Frozen fish- Code of hygiene

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0. Foreword

Fish and fish products form one of the major animal protein sources in Tanzania. In order to ensure provision of wholesome fish and fish products, the freshly caught fish and the subsequent products have to be handled and preserved in such a manner as to protect them from contamination and from microbial and spoilages.

Freezing is one of preservation techniques applied on fish and fish products with the view of maintaining their quality and controlling safety during storage, transportation and distribution.

This standard has been prepared to ensure that freezing of fresh fish and subsequent products is done under proper hygienic requirement during production, storage and handling on board fishing vessels and on shore.

1. Scope

This Tanzania Standard prescribes the hygienic requirements for the handling, production, storage, transportation and distribution of frozen fish intended for human consumption.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

TZS 186 - Fresh fish - Handling - Code of hygiene
CXS 192 - Codex General Standard for Food Additives
TZS 1808/EAS 827 - Fresh and frozen whole fin fish - Specification

3 Terms and definitions

For the purpose of this standard, the following terms and definitions apply:

3.1 air blast freezer

A freezer in which heat is removed from the product by stream of rapidly moving cold air.

3.2 chill store

store in which the raw material can be stored at a temperature of melting ice for a short period, if for one reason or another, it cannot be frozen immediately.

3.3 chilling

process of cooling fish or fish products to a temperature approaching that of a melting ice

3.4 chilling sea water

sea water whose temperature is 0°C or below.

3.5 clean sea water

water which meets the same microbiological standards as potable water and is free from objectionable substances.

3.6 cleaning

The remova1 of objectionable matter from surfaces.

3.7 contact freezer or plate freezer

freezer in which heal transfer occurs by contact between the product and metal plates through which the refrigerant passes. Two types in use today, are the vertical contact plate freezer, mostly for freezing large blocks of whole or gutted fish, and horizontal contact plate freezer, in which smaller fish or fillet blocks or

packages of fish or fillets are frozen.

3.8 contamination

direct or indirect transmission of objectionable matters to the fish or fish products.

3.9 cryogenic freezer

freezer in which heat is extracted from the product by direct contact with liquified gas or vapour

3.10 defrosting

process of removing frost and ice from freezer and freezer store, refrigerated plates or coils, by the introduction of heat, or by brushing and scraping

3.11 dehydration

loss of moisture from frozen products through evaporation

3.12 denaturation

change which takes place slowly in the protein of fish during frozen storage and which adversely affects the texture and flavour of the product

3.13 disinfection

application of hygienically satisfactory chemical or physical agents and processes to clean surfaces, with the intent ion of eliminating micro-organisms

3.14 fillet

slice of fish removed from the carcass by cuts made parallel to the backbone

3.15 fish

any of the cold-blooded aquatic vertebrates

3.16 freezing process

process which is carried out in appropriate equipment in such a way that the range of temperature of maximum crystallization is passed quickly

3.17 freezer

equipment designed for freezing fish and other food products, by quickly lowering the temperature so that after thermal stabilization the temperature in the thermal center is the same as the storage temperature

3.18 freezer store

insulated and refrigerated room specially designed for the storage of frozen products, Freezer store should have sufficient refrigeration capacity to maintain a temperature of - l8°C or lower for products already frozen, but are not designed to freeze products or to cool them down to storage temperature

3.19 fresh fish

freshly caught fish which have received no preserving treatment or which have been preserved only by chilling

3.20 frozen fish

fish which have been subjected to a freezing process sufficient to reduce the temperature of the whole product to a level enough to preserve the inherent quality of the fish and which have been maintained at its low temperature during transportation, storage and distribution up to and including the time of final sale. For the purpose of this standard, the terms "frozen", "deep frozen", "quick frozen" unless otherwise stated, should be regarded as synonymous.

3.21 glaze

thin protective layer of ice which is formed on the surface of a frozen product by spraying it with, or dipping it into, potable water with approved food additives

3.22 gutted fish

fish from which the guts have been removed

3.23 jacketed freezer store

insulated room which is maintained at a temperature of - l 8°C or lower by refrigerating the walls, including ceiling and floor, usually by circulation of cold air through the insulation and the inner lining of the store

3.24 keeping time

he length of time that fish will remain whole some and acceptable as human food

3.25 packaging materials

All those materials such as foils, films, wax paper, cartons and boxes, used for covering and

protecting frozen fish or frozen fish products

3.26 plant or establishment

the building or buildings, or par-ts thereof, used for, or in connection with, the manufacture or holding of food for human consumption

3.27 potable water

Fresh water fit for human consumption

3.28 pounds or pens

areas in the fish hold and on deck divided off by stanchions and portable or fixed board structures, for the storage of fish

3.29 refrigerated brine

concentrated solution of food grade salt (sodium chloride) in potable water or clean sea water cooled by a suitable refrigeration system

3.30 refrigerated sea water

Clean sea water cooled by the addition of ice prepared from potable water or clean sea water and/or by suitable refrigeration system

3.31 rigor mortis

The stiffening of the muscles of an animal which results from a series of complex changes that take place in the tissue shortly after death

3.32 sharp freezer

refrigerated room in which fish are laid on shelves or hung on hooks and there is forced circulation of air

3.33 suitable corrosion-resistant material

impervious material, which is free from pits, crevices and scale, is not-toxic and unaffected by sea water, ice, fish slime or any other corrosive substance with which it is likely to come in contact

3.34 thawing

process whereby heat is introduced into the frozen product, in order to raise its temperature above freezing point

3.35 white fish

Species of fish with white flesh containing relatively little fat

3.36 whole fish

fish as captured, ungutted

4. Freezing fish at sea

4.2 Fishing vessels facilities and operating requirements

4.2.1 General

Construction and hygienic design of the fishing vessel equipped for freezing of fish at sea should follow the requirements for the design of fishing vessels detailed in TZS 186 (see clause 2) The vessel should be designed for rapid and efficient handling and freezing of fish, ease of cleaning and disinfection, and should be of such material and construction as to minimize any damage or contamination of the catch.

4.2.2 Construction

4.2.2.1 Fishing vessels equipped for freezing at sea should be so designed as to provide for efficient operations. Fish holds or bins where fish can be kept sufficiently chilled before being processed should be provided for in the design.

4.2.2.2 Deck pounds or pens; stanchions and dividing boards should be constructed of suitable corrosion resistant material and they will be adequate in number and height as to prevent crushing of the fish due to excessive weight or the vessel's motion. Where wood is used, it should be treated to prevent absorption of moisture. Steel work should be coated with marine anti-corrosion and non-toxic paint.

4.2.2.3 Vessel holds or tanks where fish are held before processing and freezing should be adequately insulated with a suitable material. Any pipes, chains or conduits passing through the hold should be sunk flash or neatly boxed in and insulated.

4.2.2.4 Fish hold or tank lining should be completely water tight. The insulation layer should be protected by a lining made of corrosion resistant metal sheets or any other suitable food grade material having water tight joints.

4.2.2.5 Wooden holding tanks or holds should be lined with a suitable material similar to that described in 4.2.2.4. They should be sealed and coated with suitable impervious and food grade material which is easy to keep clean and not difficult to repair. There should be no sharp corners or projections in the hold or tank, as these will make cleaning difficult and may damage the fish.

4.2.2.6 Vessels using refrigerated sea water for chilling or refrigerated brine systems for freezing fish, should have the tanks, heat exchangers, pumps and associated piping, made of, or coated with suitable corrosion-resistant material and designed so that they can easily be cleaned and disinfected.

4.2.2.7 Clean sea water or brine and ice mixture used for cooling and temporary storage of the fish should be effectively circulated round the mass of the fish. The holding tanks should be equipped with suction screen arrangements which are enough to withstand the pressure exerted by the brine-fish mixture as well as the negative pressure (suction) created by the circulating pump. The screens should be designed and located so as to allow constant and nob structed flow of cold brine or sea water.

4.2.2.8 Refrigerated Sea water or refrigerated brine tanks should be insulated to minimize heat leakage from the surroundings. The refrigerated plant and sea water or brine circulating equipment should be adequate to maintain the core temperature of the fish at -1 ^{o}C.

4.2.2.9 Freezer store onboard the fishing vessel should be adequate for the intended production and should be constructed as to protect the frozen fish from fluctuations in temperature, dehydration and physical damage. Adequate size of the storage and capacity of refrigeration system, provision for an emergency,

4.3 Equipment and utensils

4.3.1 The fish storage, handling, conveying, processing and freezing equipment used on board fishing vessels should be designed for rapid and efficient handling of fish, be suitable for easy and thorough cleaning and should be constructed properly to avoid contamination of the catch. The equipment used on board vessel should be re-assembled for thorough cleaning.

4.3.2 Mechanical conveyors should be installed wherever practical, to handle the fish during pre-freezing operations. Fish washing and conveying equipment should be constructed of suitable corrosion resistant material to prevent bruising or other damage to the fish.

4.3.3 The freezing equipment should be reliable and suitable for the tropical water fish species and products. The freezers should have proper defrosting facilities and designed well so that they are easy to clean. The refrigeration equipment needs to be reliable and of robust construction and should have automatic devices for shutting it down in an emergency.

4.3.4 Contact plate freezers should incorporate a system for defrosting the plates to facilitate loading and unloading operations. Air blast freezer cooling surfaces should also have defrosting facilities.

4.3.5 Lift or conveyors should be installed for moving frozen fish from the freezers to frozen storage. The containers used for unloading and transporting frozen fish should be strong and constructed from suitable, impervious materials. The materials used should be capable of being thoroughly cleaned and should not present any contamination.

4.4 Hygienic operating requirements

4.4.1 The decks, pounds or pens, boards and all other deck equipment which will come in contact with fish should be hosed down with clean sea water and brushed to remove all visible dirt, slime and blood, before any fish comes aboard and between haul of the gear.

4.4.2 All the tubs, tanks barrels and other equipment used in handling, cutting, washing, filleting and conveying operations should be thoroughly cleaned, disinfected and rinsed after each cycle of operations.

4.4.3 During fishing trips the fish hold bilge sump should be regularly drained. The sump should be accessible at all times.

4.4.4 Sea water which has been used for cooling engines, condensers or similar equipment should not be used for washing fish, deck, hold or any other equipment which might come in contact with fish.

4.4.5 Cutting benches if installed, should be provided with channels chutes which have continuous supply of clean sea water to carry the guts over the shipside or to a suitable collecting container. Fish guts should not be allowed to contaminate other fish on deck. Disposing of offals into sheltered water, or close to public beaches or inhabited areas should be avoided.

4.4.6 As soon as the catch is unloaded, the deck and all the deck equipment should be hosed down, brushed, thoroughly cleaned with cleaning agent disinfected and rinsed with potable water or clean sea water.

4. 4.7 In the vessels using refrigerated sea water or refrigerated brine system for the holding, chilling and freezing of the catch, all the tanks, pumps, heat exchangers and other associated equipment should be cleaned immediately after discharging the catch. Potable water or clean sea water with cleaning agent should be circulated through all the parts of the system followed by circulation of a disinfectant. Tanks should be inspected carefully and cleaned out by brushing if necessary.

4.4.8 Where refrigerated water is used for holding or chilling of fish, only clean sea water should be used and should be changed as often as possible to prevent the accumulation of contaminating materials.

4.4.9 Human and other wastes from the fishing vessels should be disposed of in a manner that they will not constitute a public health or hygienic hazard. They should not be discharged into sheltered waters close to man inhabited areas, or over shellfish growing areas.

4.4.10 The fishing vessels should have effective protection and control measures against infestation by insects, birds and rodents. Regular examination for evidence of infestation should be done and proper eradication measures should be taken. Only fumigants, rodenticides and insecticides or any other pesticides approved by competent authority should be used.

4.4.11 Dogs, cats and other animals should be prohibited in a fishing vessel.

4.4.12 Food supplies for the vessel's kitchen or for the crew's mass should not be stored in containers or areas where fish are kept.

4.5 Operating practices and production requirements

4.5.1 Fish for freezing

Fish intended for freezing should have the following characteristics:-

i. be in a sound, wholesome condition;
ii. be bright in appearance;
iii. have a fresh characteristic smell of its species;
iv. have prominent, bright, clear and moist eyes;
v. have bright red gills;
vi. have bright abdominal blood;
vii. be firm, and shall have elastic flesh;
viii. have scales which adhere strongly to the skin where this is normal; and
ix. be free from diseases and parasites.

4.5.2 Handling the fish before freezing.

4.5.2.1 The fish should be sorted as the fish are taken on board and all fish unfit for human consumption removed. Also mixed species catches should be sorted rapidly to avoid damage due to abrasion by spiny and rough skin species and to prevent transferring undesirable odours and tastes which may affect the organoleptic quality of the differing species.

4.5.2.2 Fish should not be trampled or stood upon, and should not be piled deeply on deck. All the fish on deck should be protected from sun and drying effects of wind.

4.5.2.3 Fish kept in pre-gutting storage should not be piled too deeply. Stanchion and dividing boards should be adequate to prevent movement and-crushing of the fish due to vessels motions. The stowage of fish in depth and in large undivided pounds or pens will result in damage to the catch by pressure and mass movement of fish with the motions of the vessel due to sea or weather conditions.

4.5.2.4 Fish should be maintained at a core temperature of 0°C at all time until loaded into a freezer Chilling of whole or gutted fish should be done rapidly by the use of ice or by immersion in or spraying with refrigerated sea water.

4.5.2.5 When fish are to be bled, this should be done immediately after the fish are landed on deck. Gutting should be done rapidly and carefully as soon as the catch comes on deck. Where rapid gutting is not practicable, whole fish should be washed and chilled as soon as it comes on deck. Separate adequate storage facilities should be provided for fish roe, milt and livers if these are saved for later utilization. Immediately after gutting, fish should be washed with cold potable water or clean sea water and any further handling should be carried out without delay.

4.5.2.6 Fish which are waiting to be frozen should be stored under chill conditions and in such a way that they will not be damaged by crushing or by movement due to the vessels motions. With buffer stowage of fish, refrigerated sea water or refrigerated brine is preferred. The recommendations of

refrigerated sea water or refrigerated brine stowage for maintaining fish in a chilled condition.

4.5.2.7 Where bins are used to store small quantities of fish at the freezer loading area, each bin should only hold one species or one size range of that species.

4.5.3 Freezing of fish

4.5.3.1 The freezing plant should be adequate to deal with the normal catching rates of the vessel. so that fish are not held for long periods prior to freezing. The first-caught fish should be frozen first. Fish which are in rigor and stiffened in a bent position should not be straightened forcibly when loaded into the freezer.

4.5.3.2 The precise freezing times for the fish products should be carefully determined. The freezing process should be rapid and the temperature reduction adequate to avoid quality losses associated with badly frozen fish. Frozen fish blocks should be of regular size and shape.

4.5.3.3 In vertical plate freezers. fish should be packed between the plates with as few gaps as possible. The freezers should not be over-loaded with fish. Fish should not be loaded above the top of the freezer plates. The fish may be gently compressed, but any undue pressure should not be used in an attempt to fit oversize fish into the freezer. Very large fish may be headed before freezing into blocks, or they may be frozen by other means.

4.5.3.4 In using horizontal plate freezers, fish should be packed in trays or other forms to produce uniform compact blocks or packages. There should be no voids in blocks and that surfaces should be uniform and flat. The trays should not be over-filled as this will cause damage to the fish by excessive pressure or result in bad contact with the plates and poor heat transfer conditions respectively.

4.5.3.5 The defrosting time for contact plate freezers should be just long enough to allow easy loading and unloading of the blocks from sections. The frozen blocks should be removed from vertical plate freezers immediately after adhesion to the plates is broken by defrosting. Before reloading the freezers, both refrigeration and defrosting valves should be closed so that the plates are neither heated nor chilled during the operation.

4.5.3.6 Blast freezer should be loaded in such a way that there is a sufficient flow of cold air around the product Fish should not be over- loaded in the freezer as air circulation around the surfaces of the individual fish will be obstructed.

4.5.3.7 All the freezing process should be completed in the freezer by allowing the full time for each cycle. The refrigeration equipment manufacturer's operation instructions should be rigorously adhered to. Frequent checks should be made on the pressures and temperatures in the refrigeration system to ensure correct operation

Accurate records of all freezing operations should be kept, and a system of labels or colour codes should be used when loading fish into a freezer to assist in the later identification of frozen products. The labelling -should indicate location of catch, date of freezing, quality and state of raw material. The identification should indicate the species, size, condition of fish and its suitability for further processing and handling.

4.5.4 Glazing and storing

4.5.4.1 Frozen fish should be glazed or wrapped immediately after freezing to protect them from dehydration and oxidation in the freezer store

4.5.4.2 Frozen fish or blocks should be conveyed to the freezer store immediately after glazing or wrapping. They should be handled with care to avoid breakage or damage to the glaze or protective wrapper.

4.5.4.3 Frozen blocks should be stored in the freezer store in such a way that they will not be broken

or damaged. Frozen fish should be stored on board the vessel at a core temperatures -18^{o}C or below. A proper plan of the freezer store should be kept to facilitate locating fish of different species and size.

4.5.5 Unloading of the frozen fish

When unloading the frozen fish, care should be taken to avoid breakage. The frozen fish should be quickly transferred from the ship's freezer store to the shore-based freezer store.

4.6 Hygiene control programme

Each fishing vessel should have a hygiene control programme involving the whole crew and should assign to each member a definite task in cleaning and disinfecting the boat. A permanent cleaning and disinfection schedule should be drawn up to ensure that all parts of the boat and equipment thereon are cleaned appropriately and regularly. The fishermen should be well trained in the use of special cleaning tools, methods of dismantling equipment for cleaning, and should be knowledgeable in the significance of contamination and hazards involved.

5 FREEZING FISH ON SHORE

5.1 Plant facilities and operating requirements

5.1.1 General

5.1. 1. 1 Fish freezing operations including the storage should be designed to produce safe and wholesome frozen products for either further processing or direct marketing. The handling and processing of fish should be done in separate buildings or areas which are physically separated to prevent any contamination of fish or fish products.

5.1.1.2 Fish processing and freezing operations should be planed and designed to have sufficient capacity to process, freeze and store frozen fish at the predetermined rate of daily delivery and should not be operated beyond their full rated capacity for any extended period. There should be sufficient standby replacement for all the processing and freezing equipment to allow for servicing and in case of an emergency.

5. 1.1.3 The plant for the processing and freezing of fish should be designed and equipped so that all handling, processing and freezing operations can be carried out efficiently and the fish can pass from the stage of processing to the next in an orderly manner and with minimum delay.

5.1.2 Construction

5.1.2.1 Fish processing and freezing plant should be specially designed for the purpose. The processing and freezing plant should meet the requirements for construction and hygienic facilities as the fresh fish processing establishment detailed in TZS 186 (see clause 2) and repeated in this standard under subsclauses 5.1.2 and 5.1.3, respectively.

5.1.2.2 The plant and the surrounding area should be kept free from objectionable odours, smoke, dust or other contamination. The building should be sufficient in size without crowding of equipment or personnel, well-constructed and kept in good repair. They should be of such design and construction as to protect against entrance and harbouring of insects, birds or other vermin, and to permit ready and adequate cleaning.

5.1.2.3 The floor should be constructed of durable waterproof, non-toxic, non-absorbent materials which are easy to clean and disinfect. It should be non-slip and without crevices and should slope evenly and sufficiently for liquids to drain off to trapped outlets fitted with removable grill. If the floor is ribbed or grooved to facilitate traction, any grooving of this nature should run toward the drainage channel. The junctions between the floor and walls should be impervious to water and should be curved for ease of cleaning.

5.1.2.4 The drains should be of an adequate size, suitable type, equipped with traps and with removable gratings to permit cleaning. The drains should be constructed of smooth and impervious material and should be designed to cope with maximum flow of liquid without overflowing and flooding. Each drainage inlet should be provided with deep seal trap which is appropriately located and easy to clean.

5.1.2.5 The internal walls should be smooth, waterproof, resistant to fracture, light coloured and readily cleanable. They should be made of suitable corrosion resistant, non-toxic, non- absorbent materials which are easy to clean and disinfect.

The wall to wall and wall to floor junctions should be curved or rounded to facilitate cleaning. The walls should be free from projections and all pipes or cables should be sunk flush with the surface or neatly boxed to the wall or neatly boxed in and mounted from the wall to allow adequate cleaning and prevention of insect harbourage.

5.1.2.6 The window sill should be kept to a minimum size and slopped inward at least 45° and be at least 1 m from the floor.

The window sill and frames should be made of smooth, water proof material, and if wood, should

be kept painted. The windows should be filled with whole panes and those which open should be fitted with easily removable screens which are easy to clean and made of suitable corrosion, resistant material.

5.1.2.7 The doors through which fish or their products are moved should be sufficiently wide and either covered or made of corrosion-resistant metal or other suitable material with adequate impact resistance and, unless provided with an effective air screen, should be of self-closing type. The doors and the frames of doorways should have a smooth and readily cleanable surfaces. The door through which fish or their products are not moved, such as those providing staff access should be appropriately surfaced, at least on the processing side to allow easy cleaning.

5.1.2.8 The ceiling should be designed, constructed and finished to prevent accumulation of dirt and minimize condensation, mould development and flaking and should be easy to clean. The ceiling should be at least 3m in height, free from cracks and open joints and should be of smooth, water proof, light coloured finish.

5.1.2.9 The premises should be well ventilated to prevent excessive heat, condensation, mould growth on overhead structures, and contamination with abnoxious odours, dust, vapour or smoke. The air-flow in the premises should be from the more hygienic areas to the less hygienic ones. Ventilation openings should be fitted with easily removable screens made of suitable corrosion-resistant material.

5.1.2.10 The premises should be well lighted with minimum illumination of 220 lux in general working areas and not less than 540 lux at points requiring close examination of the product.

Light bulbs and fixtures suspended over working areas where fish are handled at any stage of preparation should be of the safety type or otherwise protected to prevent contamination of the fish incase of breakage. The light fixtures or their upper surfaces should be recessed or filled flush with the ceiling, in order to prevent the accumulation of dust on them.

5.1.2.11 The freezer store should be adequate for the predetermined production, time and temperature of storage. The location and design of the freezer store should be integrated into the general layout of the whole establishment and its operation should be incorporated into the flow pattern of the overall operation.

5.1.2.12 A proper vapour seal should be put on the outside surface of the freezer store and precautions should be taken to avoid danger of frost heave.

5.1.2.13 The inflow of outside air into the freezer store should be minimized as much as possible. Where a freezer store must be opened frequently the flow of air through the door should be restricted by the use

of an air lock chamber a cold air curtain, self-closing shutters or some other similar devices.

5.1.2.14 The relative humidity in the freezer store should be as high as possible not below 75°C and excessive air circulation should be avoided.

5.1.2.15 Provision should be made for an effective and regular defrosting of the freezer store cooling surfaces.

5.1.2.16 The freezer stores should be filled with an alarm device, operated from inside, so that any one trapped inside can obtain assistance quickly.

5.1.3 *Hygiene facilities*

5.1.3.1 The areas where fresh fish are received, or stored should be separated from areas in which product preparations or packaging are conducted in order to protect the finished product from contamination. Separate rooms or well-defined areas of adequate size, should be provided for receiving and storing raw materials and for operations like gutting, washing, filleting, steaking or other processing and packaging.

5.1.3.2 Refuse room or equally adequate offal storage facilities should be provided on the premises. Offals or other refuse collected and held before removal should be adequately protected against rodents, birds, insects and exposure to warm temperatures. Refuse should be stored in elevated watertight containers or offal bins. The walls, floor and ceiling of the storage room and the area under the elevated bins should be constructed of impervious material which can be readily cleaned. Waste material held outside the establishment should be hidden and separate enclosures should be provided for their storage with easy access for vehicles loading and unloading.

5.1.3.3 By-product plant should be entirely separate from the plant which is processing fish for human consumption.

5.1.3.4 An ample supply of cold and hot potable and/or clean sea water at a minimum temperature of 85°C should be available at numerous points throughout the premises at all times during the working hours. The cold water supply used for cleaning purpose should be fitted with an in line chlorination system allowing the residual chlorine content of the water to be varied at will in order to reduce multiplication of micro-organisms and prevent the build-up of fish odours.

5.1.3.5 When in plant chlorination of water is used the residual content of free chlorine should be maintained at the concentration of 10 mg/kg during normal use and residual concentration of 100mg/kg during cleaning up operations.

5.1.3.6 Ice should be made from potable water or clean sea water and should be manufactured, handled and stored so as to protect it from contamination and excessive meltage.

5.1.3.7 Where a non-potable auxiliary water supply is used for example for the purpose of producing steam, cooling heat exchangers and fire protection, water should be stored in separate tanks and carried in separate lines, identified by contrasting colours and labelled and with no cross-connections or back siphonage with the lines carrying potable water.

5.1.3.8 All plumbing and waste disposal lines, including sewer system, should be large enough to carry peak loads and should be properly constructed. All lines should be water tight and have adequate deep seal traps and vents. Disposal of waste should be effected in such a manner as not permit contamination of potable water or clean sea water supplies. Sumps or solid matter of the drainage system should preferably be located outside the processing area and designed to allow them to be emptied and

thoroughly cleaned at the end of each working day.

5.1.3.9 Proper facilities for washing and disinfection of equipment should be provided. Such facilities should be located in a separate room or in designated areas in the work rooms where there is an adequate supply of hot and cold potable water or clean sea water, and where there is proper drainage. Any containers and equipment used for offal or contaminated materials should not be washed in the same area, then used for products intended human consumption.

5.1.3.10 Adequate and conveniently located toilet facilities should be provided. Toilet rooms to have walls and ceilings of a smooth washable, light coloured surface and floors structed of impervious and readily cleanable material. Toilet facilities should be well lightened, ventilated and kept in a hygienic condition at all times. Adequate supply of toilet paper should available in each toilet cubicle.

The doors leading to the facilities should be of a self-closing type and should not open directly the fish processing areas. The hand washing facilities in the toilet rooms should be of a type requiring operation by hand and should have an adequate supply of hot and cold potable water or clean sea water and liquid or powdered soap should be provided. Suitable hygienic means of drying hands. Where paper towels are used, a sufficient number of dispensers and receptacles for used paper towels should be provided.

Notice should be posted requiring personnel to wash their hands after using the toilets. The following formula should be used in assessing the adequacy of toilet facilities in relation to number of employees:

1 to 25 employees - 1 toilet

26 to 50 employees - 2 toilets

51 to 75 employees - 3 toilets

76 to 100 employees - 4 toilets

for every 40 employees over 100- 1 toilet

5.1.3.11 Facilities should be available in the processing areas for employees to wash and dry their hands. In addition to hand washing facilities available in toilet rooms, a number of washbasins with an adequate supply of hot and cold potable water or clean sea water and liquid or powdered soap should be provided whenever the process demands.. The facilities should be kept in hygienic condition at all times.

5.1.3.12 Staff amenities consisting of lunchrooms, changing-rooms or rooms containing shower or washing facilities should be provided. Where workers of both sexes are employed, separate facilities should be present for each except that the lunchrooms may be shared. The lunch rooms should provide seating accommodation for all employees and the changing rooms should provide enough space for lockers for each employee without causing undue congestion. Clothing and footwear not worn during working hours must not be kept in any processing area.

5.1.3.13 Storage facilities should be available for the proper dry storage of packaging material

Separate facilities for the storage of cartons, wrappings or other packaging materials should be provided in order to protect them against moisture, dust or other contamination.

5.1.3.14 If poisonous or harmful materials, including cleaning compounds, disinfectants, sanitizers and pesticides are stored, they should be kept in a separate room designed and marked specifically for this purpose. All such material must be prominently and distinctly labelled so that they can be easily identified.

The room should be kept locked and the materials contained in it should be handled only by personnel trained in their use.

5.2 Equipment, utensils and working surfaces

5.2.1 Equipment and utensils for the handling, storing, filleting or similar processing of the fresh fish prior to freezing should meet the requirements detailed in subclause 4. 1 of TZS 186 (see clause 2).

5.2.2 All work surfaces and all containers, trays, tanks or other equipment used for processing fish should be of smooth, impervious, non-toxic material which is corrosion-resistant and should be designed and constructed to prevent hygienic hazards and permit easy and thorough cleaning. In general, the use of wood for this purpose is not recommended.

All food contact surfaces should be made of food-grade materials. The surfaces should be smooth, free from pits, crevices and loose scale capable of withstanding repeated cleaning and disinfection. Machines and equipment should be designed in such a way they can be easily dismantled to facilitate thorough cleaning and disinfection.

Containers used for holding fish should preferably be constructed of plastic or corrosion-resistant metal. Wicker baskets should not be used. Stationary equipment should be installed in such a manner that will permit easy access, thorough cleaning and disinfection.

Fish washing tanks should be designed to provide a constant change of water with good circulation, and to have provisions for drainage and to be easily cleaned. Equipment and utensils used for inedible or contaminated materials should be identified as such and should not be used for handling of fish and products intended for human consumption.

5.2.3 Properly designed machines for unloading, gutting, filleting, skinning, steaking and similar operations should be used. The filleting line should be designed as continual processing unit with all the operations arranged sequentially in such a way that the fish could move uniformly fast through the line without any stoppages or slowdowns. The filleting line should be easy to dismantle for cleaning purposes and should be constructed of a corrosion-resistant material. There should be an easy access to every part of the line.

5.2.4 Cutting boards and other surfaces on which fish are cut should be made of impervious materials which meet the physical requirements for cutting surfaces. Wooden cutting surfaces are not recommended5.2.5 Mechanical conveyors should be installed whenever practicable to handle the fish during pre-freezing operations. Lifts or other conveyors should be installed for moving fish from freezers to frozen storage.

5.2.5 Freezing equipment should be suitable for the particular product and should have adequate capacity to deal with the expected peaks in fluctuating fish deliveries.

5.3 Hygienic operating requirements

5.3.1 Hygienic operating requirements in fish freezing operations should be similar to those recommended for fresh fish processing plants described in TZS 186 (see clause 2).

The building, equipment, utensils and other physical facilities of the plant should be kept clean, in good repair and should be maintained in an orderly and hygienic condition. All surfaces which come in contact with fish should be hosed down with cold or hot potable water or clean sea water frequently to ensure cleanliness. The cleaning method should be capable of removing all residues and the disinfecting method will reduce the microbial population of the surface being cleaned. A preliminary rinse in potable cold or

clean sea water should be done then followed by a wash in water at a minimum temperature of 43°C. After the application of cleaning and disinfecting agents the surfaces which come in contact with fish should be rinsed thoroughly with cool potable or cool clean sea water before use.

Cleaning agents and disinfectants used should be appropriate for the purpose and should be so used as to present no hazard to public health and should meet the requirements set out by Tanzania Bureau of Standards.

5.3.2. Wherever practicable the cutting boards should be continuously flushed with clean running potable water or clean sea water during use.

5.3.3 If barrels or other containers are used on the processing line for the collection and disposal of offal they should be located below the level at which the fish are processed and in such a way that there is non splash-back on the processing line. If the containers are not being used, then they should be lidded.

5.3.4 All machines used for processing frozen fish should be thoroughly cleaned, disinfected and rinsed during any rest and before resumption of production following other work stoppages.

5.3.5 All machinery and equipment should be inspected before processing begins to ensure they have been properly cleaned, disinfected, rinsed and reassembled. Mechanized or automated equipment should be regularly checked to prevent breakdowns.

5.3.6 All product trapped or accumulated in machinery and equipment should be removed periodically throughout the working day.

5.3.7 Removal of solid, semi-solid or liquid wastes from fish unloading, holding and processing areas should be on a continuous basis using water and/or appropriate equipment so that these areas are kept clean and there is no danger of contaminating the product. All waste materials resulting from the operation of a fish processing plant should be disposed of as soon as possible in a way that they cannot be used for human food and in a manner that they cannot contaminate food and water supplies or offer harborage of breeding places for rodents, insects or other vermin. All waste material from containers and vehicles should be removed to avoid contamination.

5.3.8 Freezer stores should be free from odours and maintained in a good hygienic condition. A regular clean-up procedure should be maintained to ensure good hygienic environment.

5.3.9 All wharves, quays, markets and similar areas where fish are unloaded or displayed for sale should be kept clean and disinfected.

5.3.10 Effective measures should be taken to protect against the entrance into the premises and harborage of insects, rodents, birds or other vermin. There should be an effective and continuous programme for the control of pests. The establishment and the surrounding areas should be regularly examined for evidence of infestation and if detected eradication measures should be instituted immediately. Control measures involving treatment with chemical, physical or biological agents should only be undertaken by or under direct supervision of personnel who have a thorough understanding of the potential hazards to health resulting from the use of these agents, including those which may arise from residue retained in the product

5.3.11 Dogs, cats and other animals should be prohibited in areas where fish is received, handled, processed or stored.

5.3.12 Market containers and all returnable fish boxes should be thoroughly cleaned and treated with

disinfectant immediately after each use.

5.3.13 Conveyances used for transporting fish should be cleaned and disinfected immediately after each use and maintained to avoid contamination of the product. The cleaning of vehicles, together with receptacles and equipment thereon, should be planned to a regular routine. Hosing, scrubbing and cleaning, with potable water or clean sea water to which detergent and disinfectant have been added, should be done. Forklift trucks should not be used outside the plant unless they can be adequately cleaned upon re-entry.

5.4 Personnel hygiene

5.4.1 All persons working in a fish processing and freezing plant should be examined by an authorized medical practitioner as required by the Competent Authority. A record of such examination should be maintained.

5.4.2 The management should impress on all employees that they should notify the medical officer at the processing unit on health issues which has direct implications to the product. No worker who is known or suspected to be suffering from any of the disorders should be permitted to handle frozen fish. The supervisor should check the personal hygiene of the workers before the start of work and whenever they enter any processing area after any absence.

5.4.3 Employees should keep their finger nails short and clean and wash their hands with soap and detergent and water before commencing work after each absence especially after sanitary conveniences. No ornaments should be worn during processing.

5.4.4 No worker should be allowed to work without proper protective clothing. They should adopt strict hygienic practices so as to avoid contaminating the frozen fish.

5.4.5 Employees should be provided with protective clothing.

5.4.6 Separate room or place for changing the clothes should be provided. The clothes should not be hung in the fish handling areas.

5.4.7 The uniforms should not be worn outside the plant but put on just before starting the work and changed when leaving.

5.4.8 Eating, spitting, nose cleaning or the use of tobacco in any form or any form of chewing should be prohibited within the manufacturing, packaging and storage areas of the plant. Notice to this effect should be prominently displayed and enforced.

5.4.9 Gloves, if used in the handling of fresh fish, should be maintained in a sound, clean and sanitary conditions. The wearing of gloves, does not exempt the operator from having thoroughly washed hands. Gloves should be made of an impermeable material except where their usage will be inappropriate or incompatible with the work involved.

5.4.10 Precautions should be taken to prevent visitors to fresh fish handling areas from contaminating the fish. These may include the use of protective clothings. All visitors should observe the relevant provisions recommended in subclause 5.4

5.4.11 This clause 5.4 should also be applicable to freezing fish at sea

5.5 Operating practices and production requirements

5.5.1 Handling of fish before freezing

5.5.1.1 On shore handling of fresh fish intended for freezing should be in accordance with the recommendations given in TZS 186 (see clause 2) or in clause 4 of this standard freezing fish at sea.

5.5.1.2 Fresh fish should be treated in a hygienic manner. Evisceration and other operations in the handling of fish should be clean and hygienic. Precautions should be taken to protect the fish from contamination by animals, birds, chemical or microbiological contaminants or other objectionable substances during processing, handling and storage. Preparatory operations leading to the finished product and the freezing operations should be so timed as to permit expeditious handling of the consecutive batches in production within the time and temperature range that will prevent deterioration and spoilage and will allow for proper freezing

5.5.1.3 Fish which has undergone deterioration or any process of decomposition or which has been contaminated with foreign matter to the extent which has made it unfit for human consumption, should not be used for processing. Fresh fish should be rejected if it is known to contain harmful decomposed or extraneous substances which cannot be removed to acceptable level by the normal procedures of sorting or preparation. Fish in diseased condition should be discarded or the disease portion removed.

5.5.1.4 Fish which cannot be processed immediately on arrival at the plant should be well iced in clean containers and stored in specially designated areas within the plant where they will be protected from heat and weather conditions and will not be contaminated by dust, insects, or vermin. Where possible the iced fish should be stored in a chill room, the temperature of which is just above that of melting ice.

5.5. 1.5 Where the fish are dipped or sprayed with food additives the used food additive should comply to CXS 192. Where the products are to be packed before freezing, this should be done rapidly to avoid rise in temperature.

5.5.2 Freezing of fish.

5.5.2.1 The recommendations for freezing fish on shore will be the same as those given in this standard for freezing at sea. The recommendations given in subclause 4.5.2 of this standard should also apply to on shore operations.

5.5.2.2 Where cryogenic freezing methods are applied, care should be taken to ensure that the product does not become deformed or cracked.

5.5.2.3 Where conveyors are used to feed the product through the freezers, the speed should be adjusted so that the product is properly frozen by the time it reaches the end of the freezing chambers.

5.5.2.4 Distortion of blocks or packages during freezing should be avoided and freezing should be completed in the freezer and should never be carried out by placing unfrozen or partially frozen products in a freezer store.

5.5.3 Glazing and packaging

5.5.3.1 Frozen fish or fish products should be glazed, wrapped or packaged to protect their quality storage. Glazing should be controlled as much as possible so that the thickness of the glaze deposited on fish is uniform and the amount of glaze expressed as percentage of the total fish weight, is fairly constant and known to the buyer.

5.5.3.2 Fish products that are not packaged or wrapped should be glazed as soon as they are removed

from the freezer. When additives are used in the glazing solution, care should be taken to ensure that the resulting glaze will in no way detract from the appearance of product. The temperature of glazing solution should not be above 5ºC.

5.5.3.3 frozen products should be transferred to the freezer store immediately after removal from the freezer or after glazing. The stored glazed fish or fish products should be checked periodically for the deterioration of the glaze. If deterioration of the glaze is noted and if the fish or fish product is to remain in storage for undetermined time, then the fish or fish product should be reglazed as soon as possible to protect it from dehydration (freezer burn) and oxidative rancidity.

5.5.3.4 Packaging should be designed and materials chosen to create package which will protect the product adequately. The packaging materials should be sufficiently strong and durable to withstand stresses during processing, storage and distribution. The packages should be impermeable to fats and oils, and should not stick to wet or frozen surfaces of the product.

5.5.3.5 Master cartons for wholesale packaging should be light, strong and should provide good protection for the frozen products.

5.5.3.6 Cartons, wrappings and other packaging materials should not be stored in the processing area and only those packages required for immediate use at any given time should be introduced to the area.

5.5.4 Storage and distribution

5.5.4.1 During freezing, the temperature of the product should be lowered to such an extent that after thermal equalization the core temperature of the product should be -18°C or below.

5.5.4.2 Partially thawed products received for storage should be refrozen in appropriate freezing equipment before being stored in the freezer store.

5.5.4.3 The temperature of the freezer store should be controlled carefully to avoid fluctuations, and should be checked regularly and records should be maintained.

5.5.4.4 The products should be stacked in the freezer store so that there is always a space for cold air to circulate along the walls and floor. The longest stored products should be removed from the freezer store first, thus the principle of "first in first out" should be adhered to.

5.5.4.5 All the vehicles used in the transport of frozen fish should be capable of maintaining the low temperature required to preserve the quality of the product. Care should be taken that frozen fish products are not exposed to high temperature during loading and unloading of the transport vehicles.

5.5.4.6 The operation of the refrigeration units on transport vehicles should be checked frequently en-route. The suitability of refrigerated transport vehicles and the care with which they are loaded, operated and maintained should be checked by measuring product temperature at the beginning and at the end of the journey.

5.6 Thawing of frozen fish

5.6.1 Only very high-quality frozen fish should be selected for further processing which involves thawing and freezing. The exposure of fish to elevated temperatures during thawing should be carefully controlled. The thawing method chosen should suit the volume and type of product that is to be processed and should be economically practicable.

5.6.2 All the thawing operations should be carried out under hygienic conditions. Since thawed fish are subject to the same risks of contamination and spoilage as fresh fish, it is essential that all areas, equipment, tanks and other facilities used in thawing, and all the handling practices, should meet the high standards for sanitation and hygiene as set out in TZS 186 (See clause 2).

5.6.3 Fish which have been frozen pre-rigor or during rigor should be thawed carefully at low temperature.

5.6.4 Where fish are thawed in still air, the ambient temperature should not exceed 18°C. With air blast thawing, the air should be humidified and its temperature should not exceed 21°C. Where fish are thawed in water, the water used should be either clean sea water or fresh water of potable quality and its temperature should not exceed 21 °C. When dielectric thawing or electrical resistance thawing is used, precautions should be taken to avoid overheating in parts of the product.

5.6.5 Immediately after thawing the fish should be either processed and refrozen or thoroughly chilled and maintained in a chilled condition until it is processed or distributed to consumer.

5. 7 Hygiene control programme

5.7.1 Each fish processing and freezing plant should designate a person whose duties are excluded from production, to be responsible for the cleanliness of the establishment. Such a person should be a permanent part of the organization or employed by the organization and should be well trained in the use of special cleaning tools, methods of dismantling equipment for cleaning and in the significance of contamination and hazards involved.

5.7.2 A permanent cleaning and disinfection schedule should be drawn up to ensure that all parts of the establishment are cleaned appropriately and that critical areas, equipment and materials are designated for cleaning and/or disinfection daily or more frequently if required.

5.8 Quality control

Each fish processing and freezing plant should have access to laboratory control to establish hygienic quality of the products processed.

6. Endproduct specifications

Frozen fish should comply with TZS 1808.

7 Retail display

7.1 Frozen fish and fish products should be offered for sale from refrigerated cabinets designed for the purpose. The product temperature should not be allowed to become higher than – 18ºC while in the cabinet.

7.2 Frozen fish should not be stored in retail cabinet for long periods and should never be stacked above the designated load line mark.

7.3 Retail display cabinets should be used to store already frozen products, and should be defrosted at least once a week.

7.4 Frozen fish which have been partly or completely thawed for retail sale should not be returned to the frozen fish cabinet.