In most cases use is made of wet steam in contrast to superheated steam, which is dry and reaches very high temperatures (> 110 °C) but is difficult to maintain and necessitates an extensive piping system. Lances producing steam jets are useful to disinfect surfaces of machinery and other surfaces that are difficult to reach or that shall be disinfected in situ. The heating of surfaces during the application of high temperature steam promotes their subsequent drying. The use of steam can present problems since condensation on other equipment and other parts of the structure might result. High pressure steam can strip paint from painted surfaces and lubricants

from the working parts of machinery. Moreover, some types of materials, such as plastics, are unsuitable for treatment with steam. Steam jets can be dangerous in unskilled hands and should only be used by trained personnel.

C.3.3 Chemical disinfection

The following factors affect the performance of chemical disinfectants:

a) **Inactivation by soiled conditions:** The effectiveness of most chemical disinfectants is reduced by the presence of soil and other soiling matter and, in particular, organic materials. Disinfectants will not be effective at all where there is gross soiling since micro-organisms are physically protected by the soil and the disinfectant is chemically neutralized by the organic matter. Disinfection with chemicals shall, therefore, always follow or be combined with a cleaning process.

b) **Temperature of solution:** In general, the higher the temperature, the more effective the disinfection will be. A warm or hot solution of disinfectant is therefore preferable to a cold solution. There are limitations to the temperature that may be used, and the manufacturer's guidance should be followed. Iodophors release iodine at temperatures above 43 °C, which can result in staining of materials. When hot solutions of hypochlorite or other chlorine-based disinfectants are used, the corrosive action of chlorine is increased and chlorine rapidly escapes from the solution, resulting in a neutralized disinfectant solution.

c) **Time:** All chemical disinfectants need a minimum contact time to be effective. This time will vary according to the activity of the disinfectant and the temperature during application.

d) **Concentration:** The concentration of the chemical solution that is required will vary according to the conditions of use and should be suitable for the particular purpose and environment in which it is to be used. The solutions should be made up strictly in accordance with the manufacturer's instructions.

e) **Stability** All disinfectant solutions should be freshly prepared in clean containers. Topping up existing solutions or prolonged keeping of ready-to-use dilute solutions might render the disinfectant solution ineffective or allow it to become a reservoir of resistant organisms. Disinfectants might be inactivated if mixed with detergents or other disinfectants.

C.3.4 Chemicals suitable for disinfection in food premises

Chemical disinfectants that are liable to taint the food, such as phenolics, should not be used in food premises or vehicles. Care should be taken to ensure that chemical disinfectants do not cause harm to personnel and, when used in places where live animals are kept or transported, such as lairages and vehicles, do not cause distress to the animals. Among the disinfectants more commonly used in the food industry are those listed in (a) to (e) of C.3.3.

a) **Chlorine and chlorine-based products**, including hypochlorite compounds, if properly used, are the most suitable for food plants and vehicles. They can be obtained as liquid hypochlorite solutions containing 50 000 mg to 120 000 mg of available chlorine per gram, or they can be combined with a detergent in a chlorinated crystal form. They can also be specially stabilized for longer storage life. These disinfectants act rapidly against a wide range of micro-organisms and are relatively cheap. They are the most suitable for general-purpose disinfection in food premises. These disinfectants should be used at concentrations of 100 mg to 250 mg of available chlorine per litre. This group of disinfectants is corrosive to metals and also has a bleaching action. Therefore, surfaces disinfected with them should be subjected to a final rinsing as soon as possible, after allowing an adequate contact time. Chlorine disinfectants are readily inactivated by the presence of organic soil.

b) **Iodophors** are always blended with a detergent in an acid medium and they are, therefore, particularly suitable in those circumstances where an acidic cleaner is required. They have a rapid action and a wide range of anti-microbial activity. A solution of about 25 mg to 50 mg per litre of available iodine at a pH value below 4 is usually required for disinfection of clean surfaces. Iodophors are readily inactivated by organic matter. They give a visual indication of their effectiveness since they lose their colour when the residual iodine has dropped to ineffective levels. They are not toxic when used in normal concentrations but might add to the total dietary iodine load. They have little taste or smell, but might combine with substances in the food to cause taint. It is therefore, inadvisable to use iodophors where they might come into contact with food or food contact surfaces, iodophors might have a corrosive action on metals, depending on the particular formulation of the iodophor and the nature of the surface to which the iodophor is being

applied. For these reasons, special care should be taken to rinse iodophors away after use.

c) **Quaternary ammonium compounds** also have some detergent characteristics. They are non-toxic, colourless and are relatively non-corrosive to metal but might have a bitter taste. They are not as effective against Gram-negative bacteria as are chlorine, chlorine-based disinfectants and iodophors. The solutions tend to adhere to surfaces and thorough rinsing is necessary. They should be used at the concentrations recommended by the manufacturer. For normal use, recommended dilutions are between 1:50 and 1:250, depending on the particular product. Higher concentrations are necessary when these compounds are used with hard water. They are not compatible with soaps or anionic detergents.

d) **Amphoteric surfactants** are comparatively new disinfectants that consist of active agents with both detergent and bactericidal properties. They are of low toxicity, are relatively non-corrosive, tasteless and odourless and should be used strictly according to the manufacturer's recommendations to obtain disinfection. They are inactivated by organic matter and are not as effective as chlorine-based disinfectants or quaternary ammonium compounds.

e) **Strong acids and alkalis** have a considerable anti-microbial activity in addition to their detergent properties. Particular care should be taken that they do not contaminate food. After an adequate contact time, all surfaces that have been treated should be rinsed thoroughly with potable water.

NOTE Acids are extremely corrosive to concrete.

C.3.5 Disposal of disinfectants

The chemicals listed in C.3.4 fall under the hazardous classification, according to the relevant hazardous substances regulations, as such, they are classified as Class 1 Hazardous Waste, and should be disposed of in accordance with the guidelines set by the responsible authority.

C.4 Checks on effectiveness of procedures

C.4.1 The effectiveness of cleaning and disinfection procedures should be verified by microbiological monitoring of the product and food contact surfaces. For monitoring the efficacy of the cleaning of plant, equipment and utensils, use FRES 932. Similar regular microbiological monitoring of the product at all stages of production will also give information on the effectiveness of cleaning and disinfection procedures as well as the hygienic handling of the product.

C.4.2 When sampling for microbiological monitoring of equipment and food contact surfaces, the use of a quenching (neutralizing) agent is required to eliminate any residual disinfectant (ES 932)

C.4.3 The following symbols and surface counts can be used as guidelines to indicate satisfactory cleaning operations when using the swab technique (ES 932)

S = Satisfactory: 0-15 organisms per 1 000 mm².

FS = Fairly satisfactory: 16-75 organisms per 1 000 mm².

UNS = Unsatisfactory: more than 75 organisms per 60 mm², or the presence of the undesirable organism indicated.

TNTC = Too numerous to count.

NOTE1: These counts are for guidance only and could vary in different areas.

Note 2: An undesirable organism can be any organism that the management of the establishment regards as detrimental to the facility. In most cases, however, *Escherichia coli* is regarded as undesirable organism and is used as an indicator of faecal contamination

Annex D

(Informative)

Disinfecting agents - Recommended types, their advantages and disadvantages

The objective of table D.1 is to assist the user in understanding the general principles of disinfection on the basis of which this standard was developed.

Table D.1 - Disinfecting agents: Types and recommendations

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Type	Use	Effective agent	Factors controlling efficacy	Circumstances		Cost	Convenience	Penetration	Suitability	Heat effect	Persistence	Corrosion	Odour	Rinsing
Steam ^a	Disinfecting AFTER cleaning			Indicated	Inadvisable									
Hot water ^b	Disinfecting AFTER cleaning	Heat	Temperature, time	CLP pipelines	See heat effect	varies	Recirculating system necessary	Good	Very suitable for pipeline	Less than steam	Not persistent	None	None	Unnecessary
Chlorine compounds ^c	A disinfectant rinse AFTER cleaning Combined with detergents and inorganic salts	Chlorine	Available chlorine concentration, temperature (40°C max.), time	Where drastic action is required When low cost is important Where all types of microorganisms are likely to be encountered Where alkaline detergents are used	Where odour is inadvisable Where corrosion is likely, especially crevice corrosion	Low	Very convenient	Clean plant essential	all purposes	None	Not persistent	Very corrosive unless maintained at pH value of 9 or above	Marked	Good rinsing essential
Quaternary ammonium compounds ^d	A disinfectant rinse AFTER cleaning Combined with non-ionic detergent	Quaternary ammonium ion	Concentration, temperature (70 °C max.), time	Where odour, tests and toxicity are to be avoided Where safety in use is important Where Gram-positive organisms are the major	When low cost is important Where Gram-negative organisms are a likely danger Where rinsing is difficult (e.g. rough	High	Very convenient	Clean plant essential	All purposes	According to recommended temperature	Persistent	None	None	Good rinsing essential

Table D.1 (concluded)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Type	Use	Effective agent	Factors controlling efficacy	Circumstances		Cost	Convenience	Penetration	Suitability	Heat effect	Persistence	Corrosion	Odour	Rinsing
Iodophors ^e	A disinfectant rinse AFTER cleaning Combined with non-ionic detergent	Iodine	Available iodine concentration, temperature (40°C max.), time	Indicate scale is a problem	Inadvisable	Intermediate	Very convenient	Clean plant essential Have detergent action	All purposes	None	Not persistent	Not corrosive if thoroughly rinsed away	None below 40°C	Good rinsing essential
				Manual cleaning and disinfecting Where odour, toxicity and corrosion are to be avoided	Mild steel, rubber at too high a temperature CIP									
Ampholytics (Amphoteric) ^f	A disinfectant rinse AFTER cleaning	Amino acids positive and negative charge	Time, pH value	Where all types of microorganisms are likely to be	Rubber and metal connections When low cost	High	Very convenient	Some detergent proper ties present	All purposes	None	Not persistent	None	None	Good rinsing essential

^a At atmospheric pressure, steam will not destroy all bacterial spores but it is effective against vegetable bacteria, yeasts and moulds. For storage tanks and other large vessels, the condensate during steam injection should reach 85 °C and application should continue for at least a further 10 min.

^b The temperature of the circulating hot water at its coolest point determines the time of treatment, Pouring of so-called boiling water into buckets or utensils is not a method of disinfection.

^c For most purposes, treatment for 15 min with cold solutions containing chlorine at a concentration of 100 mg/l is adequate.

^d The user should not add QAC agents at random to detergent solutions. QACs may be used at a higher temperature and for longer contact time than hypochlorites. QACs are usually used at concentrations of 15 mg/l to 250 mg/l at a temperature above 40 °C and for a minimum contact time of 2 min.

^e These are usually used at concentrations of 25 mg free iodine per litre. They yield pH values of 3 or less in water of moderate alkaline hardness and might help prevent accumulation of scale formation but should not be expected to remove existing scale.

^f Excessive dilution of ampholytics with high alkalinity hard water will seriously impair efficiency.



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- ❖ Develop Ethiopian standards and establish a system that enable to check whether goods and services are in compliance with the required standards,
- ❖ Facilitate the country's technology transfer through the use of standards,
- ❖ Develop national standards for local products and services so as to make them competitive in the international market.

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