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CODE OF HYGIENIC PRACTICE FOR

THE PROCESSING OF LOBSTERS AND PRAWNS

(SECOND REVISION)

SRI LANKA STANDARDS INSTITUTION

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SLS 208 : 1988

Gr. 22

SRI LANKA STANDARDS INSTITUTION
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DRAFTING COMMITTEE ON THE CODE OF HYGIENIC PRACTICE FOR PROCESSING OF LOBSTERS AND PRAWNS

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Sri Lanka Standards are subject to periodical revision in order to accommodate the progress made by industry. Suggestions for improvement will be recorded and brought to the notice of the Committees to which the revisions are entrusted.

This standard does not purport to include all the necessary provisions of a contract.

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SRI LANKA STANDARD
CODE OF HYGIENIC PRACTICE FOR THE PROCESSING OF LOBSTERS AND PRAWNS
(SECOND REVISION)

FOREWORD

This Sri Lanka Standard was authorized for adoption and publication by the Council of the Sri Lanka Standards Institution on 1988 - 12 - 12, after the draft, finalized by the Drafting Committee on the code of hygienic practice for the processing of lobsters and prawns, had been approved by the Agricultural and Food Products Divisional Committee.

This standard is the second revision of SLS 208 : 1973, Code of hygienic practice for the processing of frozen lobsters and prawns. The first revision was issued in 1981.

This code of practice has been updated to keep abreast with the relevant Codex Standards with modifications to suit local conditions. A new section covering recommendations for handling products at sea has been included. It also provides additional background information on technological and hygienic aspects relating to all operations.

Requirements for the quality of water and ice used as well as recommended residual chlorine levels for different applications have been included in this revision. The temperature/time relationships for freezing operations have been reviewed. Provision has been made for monitoring the quality of raw materials and end products by cross-referring to the relevant national standards.

In the preparation of this revision, the assistance derived from the publications of the Codex Alimentarius Commission and the New Zealand Standards Association is gratefully acknowledged.

1 SCOPE

This standard recommends a code of hygienic practice to be adopted for the processing of lobsters and prawns.

2 REFERENCES

SLS 10 Frozen prawns
SLS 188 Quick frozen lobsters
SLS 614 Potable water
Part 1 : Physical and chemical requirements
Part 2 : Bacteriological requirements

3 HANDLING AT SEA

3.1 General consideration

3.1.1 THE FISHING VESSEL SHOULD BE DESIGNED FOR RAPID AND EFFICIENT HANDLING OF RAW MATERIAL, EASE OF CLEANING AND DISINFECTION, AND SHOULD BE OF SUCH MATERIAL AND CONSTRUCTION SO AS TO MINIMIZE ANY DAMAGE OR CONTAMINATION OF THE CATCH.

In designing a fishing vessel, many other factors, apart from the vessel's performance as a harvesting unit, should be considered. Contamination of the catch with bilge water, sewage, smoke, fuel, oil, grease or other objectionable substances must be avoided. The catch should be protected against physical damage, exposure to high temperatures and drying effects of sun and wind.

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

3.1.2 THE VESSEL SHOULD BE EQUIPPED TO FREEZE THE PRODUCTS AT SEA IF THE FISHERY CANNOT BE OPERATED WITHIN THE RECOMMENDED MAXIMUM STORAGE TIME IN ICE (SEE TABLE 2)

Lobsters and prawns are extremely perishable.

Appearance, texture, odour and flavour are easily affected by time and temperature of storage. Even when well iced, the raw material will not keep longer than seven days without appreciable deterioration in quality.

A uniform cold storage temperature of -18 ^{o}C should be provided, but the original quality will be extended in lower temperature conditions.

3.2 Vessel construction and sanitary design

3.2.1 DECK POUNDS OR PENS, STANCHIONS, DIVIDING BOARDS AND HOLDING TANKS 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 DUE TO THE VESSEL'S MOTION, AND ALSO 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 cleaned. Steelwork should be coated with anti-corrosion and non-toxic paint. Whenever possible, suitable corrosion-resistant materials should be used. On vessels which hold live lobsters, only small deck pounds are required as the lobsters should be sorted and conveyed with care to the tank, well or bag as soon as possible after being brought on board.

3.2.2 VESSEL HOLDS FOR STORAGE OF PRAWNS OR ICED LOBSTER TAILS 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 reduce the rate of ice meltage. If the quality and structure of the insulation is poor, considerable ice meltage will take place near bulkheads and the shipside.

3.2.3 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 SUITABLED NON-TOXIC MATERIAL HAVING WATER-TIGHT JOINTS.

The insulation should be covered with corrosion-resistant metal sheets, having water-tight joints to ensure protection from contamination.

3.2.4 WOODEN HOLDING TANKS OR HOLDS SHOULD BE LINED WITH A SUITABLE MATERIAL.

The linings of wooden holding tanks or holds should be similar to those described in sub-section 3.4. They should sealed and coated with a suitable imprevious and non-toxic material which is easy to keep clean and not difficult to repair.

3.2.5 THERE SHOULD BE NO SHARP CORNERS OR PROJECTIONS IN THE HOLD OR TANK, AS THESE WILL MAKE CLEANING DIFFICULT AND MAY DAMAGE THE RAW MATERIAL.

Contamination with debris, blood and offal will build up rapidly on surfaces, on corners or around projections which are not smooth and impervious.

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

3.2.6 PORTABLE BOARDS OF SUITABLE CORROSION-RESISTANT MATERIAL OR IMPREGNATED AND PAINTED WOOD SHOULD BE USED FOR MAKING SHELVES AND VERTICAL DIVISIONS IN THE HOLDS.

The use of portable boards, which are a good fit in the stanchions, allows the shelf and dividing structure 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 repairable. Wherever possible, the shelving and the partitioning boards should be interchangeable in size.

3.2.7 SHELVING BOARDS SHOULD BE DESIGNED TO ALLOW ADEQUATE DRAINAGE.

A continuous trickle of melt water will help to carry away any debris in raw material, blood and micro-organisms which should not be allowed to collect on the shelves. Corrugated boards of corrosion-resistant material are most suitable for this purpose.

3.2.8 THE SHELVES SHOULD BE INSTALLED SO THAT WHEN BULK STOWING PRAWNS, THE MAXIMUM DEPTH OF PRAWNS IS NOT EXCESSIVE.

Experience has shown that the preassure towards the bottom of a deep pile of iced prawns can result in loss of mass and damage. Where iced prawns are stowed in deep pounds, shelves should be fitted at frequent intervals, to transfer the weight of the load to the hold structure and hull, without undue preassure on prawns stored below.

3.2.9 THERE SHOULD ALWAYS BE AMPLE DRAINAGE SPACE BETWEEN THE LOWEST SHELVES AND THE FLOOR OF THE HOLD. THIS SPACE SHOULD BE OPEN TO A GENERAL DRAIN, DISCHARGING DIRECTLY INTO ONE OR MORE SUMPS OR WELLS, LOCATED SO THAT THE HOLD CAN BE EFFICIENTLY DRAINED AT ALL TIMES. BILGE PUMP CONNECTIONS TO THESE SUMPS SHOULD BE FITTED WITH COARSE SCREEN FILTERS.

Proper drainage facilities can prevent a build-up of large quantities of melt water, blood and debris. If drainage is inadequate, the bottom layers of the material in the hold may be contaminated by this dirty liquid, especially during the 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.

3.2.10 TANKS AND WELLS USED FOR HOLDING LIVE LOBSTERS SHOULD BE PLACED AND CONSTRUCTED SO AS TO ENSURE SURVIVAL OF THE LOBSTERS AND TO PROTECT THEM FROM DAMAGE.

A tank for storing live lobsters should have forced circulation of clean sea water by pumping from the bottom to the top of the tank. Care should be taken to avoid "dead spots" in the tank. This can be accomplished by the use of a grating in the bottom of the tank. The tank should not be too large and when full of lobsters, the rate of change of water should be at least four times per hour. The tanks should be divided into compartments for the purpose of segregating the catch and also be provided with baskets of impervious corrosion-resistant material in case of unloading. Baskets of one metre cube have been found to be satisfactory, but experimentation on packing density is necessary for each fishery.

Where wet wells are used, the holds in the hull of the boat should be large enough to provide effective exchange of water. It should be remembered that the motion of the boat is an essential factor to successful circulation unless auxiliary aids are used, such as pumps. If the water stagnates, the lobsters will die.

3.2.11 PROPERLY DESIGNED FACILITIES SHOULD BE PROVIDED FOR HAULING TRAPS, POTS AND NETS TO PREVENT DAMAGE DURING CATCHING.

This will enable undersized lobsters to be returned to the sea where required, and to minimize damage to the commercial part of the catch. Lobsters are fragile and legs and other appendages are easily broken. This causes loss of blood and the risk of infection with consequent weakening of the lobster. The market value of damage lobsters may also be reduced.

3.2.12 WHERE BOXING AT SEA IS CARRIED OUT, THE STANCHIONS AND DIVIDING STRUCTURE SHOULD BE DESIGNED TO ACCOMMODATE BOXES OF PRAWNS WITHOUT LEAVING LARGE AIR GAPS.

If the structure is not designed to suit the box dimensions, large gaps will be left where the air can circulate causing excessive ice meltage. Unless these spaces are filled with extra ice, the temperature of the prawns will rise.

3.2.13 IF COOLING GRIDS ARE FITTED IN THE HOLD THEY SHOULD BE PROPERLY INSTALLED AND OPERATED.

Cooling grids, fitted into the boat's hold, can be used to prevent excessive ice meltage during the voyage to the fishing grounds. They are valuable in cooling the hold and absorbing heat leaks, especially in tropical waters. To be effective, they should be fitted under the deckhead and on the ship sides and, once the raw material has been stowed in the hold, control must be such that the hold temperature does not fall below 0 ^{o}C. If it does, the top layer of ice may freeze into a solid crust, resulting in the freezing of the adjacent layer of raw material, thus affecting its quality.

When the ice stops melting because of low temperature, its effectiveness as a cooling agent diminishes considerably. The frozen crust of ice and raw material will act as an insulating blanket preventing the layers below from being adequately chilled. Only when the ice is melting and the resulting ice-cold melt water percolates downward through the layers of raw material, the removal of heat (chilling) takes place. The cooling grids alone, fitted into the well-insulated hold, will not cool the raw material nor maintain them in a chilled condition.

3.2.14 EXCEPT FOR TANK STOWAGE IN REFRIGERATED SEA WATER OR REFRIGERATED BRINE, THE BULK STOWAGE OF PRAWNS IN HOLDS THAT ARE NOT DIVIDED INTO POUNDS WHICH COULD BE SHELVED IS NOT RECOMMENDED.

Crushing of prawns could result from either the excessive depth at which the prawns are stowed, or from horizontal shifting of large quantities of the ice-prawn mixture caused by the movement of the fishing vessel.

3.2.15 HOLDS THAT ARE NOT DIVIDED INTO POUNDS OR PENS SHOULD HAVE AN ADEQUATE NUMBER OF DRAIN LINES LOCATED AT INTERVALS ALONG THE HOLD, DISCHARGING TO A CENTRAL DRAIN OR BILGE. VERTICAL DRAIN SLOTS SHOULD BE LOCATED ALONG BOTH THE FORWARD AND AFT BULKHEADS RUNNING FROM DECKHEAD TO BILGE.

As has already been stated, holds which are not divided into pounds are not to be recommended. Those that do exist in very small vessels also require adequate drainage facilities. This could be achieved by providing a "false bottom" with holes that will allow the melt water to drain.

3.2.16 IF REFRIGERATED SEA WATER OR REFRIGERATED BRINE SYSTEMS ARE USED THEY SHOULD BE PROPERLY DESIGNED TO GIVE ADEQUATE COOLING CAPACITY.

If the use of a refrigerated sea water or brine system is considered, the system should be the subject of much research before an investment of money is made. The system should be designed by refrigeration experts having a knowledge of the fishery, including catching and stowage rates, species of prawn, water quality, and the prevailing ambient and water temperatures. The cooling capacity must be related to catching rates. The system must be capable of rapidly chilling large quantities of prawn.

3.2.17 IN VESSELS USING REFRIGERATED SEA WATER OR REFRIGERATED BRINE SYSTEMS FOR CHILLING OR STOWING OF THE CATCH, ALL TANKS, HEAT EXCHANGER, PUMPS AND ASSOCIATED PIPING SHOULD BE MADE OF, OR COATED WITH, SUITABLE CORROSION-RESISTANT MATERIAL. THEY SHOULD BE SO DESIGNED THAT THEY CAN BE EASILY 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 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 designed so 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.

3.2.18 REFRIGERATED SEA WATER OR REFRIGERATED BRINE TANKS SHOULD BE INSULATED TO MINIMIZE HEAT LEAKAGE FROM THEIR SURROUNDINGS.

The tempereature 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.

3.2.19 THE REFRIGERATION PLANT AND THE SEA WATER OR BRINE CIRCULATING EQUIPMENT SHOULD BE ADEQUATE TO MAINTAIN THE TEMPERATURE OF THE RAW MATERIAL AT -1 °C.

At the temperature of -1 °C, maximum delay of spoilage is obtained. If the temperature is reduced below -1 °C, the raw material may be damaged because of partial freezing. In practice it is extremely difficult to control the temperature so precisely, but a range of -1 °C to +2 °C is achievable.

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

Rapid cooling of prawns is the primary task of the system. Once the initial cooling of prawns 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 prawns and brine should prevent sudden and significant fluctuations in temperature.

3.2.20 WHERE CLEAN SEA WATER OR BRINE AND ICE MIXTURES ARE USED FOR COOLING AND STORING THE CATCH, THERE SHOULD BE ADEQUATE CIRCULATION OF THE LIQUID.

Effective means of circulating the cold liquid a round the mass of prawns should be provided. If pumping facilities are inadequate, some of the load may not be cooled properly, resultiung in prawns 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-prawn mixture, as well as negative pressure (suction) created by the circulating pump. Such screens should be designed and located to allow a constant and unobstructed flow of cold brine or sea water.

3.2.21 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 or obliterate navigational lights.

3.3 Hygiene facilities

3.3.1 AREAS OF THE DECK WHERE RAW MATERIAL IS UNLOADED AND HANDLED, OR THE HOLD WHERE RAW MATERIAL IS STOWED SHOULD BE KEPT CLEANED.

Storage of fuel, other petroleum products and different cleaning and disinfecting agents should be arranged such that there is no possibility of contamination of surfaces with which the raw material come into contact.

3.3.2 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 with addition of chlorine if possible, should be available.

The intake of clean sea water should be from an area on the opposite side of the vessel, in front of and well away from the area from which toilet waste and engine cooling discharge is effected. Sea water should not pumped while the vessel is in habour nor in areas where there is any form of water pollution. Clean sea water should be taken in while the vessel is moving forward.

The piping for the clean sea water supply should not have cross-connections with the engine or condenser cooling system. It should be constructed to prevent any possibility of back-syphonage from the kitchen sink, washbasins or toilets.

3.3.3 ICE SHOULD BE MADE FROM POTABLE WATER CONFORMING TO SLS 614 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 raw material with water-borne micro-organisms or other objectionable or even harmful substances. Such contamination might create a health hazard.

Ice manufacturing plants should be cleaned regularly and maintained in a clean condition at all times.

3.3.4 TOILET FACILITIES AND ALL PLUMBING AND WASTE DISPOSAL LINES SHOULD BE SO CONSTRUCTED AS NOT TO CONTAMINATE THE CATCH.

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 holds where raw materials are being handled or stored.

3.3.5 AN AMPLE SUPPLY OF COLD POTABLE WATER OR CLEAN SEA WATER UNDER ADEQUATE PRESSURE SHOULD BE AVAILABLE AT A SUFFICIENT NUMBER OF POINTS THROUGHTOUT THE FISHING VESSEL. ON LARGE VESSELS ENGAGED IN PRAWN PROCESSING, A SUPPLY OF HOT WATER AT A MINIMUM TEMPERATURE OF 65 ^{o}C SHOULD ALSO BE AVAILABLE.

Only potable water or clean sea water should be used on prawns and on surfaceds with which the prawns might come in contact. Even if the prawns are caught in polluted waters, this water should not be used for washing prawns or for the preparation of refrigerated sea water or refrigerated brine.

3.3.6 A SYSTEM ENABLING INJECTION OF CHLORINE INTO THE LINES OF SEA WATER WHICH IS USED IN THE PROCESSING OF PRAWNS OR FOR CLEANING THE VESSEL SHOULD BE PROVIDED WHERE PRACTICABLE.

It has been established in the fish processing industry that the injection of chlorine into a supply of cold water used for general wash-up helps to control microbial contamination.

3.3.7 WHERE BAIT IS CARRIED, IT SHOULD BE HELD IN SUCH A MANNER THAT IT WILL NOT CONTAMINATE THE CATCH.

On vessels which carry bait, a separate confined space or special container should be set aside for bait storage. The bait could be held well protected and away from the catch.

The ice used for bait preservation should never come in contact with the catch.

3.3.8 THE FISHING VESSEL SHOULD BE EQUIPPED WITH BRUSHES, SCRAPERS, WATER HOSES, SPRAY NOZZLES AND OTHER SUITABLE WASHING AND DISINFECTION EQUIPMENT.

Although there is a variety of cleaning and disinfecting equipment available on 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 mg/kg 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 good brush, alternately, brightly-coloured plastic scouring pads might be used.

The use of high-pressure and high-frequency oscillating water or detergent-spraying equipment have been found to be quite effective in cleaning, but it usually requires an experienced operator to prevent damage to painted surfaces.

3.3.9 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 PURPOSES.

Extreme caution must be exercised to prevent poisonous or harmful materials from contaminating the raw material. All such materials should be prominently and distinctly labelled so that there can be no confusion between these and the 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.

3.4 Equipment and utensils

3.4.1 ALL CONTAINERS USED FOR STOWING ICE OR RAW MATERIAL SHOULD BE OF UNIFORM AND SUITABLE SIZE, EASY TO HANDLE WHEN LOADED AND SHOULD BE CONSTRUCTED OF SUITABLE CORROSION-RESISTANT MATERIAL.

Such containers, when fully loaded, should be easy to handle by one or two men without tilting, tipping or jerking.

The use of wooden boxes should be discouraged but if used, they should be of a smooth construction and of durable, non-toxic and waterproof finish.

Baskets which are difficult to clean and disinfect should not be used for handling raw material on board the vessel or on shore.

3.4.2 ALL STORAGE, HANDLING, CONVEYING, PROCESSING AND FREEZING EQUIPMENT USED ON BOARD FISHING VESSELS SHOULD BE DESIGNED FOR RAPID AND EFFICIENT HANDLING OF RAW MATERIAL, BE SUITABLE FOR EASY AND THOROUGH CLEANING AND BE CONSTRUCTED SO AS NOT TO CAUSE CONTAMINATION OF THE PRODUCT.

When obtaining equipment, only those which can be readily dismantled for thorough cleaning should be considered.

3.4.3 TABLES OR CONVEYERS USED FOR SORTING AND GRADING OF RAW MATERIAL SHOULD BE CONSTRUCTED AND LOCATED SO AS TO PROTECT THE RAW MATERIAL FROM THE DRYING EFFECTS OF SUN AND THE WIND.

It is essential to prevent the temperature of the prawns from rising. The drying effect of wind will lower the quality of prawns by changing their appearance.

3.4.5 COOKERS SHOULD BE DESIGNED TO PROVIDE CONSTANT AND ADEQUATE SUPPLY OF HEAT SO THAT ALL RAW MATERIAL COULD BE GIVEN THE SAME TIME/TEMPERATURE EXPOSURE DURING COOKING OPERATIONS.

Cooking, or any other heat treatment of prawns, is a very critical process as far as the yield and quality of the final product are concerned.

Cookers should be constructed to provide a good control of time/temperature exposure for all raw material at the maximum processing load. In the case of certain species of prawns, it might be necessary to agitate the prawns during the cooking.

It is bad practice to keep prawns in hot brine for a long time before the boiling commences. Furthermore, an inadequately fired cooker will slow down the whole operation sequence.

3.4.6 COOKERS SHOULD BE MADE OF SUITABLE CORROSION-RESISTANT MATERIAL AND BE BUILT IN SUCH A WAY THAT THEY CAN BE DRAINED AND EASILY DISMANTLED FOR CLEANING.

All parts of the cookers that come in contact with raw material should be made of suitable corrosion-resistant material. The cooker, of a conventional or continual type, should be designed to permit easy and frequent drainage and dismantling for washing and disinfection.

3.4.7 IN THE CASE OF PRAWNS, SUITABLE EQUIPMENT FOR COOLING OF COOKED PRAWNS SHOULD BE PROVIDED.

Prawns should be cooled rapidly and thoroughly either by immersion in a tank containing clean sea water or by exposure to an effective air cooling system.

The cooling tank should be of suitable corrosion-resistant material and should be designed to provide a constant change of water with good circulation. It should be located close to the cooker but in such a way that the chance of contamination with micro-organisms derived from the raw prawns is reduced to a minimum.

3.4.8 SHOVELS AND RAKES USED IN THE HANDLING OF THE PRAWNS SHOULD ALSO BE MADE OF A SUITABLE CORROSION-RESISTANT MATERIAL AND SHOULD BE KEPT CLEAN.

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

3.4.9 FREEZING EQUIPMENT SHOULD BE RELIABLE AND SUITABLE FOR FREEZING THE RAW MATERIAL.

It is most important that all freezing be carried out in an orderly manner, using equipment that is of sufficient capacity and which is suitable for the product. The freezers should have proper defrosting facilities and should be designed so that they are easy to clean. Refrigeration equipment needs to be reliable and of robust construction. It should be capable of running for long periods with little attention, and should have automatic devices for shutting down in an emergency.

3.5 Hygienic operating requirements

3.5.1 VESSEL, EQUIPMENT, UTENSILS AND OTHER FACILITIES USED IN THE HARVESTING, HANDLING AND PROCESSING OF LOBSTERS AND PRAWNS SHOULD BE KEPT IN CLEAN AND IN GOOD REPAIR.

Repairs to equipment should be made as soon as they become necessary.

All equipment and utensils should be thoroughly cleaned after each cycle of use. A cleaning schedule should be drawn up and the crew instructed to adhere strictly to it.

3.5.2 BEFORE ANY RAW MATERIAL COME ON BOARD AND BETWEEN EACH HAUL, DECKS, POUNDS, PEN BOARDS AND ALL OTHER DECK EQUIPMENT WHICH WILL COME IN CONTACT WITH THE RAW MATERIAL SHOULD BE HOSED DOWN WITH CLEAN SEA WATER AND BRUSHED TO REMOVE ALL VISIBLE DIRT AND DEBRIS.

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

It is also important to cool the surface of the deck and deck pounds by hosing them with clean cold water before the catch comes on board. During warm weather, the surface temperature of the deck may be very high.

3.5.3 ALL TUBES, TANKS, BARRELS AND OTHER EQUIPMENT USED IN HANDLING, GRADING, WASHING AND CONVEYING OPERATIONS SHOULD BE THOROUGHLY CLEANED AFTER EACH CYCLE OF OPERATIONS.

Any fish, slime or blood allowed to dry and accumulate on surfaces with which raw material come in contact, will be very difficult to remove later and will thus contaminate the subsequent loads.

3.5.4 DURING FISHING TRIPS THE VESSEL'S 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 hold. The bilge sump should be cleaned and disinfected frequently.

3.5.5 COD ENDS AND OTHER PARTS OF THE FISHING GEAR OR PRAWN TRAPS SHOULD BE FREED OF DEAD FISH, PRAWNS AND ORGANIC MATERIAL AFTER EACH HAUL. ALL GEAR SHOULD BE THOROUGHLY CLEANED WHEN FISHING HAS CEASED.

Dead fish, prawns, and organic matter left in the nets or in the traps, will decompose and contaminate subsequent catches.

3.5.6 SEA WATER WHICH HAS BEEN USED FOR COOLING ENGINES, CONDENSERS OR SIMILAR EQUIPMENT SHOULD NOT USED FOR WASHING DECK, HOLD OR ANY EQUIPMENT WHICH MIGHT COME IN CONTACT WITH THE CATCH.

The water used for cooling engines is usually at 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, if used for washing, will considerably accelerate spoilage of the raw material by raising their temperature and might impart objectionable taste, odour or undesirable discolouration.

3.5.7 ONLY POTABLE WATER CONFORMING TO SLS 614 OR CLEAN SEA WATER SHOULD BE USED FOR COOKING AND COOLING OF PRAWNS AND LOBSTERS OR PREPARATION OF BRINE IN REFRIGERATED BRINE OR SEA WATER SYSTEMS.

Prawns, lobsters or their products cooked at sea may be eaten without further heat treatment and the presence of any micro-organisms of public health significance on these products may therefore endanger the health of the consumer.

Equally dangerous is the presence of these micro-organisms on fresh or frozen raw material.

3.5.8 ALL EQUIPMENT USED IN COOKING AND COOLING SHOULD BE FREQNTLY HOSED DOWN, BRUSHED TO REMOVE ALL VISIBLE DIRT, CLEANED WITH A SUITABLE CLEANING AGENT, DISINFECTED AND RINSED THOROUGHLY.

During the cooking of raw material, impurities such as sand, clay, sea-bottom detritus, parts of raw material and coagulated proteinaceous material accumulate. These may discolour boiled products and introduce undesirable odours and flavours. Foam which is formed in dirty cooking water may harbour and protect the spores of thermophilic micro-organisms and this may cause problems duringE14 the subsequent canning (retorting).

It is important, therefore, that a thorough cleaning of the cooker, cooling tank and other associated equipment should be carried out frequently and at least once daily.

3.5.9 PERSONNEL ENGAGED IN COOKING, COOLING AND HANDLING OF COOKED RAW MATERIAL SHOULD TAKE ALL THE NECESSARY PRECAUTIONS NOT TO CONTAMINATE THE COOKED PRODUCT WITH MICRO-ORGANISMS WHICH MIGHT CAUSE SPOILAGE OR CONSTITUTE A PUBLIC HEALTH HAZARD.

Prawns in particular, when removed from the cooker are practically free from living micro-organisms. Recontamination commences during cooling and increases progressively during further handling. As prawns cooked at sea are frequently eaten without additional heat treatment, contamination of the product with micro-organisms of public health significance is dangerous and contamination with spoilage organisms will reduce the potential shelf-life of the product. Workers engaged in cooking, cooling or handling of prawns at sea should maintain the same high degree of personal cleanliness as workers in processing plants. If the same workers handle the raw as well as cooked prawns, precautions should be taken to prevent contamination of cooked prawns from the raw material.

3.5.10 ADEQUATE PRECAUTIONS SHOULD BE TAKEN TO ENSURE THAT HUMAN AND OTHER WASTES FROM THE FISHING VESSEL ARE DISPOSED OF IN SUCH A MANNER SO AS NOT TO CONSTITUTE A PUBLIC HEALTH HAZARD.

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 into shell-fish growing areas, should not be practised.

3.5.11 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.

Left over raw material, slime and unused fish that are left on the deck will support multiplication of micro-organisms which may contaminate future catches. If allowed to dry, slime, blood and scales are very difficult to remove.

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

3.5.12 IMMEDIATELY AFTER THE CATCH IS LANDED, THE FISH-HOLD AND BILGE SUMP SHOULD ALSO BE EMPTIED COMPLETELY. ALL SURFACES IN THE HOLD, POUND BOARDS AND SUMP SHOULD BE THOROUGHLY CLEANED WITH A SUITABLE CLEANING AGENT, DISINFECTED AND RINSED.

This is necessary to remove all fish or prawns, slime, blood and other residues as soon as the catch is landed, in order to avoid multiplication of micro-organisms, building up of offensive odours and the drying of residues on the hold or other surfaces. Cleaning should be completed before fresh ice is taken on board for the next trip.

3.5.13 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 subsequently contaminate the new catch. When vessels are taking ice to sea, only fresh, clean ice should be taken on aboard at the beginning of each voyage.

3.5.14 WHEN CLEANING AND HOSING OPERATIONS ARE CARRIED OUT WHILE THE VESSEL IS IN PORT, ONLY POTABLE WATER OR CLEAN SEA WATER SHOULD BE USED.

Cleaning water should be free from contamination in amounts harmful to man. The total number of micro-organisms in it should be low, and it should not contain any micro-organisms of public health significance. Contamination of the raw material by water-borne micro-organisms and undesirable substances will result in loss of quality and might create a health hazard.

Habour water is usually heavily polluted and should never be used for cleaning purposes. This is also true for sea water in the close vicinity of towns, villages, industrial plants, fish-processing establishments and factory ships.

3.5.15 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 the raw material. 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 raw material.

In choosing and applying 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, type of soil or dirt and mode of application, are some of the factors that will determine the usefulness of the cleaning agent. Different agents should not be combined since one agent may neutralize the activity of another.

3.5.16 EMPTY VESSEL HOLDS OR STORAGE TANKS USED FOR RAW MATERIAL 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.

3.5.17 IN THE CASE OF PRAWNS, IN VESSELS USING REFRIGERATED SEA WATER OR REFRIGERATED BRINE SYSTEMS FOR HOLDING, CHILLING OR FREEZING 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 the buildup and sread of infection from one tank to another.

Immediately after unloading and while 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 and rinsed with warm and cold potable water or clean sea water.

All pumps, pipes and heat exchangers should be thoroughly flushed with clean cold potable water or clean cold sea water, followed by circulating through the system, either a hot alkaline solution or cold water to which a strong cleaning agent has been added. After rinsing with potable water or 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 the tanks are filled with prawns.

3.5.18 WHERE REFRIGERATED SEA WATER IS USED FOR HOLDING OR CHILLING OF PRAWNS, 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 and 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.

3.5.19 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 the raw material. Fishing vessel should be regularly examined for evidence of infestation and when required, effective control measures should be taken.

3.5.20 VESSELS MOORED TO DOCKS FOR MORE THAN TWO HOURS SHOULD, WHERE NECESSARY, HAVE RODENT GUARD DEVICES ATTATCHED 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.

3.5.21 DOGS, CATS AND OTHER ANIMALS SHOULD BE EXCLUDED FROM AREAS OF THE VESSEL WHERE THE RAW MATERIAL IS RECEIVED, HANDLED, PROCESSED AND STORED.

Because of public health hazards, no surface of the fishing vessel and of the equipment therein which comes in contact with the raw material, should be exposed to contamination with animal hair or excreta.

3.5.22 FOOD SUPPLIES FROM THE VESSEL'S KITCHEN OR FOR THE CREW'S MESS SHOULD NEVER BE STORED IN ICE BINS WHERE THE CATCH IS KEPT.

Storage of such materials in ice intended for the catch might contaminate the ice and also the catch.

3.6 Handling the catch on board

3.6.1 *General considerations*

3.6.1.1 DURATION OF THE TRIP OF A CATCHING VESSEL SHOULD BE DETERMINED BY THE FACILITIES AVAILABLE ON THE VESSEL FOR HANDLING AND KEEPING THE CATCH WELL CHILLED OR FROZEN, DISTANCE FROM THE PROCESSING PLANT OR MARKETS AND THE LOCAL ENVIRONMENTAL CONDITIONS.

From the time the catch is caught, there is a continual and irreversible deterioration in quality. The progress and degree of such deterioration are governed mainly by the time the raw material is held and the temperature at which it is handled and stored on board the fishing vessel. With short distances from the processing plant or market, more time might be spent on the fishing grounds providing the boat is equipped with adequate facilities to handle, effectively chill and hold the catch at a low temperature. With more distant fishing grounds, proper freezing and freezer storage facilities should be provided.

3.6.1.2 THE TIME OF TRAWLING SHOULD BE KEPT SHORT.

The time of trawling depends on factors such as the depth of the trawl, condition of the sea bed, the size of the catch, species of the catch and the incidence and kind of the by-catch.

A large amount of by-catch, mud and other sea-bottom material caught in the net, will exert a considerable pressure on the prawns during the trawling. The longer the time of drag, the more extensive will be the damage caused to prawns by crushing and breaking.

A trawling time of short duration results in better quality prawns and gives the crew more time for the proper handling of the catch.

3.6.1.3 IT IS OFTEN ADVISABLE TO TOW THE NET FOR A SHORT TIME NEAR THE SURFACE PRIOR TO BRINGING THE CATCH ABOARD THE VESSEL.

The net, after being brought to the surface, may be towed for a short time behind the boat to wash away mud, sand and other sea-bottom detritus.

However, as the temperature of the surface water can be considerably higher than that of the deeper water where the prawns are caught, a prolonged exposure of the catch to these higher temperature will result in increased spoilage.

3.7 Handling

3.7.1 AS SOON AS THE CATCH IS BROUGHT ABOARD THE VESSEL, IT SHOULD BE SEPARATED FROM THE BY-CATCH.

Other fish are usually caught in addition to prawns and, where the by-catch forms a large proportion of the total catch, sorting may take a long time. The longer prawns are left without being washed and iced, the more rapidly they will deteriorate.

3.7.2 PRAWNS SHOULD NOT BE TRAMPLED UNDERFOOT AND SHOULD NOT BE PILED DEEPLY ON DECK.

Any physical damage, whether by crushing or breaking, assists in spoilage and reduces the value of the prawns.

3.7.3 ALL PRAWNS ON DECK SHOULD BE PROTECTED FROM SUN, FROST, AND THE DRYING EFFECTS OF WIND.

It is essential to prevent the temperature of the prawns 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 awaning, ice, or even a wet, clean canvas or burlap. One method to shade the deck area where the catch is held, is with a raised white tarpaulin attached to a topping line and stayed at the corners. This also protects the catch from engine fumes and the faeces of birds.

If the vessel is undecked, then a clean container, preferably insulated and lidded, should be provided for the protection of the catch.

3.7.4 AFTER SORTING, PRAWNS SHOULD BE WASHED THOROUGHLY WITH CLEAN SEA WATER AND CHILLED QUICKLY.

Prawns should be washed to remove sediment and where possible should be graded for size.

3.7.5 HEADING OF PRAWNS SHOULD BE CARRIED OUT WHENEVER PRACTICABLE.

The greater part of then normal bacterial load is believed to be in the head (cephalothorax). Removal of the cephalothorax of prawns at sea will reduce the bacterial load and also be more economical for icing and storage space.

3.8 Stowage of fresh prawns

3.8.1 PRAWNS, UNLESS COOKED OR PARBOILED IMMEDIATELY AFTER CATCHING, SHOULD BE CHILLED RAPIDLY IN MELTING IC E OR IN REFRIGERATED SEA WATER OR BRINE AND SHOULD BE STOWED SO THAT THE TEMPERATURE DOES NOT RISE.

Temperature is the most important single factor influencing the keeping quality of fresh prawns.

The effects of increasing temperature are cumulative; that is, some potential keeping time is lost each time the temperature of the prawns rises. The extent of this loss depends both on the degree of rise and the length of time the prawns remain at the higher temperature. It is, therefore, important to chill the catch quickly to the temperature of melting ice and to maintain it in a chilled condition until it reaches the processor or the market.

3.8.2 PRAWNS IN ICE SHOULD BE STOWED IN SHALLOW LAYERS.

Prawns can lose considerable weight when stowed in a deep pile. In bulk stowing, the prawns should be well mixed with finely divided ice or iced in layers which are not excessive in depth. Adequately shelved holds, or pens, or proper containers, should be used for this purpose. Chilling of prawns in bulk by top icing alone should be avoided.

3.8.3 PRAWNS SHOULD BE SURROUNDED BY ADEQUATE QUANTITIES OF ICE.

Ice is necessary, not only to cool the prawns, but to maintain them in a cool condition. There should be enough ice to cope with any heat leaking into the fish room. If, at the end of a voyage, prawns are no longer surrounded by ice, then insufficient ice has been used. It is difficult to lay down precise quantities required, but icing should be heaviest against ship sides and bulkheads. In warm waters it will be necessary to use more ice than in colder climates, and this will also depend on whether the hold is insulated. The correct quantities of ice required should be worked out for individual vessels by trial and error.

3.8.4 FINELY DIVIDED ICE SHOULD ALWAYS BE USED.

This gives close contact with the prawns, reduces damage by crushing and gives rapid cooling.

3.8.5 **WHERE BOXES ARE USED FOR STOWING PRAWNS THEY SHOULD BE PROPERLY ICED AND NOT OVERFILLED.**

It is sometimes an advantage to pack prawns with ice into boxes at sea. The prawns, if adequately iced, can remain undisturbed in the boxes until they reach the processor or the market. Unloading the catch can be simpler and, if required, ice can be added to the boxes on landing without disturbing the prawns.

The daily catch can also be separated more easily. Since boxes are stacked one on top of another in the hold, overfilling will result in damage to the prawns. For efficient cooling, each box should contain a layer of ice on the bottom, then some prawns and ice mixed together, and lastly a top layer of ice. Boxing should not be mixed with other methods of stowage during the same trip.

3.8.6 **A STOWAGE PLAN SHOULD BE KEPT ON ANY VESSEL FISHING FOR MORE THAN A DAY OR TWO.**

A well prepared stowage plan enables the different catches to be kept separate when unloading. Prawns from different day's catches should never be mixed together when stowed.

3.8.7 **IF REFRIGERATED SEA WATER OR BRINE IS USED FOR CHILLING OR STOWING OF FRESH PRAWNS, CHILLING SHOULD BE RAPID AND THE SYSTEM SHOULD BE CAPABLE OF MAINTAINING THE PRAWNS AT −1 °C.**

For the stowage and transportation of prawns it is strongly recommended that the method should be well researched under the local conditions and with the local species.

3.8.8 **NETS SHOULD NOT BE EMPTIED DIRECTLY INTO BRINE OR REFRIGERATED SEA WATER TANKS.**

If the unwashed and unsorted catch is emptied directly into the tanks, the prawns become contaminated and the proper functioning of the system may be endangered.

3.9 Cooking and cooling

3.9.1 **COOKING AND PARBOILING OF PRAWNS IS A VERY CRITICAL OPERATION AND SHOULD BE CONTROLLED CLOSELY.**

Cooking or parboiling of prawns aboard the fishing vessel should be conducted in the same way as in shore procesing plants (see 9.3 of this code).

3.9.2 **WHEN PRAWNS ARE COOKED AT SEA THE OPERATION SHOULD BE CARRIED OUT WITH MINIMUM DELAY.**

The best quality and the highest yield are usually obtained when prawns are cooked immediately after catching.

However, for species such as *Pandalus*, a delay of about 4 hours to 6 hours before cooking will prevent a tough chewy texture.

3.9.3 **PRAWNS SHOULD BE COOLED RAPIDLY IMMEDIATELY AFTER COOKING.**

The cooling may be carried out in cool potable water, cool sea water or air. The choice of cooling medium employed should be that which is most beneficial for the particular species, as some lose colour in water and others lose colour in air, while on the other hand, the shelf-life of some is extended when cooled in air. Cooling in air should be carried out in shallow trays or in air coolers specially designed for the purpose. Water cooling has been found to be effective in the removal of extraneous material from the prawns which may still remain after cooking. Care must be taken after cooking to prevent contamination.

3.9.4 **COOKED COOLED PRAWNS, WHETHER PEELED OR UNPEELED, SHOULD NOT COME IN DIRECT CONTACT WITH THE ICE OR MELTING ICE WATER DURING SUBSEQUENT STORAGE AND HANDLING.**

Rapid cooling is essential and ice is very effective for this purpose. Direct contact with ice, however, results in leaching of flavour and colour from the product.

The cooked and cooled prawns can be put into plastic bags which should be small so as to give a good rate of cooling with minimal crushing of the product.

3.10 **Food additives**

3.10.1 **IF FOOD ADDITIVES ARE TO BE USED 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.

3.10.2 USE OF SODIUM BISULFITE FOR THE PREVENTION OF "BLACK SPOT" SHOULD BE CAREFULLY CONTROLLED.

A pigmentation defect affecting the appearance known as "black spot" (melanosis) frequently appears on prawns harvested from tropical or semi-tropical waters and, if very pronounced, presents a major marketing problem. Such a condition may be retarded by the proper application of sodium bisulfite or other related compounds.

The usual method is that prawns, after sorting, deheading and washing, but prior to icing, are dipped into a solution of 1.25 per cent of sodium bisulfite. The immersion should last approximately one minute and care should be taken to ensure a thorough treatment. The time of dip must be carefully controlled as too short a time will be ineffective while too long exposure will discolour the prawns. Some experimentation will be necessary to achieve the correct treatment. The dip solution should be changed as often as necessary to ensure uniform concentration and to prevent bacterial contamination. In some countries sodium bisulfite is not permitted and therefore, before using it the advice of the official agency having jurisdiction should be sought.

Ascorbic acid has also been reported to be effective in preventing "black spot" if used as a dip in a concentration up to 1 per cent.

3.11 Freezing and freezer storage

3.11.1 FREEZING AND FREEZER STORAGE OF PRAWNS ABOARD THE FISHING VESSEL SHOULD FOLLOW THE RECOMMENDATIONS OUTLINED IN CLAUSE 7.

3.11.2 PRAWNS SHOULD PREFERABLY BE FROZEN IN BLOCKS RATHER THAN INDIVIDUALLY OR IN BULK.

Block frozen and glazed prawns are less vulnerable to desiccation, oxidation and physical damage than individually frozen ones and require less freezer storage space. If prawns are packaged at sea into consumer packs before freezing, it is necessary to weigh the correct amounts to avoid the need for repacking on shore. It is essential to ensure that the blocks are completely frozen as serious loss can occur otherwise.

3.11.3 PRAWNS FROZEN AT SEA SHOULD BE KEPT IN A PROPERLY DESIGNED COLD STORE WHILE ABOARD AND SHOULD BE PROTECTED FROM DEHYDRATION.

Frozen prawns should be glazed as soon as possible after freezing or should be protected in some other manner against dehydration.

3.12 Handling of lobsters on board

3.12.1 *Holding live lobsters*

3.12.1.1 LIVE STORAGE IS STRONGLY RECOMMENDED FOR PRODUCTION OF HIGH QUALITY PRODUCTS.

Lobsters can be held alive either on board vessels or at shoreside establishments in tanks, wet wells or floating cages. They can also be held for short periods in air in clean weave bags. Live storage is not practicable in all fisheries and therefore other methods of storage involving part-processing on board should be considered, eg. tailing and chill storage of the tails. These storage methods should also be used in fisheries where the lobsters are killed during catching such as spearing (through the thorax only) or by trawling.

3.12.1.2 SPECIES WHICH MUTILATE EACH OTHER SHOULD HAVE THE CLAWS BANDED AS SOON AS POSSIBLE AFTER CATCHING.

Cutting sinews or driving pegs into the claws should be avoided as this will weaken the lobster and make it vulnerable to infection.

3.12.1.3 LIVE LOBSTERS SHOULD BE HELD AT AS LOW A TEMPERATURE AS PRACTICABLE, BUT NOT BELOW 4 °C.

3.12.1.4 STORAGE TIMES AND STOCKING DENSITY SHOULD BE CONTROLLED.

Holding tanks are regarded as a better method of storage for long-term handling than well storage. In some fisheries lobsters are kept in tanks for six weeks.

In either method, lobsters should not be tightly packed and it is recommended that in a well, horizontal divisions should be not less than 700 mm apart. On the other hand, very loose packing in wells or tanks will permit the lobsters to damage each other.

Lobsters stored in bags should be tightly packed to prevent movement and damage. Maximum weight of bag must be determined for each fishery.

Bags cannot be recommended for storage over 24 hours, but where used, they should be thoroughly clean and of open weave construction. Slime or mud in the weave of the bag will cause rapid suffocation of the lobsters. Bags should not be stored at high humidity and should be kept dry to keep the lobsters inactive. The use of clean hessian or jute bags is preferred. In some fisheries, bags made of woven synthetic material have been found to cause excessive mortality.

3.12.1.5 LOBSTERS SHOULD NOT BE EXPOSED TO STRONG SUNLIGHT, WIND OR EXTREME TEMPERATURE.

Exposure will cause rapid drying of the gills. When the gills dry the lobsters cannot breathe and therefore die quickly. A temperature of between 4 ^{o}C and 10 ^{o}C is recommended. In the inshore fishery this may be achieved by the use of holding tanks with circulating sea water. The practice of using wetted canvas to cover the crates is followed in some areas.

3.12.1.6 WHERE APPROPRIATE A STOWAGE PLAN SHOULD BE KEPT ON ANY VESSEL FISHING LIVE LOBSTERS FOR MORE THAN A DAY OR TWO.

A well prepared stowage plan enables the various day's catches to be kept separate when unloading. Lobsters from different day's catches should never be mixed together when stowed.

3.12.1.7 LOBSTERS SHOULD BE UNLOADED CAREFULLY AND ANY DEAD OR UNHEALTHY LOBSTERS SHOULD BE REMOVED AND DISCARDED.

This requirement applies in bringing lobsters on board or during the unloading of vessels. Excessive handling inevitably leads to increased mortality.

3.13 Handling of lobsters killed on catching

3.13.1 WHEN LOBSTERS ARE NOT LANDED ALIVE, THE TAIL (ABDOMEN) AND CEPHALOTHORAX SHOULD BE SEPARATED AFTER CATCHING.

This should be done as soon as they are brought on board. Whole lobsters which have died or have been killed deteriorate rapidly. They can easily be identified, even after cooking, by brown discolouration and soft texture of the butt end of the tail, formation of black spot between the segments and a condition known as "drop tail" or "loose neck".

3.13.2 ALL LOBSTERS SHOULD BE STORED OR PROCESSED AS SOON AS POSSIBLE.

The intestinal tract of the whole uncooked lobsters breaks down within hours of death and releases potent digestive enzymes oer the butt end of the tail causing rapid autolysis.

3.13.3 TAILS SHOULD BE REMOVED IN A MANNER OUTLINED UNDER 10.3 OF THIS CODE.

The spoilage rate of properly cleaned and deveined tails is substantially lower than that of whole dead lobsters.

3.14 Freezing at sea

3.14.1 FREEZING AND FROZEN STORAGE ON BOARD VESSELS SHOULD BE CARRIED OUT IN ACCORDANCE WITH THE RECOMMENDATIONS SET OUT IN THIS SECTION AND ALSO IN ACCORDANCE WITH CLAUSE 7.

The hygienic requirements on board vessels should be just as high as those required in shore processing plants.

3.14.2 TAILS SHOULD PREFERABLY BE FROZEN IMMEDIATELY.

Optimum quality can be maintained by immediate freezing after tailing. This can be accomplished on board in properly designed vessels.

3.14.3 FIRST CAUGHT LOBSTERS SHOULD BE FROZEN FIRST.

The sequence of operations should ensure that lobsters caught and processed earlier do not accumulate while subsequent catches are being frozen.

3.14.4 THE FREEZING PLANT SHOULD BE ADEQUATE TO DEAL WITH THE NORMAL CATCHING RATES OF THE VESSEL, SO THAT LOBSTER ARE NOT HELD FOR LONG PERIODS PRIOR TO FREEZING.

Lobsters are best frozen soon after capture. It is very important to maintain all raw material in a chilled condition prior to freezing. Delays in freezing may have serious effects on the quality and appearance of the thawed product.

3.14.5 FROZEN LOBSTERS AND LOBSTER PRODUCTS SHOULD BE STORED ON BOARD THE VESSEL AT TEMPERATURES APPROPRIATE FOR THE SPECIES AND END-PRODUCT.

It should be borne in mind that although frozen lobsters may only be stored for relatively short periods aboard the ship, the frozen products may be stored for much longer periods ashore. Deterioration during the initial storage at sea cannot be corrected by later storage at a lower temperature. It is thus recommended that storage aboard fishing vessels be at the temperature needed to retain the intrinsic quality during the envisaged storage period but it should be at -18 ^{o}C or lower.

3.15 Icing on board

3.15.1 IF IT IS NOT POSSIBLE TO FREEZE ABOARD THE VESSEL THE TAILS SHOULD BE CHILLED QUICKLY TO THE TEMPERATURE OF MELTING ICE AND MAINTAINED IN A CHILLED CONDITION UNTIL THEY REACH THE PROCESSOR OR THE MARKET.

Temperature is the most important single factor influencing the keeping quality of fresh lobsters.

The effects of increasing temperature are cumulative; that is, some potential keeping time is lost each time the temperature of the lobsters rises. The extent oi this loss depends both on the degree of rise and the length of time lobsters remain at the higher temperature.

3.15.2 LOBSTERS IN ICE SHOULD BE STOWED IN SHALLOW LAYERS.

In bulk stowing, the lobsters should be well mixed with finely divided ice or iced in layers in depth not greater than 1 metre. Adequately shelved holds, or pens or proper containers, should be used for this purpose.

3.15.3 LOBSTERS SHOULD BE SURROUNDED BY ADEQUATE QUANTITIES OF ICE, CHILLING OF LOBSTERS IN BULK BY TOP ICING ONLY IS NOT SUFFICIENT.

See 3.8.3.

3.15.4 FINELY DIVIDED ICE SHOULD BE USED.

This gives close contact with the lobsters, reduces damage by crushing and gives rapid cooling.

3.15.5 WHERE BOXES ARE USED FOR STOWING LOBSTER TAILS THEY SHOULD BE PROPERLY ICED AND NOT OVERFILLED.

It is sometimes an advantage to pack lobster tails with ice into boxes at sea. The lobster tails, if adequately iced, can remain undisturbed in the boxes until they reach the processor or the market. Unloading the catch can be simpler and if required, more ice can be added to the boxes on landing without disturbing the lobsters.

The daily catch can also be separated more easily. Since boxes are stacked one on top of another in the hold, overfilling will result in damage to the lobsters. For efficient cooling, each box should contain a layer of ice on the bottom, then lobsters and ice mixed together, and lastly a top layer of ice. Boxing should not be mixed with other methods of stowage during the same trip.

3.15.6 STORAGE IN REFRIGERATED SEA WATER IS NOT RECOMMENDED FOR LOBSTER TAILS.

Excessive salt penetration into the muscle will take place rapidly. However, refrigerated sea water systems can be used for rapid pre-cooling before freezing or storage in ice.

4 UNLOADING AND TRANSPORT OF THE CATCH

4.1 Suitable landing areas should be provided.

Landing of lobsters and prawns directly on beaches or uncontrolled areas can lead to contamination. Provision of wharf, quay or pier is mot desirable.

Landing areas should be kept clean.

Refluelling and handling of fuel, lubricants and other material which might contaminate the catch should be done in areas separate from the places where the catch is unloaded. It should be the specific responsibility of an individual to keep the unloading areas clean.

4.2 UNLOADING FACILITIES SHOULD EITHER BE PROVIDED ON THE WHARF OR INCORPORATED ON THE VESSEL. THESE SHOULD ENABLE THE CATCH TO BE TRANSFERRED SMOOTHLY AND WITHOUT DAMAGE.

4.3 CONTAINERS USED FOR UNLOADING SHOULD BE CONSTRUCTED OF CORROSION RESISTANT MATERIAL. THEY SHOULD BE KEPT CLEAN TO AVOID CONTAMINATION AND STRONG ENOUGH TO PREVENT PHYSICAL DAMAGE TO THE CONTENTS DURING TRANSPORT.

It is recommended that wicker baskets and wooden boxes are not used for lobsters. Live lobsters will grip any available part of the container and legs will often protrude. Care should be taken not to damage lobsters during unloading and removal from the container.

Bulk stowed prawns should be unloaded into clean containers and placed immediately in a suitable cover area. The catch should be kept chilled at all times.

4.4 RAW MATERIAL SHOULD BE CLEAN. PRAWNS SHOULD BE WASHED WITH CLEAN WATER OR CLEAN SEA WATER.

4.5 LOBSTERS AND PRAWNS SHOULD NOT BE ALLOWED TO LIE ON THE BEACH, FLOORS OR ON OTHER UNCLEAN SURFACES AND SHOULD NOT BE EXPOSED TO SUNLIGHT OR TO THE DRYING EFFECT OF THE WIND. THE USE OF CLEAN CONTAINERS AND IN THE CASE OF PRAWNS A SUFFICIENT QUANTITY OF ICE WILL INCREASE THE KEEPING TIME AND PREVENT RAPID DETERIORATION.

4.6 LOBSTERS AND PRAWNS AFTER UNLOADING SHOULD BE TRANSFERRED WITHOUT DELAY INTO TRANSPORT VEHICLES. TRANSPORT VEHICLES SHOULD PREFERABLY BE INSULATED OR REFRIGERATED TO KEEP THE CATCH COOL.

Live lobsters should be held under conditions which will prevent losses due to mortality and diseases.

4.7 Hygienic control programme

IT IS DESIRABLE THAT EACH FISHING VESSEL SHOULD DEVELOP ITS OWN SANITARY CONTROL PROGRAMME.

The fishermen should be properly trained in the use of special cleaning equipment, method of dismantaling equipment for cleaning and should be knowledgable of the significance of contamination and hazards involved.

5 PLANT CONSTRUCTION AND LAY OUT

5.1 General considerations

5.1.1 DE-HEADING AND PEELING CENTRES FOR PRAWNS AND PRAWN PROCESSING PLANTS SHOULD BE SPECIALLY DESIGNED FOR THE PURPOSE.

5.1.2 LOBSTERS BOILING CENTRES AND LOBSTER PROCESSING PLANTS SHOULD BE SPECIALLY DESIGNED FOR THE PURPOSE.

5.2 Construction

5.2.1 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 DESIGNED AND CONSTRUCTED SO AS TO PROTECT AGAINST THE ENTRY AND HARBOURING OF INSECTS, BIRDS OR OTHER VERMIN, AND TO PERMIT READY AND ADEQUATE CLEANING.

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

National or local authorities should always be consulted with regard to building codes, hygienic requirements of the operation and sanitary disposal of sewage or plant waste.

Prior to the construction of a new plan or modification of the existing one, a proper flow pattern of operation should be considered (see annex C). Only a well organized work flow will assure the maximum efficiency of the operation and a better quality product.

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

5.2.2 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 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.

Junctions between the floors and walls should be impervious to water and, if possible, should be curved 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.

5.2.3 DRAINS SHOULD BE OF AN ADEQUATE SIZE, SUITABLE TYPE, EQUIPPED WITH TRAPS AND WITH REMOVABLE GRATINGS TO PERMIT CLEANING.

Suitable and adequate facilities are essential for the removal of liquid or semi-liquid wastes from the plant. There should be no 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 provided with a deep seal trap which is accessible and easy to clean.

Drainage lines carrying waste effluent should be properly vented, have minimum internal diameter of 100 mm and if required, run to a catch basin for removal of the 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 approved by the local authorities having jurisdiction.

5.2.4 INTERNAL WALLS SHOULD BE SMOOTH, WATERPROOF, RESISTANT TO FRACTURE, LIGHT COLOURED AND READILY CLEANABLE.

Acceptable material for finishing walls inside are cement render, ceramic tiles, various kinds of corrosion-resistant metallic sheeting, such as stainless steel or aluminium alloys and a variety of non-metallic sheetings which have adequate impact resistance, desirable surface qualities and are easily repairable.

All sheeting joints should be sealed with a mastic or other compound resistant to hot water and cover strips should be applied where necessary.

Wall-to-wall and wall-to-floor junctions should becovered 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 100 mm from the wall to allow for adequate cleaning and prevention of insect harbourage.

5.2.5 WINDOW SILLS SHOULD BE KEPT AT A MINIMUM SIZE, BE SLOPED TOWARDS THE PROCESSING AREA AT 45 ° AND BE AT LEAST 1 METRE FROM THE FLOOR.

Window sills and frames should be made of smooth, waterproof 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 fitted with permanently closed panes and those which open shall be screened. The screens should be constructed so as to facilitate easy cleaning.

5.2.6 ALL DOORS, THROUGH WHICH PRAWNS AND LOBSTERS OR THEIR PRODUCTS ARE MOVED, SHOULD BE SUFFICIENTLY WIDE, WELL CONSTRUCTED OF A SUITABLE MATERIAL AND SHOULD BE OF A SELF-CLOSING TYPE AS FAR AS POSSIBLE.

Doors through which prawns and lobsters or their products are moved, should be either sheeted with or made of a non-corrodible metal or other suitable material with adequate impact resistance.

Both the doors and the frame 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 easy cleaning.

5.2.7 CEILINGS SHOULD BE DESIGNED, CONSTRUCTED AND FINISHED SO AS TO PREVENT ACCUMULATION OF DIRT AND MINIMIZE CONDENSATION, MOULD DEVELOPMENT, FLAKING AND SHOULD BE EASY TO CLEAN.

Ceiling should be at least 3 metres in height, free from cracks and open joints and should be of 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, provided 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 prawns and lobsters and their products from falling debris, dust or condensate.

5.2.8 A MINIMUM ILLUMINATION OF 200 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 (including fluor escent tubes) and fixtures suspended over the working areas where prawns and lobsters or their products are handled at any stage of preparation should be of the safety type, or otherwise protected to prevent food contamination in case of breakage.

It is desirable to have the light fixtures either recessed flush with the ceiling or with the upper surfaces of the light fixtures fitting flush with the ceiling to prevent accumulation of dust on them.

5.2.9 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, vapour or contaminating aerosols. Good ventilation is important to prevent condensation and growth of mould in overhead structures.

Ventilation openings should be screened and if required, equipped with proper air filters. Windows which open for ventilation purposes should be screened. The screens should be made so as to facilitate easy cleaning.

5.3 Sanitary facilities

5.3.1 AREAS WHERE RAW MATERIAL IS RECEIVED OR STORED SHOULD BE SEPARATED FROM AREAS IN WHICH PREPARATIONS OR PACKAGING ARE CONDUCTED SO AS TO PRECLUDE CONTAMINATION OF THE FINISHED PRODUCT.

Separate rooms, or well defined areas of adequate size, should be provided for,

a) receiving and storing raw materia; and
b) operations like deheading, washing, cooking, peeling or other processing and packaging.

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

The food handling areas should be completely divorced 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 prawns and lobsters or their products from deterioration and contamination.

5.3.2 A SEPARATE REFUSE ROOM OR 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 precuations should be taken to protect it against rodents, birds, insects and exposure to warm temperature.

A separate refuse room for storing waste in water-tight containers or offal bins should be provided. The walls, floors and ceiling of such bins, should be constructed of impervious material which can be readily cleaned. If waste material is held in containers outside the establishment, the containers should be lidded. If containers are used in large numbers, a mechanical washing plant may be advisable to provide for routine washing. Containers should be capable of withstanding repeated exposure to normal cleaning process.

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

5.3.3 ANY BY-PRODUCT PLANT SHOULD BE ENTIRELY SEPARATE FROM THE PLANT WHICH IS PROCESSING MATERIAL 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 of contamination of lobsters, prawns or their products.

5.3.4 AN AMPLE SUPPLY OF COLD WATER OF POTABLE QUALITY, COMPLYING WITH THE REQUIREMENTS OF SLS 614 SHOULD BE AVAILABLE AT NUMEROUS POINTS UNDER ADEQUATE PRESSURE THROUGHOUT PREMISES AT ALL TIMES DURING THE WORKING HOURS.

All water available for use in those parts of the establishment where lobsters and prawns are received, held, processed, packaged and stored should be potable water and should be supplied at a pressure of not less than 1.4 kg/cm^2.

5.3.5 THE COLD WATER SUPPLY USED FOR CLEANING PURPOSES SHOULD BE CHLORINATED ALLOWING THE RESIDUAL CHLORINE CONTENT OF THE WATER TO BE VARIED AT WILL IN ORDER TO REDUCE THE NUMBER OF MICRO-ORGANISMS AND PREVENT THE BUILDING UP OF BAD ODOURS.

The residual chlorine levels should be maintained as given in Table 1.

Water used for washing or conveying of raw materials should not be re-circulated unless it is restored to a level of potable quality conforming to SLS 614.

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 hygiene problems. Indiscriminate use of chlorine cannot compensate for unhygienic conditions for processing plant.

TABLE 1 - Recommended residual chlorine levels

	Application	Residual chlorine content mg/kg
i	Washing of prawns	5
ii	Washing of equipment and utensils	200
iii	Cleaning of floor	200

5.3.6 ICE USED SHOULD BE MADE POTABLE WATER CONFORMING TO SLS 614 AND SHOULD BE MANUFACTURED, HANDLED AND STORED SO AS TO PROTECT IT FROM CONTAMINATION. CARE MUST BE TAKEN TO ENSURE THAT ICE USED TO CHILL PRAWN OR LOBSTER PRODUCTS DOES NOT CONTAMINATE THEM.

Ice used in the operation of the prawn or lobster processing establishments should be made from potable water conforming to SLS 614. A special room or other storage facility should be provided to protect the ice from contamination and excessive melting. Dust, flakes of paint, bits of wood or saw dust, straw and rust are the most frequent contaminants transferable by ice into the final product. Foot traffic must be kept to a minimum.

5.3.7 WHERE A NON-POTABLE AUXILIARY WATER SUPPLY IS USED, THE WATER SHOULD BE STORED IN SEPARATE TANKS AND CARRIED IN SEPARATE LINES, IDENTIFIED BY CONTRASTING COLOUR AND WITH NO CROSS-CONNECTIONS OR BACK-SIPHONAGE WITH THE LINES CARRYING POTABLE WATER.

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

It is very important that systemsof storage and distribution of potable and non-potable water are entirely separate and there is no possibility for cross-connection or inadvertant usage of non-potable water in the processing areas.

5.3.8 ALL PLUMBING AND WASTE DISPOSAL LINES, INCLUDING THE SEWER SYSTEM, SHOULD BE LARGE ENOUGH TO CARRY PEAK LOADS AND SHOULD BE PROPERLY CONSTRUCTED.

All lines should be water-tight and have adequate deep seal traps and vents. Disposal of waste, should be effected in such a manner so as not to permit contamination of potable water supplies.

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

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.

The plumbing and manner of waste disposal should be approved by the official agency having jurisdiction.

5.3.9 PROPER FACILITIES FOR WASHING AND DISINFECTION OF EQUIPMENT SHOULD BE PROVIDED.

Facilities should be present in every lobster and prawn processing establishment for cleaning and disinfection of trays, removable cutting 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 cold water of potable quality, under good pressure, and where there is proper drainage.

Containers and equipment used for offal or contaminated materials should not be washed in the same area.

5.3.10 ADEQUATE AND CONVENIENTLY LOCATED TOILET FACILITIES SHOULD BE PROVIDED.

Adequate, suitable and conveniently located changing facilities and toilets should be provided in all establishments. Toilet should be designed to ensure hygienic removal of waste matter.

Toilet areas should be well lit, ventilated and kept in good sanitary condition at all times. They should not open directly into food handling areas.

Hand washing facilities should consist of an adequate number of wash basins with potable water conforming to SLS 614 and furnished with waste pipes leading to a drain. These basins and accessories should be kept clean and should be well maintained. A suitable hand-cleaning preparation together with suitable hygienic means of drying hands should be provided. Single-service towels such as paper towels should be provided for this purpose. Where paper towels are used, a sufficient number of dispensers or receptacles should be provided near each washing facility.

Washing facilities should be provided adjacent to the toilets and in such a position that the employee must pass them when returning to the processing area.

When hot and cold water are available, mixing taps should be provided. Taps of non-hand operable types are desirable.

Notices should be pasted 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 these facilities should be of a self-closing type and should not open directly into processing areas.

The following formula could be used as a guideline in assessing the adequacy of toilet facilities in relation to the number of employees.

01 to 09 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.

5.3.11 FACILITIES SHOULD BE AVAILABLE IN THE PROCESSING AREAS FOR EMPLOYEES TO WASH AND DRY THEIR HANDS AND IF REQUIRED, FOR DISINFECTION OF PROTECTIVE HAND COVERING.

In addition to hand washing facilities available in toilet rooms, a number of wash basins with an adequate supply of cold water of potable quality conforming to SLS 614 and soap or other similar cleaning agent should be provided whenever needed. They should be located in full view of the processing floor and should be of a type not requiring operation by hand or should be fed by a continuous flow of potable water. Single use paper towels are recommended. Otherwise the method of drying hands should be approved by the official agency having jurisdiction. The faiclities should be kept in a sanitary condition at all times.

5.3.12 STAFF AMENITIES CONSISTING OF LUNCHROOMS, CHANGING ROOMS OR ROOMS CONTAINING SHOWER OR WASHING FACILITIES SHOULD BE PROVIDED. WHERE WORKERS OF BOTH SEXES ARE EMPLOYED, SEPARATE FACILITIES SHOULD BE PROVIDED FOR EACH EXCEPT THAT THE LUNCHROOMS MAY BE SHARED. AS A GENERAL GUIDE, THE LUNCHROOMS SHOULD PROVIDE SEATING ACCOMMODATION FOR ALL EMPLOYEE AND THE CHANGING ROOMS SHOULD PROVIDE ENOUGH SPACE FOR LOCKERS FOR EACH EMPLOYEES WITHOUT CAUSING UNDUE CONGESTION. CLOTHING AND FOOTWEAR NOT WORN DURING WORKING HOURS SHOULD NOT BE KEPT IN ANY PROCESSING AREA.

5.3.13 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.

5.3.14 ALL POISONOUS MATERIALS, INCLUDING CLEANING COMPOUNDS, DISINFECTANTS, SANITIZERS AND PESTICIDES SHOULD BE STORED IN A SEPARATE ROOM DESIGNED OR MODIFIED SPECIFICALLY FOR THIS PURPOSE.

All such materials must be prominently and distinctly labelled so that they can be easily identified.

5.3.15 ARRANGEMENTS TO SANITIZE FEET SHOULD BE PROVIDED AT THE ENTRANCES TO PROCESSING SECTIONS

Food dips with suitable disinfectants are satisfactory for this purpose. These foot dips should be large enough to prevent people from crossing over them.

6 EQUIPMENT AND UTENSILS

6.1 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, ODOUR OR TASTES, IS NON-ABSORBENT, IS RESISTANT TO CORROSION AND IS CAPABLE OF WITHSTANDING REPEATE 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 products during processing can be caused by contact with unsatisfactory surfaces. All food contact surfaces should be smooth, free from pits, crevices and loose scale, non-toxic, unaffected by salt, or other ingredients used, and capable of withstanding repeated cleaning and disinfection. Wood, could be used for cutting survfaces only when no other suitable material is available. Machines and equipment should be so designed that they can be easily dismantled to facilitate through cleaning and disinfection.

Boxes used for holding raw material should preferably be constructed of plastic or a non-corrodible material, 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 raw material. Wicker baskets should not be used for lobsters.

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

Washing tanks should be designed to provide a constant change of water with good circulation, and should have provision for drainage and easy cleaning.

Equipment and utensils used for processing inedible or contaminated materials should be identified as such and should not be used for processing of products intended for human consumption.

6.2 ADEQUATE FACILITIES SHOULD BE AVAILABLE, AT PROCESSING PLANTS, TO MAINTAIN RAW MATERIAL IN A CHILLED CONDITION. AT NO TIME SHOULD COOKED PRODUCTS BE STORED WITH UNCOOKED PRODUCTS.

Where raw material cannot be processed on arrival, or when the final product cannot be distributed soon after packing, adequate facilities are required to keep the raw materials cool. Chill rooms should not be used to cool the raw material but only to maintain them chilled after they have been cooled by ice or other means.

It is poor practice, therefore, to load the chill rooms with large quantities of raw material that were not prechilled effectively to the temperature of melting ice.

The chill room where avialable should be preferably equipped with a recording thermometer and an automatic temperature control and should be so designed that it could be kept clean.

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 or rises above 10 ^{o}C.

As the temperature requirements for the chilling of live lobsters and for the chilling of lobster products differ, separate chill rooms should be provided for these purposes.

A system of tanks through which clean sea water is pumped and aerated is recommended for short-term live storage, either in a building or in the open but covered to protect lobsters from the sun.

6.3 CRACKING BLOCKS AND MALLETS SHOULD BE CONSTRUCTED OF NON-ABSORBENT AND CREVICE FREE MATERIAL.

Cracking blocks and mallets should be constructed of a suitable corrosion-resistant material which is non-absorbent and crevice-free so that they will not become saturated with juices containing bacteria which would give rise to off-odours and be a source of contamination. Corrodible materials are objectionable because the products of corrosion may contaminate the product. Hard rubber and certain forms of plastic have been found to be suitable. These blocks and mallets should be well maintained. Wooden blocks or mallets should not be used.

6.4 TABLES AND THE CONTAINERS USED IN HAND PEELING OPERATIONS SHOULD BE CONSTRUCTED OF SUITABLE CORROSION-RESISTANT MATERIAL. THE BENCHES OR INDIVIDUAL STOOLS SHOULD ALSO BE SO CONSTRUCTED AS TO FACILITATE THEIR WASHING AND DISINFECTION.

Hand peeling of prawns is still the most common method of shelling. Often a large table is used with prawns piled in the middle and the peeling operation is done by workers surrounding the table.

All equipment connected with peeling should be constructed, designed and positioned to permit frequent and thorough cleaning and sanitizing.

6.5 THE USE OF PROPERLY DESIGNED MACHINES FOR UNLOADING, WASHING, SIZE GRADING AND SIMILAR OPERATIONS IS TO BE ENCOURAGED.

Where large quantities of prawns are processed, properly designed machines will simplify the production of prawn products in quantity, with consistently low microbial counts. 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 prawns with a minimum of delay.

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

6.6 AUTOMATED PRAWN PROCESSING LINES SHOULD BE DESIGNED AS CONTINUOUS PROCESSING UNITS WITH ALL OPERATIONS ARRANGED SEQUENTIALLY SO THAT PRAWNS COULD MOVE UNIFORMLY FAST THROUGH THE LINE WITHOUT ANY STOPPAGES OR SLOW-DOWNS.

Properly designed prawn processing lines reduce processing costs and result in a better quality final product. When the prawns are moved through the line by a conveyor, the conveyor should be provided with scrapers and spray-washers at least at its two terminal pulleys.

The processing line should be easy to dismantle for cleaning and should be constructed from corrosion-resistant material, such as stainless steel or marine grade aluminium. There should be an easy access to every part of the line.

6.7 DIP TANKS USED FOR PRAWNS 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 desirable and permissible to use such dips as anti-oxidants, bisulfites or polyphosphates, the dangers of contamination must be fully appreciated.

bacterial numbers will increase rapidly during use and this requires that the tanks be frequently and thoroughly cleaned and refilled with fresh solutions. The use of sprays instead of dips have been found by many operators as a more efficient method of treatment. It eliminates additional contamination with bacteria, provides a continuously uniform solution strength and lends itself to a better temperature control. No recirculation of the solution should be permitted unless the solution is filtered, pasteurized and cooled.

6.8 EQUIPMENT USED FOR THE COOKING OR PARBOILING OF LOBSTERS AND PRAWNS SHOULD BE LARGE ENOUGH TO HANDLE THE MAXIMUM PRODUCTION LOAD AND SHOULD BE DESIGNED TO PROVIDE CONSTANT AND ADEQUATE SUPPLY OF HEAT SO THAT THE MATERIAL IS GIVEN THE SAME TIME/TEMPERATURE TREATMENT.

The cooking or any other heat treatment is a very critical process as far as the yield and quality are concerned. To ensure the adequacy and uniformity of treatment, the equipment used should be designed to operate at the estimated maximum processing load. To protect the quality of the product, the equipment should be constructed from suitable corrosion-resistant material and should be so designed that it could be readily drained, washed and sanitized.

6.9 TABLES SHOULD BE SO CONSTRUCTED TO ENABLE EASY CLEANING OF THE TABLES AND THE AREAS BENEATH THEM.

Tables should be constructed to exclude all inaccessible points which may be omitted in establishment clean-up. Stands for workers along the processing lines should be constructed of metal. The stands should be well maintained and should be moveable or constructed so as to enable proper cleaning of the stands as well as the floor beneath.

6.10 MARKET CONTAINERS AND ALL RETURNABLE PRAWN BOXES SHOULD BE THOROUGHLY CLEANED AND TREATED WITH DISINFECTANT IMMEDIATELY AFTER EACH USE.

6.11 HEATING EQUIPMENT USED IN THE PASTEURIZATION OF PRAWNS SHOULD BE PROVIDED WITH AUTOMATIC TEMPERATURE CONTROLLING AND RECORDING DEVICES.

It is essential that time and temperature are strictly controlled during the pasteurization process. Automatic time/temperature controlling and recording devices are helpful but it is important to calibrate them properly. Accurate heating records should be kept for each lot of pasteurized prawns.

7 REFRIGERATION AND FREEZING

7.1 Freezers

FREEZING SHOULD BE EFFECTED BY THE REFRIGERATION PLANT CAPABLE OF ACHIEVING THE REQUIREMENTS OF FREEZING SET OUT IN TABLE 2.

TABLE 2 - Temperature and time requirements during processing, bulk storage and transport of quick frozen lobsters and prawns

Product	Stage	Maximum product temperature on completion or during stage, °C	Desirable product temperature on completion or during stage, °C	maximum time for completion of stage in hours
Cooked rock lobsters	Draining and cooling after cooking	7	2	4
and/or	chilled storage	7	-	36
Prawns	chilled storage	2	-	72
Quick frozen products a) Lobsters and lobster products	Intitial freezing	-5	-5	3 (from time placed in freezer)
	Total freezing	-18	-30	6
b) Prawns	Initial freezing	- 5	- 5	2(from time placed in freezer)
	Total freezing	-18	-30	6
Frozen lobster tails and prawns processed at sea and thawed for export packaging	Thawing and repacking	During 7	During -2	4
		end 0	end -5	4
All frozen products	Storage	-18	-30	-
All frozen products	Transportation	-18	-30	-
All frozen products	Loading and unloading	-18	-30	-

7.2 THE COLD STORE SHOULD BE ADEQUATE FOR THE INTENDED PRODUCTION, TIME AND TEMPERATURE OF STORAGE, DESIGNED BY AN EXPERT AND CONSTRUCTED BY CRAFTSMEN COMPETENT AND EXPERIENCED IN THIS FIELD.

The cold store should be designed taking into account the size of intended production, the type of product handled, the intended time of storage and the optimal temperature requirements.

7.3 THE FREEZING PROCESS SHOULD BE RAPID AND THE TEMPERATURE REDUCTION ADEQUATE TO AVOID QUALITY LOSSES ASSOCIATED WITH BADLY FROZEN PRODUCTS.

Slow freezing, incomplete freezing and freezing to inadequately low temperature promote changes in the flesh which adversely affect the texture, flavour and keeping time. Since these changes are minimized by quick freezing and rapid reduction of temperature for store level, an adequate freezing capacity of the freezers is necessary for production of high quality frozen products.

7.4 BLAST FREEZERS SHOULD BE LOADED IN SUCH A WAY THAT THERE IS A SUFFICIENT FLOW OF COLD AIR AROUND THE PRODUCT.

In this process, heat is transferred from the product to a cold air stream and carried to the cooling surfaces of the freezer. Adequate air circulation is essential and any obstruction to the flow of air around the product will result in poor freezing rates and variable product quality. If products are placed too close together because of overloading, cold air circulation around the individual units will be obstructed and freezing times may be greatly increased. Wrapping up the products or placing them in cartons will also slow down the rate of freezing.

7.5 ALL FREEZING PROCESSES SHOULD BE COMPLETED IN THE FREEZER BY ALLOWING THE FULL TIME FOR EACH CYCLE.

The manufacturer of the refrigeration equipment should provide all necessary information for the correct operation of the plant, including time required for each freezing cycle. If the plant is functioning properly and loading and unloading is done according to instructions, products coming out of the freezers should be properly frozen. There is always a temptation to reduce the freezing time or overfill freezers during periods of heavy catching. This should be avoided. If the freezing time is too short, the centre of the product will not be frozen, eventhough the surface may be hard. If many partly frozen products are stored, the cold store temperature may rise, placing an extra load on the refrigeration equipment and also causing temperature fluctuations that will adversely affect the quality of products in storage.

On the other hand, if products are left in the freezers long after proper freezing, freezer capacity is wasted and unnecessary delays in the freezing of the products will occur. In the case of air blast freezers or sharp freezers, there will also be quality losses due to dehydration of the product surface.

7.6 FREQUENT CHECKS SHOULD BE MADE ON THE PREASSURES AND TEMPERATURES IN THE REFRIGERATION SYSTEM TO ENSURE CORRECT OPERATION.

If frequent checks are made and records maintained, there will be few chances of the refrigerant temperature being too high or of malfunctioning of the equipment. Any defects noted should be rectified quickly. It is important to watch the temperature guages for superheating at the delivery side of the compressor and sub-cooling of the liquid before the expansion values. Sometimes, these two reading will indicate leaks of the refrigerant before occurance of any serious loss of freezer capacity.

7.7 THE TEMPERATURE OF THE COLD ROOM SHOULD BE CAREFULLY CONTROLLED TO AVOID FLUCTUATIONS.

Excessive product temperature fluctuations either in range or frequency are undesirable. Fluctuations of more than 2 ^{o}C in the freezer temperature should be avoided. Moisture transfer from the product to the colder refrigeration surfaces is accelerated as the temperature difference is increased. Consequently, fluctuations of the freezer temperature promotes dehydration of the stored products. The air velocity in the cold stores should be moderate and no higher than necessary to achieve sufficiently uniform temperature within the store.

7.8 DURING FREEZING, THE TEMPERATURE OF THE PRODUCT SHOULD BE LOWERED TO SUCH AN EXTENT THAT AFTER THERMAL EQUILIZATION, THE TEMPERATURE OF THE PRODUCT IS THAT OF THE COLD STORE OR BELOW.

Products should not be placed in frozen storage until their temperature has been brought down to that of the cold store or below.

The cold store is designed to hold products at the proper frozen storage temperature and should not be used either for freezing products or for reducing the temperatured of the frozen product to the temperature level of the cold store.

7.9 IF PARTIALLY THAWED PRODUCTS ARE RECEIVED FOR FROZEN STORAGE, THEY SHOULD BE RE-FROZEN IN PROPER FREEZING EQUIPMENT PRIOR TO THEIR STORAGE IN THE COLD STORE.

In some cases, frozen products may become partially thawed during transfer or shipment. If these products are still considered to be of acceptable quality, they should be re-frozen rapidly in a proper freezing plant.

7.10 THE PRODUCTS SHOULD BE STACKED IN THE COLD STORE SO THAT THERE IS ALWAYS A SPACE FOR COLD AIR TO CIRCULATE ALONG THE WALLS AND FLOOR.

Although distances of 50 mm to 100 mm from walls and floors are sometimes regarded as adequate, occasionally large gaps may be required. Where possible, pallet storage should be practised allowing air spaces below and around the outside to the stacked products. If this is done, then heat which might leave into the room will be absorbed by the circulating cool air instead of the product.

7.11 WHEREVER POSSIBLE, LONGEST STORED PRODUCTS SHOULD BE MOVED INTO DISTRIBUTION FIRST.

Products held in frozen storage should be clearly identified and records should be kept to prevent older stocks from being allowed to deteriorate in quality through lengthy storage while newer stocks are being passed into distribution channels. A first-in, first-out principle should be followed.

7.12 A GOOD VAPOUR SEDAL IS REQUIRED ON THE OUTSIDE SURFACES OF THE COLD STORE AND PRECAUTIONS SHOULD BE TAKEN TO AVOID DANGER OF FROST HEAVE FROM THE SUB SOIL.

7.13 THE INFLOW OF OUTSIDE AIR INTO THE COLD STORE SHOULD BE MINIMIZED AS MUCH AS POSSIBLE. WHERE A COLD STORE DOOR MUST BE OPENED FREQUENTLY THE FLOW OF AIR THROUGH THE DOOR SHOULD BE RESTRICTED BY THE USE OF AN AIR LOCK CHAMBER, A COLD AIR CURTAIN, SELF CLOSING SHUTTERS OR SOME OTHER SIMILAR DEVICE.

When a cold store door is opened to the outside atmosphere, a strong convection current will rapidly exchange the cold air in the store with warm air from outside. This is turn will raise the temperature of the store and place an additional load on the cooling equipment. The moisture brought in with the outside air will also freeze on the cooling surfaces and reduce their efficiency.

If a cold store has more than one entrainer, only one door should be open at a time, otherwise, air current may greatly increase the inflow of warm outside air.

The proper installation and use of air lock chambers, cold air curtains, self-closing shutters or similar devices will greatly reduce the flow of warm air into a cold store during loading and unloading operations.

7.14 THE RELATIVE HUMIDITY IN THE COLD STORE SHOULD BE AS HIGH AS POSSIBLE AND EXCESSIVE AIR CIRCULATION SHOULD BE AVOIDED.

The bigger the difference between the temperature of the store and the product the faster dehydration will be. The drying of products in a cold store is, however, a complex matter depending on many factors, such as movement of air, its humidity, incidental leakage of heat into the store (frequent opening of the doors), fluctuation in storage temperature and condition of the glaze or type of packaging material used for the products. Even with the best conditions of storage and packaging, frozen products will dry slowly if held too long.

7.15 PROVISION SHOULD BE MADE FOR AN EFFECTIVE AND REGULAR DEFROSTING OF THE STORE COOLING SURFACES.

All cold store cooling surfaces should be regularly defrosted in order to prevent an excessive build-up of ice or frost which could seriously affect the efficiency of the cooling system and may unnecessarily overload refrigeration equipment.

Defrosting in modern plants is done automatically while in some older installations it could be done either manually by scrapping and brushing off, or by a hot defrost.

During the defrosting operations care should be taken to prevent any frost, ice or melt water falling on to the stored products.

7.16 ALL COLD STORES SHOULD BE FITTED WITH AN ALARM DEVICE, OPERATED FROM INSIDE, SO THAT ANYONE TRAPPED INSIDE CAN OBTAIN ASSISTANCE QUICKLY.

It should always be possible to open cold store doors from within. An efficient system of signalling for aid is however necessary in case a person is trapped inside a cold store. The alarm should sound in an area of the plant where there is always someone on duty. Workers should not enter cold stores alone without advising someone else of their intention to do so.

7.17 Transport

7.17.1 ALL VEHICLES USED IN THE TRANSPORT OF FROZEN PRODUCTS SHOULD BE CAPABLE OF MAINTAINING THE LOW TEMPERATURE REQUIRED TO PRESERVE THE QUALITY OF THE PRODUCT.

Under ideal conditions the temperature of frozen products during transport should be the same as the cold store temperature. It is recommended that vehicles transporting frozen products should be capable of maintaining temperature at -18 ^{o}C or lower by means of mechanical refrigeration systems, dry ice, or liquified gases.

Frozen products should not be stacked directly against the floor, walls or roof of the carrier unless the carrier has a body of the jacketed type, but should be stacked in such a manner that cold air can circulate around the load to absorb heat which leaks into the vehicle. A minimum distance of 50 mm between the load and the vehicles floor, roof and walls is recommended.

For the purpose of effective cleaning, the vehicles transporting raw material and products should have the wall, floor and roof-linings made of a suitable corrosion resistant material with smooth and non-absorbent surfaces. Floors should be adequately drained.

Low temperature deliveries of small orders may also be made in individual insulated boxes which are packed in the cold store prior to loading for distribution.

7.17.2 CARE SHOULD BE TAKEN THAT FROZEN PRODUCTS ARE NOT EXPOSED TO HIGH TEMPERATURES DURING LOADING AND UNLOADING OF TRANSPORT VEHICLES.

Frozen products warm very quickly. The effects of any temperature fluctuations, even of short duration, are cumulative and deterimental.

The load should be assembled in the cold store on pallets, and mechanical methods of loading should be used wherever possible. It is important that the products should not be allowed to stand in non-refrigerated areas. Vehicles should be pre-cooled to 10 ^{o}C or lower prior to loading and should be equipped with devices to record temperatures during transport. Loading into and unloading from vehicles and into and from cold stores should be as fast as practicable and the methods used should minimize the rise in product temperature.

Construction of cold stores providing low temperature loading bays, with flexible connecting loading tunnels that fasten directly to the doors of transport vehicles is recommended.

7.17.3 THE OPERATION OF THE REFRIGERATION UNITS ON TRANSPORT VEHICLES SHOULD BE CHECKED FREQUENTLY EN ROUTE.

A temperature rise of the product during transport from one cold store to another to -15 ^{o}C due to unforeseen circumstances may be tolerated. Otherwise, any rise in temperature of the product higher than -18 ^{o}C should be reduced to at least this temperature without unnecessary delay.

Every frozen product transport vehicle should be fitted with a properly installed thermometer so that the temperature in the cargo space can be checked regularly without having to open doors. A record of these temperature readings should be kept for future reference. An insulation test should be carried out at regular intervals; tests every two years are recommended.

7.17.4 THE SUITABILITY OF REFRIGERATED TRANSPORT VEHICLES AND THE CARE WITH WHICH THEY ARE LOADED, OPERATED AND MAINTAINED SHOULD BE CHECKED OCCASIONALLY BY MEASURING PRODUCT TEMPERATURES AT THE BEGINNING AND END OF A JOURNEY.

Occasional checks should be made by measuring the temperature of the product at the bottom, sides and top of the load when the vehicle is being loaded and again when it is unloaded. If any excessive warming has occurred, the cause should be determined and the fault corrected.

Specially designed thermometers are used for this purpose.

8 HYGIENIC OPERATING REQUIREMENTS

8.1 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 SANITARY CONDITION.

All surfaces which come into contact with raw material should be washed down with cold potable water as frequently as necessary to ensure cleanliness. It is important that the cleaning method used will remove all residues and the disinfecting method will reduce the microbial population of the surface being cleaned. A preliminary rinse in potable cold water conforming to SLS 614, followed by a wash in water of a sufficient temperature provides for effective cleaning. An ample supply of potable 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 potable 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 in contact with the product should be rinsed thoroughly with potable 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. The use of sponges and towels to wipe table or container surfaces which come in contact with products should not be allowed (see Appendix D).

8.2 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 requirement should 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 be subsequently washed, disinfected and rinsed prior to re-use. Wherever practicable, stored containers and utensils should be covered and inverted.

8.3 ALL MACHINES USED FOR SORTING, WASHING, TAILING, COOKING, COOLING OR SIMILAR OPERATIONS SHOULD BE THOROUGHLY CLEANED AND DISINFECTED DURING REST AND MEAL BREAKS AND OTHER STOPPAGES OF WORK BEFORE RESUMPTION OF PRODUCTION.

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

8.4 RAW MATERIAL TRAPPED OR ACCUMULATED IN MACHINERY OR EQUIPMENT SHOULD BE REMOVED PERIODICALLY THROUGHOUT THE WORKING DAY.

Prawns or pieces of prawns trapped in equipment spoil rapidly and can contaminate the rest of the product. Prawns which drop on thefloor should be discarded.

8.5 ALL MACHINERY AND EQUIPMENT SHOULD BE INSPECTED BEFORE PROCESSING BEGINS TO SEE THAT THEY HAVE BEEN CLEANED AND RE-ASSEMBLED.

Dirty (soiled) surfaces and residues of the cleaning and disinfecting agents which have not been removed by rinsing will contaminate the product. It is a better practice to start with a wet line rather than with a dry surface.

Mechanical or automated equipment should be regularly checked to prevent breakdowns.

8.6 ONLY POTABLE WATER CONFORMING TO SLS 614 SHOUL BE USED FOR WASHING, COOKING, COOLING AND CONVEYING OF RAW MATERIAL.

Cooked prawns and lobsters can be eaten without further heat treatment and the presence of micro-organisms on this product could endanger the health of the consumer or reduce the shelf life of this product.

8.7 PERSOONNEL HANDLING RAW UNWASHED PRAWNS AND LOBSTERS SHOULD NOT BE PERMITTED INTO THE AREAS WHERE COOKED PRAWNS AND LOBSTERS ARE BEING PROCESSED UNLESS ADEQUATE PRECAUTIONS ARE TAKEN BY SUCH PERSONNEL TO PREVENT CONTAMINATION.

8.8 SPECIAL ATTENTION SHOULD BE PAID TO THE SANITARY CONDITION OF HAND PEELING.

Hand peeling is particularly important with cooked prawns which may be peeled at temperatures around 10 ^{o}C. The elevated temperatures and the inherent slowness of the operation and a large contact surface of the product with the workers hands, create the optimal conditions for contamination and multiplication of micro-organisms. The usual practice of palming prawns, that is; transferring handfuls of prawns from one hand to another during the process of peeling should be discouraged.

Peelers should wash their hands thoroughly before starting work and frequently thoroughout the operations.

8.9 **REMOVAL OF SOLID, SEMI-SOLID OR LIQUID WASTES FROM AREAS USED FOR UNLOADING, HOLDING AND PROCESSING OF RAW MATERIAL, 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 or processing plant, should be disposed of, as soon as possible in a way that they cannot contaminate food and water supplies or offer harbourage and breeding places for rodents, insects or other vermin.

Containers, flumes, conveyors, bins or storage bags used for removal, collection or storage of offal and other waste should be cleaned frequently with potable water containing an appropriate amount of free chlorine (see Table 1) 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.

Arrangement for the frequent removal and disposal of waste material should be approved by the appropriate official agency having jurisdiction.

8.10 **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 with chemical, biological or physical agents should be undertaken only in accordance with recommendations of the appropriate official agency having jurisdiction and/or under the direct supervision of personnel with a thorough understanding of the hazards involved such as the possibility of toxic residues being retained by the prawns and lobsters or their products.

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 light insecticutor lamps with attached collecting trays, is recommended. Insect traps should not be located directly over the processing areas and should be away from windows and doors.

8.11 ALL RODENTICIDES, FUMIGANTS, INSECTICIDES OR OTHER TOXIC SUBSTANCES SHOULD BE OF AN APPROVED TYPE AND SHOULD BE STORED IN SEPARATE LOCKED ROOMS OR CABINETS AND HANDLED ONLY BY PROPERLY TRAINED PERSONNEL.

8.12 DOGS, CATS AND OTHER ANIMALS SHOULD BE EXCLUDED FROM AREAS WHERE PRAWNS AND LOBSTERS ARE RECEIVED, HANDLED, PROCESSED OR STORED.

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

Domestic animals should not be allowed in any part of the processing establishment and there should be maintained in some conspicuous place in the establishment, a notice (as given below) painted in plain capital letters.

"ANIMAL AND BIRDS ARE NOT PREMITTED WITHIN THE PROCESSING SECTION'.

8.13 ALL PERSONS WORKING IN A PROCESSING PLANT SHOULD MAINTAIN A HIGH DEGREE OF PERSONAL CLEANLINESS WHILE ON DUTY AND SHOULD TAKE ALL NECESSARY PRECAUTIONS TO PREVENT THE CONTAMINATION OF THE PROCESSING MATERIAL OR INGREDIENTS WITH ANY FOREIGN SUBSTANCE.

All employees should wear, appropriate to the nature of their work, clean, protective clothing including a head covering and footwear, all of which 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 waterproof protective sleeves are used to cover the arms.

Gloves used in the handling of prawns and lobsters or their products should be maintained in a sound, clean and sanitary condition and should be made of an impermeable material except when incompatible with the work involved. Hands should be washed thoroughly with soap or another cleansing agent and potable water conforming to SLS 614 before commencing work, every occasion after visiting a toilet, before resuming work and whenever necessary. The wearing of gloves does not exempt the operator from having thoroughly washed hands.

Eating, smoking, chewing of tobacco or other materials and spitting should be prohibited in any part of the handling areas.

8.14 NO PERSON WHO IS SUFFERING FROM OR WHO IS A CARRIER OF ANY COMMUNICABLE DISEASE OR HAS AN INFECTED WOUND OR OPEN LESION SHOULD BE ENGAGED IN THE PREPARATION, HANDLING OR TRANSPORTATION OF PRAWNS, LOBSTERS OR THEIR PRODUCTS.

Plant management should require that any person affected with infected wounds, sores or any illness notably diarrhoea, should immediately report to the management. The management should not allow any person known to be affected with a disease capable of being transmitted through food or known to be a carrier of such disease, or while afflicted with infected wounds, sores or any illness, to work in any area of a plant in a capacity in which there is a likelihood of such a person contaminating the products with disease-causing micro-organisms.

Minor cuts and abrasions on the hands should be immediately treated and covered with a suitable waterproof dressing. Adequate first-aid facilities should be provided.

9 OPERATING PRACTICE AND PRODUCTION REQUIREMENTS FOR PRAWNS

9.1 General considerations

9.1.1 PRAWNS SHOULD BE HANDLED AND PROCESSED WITH CARE AND A MINIMUM DELAY.

Poor handling of prawns on shore can ruin the best efforts of the fishermen. If unnecessary delays occur after the prawns are landed, their quality and the keeping time can be reduced considerably. Everyone concerned should therefore exercise the greatest care and at the same time endeavour not to delay any stage in the handling, processing and distribution chain.

9.1.2 PRAWNS SHOULD BE EXAMINED IMMEDIATELY ON RECEIPT AT THE PLANT TO DETERMINE THE TEMPERATURE AND ORGANOLEPTIC QUALITIES.

Prawns stored in ice or refrigerated sea water when delivered to the plant should be close to the temperature of melting ice (0 °C).

If the temperature if higher but the prawns are otherwise acceptable, they should be chilled in the plant immediately after delivery and before processing.

Prawns frozen and stored aboard a fishing vessel should have an internal temperature close to -18 °C. It is poor practice to thaw frozen prawns by exposure to ambient temperatures during the unloading, transportation or storage on the plant premises. Thawing should be carried out in specially designed equipment and under strict control of time and temperature.

9.1.3 NO PRAWNS SHOULD BE OFFERED FOR SALE OR USED FOR FURTHER PROCESSING WHICH HAVE UNDERGONE DETERIORATION OR ANY DECOMPOSITION, OR WHICH HAVE BEEN CONTAMINATED WITH FOREIGN MATTER TO AN EXTENT WHICH HAS MADE THEM UNFIT FOR HUMAN CONSUMPTION.

Prawns should be rejected if they are known to be decomposed or to contain harmful or extraneous substances which will not be removed to an acceptable level by normal procedures of sorting and preparation. Only clean, sound, prawns should be used for further processing.

9.1.4 IF PRAWNS ARE TO BE DIPPED OR SPRAYED WITH FOOD ADDITIVES, THE ADVICE OF THE OFFICIAL AGENCY HAVING JURISDICTION SHOULD BE SOUGHT.

The use of additives or additional treatment of prawns during the processing increases their cost and therefore, should be measured against the benefits gained. 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 the other and it is essential to consider these regulations for export products.

9.2 Handling of raw prawns

9.2.1 ICED RAW PRAWNS SHOULD BE DE-ICED AND WASHED THOROUGHLY IN POTABLE WATER CONFORMING TO SLS 614 PRIOR TO PROCESSING.

Prawns should not be spilled on the ground during de-icing.

Wash water should neither be re-circulated nor re-used unless it is restored to a lev el of potable quality.

Prawns that have been de-iced for weighing should be re-iced or chilled if they cannot be processed at once.

9.2.2 PRAWNS SHOULD BE GRADED AND INSPECTED.

All collection containers used in grading should not be allowed to rest on the floor of the plant but rather should be placed on pallets or other suitable device to prevent the contamination of the prawns by water splashes from the floor. If pallets are used, they should be clean, well painted and should not be taken outside the plant.

9.2.3 WHEN "AGEING" IS REQUIRED FOR PRAWNS TO BE PEELED RAW, THIS SHOULD BE CAREFULLY CONTROLLED.

Freshly caught prawns, especially of the smaller Pandalidae species are difficult to peel. Such prawns require a controlled "ageing" by keeping them well iced from 4 hours to 18 hours to facilitate the removal of shell.

The same effect could also be attained by freezing the freshly caught prawns and thawing them later for peeling. The latter method allows for a more uniform supply of the raw material into the processing line and a better control of the quality.

9.2.4 CARE SHOULD BE EXERCISED WHEN THAWING FROZEN PRAWNS. PRAWNS SHOULD BE THAWED RAPIDLY IN PROPERLY DESIGNED EQUIPMENT PREFERABLY STAINLESS STEEL OR PLASTIC CONTAINERS. THE WATER TEMPERATURE SHOULD BE NOT HIGHER THAN 20 °C AND RECIRCULATION OF THE WATER SHOULD NOT BE PRACTISED. WATER USED SHOULD BE OF POTABLE QUALITY CONFORMING TO SLS 614.

Prior to thawing, the packaging material, such as wax cartons, should be removed so that they will not come in contact with the thawing water.

It is desirable for the exit conveyor, leading from the thawing tanks, to be equipped with a series of low velocity sprays to wash the prawns as they leave the tank. The water used for this purpose should be cold so that the prawns are chilled while being washed.

9.3 Heat processing of prawns

9.3.1 PRAWNS SHOULD BE THOROUGHLY WASHED BEFORE COOKING.

Prawns to be cooked in steam or water should be free from mud or any other detritus which might discolour the meat and impart an undesirable taste or odour.

9.3.2 COOKING OR PARBOILING OF PRAWNS SHOULD BE CARRIED OUT BEFORE FREEZING.

Prawns that are cooked after freezing lose more weight than fresh prawns and have somewhat an inferior texture.

In some occasions, depending on the species of the prawns, parboiling has been practised in order to fix the colour, induce curling of the tail, reduce breakage in handling and to eliminate some micro-organisms from the surface. The heat treatment given in parboiling is usually insufficient to render the product ready for consumption without additional cooking.

9.3.3 **TIME AND TEMPERATURE OF COOKING SHOULD BE STRICTLY CONTROLLED.**

Cooking is a critical operation. It affects the texture, colour, taste and if carelessly carried out, might result in considerable loss in weight.

Prawns may be cooked in steam or fresh water with or without the addition of salt. For species such as Pandalus, the total cooking time should not exceed three minutes to four minutes at 99 °C to 100 °C, if undesirable textural changes in the meat and unnecessary loss in weight are to be avoided. The thermal capacity of the cooker should be sufficient to bring the water to the boil, 1 minute to 2 minutes after the prawns have been added.

Cooking time should be measured from the moment the required temperature is reached. The cooking time, based on the time taken by the prawn to float, is not a suitable criterion of sufficient cooking.

It is suggested that for a new operation, an inplant experimentation should be carried out to determine the optimal conditions of cooking that will suit the local species and market preferances.

9.3.4 **PRAWNS SHOULD BE COOLED RAPIDLY IMMEDIATELY AFTER COOKING.**

Cooling should be carried out in chilled potable water conforming to SLS 614.

9.3.5 **PASTEURIZATION SHOULD BE CARRIED OUT PROPERLY IN ORDER TO BE EFFECTIVE.**

Pasteurization of cooked prawns: The partial sterilization of cooked prawns meat by heat at suitable time/temperature combinations which will reduce appreciably, the total number of micro-organisms present and destroy all those of public health significance. As it involves application of heat, further reduction in weight and undesirable changes in texture, appearance and taste could easily occur unless the technique is well researched to suit the local conditions and strictly controlled.

Pasteurization can be carried out in metal or glass containers from which the air has been evacuated or in vacuum packages and heat sealed pouches.

The process usually involves heating of packaged prawns in a water bath for an appropriate period and chilling them rapidly. Factors such as the weight and size of the containers, thickness of the prawns layer, heat conductivity of the container, presence of air or liquid inside, and the initial number of micro-organisms on the product, will determine the time and temperature of treatment.

9.4 Peeling and deveining

9.4.1 **HEADING, PEELING AND DEVEINING SHOULD BE CARRIED OUT RAPIDLY TO PREVENT CONTAMINATION AND GROWTH OF MICRO-ORGANISMS.**

These operations affect the yield as well as the quality, wholesomeness and shelf life of the product.

In hand peeling, the cost of labour increases as the size of prawns diminishes and at the same time, increases the chance of contamination. The peeling machine may allow for a rapid movement of product, shorter exposure to ambient temperature and if conducted in a hygienic manner, decreases possibility of contamination. It may be desirable to peel large prawns by hand unless the size of production is considerable. When very small prawns are peeled by machine, reduced yields may be obtained because of a high proportion of breakage.

Any offal derived from the heading, peeling and deveining operations may be profitably processed for animal feed, fish feed or fertilizer.

9.4.2 **ALL AUTOMATIC PEELING EQUIPMENT SHOULD BE PERIODICALLY CHECKED THROUGHOUT THE PROCESSING DAY.**

Badly adjusted peeling machines reduce yield and may cause damage to the prawns.

Peeled prawns should be examined frequently for broken or squashed meats, incomplete peeling and smoothness of the meat surface.

Prawns leaving the machine should also be checked for incomplete removal of shell and the presence of unshelled or broken pieces.

9.4.3 **PEELED PRAWNS SHOULD BE CLEANED AFTER SHELLING.**

After shelling and before being packed, the peeled prawns should be examined for pieces of shell, attached appendages, antennae, and other parts of exoskeleton which should be removed.

Peeled and deveined prawns should be examined for absence of the vein.

Peeled prawn meats should be thoroughly washed and chilled, preferably by a spray of cold potable water conforming to SLS 614 or ice made from potable water or a weak brine solution. All these operations can also be performed by automated equipment presently available in the market.

9.4.4 **WHERE PACKING IS CARRIED OUT BEFORE FREEZING, SPECIAL CARE SHOULD BE TAKEN TO PREVENT CROSS-CONTAMINATION, SPECIALLY WHEN COOKED PRODUCTS ARE HANDLED.**

9.5 Freezing and storage

9.5.1 FREEZING AND STORAGE SHOULD BE CARRIED OUT IN ACCORDANCE WITH THE RECOMMENDATIONS GIVEN IN CLAUSE 7.

Good commerical practices and proper equipment are essential factors for producing good quality prawns irrespective of whether the products are frozen at sea or on shore. The recommendation given in clause 7 should apply.

9.5.2 IT IS RECOMMENDED THAT PRAWNS RECEIVED FIRST AT THE PLANT SHOULD BE FROZEN FIRST.

9.5.3 THE FREEZING PLANT SHOULD BE ADEQUATE TO DEAL WITH THE NORMAL SUPPLY RATES OF THE RAW MATERIAL TO THE PROCESSING SECTION OF THE PLANT, SO THAT PRAWNS ARE NOT HELD FOR LONG PERIODS PRIOR TO FREEZING.

9.5.4 FREEZING TIMES FOR PRAWNS AND PRAWNS PRODUCTS SHOULD BE CAREFULLY OBSERVED (SEE TABLE 2).

The freezing process should be rapid and the drop in temperature should be adequate to avoid quality losses associated with badly frozen prawns.

9.5.5 FROZEN BLOCKS SHOULD BE OF REGULAR SIZE AND SHAPE.

Frozen blocks which are uniform in size and shape are easier to stow compactly with less likelihood of damage to the product. They also facilitate easy removal. Furthermore, control of temperature and speed of operation in industrial thawing of frozen blocks is more readily obtained if the units are of regular shape and uniform size.

9.5.6 IN USING HORIZONTAL PLATE FREEZERS, THE PRODUCT SHOULD BE PACKED IN TRAYS OR OTHER FORMS TO PRODUCE UNIFORM COMPACT BLOCKS OF PACKAGE.

It is important that there should be no voids in blocks and that surfaces are uniform and flat. Overfilling trays will cause damage to the product by excessive pressure while underfilling will result in bad contact with the plates and poor heat transfer conditions. Distorted or damaged trays should not be used.

9.5.7 COMPOUNDS USED IN THE IMMERSION OR SPRAY FREEZING OF PRAWNS SHOULD BE ACCEPTABLE TO THE OFFICIAL AGENCY HAVING JURISDICTION.

Cryogenic methods of freezing prawns have been found to be highly effective. However, prior to employing them, competent expert advice should be sought. Compounds used in the immersion or spray freezing, such as freon, liquid nitrogen, and food additives, should be acceptable to the official agency having jurisdiction.

9.5.8 WHERE PRAWNS ARE PLACED IN METAL CONTAINERS FOR FROZEN STORAGE THE PLANT SHOULD BE EQUIPPED WITH A PROPERLY DESIGNED CAN SEALER AND AN ADEQUATE VACUUM PUMP.

Freezing of cooked and peeled shrimp in metal containers under vacuum, is applied to the top quality products intended for export. The containers should be thoroughly evacuated and well sealed to protect the quality of the product.

9.6 Packaging and distribution

9.6.1 PACKAGING OF PRAWNS SHOULD BE CARRIED OUT UNDER CONDITIONS THAT WILL NOT CAUSE CONTAMINATION OF THE PRODUCT OR DETERIORATION OF ITS QUALITY.

9.6.2 PACKAGING MATERIALS SHOULD NOT CONTAMINATE THE PRODUCT.

9.6.3 PACKAGING MATERIALS SHOULD BE STRONG AND DURABLE TO WITHSTAND STRESSES DURING PROCESSING, HANDLING, STORAGE AND DISTRIBUTION.

9.6.4 MASTER CARTONS FOR WHOLESALE PACKAGING SHOULD BE LIGHT, STRONG AND PROVIDE GOOD PROTECTION FOR THE PRODUCTS.

9.6.5 CARTONS, WRAPPING AND OTHER PACKAGING MATERIALS SHOULD NOT BE STORED IN THE PROCESSING AREA.

Deliveries of 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.

9.6.6 TRANSPORT SHOULD BE CARRIED OUT UNDER CONDITIONS GIVEN IN CLAUSE 7.17.

10 OPERATING PRACTICES AND PRODUCTION REQUIREMENTS FOR LOBSTERS

10.1 General consideration

10.1.1 ONLY GOOD QUALITY LOBSTERS SHOULD BE ACCEPTED FOR PROCESSING.

The raw material should be rejected if it is known to contain decomposed lobsters or to contain toxic or extraneous substances which will not be removed to acceptable levels by normal procedures of sorting or preparation.

10.1.2 LIVE LOBSTERS SHOULD BE HANDLED AND PROCESSED WITH CARE AND A MINIMUM OF DELAY.

Lobsters should be kept alive until they are processed.

Lobsters will live for varying lengths of time depending on conditions under which they are held. These factors vary with the season. They are temperature, salinity, oxygen content and load, if held in sea water.

For short-term storage, lobsters are held in ordinary crates or in land-based tank units supplied with circulating sea water. Long term storage of up to six months is usually restricted to tidal ponds commonly made by damming off natural coves. If circulation is not provided the oxygen content of the water will be controlled by surface area and water temperature.

A system of tanks through which cool water is pumped and aerated is recommended, either in a building or in the open, but covered to protect lobsters from the sun.

10.1.3 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.

See 9.1.4.

10.1.4 LOBSTER MEAT SPOILS EVEN MORE RAPIDLY BECAUSE OF THE HIGH NON-PROTEIN NITROGEN CONTENT. IT IS THEREFORE ESSENTIAL THAT THE PROCESSING IS CARRIED OUT RAPIDLY AND THAT NO BUILD-UP OF PART-PROCESSED PRODUCTS OCCURS.

10.1.5 PLANTS SHOULD REGULATE THE INTAKE OF RAW MATERIAL SO THAT THEIR SUPPLIES DO NOT BECOME TOO LARGE TO BE PROCESSED WHILE THE LOBSTERS ARE IN PRIME CONDITION.

Raw material should always be processed as soon as possible after capture. The length of time that lobsters can be satisfactorily held at the plant before processing will depend on the length of time which has already elapsed since capture and on the care with which they were handled during transport to the plant. Plants should limit the amount of lobsters they accept to the amount that they can process while they are still in good condition.

10.2 Preparatory operations

10.2.1 ALL LOBSTERS SHOULD BE EXAMINED BEFORE PROCESSING STARTS. (SEE 3.13.1).

Where iced tails are processed any defective or deteriorated tails should be removed.

10.2.2 PREPARATORY OPERATIONS FOR PRESERVATION SUCH AS SORTING, COOKING, COOLING, SHUCKING AND WASHING SHOULD BE DONE IN A CLEAN AND SANITARY MANNER AND SHOULD BE CARRIED OUT CAREFULLY TO AVOID SPOILING THE QUALITY OF THE PRODUCT AND/OR WASHING RAW MATERIAL.

Preparatory operations leading to the finished product should be so timed as to permit expeditious handling of consecutive operations.

Shucking, deveining and washing should be done thoroughly so that no viscera, blood clots or shell pieces are left to spoil the appearance or the flavour of the final product.

10.3 Tailing

10.3.1 TAILING OF LOBSTERS SHOULD BE CARRIED OUT AS SMOOTHLY AS POSSIBLE AND CARE SHOULD BE TAKEN THAT THE CUT IS WELL PLACED AND EVEN, TO OBTAIN MAXIMUM YIELD.

10.3.2 TAILING KNIVES SHOULD BE CONSTRUCTED OF SUITABLE IMPERVIOUS, CORROSION-RESISTANT MATERIAL AND BE FREE FROM CREVICES WHERE BLOOD AND DEBRIS CAN ACCUMULATE.

10.3.3 THE LOBSTER TAILS SHOULD BE WASHED ON ALL SURFACES, USING POTABLE WATER CONFORMING TO SLS 614.

Particular attention should be paid to removing blood from the butt end of the tail as this will coagulate and cause blue discolourations. Sand and debris may be caught between the segments. Washing is most effective in equipment which provides a swirling action.

10.3.4 THE INTENSTINE SHOULD BE REMOVED IMMEDIATELY.

The removal of the intestine (deveining) can be accomplished by cutting around the anus with a rotating stainless steel tube sharpened or serrated at the end. The intestine is either ejected by water pressure or sucked out by vacuum.

Effective washing will ensure that no remants of the gut or its contents remain as this detracts the appearance of the flesh and leads to deterioration due to microbial or enzyme activity.

10.3.5 CHILLING TANKS MADE OF SUITABLE CORROSION-RESISTANT AND IMPREVIOUS MATERIAL SHOULD BE PROVIDED FOR RAPID CHILLING.

The tank should be inspected regularly during use and cleaned frequently. Flake ice and water is an effective chilling medium. Immediate chilling retains quality and substantially increases yield.

10.3.6 THE TIME FROM TAILING TO FREEZING SHOULD BE AS SHORT AS POSSIBLE. QUALITY AND YIELD WILL BE REDUCED IF HANDLING IS SLOW.

10.4 Cooking

10.4.1 THE METHOD USED TO PREPARE COOKED LOBSTERS SHOULD BE CHOSEN TO PRODUCE THE DESIRED EFFECT WITH A MINIMUM AMOUNT OF DELAY AND HANDLING.

Some species (not Homarus) are prepared for cooking by drowning them in a drowning tank. If they are not drowned before cooking, the shock of the hot water causes excessive breakage of legs and appendages. Lobsters are usually lowered into the drowning tank packed in stainless steel baskets which are also used for cooking and cooling.

It may be necessary to raise the temperature of the water by a few degrees to hasten the drowning process.

10.4.2 COOKING SHOULD BE DONE BY BOILING OR STEAMING THE LOBSTERS.

A disadvantage with boiling is that the water (potable water conforming to SLS 614 to which 3 per cent to 4 per cent salt has been added) quickly becomes dirty and unfit for use and also affects the flavour. It is recommended that no more than two batches be cooked in the same water. Replacing the water creates a loss of time depending on the temperature of the water, as cold water must be brought to boiling again. If the vat is more than half full there is a strong possibility that the lobsters in the bottom of the vat will be overcooked while those on the top will be undercooked.

Steaming may be a more economical and a cleaner method for cooking lobsters but it is more difficult to control the uniformity of cooking. The lobsters are placed in wire baskets and lowered into the steaming vat. Therefore there is no dirty water and no wastage of heat by discarding boiling water. As soon as one batch leaves the vat another can be put in without delay.

Packers should not cook more lobsters than the quantity which can be handled by the staff. Cooking operations should be stopped in time to allow the staff to pack all cooked lobsters before any stoppage of work. It is not advisable to hold cooked lobsters overnight.

10.4.3 COOKING SHOULD BE CONTROLLED SO AS TO BE ADEQUATE FOR THE PURPOSE FOR WHICH THE PRODUCT IS INTENDED.

Cooking coagulates protein in the lobster tissue and releases aqueous fluid which is lightly bound in the flesh. The extent to which this occurs depends largely on the temperature reached in the flesh. If the lobsters are not heated sufficiently the desired effect will not be achieved, but too much heat will reduce the quality of the product and also reduce the yield.

Where different sizes of lobsters are processed, it is advantageous to carry out sorting according to size simultaneously with the inspection of the raw material for dead, weak or decomposed lobsters. The cooking time should be varied as appropriate to different sizes.

Lobsters should be cooked until the shell is uniformly red in colour, and where necessary, until the meat can be easily removed from the shell. Too much cooking causes the meat to shrink excessively and too little cooking makes it difficult to remove the meat from the shell.

It is difficult to specify cooking times throughout the industry, due to differences in size and other variables including physiological conditions.

As a guideline, lobsters with a mass of approximately 500 g generally require a cooking period of 10 minutes.

10.5 Cooling

10.5.1 COOLING OF COOKED LOBSTERS SHOULD BE CARRIED OUT QUICKLY WITHOUT CONTAMINATION OF THE PRODUCT.

Freshly cooked lobsters are practically free of spoilage micro-organisms but during a large part of the cooling period, they are within the temperature range in which, any micro-organisms present will multiply rapidly.

Cooling times should therefore be kept as short as possible and every effort should be made to avoid contamination of the product during this period.

Where lobsters have to be held after cooling they should be held in specially designed, clean, dust-free areas where there is a good circulation of air. The areas should be free from contamination by vermin and other possible sources.

Cooling is one of the most important operations in lobster canning and lobster meat packing. The water used for cooling must be potable water conforming to SLS 614 and the same water should not be reused for cooling more than one batch.

The reasons for cooling the lobsters is to complete the cooking process uniformly throughout the batch and to avoid 'holding' at temperatures which would encourage the growth and multiplication of bacteria. Cooked lobsters should be removed simultaneously from the cooker and cooled as rapidly as possible with clean potable cold water to a temperature of less than 38 ^{o}C. This temperature has been found to be attainable in less than ten minutes by immersing the baskets of lobsters in clean, cold, circulating potable water.

10.5.2 THE DROWNING TANK, COOKER AND COOLING TANK SHOULD BE LOCATED ADJACENT TO EACH OTHER WITH AN OVERHEAD HOIST OR GANTRY PROVIDED TO TRANSFER BASKETS FROM ONE TO THE OTHER.

This enables lobsters packed in a basket for drowning to be cooked and cooled in the same container.

10.5.3 AFTER COOLING, THE LOBSTERS SHOULD BE TAKEN FROM THE CONTAINER AND ALL ADHERING COAGULATED PROTEIN REMOVED.

Spray washing on a conveyor is sometimes sufficient but it may be necessary to brush by hand. These methods can be combined. Potable water conforming to SLS 614 should be used.

10.5.4 AFTER WASHING, THE LOBSTERS SHOULD BE ADEQUATELY DRAINED IN AN AREA SET ASIDE FOR THE PURPOSE.

In some species the body cavity contains a considerable amount of water. Whilst adequate drainage is desirable, the lobsters should not be allowed to drain unnecessarily.

10.6 Shucking and deveining

10.6.1 THE SHUCKING OR SHELLING AND DEVEINING OF COOKED LOBSTERS INTENDED FOR FURTHER PROCESSING SHOULD BE CARRIED OUT QUICKLY AND CAREFULLY.

It is essential that the processing operation is carefully controlled in order to provide an attractive and edible product and to prevent bacterial spoilage.

After cooling, the lobsters pass to the breaking-off table where the claws, tail and bodies are separated and each portion passes in containers to different operations.

The tail meat should be removed in one piece by using a stainless steel double-pronged fork. The tail is split along the underside and the intestine removed. Care should be taken not to cut through to the pigment side as this will spoil the appearance of the meat.

10.7 Washing

10.7.1 LOBSTER MEAT SHOULD BE THOROUGHLY WASHED ON ALL SURFACES.

Meat removed by hand is especially vulnerable to contamination with pathogens from human carriers. After being shucked, all lobster meat should be washed in cold potable running water conforming to SLS 614. The use of a well constructed rotary-type washer made in the shape of a drum from perforated stainless steel is common.

The main object of washing the meat is to remove all debris that has been spread over the meat during breaking and shelling of the cooked lobsters particularly "green liver" (tomalley), gut contents and all white or blue blood clots.

10.8 Holding

10.8.1 WHERE COOKED LOBSTERS ARE HELD BEFORE DISTRIBUTION, FREEZING OR FURTHER PROCESSING, THEY SHOULD BE CHILLED. COOKED LOBSTER MEAT WHICH IS TO BE SOLD DIRECTLY SHOULD BE HANDLED AND STORED SO AS TO INHIBIT DETERIORATION OF THE PRODUCT.

There should be no unnecessary delay between commencement of the production process and its completion. Where the final product is to be marked as chilled lobster meat the cooked lobsters in the shell or the shucked, washed meat should be chilled to a temperature approaching that of melting ice and marketed within 18 hours.

10.9 Packaging

10.9.1 PACKAGING MATERIALS SHOULD BE OF A TYPE APPROVED BY THE OFFICIAL AGENCY HAVING JURISDICTION AND SHOULD BE CLEAN AND STORED IN A HYGIENIC MANNER. PACKAGING SHOULD BE CARRIED OUT UNDER CONDITIONS THAT PREVENT CONTAMINATION OF THE PRODUCT.

All packaging material should be stored in a clean and sanitary manner. The material should be appropriate for the product to be packed and for expected conditions of storage and should not transmit to the product objectionable substances beyond the limits acceptable to the official agency having jurisdiction. The packaging material should be sound and should provide appropriate protection from contamination.

Packaging in metal containers is used for the purpose of freezing or for retorting. Care should be taken to ensure that empty containers are removed from the packing room and conveyors to the filling machines before the plant is washed down in order to avoid splatter with dirty water or debris.

10.9.2 THERE SHOULD BE NO BUILD UP OF RAW MATERIAL OR PART PROCESSED PRODUCTS DURING THE PROCESSING.

Since any delay in processing will have an adverse effect on quality, there should be no large backlog of raw material or filled containers in the plant. The packers should package the products in the order in which they to arrive.

10.9.3 CARTONS, 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.

10.9.4 LOBSTERS AND LOBSTER PRODUCTS SHOULD BE INSPECTED FOR QUALITY AS WELL AS WORKMANSHIP OF THE PACKER AT THE TIME OF PACKING.

This inspection should take place just before final closing of containers. Each packer's output should be inspected regularly so that faults can be corrected and a high standard of workmanship achieved.

10.9.5 FINAL CONTAINERS IN WHICH LOBSTERS AND LOBSTER PRODUCTS ARE PACKED SHOULD BE INDELIBLY MARKED WITH THE LOT IDENTIFICATION.

This is good commercial practice as it enables the manufacturer to withdraw defective products, if necessary.

10.9.6 VACUUM PACKAGING IS RECOMMENDED FOR COOKED FROZEN LOBSTER MEAT TO EXTEND THE STORAGE LIFE.

Vacuum packaging in cans or flexible packages of suitable, waterproof and gas or moisture-vapour-impermeable material has been shown to give significant extension of high quality storage life provided care is being taken to ensure efficient sealing. If used, care should be taken that vacuum is maintained and that the product remains frozen until use. Polyethylene alone is not sufficient.

11 FREEZING, STORAGE AND DISTRIBUTION

11.1 FREEZING STORAGE AND DISTRIBUTION SHOULD BE CARRIED OUT IN ACCORDANCE WITH RECOMMENDATIONS GIVEN IN CLAUSE 7.

Good commercial practices and proper equipment are essential factors for producing good quality frozen lobsters and lobster products. The recommendations given in Clause 7 also apply to freezing lobsters and lobster products. Some of the most important things to remember when freezing the lobsters are the following:

a) Freezing should be rapid enough to prevent development adverse quality changes in the product;
b) Air-blast freezers should be loaded in such a way that there is always a sufficient flow of cold air around the product;
c) Sharp freezers should not be overloaded with lobsters;
d) In brine freezing, there should be rapid circulation of the cooling medium and the ratio of lobsters to brine should be carefully controlled;
e) Freezing processes should be allowed to run their full allocated time to ensure their completion; and
f) Frequent checks should be made of refrigerant pressures and temperatures and accurate records maintained.

11.2 FREEZING SHOULD BE COMMENCED PREFERABLY WITHIN ONE HOUR AFTER PACKING.

Spoilage of lobster meat in containers can take place fairly quickly at usual plant temperatures.

Therefore, lobster meat should be frozen as soon as possible after packaging in order to inactivate spoilage micro-organisms.

11.3 BLAST FREEZING SHOULD BE USED TO PRODUCE HIGH QUALITY WHOLE COOKED LOBSTERS OR LOBSTER TAILS.

Blast freezing is the best method of producing a high quality finished pack. As the carapace is rigid, lobster products cannot be tightly packed; thus because of the air spaces there is no advantage in using a plate freezer. It is very difficult to pack Individually Quick Frozen (IQF) lobsters together in a carton without breakage. Brine immersion freezers can be used for whole lobsters but there is a risk of salt penetration and unless packed in a wire basket, with the same dimensions as the final carton, broken IQF products result.

11.4 THE FREEZING AND STORAGE OF WHOLE UNCOOKED LOBSTERS IS NOT RECOMMENDED.

During freezing the intestinal tract breaks down and when the lobsters are thawed the digestive enzymes immediately attack the meat causing autolysis, off-flavour, odours and unsightly browning. The practice should therefore be avoided if at all possible.

11.5 TRANSPORT SHOULD BE CARRIED OUT UNDER CONDITIONS GIVEN IN CLAUSE 7.17.

12 HYGIENE CONTROL PROGRAMME

IT IS DESIRABLE THAT EACH PROCESSING PLANT DESIGNATES A SINGLE INDIVIDUAL WHOSE DUTIES ARE PREFERABLY DIVORCED 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 well aware of 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 material are designated for cleaning and/or disinfection daily or more frequently if required.

13 LABORATORY CONTROL

IN ADDITION TO ANY CONTROL BY THE OFFICIAL AGENCY HAVING JURISDICTION, IT IS DESIRABLE THAT EACH 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 product as well as the needs of management. Such control should reject all raw material and products which are unfit for human consumption.

Analytical procedures used should follow recognized standard methods in order that the results may be readily interpreted.

14 RAW MATERIAL AND END-PRODUCT QUALITY

THE QUALITY OF RAW MATERIAL AND END PRODUCTS SHOULD CONFORM TO THE FOLLOWING SRI LANKA STANDARD SPECIFICATIONS AS APPLICABLE:

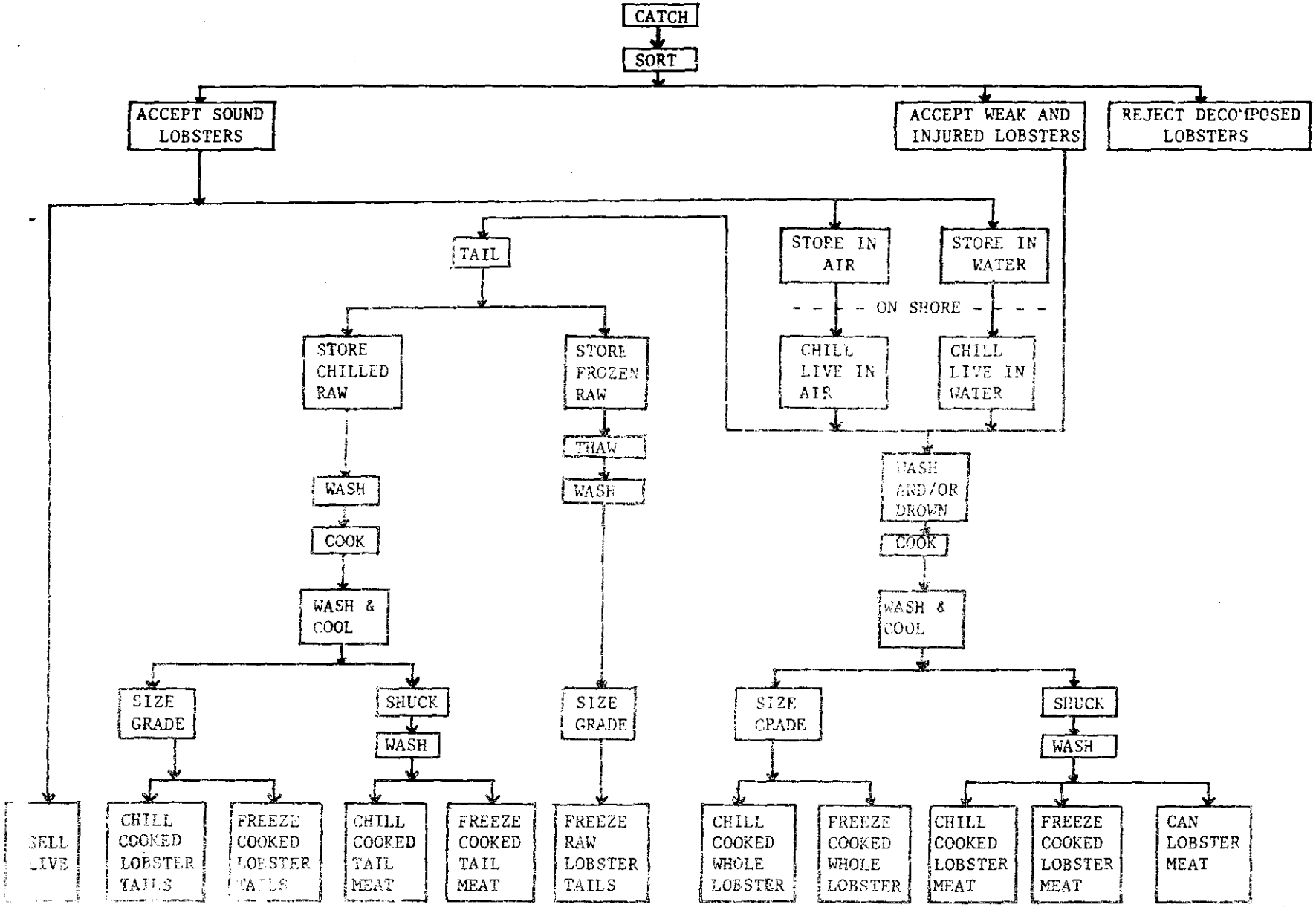
14.1 SLS 10 : FROZEN PRAWNS, AND

14.2 SLS 188: QUICK FROZEN LOBSTERS.

14.3 IN THE CASE OF LOBSTERS KILLED ON CAPTURE, THE QUALITY OF THE RAW MATERIAL SHOULD ALSO BE INSPECTED FOR DEFECTS GIVEN IN 3.13.1.

APPENDIX A

FLOW CHART FOR HANDLING LOBSTERS



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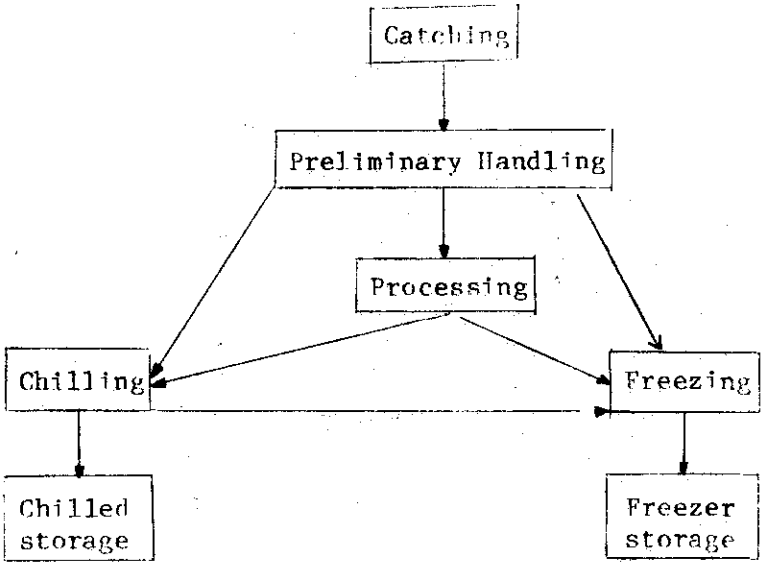
APPENDIX B
FLOW DIAGRAM FOR HANDLING AND PROCESSING OF PRAWNS AT SEA

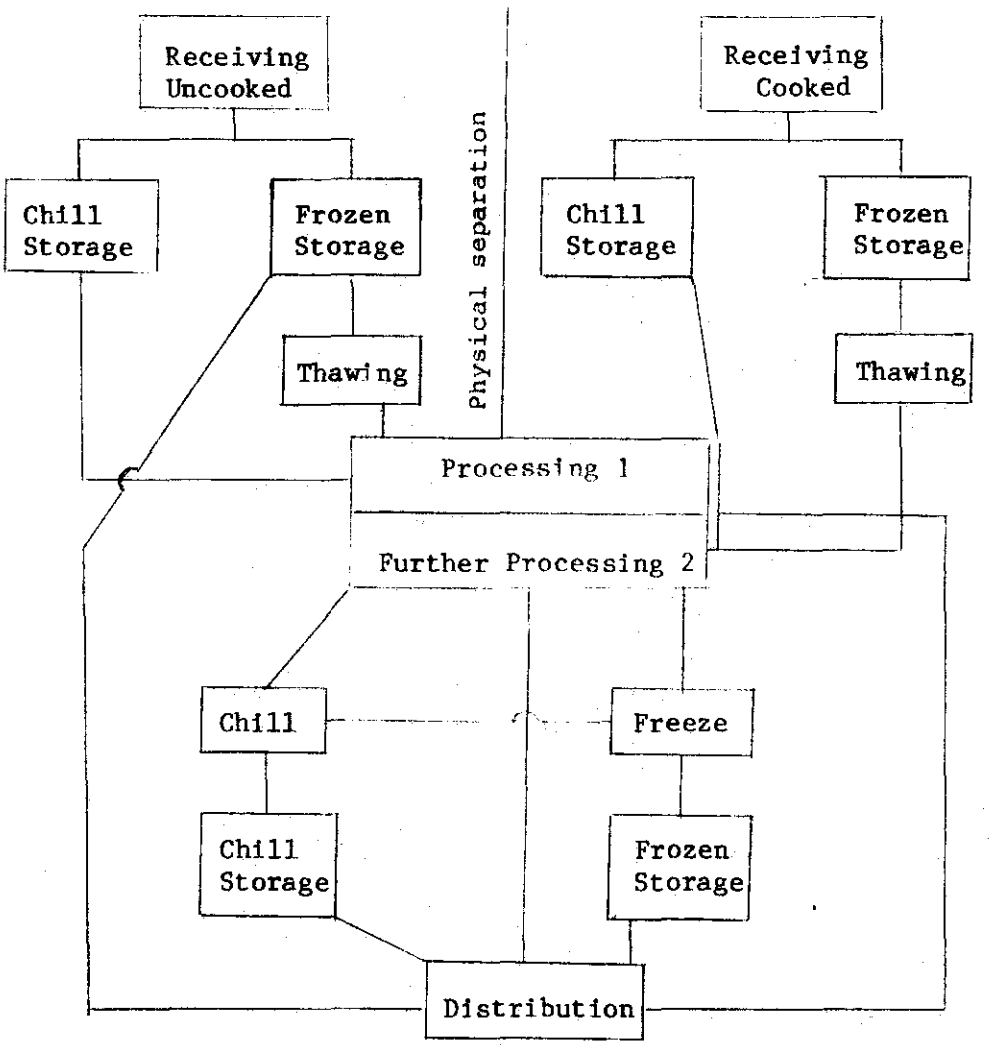


These steps may include any of the following operations:

1. Preliminary Handling
   - Sorting
   - Washing
   - Size grading
   - Heading
   - Use of dips

2. Processing
   - Cooking
   - Parboiling
   - Cooling
   - Packaging

APPENDIX C
FLOW DIAGRAM FOR HANDLING AND PROCESSING OF PRAWNS ON SHORE



These steps may include any of the following operations

1. Processing
   - Washing
   - Heading
   - Cooking
   - Parboiling
   - Cooling

2. Further processing
   - Size grading
   - Peeling
   - Deveining
   - Washing
   - Breading
   - Packaging
   - Pasteurisation
   - Sun-drying
   - Canning (retorting)
   - Freeze drying.

APPENDIX D
CLEANING AND DISINFECTION

D.1 GENERAL PRINCIPLES

Good hygiene demands effective and regular cleaning of establishments, equipment and vehicles to remove food residues and dirt which may contain food poisoning and spoilage micro-organisms and act as a source of food contamination. This cleaning process may where necessary be followed by, or associated with, disinfection to reduce the number of any micro-organisms remaining after cleaning to a level which will not cause harmful contamination of food. Sometimes the cleaning and disinfection stages are combined by the use of a detergent disinfectant mixture, although it is generally considered that this is less efficient than a two-stage cleaning and disinfection process.

The methods of cleaning and disinfection should be considered satisfactory by the official agency having jurisdiction.

Cleaning and disinfection procedures should be properly established by a hygiene specialist after consultation with production management, plant' engineers and detergent and disinfectant manufacturers. The cleaning and disinfection procedures should be designed to meet the particular needs of the process and product concerned, and should be set down in written schedules which should be made available for the guidance of employees and management. Procedures should be established not only for cleaning and disinfecting the establishment, equipment and vehicles but also for cleaning and disinfection of the equipment which is itself used for cleaning, eg. mops, swabs, buckets, etc. There must be adequate supervision by management to ensure that the procedures set down are carried out in an effective manner at the specified intervals of time.

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

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

D.2 CLEANING

D.2.1 *Cleaning procedures*

Cleaning procedures will require the following;

a) The removal of gross debris from surfaces by brushing, vacuuming and scraping deposits or other methods where necessary followed by the application of water. The temperature of water used will depend upon the type of soil to be removed;
b) The application of detergent solution to loosen soil and bacterial film and to hold them in solution or suspension;
c) Rinsing with water to remove loosened soil and residues of detergent;
d) Care should be taken that the use of abrasive material does not alter the character of the food contact surface and that fragments from brushes, scrapers, and other cleaning materials do not contaminate the food.

D.2.1.2 When these requirements have been met they may be followed by a disinfection process (see D.3).

D.2.2 *Cleaning methods*

Cleaning is carried out by the separate or combined use of physical methods, such as scrubbing or turbulent flow, and/or chemical methods, eg. the use of detergents, alkalis or acids. Heat is an important adjunct to the use of physical and chemical methods. Care must be employed in the selection of the temperature depending on the detergents and the nature of the soil and working surfaces. Some synthetic organic materials can absorb constituents of food, such as milk fat, and the amount absorbed rises with the temperature.

One or more of the following methods should be used according to the circumstances:

a) **Manual** : involves removal of soil by scrubbing in the presence of a detergent solution. For parts of machinery and for small items of equipment, soaking in a detergent solution in a separate receptacle may be necessary to loosen the soil prior to the scrubbing process;
b) **In place cleaning** : The cleaning of equipment including pipe runs, with water and detergent solution, without dismantling the equipment or pipe runs. The equipment must be properly designed for this cleaning method. A minimum fluid velocity of 1.5 metres per second with turbulent flow is required for effective cleaning of pipe runs. As far as possible parts of equipment which cannot be satisfactorily cleaned by this method should be identified and eliminated. If this cannot be done satisfactorily, the parts should be dismantled for cleaning to prevent build up of contamination;

c) **Low pressure high volume spray** : The application of a water or detergent solution in large volumes at pressures up to approximately 6.8 bar (100 psi);
d) **High pressure low volume spray** : The application of water or detergent solution in low volume at a high pressure, i.e. up to 68 bar (1,000 psi);
e) **Foam cleaning** : The application of a detergent in the form of a foam which is allowed to remain for 15 to 20 minutes and is then rinsed off with a water spray;
f) **Washing machines** : Some containers and equipment used in food processing can be washed by machines. These machines carry out the cleaning procedures set out above with the addition of disinfection by hot water rinse at the completion of the cleaning cycle. Good results can be obtained with such machines provided that the effectiveness and efficiency of the machine is maintained by adequate and regular servicing.

D.2.3 *Detergents*

Detergents must have a good wetting capacity and the ability to remove soil from surfaces and to hold the soil in suspension. They must also have good rinsing properties so that residues of soil and detergents can be easily removed from equipment. There are many types of detergents and advice should be sought to ensure that the detergent used in any particular circumstance is suitable to remove the type of soil resulting from a particular food process and is used at the correct concentration and temperature. The detergent used should be non-corrosive and compatible with other materials including disinfectants used in the sanitation programme. Whilst cold solutions of detergent may be effective in some circumstances, removal of residues of fat requires the use of heat. The deposition of mineral salts on equipment may form a hard scale ("stone") especially in the presence of fats or proteins; the use of an acid or alkaline detergent or both sequentially may be necessary to remove such deposits. The "stone" can be a major source of bacterial contamination. It can be easily detected by its fluorescence under ultraviolet light which will detect deposits usually missed by ordinary visual inspection.

D.2.4 *Drying after cleaning*

If equipment is left wet after cleaning micro-organisms may grow in the water film. It is important to ensure that equipment is left dry as soon as possible after cleaning and where possible to allow equipment to air-dry naturally. Single use tissue or absorbent materials may be used for drying but they should be used once and discarded.

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

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

D.3 DISINFECTION

D.3.1 *General considerations*

While disinfection results in the reduction of numbers of living micro-organisms, it does not usually kill bacterial spores. Effective disinfection does not necessarily kill all micro-organisms present but reduces their numbers to a level at which they can be reasonably assumed to present no risk to health. No disinfection procedure can exert its full effect unless its use is preceded by thorough cleaning. Disinfectants should be chosen according to the micro-organisms to be killed, the type of food being processed and the material making up the food contact surfaces and where appropriate the criteria mentioned in D.3.4. Selection is also affected by the character of the water available and the method of cleaning used. The continued use of certain chemical disnfectants may lead to the selection of resistant micro-organisms. Chemical disinfectants should be used where use of ehat would not be practicable. The method used for cleaning under D.2.2 could also be used for the application of disinfectants.

D.3.2 *Disinfection by heat*

The application of moist heat to raise the surface temperature to at least 70 ^{o}C is one of the commonest and most useful forms of disinfection. High temperatures, however, will denature protein residues and bake them on the surface of food equipment. It is therefore essential that all material such as residual food is removed by thorough cleaning before the application of heat for disnfection.

a) *Hot water disinfection :* This is the method of choice and is commonly used throughout the food industry. Removable parts of machinery and smaller items of equipment can be submerged in a sink or tank containing water at disinfection temperature for a suitable time, eg. at 80 ^{o}C for two minutes. The disinfectant rinse in mechanical washing machines should reach this disinfection temperature and the period of immersion should be sufficient to allow the equipment surfaces to reach this temperature. Water at disinfection temperature will scale bare hands so basket racks or some other type of receptacle will have to be used where the process is manual.

b) *Steam disinfection :* Where steam is used the surface to be disinfected must be raised to a disinfecting temperature for a suitable time. It may not be practicable to have steam available for disinfection throughout the premises. Lances producing steam jets are useful to disinfect surfaces of machinery and other surfaces which are difficult to reach or which must be disinfected in situ on the factory floor. The heating of surfaces during the application of high temperature steam promotes their subsequent drying. The use of steam can present problems by creating condensation on other equipment and other parts of the structure. High pressure steam can strip paint from painted surfaces and lubricants from the working parts of machinery. Moreover, some types of materials, such as plastics, are unsuitable for treatment with live steam. Steam jets should only be used by trained personnel as they can be dangerous in unskilled hands.

D.3.3 *Chemical disinfection*

The following factors affect the performance of chemical disinfectants:

a) *Inactivation by dirty conditions :* The effectiveness of all chemical disinfectants is reduced by the presence of dirt and other soiling matter. Disinfectants will not act at all where there is gross soiling. Disinfection with chemicals must, therefore, always follow or be combined with a cleaning process.

b) *Temperature of solution :* In general, the higher the temperature the more effective will be the disinfection. A warm or hot solution is therefore preferable to a cold solution of disinfectant. There are, however, limitation to the temperature that may be used, and the manufacturer's guidance should be followed. Iodophors release iodine at temperature aboved 43 °C which can result in staining of materials. The corrosive action of chlorine is increased when hot hypochlorite solutions are used.

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

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

e) *Stability :* All disinfectant solutions should be freshly made in clean utensils. Topping up existing solutions or prolonged keeping of ready-to-use dilute solutions may render the disinfectant solution ineffective or may allow it to become a reservoir of resistant organisms. Disinfectants may be inactivated if mixed with detergents or other disinfectants. The strength of disinfectants should be checked regularly, particularly when diluted for use. Easy-to-use inexpensive test kits are available for this purpose.

D.3.4 *Chemicals suitable for disinfection in food premises*

Chemical disinfectants that are liable to taint the food such as phenolics should not be used in food premises or vehicles. Care should be taken that chemical disinfectants do not cause harm to personnel and when used in places where animals are kept or transported, such as lairages and vehicles, do not cause distress to the animals.

After an adequate contact time all surfaces which have been disinfected should be subjected to a final rinse with water. (Among the disinfectants more commonly used in the food industry are those listed below.)

a) *Chlorine and chlorine based products including hypochlorite compounds :* Properly used, these substances are among the most suitable for food plants and vehicles. They can be obtained as liquid hypochlorite solutions containing 100,000 to 120,000 milligrammes of available chlorine per litre, or they can be combined with a detergent in a chlorinated crystal form. These disnfectants act rapidly against a wide range of micro-organisms and are relatively cheap. They are the most suitable for general purpose disinfection in food premises. These disinfectants should be used at concentration of 100 to 250 milligrammes of available chlorine per litre. This group of disinfectants is corrosive to metals and they also have a bleaching action. Surfaces disinfected with them should therefore be subjected to a final rinsing as soon as possible after an adequate contact time. Chlorine disinfectants with the exception of chlorine dioxide are readily inactivated by the presence of organic soil.

b) *Iodophors :* These substances are always blended with a detergent in an acid medium and they are therefore particularly suitable in those circumstances where an acid cleaner is required. They have a rapid action and a wide range of antimicrobial activity. A solution of about 25-50 milligrammes per litre of availabled iodine at pH 4 is usually required for disinfection of clean surfaces. They are readily inactivated by organic matter. Iodophors give a visual indication of their effectiveness since they lose their colour when the residual iodine has dropped to ineffective levels. They are not toxic when used in normal concentrations but may add to the total dietary iodine load. They have little taste or smell, but may combine with substances in the food to cause taint. Iodophors may have a corrosive action on metals depending on the particular formulation of the iodophors and the nature of the surface to which the iodophor is being applied. For these reasons special care should be taken to rinse them away after use.

c) *Quarternary ammonium compounds :* All these compounds also have good detergent characteristics. They are colourless and are relatively non-corrosive to metal and non-toxic but may have a bitter taste. They are not as effective against Gram-negative bacteria as are chlorine, chlorine-based disinfectants and iodophors. They solutions tend to adhere to surfaces and thorough rinsing is necessary. They should be used at a concentration of approximately 200-1200 milligrammes per litre. The higher concentrations are necessary when used with hard water. They are not compatible with soaps or anionic detergents.

d) *Amphoteric surfactants :* This comparatively recent type of disinfectant consists of active agents with detergent as well as bactericidal properties. They are of low toxicity, relatively non-corrosive, tasteless and odourless and are efficient disinfectants when used according to the manufacturer's recommendations. They are inactivated by organic matter.

e) *Strong acids and alkalis :* In addition to their detergent properties strong acids and alkalis have considerable antimicrobial activity. Particular care should be taken that they do not contaminate food.

D.4 CHECKS ON EFFECTIVENESS OF PROCEDURES

The effectiveness of cleaning and disinfection procedures should be verified by microbiological monitoring of the product and food contact surfaces. Similar regular microbiological monitoring of the product at all stages of production will also give information on the effectiveness of cleaning and disinfection procedure.

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

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.*

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SRI LANKA STANDARDS INSTITUTION

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The principal objects of the Institution as set out in the Act are to prepare standards and promote their adoption, to provide facilities for examination and testing of products, to operate a Certification Marks Scheme, to certify the quality of products meant for local consumption or exports and to promote standardization and quality control by educational, consultancy and research activity.

The Institution is financed by Government grants, and by the income from the sale of its publications and other services offered for Industry and Business Sector. Financial and administrative control is vested in a Council appointed in accordance with the provisions of the Act.

The development and formulation of National Standards is carried out by Technical Experts and representatives of other interest groups, assisted by the permanent officers of the Institution. These Technical Committees are appointed under the purview of the Sectoral Committees which in turn are appointed by the Council. The Sectoral Committees give the final Technical approval for the Draft National Standards prior to the approval by the Council of the SLSI.

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