SRI LANKA STANDARD 1017: 2010

UDC 664.951.2:351.773

CODE OF HYGIENIC PRACTICE FOR SALTED AND DRIED SALTED FISH (First Revision)

SRI LANKA STANDARDS INSTITUTION

Sri Lanka Standard

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(First Revision)

SLS 1017 : 2010

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SRI LANKA STANDARDS INSTITUTION
17, Victoria Place
Elvitigala Mawatha
Colombo 08
Sri Lanka

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FOREWORD

This Sri Lanka Standard was approved by the Sectoral Committee on Agricultural and Food Products and was authorized for adoption and publication as a Sri Lanka Standard by the Council of the Sri Lanka Standards Institution on 2010-10-15.

Salting is one of the oldest methods of food preservation. Many other techniques of fish preservation use salt either as a condiment or an auxiliary preservative. Although some smoked fish may be heavily salted, they are considered to be smoked because of their characteristic smoked flavour and these practices are not covered in this standard. For the purpose of this Code, "salting" is that process of preservation in which salt is the main preservative used.

There are three major techniques of salting as described in this Code : brining , a process by which fish is salted in a previously prepared water solution of salt ; dry-salting, where the fish are salted with dry crystalline salt and the resulting brine liquor is allowed to escape ; and pickling, in which the fish is salted in a manner similar to dry-salting but the exuded liquor is retained. In the latter process, brine may be added.

Salt acts upon fish as upon other foods by withdrawing water from the tissue. Fish flesh is made up of 75 to 80 per cent water (in the case of really fatty fish 60 to 65 per cent) and through the action of diffusion and osmosis, this water can be partly replaced by salt. The water which diffuses from the fish becomes saturated with the surrounding salt and is termed "pickle". Dry –salting results in a rapid loss of weight by the fish, while with "wet" salting, after an initial weight loss there is a gradual weight gain. Salt uptake and water loss are influenced by the fat content of the fish, thickness of the flesh, freshness, temperature, chemical purity of the salt and other factors. Fat acts as a barrier both to the entry of salt and withdrawal of water. This water loss becomes increasingly slower with more fatty fish.

This Code was first published in 1994 and is being revised with a view to updating it with the latest publication of Codex Alimentarius Commission, i.e. Code of Practice for fish and fishery products-CAC/RCP 52 – 2003 (2008).

This Code is subject to the restrictions imposed under the Food Act No. 26 of 1980 and the regulations framed thereunder, wherever applicable.

The provisions of this Code are supplemental to and should be used in conjunction with, the SLS 143-Code of Practice for General Principles of Food Hygiene.
In revising this Code, the assistance derived from the publications of the Codex Alimentarius Commission (CAC) is gratefully acknowledged.

1 SCOPE

1.1 This Code applies to fish and fishery products from marine and freshwater sources preserved by brining, dry-salting and pickle curing, which are intended for human consumption.

1.2 This Code also applies to the harvesting, handling, production, processing, storage, transportation and retail of salted lean and fatty fish both on vessels at sea and in establishments on shore.

2 REFERENCES

SLS 143 Code of practice for general principles of food hygiene
SLS 467 Code of practice for labelling of prepackaged foods
SLS 614 Potable water
SLS 974 Code of hygienic practice for fresh fish
SLS 975 Code of hygienic practice for frozen fish

3 DEFINITIONS

For the purpose of this Code, following definitions shall apply :

3.1 barrel : A cylindrical container made from wood or plastic or other suitable food contact material with a lid for water-tight closure.

3.2 black membrane : Parietal peritorium, the pigmented lining of the abdominal cavity.

3.3 brine : Solution of salt in water

3.4 brine injection : The process for injecting brine directly into the fish flesh.

3.5 brining : The process of placing fish in brine for a period of sufficient length for the fish tissue to absorb a specific quantity of salt.

3.6 chilling : The process of cooling fish to a temperature approaching that of melting ice.

3.7 clean water : Water from any source where harmful microbiological contamination, substances and/or toxic plankton are not present in such quantities as may affect the health quality of fish and their products.

3.8 cleaning : The removal of soil, food residues, dirt, grease or other objectionable matter.

3.9 contaminant : Any biological or chemical agent, foreign matter, or other substances not intentionally added to food which may compromise food safety or suitability.

3.10 contamination : The introduction or occurrence of a contaminant in fish and their products.

3.11 control measure : Any action and activity that can be used to prevent or eliminate a food safety hazard or reduce it to an acceptable level.

3.12 decomposition : The deterioration of fish and their products including texture breakdown and causing a persistent and distinct objectionable odour or flavour.

3.13 disinfection : The reduction, by means of chemical agents and /or physical methods, the number of micro-organisms in the environment, to a level that does not compromise food safety or suitability.

3.14 dressed : The portion of fish remaining after heading and gutting.

3.15 dry-salting : The process of mixing fish with suitable food grade salt and stacking the fish in such a manner that the resulting brine drains away.

3.16 dun : A discolouration and a development of the mould *Sporendonema epizoum*_ which affect the fish surface and make it look like peppered. The fish flesh is unaffected.

3.17 facility : Any premises where fish and fishery products are prepared, processed, chilled, frozen, packaged or stored. For the purpose of this Code, premises also include vessels.

3.18 fish : Any of the cold-blooded (exothermic) aquatic vertebrates. Amphibians and aquatic reptiles are not included.

3.19 fatty fish : Fish in which the main reserves of fat are in the body tissue and the fat content is more than 2 per cent.

3.20 gibbing : The process of removing the gills, long gut and stomach from fatty fish, such as herring, by inserting a knife or using hands at the gills , the milt or roe and some of the pyloric caeca are left in the fish.

3.21 hazard : A biological, chemical or physical agent in, or condition of, food with the potential to cause an adverse health effect.

3.22 lean fish (white fish) : Fish in which the main reserves of fat are in the liver and less than 2 per cent fat in the body tissue.

3.23 maturing : The process from salting until the fish is salt - matured.

3.24 nobbing : Removing the head and gut from fatty fish, such as herring, in one operation by partially severing, the head and pulling the head away together with attached gut, the roe or milt is left in.

3.25 pickle : Brine which may contain vinegar and spices.

3.26 pickling : The process whereby primary fatty fish is mixed with suitable salt which may contain vinegar and spices and stored in watertight containers under the resultant pickle which forms by solution of salt in the water extracted from the fish tissue. Pickle may be added to the container. Pickled products will always remain in a brine solution.

3.27 pink : A discolouration caused by red halophilic bacteria which damages the fish flesh.

3.28 potable water : Fresh water conforming to SLS 614.

3.29 refrigerated water : Clean water cooled by a suitable refrigeration system.

3.30 salt : A crystalline product consisting predominantly of sodium chloride. It is obtained from the sea, from underground rock salt deposits or from vacuum processed and refined brine.

3.31 salt – matured fish : Salted fish that has an appearance, consistency and flavour characteristic of the final product.

3.32 salted fish /salted fillet : Fish/fillets which have been treated by either brining, brine injection, dry-salting, pickling or wet-salting or a combination of these.

3.33 saturated : The water phase of the fish muscle is saturated with salt (26.4 g salt/100 g water phase).

3.34 shelf – life : The period during which the product maintains its microbiological and chemical safety and sensory qualities at a specific storage temperature. It is based on identified hazards for the product, heat or other preservation treatments, packaging method and other hurdles or inhibiting factors that may be used.

3.35 split fish : Fish that have been cut open from throat or nape to the tail, with gills, guts, roe or milt removed. Head and whole or part of backbone may be left in or removed.

3.36 stacking : Laying fish in piles with salt spread evenly on the surface.

3.37 whole fish : Fish as captured, ungutted.

3.38 wet – salting : The process whereby primary lean fish is mixed with suitable food grade salt and stored in watertight containers under the resultant brine which forms by solution of salt in the water extracted from the fish tissue. Brine may be added to the container. The fish can be removed from the container and stacked so that the brine drains away.

3.39 corrosion-resistant material : Impervious material, which is free from pits, crevices and scale, is non-toxic and unaffected by sea water, salt, ice, fish slime or any other corrosive substance with which it is likely to come into contact. Its surface must be smooth and it must be capable of withstanding exposure to repeated cleaning, including the use of detergents.

4 RAW MATERIAL AND INGREDIENT REQUIREMENTS

4.1 General considerations

4.1.1 *Fish intended for salting should be of good quality* .

The fisherman and the processors should discard any fish that is diseased or highly infested with parasites or is known to contain harmful substances or has undergone deterioration or any process of decomposition or which has been contaminated with foreign matter to an extent which has made it unfit for human consumption.

4.1.2 *Fresh fish intended for salting should receive the same care and attention from the time of capture until they are processed as those intended for marketing fresh.*

The processes and the principles involved in the preparation of fish for salting are for the most part similar to those that would be involved in preparing them for marketing as fresh. Therefore, the recommendation of the SLS 974 and where applicable, the recommendation of the SLS 975 should be used as a guide for the handling and preparation of fish for salting.

4.1.3 *Salt of suitable quality and crystal size should be used.*

See salt requirements in 6.4.2 and Appendix I, The General Principles of fish salting.

SALTING FISH AT SEA

5 FISHING VESSEL FACILITIES AND OPERATING REQUIREMENTS

5.1 Fishing vessel design and construction

5.1.1 *General considerations*

5.1.1.1 Fishing vessels which are engaged in the salting of fish at sea should be designed for rapid and efficient handling 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.

Fishing vessels should be designed and constructed so as not to cause contamination of fish with bilge water, sewage, smoke, fuel, oil, grease or other objectionable substances. Fish, if not salted quickly after capture, should be protected against physical damage, exposure to high temperatures and drying effects of sun and wind.

All surfaces with which the fish might come into contact should be made of suitable corrosion-resistant material which is smooth and easily cleanable.

A vessel that is used for salting fish at sea should be large enough to allow for proper processing and storage of salted fish, and its design, layout, construction and equipment should meet the requirements of shore establishments.

5.1.2 *Construction*

5.1.2.1 Fishing vessels equipped for salting at sea should be so designed as to provide for efficient operation even during heavy catches.

Considerable elasticity of operation may be attained by having adequate storage facilities for the incoming fish.

Fish holds or bins where fish can be kept sufficiently chilled before being processed should be incorporated into the design of the boat. Use of refrigerated sea water or refrigerated brine tanks, either as an integral part of the vessel or as separate installable equipment items, may be of value in some fisheries.

5.1.2.2 Deck pounds or pens, stanchions, dividing boards and holding tanks used in holding freshly caught fish should be constructed of suitable corrosion-resistant material. They should be adequate in number and height to prevent crushing of the catch due to excess weight or to the vessel's motion, and to hold the estimated catch.

In practice, wood is still used in many fisheries for deck pound boards, and steel for stanchions and other fixtures. Where this is the case, the wood should be treated to prevent the entry of moisture and should be coated with a durable, non-toxic light coloured paint or other non-toxic surface coating that is smooth and readily cleanable. Steelwork should be coated with anti-corrosion and non-toxic paint. Whenever possible, suitable corrosion-resistant materials should be used. Attention should be drawn to special materials able to withstand high concentrations of salt.

5.1.2.3 If portable boards are used for making shelves and vertical divisions in the fish room they should be of suitable corrosion-resistant material or impregnated and painted wood.

The use of portable boards, which are a good fit in the stanchions, allows the shelf and dividing structures to be dismantled and removed for cleaning. Wooden boards should be treated to prevent the entry of moisture and should be coated with a durable non-toxic paint or other equally suitable surface coating that is smooth, readily cleanable and reparable. Wherever possible, the shelving and the partitioning boards should be interchangeable in size.

5.1.2.4 Vessel holds or tanks where fish are held before processing or during the curing operation should be adequately insulated with a suitable material. Any pipes, chains or conduits passing through the hold should, if possible, be sunk flush or neatly boxed in and insulated.

Adequate insulation will reduce the amount of heat entering the hold and consequently will permit a longer storage of fresh fish prior to salting or provide more controllable conditions for salt curing.

5.1.2.5 Hold or tank linings should be completely water-tight. The insulation layer should be protected by a lining made of corrosion-resistant metal sheets or any other equally suitable non-toxic material having water- tight joints.

It is most important to prevent water from carrying fish slime, blood, scales and offal to parts of the vessel where effective cleaning is virtually impossible. Water or brine seeping through the fish hold lining will also reduce the efficiency of the insulation. The insulation should be covered with corrosion-resistant metal sheets or any other equally suitable non-toxic, corrosion-resistant material having water-tight joints to ensure protection from such contamination. An effective drainage system should be able to remove liquid waste into a sump as fast as it accumulates.

5.1.2.6 Wooden holding tanks or holds should be lined with a suitable material.

The lining of wooden holding tanks or holds should be similar to that described in **5.1.2.5.** They should be sealed and coated with a suitable impervious and non-toxic material which is easy to keep clean and not difficult to repair. However, if the fish is to be dry-salted on board, it is not necessary to cover wooden parts of the hold with metal especially if the wood is saturated with salt.

5.1.2.7 There should be no sharp corners or projections in the hold or tank as these will make cleaning difficult and may damage the fish.

Contamination with fish slime, blood, scales and guts will build up rapidly on surfaces, in corners or around projections which are not smooth and impervious.

Any edges or projections resulting from the encasement of pipes, wires, chains and conduits that are passing through the fish hold should be so constructed as to minimize any physical damage to the fish and to allow free drainage and ease of cleaning.

5.1.2.8 If cooling grids are fitted in the fish hold they should be properly installed and operated.

Cooling grids are valuable in cooling the fish hold and absorbing heat leaks, especially in tropical waters. To be effective they should be fitted under the deck head and on the ship sides, and once fish has been stowed in the hold, control must be such that the hold temperature does not fall below 0°C (32 ºF). If fish which are dry-salted are exposed to freezing temperatures, especially during the initial curing period, they will freeze and eventually turn sour and rancid. Salting and curing in salt should be done under cool and well controlled temperature conditions.

5.1.2.9 There should always be ample drainage space between the lowest shelves and the floor of the fish hold. This space should be open to a central drain, discharging directly into one or more sumps or wells, located so that the hold can be efficiently drained at all times. Bilge pump connexions to these sumps should be fitted with coarse screen filters.

Proper drainage facilities are required to prevent a build – up of large quantities of liquid waste. If drainage is inadequate, the bottom layers of the fish in the hold will be contaminated by this dirty liquid, especially during any periods of severe motion of

the vessel. Pumps, slush wells, bilges, etc. from the fish room should be completely separate from the engine room bilge system to prevent contamination.

5.1.2.10 Bulkheads should be constructed of smooth, non-absorbent, easily cleanable material.

The fitting of removable type bulkheads increases the versatility of fishing vessels and prevents movement of the stowed fish. They also permit rapid conversion to other types of fish stowage.

5.1.2.11 In all ships using refrigerated sea water or refrigerated brine systems for holding fish, tanks, heat exchangers, pumps and associated piping should be made of, or coated with, suitable corrosion-resistant material. They should be so designed that they can easily be cleaned and disinfected.

With hard, non-porous surfaces such as stainless steel, aluminium alloys or plastics, spoilage micro-organisms, together with all the debris deposited during storage of the fish can be readily removed if the operation is performed immediately, thus reducing the risk of contaminating later catches. It is important to avoid corners, cracks and edges in which filth can lodge.

The whole system should be so designed as to allow an easy introduction and effective circulation of the cleaning and disinfecting solutions. There should be no place where a proper cleaning cannot be carried out.

It is important to remember that with ice storage only part of a load may spoil but with refrigerated sea water or brine, any malfunctioning of the system or neglect on the part of operators can result in the whole catch being rejected for spoilage.

5.1.2.12 Where clean sea water or brine and ice mixtures are used for cooling and temporary storage of the catch, there should be adequate circulation of the liquid.

Effective means of circulating cold liquid round the mass of fish should be provided. If pumping facilities are inadequate some of the load may not be cooled properly, resulting in fish with highly unpleasant odours and flavours.

The holding tanks should be equipped with suction screen arrangements which are strong enough to withstand the pressure exerted by the brine-fish mixture as well as negative pressure (suction) created by the circulating pump. Such screens should be so designed and located as to allow a constant and unobstructed flow of cold brine or sea water.

5.1.2.13 Refrigerated sea water or refrigerated brine tanks should be insulated to minimize heat leakage from their surroundings.

The temperature of the refrigerated sea water will be more uniform throughout the tank and more easily controlled if the heat-leak from other sources is reduced by effective insulation.

5.1.2.14 Refrigeration plant and sea water or brine circulating equipment should be adequate to maintain the temperature constantly low.

There should be a sufficient compressor capacity to prevent a significant rise in temperature of the pre-chilled sea water or brine solution when the holding tanks are being loaded with the freshly caught fish.

Rapid cooling of fish is the primary task of the system. Once the initial cooling of fish is accomplished, the subsequent maintenance of constantly low temperature requires only a fraction of the compressor's load. Thermal inertia of a large body of chilled fish and brine should prevent sudden and significant fluctuations in temperature.

5.1.2.15 Vessels engaged in night fishing should have sufficient deck illumination in the areas where the catch is landed, sorted, iced or processed.

Inadequate lighting reduces efficiency, makes difficult the practice of proper hygienic and quality control procedures and increases the possibility of accidents. Lighting for the deck area is usually provided by mast spreader or boom lights. Care must be exercised that deck lighting does not mask obliterate navigational lights.

5.1.3 ***Hygienic facilities***

5.1.3.1 Areas of the deck where fish are unloaded and handled, or the fish hold where fish are stowed, processed and cured should be maintained in a clean condition.

All such areas should be well defined, be readily capable of being maintained in a clean condition and should be kept clean.

Storage of fuel and other petroleum products, or of different cleaning and sanitizing agents, should be so arranged that there is no possibility of contamination of surfaces with which fish come into contact.

Any exposure, even for a short time, of fish to petroleum products very often results in rejection or eventual destruction of the whole load. Fish contaminated with fuel or other similar compounds have a bad odour and taste which is difficult to remove during the subsequent processing ; such fish should therefore be discarded.

5.1.3.2 An ample supply of cold potable water or clean sea water under adequate pressure should be available at a sufficient number of points throughout the fishing vessel. On large vessels engaged in fish processing a supply of hot water at a minimum temperature of 82 $^{\circ}$C (180 $^{\circ}$F) should also be available.

Only potable water or clean sea water should be used on fish and on surfaces with which fish might come into contact. Even if the fish is caught in polluted waters, as occasionally happens, the water should not be used for washing fish or for the preparation of refrigerated sea water or refrigerated brine.

5.1.3.3 Deck hoses should be supplied with clean sea water, at adequate pressure, by a pump used only for clean sea water.

A good supply of clean sea water, at adequate pressure, should be available for washing fish and for flushing and rinsing of decks, holds, gear and other equipment which comes into contact with the fish.
The intake for sea water should be well forward of and on the opposite side of the vessel from the toilet waste and engine cooling discharge. Sea water should not be pumped while the vessel is in harbour or in areas where there is a danger of it being polluted. Clean sea water should be taken in while the vessel is in forward motion.

The piping for the clean sea water supply should have no cross-connections with the engine or condenser – cooling system. It should be so constructed as to prevent any possibility of back syphonage from the kitchen sink, wash basins or toilets.

5.1.3.4 Ice used in every fishery should be made from potable water or clean sea water and should not be contaminated when manufactured, handled or stored.

Ice made from water which is neither potable water nor clean sea water may contaminate the fish with water-borne micro-organisms or other objectionable or even harmful substances. Such contamination will result in loss of quality, reduced keeping time or might create a definite health hazard.

Some of the larger fishing vessels might have their own ice-making machines. The water used in the ice manufacture should be potable water or clean sea water. The sea water intake for the pump should be located on the opposite side away from the waste discharge and engine cooling outlets of the boat. Sea water for ice manufacture should only be taken from areas known to be relatively unpolluted and without any visible discoloration or suspension.

The ice-making plant should be cleaned regularly and maintained in a clean, hygienic condition at all times.

5.1.3.5 Adequate toilet facilities should be provided and all plumbing and waste disposal lines should be so constructed as not to contaminate the fish.

All the plumbing and waste disposal lines servicing the vessel's toilets, hand wash basins or kitchen sinks should be large enough to carry peak loads, be watertight and preferably should not go through the fish holds where the fish is being handled or stored.

5.1.3.6 On large fishing vessels, engaged in fishing as well as fish processing, suitable washing facilities should be provided.

Such facilities should be located in toilets and close to the fish handling and processing areas. They should be supplied with hot and cold potable water and/or clean sea water, liquid soap and single-use towels. A sufficient number of dispensers as well as receptacles for used towels should be available.

5.1.3.7 The fishing vessels should be equipped with brushes, scrapers, water hoses, spray nozzles and other suitable cleaning, washing and disinfecting equipment.

Although there is a variety of cleaning and disinfecting equipment available in the market, good quality hand brushes of several sizes and shapes are still the most inexpensive and versatile tools for cleaning operations. Brushes should be kept in a clean and sound condition, disinfected after each use (dipping in 50 ppm chlorine solution is recommended) and when not used should be stored in a dry state. Brushes could spread dirt and micro-organisms. Micro-organisms will proliferate in a dirty brush when stored in a wet condition. The use of steel-wool for scouring should be avoided as there is a constant danger of introducing small, sometimes hardly visible, bits of wire into the final product. If for some reason cleaning cannot be done effectively with a god brush, then plastic, brightly coloured scouring pads might be used.
The use of high pressure and high frequency oscillating water or detergent spraying equipment has been found to be quite effective in cleaning, but it usually requires an experienced operator to prevent damage to painted surfaces.

5.1.3.8 Salt and other ingredients used in curing of fish should be stored dry and in a manner to prevent their contamination.

If salt is kept in a moist environment it will absorb moisture readily, become more difficult to handle, it might cake or form a crust, and may result in less uniformly salted fish.

5.1.3.9 If poisonous and harmful materials, including cleaning compounds, disinfecting materials and pesticides are stored on board the vessel they should be kept in a separate compartment reserved and marked specifically for this purpose.

Extreme caution must be exercised to prevent poisonous or harmful materials from contaminating the fish. All such materials should be prominently and distinctly labelled so that there can be no confusion between these and edible materials used aboard the vessel. Compartments in which these poisonous or harmful materials are stored should be kept locked and the materials contained in them should be handled only by personnel trained in their use.

5.2 Equipment and utensils

5.2.1 All fish storage, handling, conveying and processing equipment used on board the vessel should be of suitable corrosion-resistant material designed for the rapid and efficient handling of fish and for easy and thorough cleaning.

All food contact surfaces should be smooth, free from pits, crevices and loose scale, substances harmful to man, unaffected by salt, fish juices or other ingredient used, and capable of withstanding repeated cleaning and disinfection. Wood should be used for cutting surfaces only when no other suitable material is available. Machines and equipment should be so designed that they can be easily dismantled to facilitate thorough cleaning and disinfection.

Containers, vats and barrels used for holding fish should preferably be constructed of plastic or corrosion-resistant metal, and if of wood, they should be treated to prevent the entry of moisture and coated with a durable, non-toxic paint or other surface coating that is smooth and readily washable.

Equipment used in the curing of fish should meet the same requirements as the equipment employed in a plant processing salted fish on shore. (see sub-Clause 6.2)

5.2.2 Conveyors used in the fish hold should be made of corrosion-resistant material and should be easy to dismantle and remove for cleaning purposes.

Fish holds are difficult to clean thoroughly and any board structure or any conveying equipment should be capable of easy removal, so that access can be gained to all areas of the fish hold.

5.2.3 Where sizable quantities of fish are handled on board large fishing vessels, the use of machinery designed to carryout such operations as gutting, washing, splitting or filleting should be considered.

In many fisheries there is a growing need to save manpower but this cannot be accomplished without the introduction of more mechanical aids for working the fishing gear and handling the catch. These two principle tasks have to be performed by the same crew.

Gutting, washing, splitting or filleting, which are usually the most time-consuming operations, could easily be carried out by machines. Such machines have been developed and have been used by some fishermen in various countries.

It is advisable, before large expenditure of capital is made, that such machinery should be tested, bearing in mind that it will be operating under extremely rigorous conditions with limited possibilities for proper maintenance or immediate repair.

5.2.4 Shovels and rakes used in the handling of fish should also be made of a suitable corrosion - resistant material and should be kept clean.

These implements are used frequently in many stages of fish handling or processing and, therefore, should met the same hygienic requirements as other equipment and utensils.

5.3 Hygienic operating requirements

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

The purpose of this washing is to remove all traces of contaminating matter, such as slime, blood, tar, etc. which may cause discoloration and offensive odours in the fish. In most fisheries this cleaning can be carried out while the net is in the water.

It is also important to have the surface of the deck and deck pounds well pre-cooled by hosing them down with cold clean water before the fish is unloaded. During warm weather, the surface temperature of the deck would be very high. It would be bad practice, therefore, to dump the catch on such a deck without any concern for the quality of the fish, especially those from the bottom layer which, in all probability, would remain for a longer time in direct contact with the hot surface of the vessel's deck.

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

Any filth, slime, blood or scales if allowed to dry and accumulate on surfaces with which fish comes into contact, will be very difficult to remove later, and will thus contaminate the subsequent loads of fish.

5.3.3 The fish processing area should be thoroughly washed before commencement of operations.

Fish, because of its highly perishable nature, requires strict adherence to specific hygienic requirements which should become a part of a daily operational routine.

All operations should be carried out in a manner and condition suitable for the handling of food for human consumption and should follow closely the requirements detailed for a plant processing salted fish on shore. (see sub-Clause 6.3)

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

Bilge water containing blood and slime, if not regularly pumped out, will provide a good medium for the multiplication of micro-organisms and give rise to offensive odours in the fish held. The bilge sump should be cleaned and disinfected frequently.

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

The water used for cooling engines is usually of a higher temperature than fresh sea water and might be contaminated with oil or other petroleum products, or contain rust and other by-products of metal corrosion.
Such water, therefore, if use for washing, will accelerate considerably the spoilage of fish by raising their temperature and might impart objectionable taste, odour or undesirable discoloration.

5.3.6 Where gutting benches are installed these should be provided with channels or chutes which have a continuous supply of clean sea water to carry the guts over the shipside or to a suitable collecting container.

Where fish are contaminated by offal and filth from the gutting operations, the spoilage rate will be increased and all surfaces with which the guts come into contact

will also become contaminated. The installation of gutting benches makes the task easier, but care should be taken to ensure that the benches are kept in a hygienic condition.

In disposing of offal in to the surrounding water, some consideration should be given to the possibility of a serious pollution problem, especially if this is done in sheltered waters, close to public beaches or inhabited.

5.3.7 Immediately after the catch is unloaded, the deck and all deck equipment should be hosed down, brushed, thoroughly cleaned with a suitable cleaning agent, disinfected and rinsed.

It is important that thorough cleaning should always precede disinfection especially when chlorine is used as the disinfecting agent. Any organic matter, if not removed from the surfaces that are to be disinfected, will rapidly combine with and neutralize the disinfective effectiveness of chlorine or any other disinfectant.

5.3.8 At the end of each trip any unused ice should be discarded and removed from the vessel.

Despite all precautions, unused ice in the hold will become contaminated and will contaminate the new catch. When vessels are taking ice to sea, only fresh clean ice should be taken on board at the beginning of each voyage.

5.3.9 When cleaning and hosing operations are carried out while the vessel is in port, potable water or clean sea water should be used.

Cleaning water should be free from contamination in amounts harmful to humans. The total number of micro-organisms in it should be low, and it should not to contain any micro-organisms of public health significance. Contamination of the fish by water – borne micro-organisms and other undesirable substances will result in loss of quality and might create a health hazard. Harbour water is usually heavily polluted, and should never be used for cleaning purposes. This is also true for water in the close vicinity of towns, villages, industrial plants, fish processing establishments and factory ships.

5.3.10 Cleaning, washing and disinfecting procedures should be effective.

Cleaning agents and disinfectants should conform to the requirements of the official agency having jurisdiction and should not be allowed to come into contact with fish. Any residue of cleaning agents used for washing of boats and the equipment should be removed by thorough rinsing with potable water or clean sea water before the area or equipment is used again for stowing or handling fish.

In choosing and applying different cleaning agents and disinfectants, one should be fully aware of their properties and limitations. Many agents are effective only when prepared and used in strict accordance with the manufacturer’s recommendations.

Temperature of the solution, its acidity or alkalinity, concentration of the active ingredient, presence of other chemicals, kind of surface to be treated or type of soil (dirt) and mode of application, are some of the factors that will determine the

usefulness of the agent. Different agents should not be combined since one agent may neutralize the activity of another.

5.3.11 Empty vessel holds or fish storage tanks should be ventilated.

Strong odours associated with mildew, stagnant humid air and decomposing organic matter will develop in the absence of ventilation. All the containers, pails, boxes and tubs, after cleaning, washing and disinfecting, should be stacked in such a way as to permit sufficient aeration.

5.3.12 At the end of each trip the used residual salt should be discarded.

Re-use of contaminated salt may adversely affect the quality of salted fish and give rise to the occurrence of "pink" and "dun" conditions (see sub-Clause **6.4.2.4**).

5.3.13 In vessels using refrigerated sea water or refrigerated brine systems for the preservation of the catch, all tanks, pumps, heat exchangers and other associated equipment should be cleaned immediately after discharging the catch. Potable water or clean sea water containing a suitable cleaning agent should be circulated through all parts of the system. Tanks should be inspected carefully and cleaned out by brushing, if necessary.

Since anaerobic micro-organisms are particularly active under tank storage conditions, a very high standard of hygiene is required to avoid their build – up and the spread of infection from one tank to another.

Immediately after unloading, when surfaces are still wet, the holding tanks should be washed with cold potable water or cold clean sea water under adequate pressure, then scrubbed with a brush using an alkaline detergent solution, then followed by a rinse with warm and cold potable water or clean sea water.

All pumps, pipes and heat exchangers should be thoroughly flushed with cold potable water or cold clean sea water, then followed by circulating through the system either a hot alkaline solution or cold potable water or cold clean sea water to which a strong cleaning agent has been added. After rinsing with potable water or cold clean sea water, a suitable disinfectant should be circulated through the system. It has been regarded by many fishermen as good practice to leave a weak solution of a non-corrosive disinfectant in the system. This of course must be drained and rinsed out thoroughly with potable water or clean sea water before filling the tanks.

5.3.14 Where refrigerated sea 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.

Use of sea water contaminated with sewage or industrial discharges will affect the quality of the catch or render it unfit for human consumption. It is advisable for fishermen to check with the local authorities which areas are likely to be free of pollution. The intake for the vessel's sea water pump should be located on the opposite side away from sewage, waste discharge and engine cooling water outlets of the boat. Clean sea water should be taken in while the vessel is in forward motion.

5.3.15 Adequate precautions should be taken to ensure that human and other wastes from fishing vessel are disposed of in such a manner as not to constitute a public health and hygienic hazard.

With man's increased concern for the protection of his environment, in some countries the disposal of any waste from any boat into the surrounding water is restricted by law.

Fishermen should be fully aware of their responsibilities in this regard. Discharge of animal, human or any other wastes from the fishing vessel into the sheltered waters close to man-inhabited areas, or over shellfish growing areas should not be practised.

5.3.16 Effective measures should be taken to protect the fishing vessel against insects, rodents, birds or other vermin.

Rodents, birds and insects are potential carriers of many diseases which could be transmitted to man by contamination of fish. Fishing vessels should be regularly examined for evidence of infestation and, when required, effective control measures should be taken.

All rodenticides, fumigants, insecticides and other harmful substances should be used only in accordance with the recommendations of the appropriate official agency having jurisdiction.

5.3.17 Dogs, cats and other animals should be excluded from areas of the vessel where fish is received, handled, processed and stored.

Because of public health hazards and of aesthetic reasons, no surface of the fishing vessel and of the equipment thereon which comes into contact with fish should be exposed to contamination with animal hair or excreta.

5.3.18 Vessels moored to docks for more than two hours should, where necessary, have rodent guard devices attached to each mooring line.

Round, conical-shaped metal devices on mooring lines are effective in preventing the passage of rodents from the shore to the vessel.

The use of these devices is strongly recommended during night-time operations due to the nocturnal nature of rodents.

Also the end of the gangway and an area of approximately one square metre where the gangway rests upon the dock, should be painted white. This is effective in preventing rodents from entering the gangway at night.

5.3.19 Food supplies for the vessel's kitchen or for the crew's mess should never be stored in ice bins where fish are kept.

Storing such materials in ice intended for fish might contaminate the ice and the fish.

5.4 Operating practices and production requirements

5.4.1 *Handling the catch on board*

5.4.1.1 Handling the catch should begin as soon as it comes on board. Any fish unsuitable for human consumption should be removed from the catch and kept separate.

Sorting the catch should be done as soon as the fish are taken on board to remove as quickly as possible fish unsuitable for market and/or human consumption because of too small size, spoilage, damage, parasitization, poisonous nature or other reasons. Mixed species catches should also be sorted rapidly not only for the reason stated above but also to avoid damage due to abrasion, particularly where the catch contains spiny and rough skin species and to prevent transferring undesirable odours and tastes which may affect the organoleptic quality of the differing species.

5.4.1.2 When species unsuitable for human consumption are to be kept, these should always be sorted from the edible catch and kept separate at all times.

If fish unsuitable for human consumption are brought back to port as, for example, for fish meal manufacture, care should be taken to avoid contamination of the edible catch.

5.4.1.3 Fish should not be trampled or stood upon, and should not be piled deeply on deck.

Any physical damage, whether by crushing, bruising, rubbing or scraping assists spoilage and reduces the value of the fish for subsequent food processing purposes.

5.4.1.4 All fish on deck should be protected from sun, frost and the drying effects of wind.

It is essential to prevent the fish temperatures from rising. Each degree of rise in temperature increases the rate of spoilage. If the catch is to be on deck for any length of time, it should be protected by an awning, ice or even a wet, clean canvas or burlap. Drying will lower market value by spoiling the appearance and possibly inducing rancidity. Slow freezing of the catch on deck, in areas where very low temperatures are encountered, should also be avoided.
If the vessel is undecked, then a clean container, preferably insulated and lidded, should be provided for the protection of the catch.

5.4.1.5 When fish are to be bled, this should be done immediately after the fish are landed on deck.

Bleeding is usually quicker and more effective when carried out at a relatively low temperature or when the fish are still alive.

It is good practice with some fish to bleed them prior to gutting by cutting their throats or other means. On the other hand, in some fisheries, the fish are bled by

gutting. In the latter case, the fish may bleed better if they are freshly caught. In order to bring the fish on board alive the fishermen should take short hauls.

If the bleeding and gutting is done on dead or "spent" fish, the fillets out from such fish will have some discoloration.

5.4.1.6 Gutting, if required, should commence as soon as the catch comes on deck and should be done with care.

The reasons for prompt gutting are firstly, to sever some of the main blood vessels allowing the fish to bleed and, secondly, of remove the stomach and gut which would otherwise cause a softening of the flesh and accelerate spoilage. Fish in which the guts are full of food will spoil even more rapidly. Although immediate gutting is desirable with most species, the catch in certain fisheries cannot be handled rapidly enough, and advantages gained by gutting may be offset by quality loss resulting from rises in fish temperature. In such circumstances it would be preferable to get the fish under cover and chilled quickly, rather than delay the chilling operation by gutting. Removal of heads and/or gills is desirable under certain circumstances.

5.4.1.7 Fish guts should not be allowed to contaminate other fish on deck.

Fish guts contain digestive enzymes and spoilage micro-organism. If allowed to foul the rest of the catch, the spoilage rate will be increased. This contamination can be prevented by dropping guts into suitable water-tight containers or chutes discharging over the shipside.

With bigger boats, handling larger quantities of fish, the resulting offal could easily be processed into fish meal. Such machines have been developed for installation on board fishing vessels and are commercially available.

5.4.1.8 Immediately after gutting, some cures require that fish should be washed with cold clean sea water or potable water.

Depending on the product, gutted fish, before being salted, should be thoroughly washed with cold clean sea water or potable water to remove all blood, slime and pieces of gut. Fish blood coagulates rapidly and washing will facilitate more complete bleeding, which in turn will improve the appearance of the product. If tanks are used for washing gutted fish, a continual flow of potable water or clean sea water should be provided to prevent the accumulation of contaminating materials.

The practice, common in some inshore fisheries, to gut and wash the fish close to land involves the risk of using polluted sea water, and should , therefore, be discouraged. Harbour water, which is always polluted in some way, should never be used for washing fish.

5.4.1.9 On completion of washing the fish, further handling should be carried out without delay.

At higher temperatures a delay of one hour can have a serious effect on the quality of the final product.

5.4.1.10 Processing and handling of fish prior to and during the salt curing operation should follow the procedures outlined for the plant processing salted fish on shore.

Salting of fish on board fishing vessels is usually done for the purpose of preservation and, therefore, should be regarded as an initial phase of the salt curing process. Nevertheless, the fishermen should follow strictly all technological and hygienic requirements of the inshore processing establishment. (see sub-Clause 6.4)

5.4.1.11 In some fisheries certain species of small fish should be salted immediately after capture.

If fish of a small size (anchovies) are to be landed within 48 hours after capture, a light salting of 5 to 10 per cent by weight of salt homogeneously mixed with the fish is preferable to icing.

5.4.1.12 When fish is dry-salted in bulk on board a vessel, the pile should be checked after some days to ensure that curing conditions are uniform.

Dry – salting in bulk on board the vessel involves a very large quantity of fish piled for long periods before unloading. Since the quality of the salted product depends on the way the fish is salted, it is useful to ensure that the salt is present in the right amount and that it is uniformly distributed.

Further, the pile should be properly arranged. In the case of salted cod, the fish are cleaned, split then piled transversely from side to side (or longitudinal partition) in the fish hold. The fish are layered successively on their backs with napes and tails alternating with the exception of the top layer which is turned flesh side down ; this arrangement ensures adequate drainage (see sub-Clause 6.4.5.1). An extra heavy portion of salt is put on where the fish comes into contact with partitions or the sides of the vessel and precautions are taken to ensure the resulting brine is removed.

5.4.2 ***Unloading the catch***

5.4.2.1 Unloading the catch should be carried out in a careful manner and without delay.

In most fisheries the catch is landed after being separated from the ice in the fish room. Any undue delay at this stage allows the fish temperature on rise, thus increasing the rate of spoilage. For this reason, the landing of boxed iced fish is to be recommended.

There are fish landing installations where the catch could be unloaded from a vessel to a dock – side conveyor within a relatively short time. Such a conveyor will provide for cursory inspection of the catch, and will de-ice the fish, spray –wash it and convey the load through the automatic weight recording scale or individual fish counter device.

Such installations should be constructed of suitable corrosion-resistant material and so designed as not to contaminate or damage the fish or to cause its temperature to rise.

A large amount of cold potable water or cold clean sea water would be required for de-icing and washing of fish.

5.4.2.2 Mixing of different days' catches during unloading should be avoided.

Batches of fish, of mixed quality, may often fetch a lower price on the market. Poorer quality fish will soon contaminate any of higher quality if they are mixed together. A good stowage plan, showing the position of each day's catch in the hold, may avoid mixing.

5.4.2.3 Fish should not be damaged during unloading.

The use of hooks, shovels, forks and other such implements for unloading the catch should be avoided, in order that the fish suffer no damage. Where these implements are used they should be handled with great care. Tearing of the flesh reduces the value of the fish and accelerates spoilage.

5.4.2.4 Mechanical unloading equipment should be used where possible.

Properly designed systems employing mechanical conveyors, fish pumps or other such equipment can increase the unloading rate and cause less damage than the traditional manual methods. With faster unloading, the time that the fish are exposed to the outside environment may be decreased, thus delaying spoilage. Some effective fish pumps are available for large and small fish and should only be used with potable water or clean sea water. They are not yet suitable for handling all species.

5.4.2.5 Bulk or shelf stowed catch should be unloaded into clean containers and immediately placed in a suitable covered area. While lying in this area the catch should be maintained in a chilled condition.

No fish should be allowed to lie on floors or other unclean surfaces and they should not be exposed to direct sunlight. The use of clean containers and a sufficient quantity of ice will increase keeping time.

5.4.2.6 Care should be taken that fish are not damaged or contaminated during sorting, weighing and transfer to containers.

Physical damage can increase spoilage rate and badly torn fish are useless for processing purposes.

5.4.2.7 When refrigerated brine or sea water boats are unloaded by means of pumps and siphons the compensating or so-called "makeup" water should be of the same temperature and hygienic quality as the original brine.

The unloading of the refrigerated sea water boats could be accomplished either by bailing or by the use of fish pumps or siphons.

If a pump or a siphon is used, a fair amount of refrigerated sea water, as the conveying medium for the fish, will be lost at the outlet end of the system.

To retain the necessary level and volume of water in order to complete the unloading, additional ("makeup") water from an outside source should be added to the system.

Only cold, clean sea water or brine, or potable water should be used to compensate for the loss of the original brine unless a method of recovering the original brine at the fish discharging end of the system and introducing it back into the circulation could be devised.

5.5 Hygiene control programme

5.5.1 It is desirable that each fishing vessel should develop its own hygiene control programme by involving the whole crew and by assigning 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 the hazards involved.

SALTING FISH ON SHORE

6 PLANT FACILITIES AND OPERATING REQUIREMENTS

6.1 Plant construction and layout

6.1.1 *General considerations*

6.1.1.1 Salt fish processing plants should be specially designed for the purpose.

Raw fish spoils considerably faster than raw meat of warm blooded animals. The keeping time of fish delivered to the processing plant has been already reduced by time and conditions of handling and storage on the fishing vessel. Nothing can be done by the processing to improve the quality of fish delivered.

Because of this highly perishable nature of fish the processing plant demands special facilities and materials which, as compared to other food processing establishments, are in some cases rather unique. The use of salt requires particular attention to the materials of construction.

The technological and hygienic operating and production requirements also differ in being often more demanding and critical.

6.1.2 *Plant construction and sanitary design*

6.1.2.1 The plant and surrounding area should be such as can be kept reasonably free from objectionable odours, smoke, dust or other contamination. The buildings 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 the entrance and harbouring of insects, birds or other vermin and to permit ready and adequate cleaning.

The location of a salt fish processing establishment, its design, layout, construction and equipment should be planned in detail with considerable emphasis on the hygienic aspect, sanitary facilities and quality control.

Prior to construction of a new plant or modification of the existing one, a proper flow pattern of operation should be considered. Only a well-organized workflow could ensure the maximum efficiency of operation and the better quality product.

The food handling area should be completely separate from any part of the premises used as living quarters.

6.1.2.2 Floors should be hard surfaced, non-absorbent and adequately drained.

Floors should be constructed of durable, waterproof, non-toxic, non-absorbent material which is easy to clean and disinfect. They should be non-slip and without crevices and should slope evenly and sufficiently for liquids to drain off to trapped outlets fitted with a removable grill.

If floors are ribbed or grooved to facilitate traction, any grooving of this nature should always run toward the drainage channel.

The junctions between the floors and walls should be impervious to water and should be coved or rounded for ease of cleaning.

Concrete, if not properly finished, is porous and can be affected by animal oils, strong brines, various detergents and disinfectants. If used, it should be dense, of a good quality and with a well finished waterproof surface.

6.1.2.3 Drains should be of an adequate size, suitable type , equipped with traps and with removable gratings to permit cleaning.

Suitable and adequate drainage facilities are essential for removal of liquid or semi-liquid wastes from the plant. There should not be any floor area where water might collect in stagnant pools. Drains should be constructed of smooth and impervious material and should be designed to cope with the maximum flow of liquid without any overflowing and flooding. Each drainage inlet should be provide with a deep seal trap which is appropriately located and easy to clean.

Drainage lines carrying waste effluent except for open drains, should be properly vented, have a minimum internal diameter of 10 cm (4 inches) and, if required, run to a catch basin for removal of solid waste material. Such a basin should be located outside the processing area and should be constructed of waterproof concrete or other similar material, designed to the local specifications and should meet the requirements of the official agency having jurisdiction.

6.1.2.4 Internal walls should be smooth, light coloured and readily cleanable.

Acceptable materials for finishing walls inside are cement render, salt resistant metallic sheeting or wood.

All sheeting joints should be sealed with a mastic or other compound resistant to salt and hot water. In case wood is used this should be protected against penetration of water.

Wall – to –wall and wall-to-floor junctions should be coved or rounded to facilitate cleaning.

Walls should be free from projections and all pipes and cables should be sunk flush with the wall surface or neatly boxed in and sealed to the wall or neatly boxed in and mounted at least 10 cm(4 inches) from the wall to allow for adequate cleaning and prevention of insect harbourage.

6.1.2.5 Window sills should be kept to a minimum size, be sloped inward at least 45^0 and be at least 1 metre (3 FT) from the floor.

Window sills and frames should be made of a smooth, water-proof material and, if of wood, should be kept well-painted. Internal window sills should be sloped to prevent storage of miscellaneous materials or accumulation of dust and should be constructed to facilitate cleaning.

Windows should be filled with whole panes and those which open should be screened. The screens should be made so as to be easily removable for cleaning and should be made from suitable corrosion-resistant material.

6.1.2.6 All doors through which fish or their products are moved should be sufficiently wide, well constructed of a suitable material and should be of a self-closing type.

Doors through which fish or their products are moved should be either covered with or made of a corrosion- resistant metal or other suitable material with adequate impact resistance and, unless provided with an effective air screen, should be of a self –closing type.

Doors and the frames of the doorways should have a smooth and readily cleanable surface.

Doors through which the product is not moved, such as those providing staff access, should be appropriately surfaced, at least on the processing area side, to allow for ease of cleaning.

6.1.2.7 Ceilings should be so designed, constructed and finished as to prevent accumulation of dirt and minimize condensation, mould development and flaking, and should be easy to clean.

Ceilings should preferably be 3 m (10 ft) in height, free from cracks and open joints and should be of a smooth, waterproof, light coloured finish.

In buildings where beams, trusses, pipes or other structural elements are exposed, the fitting of a suspended ceiling just below is desirable.

Where the roof beams and trusses cannot be covered, the underside of the roof may constitute a satisfactory ceiling providing all joints are sealed and the supporting structures are of a smooth, well painted and light coloured surface, easily cleanable and constructed to protect the fish products from falling debris and dust.

6.1.2.8 Premises should be well ventilated to prevent excessive heat, condensation and contamination with obnoxious, odours, dust , vapour or smoke.

Special attention should be given to the venting of areas and equipment producing excessive heat, steam, obnoxious fumes, vapours or contaminating aerosols. The air-flow in the premises should be from the more hygienic areas to the less hygienic areas. Good ventilation is important to prevent condensation and growth of moulds in overhead structures. Ventilation openings should be screened and, if required, equipped with proper air filters. Windows which open for ventilation proposes should be screened. The screens should be made easily removable for cleaning and should be made from suitable corrosion-resistant material.

6.1.2.9 A minimum illumination of 220 LUX in general working areas and not less than 540 LUX at points requiring close examination of the product should be provided and should not alter colours.

Light bulbs and fixtures suspended over the working areas where fish is handled in any step of preparation, should be of the safety type or otherwise protected to prevent food contamination in case of breakage.

It is highly desirable to have the light fixture either recessed flush with the ceiling or with the upper surface of the light fixture fitting flush with the ceiling in order to prevent the accumulation of dust on them.

6.1.3 ***Hygienic facilities***

6.1.3.1 Areas where fish are received or stored prior to salting should be so separated from areas in which final product preparation or packaging is conducted as to prevent contamination of the finished product.

Separate rooms or well defined areas of adequate size should be provided for receiving and storing raw materials and for operations like heading and gutting fish, washing, salting, drying or other processing and packaging.

Manufacture or handling of products intended for human consumption should be entirely separate and distinct from the areas used for inedible materials.

The food handling area should be completely separated from any part of the premises used as living quarters.

Receiving and storage areas should be clean and readily capable of being maintained in a clean condition and should provide protection for the raw fish from deterioration and contamination.

6.1.3.2 A separate refuse room or other equally adequate offal storage facilities should be provided on the premises.

If offal or other refuse is to be collected and held before removal, adequate precautions should be taken to protect it against rodents, birds, insects and exposure to warm temperatures.

A separate refuse room for storing waste in watertight containers or offal bins should be provided. The walls, floor and ceiling of such a storage room, and the area under the elevated bins should be constructed of impervious material which can be readily cleaned.

Where waste material is held in containers outside the establishment, the containers should be lidded. A separate enclosure should be provided for their storage with easy access for vehicles loading and unloading. Stands for the containers should be of solid, hard and impervious material which can be easily cleaned and properly drained. If containers are used in large numbers, a mechanical washing plant might be advisable to provide for routine washing . Containers should be capable of withstanding repeated exposure to normal cleaning processes.

Refuse rooms or other offal storage facilities should be cleaned and disinfected regularly.

6.1.3.3 Any by –product plant should be entirely separate from the plant which is processing salt fish for human consumption.

The processing of by-products or non-fish products not fit for human consumption should be conducted in separate buildings or in areas which are physically separated in such a way that there is no possibility for contamination of fish or fish products.

6.1.3.4 An ample supply of cold and hot potable water and/or clean sea water under adequate pressure should be available at numerous points throughout the premises at all times during the working hours.

All water available for use in those parts of establishments where fish is received, held, processed, packaged and stored should be potable water or clean sea water and should be supplied at a pressure of not less than 1.4 kg/cm^2 (20 lb/in^2).

An adequate supply of hot water of potable quality should be available at all times during working hours.

Facilities should be provided so that at all times when required during working hours an adequate supply of hot water of potable quality at a minimum temperature of 65 ^oC should be available. Further provisions should be made to reduce the temperature of the water supply for other purposes such as hand washing.

The cold water supply used for cleaning purposes should be fitted with an inline chlorination system allowing the residual chlorine content of the water to be varied in order to reduce the number of micro-organisms and prevent the build-up of fish odours.

Water used for washing or conveying raw materials should not be re-circulated unless it is restored to a level of potable quality.

6.1.3.5 When in –plant chlorination of water is used, the residual content of free chlorine should be maintained at no more than the minimum effective level for the use intended.

Chlorination systems should not be relied upon to solve all hygienic problems. The indiscriminated use of chlorine cannot compensate for unhygienic conditions in a processing plant.

6.1.3.6 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.

Ice used in the operation of the salted fish processing establishment should be made from potable water or clean sea water.

A special room, or other suitable storage facilities should be provided to protect the ice from contamination and excessive melting. Dust, flakes of paint, bits of wood or sawdust, straw and rust, are the most frequent contaminants transferable by ice onto the final product. Food traffic should be kept to a minimum.

Care must be taken to ensure that ice used to chill the fish or fish products does not contaminate them.

6.1.3.7 Where a non-potable auxiliary water supply is used, the water should be stored in separate tanks, carried in separate lines, identified by contrasting colours, labelled and have no cross-connections or back siphonage with lines carrying potable water or clean sea water.

Non –potable water may be used for such purposes as producing steam, cooling heat exchangers and fire protection.

It is very important that the systems of storage and distribution of potable and non-potable water are entirely separate and there is no possibility for cross-connection or for inadvertent usage of non-potable water in the fish processing areas. Only potable quality water should be used for the supply of hot water.

6.1.3.8 All plumbing and waste disposal lines, including sewer systems, should be large enough to carry peak loads and should be properly constructed.

All lines should be watertight and have adequate deep seal traps and vents. Disposal of waste should be effected in such a manner as not to permit contamination of potable water or clean sea water supplies.

Sumps or solid matter traps of the drainage system should preferably be located outside the processing area and so designed as to allow them to be emptied and thoroughly cleaned at the end of each working day or more often as needed.

When waste systems are installed overhead in processing rooms to service upper floors, the installation and location of these systems should be such as to preclude any chance of contaminating processing lines.

6.1.3.9 Proper facilities for washing and disinfection of equipment should be provided.

Facilities should be present in every salt fish processing establishment for cleaning and disinfection of trays, removable cutting or filleting boards, containers and other similar equipment and working implements. 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 under good pressure, and where there is proper drainage. Containers and equipment used for offal or contaminated materials should be washed in a separate area than that used for products intended for human consumption.

6.1.3.10 Adequate and conveniently located toilet facilities should be provided.

Adequate, suitable and conveniently located changing facilities and toilets should be provided in all establishments. Toilets should be so designed as to ensure hygienic removal of waste matter. These areas should be well lit, ventilated and where appropriate heated and should not open directly on to food handling areas. Hand washing facilities with warm or hot and cold potable water, or clean sea water, a suitable hand-cleaning preparation, and with suitable hygienic means of drying hands, should be provided adjacent to toilets and in such a position that the employee must pass them when returning to the processing area. Where hot and cold water are available mixing taps should be provided. Where paper towels are used, a sufficient number of dispensers and receptacles should be provided near to each washing facility. Taps of a non-hand operable type are desirable. Notices should be posted directing personnel to wash their hands after using the toilet.

Toilet rooms should have walls and ceilings of a smooth, washable, light coloured surface and floors constructed of impervious and readily cleanable material. The doors leading to the facilities should be of a self-closing type and should not open directly into the fish processing area.

The following formula could be used in assessing the adequacy of toilet facilities in relation to the number of employees :

1	to	9	employees -	1 toilet
10	to	24	employees -	2 toilets
25	to	49	employees -	3 toilets
50	to	100	employees -	5 toilets

for every 30 employees over 100 - 1 toilet

NOTE : *Urinals may be substituted for toilets, but only to the extent of one-third of the total toilets required.*

6.1.3.11 Facilities should be available in the processing areas for employees to wash and dry their hands and, if required, for disinfection of protective hand coverings.

Adequate and conveniently located facilities for hand washing and drying should be provided wherever the process demands. Where appropriate, facilities for hand disinfection should also be provided. Warm or hot and cold potable water or clean sea water and a suitable hand-cleaning preparation should be provided. Where hot and cold water are available mixing taps should be provided. There should be suitable hygienic means of drying hands. Where paper towels are used, a sufficient number of dispensers and receptacles should be provided adjacent to each washing facility. Taps of a non-hand operable type are desirable. The facilities should be furnished with properly trapped waste pipes leading to drains.

6.1.3.12 Staff amenities consisting of lunchrooms and 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 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.

6.1.3.13 Salt and other ingredients used in the curing of fish should be stored dry and in a manner to prevent their contamination.

If salt is kept in a moist environment the moisture absorbed tends to bring about a modification in the crystallization of the salt. The crystals form a crust on the surface of the piles of salt which may sometimes cake, forming a solid mass that becomes difficult to handle and therefore may result in less uniformly salted fish.

6.1.3.14 Storage facilities should be available for the proper dry storage of packaging materials.

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.

6.1.3.15 If poisonous or harmful materials, including cleaning compounds, disinfectants and pesticides are stored, they should be kept in a separate room designed and marked specifically for this purpose.

All such materials 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.

6.2 Equipment, utensils and working surfaces

6.2.1 All Working surfaces, equipment and utensils used in food handling areas and which may contact food should be made of material which does not transmit

toxic substances, odours or tastes, is non-absorbent, is resistant to corrosion and is capable of withstanding repeated cleaning and disinfection. Surfaces should be smooth and free from pits and crevices. The use of wood and other materials which cannot be adequately cleaned and disinfected should be avoided except when their use would clearly not be a source of contamination. The use of different materials in such a way that contact corrosion can occur should be avoided.

Contamination of fish during processing can be caused by contact with unsatisfactory surfaces. All food contact surfaces should be smooth, free from pits, crevices and loose scale, substances harmful to human, unaffected by salt, fish juices or other ingredients used, and capable of withstanding repeated cleaning and disinfection. Wood should be used for cutting surfaces only when no other suitable material is available. Machines and equipment should be so designed that they can be easily dismantled to facilitate thorough cleaning and disinfection.

Containers, vats and barrels, used for holding fish should preferably be constructed of washable plastic or corrosion-resistant metal, and if of wood, they should be treated to prevent the entry of moisture and coated with a durable, non-toxic paint or other surface coating that is smooth and readily washable . Any container, the surface of which is pitted, corroded, scaled or has peeling paint should not be used for holding fish. Wicker baskets should not be used.

Fish washing tanks should be designed to provide a constant change of water with good circulation, and have provisions for drainage and to be easily cleaned.

Stationary equipment should be installed in such a manner as will permit easy access and thorough cleaning and disinfection.

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.

6.2.2 Boards and other surfaces on which fish are cut should be made of impervious materials which meet the physical requirements for cutting surfaces.

The fibrous nature of wood, as well as any cracks and crevices which may develop during use, serve as pockets in which bacteria may accumulate and multiply. Removal of micro-organisms from such pockets by ordinary cleaning methods is extremely difficult. Such surfaces might quickly give rise to unpleasant odours and could be a major source of microbial contamination of the product coming into contact with the surface.

If in the absence of other materials, wood has to be used, a single board of a well finished and smooth surface is recommended. Once the surface becomes badly worn or pitted then the board should be reconditioned or discarded.

The use of plywood or other boards of laminated structure should be discouraged.

6.2.3 Brining and salting vats should be made of suitable corrosion-resistant material and should be so constructed as to permit easy cleaning and complete drainage.

Such vats or containers could become a serious source of contamination by micro-organisms, rust, dirt and miscellaneous detritus if not made of suitable material or if not kept clean.

6.2.4 If machines are used for gutting, splitting, filleting, washing or other similar operations, they should be properly designed.

Where large quantities of fish are processed properly designed machines will simplify production. This is mainly because well designed machines have impervious and corrosion-resistant working surfaces are easy to dismantle, clean, disinfect and are capable of handling the fish with a minimum of delay and normally yield a more uniform product.

It is essential that the installation of new machinery should be well researched, and economically justified. The units should be rigorously tested before being put into commercial use; otherwise costly failures may arise.

6.2.5 Equipment used for dipping or spraying should be made of impervious corrosion resistant material and should be easy to clean. Dip tanks should be emptied, thoroughly cleaned and disinfected between each cycle of use.

Where it is desired and permitted to use antioxidant or insecticide or other dips, the dangers of contamination must be fully appreciated. Numbers of microbes will increase rapidly during use, and this requires that the tanks be frequently and thoroughly cleaned and refilled with new solutions. The use of sprays instead of dips has been found by many operators to be a more efficient method.

6.3 Hygienic operating requirements

6.3.1 General sanitation in an establishment where salt fish is processed for human consumption should be similar to that suggested for other fish processing establishments.

Fish, because of its highly perishable nature, requires strict adherence to specific hygienic requirements which should become a part of a daily operational routine of the plant. (see SLS 974)

All operations should be carried out in a manner and condition suitable for the handling of food for human consumption. (see SLS 143)

6.3.2 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 into contact with fish should be hosed down with cold potable water or clean sea water as frequently as necessary to ensure cleanliness. It is important that the cleaning methods used will remove all residues and the disinfecting

methods will reduce the microbial population of the surface being cleaned. A preliminary rinse in potable cold water or clean sea water, followed by a wash in water of a sufficient temperature providing for effective cleaning is recommended. An ample supply of potable water or clean sea water at adequate pressure is the first requirement and cleaning will be much easier if done immediately and the surfaces are not allowed to dry.

The use of cold or hot potable water or clean sea water alone is generally not sufficient to accomplish the required result. It is desirable, if not essential, that aids such as suitable cleaning and disinfecting agents together with manual or mechanical scrubbing, wherever appropriate, be used to assist in achieving the desired objective. After the application of cleaning and disinfecting agents the surfaces which come into contact with fish should be rinsed thoroughly with potable water or 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 of the official agency having jurisdiction.

6.3.3 Utensils and food-contact surfaces of equipment should be protected from contamination.

Cleaned and disinfected portable equipment and utensils should be stored above the floor in a clean, dry location. Suitable space and facilities should be provided for such storage so that food-contact surfaces are protected from splash, dust, and other contamination.
The same requirements should be also apply to the exposed food-contact surfaces of the fixed equipment.

Utensils should be air dried before being stored or should be stored in a self-draining position on hooks or racks constructed of corrosion-resistant material. When the storage in protective liquids or other solutions is practised, the equipment and utensils so stored should subsequently be washed, disinfected and rinsed prior to re-use. Wherever practicable, stored containers and utensils should be covered or inverted.

6.3.4 Splitting and cutting boards should be frequently and thoroughly scrubbed and treated with disinfectant. Wherever practicable the boards should be periodically washed in running potable water or clean sea water.

It is recognized that the amount of microbial contamination on cut fish is related to the amount of microbial contamination of the working surfaces. Clean surfaces become contaminated as soon as they are used, and consequently each fish that is cut, after the first one, increases the surface contamination. Cutting surfaces should, therefore, be cleaned during rest or meal breaks and before resumption of production following other work stoppages. If they are not thoroughly scrubbed and disinfected, at least at the end of each working day, there may be a serious day-to-day carry-over of microbial contamination.

6.3.5 If barrels or other containers are used on the cutting 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 no splashback on the processing line.

If individual offal containers are used close to a processing line instead of the flumes or chutes connected to a common line, they should be located in such a way that there is no possibility of splashback. If the containers are not being used then they should be lidded. In general, much could be gained in efficiency and cleanliness of an operation if flumes or other equally effective methods are employed for the disposal of fish offal.

6.3.6 All machines used for cutting, splitting, washing filleting or other processing equipment used in similar operations should be thoroughly cleaned, disinfected and rinsed during rest or meal breaks and before resumption of production following other work stoppages.

The use of machinery reduces the risk of contamination from human source. If, however, these machines are not properly maintained and regularly cleaned, they can become a serious source of contamination.

6.3.7 Removal of solid, semi-solid or liquid wastes from fish unloading, holding and processing areas should be on a continuous or near 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 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 and offer harbourage or breeding places for rodents, insects or other vermin.

Containers, flumes, conveyors, bins or storage bays used for removal, collection or storage of fish offal and other waste should be cleaned frequently with potable water or clean sea water containing an appropriate amount of free chlorine or other suitable disinfectant.

All waste material from containers and vehicles should be removed in such a way as not to cause any contamination and not to create a nuisance.

6.3.8 Effective measures should be taken to protect against the entrance into the premises and the harbourage on the premises of insects, rodents, birds or other vermin.

An effective and continuous programme for the control of insects, rodents, birds or other vermin within the establishment should be maintained. The plant and surrounding area should be regularly examined for evidence of infestation. Where control measures are necessary, treatment should be under the direct supervision of personnel with a thorough understanding of the hazards involved, including the possibility of harmful residues being retained by the fish or their products and the chemical, biological or physical agents used should meet the requirements of the official agency having jurisdiction.

The use of insecticides, during the plant operation, without any provision for collection of dead insects, should be discouraged. Instead, the use of adhesive insect traps or very efficient "black light insecticutor" lamps with the attached collecting trays, is recommended. Insect traps should not be located directly over the processing areas and should be away from windows and doors.

All rodenticides, fumigants, insecticides or other harmful substances should be of a type approved by the official agency having jurisdiction and should be stored in separate locked rooms or cabinets used for that purpose and handled only by properly trained personnel.

6.3.9 Dogs, cats and other domestic animals should be excluded from areas where fish is received, handled, processed or stored.

Dogs, cats and other animals are potential carriers of diseases and should not be allowed to enter or to live in rooms or areas where fish or their products are handled, prepared or stored.

6.3.10 All persons working in a salt fish plant should maintain a high degree of personal cleanliness while on duty and should take all necessary precautions to prevent the contamination of the fish or their products or ingredients with any foreign substance.

All employees should wear, appropriate to the nature of their work, clean light coloured protective clothing including a head covering and footwear, all of which articles are either washable or disposable. The use of waterproof aprons, where appropriate, is recommended. Light colours are required to assess visually the cleanliness of the garment. It is desirable that, except for workers operating in freezers or cold rooms, the sleeves of clothing should not extend below the elbows unless water proof protective sleevelets are used to cover the arms.

Gloves used in the handling of fish should be maintained in a sound, clean and hygienic condition and should be made of an impermeable material except where their usage would be incompatible with the work involved. Hands should be washed thoroughly with soap or another cleaning agent and warm water before commencing work, on every occasion after visiting a toilet, before resuming work and whenever otherwise necessary. The wearing of gloves does not exempt the operator from having thoroughly washed hands.

Any behaviour which can potentially contaminate the fish such as eating, smoking, chewing of tobacco or other materials, and spitting should be prohibited in any part of the fish handling areas.

6.3.11 No person who is known or suspected to be suffering from, or who is a carrier of disease likely to be transmitted through food or has an infected wound or open lesion should be engaged in the preparation, handling or transportation of fish or fish products.

The management should take care to ensure that no person, while known or suspected to be suffering from, or to be a carrier of a disease likely to be transmitted through

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

Any person who has a cut or wound should not continue to handle food or food contact surfaces until the injury is completely protected by a waterproof covering which is firmly secured, and which is conspicuous in colour. Adequate first-aid facilities should be provided for this purpose.

6.3.12 Conveyances used for transporting fish should be cleaned and disinfected frequently and should be so maintained as not to constitute a source of contamination for the product.

The cleaning of vehicles transporting salted fish, receptacles and equipment thereon, such as pallets, should be a regular planned routine. Hosing, scrubbing and cleaning with potable water or clean sea water to which a suitable detergent and disinfectant have been added is usually necessary.

Forklift trucks should not be used outside the plant unless they can be adequately cleaned upon re-entry.

6.4 Operating practices and production requirements

6.4.1 *General considerations*

6.4.1.1 Salted fish or fish products should be of good quality, well prepared and packaged so that they will be protected from contamination and remain attractive and safe to eat.

Despite the masking effect of salt on taste, odour and colour of fish, poor quality raw material will produce a poor quality salted product.

6.4.1.2 Fish intended for salting should always be treated in a hygienic manner.

All the handling, processing and packaging of fish should be clean and hygienic.

Precautions should be taken to protect the fish from contamination by animals, insects, birds, chemical or microbiological contaminants or other objectionable substances during processing, handling and storage.

6.4.1.3 Salting of fish either by brining, dry-salting or pickling should be carried out with the full understanding of their effects on the quality of the final product and should be done under strict hygienic conditions.

Salting gives the fish its taste, appearance, texture and affects its shelflife.

As there is usually a loss of moisture from the fish, strict control of the process should be maintained in order to keep the resulting loss of weight to a minimum.

There are many factors that should be carefully considered by the processor when establishing proper salt curing procedures for his plant. Curing time depends on the species of fish (amount of fat) as well as on their size and thickness. Proper salting methodology should, above all, reflect the requirements of the final products, such as taste, salt content, texture, appearance and the product's shelflife.

To assure the uniform quality of the final product, the fish should be uniform as to its size and weight unless it is to be fully salted.

6.4.1.4 Fish should be uniformly salted.

Irrespective of the method used in salt curing a condition might arise where fish is exposed to different concentrations of salt. It is very important that the brine or salt or resulting pickle is uniformly distributed among the fish salted either in a container or in a pile (stack). In general only uniform size fish should be cured in the same batch and large fish should be split, portioned or scarified to permit uniform salt penetration. This requirement does not apply to fully salted fish.
In the case of small fish, the use of cascade type mixers (the fish and salt being allowed to fall down chutes changing direction several times in order to mix them thoroughly), and revolving drum mixers may be used to ensure the homogeneity of salt and fish before their introduction to containers or salting vats.

6.4.1.5 Fish should remain in the brine or salt sufficiently long to ensure even distribution of salt concentration throughout the muscle and to allow curing.

Unless fish and salt are in contact for sufficient time, the salt distribution throughout the muscle will not be uniform.

When salt is the principal preservative, for some products a certain minimum time must be allowed for ripening, which is both an enzymatic and chemical reaction. It will result in a desirable flavour, odour and in some instances, a special texture. This is especially true in the case of anchovies.

6.4.1.6 Salt curing should preferably be done under cool and constant temperature conditions.

It is very important to protect fish when being cured from extremes of very cold or very high temperatures, in order to maintain quality and control the overall processing so as to minimize microbial spoilage and to prevent sourness or rancidity developing in the flesh.

Temperatures in excess of 10 ^{o} C will enhance the development of a "pink" or "dun" colour (see 6.4.2.4) in fish which is dry-salted.

6.4.1.7 If food additives are to be used, the advice of a food technologist should be sought and the approval of the official agency having jurisdiction should be obtained.

Food additives cannot be used indiscriminately. Some are effective only with certain types of food, and in all cases the concentration and the time of contact of the additive must be rigidly controlled in accordance with specialist advice and the official agency

having jurisdiction. Food laws differ from one country to another and it is essential to seek specialist advice before using a particular additive, whether the product is for domestic use or for export.

6.4.2 *Salt requirements*

6.4.2.1 Salt used in the salting of fish should possess an appropriate composition for the product.

The composition of salt differs according to the origin. Mine salt is usually almost pure sodium chloride but solar salt of marine origin contains several other salts like calcium sulphate, magnesium sulphate and chloride as impurities.

A relatively pure salt is needed for the dry-salting of fatty fish but for some products the presence of small quantities of calcium salts will give the product a somewhat superior appearance. Too much calcium may reduce the rate of salt penetration to an extent that spoilage may occur. In some cases, for a lean fish like cod, levels of calcium salts between 0.15 % and 0.35 % have been found satisfactory.

Magnesium salts if present at too high a concentration will give rise to unpleasant bitter flavours and may cause spoilage during the salting operation. Levels of not more than 0.15 % have been recommended.

For some products other levels of these impurities may be satisfactory but this should be determined by experimentation.

When only impure salt is available, most of the calcium and magnesium impurities can be washed away by using rain or fresh clean water and draining off the wash water. This practice will remove those calcium and magnesium salts which are more soluble than sodium chloride.

6.4.2.2 The content of copper, iron and other metals in salt should be as low as possible.

Salt sometimes contains traces of metals. Copper levels of more than 0.1 ppm and iron of more than 10 ppm may result in the development of undesirable brown discoloration of the fish.

6.4.2.3 Size of salt crystals should also be considered.

For dry-salting of fatty fish a relatively pure salt crystallized in small crystals gives a more rapid salting and a better result.

For lean fish small crystals will tend to “burn” the flesh and result in discoloration in the final product and, therefore, large crystals are preferable.

6.4.2.4 Salt should be free from micro-organisms which adversely affect the quality of the final product.

Two particular conditions that can adversely affect the quality of dry salted fish are the occurrence of (a) “pink” , a discoloration caused by red halophilic bacteria ; and

(b) "dun", a development of the mould *Sporendonema epizoum.* Both defects can be controlled by maintenance of a temperature lower than 10 ^{o}C .

Salt produced from marine sources may contain halophilic bacteria which continue to live in the salt and on dry salted fish.

The bacteria multiply rapidly if the fish are stored at a temperature of 10 ^{o}C or higher and there is also sufficient moist air present in the storage area. The result will be the appearance of a "pink" or "red" colour, sometimes combined with cheesy "off odours". The surface of the fish can be reconditioned by thorough washing and subsequent re-drying but the discoloration will reappear if storage conditions remain unsuitable.

The most common sources of the mould *Sporendonema epizoum,* apart from contaminated salted fish, are the air and dust in and around salt fish processing plants and storerooms. Known as "dun" or "mite" it will multiply rapidly if the salt concentration is between 5 % and 13 %, the relative humidity of the air is around 75 %, and the temperature between 10 ^{o}C and 30 ^{o}C. For these reasons lightly salted fish is most liable to development of "dun" though the mould may grow also on more heavily salted fish.

A number of chemicals have been tested for inhibiting effects on *Sporendonema epizoum.* The application of sorbic acid and its sodium or potassium salts were successful if used in such a manner that the sorbic acid content in the final product was 0.02 % or higher. This content can be obtained in several ways, e.g. mixing of the preservative with the salt used for curing or by dipping the fish for a short period in solutions of the preservative.

In order to minimize infections of salted fish the re-use of salt should be avoided.

6.4.3 *Handling of raw material*

6.4.3.1 All fish, fish products and ingredients used in fish salting establishments should be free from spoilage and adulteration and should be safe for human consumption.

Raw materials should not be accepted by the plant if they are spoiled, rancid, or if they are known to contain harmful or foreign substances which will not be removed to acceptable levels by normal plant procedures of sorting or preparation. Salt used in the processing of fish should be of an appropriate quality and otherwise suitable for the purpose.

6.4.3.2 Fish which cannot be processed immediately on arrival 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.

The quantities of material allowed into a salt fish processing establishment should not exceed the capacity of the plant. Nevertheless, if occasionally the fish are not

processed immediately, they should be maintained as near as possible to a temperature of 0 ^{o}C (32 ^{o} F).

Some species of fish, such as herring, are more susceptible to spoilage than others and require special care.

Where larger quantities of fish than the daily requirements are stored, the plant should have adequate chilled storage available to keep the stock of raw materials at temperature near 0 ^{o}C (32 ^{o} F). Stocks should be limited to the amount that can be processed while the fish are still in good condition.

It must be stressed that placing quantities of fish in a chill room does not remove the need for adequate icing. Chill rooms are designed to maintain a low temperature and to keep already cool fish from warming up. The refrigeration machinery used in chill room operations is not adequate to lower the temperature of a mass of fish in a short time. The initial cooling must be done by the addition of ice. It is poor practice, therefore, to load the chill room with large quantities of fresh fish that were not pre-chilled effectively to the temperature of melting ice.

The chill room should be equipped with a recording thermometer and an automatic temperature control and should be so designed that it can be kept in a clean hygienic condition at all times. The chill room should also be equipped with an automatic alarm system to alert the proper personnel when the temperature drops below 0 ^{o}C (32 ^{o} F).

6.4.3.3 All fish should be carefully inspected or sorted before they are processed. Any damaged, contaminated or otherwise unacceptable fish should be discarded.

Fish which are damaged (bruised, crushed, mutilated) will produce a very poor or unacceptable product, and if contaminated in any way, can spread this contamination to working surfaces and other fish.

If the fish is suspected of being infested with parasites, a representative sample should be filleted to examine whether to proceed with the processing (see sub-Clause 6.4.3.12)

6.4.3.4 If the fish are to be scaled, for most fisheries the scaling operation should be done before gutting and splitting.

Loose scales adhere tenaciously to exposed fish flesh and are difficult to remove. Presence of loose scales on the final product is frequently regarded as a defect.

Whole fish is easier to handle during the de-scaling operation and the loose scales which might adhere to the fish skin are readily removed by washing.

6.4.3.5 Some whole fish may require gutting on arrival at the processing plant. This operation should be carried out efficiently and with care.

Whether mechanical or manual methods are used, gutting must be complete in order to remove all pieces of guts, liver, blood along the backbone and any loose

discoloured belly membrane. During the gutting the knife should not cut through the intestines releasing their contents or go beyond the vent exposing the sterile muscles to microbial and enzymatic action. If the liver is not properly removed it may cause discoloration. Some species of fish destined for filleting need not be gutted.

All waste material from these operations should be collected immediately into suitable watertight and lidded containers which are removed and emptied regularly or be removed continuously by mechanical means or flumes.

6.4.3.6 Immediately after gutting, fish should be thoroughly washed using potable water or clean sea water.

Proper washing will remove all traces of slime, blood and gut particles which may contaminate the flesh. Containers used for washing fish should be provided with a continuous flow of cold potable water or cold clean sea water to keep the temperature down and, in sufficient amounts, to prevent the accumulation of contaminating materials.

Depending on the product desired some fish are not washed after gutting it order to aid maturation ; an example of this would be herring intended for pickling.

6.4.3.7 Large fish should be split, filleted, portioned or scarified before salting to allow for more effective and uniform salt penetration.

The majority of micro-organisms responsible for the decomposition of fresh fish increases rapidly until the salt content of fish flesh reaches a concentration of more than 3%. To ensure that the fish muscle during the salting will attain this level in the shortest possible time, the fish must be so split or portioned or scarified that the thickness of the flesh is not more than 4 cm. Furthermore, to reduce the microbial action as soon as possible the flesh of fish that have been split or portioned or scarified may also be rubbed with fine granulated salt.

6.4.3.8 Splitting of fish should be done skilfully to avoid ragged edges, uneven separation of sides and losses in recovery.

Fish should be split by a cut made parallel to the backbone straight down from the nape to the tail and in such a way as to prevent uneven and ragged edges or a loss in recovery. If the backbone is to be removed, it should be cut three joints behind the vent to avoid blood spots at that point. It is important to cut the bone rather than to break it from the flesh so that the finished salted product will display continuous non-detached vertebrae. If a mechanical splitting machine is available, it should be properly adjusted. Very large fish might be skinned, cut into fillets or portions to allow for more rapid and uniform salt penetration.

6.4.3.9 Immediately after splitting, fish should be washed with potable water or clean sea water or brine.

Fish should be thoroughly washed before salting to remove all blood, slime, pieces of gut and other extraneous material. Fish blood coagulates rapidly and washing will facilitate more complete bleeding, which in turn will improve the appearance of the product. The black membrane should be taken from the napes while the fish are being

washed. The black membrane may be left on for special markets and should in such case remain unbroken. If tanks are used for washing split fish, a continual flow of clean, cold water should be provided to prevent the accumulation of contaminating materials. After washing, fish should be drip dried to remove excess of water.

6.4.3.10 Scarification of fish should be done by cutting through the skin at regular intervals of a few centimetres.

Care should be taken not to cut too deep so that the meat will not tear during subsequent handling and processing.

6.4.3.11 Fish should be filleted with care.

The more skilful the filleter, the quicker the fish are filleted and the fewer workmanship defects, such as ragged ends, pieces of skin or skinless fillets, and blood spots will occur. Cutting through the belly cavity during the filleting of ungutted fish should be avoided. If the fillets are to be skinned, the skinning operation may be carried out more easily after the fillets have been cured for several days.

6.4.3.12 It is advisable to make the candling of fillets of certain species of fish a routine practice.

If the fish is suspected of being infested with parasites, a representative sample should be filleted and examined to determine whether to proceed with the processing.

Although most types of parasites found in fish are harmless to humans, nevertheless the presence of parasites in fish or fish products is highly objectionable to the majority of the consuming public.

Proper and careful candling will not only remove the undesirable parasites but also will detect and remove the blood spots, pieces of skin on the skinless fillets, and any other defects which otherwise might reduce the overall quality of the product.

6.4.3.13 On completion of splitting, portioning, scarifying or filleting, salting should be carried out without delay.

Postponement of salting the fish which was split, filleted, portioned or scarified might result in quality deterioration and the eventual downgrading of the product. Therefore, the fish should be salted as soon as possible.

6.4.3.14 If frozen fish is used as raw material the thawing should be done prior to salting and the raw material during thawing should not rise above 7 ^{o}C before being processed. If processing cannot commence immediately, the fish should be chilled.

Frozen fish should be thoroughly thawed in preparation for salting ; however, in the case of soft texture fish, partial thawing before splitting or filleting might be desirable in preventing tearing of the flesh.

The thawing method chosen should suit the volume and type of product that is to be processed and should be economically practical. Exposure of fish to elevated temperatures during the thawing should be carefully controlled.

Where fish are thawed in still air, the ambient temperature should not exceed 18 ºC. With air blast thawing, the air should be humidified and its temperature should not exceed 21ºC. Water used for thawing should be either clean sea water or potable water and its temperature should not exceed 21 ºC.

All thawing operations should be carried out under strict hygienic condition and in the manner recommended in the SLS 975. Surface drying should be avoided.

6.4.4 *Brining and pickling*

6.4.4.1 Fresh brine should be prepared at least each day before the start of operations.

Fresh brine of required strength can be easily prepared either by dilution of the saturated brine with water or preferably by dissolving the required amount of salt in a given amount of water (see Appendix II "Preparation of Brine of Required Strength").

A saturated brine can be produced by going upward a flow of clean water through a column of salt. The resulting overflow of saturated brine is then collected into a storage tank. With a large volume production and with the use of a continuous mechanical briner, the brine can be re-circulated and its concentration readjusted after passing it through the filtering device and through a bed of solid salt.

6.4.4.2 The ratio of brine to fish should be at least 1 : 1 by weight when using a saturated brine.

When saturated brine is used, a certain amount of solid salt should always be present on the bottom of the brining vat.

When weak (very light) brining is practised then the quantity of brine in relation to fish should be increased.

It is advisable to stir the brine during the process to obtain an even salt content in the product. Stirring can either be done by hand with a paddle or by a brine agitator such as a slow revolving electric stirrer or a pump. High speed stirrers cause foaming of the proteins dissolved in the brine and are, therefore, not recommended.

If the brine concentration is less than 12 %, the fish will absorb brine and the weight of the fish will increase. If the brine concentration is more than 12 %, there is a disruption of the equilibrium in the semi-permeable nature of the cells resulting in a loss of internal water and soluble substances.

6.4.4.3 To assure uniformly good quality and even salt content of the final product, brine strength should be checked regularly.

Brine should be checked regularly with a salinometer (brinometer) and its strength should be maintained at the required level by the addition of solid salt. Brine strength

decreases with use as water extracted from the fish tissue dilutes it and salt is absorbed by the fish.

The salinometer (brinometer) consists of a float with stem attached, marked in degrees. In a saturated brine, the stem will be almost entirely above the level of the salt solution and read 100 ^{o} (approximately 23 % salt solution). In weaker brines more of the stem will be below the level of the salt solution.

Salinometer readings should be taken at the standard temperature stated for the given instrument ; otherwise temperature correction should be applied (see Appendix II "Preparation of brine of required strength")

6.4.4.4 Fish intended for pickling should be carefully salted and properly packed into the curing container.

A thin layer of salt should be spread evenly over the bottom of the curing tank or vat. Then a layer of fish, with skin side down is laid evenly over the layer of salt and more salt then is spread over the cut surfaces of the fish. Subsequent layers of fish should be placed at right angles to the layer beneath in such a way that no fish are overlapped without a proper layer of salt between. This will prevent the fish from sticking together and becoming spotted and discoloured where they overlap.

More salt should be used on the fish near the top than at the bottom. The top layer of fish should be placed with the skin side up to prevent dust, loose scales and other impurities from depositing on the cut surfaces of the fish.

6.4.4.5 Fish should be allowed to settle in containers before the containers are closed.

Depending on the type of cure it may take up to 36 hours for the fish to settle in the containers. At that time additional fish of the same lot may be added and the containers should be filled (topped) with saturated brine.

6.4.4.6 Fish should be frequently and thoroughly mixed with the pickle during the curing.

This should be done at least once a day for the first two days to permit thorough mixing of fish with the pickle and undissolved salt. Containers such as barrels should be rolled. In some fisheries a distance of about 10 m for rolling the barrels has been recommended.

6.4.4.7 During the pickling operation all fish should be well immersed in the resulting brine.

Such practice will prevent bacterial spoilage and discolouration, reduce fat oxidation (rancidity) and provide for more uniform curing conditions. If necessary, the fish should be weighted down by a heavy lid and if there is not enough pickling juice formed to cover the fish, saturated brine should be added.

The pickling container, if practical, should be protected by covers against dust and insects.

6.4.4.8 Care should be taken to ensure the pickle is evenly saturated.

When heavy salting the fish, the salt concentration at the surface should be checked periodically with a salinometer and adjusted to saturation since lower concentrations of salt will result in fish near the surface being inadequately cured.

6.4.4.9 An appropriate temperature control should be practised during pickling, brining and storage.

This can be achieved in the chill room by the addition of small quantities of ice and required amount of saturated brine to make up for the dilution of the brine.

In a mechanical brining system the brine can be passed through a water chiller or similar cooling device.

6.4.4.10 After being placed in the salting containers, fish should be stored or maintained for a sufficient period under suitable temperatures to ensure proper curing and to prevent deterioration of the product.

It is important to store the fish and to monitor their condition during the curing period. Failure to do so will likely result in loss of quality and spoilage.
Herring may be kept for up to three weeks in a temperature range of 5 to 10 ^{o}C. However if the containers are to be held at temperatures from 0 to 5 ^{o}C the curing period may increase to 4 or 6 weeks. Fillets generally require a shorter curing time, usually 4 to 5 days. Other cures allow pickled herring to be kept for about a year at temperature of 0 to 5 ^{o}C. To ripen this product temperature of 10 to 15 ^{o}C are required.

For anchovy (*Engraulis encrasicholis*), the best temperature of storage is between 16 to 20 ^{o}C with at least four months keeping time before re-packing.

6.4.4.11 Fish while being cured should not be subject to extremes of temperature.

If fish are exposed to freezing temperatures during the initial curing period, the fatty fish may eventually turn sour and rancid. Conversely, the fish should not be subject to a high temperature as this will result in separation of fat from the fish tissue.

6.4.4.12 If the fish have to stay in brine to attain proper maturation, brine should be maintained clean.

During brining, proteinaceous compounds and oil exuded from the cells enter the brine as well as residues such as loose scales. They appear on the surface as an oil layer or fatty scum which is to be discarded. In time, such impurities, if not removed, will affect the quality of the final product.

This should be done when re-packing of fish with brine is needed to protect the quality of the product. The discarded scum may have a commercial use.

6.4.4.13 Brine should be added to barrels through a stopping hole.

It is difficult to fill a barrel completely with brine through the lid opening. Brine should be added through a stopping hole, which preferably should be located in the bulging side of a barrel, and in such a manner that all air is replaced by the brine before the stopper is inserted.

6.4.4.14 Cured fatty fish should be kept in brine or pickle.

Fatty fish should always be covered with brine during curing. Unless the brine is retained with the fish, the fat in the flesh will turn rancid. In open containers or barrels a weighted cover might be useful. Separated fat should from time to time be removed.

6.4.4.15 Curing containers should be inspected for leaks.

Curing containers such as wooden barrels can develop leaks which might result in considerable loss of brine. To compensate for such a loss, saturated brine should be added and the fish should be checked as frequently as necessary to ensure that it is well immersed in the brine.

6.4.5 ***Dry-salting or kench curing***

6.4.5.1 Fish for dry–salting should be properly arranged to ensure uniform conditions and proper drainage.

In dry-salting (kench curing), two or three rows of fish are placed down the centre of a drainage rack, which is covered with a layer of salt, and salt is sprinkled over each fish, particularly on the thicker portions. A pile is formed gradually working out to the edges of the rack. At all times the fish at the centre of the pile is kept 7 to 10 cm higher than at the edges. For first salting, piles should not be higher than 1 m but in subsequent resalting piles of a greater depth are possible. Round piles are prepared by placing the tails of the fish towards an open centre.

There should be no pockets in the pile that will cause irregular drainage. If pockets are present, the fish around the area will become tainted and dark resulting in an inferior grade product.

The edges of the pile should be checked frequently and fine salt should be sprinkled over the napes of the fish which are affected by drainage from the pile. Fish piles should never be placed directly on the floor unless it has been specifically designed for the purpose.

6.4.5.2 In the dry-salting of fish the amount of salt, the time and temperature should be carefully controlled to attain the desired product.

The amount of salt to fish may range from 1 unit of salt to 8 of fish by weight for light salting, to 1 unit of salt to 3 of split fish (or exceptionally1 to1) for heavy salting. Time in the cure may range from 6-8 days for light salting to 21-30 days for heavy salting. In view of the multiplicity of the factors involved only through experimentation and experience can the proper curing conditions be ascertained. In

general more salt is required for given weight of fish for dry-salting as compared to brining or pickling.

Dry-salting of fish should be carried out in a cool room with a temperature below 10 ^{o}C for the control of "pink" and "dun". (see **6.4.2.4**)

6.4.5.3 Fish which is dry-salted in piles should be re-stacked periodically with the addition of fresh salt to ensure uniform curing conditions and pressing.

After several days in the pile, fish should be restacked with the top of the pile going to the bottom. Each fish during the restacking operation should be carefully salted using additional fresh salt to ensure that sufficient salt will be present to complete the cure.

6.4.5.4 For salting of small fatty fish, such as anchovy or small herring, dry salting or kench curing may be used ; under certain conditions and for large fish, pickling or brining should be used in preference.

Since fatty tissue absorbs salt more slowly than lean tissue, dry salt in contact with fish will dissolve in water extracted from the tissue and run off without increasing the salinity of the muscle sufficiently fast to prevent decomposition. Furthermore, the fat of the flesh unprotected by brine or pickle will turn rancid more readily.

However, if the fish is processed in such a way that the brine and most of the oil runs off, the fish will be preserved and kept in a dry state. This occurs with pressed, salted sardines.

6.4.6 ***Packaging, storage and distribution***

6.4.6.1 Packaging materials should be of food grade and be clean and stored in a hygienic manner. Packaging should be carried out under conditions that prevent contamination of the product.

All packaging materials should be stored in a clean and hygienic manner. The materials should be appropriate for the product to be packed and for the expected conditions of storage and should not transmit to the product objectionable substances. The packaging materials should be sound and should provide appropriate protection from contamination.

6.4.6.2 Only new dry packaging material should be used for packaging dry-salted fish.

Dry-salted fish should not be packed in wet or damp containers. The containers should be clean and free from any foreign matter. Containers that had previously been used for any purpose may have odours associated with them that could permeate the fish to be packed therein.

6.4.6.3 Carton wrappings and other packaging materials should not be stored in the processing area.

Delivery wrappings of packaging materials should be removed outside the processing area and only those packages required for immediate use at any given time should be introduced to the area.

6.4.6.4 Dry salted packaged fish should be stored in a dry area that is protected from contamination and is also well ventilated.

Packaged fish should be held in a dry area where it is protected from dust, rodents and contaminants. In addition, the area should be well ventilated and cool to protect the quality of the product if the product is to be stored prior to distribution. Circulation of air between the walls of the storage area and the containers of fish will minimize deterioration as well as allow easier access to ensure that no harmful action is taking place to the containers themselves.

6.4.6.5 Containers or barrels in which fully cured fatty fish are to be marketed should be leak-proof.

Containers for fish in pickle should be watertight to prevent the loss of pickle during transit or storage. Leakage can result in the oxidation of the fat and the occurrence of a rusty discoloration and yellowing condition. This gives the product a poor appearance, odour and flavour, and may result in rejection.

If wooden containers made of soft wood are used, which usually is more porous than hard woods, it is recommended that they be waxed on the inside to a thickness of about 1 mm. The wax used should be of food grade.

6.4.6.6 Only clean, sound containers should be used for marketing pickled or brined fish.

New, unused containers or barrels should be used. The outer appearance of a container of food indicates the care that has been given in processing, packaging and handling of the product. Usually the buyer prefers to receive his consignment in new, unused containers. Therefore, it is recommended that containers, barrels or other types of package for marketing pickled fish products should be new. Frequently old containers which are dented, rusty or otherwise damaged in addition to being unattractive, could hardly provide adequate protection for the product during transportation and rough handling.

6.4.6.7 Containers should be marked or labelled in a clearly identifiable manner.

These guidelines are supplemental to those prescribed in Clause 10 of the SLS 143. Final product should be marked or labelled in accordance with the SLS 467 and the relevant labelling requirements specified in individual product standards.

6.4.7 *Desalting*

6.4.7.1 When salted fish is to be desalted, potable water should be used and changed as frequently as necessary until the desired salt content in the fish is reached.

Generally, the faster the water exchange the faster the desalting, but a too frequent exchange of water may result in a high loss of soluble protein. Too slow an exchange will reduce the speed of desalting and may cause microbial build-up in protein enriched diluted brine, causing off-odours and flavours in the final product. The frequency of water exchange will depend on the species and size of the fish and the time and salt content desired for further processing.

6.5 Hygiene control programme

6.5.1 It is desirable that each fish processing plant in its own interest designates a single individual whose duties are preferably separated from production, to be held responsible for the cleanliness of the establishment.

Such a person or his staff 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 the hazards involved. 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.

6.6 Laboratory control

6.6.1 In addition to any control by the official agency having jurisdiction, it is desirable that each fish processing plant in its own interest should have access to laboratory control to establish hygiene and quality of the products processed and to monitor the hygiene of processing.

The extent and type of such control will vary with the food product as well as the needs of management. Such control should reject all foods that are unfit for human consumption.

Analytical procedures used should follow recognized standard methods in order to that the results may be readily interpreted. Since many salt fish products are sold on the basis of fat, water and salt content, access to laboratory facilities should be ensured.

7 END – PRODUCT SPECIFICATIONS

7.1 Appropriate methods should be used for sampling and examination or analysis to determine compliance with the following specifications ;

- Salted fish or their products should be free from micro-organisms in amounts harmful to humans, free from parasites harmful to humans and should not contain any substances originating from micro-organisms in amounts which may represent a hazard to health.

- Salted fish or their products should be free from chemical contaminants in amounts which may represent a hazard to health.

- Salted fish or their products should be, to the extent possible in Good Manufacturing Practice, free from other objectionable matter and also parasites not harmful to humans.

- Salted fish and their products should comply with the requirements set for pesticide residues and food additives of the country in which the product will be sold.

APPENDIX 1
GENERAL PRINCIPLES OF FISH SALTING

During the salting of fish an equilibrium may be reached after a certain time ; however, the salting process may be ended when all the fish have achieved the required salinity and acquired the required taste, consistency and odour of the product desired.

Salting may be divided into salt preservation, as such, and ripening. Spoilage of fish is chiefly brought about by autolysis and microbial decomposition. Most enzymes and micro-organisms are inactivated by high salt concentration. A reduced moisture content in the salted fish also results in an unfavourable environment for the multiplication of micro-organisms. However, if poor quality raw fish is used and/or salting takes place at elevated temperature, decomposition may proceed faster than the salt penetration of the tissues and thus spoilage of the fish will occur.

While salting reduces the rate of autolysis, it does not completely stop enzymatic action which will increase with rises in temperature. Salting also enhances fat oxidation. Fat hydrolysis and the development of rancidity may also spoil the fish. Certain halophylic micro-organisms under the conditions of dry-salting might multiply and they too will spoil the product. It is for those reasons that salted fish should be cured and stored under cool conditions and for some fatty fish, in the absence of air, if possible.

Ripening which is desirable for some fatty fish products is a process that causes changes in the chemical and physical characteristics of fish flesh, generally by some enzymatic process. The rate of ripening depends on the fish, salt composition employed, temperature and the amount of salt absorbed by the fish tissues. These combinations give rise to many different and uniquely characteristic types of products.

The salt used in dry-salting should be of suitable size and quality for the product desired. Impurities such as iron and copper catalize the formation of a yellow or brown discoloration. Magnesium chloride retards salt penetration and the varying presence of magnesium and calcium salts may alter the appearance of some fish. Fine salt dissolves rapidly, but cakes in most weather, making uniform salting difficult. The fish may also pack too tightly not allowing uniform distribution of the pickle. Coarse salt, because of its smaller surface area, does not penetrate the flesh as fast as fine salt. This may be very important during the early stages of salting since microbial decomposition is only retarded when the salt content of the muscle reaches 5 to 6 %. In determining quality, quantity and size (mixture) of salt to be used, the following factors should be considered ; method of salting, humidity, type of product desired, temperature, the conditions of storage and methods of marketing.

APPENDIX II
PREPARATION OF BRINE OF REQUIRED STRENGTH
(The amount of salt to be dissolved in water to obtain required brine strengths)

Specific Gravity	% NaCl by Weight	Baume Degrees U. S. Standard	Salinometer degrees	kg NaCl to be dissolved in 100 1 water
1.007	1	1.0	3.8	1.0
1.014	2	2.0	7.6	2.0
1.022	3	3.1	11.4	3.1
1.029	4	4.1	15.2	4.2
1.037	5	5.2	19.0	5.3
1.044	6	6.1	22.7	6.4
1.051	7	7.0	26.5	7.5
1.058	8	7.9	30.3	8.7
1.066	9	8.9	34.1	9.9
1.073	10	9.8	37.9	11.1
1.081	11	10.9	41.7	12.4
1.089	12	11.9	45.5	13.6
1.096	13	12.7	49.3	14.9
1.104	14	13.7	53.1	16.3
1.112	15	14.6	56.8	17.6
1.119	16	15.4	60.6	19.0
1.127	17	16.3	64.6	20.5
1.135	18	17.2	68.2	22.0
1.143	19	18.1	72.0	23.5
1.151	20	19.0	75.8	25.0
1.159	21	19.9	79.6	26.6
1.168	22	20.9	83.4	28.2
1.176	23	21.7	87.2	29.9
1.184	24	22.5	91.0	31.6
1.192	25	23.4	94.8	33.3
1.201	26	24.3	98.5	35.1
1.204	26.4	24.6	100.0	35.9

(Brine strength measured at 16 ^{o}C (61 ^{o}F)).

SLS CERTIFICATION MARK

The Sri Lanka Standards Institution is the owner of the registered certification mark shown below. Beneath the mark, the number of the Sri Lanka Standard relevant to the product is indicated. This mark may be used only by those who have obtained permits under the SLS certification marks scheme. The presence of this mark on or in relation to a product conveys the assurance that they have been produced to comply with the requirements of the relevant Sri Lanka Standard under a well designed system of quality control inspection and testing operated by the manufacturer and supervised by the SLSI *which includes surveillance inspection of the factory, testing of both factory and market samples.*

Further particulars of the terms and conditions of the permit may be obtained from the Sri *Lanka Standards Institution, 17, Victoria Place, Elvitigala Mawatha, Colombo 08.*

Printed at SLSI (Printing Unit)

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