codex alimentarius commission

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

WORLD HEALTH ORGANIZATION

JOINT OFFICE: Via delle Terme di Caracalla 00100 ROME: Tel. 5797 Cables Foodagri

ALINORM 76/13A

JOINT FAO/WHO FOOD STANDARDS PROGRAMME
CODEX ALIMENTARIUS COMMISSION
Eleventh Session 1976

REPORT OF THE TWELFTH SESSION OF THE CODEX COMMITTEE ON FOOD HYGIENE
Washington, D.C., U.S.A.
12-16 May 1975

INTRODUCTION

1. The Twelfth Session of the Codex Committee on Food Hygiene was held in the Main Conference Room, Department of State, in Washington, D.C., from 12 to 16 May 1975. The session was attended by representatives and observers of 28 countries and observers from 2 international organizations (see Appendix I for list of participants).

2. The participants were welcomed on behalf of the Government of the United States by Dr. William Randolph, Deputy Assistant Commissioner of the Office of Compliance of the Food and Drug Administration, and by Dr. J.C. Olson, Jr., Chairman of the Committee.

ELECTION OF RAPPORTEUR

3. The Committee appointed Mr. E. Spencer Garrett (U.S.A.) as Rapporteur of the Session.

ADOPTION OF THE AGENDA

4. The Committee adopted the provisional agenda without change. During the discussions, however, a small change in the sequence of the items was made.

INFORMATION ON ACTIVITIES WITHIN WHO OF INTEREST TO THE COMMITTEE

5. The Committee was informed of current and planned activities of WHO relating to food hygiene since the last session of the Codex Committee on Food Hygiene. These included a meeting of an Expert Committee on Veterinary Public Health, which among other subjects dealt specifically with food hygiene. Further, four Expert Consultations supported by the United Nations Environment Programme were convened jointly with FAO as follow-up actions to recommendations of the 1972 Stockholm Conference on Human Environment. Two of these consultations were steps towards the development of the Joint FAO/WHO Food Contamination Monitoring Programme, the first dealing with the identification of contaminants to be monitored and recommendations on sampling plans and methodology and the second with handling of data within this programme. The third Expert Consultation discussed two draft documents, one entitled "General Guidelines for National Food Control Services" and the other "Food Hygiene in Catering Establishments - the Role of Legislation, Incorporating a Draft Model Code". The fourth Expert Consultation dealt with foods in international trade which represent microbiological hazards, related microorganisms, and methods of sampling and examination, and microbiological end-product specifications.

6. Further meetings on microbiological specifications for foods are planned for the years 1976 and 1978. In addition, an Expert Committee on Microbiological Aspects of Food Hygiene will be held in 1976.

7. In addition, the Committee's attention was drawn to two recent publications in the the WHO Technical Report Series with the titles: "Foodborne Disease, Methods of Sampling and Examination in Surveillance Programmes" and "Fish and Shellfish Hygiene".

8. Reference was made to other WHO activities in food hygiene, amongst these to the progress within the "WHO Programme on Surveillance of Food-borne Outbreaks of Biological Origin" and that of the "WHO Food Virology Programme"; to the work on a "Guide to Shellfish Hygiene" and to the collaborative activities with other international bodies, particularly with the International Commission on Microbiological Specifications for Foods and with the International Standardization Organization.

9. Regarding the status of work on the determination of specific viruses causing food-borne disease in shellfish, practical methods are still lacking for this purpose and are the object of current research by workers within the WHO Food Virology Programme.

REVIEW OF MATTERS RELEVANT TO THE CODEX COMMITTEE ON FOOD HYGIENE AS DISCUSSED BY THE CODEX ALIMENTARIUS COMMISSION AND VARIOUS CODEX COMMITTEES

Codex Alimentarius Commission (ALINORM 74/44)

10. The Committee noted that the Commission at its Tenth Session (July 1974) had agreed to a revision of the General Principles of Food Hygiene (see also paragraphs 57-59 of this Report).

Codex Committee on Foods for Special Dietary Uses (ALINORM 76/26)

11. The Committee was informed that the Committee on Foods for Special Dietary Uses had agreed to the wording proposed by this Committee (ALINORM 74/13, paragraph 32) for the Draft Standards for Infant Formula and for Canned Baby Foods, but with the deletion of the phrase "and (ii) other microorganisms capable of development under normal conditions of storage" (7.2 (a)). The Committee noted that the two Draft Standards included both liquid and dried products.

12. It was pointed out that neither dried products nor canned products should support the growth of microorganisms when stored properly and it was thus appropriate to recommend that they should be free of both pathogenic microorganisms and of other microorganisms which were able to grow in the product under normal conditions of storage. The Committee therefore recommended that these draft standards and the draft standard for Processed Foods for Infants and Children based on cereals should include both these provisions.

13. The Committee noted that in the Draft Standard for Processed Foods for Infants and Children Based on Cereals the Commodity Committee had amended the last hygiene provision (7.3), dealing with the hygienic requirements for ingredients used in the preparation of the product. The mandatory nature of this clause had been removed by changing "shall" to "should".

14. The Committee agreed that the third provision (sub-section 7.3) in the hygiene section in the three standards should be identical and should read: "The product shall be prepared, packed, and held under sanitary conditions and should comply with the Code of Hygienic Practice for Foods for Infants and Children" (to be prepared by the Codex Committee on Food Hygiene).

Joint ECE/Codex Alimentarius Group of Experts on Standardization of Fruit Juices (ALINORM 76/14)

15. The Committee noted that in anticipation of the nullification - as proposed by the Joint ECE/Codex Alimentarius Group of Experts on Standardization of Quick Frozen Foods - of the Code of Hygienic Practice for Quick Frozen Fruits, Vegetables and their Juices the reference to this Code in the hygiene section of various fruit juice standards had been deleted and had been replaced by reference to the General Principles of Food Hygiene.

16. The Committee endorsed or re-endorsed the Hygiene Section in the following standards contained in ALINORM 76/14:

- Grape Juice, Step 8 (Appendix II)
- Concentrated Grape Juice, Step 8 (Appendix III)
- Concentrated Labrusca Type Grape Juice, Step 8 (Appendix IV)
- Pineapple Juice, Step 8 (Appendix V)
- Non-pulpy Black Currant Nectar, Step 5 (Appendix VI)

17. It was pointed out that in the Standard for Tomato Juice there was a provision for a mould count by the Howard Method. In standards for similar products, e.g. pineapple juice and grape juice, which include fruit tissue in the final product, such a provision was not included. The Committee requested the Secretariat to bring this matter to the attention of the Chairman of the Commodity Committee for his consideration prior to the next session of the Commission. (See also para 23 of this Report).

Joint ECE/Codex Alimentarius Group of Experts on Standardization of Quick Frozen Foods (ALINORM 76/25)

18. The Chairman reminded the Committee of the decision of the Commission to retain the Code of Hygienic Practice for Quick Frozen Fruits, Vegetables and their Juices, at Step 8, pending the finalization by the Group of Experts of the Code of Practice for the Processing and Handling of Quick Frozen Foods. At a later session, the Commission had requested the Group of Experts to express their views on the position of the Code of Hygienic Practice.

19. The Processing and Handling Code had now reached Step 8 and the Group of Experts had recommended that the Code of Hygienic Practice be nullified, taking into account that this Code differed only insignificantly from the Recommended International Code of Practice - General Principles of Food Hygiene, which, moreover, was to be reviewed by the Codex Committee on Food Hygiene.

20. The Committee concurred with the views of the Commodity Committee as contained in the Report of its Ninth Session (ALINORM 76/25, paragraph 103) that it should recommend to the Commission that further work on the Code of Hygienic Practice for Quick Frozen Fruits, Vegetables and their Juices be discontinued.

21. The Committee further agreed with the proposal of the Commodity Committee to require in the hygiene section that the products covered by the standards be prepared in accordance with the General Principles of Food Hygiene. The hygiene provisions of the following standards contained in ALINORM 76/25 were endorsed:

- Quick Frozen Spinach, Step 7 (Appendix II)
- Quick Frozen Peaches, Step 8 (Appendix III)
- Quick Frozen Bilberries, Step 8 (Appendix IV)
- Quick Frozen Blueberries, Step 5 (Appendix V)

22. In 1973 in reply to a question from the Group of Experts, on the procedure to be followed with regard to standards where no specific provisions for tolerances for infestation were included, the Committee had suggested that this matter could be dealt with by including a provision in the Hygiene Section on "Protection of Product from Contaminants" or a broader kind of wording "the product should be free from objectionable matter" (ALINORM 74/13, paragraphs 21-23).

23. The Committee noted that the Joint ECE/Codex Alimentarius Group of Experts on Standardization of Quick Frozen Foods had not discussed this matter subsequently. It was agreed to request the Group of Experts to give its views on this issue at its next meeting. It was further agreed to recommend that the Group consider the desirability of including a provision on mould count in the hygiene section in fruit standards where appropriate. It was pointed out that methodology as well as guidelines for mould counts were already in existence. (See also paragraph 17 of this Report).

24. As a matter of principle, the Committee wished to go on record that relevant sections of codes elaborated by Commodity Committees which contained an element of hygiene should be referred for consideration and endorsement to the Codex Committee on Food Hygiene.

Codex Committee on Meat Hygiene (ALINORM 76/15)

25. The Committee was informed that the Codex Committee on Meat Hygiene had finalized its work on two Codes:

- Code of Hygienic Practice for Fresh Meat
- Code of Practice for Ante-Mortem and Post-Mortem Inspection of Slaughter Animals

26. It was pointed out that during the elaboration of the Fresh Meat Code, WHO had been requested to give its views on the frequency and character of medical examination of personnel. The WHO observations on this issue had been accepted with some modifications by the Meat Hygiene Committee and it was agreed to consider whether it might be useful to include this wording also in revision of the General Principles of Food Hygiene. (See also paragraphs 60-62 of this Report).

Joint FAO/WHO Committee of Government Experts on the Code of Principles concerning Milk and Milk Products

27. The Committee was informed that at its 17th Session (April 1975) the Milk Committee had considered government observations which it had requested at its 16th Session on the desirability of including hygiene requirements in standards for milk and milk products. The comments received indicated a positive attitude towards amending in this respect the various standards already existing.

28. It was noted that the Milk Committee had accepted an offer by the delegation of Australia to prepare for the next session of the Commodity Committee (Summer 1976) a code of practice for dried milk, which would provide a basis for future work on the elaboration of codes of practice. The Code would take full account of work of various specialist bodies and would consist of recommendations to governments and industry upon the basis of which adequate protection of the consumer could be achieved and would include end product specifications used for quality control in industry.

29. The Committee further noted that the Joint FAO/WHO Committee of Government Experts had agreed that work in the field of microbiological end product specifications should proceed on the basis of need and of demonstrated health hazards and should be consistent with the availability of expert recommendations on microbiological standards and methodology. The attention of the Codex Alimentarius Commission would be drawn to this procedure.

30. It was also noted that the IDF/ISO/AOAC working party on methods of sampling and analysis for milk and milk products had indicated that the three organizations were developing plans jointly to consider microbiological methods.

31. In regard to the Proposed Draft Code of Practice for Dried Milk, it was noted that the Joint FAO/WHO Committee of Government Experts on the Code of Principles concerning Milk and Milk Products was aware that the elaboration of end product specifications would require taking into account developments within those expert bodies which were currently considering microbiological specifications for food products and microbiological methodology.

32. In the light of the foregoing and having in mind its successful collaboration with the Committee on Fish and Fishery Products in respect of all direct provisions having hygienic aspects that are included in the Codes of Practice for Fish, the Committee decided to seek advice from the Executive Committee about its future role. In particular, it desired to know whether:

(i) all hygiene provisions included in Codes of Practice being elaborated by Commodity Committees should be referred to it for endorsement;

(ii) in view of its increasing activity in the area of microbiological specifications the Codex Committee on Food Hygiene should be the body to advise on and ultimately endorse microbiological specifications for food and associated methods for food.

33. The Committee held the view that all Codes containing hygiene provisions except those for which specific hygiene Committees had already been given complete responsibility, should be referred to this Committee for endorsement of those provisions. It was also the view that it should provide the direct link between Commodity Committees and meetings of Experts on microbiological specifications.

CODEX COMMITTEE ON PROCESSED MEAT PRODUCTS

34. The Committee was informed on the deliberations of the Commodity Committee on hygiene requirements in the various processed meat products standards. It noted that ICMSF had at the request of the Codex Committee on Processed Meat Products elaborated a document on "Sampling and Inspection Procedures for Microbiological Examination of Processed Meat Products" which would be sent to governments for comments at Step 3.

35. The Committee endorsed the hygiene provisions on the following standards as contained on ALINORM 76/16:

- Canned Corned Beef	Step 8	Appendix II
- Cooked Cured Ham	Step 6	Appendix III
- Cooked Cured Pork Shoulder	Step 6	Appendix IV
- Luncheon Meat	Step 8	Appendix V
- Cooked Cured Chopped Meat	Step 6	Appendix VI

CONSIDERATION AT STEP 5 OF THE PROPOSED DRAFT CODE OF PRACTICE FOR FRESH FISH (CX/FFP 75/3)

36. Prior to consideration of the proposed draft code, the representative from FAO presented a short background statement on the history of the development of codes covering both hygiene and technology, and a current status report.

Section II - Definitions

2.6 "Clean sea water" - Some delegations held the view that it was not feasible to require that sea water should meet the same microbiological standards as potable water. The Committee agreed, however, to let the definition stand as written with the understanding that the wording precluded the use of polluted sea water.

2.10 "Refrigerated sea water" - The phrase "sanitary quality" was deleted from the definition so that it did not conflict with the definition of "clean sea water".

Section III - Raw Material Requirements

3.1 General Considerations

3.1.1 The word "multiplication" relating to microorganisms was substituted by the word "growth" in the provision for reasons of technical accuracy. This change was made throughout the document.

Section IV - Handling of Fresh Fish at Sea

4.2 Fishing Vessel Construction and Sanitary Design

4.2.21 - It was noted that in this and other sub-sections throughout the Code differing minimal temperatures of -1°C (30°F) and 0°C (32°F) for holding fish were given. The Committee requested the Secretariat to harmonize these temperature requirements.

4.3 Sanitary Facilities

4.3.3 - It was noted that in small boats and in particular in smaller vessels it might not always be practicable to have an installation for chlorine injection. The Committee agreed to add the words "where practicable" to the provision. The Committee also decided that the sentence reading: "Fish may be exposed for several minutes to water containing up to 100 ppm chlorine without deleterious effect" was ambiguous and subject to misinterpretation and therefore deleted the sentence. The Committee also deleted the sentence dealing with the practicability of chlorine injection systems on boats of different sizes due to the fact that it was considered to be of little informative value.

4.3.4 The explanation section was amended to ensure that clean sea water intakes aboard vessels were placed well forward of all waste discharges, including bilge and engine cooling discharges.

4.5 Hygienic Operating Requirements

4.5.2 The provision was modified to require both disinfection and rinsing of the tubs, tanks, barrels and other equipment subsequent to cleaning after each cycle of operations.

4.5.13 There was considerable discussion on the advisability of allowing animals such as dogs or cats aboard fishing vessels. It was pointed out that such animals often accompany crews aboard vessels as mascots and also have a rodent controlling effect. The Committee agreed that the requirement relative to food hygiene was met by excluding such animals from areas aboard the vessel where fish is received, handled, processed, or stored. The delegations of Brazil and New Zealand reserved their positions in this matter and pointed out the impracticability of controlling the movement of animals aboard vessels, and that in their view animals should be excluded.

4.6 Handling the Catch on Board

4.6.2 The Committee amended the provision to emphasize that any fish unfit for human consumption should be removed and be kept separate from the catch.

4.6.12 It was agreed that fish guts dropped in containers might contaminate the catch if these containers were not watertight. The word "watertight" was included in the provision.

4.7 Unloading the Catch

4.7.1 It was pointed out by the delegation of Brazil that in many Latin American countries as well as elsewhere throughout the world, many off-loading stations were decentralized and scattered along remote areas of the coast. These small stations should not be considered plants in the sense that no processing takes place. The proposed Code therefore appeared insufficient inasmuch as specific hygienic provisions for small unloading stations were not provided.

5.1.3 Sanitary Facilities

5.1.3.4 The water temperature in the provision was changed to 82°C (180°F) to harmonize with the temperatures recommended in this and other codes.

5.1.3.5 The provision was amended to require that the residual content of free chlorine be no more than the minimum effective level for the use intended. The delegation of Poland reserved its position on this point and expressed itself in favour of establishing a specific maximum level of free chlorine to be allowed in water used in processing plants.

5.1.3.9 A new explanation was added dealing with specific recommendations for the provision of facilities for cleaning of small tools such as knives used in processing rooms.

5.1.3.11 The Committee agreed that any wording in the Code relating to "approval of the official agency having jurisdiction" be changed to " meeting the requirements of the official agency having jurisdiction". The Secretariat was requested to review the Code in detail and amend the text where applicable.

5.3 Hygienic Operating Requirements

5.3.2 The Committee agreed to provide for rinsing after disinfection. The Committee also included an explanation that neither cold nor hot water alone would be sufficient for cleaning purposes.

5.3.3 The provision was amended to explain more adequately the frequency of cleaning necessary during rest or meal breaks and before resumption of production or following other work stoppages.

5.3.5 In the light of amendments to subsection 5.3.3, the Committee modified the subsection to be more specific concerning the frequency with which equipment should be cleaned during production.

5.3.12 The Committee discussed again at some length the matter relative to dogs, cats, and other animals being allowed on plant premises. Several delegations pointed out that even though such animals were excluded from food processing areas, a possible danger from cross contamination existed. The Committee agreed to let the present wording stand and to return to the matter, which it considered to be of a general nature, during the discussion of the revision of the International Code of Practice - General Principles of Food Hygiene at a subsequent session.

5.3.14 It was pointed out that the present text placed responsibility on management to ensure that personnel afflicted with a desease transmissible by food are not allowed to work in contact with fish and that the explanatory paragraphs could be amended by adding wording similar to that used in the Meat Hygiene Code which provides for medical examination. The Committee agreed to defer consideration of the suggested amendment until the General Principles of Food Hygiene had been discussed. (See paragraphs 57-59 of this Report).

Section V - End Product Specifications

37. The Committee considered the end product specifications in great detail. It was noted that the presence of parasites could only to a limited extent be controlled by fish harvesting practice. As a consequence, it was agreed to relate the end product specifications to fishery products only. However, in order to provide for the best possible product, it was agreed that the various end product specifications should to the extent practicable also apply to fresh fish (new 6.E). It was further noted that certain fish parasites could also be harmful to man and consequently amendments were made to the specifications (6.1.A and 6.1.B).

Reference to Related Codes, Standards and other Publications (Appendix II)

38. Several delegations proposed and the Committee agreed to extend the list of references to other documents by listing also the following Codes of Practice: Smoked Fish, Shrimps and Prawns, Lobster and Related Species, Minced Fish Blocks and Molluscan Shellfish. It was also agreed to add under the heading of other publications of interest reference to the report of the WHO Expert Committee on Fish and Shellfish Hygiene, convened in cooperation with FAO.

Status of the Code

39. The Committee agreed to recommend the advancement of the Code in accordance with the proposal by the Committee on Fish and Fishery Products by omitting Steps 6, 7 and 8. The Committee further agreed that the amendments made by it in the Code were of such a nature that referral back to the Committee on Fish and Fishery Products was not necessary. The revisions in the Code are contained in Appendix II to this Report.

CONSIDERATION AT STEP 5 OF THE PROPOSED DRAFT CODE OF PRACTICE FOR CANNED FISH (CX/FFP 75/4)

40. The Committee decided that all amendments made in the hygiene provisions of the Proposed Draft Code of Practice for Fresh Fish and which were applicable to the present Code should be carried over.

Section II - Definitions

2.3 "Canned Fish or Shellfish" - The Committee agreed to define better the conditions of storage to which canned fish or shellfish could be exposed by including the word "normally" in the text. The provision would thus require that the heat treatment be sufficient to destroy or inactivate all microorganisms that will grow at any temperature at which the product is normally likely to be stored.

2.7 "Come-up Time" - It was agreed that come-up time could be included in specifying heat processes and would be adequately defined by retaining the first sentence and deleting the second sentence.

2.9 "Disinfection" - There was some discussion on whether the intention of disinfection was to reduce the number of microorganisms or to eliminate them. The Committee chose, for the sake of consistency, the wording used in the Code of Hygienic Practice for Fresh Meat in which the term "eliminating" is used.

2.14 "Heat Process" - The Committee agreed to amend this definition in line with the change made in the definition for "canned fish or shellfish" (2.3)

2.15 "Heat Processing Time" - The explanatory note to the definition contained in the second sentence was deleted.

2.26 "Swell" - As "swell" could occur independently of heat processing, the reference thereto was deleted.

Section III - Raw Material Requirements

41. The Committee discussed whether under certain circumstances the mandatory form could be justified in Codes of Practice. Some delegations held the view that specific provisions were of such a serious nature that in order to emphasize this the word "shall" should be used rather than "should". Other delegations pointed out that only the conditional form should be used in codes - which were intended to be of an advisory nature. Moreover when certain provisions of a code were attracted into a standard such provisions could be given a mandatory character. The Committee noted that it would be difficult to establish criteria for the use of the mandatory form and decided not to make any changes.

3.4 The Standards for Handling, etc. - It was pointed out that the sentence "Rapid thawing for canning as part of a pre-cooking procedure is acceptable" was not clear. The following wording was agreed to: "The pre-cooking stage may, as an acceptable operation, simultaneously thaw the product."

Section IV - Plant Facilities and Operating Requirements

4.1 Plant Construction and Layout

4.1.1.4 The provision was amended to ensure that the placement of equipment was such as to minimize crowding.

4.1.2.3 The explanation was amended for purposes of clarity relative to the deep seal traps for drainage systems, and to allow for ambien venting for open drains.

4.1.3.3 The Committee considered the reference to sea water in the explanation ambiguous and amended the sub-section so that only clean sea water would be used.

4.1.3.4 As in the Code of Practice for Fresh Fish, the delegation of Poland reserved its position on the subject of water chlorination in favour of establishing maximum free chlorine residue levels for inplant water supplies.

4.1.3.8 The delegation of Brazil stated that in its view, there should be a minimum of two toilets in a plant irrespective of the number of employees.

4.2 Equipment and Utensils

4.2.1. The explanation section was amended to provide that machines and equipment should be designed to facilitate cleaning and disinfection. The Committee also agreed to amend the sub-section further by pointing out that only when no other suitable materials are available that wood could be used for cutting surfaces.

4.3 Hygienic Operating Requirements

4.3.7 The Committee decided to defer discussions on this item until the matter could be discussed in the context of a revision of the General Principles of Food Hygiene.

4.3.8 The sub-section was amended slightly to provide for the use in combination of detergents and disinfectants.

4.4 Operating Practices and Production Requirements

4.4.3 Precooking and Smoking

4.4.3.4 The Committee agreed to amend the sub-section to explain that often during the cooling period, precooked or hot smoked fish were in temperature ranges that may allow for the multiplication of microorganisms of public health significance.

4.4.5.4 The provision was amended slightly to require that "covers" as well as "containers" should be inspected immediately prior to delivery to the filling machines or packing tables.

4.4.5.7 The sub-section was amended slightly for purposes of clarity relative to the rapid handling of raw fish by can-filling personnel.

4.4.5.9 The Committee amended the explanation to require that if dry ingredients are used, they be rehydrated before the commencement of heat processing.

4.4.5.10 A minor change was made in the explanation pointing out that when canning certain species, cans are difficult to fill.

4.4.5.13 The delegation of the United States reserved its position on the first two paragraphs of the explanatory section. The United States supported the basic provision, but felt that the first two paragraphs as they stood were completely in opposition to the requirements of the provision. The United States delegation further pointed out that presently, the only protection the consumer had was an indication that the container had a vacuum. The delegation indicated the U.S. canning industry had always required, even in flexible packages, that the consumer be able to see no swelling or gas production existing in a food container. Therefore, for the safety of the consumer who could not distinguish between a cold filled can and a "flipper", the U.S. strongly opposed the first paragraph. The delegation additionally indicated that experts were aware that adequate vacuums could be pulled on larger containers without damage which was in opposition to the statement in the second paragraph and for that reason objected to the second paragraph as well.

4.4.5.14 The third sentence of the third explanatory paragraph was amended to define that the inspection of can seams should be carried out at frequent intervals preferably not exceeding 30' and that all results should be recorded.

4.4.6.2 The explanation was amended to point out that where necessary a separate heat process should be established for partially filled retorts.

4.4.6.3 The explanatory paragraph was amended to provide that all heat processing operations be based upon heat penetration tests carried out by competent canning technologists and further that the heat process offered sufficient protection against the survival of spores of Clostridium botulinum.

4.4.6 Heat Processing and Cooling

4.4.6.6 The first explanatory paragraph was amended to define more precisely the location for thermometers in retorts.

4.4.6.10 The provision was amended to provide for approval by a competent expert for the heat processing values of the particular products to be retorted. The explanation was further amended to indicate that for any changes in the product, i.e., "temperature of fill", "composition of fill", "size of container", "fill of retort", etc., competent technologists should be consulted to determine if a heat processing change is necessary.

4.4.6.14 The explanation was changed to indicate the necessity to ensure that the contact time of the chlorine with the water was sufficient to reduce the number of microorganisms, particularly in the case of recirculated water used for can cooling.

4.6 Laboratory Control - The delegation of New Zealand proposed to include a reference to incubation of a sample of each retort batch to verify that processing had been adequate. Several delegations pointed out that from a statistical point of view the proposed procedure provided no guarantee with regard to the quality of the product. The Committee decided not to include a provision for incubation of sample cans.

Section V - End Product Specifications

42. The delegation of Poland stated in accordance with its written comments that to emphasize the particular hazard of anaerobic spore formers specific reference should be made to these microorganisms in paragraph 5.1.B(a). It was pointed out, however, that precautions against the growth of Clostridium botulinum were adequately covered in paragraph 5.1.C and the Committee agreed to leave the text as it stood.

Appendix I

5. Filling - The Committee agreed that instead of requiring that cans should be completely filled which might lead to overfilling and consequent closure difficulties it would be better to require that they be adequately filled, but not overfilled.

Appendix II

It was pointed out that the diagram of the roll seam in the second operation was inaccurate and that the compound should be shown as filling the entire space between the body hook and the cover hook. The Committee agreed that the diagram should be changed.

Appendix III

In line with the decision taken concerning additional references in the Code of Practice for Fresh Fish, the Committee agreed that the same document should be listed in the present code.

Status of the Code

43. The Committee concurred with the recommendation of the Committee on Fish and Fishery Products to advance the Code with the omission of Steps 6, 7 and 8. As no amendments of a substantial nature had been made to the document, the Committee did not consider it necessary for the Commodity Committee to review the amendments made by this Committee. The Committee expressed its satisfaction over the fruitful collaboration with the FAO Fisheries Department and the Committee on Fish and Fishery Products in the successful elaboration of the two Codes of Practice. The revisions in the Code are contained in Appendix III to this Report.

44. In the view of several delegations, the Committee had shown that by examining the hygienic provisions of the Codes, it was able to complement the work of the Commodity Committee and to assist in producing Codes of Practice which would render great service, especially in countries developing their fisheries.

Considerations on Hygiene Provisions in Codes of Practice for Fresh Fish and Canned Fish

45. At the time the codes for fresh and canned fish were discussed, it was suggested that the hygiene and health recommendations for plant personnel in the Code of Hygienic Practice for Fresh Meat suitably adapted should be incorporated in these Fish Codes. The Committee considered whether this could usefully be done in one or both of these codes, in place of the existing provisions taken from the General Principles of Food Hygiene. A number of delegations were in favour of the proposed incorporation of these provisions in the Fish Codes, while others felt that, whilst the Fresh Meat Code provisions provided a useful basis for discussion, such discussion could more properly and usefully take place in the context of the Committee's current revision of the General Principles of Food Hygiene, which would be bound to have implications for many commodity Codes of Hygienic Practice.

46. Therefore, the Committee finally agreed that the matter of medical examination should be further discussed in 1976 when the work of revising the General Principles of Food Hygiene would be further pursued and that following these discussions it may be necessary to amend the Fish Codes at a later date.

47. The Committee also agreed to bring the matter to the attention of the Executive Committee, requesting the support of that Committee for their recommendation that, in the meantime, while the matter was of hygienic significance, this one item should not delay the recommended advancement of the Fish Codes, especially as the delegation from Brazil stressed the importance of early publication of these Codes for use by countries developing their fisheries.

STANDARD METHODOLOGY FOR THE DETECTION OF SALMONELLA IN EGGS

Consideration of the Recommendation of the FAO/WHO Consultation on Microbiological Standardization of Foods

48. The Committee at its Eleventh Session had agreed to advance the Draft Code of Hygienic Practice for Egg Products to Step 8 and to suspend the action of the Task Force set up at its Tenth Session to elaborate Standard Methodology for detection of Salmonella in Eggs since the same subject was to be examined by a Joint FAO/WHO Consultation on Microbiological Specifications for Foods. This Consultation was to report its conclusions to the Twelfth Session of the Committee.

49. The representative of WHO made a brief statement on the events which led to the meeting in Geneva in April 1975 of the Joint FAO/WHO Consultation on Microbiological Specifications in Foods. The Committee was informed that the Consultation was sponsored by the United Nations Environmental Programme (UNEP) and had available to it comprehensive background material prepared by a consultant and had considered as first priority the question of microbiological end product specifications for egg products.

50. The Consultation as a result recommended the specifications for whole dried and frozen eggs which were now before the Committee for consideration (Annex V, CX/FH 75/9). The specifications covered sampling for microbiological analysis, microbiological methods and microbiological limits for Salmonella, total aerobic plate count and Coliforms and were intended to be included in section V on End Product Specifications of the Draft Code of Practice for Egg Products.

51. The Committee noted that two further joint FAO/WHO consultations were planned at which microbiological specifications for other priority food products would be considered. The first Consultation had recommended that high priority be given to the following: non-fat dried milk and pre-cooked frozen sea foods.

52. It further noted that at its recent meeting in Paris, TC 34 - Sub-Committee 9 of the International Standards Organization (ISO) had recommended a specific method for aerobic plate count which was the same as that recommended by the Expert Consultation.

Status of the Document

53. The Committee agreed that Governments should be asked in a circular letter to comment at Step 3 on all aspects of the Draft Proposal for Microbiological Specifications for Egg Products (Annex V). The letter should emphasize that the methods were to be incorporated into the Code as reference methods as distinct from routine methods. It was understood that if and when adopted into a standard or standards the methods would become referee methods for use in case of dispute.

CONSIDERATION AT STEP 2 OF THE PROPOSED DRAFT CODE OF HYGIENIC PRACTICE FOR LOW-ACID CANNED FOODS (CX/FH 75/7 & Corrigendum)

54. The Committee considered briefly the above mentioned Proposed Draft Code. The document had been elaborated by an ad hoc working group consisting of delegations of Canada (Coordinator), Netherlands, United Kingdom and U.S.A.

55. The Committee at its Eleventh Session had requested the delegation of Canada to include a consideration of processing and hygienic control requirements as well as microbiological and other requirements which might be relevant to the protection of public health (ALINORM 76/13, paragraph 93).

Status of the Document

56. The Committee agreed that the document should be submitted to Governments for comments at Step 3. The Delegation of Canada undertook to make editorial changes which appeared desirable in order to maintain consistency with the Proposed Draft Code of Practice for Canned Fish which the Committee had considered earlier during this session. The proposed Draft Code as edited is attached to this Report as Appendix IV.

CONSIDERATION AT STEP 2 OF THE PROPOSED DRAFT CODE OF HYGIENIC PRACTICE FOR FOOD FOR INFANTS AND CHILDREN (CX/FH 75/8)

57. The Committee considered briefly the above mentioned Proposed Draft Code. The document had been elaborated by the delegation of the Federal Republic of Germany in accordance with the wishes expressed by the Committee at its Tenth Session (ALINORM 74/13, paragraphs 34 and 35).

58. The delegation of the Federal Republic of Germany in introducing the document stated that the Code was modelled in conformity with what it assumed would be the revised form of the General Principles of Food Hygiene with the addition of specific provisions for foods for Infants and Children.

Status of the Document

59. The Committee agreed that the document should be submitted to governments for comments at Step 3. Comments were also requested on the microbiological specifications contained in the Annex to the Code (originating from ALINORM 74/26, Appendix III). On the basis of these comments as well as any other comments and also on the basis of the revised General Principles of Food Hygiene the delegation of the Federal Republic of Germany would prepare a revision for consideration by the Committee at its next session. The Proposed Draft Code as edited is attached to this Report as Appendix V.

REVISION OF "GENERAL PRINCIPLES OF FOOD HYGIENE"

60. The Committee noted that the Commission at its Tenth Session (1974) had agreed to a request of this Committee to revise the General Principles of Food Hygiene.

61. It was agreed to request the delegation of the Netherlands in collaboration with the delegations of the United Kingdom and the USA to revise the present document on the basis of the government comments which would be sought and further to take into account the Codes of Hygienic Practice for Fresh Meat and for Processed Meat Products. It was further thought desirable that appropriate provisions in the Proposed Draft Code of Hygienic Practice for Foods for Infants and Children, and that ideas and principles from other Codes of Hygienic Practice should, where practicable, be taken into consideration during the revision.

Status of the Document

62. The Committee agreed that the revised document - which would be distributed by the Secretariat towards the end of 1975 - should be submitted to Governments for comments at Step 3.

RECONSIDERATION AT STEP 4 OF THE PROPOSED DRAFT CODE OF HYGIENIC PRACTICE FOR MOLLUSCAN SHELLFISH - (ALINORM 76/13, Appendix IV)

63. The Committee considered the above mentioned revised Code in the light of written comments thereon received from Australia, Canada, France, Netherlands, Poland and the United Kingdom which were distributed during the session.

64. During the discussions, it appeared that a number of observations from the delegation of France were due to inconsistencies in the translation. The Secretariat undertook to revise completely the French and Spanish versions of the text.

65. Similarly the Secretariat undertook to substitute "accepted" for "approved" wherever the phrase "approved by the official agency having jurisdiction" occurred.

Section I SCOPE

66. The Committee agreed for the purposes of clarity to specify the taxonomic groups that were to be covered by the Code.

Section II - DEFINITIONS

67. A provision for disinfection in accordance with that in the General Principles was added. Also the Committee made a minor modification to the definition of shellfish for purposes of clarity. It was pointed out that for this there might be a case for two separate definitions for clean sea water; the first for use on board vessels and the second for use in processing plants. The Committee agreed for the present to leave this definition as it stood.

IV.A.2(b) Water supply. It was noted that the provision contained a reference to hot water without specifying the temperature. During the discussion of the Fish Codes, it had been observed that two temperatures for hot water had been specified and it had been agreed that for the sake of consistency, a single temperature of 82°C (180°F) should be employed. In view of the particular nature of the product where hot water at this temperature might coagulate organic material, the Committee agreed not to specify a temperature.

Section III - RAW MATERIAL REQUIREMENTS

Environmental Sanitation in Growing Areas

III.A.(1) The phrase "as appropriate" was added to the last sentence to define further the raw material requirements relative to heat processing.

Surveys of Shell Fish Growing Areas

III.A.(3)(a) The Committee agreed to delete the word sanitary as it already occurred in the subsection's title and the text was self-explanatory.

III.A.(3)(c) The paragraph was reworded to explain that it was necessary for official agencies having jurisdiction to have legal authority to close immediately areas affected by marine biotoxins. It was pointed out that the Spanish translation was incorrect with respect to the word "quarantine". The Delegation of Mexico provided to the Secretariat the correct translation of the sentence as reworded by the Committee.

Sanitary Harvesting and Food Protection

Sanitary Techniques

III.B.(2)(b) The wording was amended to point out that shellfish should be washed shortly after harvest to remove excessive mud and weeds.

Protection of Product from Contamination

III.B.(4)(b) The paragraph was reworded to eliminate the presence of animals in any part of harvesting vessels or establishments where shellstock is prepared, handled, packed, or stored. A further amendment was made to provide for effective measures of vermin control.

Handling Procedures

III.C.(2)(ii) The Committee modified the paragraph to emphasize that not only should shellstock not be exposed to extremes of heat or cold, but that problems might also arise with lowering temperatures of shellstock too rapidly.

III.C.(2)(b)(i) The Committee considered that as the provision stood it contained two contradictory sentences and therefore deleted the penultimate sentence.

IV.A.2(b) Water supply. It was noted that the provision contained a reference to hot water without specifying the temperature. During the discussion of the Fish Codes, it had been observed that two temperatures for hot water had been specified and it had been agreed that for the sake of consistency, a single temperature of 82°C (180°F) should be employed. In view of the particular nature of the product where hot water at this temperature might coagulate organic material, the Committee agreed not to specify a temperature.

Hygienic Operating Requirements

IV.B.2 "Sanitary maintenance of plant facilities and premises". Bearing in mind the discussion under IV.A.2(b), the Committee agreed to add a provision for rinsing with cold water prior to scrubbing and cleaning.

Operating Practices and Production Requirements

IV.D.1 The Committee agreed to clarify the wording of the provision to read: "Shellfish should not be accepted if they are contaminated with microorganisms or substances not removed by normal plant procedure."

IV.D.2 Relaying and purification

IV.D.2(e) The Committee decided to delete the cited examples of toxic substances that might prevent shellfish from functioning properly, since it was not feasible to give an exhaustive list of substances.

IV.D.2(g) The provision was amended to refer to the physiological condition of the shellfish during the process of purification.

IV.D.2(h) It was recognized that copper, zinc, etc., influenced the pumping mechanism of shellfish but that exposure for a short period of time to these metallic ions did not adversely affect them.

IV.D.2(l) To make this provision more informative, it was agreed to include the generic name "Mya" for soft shell clams.

IV.D.2(m) The provision was transposed to section IV.F, Lot Identification as IV.F.2.

Storage of Shellstock in Sea Water

IV.D.3(e) It was agreed to delete reference to "prevalent" high temperatures since the shellstock needed to be protected against high temperatures whether prevalent or not.

Washing, Grading and Packing of Shellstock

IV.D.4(b) It was pointed out that certain species of shellfish with one cupped shell, were packed loose in bags. To provide for this the provision was amended editorially.

Preservation of Raw or Heat-treated Shellfish

IV.D.6 It was not considered necessary to allude to preservation methods in this Code; the provision was deleted.

Laboratory Control Procedure

IV.E.2 The Committee agreed to reword the provision to define better the conditions under which samples of water and shellfish should be taken.

IV.E.5 As a consequence of the change in IV.E.2, the first paragraph of the provision has been deleted.

Annex - Current Laboratory Procedures and Standards

68. It was pointed out that the Joint FAO/WHO Expert Consultation on Microbiological Specifications for Foods had recommended that this Committee examine existing codes and standards and those in progress to determine which could be usefully supplemented by microbiological end-product specifications. The Committee concurred with this view in principle, but considered that in the case of the Code for Molluscan Shellfish, the variety of practices in the industry would make it highly difficult at this time to arrive at agreed laboratory procedures.

Status of the Document

69. The Committee agreed to advance the Proposed Draft Code of Hygienic Practice for Molluscan Shellfish to Step 5. Several delegations were of the opinion that the advanced state of the document warranted a recommendation to the Commission to omit Steps 6 to 8. Other delegations held the view that some provisions in the Code would benefit from a further round of government comments. The Committee found a consensus for advancing it to Step 5. The revised document is contained in Appendix VI to this Report.

PROPOSED DRAFT CODES OF HYGIENIC PRACTICE FOR GROUNDNUTS AND FOR FROG LEGS

70. Due to shortage of time, the Committee did not consider the two above documents which were at Step 4 of the Procedure. It was agreed to return the Codes to Step 3 so as to obtain comments from governments which would be considered at the next session of the Committee. The Code for Groundnuts which had been revised by the author country, and the Code for Frog Legs are contained in Appendices VII and VIII to this Report.

71. In view of the delay in considering the two Codes, the Committee agreed that in submitting additional comments at Step 3, countries should keep in mind the expressed desire of the Committee that the Codes be considered at the next session with a view to sending them to the Commission with a recommendation that they be advanced to Step 8 with the omission of Steps 6 and 7.

OTHER MATTERS

72. It was pointed out that Codes of Practice developed by Commodity Committees often had important hygienic implications and the question was raised as to whether this should not be recognized in the title of the Codes. A suggested amended title might be "Code of Technological and Hygienic Practice".

73. It was further pointed out that technological and hygienic requirements were often difficult to separate and required expert technical advice when hygienic provisions of a particular code were under consideration by this Committee.

74. The Committee agreed to request the Codex Alimentarius Commission to consider the possibility of representation from interested commodity committees when hygienic provisions of codes were examined by the Codex Committee on Food Hygiene.

75. The Committee noted that at its Tenth Session (July 1974) the Codex Alimentarius Commission, in considering the question of the revision of the General Principles of Food Hygiene had agreed that at the same time a glossary of terms be developed. This should be taken into account by those delegations (Netherlands, United Kingdom and U.S.A.) which were collaborating on the revisions of the General Principles of Food Hygiene.

FUTURE WORK

76. In view of the large amount of work in which the Committee was currently engaged, it was agreed not to undertake further work at present.

Date and Place of Next Meeting

77. The Committee was informed that in all probability, the next session of the Committee would take place in mid-1976 in Washington, D.C. The timing would be a matter of consultation between the Government of the U.S.A. and the Codex Secretariat and would also depend on the date for the Eleventh Session of the Commission. It was pointed out that the month of July is connected with the holiday period in many countries and further would coincide with the becentennial celebrations in USA which would give rise to difficulties in obtaining hotel reservations.

FOOD HYGIENE

STATUS OF WORK

Code/paper	Status Step	To be dealt with by	Document ALINORM App.	Working paper next session
General Principles	9	Governments and Delegations of NL, UK and USA	CAC/RCP 1-1969	
Processing and Handling of Quick Frozen Foods	8	11th CAC	ALINORM 76/25 Appendix II	
Milk and Milk Products		Expert Committee	CX 5/70-17th	
Fresh Fish	proposed 8	11th CAC	ALINORM 76/13A, Appendix II	
Canned Fish	proposed 8	11th CAC	ALINORM 76/13A, Appendix III	
Egg Products - End product Microbiological specifications	3	Governments	CX/FH 75/9	
Low Acid Canned Foods	3	Governments	ALINORM 76/13A Appendix IV	
Food for Infants and Children	3	Governments	ALINORM 76/13A, Appendix V	
Molluscan Shellfish	5	11th CAC	ALINORM 76/13A, Appendix VI	
Groundnuts	3	Governments	ALINORM 76/13A, Appendix VII	
Froglegs	3	Governments	ALINORM 76/13A, Appendix VIII	

MATTERS OF SPECIFIC INTEREST TO OTHER COMMITTEES

Codex Committee	Paragraphs
Foods for Special Dietary Uses	11-14, 54-56
Standardization of Fruit Juices	15-17
Quick Frozen Foods	15, 18-24
Meat Hygiene	25-26
Milk and Milk Products	27-33
Processed Meat Products	34-35
Fish and Fishery Products	32, 36-44

LIST OF PARTICIPANTS *
LISTE DES PARTICIPANTS
LISTA DE PARTICIPANTES

OFFICERS OF THE MEETING

Chairman

Dr. Joseph C. Olson
Director, Division of Microbiology
Bureau of Foods
Food and Drug Administration
Department of Health, Education and Welfare
Washington, D.C. 20204

Assistant to the Chairman

Dr. Joseph W. Lepak
Assitant to the Director
Division of Microbiology
Bureau of Foods
Food and Drug Administration
200 C Street, SW
Washington, D.C. 20204

Rapporteur

Mr. E. Spencer Garrett
Director, National Fishery Products Inspection and Safety Laboratory
National Oceanic and Atmospheric Administration
U.S. Department of Commerce
P.O. Drawer 1207
Pascagoula, Mississippi 39567

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS (FAO)

Mr. J.M. Hutchinson
Food Control Officer
Joint FAO/WHO Food Standards Programme
FAO
Via delle Terme di Caracalla
00100-Rome
Italy

Mr. Willem L. de Haas
Food Standards Officer
Joint FAO/WHO Food Standards Programme
FAO
Via delle Terme di Caracalla
00100-Rome
Italy

Mr. Richard Garm
Fishery Officer (Quality)
Department of Fishery
FAO
Via delle Terme di Caracalla
00100-Rome
Italy

WORLD HEALTH ORGANIZATION

Dr. L.R.R. Reinius
Food Hygienist
Veterinary of Public Health
Division of Communicable Diseases
World Health Organization
1211 Geneva 27
Switzerland

---

* The Heads of Delegations are listed first.
Les chefs de délégations figurent en tête.
Figuran en primer lugar los jefes de las delegaciones.

ARGENTINA
ARGENTINE

Mr. Jorge H. Cazenave
Agricultural Counsellor
Embassy of Argentina
1600 New Hampshire Avenue, NW
Washington, D.C. 20009
U.S.A.

AUSTRALIA
AUSTRALIE

Mr. W.C.K. Hammer
Assistant Secretary
Australian Department of Agriculture
Canberra ACT

Dr. J.H.B. Christian
Associate Chief
CSIRO, Division of Food Research
P.O. Box 52
North Ryde, New South Wales

Mr. S.W.C. Smith
Principal Chemist
Australian Department of Health
P.O. Box 100
Woden, ACT 2606

Mrs. W.I. Williams
Australian Federation of Consumer Organizations
38 Taurus Street
North Balwyn
Victoria

Mr. R.C. Stanhope
Senior Chemist and Food Technologist
Victorian Department of Health
Health Laboratory
5 Parliament Place
Melbourne, Victoria

BRAZIL
BRESIL
BRASIL

Dr. C.A.M. Lima Dos Santos
Director, Division of Inspection of Fish and Fishery Products
DIPOA - Ministry of Agriculture
Ed. Gilberto Salomao - 13º Andar SCS
Brasilia - D.F.

CANADA

Mr. Ilmar E. Erdman
Health Protection Branch
Department of Health and Welfare
Ottawa, Ontario K1A OL2

CANADA (cont.)

Mr. Geoffrey G. Anderson
Assistant Director
Inspection Branch, Fisheries and Marine Service
Department of the Environment
Ottawa, Ontario K1A OH3

Dr. D.L. Collins-Thompson
Health Protection Branch
Department of Health and Welfare
Ottawa, Ontario K1A OL2

Dr. René Troalen
Associate Director
Meat Inspection Division
Department of Agriculture
Sir John Carling Building
Ottawa, Ontario K1A OC5

DENMARK
DANEMARK
DINAMARCA

Mr. Kaj Haaning
Veterinarian
Institute of Microbiology and Hygiene
Bülowsvej 13
DK 1870 Copenhagen V

ECUADOR
EQUATEUR

Mr. Hernan Orellana
Commercial Counsellor
Embassy of Ecuador
2535 - 15th Street, NW
Washington, D.C. 20009
U.S.A.

FINLAND
FINLANDE
FINLANDIA

Mr. Toivo Salmi
Veterinarian
Head of Division of Food Hygiene
Veterinary Department
Ministry of Agriculture and Forestry
Hallituskatu 3
00170 Helsinki 17

FRANCE
FRANCIA

Dr. Alice M. Caillet
Doctor Inspector of Health
Ministry of Public Health
20 Rue d'Estrées
75700 Paris

Mr. Yves Lagoin
Veterinary Inspector
Ministry of Agriculture
5 Rue E. Renan
92.130 Issy les Moulineaux

FRANCE (cont.)

Mrs. Suzy Rochize
Inspecteur Divisionnaire SRF
Ministry of Agriculture
42bis Rue de Bourgogne
75007 Paris

GERMANY, FED. REP.
ALLEMAGNE, REP. FED.
ALEMANIA, REP. FED.

Dr. Klaus Gerigk
Director and Professor
Federal Health Office
Bundesgesundheitsamt
Postfach
D-1000 Berlin 33

Dr. H. Meyer
Director
Deutsche Nestlé GmbH
Lyonerstrasse 23
D-6000 Frankfurt/M.-Niederrad

Mr. Friedrich Frede
Stellvertretender Geschäftsführer des
Bundesverbandes der diätetishchen
Lebensmittelindustrie e.V.
Kelkheimer Str. 10
D-6380 Bad-Homburg v.d.H.

IRAN

Dr. A.A. Agah
Senior Expert of the Ministry of
Agriculture and Natural Resources
P.O.B. 3178
Tehran

Dr. Abass Khalesi
Director for the Division of
Agricultural Industries
ISIRI
P.O. Box 2937
Tehran

Mr. M. Buzari
Director for the Division of Coordination
of the Formulation and the Implementation
of Standards
ISIRI
Tehran

IRELAND
IRLANDE
IRLANDA

Dr. Thomas O'Toole
Agricultural Inspector
Department of Agriculture and Fisheries
Kildare Street
Dublin

ISRAEL
ISRAËL

Mr. Gideon Cohen
Agricultural Counsellor
Embassy of Israel
1621 22nd Street, NW
Washington, D.C. 20008, U.S.A.

ITALY
ITALIE
ITALIA

Dr. Giuseppe Verardi
Assistant Head Chemist
Ministry of Public Health
P.le Marconi, 25
00144-Rome

IVORY COAST
COTE D'IVOIRE
COSTA DE MARFIL

Mr. Jean-Michel Kouao Kouadio
Pharmacien-chef du Laboratoire de chimie,
toxicologie et de la répression des fraudes
Ministère de la Santé publique
Boîte postale 5
Abidjan

Mr. Mathieu Capet
First Secretary
Embassy of Ivory Coast
2424 Massachusetts Avenue
Washington D.C. 20008, U.S.A.

JAPAN
JAPON

Mr. Ko Namba
Technical Official
Food Sanitation Division
Environmental Health Bureau
Ministry of Health and Welfare
2-2, 1-Chome, Kasumigaseki
Chiyoda-Ku, Tokyo

Mr. Kozaburo Hirano
Executive Director
Canners Association of Japan
No. 567 Marunouchi Building
Chiyoda-Ku, Tokyo 100

KOREA, REP. OF
COREE, REP. DE
COREA, REP. DE

Mr. Joong Il Suh
Agricultural Attaché
Embassy of the Republic of Korea
2320 Massachusetts Avenue, NW
Washington, D.C. 20008, U.S.A.

Mr. Han Mo Kim
Fisheries Attaché
Embassy of the Republic of Korea
2320 Massachusetts Avenue, NW
Washington, D.C. 20008, U.S.A.

JAPAN (cont.)

Mr. Kyongsoo Kim
Third Secretary
Embassy of the Republic of Korea
2320 Massachusetts Avenue, NW
Washington, D.C. 20008
U.S.A.

LIBYAN ARAB REPUBLIC
REPUBLIQUE ARABE LYBIENNE
REPUBLICA ARABE DE LIBIA

Mr. Ali Fathi Shahawy
Director General of Food Affairs
Council of Food Affairs
Maritime Wealth
P.O. Box 1583
Tripoli

Mr. Ahmad Abudaiah Ahmad
Government Official
General Secretariat of Ministers Council
Tripoli

MEXICO
MEXIQUE

Dr. Heriberto Barrera-Benitez
Head, Quality Control, Normalization and Inspection Department
Comisión Nacional de Fruticultura
Apdo. Postal 41-740
Palo Alto
Mexico (18) D.F.

NETHERLANDS
PAYS-BAS
PAISES BAJOS

Dr. K. Büchli
Public Health Officer
Ministry of Public Health and Environment
Dr. Rejersstraat 12
Leidschendam

Dr. M. van Schothorst
Chief, Food Hygiene Laboratory
National Institute of Public Health
P.O. Box 1
Bilthoven

Mr. Arnold Parzer
Second Secretary
Embassy of The Netherlands
4200 Linnean Avenue, NW
Washington, D.C. 20008
U.S.A.

Dr. Peter J. Anema
Section Manager, Microbiology
Unilever Research Laboratory
P.O. Box 7
Zevenaar

NEW ZEALAND
NOUVELLE ZELANDE
NUEVA ZELANDIA

Mr. C.A. Rickit
Second Secretary (Commercial) and Assistant Trade Commissioner
New Zealand Trade Commission
1707 L Street, NW, Suite 600
Washington, D.C.
U.S.A.

POLAND
POLOGNE
POLONIA

Mr. Waclaw Orlowski
Chief, Fruits and Vegetables Section
Quality Inspection Office
Ministry of Foreign Trade
Stepinska 9 Str.
Warsaw

SAUDI ARABIA
ARABIE SAOUDITE
ARABIA SAUDITA

Dr.Ahmed Hassan Qutub
Director General
Saudi Arabian Standards Organization
P.O. Box 3437
Riyadh

SWEDEN
SUEDE
SUECIA

Dr. Torsten Petrelius
Head of Food Hygiene Department
The National Food Administration
Fack
S-104 01 Stockholm

Dr. Herbert Lundström
Chief Government Inspector
The National Food Administration
Fack
S-104 01 Stockholm

SWITZERLAND
SUISSE
SUIZA

Mr. Hans U. Pfister
Head of Codex Section
Federal Health Service
Haslerstrasse 16
CH-3008 Bern

Dr. J.C. de Man
Nestec
CH-1814 La Tour-de-Peilz

THAILAND
THAILANDE
TAILANDIA

Prof. Amara Bhumiratana
Director
Institute of Food Research and Product Development
Technical Adviser
Thai Food Processor's Association
P.O. Box 4-170
Bangkok

Mrs. Rabieb Bhumiratana
Deputy Director-General
Department of Science
Rama VI Street
Bangkok 4

UNITED KINGDOM
ROYAUME-UNI
REINO UNIDO

Dr. A.D. Bostock
Senior Medical Officer
Department of Health and Social Security
Alexander Fleming House
Elephant & Castle
London SE1 6BY

Mr. T.B. Williamson
Assistant Secretary
Department of Health and Social Security
Alexander Fleming House
Elephant & Castle
London SE1 6BY

Dr. A.C. Baird-Parker
Scientific Adviser
Food Manufacturers' Federation
1/2 Castle Lane
Buckingham Gate
London SW1E 6 DN

UNITED STATES OF AMERICA
ETATS-UNIS D'AMERIQUE
ESTADOS UNIDOS DE AMERICA

Mr. William V. Eisenberg
Chief, Microanalytical Branch (HFF-127)
Division of Microbiology
Food and Drug Administration
Washington, D.C. 20204

Mr. James R. Brooker
Fishery Products Inspection and Safety Division
U.S. Department of Commerce, NOAA, NMFS
3300 Whitehaven Street, NW
Washington, D.C. 20235

Mr. Cleve B. Denny
Manager, Research Services
National Canners Association
1133-20th Street, NW
Washington, D.C. 20036

UNITED STATES OF AMERICA (cont.)

Mr. Daniel A. Hunt
Assistant to the Director
Division of Shellfish Sanitation
Food and Drug Administration
Washington, D.C. 20204

Dr. Nino F. Insalata
Laboratory Manager
Technical Center
General Foods Corporation
250 North Street
White Plains, New York 10625

Dr. Robert W. Weik
Assistant to Director for International Standards
Bureau of Foods
Food and Drug Administration
200 C Street, S.W.
Washington D.C. 20204

Mr. J.B. Murray
Assistant Director, Technical Services
Animal and Plant Health Inspection Service
Department of Agriculture
Washington, D.C. 20250

OBSERVER COUNTRY
PAYS OBSERVATEUR
PAIS OBSERVADOR

SOUTH AFRICA
AFRIQUE DU SUD
SUDAFRICA

Mr. Wilhelm Lubbe
Economic Minister
Embassy of South Africa
3051 Massachusetts Avenue, NW
Washington, D.C. 20008

OBSERVER ORGANIZATIONS

INTERNATIONAL SECRETARIAT FOR THE INDUSTRIES OF DIETETIC FOOD PRODUCTS (ISDI)

Mr. Friedrich Frede
Assessor
ISDI
Kelkheimer Strasse 10
D-638 Bad Homburg vdH
Germany, Fed. Rep.

NATIONAL CANNERS ASSOCIATION

Mr. Lowrie M. Beacham
Consultant
National Canners Association
1133 20th Street, NW
Washington, D.C. 20036

NORM 76/13A
ENDIX II

AMENDED DRAFT CODE OF PRACTICE FOR FRESH FISH

CONTENTS

INTRODUCTION

The Code of Practice for Fresh Fish has been evolved by combining the code of technological practice, developed in 1969 by the FAO Department of Fisheries, Fishery Products and Marketing Branch assisted by Ad Hoc Consultations and published in the same year as FAO Fisheries Report No. 74, with the code of hygienic practice as proposed by the FAO/WHO Codex Alimentarius Commission, Codex Committee on Food Hygiene.

The aim of this code is to assist those concerned with the handling and processing of fresh fish for the fresh fish market, in achieving a high standard of product acceptable to the consumer. The quality of the end product will depend mainly on the technological and hygienic practices involved and equipment employed, from the time of catching to marketing.

Fish catching and processing for human consumption is only profitable when the consumer is satisfied with the quality and price of the product. This situation requires the introduction of higher and more uniform standards of handling and processing to those in use in many areas of the world at present. The advice given here will help to raise and maintain a higher quality of fresh fish, which should be acceptable in both national and international trade.

One aspect which requires particular consideration is the fact that different people in various parts of the world have different consumer requirements. Handling and processing practices, as advised in this code, will ensure that the quality standard of even the most sophisticated consumer can be met. Where prevailing quality requirements are less strict, handling practice may be more flexible, but advice which refers to hygienic conditions and wholesomeness of product allows for less flexibility, and the basic principles should generally be applicable throughout the world.

The code deals with fresh fish for human consumption, which are chilled but not frozen. Where present knowledge does not allow firm recommendations to be made this is clearly stated. The information given here is based on the best technological knowledge currently available, and on basic principles as established in the light of modern research results. Both the knowledge and principles are applicable to all fisheries throughout the world and the code is therefore a guide to good practice in all areas, stating broad recommendations and explaining in simple terms the underlying reason for these.

It must be acknowledged, however, that most of the practical information on fish handling and processing, both at sea and on shore, has been gained from particular areas, mainly the North Atlantic and North Pacific fisheries. Little is known from fisheries in other areas, for example in the tropics. It should be appreciated that the variety of existing fishing vessels, the many types of gear used and the number of species involved in world fisheries, do not allow for a single code of handling practice to be drawn up, covering all types of fisheries.

This code, therefore, is not intended to replace the advice or guidance of trained and experienced technologists regarding the complex technical problems which might be unique to a specific geographical area or specific fishery.

The practical application of this "international" code, with regard to "national" fisheries, will therefore require some modifications and amendments, taking into account local conditions and specific local consumer requirements. In other words, it should be possible for "national" codes of handling practice to be elaborated for the guidance of individual fisheries, based on this code.

The code is intended also as background information or as a guideline for the elaboration of national quality standards, quality control and fish inspection regulations in the countries where these, as yet, have not been developed. In addition, it could be used for training of fishermen and employees of the fish processing industry.

In this code no firm conclusions have been reached regarding the need for certain local practices, for example the removal of gills. Controversial matters of this type have therefore been omitted or mentioned without any firm recommendations being given. Similarly, super-chilling, that is the reduction of the temperature of the fish below -1°C (30°F) under controlled conditions, has also been omitted. It is thought that although this method of storage and preservation may be of considerable interest in some fisheries, there is not yet sufficient experience in the practice to permit a proper assessment of its value, or to give advice on how it should be carried out.

Food additives have been excluded from the code, since consideration of their use belongs elsewhere. No reference is therefore made to the use of antibiotics or chemical additives in ice or brine.

All operational codes of this kind will require to be revised periodically, to incorporate new developments and techniques, introduced commercially for the handling and processing of fish.

The special requirements of retailing fresh fish are not included here, but these will be dealt with in a separate code. The recommendations generally apply to fresh water fisheries but these are not dealt with specifically.

- - - - -

CODE OF PRACTICE FOR FRESH FISH

Note

- The hygienic requirements of this Code are partially based on the General Principles of Food Hygiene and the Proposed Draft Codes of Hygienic Practice for Handling of Fresh and Frozen Fish (Step 2), for Processed Meat Products (ALINORM 72/16, Appendix V) and for Fresh Meat (ALINORM 72/15, Appendix II).
- The letter and number codes given in the right hand margin indicate hygienic requirements as taken from the following codes of hygienic practice:

Proposed Draft Code of Hygienic Practice for Handling of Fresh and Frozen Fish	- FF
Proposed Draft Code of Hygienic Practice for Processed Meat Products	- MP
Proposed Draft Code of Hygienic Practice for Fresh Meat	- FM

1. SECTION I - SCOPE

This code of practice applies to fresh fish, chilled but not frozen, intended for human consumption. It contains the technological guide lines and the most essential requirements of hygiene for the handling and processing of fresh fish at sea and on shore.

The special requirements for retailing of fresh fish and their products or the use of food additives are not included.

Although the code does not deal specifically with the fresh water fisheries, most of the recommendations made would apply.

2. SECTION II - DEFINITIONS

For the purpose of this code:

2.1 "auction" is the first sale of the catch at a fishing port, by competitive buying. In some fisheries this involves unloading and display of the catch, in others only the representative samples are displayed.

2.2 "boxed stowage" is the storage of fish on board the vessel in boxes;

2.3 "bulk stowage" is the mass storage of fish in pounds on board the vessel;

2.4 "chilling" is the process of cooling fish to a temperature approaching that of melting ice; MP

2.5 "cleaning" means the removal of objectionable matter; FM

2.6 "clean sea water" is sea water which meets the same micro-biological standards as potable water and is free from objectionable substances;

2.7 "contamination" means direct or indirect transmission of objectionable matter to the fish; MP FM

2.8 "disinfection" means the application of hygienically satisfactory chemical or physical agents and processes to clean surfaces with the intention of eliminating micro-organisms; MP

2.9 "fillet" is a slice of fish of irregular size and shape removed from the carcase by cuts made parallel to the backbone;

2.10 "fish" means any of the cold-blooded aquatic vertebrate animals commonly known as such. This includes Pisces, Elasmobranchs and Cyclostomes. Aquatic mammals, invertebrate animals and amphibians are not included. It should be noted, however, that many of the recommendations given here also apply to certain invertebrates, particularly Cephalopods;

2.11 "fresh fish" are freshly caught fish which have received no preserving treatment or which have been preserved only by chilling;

2.12 " gutted fish" are fish from which the guts have been removed;

2.13 "keeping time" refers to the length of time that fish will remain wholesome and acceptable as human food;

2.14 "market" is an area or building used for the display and first sale of the catch;

2.15 "packaging materials" are all those materials such as foils, films, waxpaper, cartons and boxes, used for covering and protecting the fresh fish or fresh fish products, and which are approved by the official agency having jurisdiction;

2.16 "pounds or pens" are areas in the fish hold and on deck, divided off by stanchions and portable or fixed board structures for the storage of fish;

2.17 "potable water" is fresh water fit for human consumption. Standards of potability should not be lower than those contained in the latest edition of the "International Standards for Drinking Water", World Health Organization;

2.18 "refrigerated brine" is a potable water and salt (sodium chloride) solution of about the same salinity as sea water. It is cooled in the same manner as refrigerated sea water;

2.19 "refrigerated sea water" is a clean sea water cooled by the addition of ice and/or by a suitable refrigeration system. Its salt content is normally about 3 percent;

2.20 "rigor mortis" means the stiffening of the muscles of an animal which results from a series of complex changes that take place in the tissues shortly after death. Immediately after death, the muscles are soft and limp and can be easily flexed. At this time, the flesh is said to be in pre-rigor condition. Soon the muscles begin to stiffen and harden and no longer contract by stimulation. The animal then is in rigor. After some hours or days, the muscles gradually begin to soften and become limp again. This is called the post-rigor condition;

2.21 "shelf stowage" is the storage of fish on board the vessel in single layers, on shelves;

2.22 "steak" is a section of fish, removed by cutting approximately at right angle to the backbone;

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

2.24 "whole fish" are fish as captured, ungutted.

3. SECTION III - RAW MATERIAL REQUIREMENTS

3.1 General Considerations

3.1.1 FISH ARE AN EXTREMELY PERISHABLE FOOD, AND SHOULD BE HANDLED AT ALL TIMES WITH GREAT CARE AND IN SUCH A WAY AS TO INHIBIT MULTIPLICATION OF MICROORGANISMS FF III B (4)(a)

Fish quality deteriorates rapidly, and the potential keeping time is shortened if they are not handled and stored properly. Much of the fish landed for human consumption is unfortunately subjected to fairly rough handling treatment which should be avoided. Fish should not be exposed to direct sunlight or to the drying effect of winds, or any other harmful effects of the

elements, but should be carefully cleaned and cooled down to the temperature of melting ice, 0°C (32°F), as quickly as possible. Any careless treatment or delay in reducing the temperature of the fish will have a marked effect on their potential keeping time.

3.1.2 FISH INTENDED FOR MARKETING AS FRESH FISH SHOULD BE OF THE HIGHEST POSSIBLE QUALITY

Although there are many aspects that might be taken into account when defining what is meant by the "highest possible quality" fish, there are two major ones that should concern the fisherman as a primary producer:

1. quality of fish when caught, and
2. quality of fish on delivery to the buyer or the processor.

The first one is determined by the physical condition of the fish, its appearance, size, percentage of fat, amount of feed, presence of disease and of toxic substances. The second one will result from the methods and techniques employed in fishing, practices in handling and conditions of storage while on board the fishing vessel.

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

HANDLING OF FRESH FISH AT SEA

4. SECTION IV A - FISHING VESSEL FACILITIES AND OPERATING REQUIREMENTS

4.1 General Considerations

4.1.1 THE FISHING VESSEL SHOULD BE DESIGNED FOR RAPID AND EFFICIENT HANDLING OF FISH, EASE OF CLEANING AND DISINFECTION, AND SHOULD BE OF SUCH MATERIAL AND CONSTRUCTION AS NOT TO CAUSE ANY DAMAGE OR CONTAMINATION OF THE CATCH FF III.B(3)(a)

In designing a fishing vessel many other factors, apart from the vessel's performance as a harvesting unit, should be considered. The fisherman's earnings are determined not only by the quantity of the fish caught but, to a great extent, by the quality of the catch delivered to auction or the processing plant.

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

All surfaces with which the fish might come in contact should be of suitable corrosion-resistant material which is smooth and easily cleanable. FF III.B(6)(a)

If the vessel is large enough to engage in the processing of fish, then its design, layout, construction and equipment should meet the requirements of shore establishments and the processing should be carried out under similar hygienic and sanitary conditions.

4.2 Fishing Vessel Construction and Sanitary Design

4.2.1 DECK POUND OR PEN STANCHIONS AND DIVIDING BOARDS SHOULD BE CONSTRUCTED OF SUITABLE CORROSION-RESISTANT MATERIAL. THEY SHOULD BE ADEQUATE IN NUMBER AND HEIGHT TO PREVENT MOVEMENT OF THE FISH, DUE TO THE VESSEL'S MOTION

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 moisture from entering the wood and should be coated with a durable, non-toxic paint or other non-toxic surface coating that is smooth and readily cleanable. Steelwork should be coated with anti-corrosion and non-toxic paint. Whenever possible, suitable corrosion-resistant materials should be used.

4.2.2 DECK POUND OR PEN DIVIDING BOARDS SHOULD BE FITTED TO ALLOW FOR EASY REMOVAL, AND SHOULD HAVE HAND GRIPS. BOARDS SHOULD HAVE GATES FITTED, AS REQUIRED, AND DRAIN NOTCHES CUT IN THE LOWER EDGES

Gates are required to be fitted to the boards so that offal can easily be disposed of. Drain notches allow water, slime and blood to flow away from fish lying in the pounds.

4.2.3 FISH HOLDS 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 fish hold and consequently the rate of ice meltage. If the quality and structure of the insulation is poor, considerable ice meltage will take place near bulkheads and shipside. This may cause excessive leaching of the fish and if the amount of ice is not sufficient, this will allow fish temperatures to rise, and any fish which come in contact with the ship's structure may develop a particularly offensive smell.

4.2.4 FISH HOLD LININGS SHOULD BE COMPLETELY WATER-TIGHT. THE INSULATION LAYER SHOULD BE PROTECTED BY A LINING MADE OF CORROSION-RESISTANT METAL SHEETS OR ANY OTHER EQUALLY SUITABLE MATERIAL HAVING WATER-TIGHT JOINTS

It is most important to prevent water from carrying fish slime, blood, scales and offal to parts of the vessel where effective cleaning is virtually impossible. The melt water seeping through the fish hold lining will also reduce the efficiency of the insulation and this will, in turn, lead to an increase in the temperature of the fish. The insulation should be covered with corrosion-resistant metal sheets, having water-tight joints to ensure protection from such contamination. An effective drainage system should be able to remove the melt water into a sump as fast as it accumulates.

4.2.5 WOODEN FISH HOLDS SHOULD BE LINED WITH A SUITABLE MATERIAL

The lining of wooden fish holds should be similar to that described above. They should be sealed and coated with a suitable impervious and non-toxic material which is easy to keep clean and not difficult to repair.

4.2.6 STANCHIONS SHOULD BE LOCATED IN THE FISH HOLD SO THAT THE BASE DIMENSIONS OF EACH POUND OR PEN DO NOT EXCEED 1.4 x 1.4 METRES (4.5 x 4.5 FT)

Larger pounds may permit the stowed mass of fish to move, due to the vessel's motion thus resulting in descaling or other physical damages . They are also less convenient for separating the fish by species and date of catching. Large pounds will require the use of more top ice during periods when fishing may be interrupted, before the pounds are completely filled.

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

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 moisture from entering the wood and should be coated with a durable non-toxic paint or other equally suitable surface coating that is smooth, readily cleanable and reparable. Whenever possible, the shelving and the partitioning boards should be interchangeable in size.

4.2.8 SHELVING BOARDS SHOULD BE DESIGNED TO ALLOW ADEQUATE DRAINAGE

A continuous trickle of melt water will help to carry away slime, 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.

4.2.9 THE SHELVES SHOULD BE INSTALLED SO THAT THE MAXIMUM DEPTH OF FISH, WHEN BULK STOWING, DOES NOT EXCEED 1 METRE (3 FT)

This is considered to be a maximum depth, and may be excessive for certain types of fragile fish. Experience has shown that the pressure caused by piling iced fish in greater depth results in weight losses and damages to the fish at the bottom of the pile. Where iced fish is 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 pressure on fish stowed below.

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

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

4.2.11 WHERE BOXING AT SEA IS CARRIED OUT THE STANCHION AND DIVIDING STRUCTURE SHOULD BE DESIGNED TO ACCOMMODATE BOXES OF FISH WITHOUT LEAVING LARGE AIR GAPS

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

4.2.12 WHEN COOLING GRIDS ARE FITTED IN THE FISH HOLD THEY SHOULD BE PROPERLY INSTALLED AND OPERATED

The cooling grids, fitted in the fish hold, can be used to prevent excessive ice meltage during the voyage to the fishing grounds. They are valuable in cooling the fish hold and absorbing heat leak, especially in tropical waters. To be effective they should be fitted under the deck head and on the ship sides, and once fish has been stowed in the hold, control must be such that the hold temperature does not fall below 0°C (32°F). If it does, the top layer of ice may freeze into a solid crust, resulting in the top layer of fish being frozen slowly, on a long voyage, thus affecting their quality.

When the ice stops melting because of low temperature, its effectiveness as a cooling agent diminishes considerably. The frozen crust of ice and fish will act as an insulating blanket preventing the fish below from being adequately chilled. Only when the ice is melting and the resulting ice-cold melt water perculates downwards through the layers of fish, the removal of heat (chilling) takes place. The cooling grids alone, fitted into the well insulated fish hold, will not cool the fish or maintain them in a chilled condition.

4.2.13 EXCEPT FOR TANK STOWAGE IN REFRIGERATED SEA WATER OR REFRIGERATED BRINE, THE STOWAGE OF FISH FOR HUMAN CONSUMPTION IN HOLDS THAT ARE NOT DIVIDED INTO POUNDS IS NOT RECOMMENDED. THE HOLDS OF SMALL VESSELS CARRYING SUCH FISH AS HERRING SHOULD BE FITTED WITH AT LEAST ONE LONGITUDINAL AND ONE ATHWARTSHIP BULKHEAD, WHICH CAN BE REMOVED IF THE VESSEL CONVERTS TO OTHER TYPES OF FISHING. SUCH BULKHEADS SHOULD BE CONSTRUCTED OF SMOOTH, NON-ABSORBENT, EASILY CLEANABLE MATERIAL

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

4.2.14 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 FOWARD 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 which do exist in very small vessels also require adequate drainage facilities.

In a hold containing tanks, floor troughs should be installed, draining from all areas of the hold to a bilge sump. Fish hold bilge sumps should have separate piping and valves so that fish juices and slime do not flow into the other bilge lines.

4.2.15 THERE SHOULD BE NO SHARP CORNERS OR PROJECTIONS IN THE HOLD, AS THESE WILL MAKE CLEANING DIFFICULT AND MAY DAMAGE THE FISH

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

Any ledges or projections resulting from the encasement of pipes, wires, chains and conduits, that are passing through the fish hold, should be so constructed as to allow free drainage, ease of cleaning and not to cause any physical damage to the fish.

4.2.16 REFRIGERATED CLEAN SEA WATER OR REFRIGERATED BRINE MAY ALSO BE CONSIDERED FOR SOME FISHERIES

The storage temperature achieved by refrigerated clean sea water or refrigerated brine makes it possible to chill large quantities of fish quickly, in tanks, and maintain the fish in a chilled condition. Fish are chilled more rapidly by this immersion process than when iced, and if stowed at the correct density are in close contact with the cooling medium at all times.

This type of stowage has been found successful where very large quantities of small fish are caught in each haul and where it would be difficult to stow the catch quickly in ice. It has so far only proved successful for very short voyages. A storage time of more than a few days can affect the appearance of certain species, and the scouring effect of fish rubbing together in a tank of water can also remove the scales from some species.

There is as yet insufficient evidence to recommend refrigerated sea water or refrigerated brine for every type of fishery but experience has shown that for some species, notably Pacific halibut, Pacific salmon and tuna, it is a good method of preservation at sea.

4.2.17 REFRIGERATED SEA WATER OR REFRIGERATED BRINE SYSTEMS SHOULD BE PROPERLY DESIGNED TO GIVE ADEQUATE COOLING CAPACITY

If the use of a refrigerated 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, fish, water and ambient temperatures. The cooling capacity must be related to catching rates in the fishery involved. The system must be capable of rapidly chilling large quantities of fish.

4.2.18 IN ALL SHIPS USING REFRIGERATED SEA WATER OR REFRIGERATED BRINE SYSTEMS FOR PRESERVATION OF THE CATCH, TANKS, HEAT EXCHANGERS, PUMPS AND ASSOCIATED PIPING SHOULD BE MADE OF, OR COATED WITH SUITABLE CORROSION-RESISTANT MATERIAL. THEY SHOULD BE DESIGNED SO THAT THEY CAN EASILY BE CLEANED AND DISINFECTED

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

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

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

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

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

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

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

4.2.21 REFRIGERATION PLANT AND SEA WATER OR BRINE CIRCULATING EQUIPMENT SHOULD BE ADEQUATE TO MAINTAIN THE TEMPERATURE OF THE FISH AT $-1^{\circ}C$ ($30^{\circ}F$)

In fresh fish maximum delay of spoilage is obtained at this temperature. If the temperature is reduced below $-1^{\circ}C$ ($30^{\circ}F$) the fish may be damaged because of partial freezing. In practice it is extremely difficult to control the temperature so precisely, but a range of $-1^{\circ}C$ to $+2^{\circ}C$ (30° to $34^{\circ}F$) is achievable.

There should also 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 fish.

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

4.3 Sanitary Facilities

4.3.1 AREAS OF THE DECK WHERE FISH ARE UNLOADED AND HANDLED, OR THE FISH HOLD WHERE FISH ARE STOWED SHOULD BE USED EXCLUSIVELY FOR THESE PURPOSES

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

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

Any exposure, even for a short time, of fish to petroleum products, very often results in rejection or eventual destruction of the whole load. The odour and the taste of fish contaminated with fuel or other similar compounds are very persistent and difficult to remove during the subsequent processing.

4.3.2 AN AMPLE SUPPLY OF COLD POTABLE WATER OR CLEAN SEA WATER UNDER ADEQUATE PRESSURE SHOULD BE AVAILABLE AT A SUFFICIENT NUMBER OF POINTS THROUGHOUT THE FISHING VESSEL. WITH LARGE VESSELS ENGAGED IN FISH PROCESSING A SUPPLY OF HOT WATER AT A MINIMUM TEMPERATURE OF 82°C (180°F) SHOULD ALSO BE AVAILABLE

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

Fish when alive is relatively resistent to a polluted environment but looses its natural defences when it dies after being caught.

4.3.3 A SYSTEM FOR INJECTING CHLORINE INTO THE LINES OF SEA WATER WHICH IS USED IN THE PROCESSING OF FISH OR FOR THE CLEAN-UP OF 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 bacterial contamination.

The fishing vessels involved in handling or processing large quantities of fish might gain considerably in sanitation by having chlorine introduced into the water lines. Chlorine dosage should be around 10 ppm during the normal use and 100 ppm of residual concentration during the clean-up.

As a word of caution, the use of strongly chlorinated water in confined spaces such as a vessel's hold could prove objectionable to the operator. For that reason, a system for injecting chlorine should be capable of varying the amount of chlorine delivered.

There are a number of relatively inexpensive and easily operable instruments on the market that will perform this task with the minimum of cost and maintenance.

4.3.4 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 an addition of chlorine, if possible, should be available for washing fish and for flushing and rinsing of decks, holds, gear and other equipment which comes in contact with the fish.

The intake for sea water should preferably be forward of and on the opposite side of the vessel from the toilet waste discharge and engine cooling. Sea water should not be used while the vessel is in harbour nor in areas where there is a danger of it being polluted.

FF

III.B(3)(a)(vii)

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

4.3.5 ICE USED IN EVERY FISHERY SHOULD BE MADE FROM POTABLE WATER OR CLEAN SEA WATER AND SHOULD NOT BE CONTAMINATED WHEN MANUFACTURED, HANDLED OR STORED

Ice made from water which is neither potable or clean sea water may contaminate the fish with water-borne micro-organisms or other objectionable or even toxic substances. Such contamination will result in the loss of quality, reduced keeping time or might create a definite health hazard.

Some of the larger fishing, collecting or fish processing vessels might have their own ice making machines. The water used in the ice manufacture should be potable water or clean sea water. The intake for the pump should be located away from the waste discharge outlet of the boat. Chlorine injection into the lines or water storage tanks, or the use of UV lights for continual flow purification should be provided. Both systems are easy and inexpensive to operate. The water for ice manufacture should only be taken from areas known to be relatively unpolluted and without any visible discolouration or suspension.

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

4.3.6 THE USE OF CLEAN SEA WATER ICE CANNOT BE GIVEN UNQUALIFIED RECOMMENDATION

The use of clean sea water ice may be necessary in some areas, where there is a shortage of potable water, and there may also be some advantage in using clean sea water to manufacture ice at sea. The initial melting temperature of clean sea water ice may be as low as -5° to -6°C (23° to 21°F), but due to the leaching away of salt in the melt water, the melting temperature may rise again to nearly 0°C (32°F). Temperature, therefore, is variable. There is a risk that some of the fish stored in clean sea water ice will become partly frozen or too salty. Some experimentation prior to deciding on the kind of water for ice production is recommended.

4.3.7 THE VESSEL'S TOILET FACILITIES, ALL PLUMBING AND WASTE DISPOSAL LINES SHOULD BE SO CONSTRUCTED AS NOT TO CONTAMINATE THE FISH — FF III.A(1)

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

4.3.8 WHERE BAIT IS CARRIED, IT SHOULD BE HELD IN SUCH A MANNER THAT IT WILL NOT CONTAMINATE THE CATCH — FF III.B(3)(h)

Fishing vessels which depend on bait for their fishing activities should have a separate pound or special container where the bait could be held well protected and away from the catch. When fishing is finished, the ice used for bait preservation should be discarded rather than re-used on fresh fish intended for human consumption.

4.3.9 ON LARGE FISHING VESSELS, ENGAGED IN FISHING AS WELL AS FISH PROCESSING, SUITABLE HAND WASHING FACILITIES SHOULD BE PROVIDED — FF III.B(3)(vi)

Such facilities should be located in toilets or close to the fish handling or processing areas. They should be supplied with clean water and should be of a type not requiring operation by hand.

4.4 Equipment and Utensils

4.4.1 ALL FISH HANDLING, CONVEYING AND STORAGE EQUIPMENT, USED ON BOARD FISHING VESSELS, SHOULD BE DESIGNED FOR THE RAPID AND EFFICIENT HANDLING OF FISH, BE SUITABLE FOR EASY AND THOROUGH CLEANING AND SHOULD BE CONSTRUCTED AS NOT TO CAUSE CONTAMINATION OF THE CATCH

Some of the equipment currently used in the fishing industries is quite unsuitable for the purpose in which it is employed. More thought should be given to the design and layout of fixtures and plant used for the handling, conveying and storage of fresh fish.

4.4.2 FISH WASHING AND CONVEYING EQUIPMENT SHOULD BE CONSTRUCTED OF SUITABLE CORROSION-RESISTANT MATERIAL AND SHOULD BE EASY TO DISMANTLE FOR CLEANING PURPOSES AND BE FITTED WITH CHUTES OR SIMILAR MEANS OF CONVEYING FISH INTO RHE HOLD. CHUTES SHOULD BE OF SUFFICIENT LENGTH AND FITTED IN SUCH A MANNER THAT FISH DO NOT HAVE TO DROP MORE THAN 1 METRE(3FT) INTO THE HOLD.

Washers should, when possible, be fitted with chutes or conveyors for efficient handling purposes and to prevent bruising or other damage to the fish, which often occurs when rough manual methods are used. Washers should be designed to give an adequate washing

period, and should have a copious and continuous supply of cold clean sea water. The water should enter the washer through a number of jets, placed so that a water swirl is formed in the washer, allowing dirty water and scum to spill off and drain away. Water used in fish washing and cooling should not be recirculated.

4.4.3 CONVEYORS USED IN THE FISH HOLD SHOULD BE MADE OF CORROSION-RESISTANT MATERIAL AND SHOULD BE EASY TO DISMANTLE AND REMOVE FOR CLEANING PURPOSES

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

4.4.4 ALL TUBS, TANKS, BARRELS AND OTHER CONTAINERS USED FOR HANDLING AND CONVEYING FISH SHOULD BE OF CORROSION-RESISTANT MATERIAL AND EASY TO CLEAN

In many areas wicker baskets are used for handling fish on deck. These are very difficult to clean properly, as slime, blood, scales and small pieces of offal or parts of fish body become lodged within the framework. Containers with smooth, waterproof surfaces which are easy to clean and disinfect are recommended for handling quantities of fish on deck.

4.4.5 WHERE SIZEABLE QUANTITIES OF FISH ARE HANDLED ON BOARD LARGE FISHING VESSELS, THE USE OF MACHINERY DESIGNED TO CARRY OUT GUTTING AND CLEANING SHOULD BE CONSIDERED

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

Gutting, which is usually the most time consuming operation, could easily be carried out by a gutting machine which has been developed and has been used by some fishermen in various countries.

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

4.4.6 ALL BOXES USED FOR ICE STOWING OF FISH SHOULD BE OF UNIFORM AND PROPER SIZE, EASY TO HANDLE WHEN LOADED, AND SHOULD BE CONSTRUCTED OF SUITABLE CORROSION-RESISTANT MATERIAL

Such boxes should be capable of accommodating the larger fish without bending and, when fully loaded, should be easy to handle by one or two men without tilting, tipping or jerking.

If wooden boxes are used, they should be of a smooth construction and of durable, non-toxic and waterproof finish.

Baskets should not be used for handling fish on board the vessel or on shore, as they are difficult to clean and disinfect.

4.4.7 THE FISHING VESSELS SHOULD BE EQUIPPED WITH BRUSHES, SCRAPERS, WATER HOSES, SPRAY NOZZLES AND OTHER SUITABLE WASHING AND SANITIZING EQUIPMENT

Although there is a variety of cleaning and sanitizing 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 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, then plastic, brightly coloured scouring pads might be used.

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

4.5 Hygienic Operating Requirements

4.5.1 BEFORE ANY FISH COMES ABOARD, AND BETWEEN EACH HAUL OF THE GEAR, DECKS, BOARDS, STANCHIONS AND ALL OTHER DECK EQUIPMENT WHICH WILL COME IN CONTACT WITH FISH SHOULD BE HOSED DOWN WITH CLEAN SEA WATER AND BRUSHED TO REMOVE ALL VISIBLE DIRT, SLIME AND BLOOD

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

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

4.5.2 ALL TUBS, TANKS, BARRELS AND OTHER EQUIPMENT USED IN HANDLING, GUTTING, WASHING AND CONVEYING OPERATIONS SHOULD BE THOROUGHLY CLEANED, DISINFECTED AND RINSED AFTER EACH CYCLE OF OPERATIONS

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

4.5.3 DURING FISHING TRIPS THE FISH HOLD BILGE SUMP SHOULD BE DRAINED REGULARLY. THE SUMP SHOULD BE ACCESSIBLE AT ALL TIMES

Bilge water containing blood and slime, if not regularly pumped out, will provide a perfect medium for the multiplication of microorganisms and give rise to offensive odours in the fish hold.

4.5.4 COD ENDS AND OTHER PARTS OF THE FISHING GEAR WHICH COME IN CONTACT WITH FISH SHOULD BE FREED OF DEAD FISH AND ORGANIC MATERIAL AFTER EACH HAUL. ALL GEAR SHOULD BE THOROUGHLY CLEANED WHEN FISHING HAS CEASED

Dead fish and organic matter left in the nets will decompose and contaminate later catches.

4.5.5 SEA WATER WHICH HAS BEEN USED FOR COOLING ENGINES, CONDENSERS OR SIMILAR EQUIPMENT SHOULD NOT BE USED FOR WASHING FISH, DECK , HOLD OR ANY EQUIPMENT WHICH MIGHT COME IN CONTACT WITH FISH

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, therefore, will accelerate considerably the spoilage of fish by raising their temperature and might impart objectionable taste, odour or undesirable discolouration.

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

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

4.5.7 IMMEDIATELY AFTER THE CATCH IS UNLOADED, THE DECK AND ALL DECK EQUIPMENT SHOULD BE HOSED DOWN, BRUSHED, THOROUGHLY CLEANED WITH A SUITABLE CLEANING AGENT, DISINFECTED AND RINSED FF III B (3)(v)

Fish blood, guts, slime and dead fish left on the deck will support bacterial multiplication which may contaminate future catches. If allowed to dry, slime, blood and scales are very difficult to remove.

It is important to realize that thorough cleaning should always precede disinfection especially when chlorine is used as the disinfecting agent. Any organic matter which if not removed from the surfaces that are to be disinfected, will rapidly combine with and neutralise the micro-organism killing ability of chlorine or any other disinfectant.

4.5.8 IMMEDIATELY AFTER THE CATCH IS UNLOADED, 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 slime, blood and other residue as soon as the catch is landed, in order to avoid bacterial growth, offensive odours and the drying of residues on the hold or other surfaces. Cleaning should be completed before the fresh ice is taken on board for the next trip.

4.5.9 IN SHIPS USING REFRIGERATED SEA WATER OR REFRIGERATED BRINE SYSTEMS FOR THE PRESERVATION OF THE CATCH, ALL TANKS, PUMPS, HEAT EXCHANGERS AND OTHER ASSOCIATED EQUIPMENT SHOULD BE CLEANED IMMEDIATELY AFTER DISCHARGING THE CATCH. POTABLE WATER 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 anearobic bacteria are particularly active under tank storage conditions, a very high standard of sanitation is required to avoid their build up and the spread of infection from one tank to another.

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

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

4.5.10 WHERE REFRIGERATED SEA WATER IS USED FOR THE PRESERVATION OF FISH, ONLY CLEAN SEA WATER SHOULD BE USED AND SHOULD BE CHANGED AS OFTEN AS POSSIBLE TO PREVENT THE ACCUMULATION OF CONTAMINATING MATERIALS

Use of sea water contaminated with sewage or industrial discharges will affect the quality of the catch or render it unfit for human consumption. It is advisable for fishermen to check with the local authorities which areas are likely to be free of pollution. The intake for the vessel's sea water pump should be located 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.

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

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

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

4.5.12 EFFECTIVE MEASURES SHOULD BE TAKEN TO PROTECT THE FISHING VESSEL AGAINST INSECTS, RODENTS, BIRDS OR OTHER VERMIN

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

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

4.5.13 DOGS, CATS AND OTHER ANIMALS SHOULD BE EXCLUDED FROM AREAS OF THE VESSEL WHERE FISH IS RECEIVED, HANDLED, PROCESSED AND STORED

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

4.5.14 WHEN A VESSEL CONVERTS TO STORING FISH IN ICE FOR HUMAN CONSUMPTION, AFTER CATCHING SPECIES SUCH AS HERRING FOR REDUCTION PURPOSES, THE HOLD AND BILGE MUST BE THOROUGHLY CLEANED, DISINFECTED AND RINSED

Cleaning should be carried out with high pressure potable water containing a suitable cleaning agent, followed by a thorough rinsing. A suitable disinfectant should then be applied to all surfaces and remain in contact long enough to complete the disinfection. Always, when using commercial products, the manufacturer's recommendations as to the concentration and treatment time should be followed. Finally the hold should be thoroughly rinsed with potable or clean sea water.

4.6 Handling the Catch on Board

4.6.1 DURATION OF THE FISHING TRIP FOR A FISHING VESSEL SHOULD BE DETERMINED BY THE FACILITIES AVAILABLE ON THE VESSEL FOR HANDLING AND KEEPING THE CATCH WELL CHILLED, DISTANCE FROM THE PROCESSING PLANT AND THE LOCAL ENVIRONMENTAL CONDITIONS

From the time the fish are caught there is a continual and irreversible deterioration in quality. The progress and degree of such deterioration are governed mainly by the time the fish are held and the temperature at which they are handled and stored on board a fishing vessel. With short distances from the processing plant or market more time could 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.

4.6.2 HANDLING THE CATCH SHOULD BEGIN AS SOON AS IT COMES ON BOARD. ANY FISH UNSUITABLE FOR HUMAN CONSUMPTION SHOULD BE REMOVED FROM THE CATCH AND KEPT SEPARATE

In those fisheries where sorting is done immediately the fish are taken on board, it should be carried out quickly, to avoid any risk of damage due to abrasion, particularly where the catch contains spiny and rough-skinned species. The fish that are capable of producing distinctive ammoniacal odours on storage should also be separated from the other fish as soon as possible. Fish unsuitable for human food because of small size, spoilage, damage, parasitization, poisonous nature or any other reason should also be quickly removed from the catch.

4.6.3 WHERE IT IS REQUIRED TO KEEP SPECIES UNSUITABLE FOR HUMAN FOOD, THESE SHOULD ALWAYS BE SORTED FROM THE EDIBLE CATCH AND KEPT SEPARATE AT ALL TIMES

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

4.6.4 FISH SHOULD NOT BE TRAMPLED OR STOOD UPON, AND SHOULD NOT BE PILED DEEPLY ON DECK

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

4.6.5 ALL FISH ON DECK SHOULD BE PROTECTED FROM SUN, FROST, AND THE DRYING EFFECTS OF WIND

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

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

4.6.6 LINE CAUGHT FISH SHOULD, WHEREVER PRACTICABLE, BE STUNNED AS SOON AS THEY ARE TAKEN ON BOARD THE VESSEL

If fish are allowed to struggle and thrash about on deck, they not only be badly bruised, but may become exhausted before they die, and their quality impaired. It is of course recognized that the stunning of small fish is impracticable.

Stunning should be done only on the head and, with some fish, preferably while the fish is still in water. Fish should be landed by hooking under the gills rather than gaffing in the body or lifting by the tail. With heavy fish the spine might break when the fish is lifted by its tail thus resulting in local flesh discolouration and muscle separation.

4.6.7 WHEN FISH ARE TO BE BLED, THIS SHOULD BE DONE IMMEDIATELY AFTER THE FISH ARE LANDED

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

It is good practice with some fish to bleed them prior to gutting. On the other hand, in some fisheries, the fish are bled by gutting. In the latter case, the fish will bleed better if they are freshly caught. For this purpose the fishermen should take short hauls in order to bring the fish on board alive.

If the bleeding and gutting is done on dead or "spent" fish, the fillets cut from such fish will have a pronounced reddish discolouration rather than the highly desirable white appearance when properly bled.

4.6.8 GUTTING SHOULD COMMENCE AS SOON AS THE CATCH COMES ON DECK

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

4.6.9 WHERE RAPID GUTTING IS NOT PRACTICABLE WHOLE FISH SHOULD BE WASHED AND CHILLED AS SOON AS IT COMES ON DECK

This helps to remove filth, particularly gut contents squeezed out of the fish in the net, and it helps to prevent excessive contamination during subsequent gutting and handling.

A thorough washing of the fish will reduce considerably the number of spoilage micro-organisms and remove some of the protein digestive enzymes which come from the viscera of the fish.

4.6.10 IT IS USUALLY IMPRACTICABLE TO GUT VERY SMALL FISH. THESE SHOULD THEREFORE BE PLACED IN CHILLED STORAGE QUICKLY

Any delay in chilling very small whole fish will have an adverse effect on their quality. Failure to stow these fish quickly may expose them to the effect of weather as well as to physical damage.

4.6.11 GUTTING SHOULD BE COMPLETE AND CARRIED OUT WITH CARE. BAD GUTTING MIGHT BE WORSE THAN NO GUTTING AT ALL

Pieces of gut or liver, if not completely removed, will act as centres from which spoilage will develop. Enzymes from pieces of gut and liver will digest the flesh and facilitate the entry of bacteria. Careless gutting, for example, cutting beyond the vent of a fish will also allow the entry of bacteria into the flesh. Nevertheless, cuts should be adequate to allow easy access to the belly cavity and complete removal of guts.

4.6.12 FISH GUTS SHOULD NOT BE ALLOWED TO CONTAMINATE OTHER FISH ON DECK

Fish guts contain digestive enzymes and spoilage bacteria. If allowed to foul the rest of the catch, the spoilage rate will be increased. This contamination can be prevented by dropping guts into suitable watertight containers or chutes discharging over the ship side.

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

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

4.6.13 SEPARATE AND ADEQUATE STORAGE FACILITIES SHOULD BE PROVIDED FOR THE FISH ROE, MILT AND LIVERS IF THESE ARE SAVED FOR LATER UTILIZATION

In some fisheries certain by-products of gutting operation are saved either for human food, like fish roe and milt, or for utilization in pharmaceutical industry, like fish liver used in vitamin extraction.

All these by-products should be stored separately from the fresh fish intended for human consumption and should be kept well chilled and protected from sun, rain, wind and frost. Partial freezing of roe might damage it.

4.6.14 IMMEDIATELY AFTER GUTTING, FISH SHOULD BE WASHED WITH CLEAN SEA WATER OR POTABLE WATER

Fish should be thoroughly washed with clean sea water or potable water before being placed under refrigeration to remove all blood, slime and pieces of gut. Fish blood coagulates rapidly and washing will facilitate more complete bleeding, which in turn will improve the appearance of the product. If tanks are used for washing gutted fish, a continual flow of clean sea water should be provided to prevent the accumulation of contaminating materials. The practice, common in some inshore fisheries, to gut and wash the fish close to land involves the risk of using polluted sea water, and should therefore be discouraged. FF III.B(2)(d)

Harbour water, which is always polluted in some way, should never be used for washing fish.

4.6.15 ON COMPLETION OF WASHING THE FISH, FURTHER HANDLING SHOULD BE CARRIED OUT WITHOUT DELAY

Any further postponement in handling the washed fish before it is chilled, reduces its potential keeping time.

Therefore, with the least possible delay the fish should be thoroughly iced or immersed in ice water to bring its temperature down to 0°C (32°F) as quickly as possible. FF III.B(4)(a)

In warm climates a delay of one hour can have a serious effect on the quality of the final product.

Chilling of fish in bulk by cold air or by top icing only should be avoided. It should be mentioned that the rapid chilling of the freshly caught fish will also slow down the onset, duration and relaxation stages of the rigor mortis phenomenon. Although this problem concerns mostly the quality of frozen fish, it could also affect the quality of freshly caught fish when they are left unprotected on the deck exposed to a high temperature. At such a temperature the stiffening of the muscles is accelerated, thus creating strong internal stresses which might result in a break-down of the muscular tissue. In some species of fish the severity and rapidity of this reaction will have a detrimental effect on the quality. Also to many buyers the sign of rigor is equated with freshness. When the rigor is over the muscles become flabby and the fish "pits" easily on application of a slight pressure.

4.6.16 DECK HATCHES SHOULD NOT BE LEFT OPEN LONGER THAN NECESSARY TO LOAD THE FISH

Only one fishroom hatch should be opened to allow the loading of fish and to prevent undesirable heat leak into the hold. Where two or more hatches are open at the same time, a current of warm air may flow through the fishroom, causing undue ice meltage.

4.6.17 FISH SHOULD BE ALLOWED TO SLIDE DOWN CHUTES INTO THE HOLD OR BE LOWERED IN SUITABLE CONTAINERS

Fish can be damaged and their market value reduced if they are thrown or dropped into the hold.

Heavy fish should never be lifted by their tails or dropped on their tails into the hold.

Indiscriminate use of pughs, hay-forks, shovels, rakes and gaffs for handling of fish should be discouraged. Physical damage caused by these sharp instruments will result in shortening of the shelf life of fish, deterioration in quality and diminishing recovery as the fish go through the processing.

Fish are extremely perishable food and should be handled with utmost care at all times.

4.6.18 FISH SHOULD BE CHILLED RAPIDLY IN MELTING ICE AND SHOULD BE STORED SO THAT THE TEMPERATURE DOES NOT RISE. FOR SHORT TERM STORAGE, HOWEVER REFRIGERATED SEA WATER OR REFRIGERATED BRINE MAY BE USED

It is well known that temperature is the most important single factor influencing the keeping quality of fish. It has been shown that cod spoils about 5½ times as fast at 10°C (50°F), and about 2½ times as fast at 4.4°C (40°F), as it does at 0°C (32°F). Expressing this in another way, cod that would remain edible for about 14 days stored at 0°C (32°F) would be edible for only 6 days if stored at 4.4°C (40°F) and for less than 3 days if stored at 10°C (50°F). It is also known that the effects of increasing temperature are cumulative; that is, some potential keeping time is lost each time the temperature of the fish is allowed to rise. The extent of this loss depends both on the degree of temperature rise and the length of time the fish remains at the higher temperature. It is, therefore, most important to chill quickly the fish to the temperature of melting ice, soon after capture, and maintain it in a chilled condition until it reaches the consumer. In some areas refrigerated sea water or refrigerated brine is used for chilling and storing the fish. Here again the chilling should be rapid and the system should be capable of maintaining the fish at -1°C (30°F).

4.6.19 FISH IN ICE SHOULD BE STOWED IN SHALLOW LAYERS

The best bulk stowage is the shallowest, with the fish well mixed with finely divided ice. It is appreciated that in some fisheries a compromise is necessary, because it is rarely possible to stow all the catch in very shallow layers, a few fish deep, between shelves. It is perhaps not sufficiently recognized that fish at the bottom of a deep pile can lose considerable weight. It has been observed, for instance, that haddock at the bottom of a pound 1 metre (3 ft) deep can lose as much as 15 percent of its initial gutted weight after about two weeks' storage.

4.6.20 THE PRACTICE OF SHELF STOWAGE IS NOT TO BE RECOMMENDED, UNLESS THE SINGLE LAYERS OF FISH ARE COMPLETELY COVERED WITH LAYERS OF ICE

In practice, shelf stowage involves the laying out of single layers of fish side by side and head to tail, belly down on a bed of ice, but with no ice among or on top of the fish. Single fish laid out in this manner are only cooled from one side, and therefore cool down less rapidly than fish well mixed with ice. The backs and heads of the fish can remain quite warm throughout the storage period, and bacteria originating in the gills can spread rapidly along the backbone. It has been found that these shelf stowed fish are inferior in quality compared with fish which have been shallow bulk stowed at the same time.

Where fish are shelf stowed, ice should always be added, around and on top of each layer.

4.6.21 FISH SHOULD BE SURROUNDED BY ADEQUATE QUANTITIES OF ICE

Sufficient quantities of ice are necessary, not only to cool the fish, but to maintain it in a cool condition. There should be enough ice to cope with any heat leaking into the fish room and the ice should be properly distributed. If, at the end of a voyage, fish are no longer completely surrounded by ice, then insufficient quantities of ice have been used. It is difficult to lay down precise quantities required, but icing should be heaviest against shipsides and bulkheads. The heat leak into the hold will depend on its construction, the temperature of the surrounding sea and areas of the vessel adjacent to the fish hold. In warm waters it will be necessary to use greater proportions of ice than in colder climates, and the quantity will also depend on whether the hold is insulated. It must be emphasized that the correct quantities of ice require to be worked out for individual vessels by trial and error. In the final analysis the best way to determine correct ice quantities is to measure the temperature of the fish from time to time. In many countries fishery research organizations are available to give advice on how to measure these temperatures.

Stowage of fish in ice is generally practiced on fishing vessels making trips of a few days or more, but many small inshore vessels do not use ice or any other form of preservation, and consequently there is often considerable and unnecessary loss of fish quality.

4.6.22 ICE SHOULD ALSO BE USED TO PREVENT CONTACT WITH ALL SURFACES IN THE FISH HOLD

It is good practice to prevent fish from coming in contact with shipsides, bulkheads and all fishroom structures. If fish are pressed against those surfaces, or even against one another, so that air is excluded, a peculiarly offensive type of bacterial spoilage takes place, and fish which otherwise appear to be in good condition are rendered quite inedible, because of the development of foul odours and flavours. Inadequate icing may result in fish coming in contact with these surfaces.

4.6.23 FINELY DIVIDED ICE SHOULD ALWAYS BE USED TO GIVE CLOSE CONTACT WITH THE FISH

To maintain close contact with the fish at all times, ice used for chilling and preservation should always be finely divided in one form or another. Any large lumps of ice can cause damage to fish, and will be less effective in cooling because of poor surface contact with the fish. Various forms of ice are used in many fisheries, the important factors are that they should be made from potable quality water and should consist of finely divided particles to increase their cooling effectiveness.

4.6.24 WHERE BOXED STOWAGE IS USED, THE FISH SHOULD BE PROPERLY ICED AND THE BOXES NOT OVERFILLED

The packing of fish with ice, into containers at sea, in some areas, offers a number of advantages for certain fisheries. When properly iced the fish can remain undisturbed in the boxes until they reach the processor. Unloading the catch can become a simpler operation, and more ice can be added to the boxes on landing, without disturbing the fish.

Generally, properly boxed iced fish should be of a higher quality than fish caught the same day and stored in other ways. Each day's catch can also be separated more easily. Since boxes are stacked one on top of another in the fish hold, overfilling with ice or fish will result in crushing and damage to the fish. For efficient cooling, each box should contain a layer of ice on the bottom, then some fish 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.

4.6.25 FISH SHOULD NOT BE PACKED IN REFRIGERATED SEA WATER OR REFRIGERATED BRINE TO A DENSITY OF MORE THAN 800 KG PER CUBIC METRE (50 LB PER CUBIC FOOT)

If too much fish is loaded into the tanks, there will not be sufficient space for the free circulation of refrigerated sea water or brine throughout the load, and therefore some fish will not be cooled efficiently. This practice of overloading the tanks will also add an extra load on the refrigeration equipment in which case it will take a longer time to attain the desired temperature conditions or, in extreme cases, might never be reached. The density of the fish given above is an upper limit and may be high for certain species.

4.6.26 WHERE SEA WATER OR BRINE STOWAGE TANKS ARE COOLED BY THE ADDITION OF ICE, SALT CONCENTRATION SHOULD BE MAINTAINED AT ABOUT 3 PERCENT

In practice this can be achieved by the addition of salt, the quantity being regulated by the amount of ice used. If the sea water or brine is too diluted, the fish can absorb water and hence quality can suffer.

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

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

4.7 Unloading the Catch

4.7.1 UNLOADING THE CATCH SHOULD BE CARRIED OUT IN A CAREFUL MANNER, AND WITHOUT DELAY

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

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

Such installations should be constructed of suitable corrosion-resistant material and so designed as not to contaminate or damage the fish or to cause its temperature to rise. A large amount of cold potable quality water would be required for de-icing and washing of fish.

4.7.2 AT THE CONCLUSION OF EACH FISHING TRIP, ALL UNUSED ICE SHOULD BE DISCARDED BEFORE CLEANING BEGINS

Ice left in the fishroom, even if it has not been used on the previous trip, may be contaminated with fish spoilage bacteria. If this ice is used on any subsequent trips, for cooling fish, it may accelerate spoilage of the catch.

4.7.3 MIXING OF DIFFERENT DAYS' CATCHES DURING UNLOADING SHOULD BE AVOIDED

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

4.7.4 FISH SHOULD NOT BE DAMAGED DURING UNLOADING

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

4.7.5 MECHANICAL UNLOADING EQUIPMENT SHOULD BE USED WHERE POSSIBLE

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

4.7.6 BULK OR SHELF STOWED CATCH SHOULD BE UNLOADED INTO CLEAN CONTAINERS AND IMMEDIATELY PLACED IN A SUITABLE COVERED AREA. WHILE LYING IN THIS AREA THE CATCH SHOULD BE MAINTAINED IN A CHILLED CONDITION

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

4.7.7 CARE SHOULD BE TAKEN THAT FISH ARE NOT DAMAGED OR CONTAMINATED DURING SORTING, WEIGHING AND TRANSFER TO CONTAINERS

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

4.7.8 WHEN REFRIGERATED BRINE OR SEA WATER BOATS ARE UNLOADED BY MEANS OF PUMPS AND SIPHONS THE COMPENSATING OR SO CALLED "MAKEUP" WATER SHOULD BE OF THE SAME TEMPERATURE AND SANITARY QUALITY AS THE ORIGINAL BRINE

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

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

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

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

4.8 Sanitary Control Programme

4.8.1 IT IS DESIRABLE THAT EACH FISHING VESSEL SHOULD DEVELOP ITS OWN SANITARY CONTROL PROGRAMME BY INVOLVING THE WHOLE CREW AND BY ASSIGNING TO EACH MEMBER A DEFINITE TASK IN CLEANING AND DISINFECTING THE BOAT

A permanent cleaning and disinfection schedule should be drawn up to ensure that all parts of the boat and equipment thereon are cleaned appropriately and regularly.

The fishermen should be well trained in the use of special cleaning tools, methods of dismantling equipment for cleaning and should be knowledgeable in the significance of contamination and the hazards involved.

HANDLING FRESH FISH ON SHORE

5. SECTION IV B - PLANT FACILITIES AND OPERATING REQUIREMENTS

5.1 Plant Construction and Layout

5.1.1 General Considerations

FRESH FISH PROCESSING PLANTS SHOULD BE SPECIALLY DESIGNED FOR THE PURPOSE

Raw fish spoils considerably faster than raw meat of warm blooded animals or other common foods like milk, fresh fruits or green vegetables. The keeping time of fish delivered to processing plants has been already reduced by time and conditions of handling and storage on the fishing vessel. There is little that could be done by the processor to improve the quality of fish delivered to him by the fishermen. With the best of treatment the fresh fish, depending on species and physical conditions of the animal when caught, after ten to twelve days in ice will be considered, in most of the cases, as unfit for human consumption.

Because of this highly perishable nature of fish, the processing plant demands special facilities and material which, as compared to other food processing establishments, are in some cases rather unique.

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

The fresh fish processing plant, therefore, should be designed to process the fish with the minimum of delay and of any further reduction in fish quality.

5.1.2 Plant Construction and Sanitary Design

5.1.2.1 THE PLANT AND SURROUNDING AREA SHOULD BE SUCH AS CAN BE KEPT REASONABLY FREE FROM OBJECTIONABLE ODOURS, SMOKE, DUST OR OTHER CONTAMINATION. THE BUILDING SHOULD BE SUFFICIENT IN SIZE WITHOUT CROWDING OF EQUIPMENT OR PERSONNEL, WELL CONSTRUCTED AND KEPT IN GOOD REPAIR. THEY SHOULD BE OF SUCH DESIGN AND CONSTRUCTION AS TO PROTECT AGAINST THE ENTRANCE AND HARBOURING OF INSECTS, BIRDS OR OTHER VERMIN AND TO PERMIT READY AND ADEQUATE CLEANING — FF IV.A.(1)(a)

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

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

The food handling area should be completely separate from any part of the premises used as living quarters. — FF IV.A(2)(a)(i)

5.1.2.2 FLOORS SHOULD BE HARD SURFACED, NON-ABSORBENT AND ADEQUATELY DRAINED — FF IV.A.(1)(b)

Floors should be constructed of durable, waterproof, non-toxic, non-absorbent material which is easy to clean and disinfect. They should be non-slip and without crevices and should slope evenly and sufficiently for liquids to drain off to trapped outlets fitted with a removable grill. — FM 22(i)

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

The junctions between the floors and walls should be impervious to water and, if possible, should be coved or rounded for ease of cleaning. — MP 27(k)(ii)

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 with a well finished waterproof surface. — FF IV.A(1)(b)

5.1.2.3 DRAINS SHOULD BE OF AN ADEQUATE SIZE, SUITABLE TYPE, EQUIPPED WITH TRAPS AND WITH REMOVABLE GRATINGS TO PERMIT CLEANING — FF IV.A(1)(b

Suitable and adequate drainage facilities are essential for removal of liquid or semiliquid wastes from the plant. There should not be any floor area where water might collect in stagnant pools. Drains should be constructed of smooth and impervious material and should be designed to cope with the maximum flow of liquid without any overflowing and flooding. Drainage systems should be provided with deep seal traps which are appropriate, accessible and easy to clean.

Drainage lines carrying waste effluent except for open drains, should be properly vented, have a minimum internal diameter of 10 cm (4 inches) and, if required, run to a catch basin for removal of solid waste material. Such a basin should be located outside the processing area and should be constructed of waterproof concrete or other similar material, designed to the local specifications and should meet the requirements of the official agency having jurisdiction. — FF IV.A(1) FF IV.2(e)(ii) FM 26(h)

5.1.2.4 INTERNAL WALLS SHOULD BE SMOOTH, WATERPROOF, RESISTANT TO FRACTURE, LIGHT COLOURED AND READILY CLEANABLE — FF IV.A(1)(c)

Acceptable materials 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 be coved or rounded to facilitate cleaning. — FM 22(ii)

Walls should be free from projections and all pipes and cables should be sunk flush with the wall surface or neatly boxed in.

5.1.2.5 WINDOW SILLS SHOULD BE KEPT TO A MINIMUM SIZE, BE SLOPED INWARD AT 45° AND BE AT LEAST 1 METRE (3 FT) FROM THE FLOOR — FF IV.A(1)(e)

Window sills and frames should be made of a 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 filled with whole panes and those which open should be screened. The screens should be constructed so as to be easily removable for cleaning and should be made from suitable corrosion-resistant material. — MP 29(j) FM 26(j)

5.1.2.6 ALL DOORS THROUGH WHICH FISH OR THEIR PRODUCTS ARE MOVED SHOULD BE SUFFICIENTLY WIDE, WELL CONSTRUCTED OF A SUITABLE MATERIAL AND SHOULD BE OF A SELF-CLOSING TYPE — FF IV.A(1)(f)

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

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

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

5.1.2.7 CEILINGS SHOULD BE DESIGNED AND CONSTRUCTED TO PREVENT ACCUMULATION OF DIRT AND CONDENSATION AND SHOULD BE EASY TO CLEAN — MP 27(k)(iii)

Ceilings should be at least 3 metres (10 ft) in height, free from cracks and open joints and should be of a smooth, waterproof, light coloured finish. — FF IV.A(i)(d)

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

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

5.1.2.8 A MINIMUM ILLUMINATION OF 220 LUX (20 FOOT CANDLES) IN GENERAL WORKING AREAS AND NOT LESS THAN 540 LUX (50 FOOT CANDLES) AT POINTS REQUIRING CLOSE EXAMINATION OF THE PRODUCT SHOULD BE PROVIDED AND SHOULD NOT ALTER COLOURS — FF IV.A.2(f)(ii)

Light bulbs and fixtures suspended over the working areas where fish is handled in any step of preparation, should be of the safety type or otherwise protected to prevent food contamination in case of breakage. — MP 29(i)

5.1.2.9 PREMISES SHOULD BE WELL VENTILATED TO PREVENT EXCESSIVE HEAT, CONDENSATION AND CONTAMINATION WITH OBNOXIOUS ODOURS, DUST, VAPOUR OR SMOKE — FF IV.A.2(f)(i)

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

5.1.3 Sanitary Facilities

5.1.3.1 AREAS WHERE FISH ARE RECEIVED OR STORED SHOULD BE SO SEPARATED FROM AREAS IN WHICH FINAL PRODUCT PREPARATION OR PACKAGING IS CONDUCTED AS TO PRECLUDE CONTAMINATION OF THE FINISHED PRODUCT — FF IV.A.2(a)(i)

Separate rooms or preferably well defined areas of adequate size should be provided for receiving and storing raw materials and for operations like washing, filleting, steaking or other processing and packaging.

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

The food handling area 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 raw fish from deterioration and contamination. — FF IV.A.2(a)(ii)

5.1.3.2 A SEPARATE REFUSE ROOM OR OTHER EQUALLY ADEQUATE OFFAL STORAGE FACILITIES SHOULD BE PROVIDED ON THE PREMISES — FF III.A(1)

If offal or other refuse is to be collected and held before removal, adequate precautions should be taken to protect it against rodents, birds, insects and exposure to warm temperatures. — FF IV.B(3)(b)

A separate refuse room for storing waste in water-tight containers or offal bins should be provided. The walls, floor and ceiling of such a storage room, and the area under the elevated bins should be constructed of impervious material which can be readily cleaned. Where waste material is held in containers outside the establishment, the containers should be lidded. A separate enclosure should be provided for their storage with easy access for vehicles loading and unloading. Standing for the containers should be of solid, hard and impervious material which can be easily cleaned and properly drained. If containers are used in large numbers, a mechanical washing plant might be advisable to provide for routine washing. Containers should be capable of withstanding repeated exposure to normal cleaning processes. — FF IV.3(1)(b)

5.1.3.3 ANY BY-PRODUCT PLANT SHOULD BE ENTIRELY SEPARATE FROM THE PLANT WHICH IS PROCESSING FRESH FISH FOR HUMAN CONSUMPTION

The layout and construction of a processing plant for fish for human consumption should be such as to ensure that the areas in which fish are held, processed and stored are used for that purpose only.

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

5.1.3.4 AN AMPLE SUPPLY OF COLD AND HOT WATER OF POTABLE QUALITY UNDER ADEQUATE PRESSURE SHOULD BE AVAILABLE AT NUMEROUS POINTS THROUGHOUT THE PREMISES AT ALL TIMES DURING THE WORKING HOURS FF IV.A.2(b)(i)

All water available for use in those parts of establishments where fish is received, held, processed, packaged and stored should be of potable quality. If sea water is used, it must meet the same micro-biological standards as fresh potable water.

An adequate supply of hot water of potable quality at a minimum temperature of 82°C (180°F) should be available at all times during the plant operation.

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

Water used for washing or conveying raw materials should not be re-circulated.

5.1.3.5 WHEN INPLANT 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 sanitation problems. The indiscriminate use of chlorine cannot compensate for unsanitary conditions in a processing plant.

5.1.3.6 ICE SHOULD BE MADE FROM WATER OF POTABLE QUALITY AND SHOULD BE MANUFACTURED, HANDLED AND STORED SO AS TO PROTECT IT FROM CONTAMINATION FF IV.A.2(c)(i)

Ice used in the operation of the fresh fish processing establishment should be made from water of potable quality.

When vessels are taking ice to sea, only fresh clean ice should be taken on board at the beginning of each voyage. Ice left from the previous voyage should be discarded and removed from the vessel. FF IV.A.2(c)(ii)

5.1.3.7 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 FF IV.A.2(d)

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

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

5.1.3.8 ALL PLUMBING AND WASTE DISPOSAL LINES, INCLUDING SEWER SYSTEM, SHOULD BE LARGE ENOUGH TO CARRY PEAK LOADS AND SHOULD BE PROPERLY CONSTRUCTED FF IV.2(e)(i)(ii)

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

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

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

5.1.3.9 PROPER FACILITIES FOR WASHING AND DISINFECTION OF EQUIPMENT SHOULD BE PROVIDED FM 26(p)(iv)

Facilities should be present in every fresh fish processing establishment for cleaning and disinfection of trays, removable cutting or filleting boards, containers and other similar equipment and working implements. Such facilities should be located in a separate room or in designated areas in the work rooms where there is an adequate supply of hot and cold water of potable quality, under good pressure, and where there is proper drainage. MP 29(r)(iv)

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

5.1.3.10 ADEQUATE AND CONVENIENTLY LOCATED TOILET FACILITIES SHOULD BE PROVIDED FF IV.A.2(g)

Toilet rooms should have walls and ceilings of a smooth washable, light coloured surface and floors constructed of impervious and readily cleanable material. Toilet facilities should be well lit, ventilated and kept in a sanitary condition at all times. Adequate supply of toilet paper should be available in each toilet cubicle.

The doors leading to the facilities should be of a self-closing type and should not open directly into the fish processing areas.

The hand washing facilities in the toilet rooms should be of a type not requiring operation by hand and should have an adequate supply of hot and cold water of potable quality and liquid or powdered soap should be provided. Suitable hygienic means of drying the hands such as single use towels should be available. Where paper towels are used, a sufficient number of dispensers and receptacles for used towels should be provided.

Notices should be posted requiring personnel to wash their hands after using the toilets.

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

1 to 9 employees - 1 toilet
10 to 24 employees - 2 toilets
25 to 49 employees - 3 toilets
50 to 100 employees - 5 toilets
for every 30 employees over 100 - 1 toilet.

5.1.3.11 FACILITIES SHOULD BE AVAILABLE IN THE PROCESSING AREAS FOR EMPLOYEES TO WASH AND DRY THEIR HANDS AND, IF REQUIRED, FOR DISINFECTION OF PROTECTIVE HAND COVERINGS FF IV.A.2(h)

In addition to hand washing facilities available in toilet rooms, a number of sanitary washbasins with an adequate supply of hot and cold water of potable quality and liquid or powdered soap should be provided whenever the process demands. They should be located in full view of the processing floor and should be of a type not requiring operation by hand or be fed by a continuous flow of potable fresh or clean sea water. Single use towels are recommended, otherwise the method of drying hands should meet the requirements of the official agency having jurisdiction. The facilities should be kept in a sanitary condition at all times.

5.1.3.12 STAFF AMENITIES CONSISTING OF LUNCHROOMS, CHANGING-ROOMS OR ROOMS CONTAINING SHOWER OR WASHING FACILITIES SHOULD BE PROVIDED FF IV.A.2(i)

Where workers of both sexes are employed, separate facilities should be present for each except that the lunchrooms may be shared. As a general guide, the lunchrooms should provide seating accommodation for all employees and the changing-rooms should provide enough space for lockers for each employee without causing undue congestion. Clothing and footwear not worn during working hours must not be kept in any processing area. FF IV.A.2(f)

5.1.3.13 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.

5.2 Equipment and Utensils

5.2.1 ALL WORK SURFACES AND ALL CONTAINERS, TRAYS, TANKS OR OTHER EQUIPMENT USED FOR PROCESSING FISH SHOULD BE OF SMOOTH, IMPERVIOUS, NON-TOXIC MATERIAL WHICH IS CORROSION-RESISTANT AND SHOULD BE DESIGNED AND CONSTRUCTED TO PREVENT HYGIENIC HAZARDS AND PERMIT EASY AND THOROUGH CLEANING

Contamination of fish during processing can be caused by contact with unsatisfactory surfaces. All food contact surfaces should be smooth, free from pits, crevices and loose scale, non-toxic, unaffected by salt, fish juices or other ingredients used, and capable of withstanding repeated cleaning and disinfection. Wood could be used for cutting surfaces only when no other suitable material is available.

Fish boxes used for holding fish should preferably be constructed of plastic or corrosion-resistant metal, and if of wood, they should be treated to prevent moisture entering the wood and coated with a durable, non-toxic paint or other surface coating that is smooth and readily washable. Wicker baskets should not be used.

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

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

5.2.2 MARKET CONTAINERS FOR REPEATED USE SHOULD BE MADE OF SUITABLE CORROSION-RESISTANT MATERIAL AND SHOULD BE CONSTRUCTED SO THAT THEY CAN BE EASILY CLEANED

The type of container used in fish markets varies from area to area, but whatever shape or dimension, they should not have crevices, lips or sills which render them difficult to clean. Containers of wood and wicker cannot be cleaned satisfactorily and their use should be discouraged. A number of plastic and light alloy containers are now available for the handling and storage of fish.

5.2.3 CONTAINERS SHOULD BE LARGE ENOUGH TO HOLD ADEQUATE QUANTITIES OF ICE AS WELL AS THE CORRECT WEIGHT OF FISH. THEY SHOULD BE STRONG ENOUGH TO WITHSTAND FAIRLY ROUGH HANDLING AND BE SUITABLE FOR STACKING WHEN FILLED, WITHOUT DAMAGE TO FISH IN BOXES BELOW. DRAINAGE SHOULD ALSO BE ARRANGED TO AVOID CONTAMINATION OF FISH IN STACKED BOXES

As the fish should always be well iced, it is necessary that the containers be large enough to hold adequate quantities of ice for the standard amount of fish being sold. It should be possible to stack containers close together to reduce the amount of heat absorbed from the surrounding atmosphere. Good drainage arrangements prevent fish lying in melt-water containing bacteria and the digestive enzymes derived from the stomach and intestines of the fish.

5.2.4 RETURNABLE BOXES SHOULD BE OF SUITABLE CORROSION-RESISTANT MATERIAL

Returnable boxes should be clean to avoid contamination, and strong enough to withstand physical damage to the fish during transit. The boxes should also be large enough to hold sufficient ice in order to maintain the fish in a chilled condition while being transported. Boxes of plastic or light-alloy material are recommended, as raw wood cannot be cleaned properly.

New developments in some areas include the use of plastic non-returnable liners and returnable outer boxes in alloy material. Some have built-in melt-water collecting compartments so that they can be transported along with other goods, which might otherwise be contaminated by the melt-water.

5.2.5 NON-RETURNABLE BOXES SHOULD BE STRONGLY CONSTRUCTED AND DURABLE ENOUGH FOR ANY NORMAL HANDLING OPERATION DURING DISTRIBUTION. THEY SHOULD BE LARGE ENOUGH TO HOLD AN ADEQUATE AMOUNT OF ICE AS WELL AS THE REQUIRED WEIGHT OF FISH. PROVISION SHOULD BE MADE FOR THE DRAINAGE OF MELT-WATER. WHERE WOOD IS USED IT SHOULD BE CLEAN AND NEW

Non-returnable boxes, in a variety of materials, are used in various fisheries. Many are of poor construction and are easily broken during distribution, thus damaging the contents, or allowing outside contamination to take place. In some cases boxes are too small to hold adequate quantities of ice. Overfilling a box will result in the crushing and bruising of fish when the boxes are stacked for transport. In many areas, non-returnable boxes are now available constructed of specially treated fibre-board. Others are made from expanded plastic material which acts as an insulant as well as a container but the fish must of course be chilled before packing, or the insulation would maintain them at a higher temperature.

5.2.6 FILLETING BOARDS AND OTHER SURFACES ON WHICH FISH ARE CUT SHOULD BE MADE OF IMPERVIOUS MATERIALS WHICH MEET THE PHYSICAL REQUIREMENTS FOR CUTTING SURFACES

A lot of bacterial contamination of fillets and steaks is caused by contact with the filleting and cutting boards. Wooden cutting surfaces are porous and quickly become water-logged and are practically impossible to clean thoroughly. They are not recommended as suitable for this type of work.

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

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

5.2.7 THE FILLETING LINE SHOULD BE DESIGNED AS A CONTINUOUS PROCESSING UNIT WITH ALL OPERATIONS ARRANGED SEQUENTIALLY IN SUCH A WAY THAT THE FISH COULD MOVE UNIFORMLY FAST THROUGH THE LINE WITHOUT ANY STOPPAGES OR SLOW DOWNS

Properly designed filleting line means saving in the cost of processing and

will result in a better quality of the final product. When the fish or fillets 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. If the fish are flumed, no recirculation of the fluming water should be allowed. Offal chutes should be located as close as possible to the filleter's stations but in such a way that there is no possibility for a splash-back. Each filleter's station should have a line of potable water with a tap to regulate the flow of water over the surface of the filleting board.

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

5.2.8 THE USE OF PROPERLY DESIGNED MACHINES FOR GUTTING, WASHING, FILLETING, SKINNING, STEAKING AND SIMILAR OPERATIONS IS TO BE ENCOURAGED

Where large quantities of fish are processed properly designed machines will simplify the production of fillets and similar products in quantity, with consistently low bacterial counts. This is mainly because well designed machines have impervious and corrosion-resistant working surfaces, are easy to clean and are capable of handling the fish with a minimum of delay.

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

5.2.9 CANDLING TABLES SHOULD BE EASY TO CLEAN AND THEY SHOULD NOT RAISE THE TEMPERATURE OF THE FILLETS

Since heat from the light may produce rapid growth and activity of bacteria on candling surfaces, these should be thoroughly cleaned and treated with disinfectant at frequent intervals. The frame and the body of a candling table should be made of a suitable corrosion-resistant material. A heavy sheet of opaque glass or translucent plastic should be used for the candling surface.

Preferably white, fluorescent light tubes should be employed as a source of a strong and shadow-free light. The encasement, where the lights are located, should be made of waterproof material and should be well ventilated to reduce the heat. A constant flow of cold fresh water across the candling surface is highly desirable to keep the surface constantly wet, clean and cold.

Electrical wiring of a candling table should be done by a competent electrician.

To increase the efficiency of candling operation, any extraneous or overhead source of light should be reduced to a minimum.

5.2.10 DIP TANKS USED FOR FILLETS SHOULD BE MADE OF IMPERVIOUS CORROSION-RESISTANT MATERIALS AND SHOULD BE EASY TO CLEAN. DIP TANKS SHOULD BE EMPTIED, THOROUGHLY CLEANED AND DISINFECTED BETWEEN EACH CYCLE OF USE

Where it is desired and permissible to use such dips as anti-oxidants 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 new solutions. The use of sprays instead of dips has been found by many operators as a more efficient method for treatment of fillets or fish steaks. It eliminates an 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, except if the solution is filtered, pasteurized and cooled.

5.2.11 FISH TRANSPORT VEHICLES SHOULD BE DESIGNED TO ALLOW ADEQUATE ICING OF FISH, TO PROTECT FISH FROM WARMING UP DURING TRANSPORT, AND SHOULD BE OF SUCH MATERIAL AND CONSTRUCTION AS TO PERMIT EASY AND THOROUGH CLEANING

Vehicles used for transporting fresh fish should be designed and constructed to provide constant protection to the fish against contamination by dust, exposure to higher temperatures and the drying effect of sun or wind. Even where ice is very cheap and journey times or distances are relatively short, the use of an insulated vehicle provides an additional insurance against inadequate icing or unforeseen delays. The insulation should cover completely the walls, roof and the floor of the vehicle. The thickness of insulation employed will depend on the outside temperatures normally encountered. It should be remembered that insulation cannot help to cool the fish but helps to keep it at the temperature at which it was put into the vehicle.

For the purpose of cleaning, the vehicles transporting fish should have the walls, floors and roofs made of a suitable, corrosion-resistant material with smooth and non-absorbent surface. Floors should be adequately drained.

5.3 Hygienic Operating Requirements

5.3.1 GENERAL SANITATION IN AN ESTABLISHMENT WHERE FRESH FISH IS PROCESSED FOR HUMAN CONSUMPTION SHOULD BE OF THE HIGHEST STANDARD PRESENT IN ANY FOOD PROCESSING INDUSTRY

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

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

5.3.2 THE BUILDING, EQUIPMENT, UTENSILS AND OTHER PHYSICAL FACILITIES OF THE PLANT SHOULD BE KEPT CLEAN, IN GOOD REPAIR AND SHOULD BE MAINTAINED IN AN ORDERLY AND SANITARY CONDITION FF IV.C(1)

All surfaces which come in contact with fish should be hosed down with cold or hot potable water or clean sea 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.

The use of hot 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, to be used to assist in achieving the desired objective. After the application of cleaning and disinfecting agents the surfaces which come in contact with fish should be rinsed thoroughly with potable or clean sea-water before use.

Cleaning agents and disinfectants used should be appropriate for the purpose and should be so used as to present no hazard to public health and should meet the requirements of the official agency having jurisdiction.

5.3.3 FILLETING AND CUTTING BOARDS SHOULD BE FREQUENTLY AND THOROUGHLY SCRUBBED AND TREATED WITH DISINFECTANT. WHEREVER PRACTICABLE THE BOARDS SHOULD BE CONTINUOUSLY FLUSHED WITH CLEAN RUNNING WATER DURING USE. THE FLUSHING WATER SHOULD CONTAIN 4 ppm OF RESIDUAL CHLORINE

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

It has been proved that this contamination of both fillets and boards can be considerably reduced by continuous flushing with clean cold water. A further reduction in contamination has been observed when using chlorinated water for flushing.

5.3.4 IF BARRELS OR OTHER CONTAINERS ARE USED ON THE FILLETING LINE FOR THE COLLECTION AND DISPOSAL OF OFFAL, THEY SHOULD BE LOCATED BELOW THE LEVEL AT WHICH THE FISH ARE PROCESSED AND IN SUCH A WAY THAT THERE IS NO SPLASH-BACK ON THE PROCESSING LINE

If individual offal containers are used close to a processing line instead of the flumes or chutes connected to a common line, they should be located in such a way that there is no possibility of splash-back. Placement of the filleting boards or the fillet containers on the rims of the offal barrels should not be practiced.

If the containers are not being used then they should be lidded. In general, much could be gained in efficiency and cleanliness of an operation if flumes or other equally effective methods are employed for the disposal of the fish offal.

5.3.5 ALL MACHINES USED FOR GUTTING, WASHING, FILLETING, SKINNING, STEAKING OR SIMILAR OPERATIONS SHOULD BE THOROUGHLY CLEANED AND DISINFECTED DURING REST OR MEAL BREAKS AND BEFORE RESUMPTION OF PRODUCTION FOLLOWING OTHER WORK STOPPAGES

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

5.3.6 ALL HANDLING AND PROCESSING OPERATIONS INVOLVED IN THE PREPARATION AND DISTRIBUTION OF FILLETS AND SIMILAR PRODUCTS SHOULD BE CARRIED OUT UNDER SANITARY AND HYGIENIC CONDITIONS

Fillets and similar products are particularly vulnerable to contamination, as their preparation usually involves much handling. When the flesh is exposed, any contamination with micro-organisms will rapidly reduce potential keeping time. All plant, equipment and fish workers should therefore comply with the hygienic operating requirements.

5.3.7 MARKET CONTAINERS AND ALL RETURNABLE FISH BOXES SHOULD BE THOROUGHLY CLEANED AND TREATED WITH DISINFECTANT IMMEDIATELY AFTER EACH USE

The use of properly designed washing machines is recommended wherever practicable. Good washing by hand can be achieved by scrubbing with stiff brushes and by using high pressure water jets, with detergent added to the water. A preliminary rinse in potable cold water, followed by a wash with hot water at a minimum temperature of 43°C (110°F) has been recommended for efficient cleaning. An ample supply of potable water at adequate pressure is the first requirement and cleaning will be much easier if slime and blood are not allowed to dry on to the container surfaces.

5.3.8 ONLY NEW AND CLEAN BOXES, CARTONS AND WRAPPING MATERIAL SHOULD BE USED FOR THE TRANSPORT AND DISTRIBUTION OF FILLETS AND SIMILAR PRODUCTS. WHERE RETURNABLE BOXES ARE USED THEY SHOULD BE OF CORROSION-RESISTANT MATERIAL AND THOROUGHLY CLEANED AND DISINFECTED AFTER EACH USE

The practice of using returnable boxes for the transport and distribution of fillets and similar products should be discouraged, unless the box is constructed of light inner non-returnable container protected by a stronger returnable outer case.

All too often, returnable boxes lie around processing plant yards in an unwashed, filthy condition, where blood and slime are allowed to dry on to the box surfaces. They are then found to be extremely difficult to clean properly and may only receive a quick hose down with cold water.

As the importance of protecting fillets and other similar products from all sources of contamination cannot be overemphasized, new and clean non-returnable containers should always be used.

5.3.9 ALL WHARVES, QUAYS, MARKETS AND SIMILAR AREAS WHERE FISH ARE UNLOADED AND DISPLAYED FOR SALE, SHOULD BE KEPT CLEAN AND DISINFECTED

Fish, as a food for human consumption should be treated as such, in clean surroundings. Any dirty surfaces in the vicinity of the unloading area involves the risk that fish will be contaminated with filth and micro-organisms of public health significance.

5.3.10 REMOVAL OF SOLID, SEMI-SOLID OR LIQUID WASTES FROM FISH UNLOADING, HOLDING AND PROCESSING AREAS SHOULD BE ON A CONTINUOUS OR NEAR CONTINUOUS BASIS USING WATER AND/OR APPROPRIATE EQUIPMENT SO THAT THESE AREAS ARE KEPT CLEAN AND THERE IS NO DANGER OF CONTAMINATING THE PRODUCT

All waste materials resulting from the operation of a fish plant should be disposed of as soon as possible in a way that they cannot be used for human food and in a manner that they cannot contaminate food and water supplies and offer harbourage or breeding places for rodents, insects or other vermin.

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

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.

Arrangements for the disposal of trade refuse and inedible waste should be approved by the appropriate official agency having jurisdiction.

5.3.11 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 FF IV.C(2)

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 meet the requirements of the official agency having jurisdiction and should be undertaken under the direct supervision of personnel with a thorough understanding of the hazards involved, including the possibility of toxic residues being retained by the fish, or their products. FM 34(a) FM 34(b) FF III.A(2)

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

All rodenticides, fumigants, insecticides or other toxic substances should be of approved type and should be stored in separate locked rooms or cabinets and handled only by properly trained personnel. FF IV.C(5)

5.3.12 DOGS, CATS AND OTHER ANIMALS SHOULD BE EXCLUDED FROM AREAS WHERE FISH IS RECEIVED, HANDLED, PROCESSED OR STORED FF IV.C(3)

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

5.3.13 ALL PERSONS WORKING IN A FRESH FISH PLANT SHOULD MAINTAIN A HIGH DEGREE OF PERSONAL CLEANLINESS WHILE ON DUTY AND SHOULD TAKE ALL NECESSARY PRECAUTIONS TO PREVENT THE CONTAMINATION OF THE FISH OR THEIR PRODUCTS OR INGREDIENTS WITH ANY FOREIGN SUBSTANCE FF IV.C(6)

All employees should wear, appropriate to the nature of their work, clean protective clothing including a head covering and footwear all of which articles are either washable or disposable.

Gloves used in the handling of fish should be maintained in a sound, clean and sanitary condition and should be made of an impermeable material except where their usage would be incompatible with the work involved. Hands should be washed thoroughly with soap or another cleansing agent and warm water before commencing work, on 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 fish handling areas.

5.3.14 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 TRANSPORTING OF FISH OR FISH PRODUCTS

Plant management should require that any person afflicted with infected wounds, sores, or any illness, notably diarrhoea, should immediately report to management. 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 fish plant in a capacity in which there is a likelihood of such a person contaminating fish or fish products with disease-causing micro-organisms. FF IV.C(4)

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. FF IV.6(e)

5.3.15 CONVEYANCES USED FOR TRANSPORTING FISH SHOULD BE CLEANED AND DISINFECTED IMMEDIATELY AFTER EACH USE AND SHOULD BE SO MAINTAINED AS NOT TO CONSTITUTE A SOURCE OF CONTAMINATION FOR THE PRODUCT

The cleaning of vehicles, together with receptacles and equipment thereon, should be planned to a regular routine. Hosing, scrubbing and cleaning with water of potable quality to which a suitable detergent and/or disinfectant has been added is usually necessary.

5.4 Operating Practices and Production Requirements

5.4.1 General considerations

5.4.1.1 FRESH FISH SHOULD BE HANDLED, PROCESSED AND DISTRIBUTED WITH CARE AND A MINIMUM OF DELAY

Poor handling of fish on shore can ruin the best efforts of the fisherman. As has already been explained, even well iced fish loses quality in a relatively short time. If unnecessary delays occur after the fish 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.

Fresh fish is often handled a number of times after it is landed, and the effects of bruising, contamination or exposure to unduly high temperatures will become apparent by the time the final product reaches the consumer. Fresh fish have a very short time in which to remain in a marketable condition.

The precise steps which follow unloading of the fish from the vessel vary from one fishery to another. In some areas the catch may be unloaded and transported directly to a large processing factory, in others it may be laid out in containers in a market and sold by auction. Sales may also be made through intermediates before the fish reaches the processor.

Whatever the system, it is essential to ensure that the fish reaches the consumer in an acceptable condition.

5.4.1.2 FRESH FISH SHOULD ALWAYS BE TREATED IN A SANITARY AND HYGIENIC MANNER

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

Preparatory operations leading to the finished product and the packaging operations should be so timed as to permit expeditious handling of consecutive batches in production within the time and temperature range that will prevent deterioration, spoilage or the development of micro-organisms of public health significance.

It is considered good practice to develop a schedule of permitted times in which each operation will be allocated a portion of a total time permitted for each fish to remain on the premises of the fresh fish processing plant.

5.4.1.3 ADEQUATE FACILITIES SHOULD BE AVAILABLE, AT THE PROCESSING PLANT, TO MAINTAIN FISH IN A CHILLED CONDITION

Where supplies of fish cannot be processed on arrival at the factory, or when the final product cannot be distributed soon after packing, adequate facilities are required to keep the fish or their products cool. It must be noted, however, that where chill rooms are installed, these are not designed to cool the fish but only to maintain them in this condition after they have been cooled by ice or other means.

It is poor practice, therefore, to load the chill room with large quantities of fresh fish that were not prechilled effectively to the temperature of the melting ice.

The chill room should be equipped with the recording thermometer and an automatic temperature control, and should be so designed that it could be kept in a clean sanitary condition at all times.

5.4.1.4 NO FISH SHOULD BE OFFERED FOR SALE OR USED FOR FURTHER PROCESSING WHICH HAS UNDERGONE DETERIORATION OR ANY PROCESS OF DECOMPOSITION OR WHICH HAS BEEN CONTAMINATED WITH FOREIGN MATTER TO AN EXTENT WHICH HAS MADE IT UNFIT FOR HUMAN CONSUMPTION

The fresh fish should be rejected if it is known to contain toxic, decomposed or extraneous substances which will not be removed to an acceptable level by normal procedures of sorting or preparation. Fish in a diseased condition should be discarded or the diseased portion removed. Only clean, sound fish should be used for further processing and distribution. FF IV.D(1)(a)

5.4.2 Handling of Whole and Gutted Fish

5.4.2.1 FISH SHOULD NOT BE DISPLAYED OR LEFT LYING ABOUT MARKETS OR AUCTION HALLS ANY LONGER THAN NECESSARY TO MEET INSPECTION REQUIREMENTS AND SALE

The auction system of selling fish offers some economic advantages, but where the auction requires the laying out of unchilled fish, the practice is technologically undesirable. The fish should always be mixed with suitable quantities of ice. In areas where only one auction takes place in a day, the sale may be delayed for a number of reasons, increasing the rate of spoilage. This undesirable situation can be avoided in fisheries holding several auctions of various catches in one day.

In certain areas fish are sold by sample, and this method avoids the exposure of the catch on the market without ice, as the fish can remain on board until transport is available to take it immediately to the processor or merchant. It is difficult, where large quantities of fish are being weighed into market containers, to ensure adequate icing. Here again fish boxed and iced at sea, and unloaded and distributed in the same boxes, have a distinct advantage.

5.4.2.2 FINELY DIVIDED ICE SHOULD BE WELL DISPERSED AMONG THE FISH WHEN FILLING MARKET CONTAINERS

Top and bottom icing should be used with more ice dispersed through smaller fish. Bottom icing will retard conduction of heat from the market floor and top icing prevents drying, cools and protects the fish. Even where proper icing is not practicable a layer of finely divided top ice is better than no ice at all.

5.4.2.3 FISH OFFERED FOR SALE ON THE MARKET SHOULD BE GRADED AND SORTED SO THAT ALL FISH IN A CONTAINER ARE OF SIMILAR SPECIES, SIZE AND QUALITY

Care in grading, weighing and sorting ensures that all fish in a container are uniform in species, size and quality. This will result in the use of better quality fish to the best advantage and can help to retain the confidence of the buyer.

5.4.2.4 WALKING ON OR KICKING FISH AND WALKING OVER BOXES IN THE MARKET SHOULD BE DISCOURAGED

Rough careless handling or exposure to contamination may reduce the quality of fish through physical damage or increased spoilage.

5.4.2.5 INSPECTION PROCEDURES SHOULD NOT INVOLVE DELAYING THE SALE OF THE CATCH

Inspection should be carried out quickly and to good technological standards. It should not result in a temperature rise of the fish.

5.4.2.6 BOXES SHOULD NOT BE EMPTIED OUT ON THE MARKET FLOOR FOR EXAMINATION

This involves the risk of contamination from unclean surfaces. If fish are graded and sorted properly, then only one of the top fish in a box or batch need be inspected.

5.4.2.7 FISH SHOULD BE REMOVED FROM THE MARKET IMMEDIATELY AFTER THE SALE

Distributors and processors should arrange to remove their fish immediately following the sale, and where necessary ice should be added quickly.

Some observations have shown that even in temperate climates the temperature of uniced fish, exposed while lying on market floors or similar places, may rise to as high as 16°C (61°F) at the top of containers. It has already been explained that fish will spoil very rapidly at these temperatures.

5.4.2.8 THE FISH SHOULD AT ALL TIMES BE KEPT CHILLED AND MOVED THROUGH THE PROCESSING CHAIN QUICKLY

Distributors and processors should realize that the fish they receive is usually at least one day, and often several days old. It should therefore be handled as a highly perishable food and when it cannot be dealt with immediately, it should be packed in ice, in clean containers. Where possible these iced containers should be stored in a chill room.

In some cases refrigerated sea water or brine or chilled sea water storage may be satisfactory, provided that the fish are not cooled below -1°C (30°F). Fish should not be stored in this way for more than a day or so.

5.4.2.9 SOME WHOLE FISH MAY REQUIRE GUTTING ON ARRIVAL AT THE PROCESSING PLANT. THIS OPERATION SHOULD BE CARRIED OUT EFFICIENTLY AND WITH CARE

Whether mechanical or manual methods are used, gutting must be complete in order to remove all pieces of guts, liver, blood along the backbone and any loose discoloured belly membrane. During the gutting the knife should not cut through the intestines releasing their contents or go beyond the vent exposing the sterile muscles to microbial and enzymatic action. Some species of fish destined for filleting need not be gutted.

5.4.2.10 IMMEDIATELY AFTER GUTTING AND BEFORE PACKING, ALL FISH SHOULD BE THOROUGHLY WASHED USING COOL POTABLE WATER. THE FISH SHOULD NOT BE EXPOSED TO ANY WARMING EFFECTS OF THE WATER FOR LONG PERIODS. AFTER WASHING, THE FISH SHOULD BE DRAINED PROPERLY

Proper washing will remove all traces of slime, blood and gut particles which may contaminate the flesh. Leaving fish in washing water for long periods will accelerate spoilage due to temperature rise. Containers used for washing fish should be provided with a continuous flow of cold potable water to keep the temperature down and, in sufficient amounts, to prevent the accumulation of contaminating materials. If the fish are not drained, but packed while very wet, excessive ice meltage will take place in the box.

5.4.2.11 FISH SHOULD BE THOROUGHLY PRECHILLED BEFORE BEING PACKED FOR SHIPMENT

If there should be any delay in packing, the fish should be prechilled by an immersion in ice and water mixture or chilled sea water. Prechilling of the fish will reduce the meltage of ice used in the shipping containers.

5.4.2.12 ADEQUATE QUANTITIES OF FINELY DIVIDED ICE SHOULD BE USED IN PACKING FISH FOR TRANSPORT. THE ICE SHOULD BE WELL DISPERSED AMONGST THE FISH AND SHOULD ALSO SURROUND IT IN SUFFICIENT AMOUNTS TO KEEP IT OUT OF CONTACT WITH THE BOX SURFACES DURING THE JOURNEY

The amount of ice required when packing will depend on the length of journey and the ambient temperatures involved. The ice should always be more than enough to last the journey. A suggested minimum is one part of ice to three parts of fish. If the ice is well mixed through the load and surrounding it, then deterioration of fish quality due to rise of temperature and the resulting growth of micro-organisms will be minimized.

5.4.2.13 FOR TRANSPORT TO THE VARIOUS OUTLETS, BOXES OF ICED FISH SHOULD BE LOADED IN INSULATED VANS AND SHOULD BE STACKED CLOSE TOGETHER, TO PRESENT AS LITTLE SURFACE AS POSSIBLE FOR HEAT ABSORPTION. A LAYER OF ICE BELOW AND ON TOP OF THE STACK OF BOXES FOR ADDITIONAL COOLING IS OF FURTHER BENEFIT. IF POSSIBLE THE VEHICLE CONTAINER SHOULD BE PRE-COOLED BEFORE LOADING STARTS

Heat flows from regions of higher temperature to those of lower temperature and will thus enter the boxes of fish through surfaces which are exposed to warmer surroundings. It follows that the rate at which heat flows into a load of stacked boxes may be reduced by minimizing the total box surface area exposed. This can be done by stacking boxes compactly and by placing a layer of finely divided ice around the stack wherever practicable.

Insulation will, of course, reduce the amount of heat leak into the vehicle container, particularly during warm, sunny weather. This in turn will reduce excessive ice meltage. In warm climates, ice packed with the fish in large transport containers may be quickly depleted, if the containers themselves are not initially cooled. The difficulty here is that the time taken to load the vehicle often nullifies the effect of any pre-cooling operation.

In many areas where container transport is not available, and short distances are involved, open vehicles are used. Fish boxes stacked on these should be surrounded with ice and covered by ice blankets, canvas or tarpaulin.

5.4.2.14 WHERE FISH IS TRANSPORTED IN VEHICLES HAVING MECHANICALLY REFRIGERATED CONTAINERS, THE COLD AIR SHOULD BE CIRCULATED COMPLETELY ROUND THE LOAD. THE TEMPERATURE SHOULD BE MAINTAINED SLIGHTLY ABOVE THE MELTING POINT OF ICE, SO THAT SOME ICE MELT-WATER IS ALWAYS COOLING THE FISH, AND TO AVOID PARTIAL FREEZING OF THE OUTER LAYERS OF FISH

The prime function of the cold air is to absorb heat entering through the walls of the container. If the free passage of cold air is obstructed by boxes, there

is a risk that part of the load will be higher in temperature. Temperatures slightly above the melting point of ice are fairly easy to control automatically, therefore damage through partial freezing can be avoided. It should be borne in mind that refrigerated vehicles are not meant to cool the loads. Their purpose is to maintain the load in a cool condition after it has been chilled with ice.

5.4.3 Handling of Fillets and Similar Products

5.4.3.1 FISH WHICH CANNOT BE PROCESSED IMMEDIATELY ON ARRIVAL AT THE FACTORY SHOULD BE WELL ICED IN CLEAN CONTAINERS AND STORED IN SPECIALLY DESIGNATED AREAS WITHIN THE PLANT, WHERE THEY WILL BE PROTECTED FROM HEAT AND WEATHER CONDITIONS, AND WILL NOT BE CONTAMINATED BY DUST, INSECTS OR VERMIN. WHERE POSSIBLE THE ICED FISH SHOULD BE STORED IN A CHILL ROOM, THE TEMPERATURE OF WHICH IS JUST ABOVE THAT OF MELTING ICE 0°C (32°F)

In order to produce good quality fillets or similar products, the quality of the fish must be maintained by protecting it from heat, contamination from other sources, and physical damage.

It must be stressed again that placing quantities of fish in a chill room does not remove the need for adequate icing. Chill rooms are designed to maintain a chill temperature and to keep already cool fish from warming up. The refrigeration machinery used in chill room operation is not adequate to lower the temperature of a mass of fish in a short time. The initial cooling must be done by the addition of ice.

5.4.3.2 ALL FISH SHOULD BE CAREFULLY SORTED BEFORE THEY ARE FILLETED OR PROCESSED IN A SIMILAR MANNER. ANY DAMAGED, CONTAMINATED OR OTHERWISE UNACCEPTABLE FISH SHOULD BE DISCARDED

As has already been stated, the quality and keeping time of fillets and similar products is largely dependent on the quality of the fish from which they are produced.

Fish which are damaged will produce poor, unacceptable fillets, and if contaminated in any way can spread this contamination to working surfaces and other fillets. Fillets of some species of fish will darken appreciably with the exposure to air and, therefore, it would be better to freeze them without delay rather than to market them as fresh fish.

5.4.3.3 ALL FISH SHOULD BE THOROUGHLY WASHED BEFORE BEING PLACED ON THE FILLETING AND CUTTING TABLES. SOME SPECIES MAY REQUIRE SCALING AND SHOULD BE WASHED AFTER THIS OPERATION

Spoilage bacteria come mainly from the surfaces of the fish being processed. Experience has shown that most of the surface bacteria can be removed by proper washing.

The removal of scales from certain species is sometimes required, particularly if they are to be marketed as unskinned fillets. Fish should be well washed after scaling, otherwise loose scales adhering to the surfaces may find their way on to the fillets, thus detracting from their appearance.

In handling of unskinned fillets, it is advisable not to stack them in a skin-to-flesh manner, as this practice will contaminate the almost sterile flesh surfaces of the fillets with micro-organisms from the skins. This will occur even when the fish are thoroughly washed prior to filleting.

5.4.3.4 ALL FILLETERS SHOULD BE TRAINED AND REQUIRED TO USE FILLETING TECHNIQUES IN WHICH CONTACT BETWEEN THE CUT SURFACES OF THE FILLET AND THE FILLETING BOARD IS MINIMIZED

The more skilled the filleter, the quicker the fish are filleted, with less risk of contamination from cutting surfaces.

The surface of a freshly cut fillet is practically free from micro-organisms except those that have been introduced by the blade of a filleting knife. The fillet, therefore, should be lifted by the same knife away from the carcass without touching the surface of the filleting board which usually is contaminated with micro-organisms derived from the skin or intestinal content of the fish.

Cutting through the belly cavity during the filleting of ungutted fish should be avoided.

5.4.3.5 WITH NON-MECHANIZED FILLETING LINES THE SUPPLY OF RAW FISH TO THE LINE SHOULD BE REGULATED SO THAT EACH FISH COULD BE PROCESSED WITH THE MINIMUM OF DELAY

It is a frequent occurrence that the filleting lines are being oversupplied resulting in accumulation of raw fish in front of the filleters. In such an event, usually the top layer or the fish most easily accessible to the filleters will be the first one to go through the processing line, while the fish at the bottom and away from the filleter's easy reach, could remain for hours pressed against the revolving surface of the conveyor or left in the pools of stagnant water containing fish slime, blood and digestive juices.

5.4.3.6 AFTER CUTTING, THE FILLETS OR SIMILAR PRODUCTS SHOULD BE PLACED DIRECTLY ON CLEAN CONVEYORS OR INTO CLEAN CONTAINERS. PILING LARGE QUANTITIES IN ONE CONTAINER SHOULD BE AVOIDED

Wherever possible during processing, unskinned fillets should be transferred individually by conveyor so that contact between skin and other fillets can be largely avoided, thus reducing the risk of spoilage contamination.

Containers in which fresh fillets or steaks are kept immediately after being filleted or cut, should be of a size that will not require longer than 15 minutes to fill them.

When the containers are full, they should be transferred to the next stage of processing without any delay. Leaving the full containers, as occasionally happens, stacked on the floor or pallet boards close to the filleting line and below the processing level of the line, might result in a serious contamination caused by the splash of dirty water from the processing line.

5.4.3.7 IT IS ADVISABLE TO MAKE THE CANDLING OF FILLETS OF CERTAIN SPECIES OF FISH A ROUTINE PRACTICE

If the fish is known to be highly parasitized, it pays to fillet and candle a few which are picked at random in order to decide whether to proceed with the processing.

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

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

5.4.3.8 IF THE FISH ARE TO BE DIPPED OR SPRAYED WITH FOOD ADDITIVES, THE ADVICE OF AN EXPERIENCED FOOD TECHNOLOGIST OR AN OFFICIAL AGENCY HAVING JURISDICTION SHOULD BE SOUGHT

Undoubtedly, any additive or additional treatment of fish during the processing, increases its cost and, therefore, should be measured against the benefits gained. An additive permitted in one country might not be allowed in another. Any additive, if used, and its concentration should be declared on the label of the final product.

5.4.3.9 IN ORDER TO PRESERVE THE QUALITY AND KEEPING TIME OF FILLETS AND STEAKS, THEY SHOULD BE MAINTAINED AS COOL AS POSSIBLE THROUGHOUT THE WHOLE OF THE PROCESSING OPERATIONS. ALL THE WORK SHOULD BE CARRIED OUT WITH CARE, AS QUICKLY AS POSSIBLE, THERE BEING NO UNNECESSARY DELAY BETWEEN THE TIME THE FISH ARE CUT AND THE TIME THE FILLETS OR SIMILAR PRODUCTS ARE AGAIN IN A COOL CONDITION

It is inevitable that the fillet or similar product temperatures will rise between the time that the gutted fish are taken out of chilled storage and the time the finished products can again be placed in chilled conditions. While cold potable water, used for washing, and cold dip solutions will assist in keeping fillet and steak temperatures down, even these slight warming effects can be reduced by quick and efficient operations.

5.4.3.10 FILLETS AND SIMILAR PRODUCTS SHOULD BE PROPERLY CHILLED BEFORE BEING PACKED FOR SHIPMENT

If there should be any delay in packing, pre-cooling the product will conserve ice used to pack the box. Individual or thin layers of fillets will cool more rapidly than those in bulk quantities. In some cases fillets or similar products may be chilled by brief immersion in an ice and water mixture. Satisfactory chilling by short exposure to a temperature of about -5°C (23°F) has also been reported. Great care must be taken in this case, however, to avoid damage by partial freezing.

5.4.3.11 FILLETS AND SIMILAR PRODUCTS WHICH HAVE NOT BEEN COOLED BEFORE PACKING SHOULD BE PACKED SO THAT NO PART OF ANY FILLET IS MORE THAN 4 cm (1½ in) FROM ICE OR OTHER SUITABLE COOLING MEDIUM

Fish flesh is a poor conductor of heat and the rate at which fillets can be cooled decreases considerably if the depth of the layer in which they are packed is increased. It is known that the centre of a 7.5 cm (3 in) layer of fillets, initially at 4.4°C (40°F) and iced top and bottom, will cool to 1.7°C (35°F) in 1½ hours. Under similar conditions a time of 8 hours is required for the centre of a 15 cm (6 in) layer to reach the same temperature.

5.4.3.12 FILLETS AND SIMILAR PRODUCTS SHOULD BE PACKED FOR TRANSPORT SO THAT THERE IS NO DIRECT CONTACT WITH ICE OR MELT-WATER. WET-STRENGTH PAPER OR PLASTIC FILMS SHOULD BE USED TO WRAP THE PRODUCTS AND SEPARATE THEM FROM ICE USED IN PACKING

Immediately after weighing, packaging should be carried out quickly and efficiently. Prolonged contact with ice or melt-water may result in the leaching away of flavour and nutrient constituents, a softening of the texture and spoilage of surface appearance.

Technical and commercial developments have resulted in a wide variety of materials and styles of packing being used for the distribution of fillets. These range from bulk shipments of unwrapped fillets to various types and sizes of package, including hermetically sealed self-service packs with a specified shelf life. Ice packed in the same container with the fillets, but not in direct contact with them, is still the most common method of maintaining a chilled condition during transport. Dry ice or pre-chilled eutectic solutions, in plastic or metal containers, are used in master containers having good insulating properties. Carefully controlled mechanical refrigeration is also used. Transport facilities should be similar to those already recommended for whole and gutted fish.

Whatever the method employed it is most important that fillets and similar products are protected from contamination, in some circumstances from dehydration, and are always kept as near as possible to the temperature of melting ice until they reach the consumer.

5.4.3.13 PACKAGING MATERIALS SHOULD BE CLEAN AND STORED IN A SANITARY MANNER. PACKAGING SHOULD BE CARRIED OUT UNDER CONDITIONS THAT PRECLUDE CONTAMINATION OF THE PRODUCT FF IV.D.4(a)

Packaging materials should not transfer to the product any objectionable or toxic substances or odours and tastes, and should protect the product against damage, deterioration and contamination.

5.4.3.14 IF POSSIBLE THE PREPACKAGING SHOULD ALSO BE DONE BY THE FRESH FISH PROCESSING PLANT RATHER THAN BY A DISTRIBUTOR OR RETAILER

Fish which has been prepacked into the final consumer packages, has the advantages that it can be handled by a non-specialized staff, and can be easily examined by the buyer for species, additives, quantity, price and methods of preparation. If properly packed, it can be carried and held with other foods without the danger of contaminating them with the fish juices or the fishy odour.

Only the best quality fish should be prepacked and the packing materials should be such as to protect the contents from dehydration, inside condensation and accumulation of unsightly fish juices. The final package should be sturdy and attractive.

5.4.3.15 BOXES FOR FILLETS AND SIMILAR PRODUCTS SHOULD BE HANDLED VERY CAREFULLY DURING TRANSPORT AND DISTRIBUTION. THEY SHOULD NEVER BE UP-ENDED

In some areas, boxes may be handled and stacked many times during distribution. Handling practices are often very rough, due to shortage of time at transfer points, and use of outdated methods for handling large quantities of boxes. It should be borne in mind that these boxes contain food for human consumption and modern handling techniques require to be introduced to avoid damage which may result in contamination of the packed product. Boxes should never be up-ended as this can result in fillet distortion and creasing and may cause loss of weight through excessive pressure on fillets at the bottom. It may also contaminate the fillets with ice melt-water.

5.5 Sanitary Control Programme

5.5.1 IT IS DESIRABLE THAT EACH FISH PROCESSING PLANT IN ITS OWN INTEREST DESIGNATES A SINGLE INDIVIDUAL WHOSE DUTIES ARE PREFERABLY DIVORCED FROM PRODUCTION, TO BE HELD RESPONSIBLE FOR THE CLEANLINESS OF THE ESTABLISHMENT — FM 45, FF IV.E, MP 52

Such a person or his staff should be a permanent part of the organization or employed by the organization and should be well trained in the use of special cleaning tools, methods of dismantling equipment for cleaning and in the significance of contamination and the hazards involved. A permanent cleaning and disinfection schedule should be drawn up to ensure that all parts of the establishment are cleaned appropriately and that critical areas, equipment and material are designated for cleaning and/or disinfection daily or more frequently if required.

5.6 Laboratory Control

5.6.1 IN ADDITION TO ANY CONTROL BY THE OFFICIAL AGENCY HAVING JURISDICTION, IT IS DESIRABLE THAT EACH FISH PROCESSING PLANT IN ITS OWN INTEREST SHOULD HAVE ACCESS TO LABORATORY CONTROL OF THE SANITARY QUALITY OF THE PRODUCTS PROCESSED — FF IV.F

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

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

6. SECTION V - END PRODUCT SPECIFICATIONS

6.1 Appropriate methods should be used for sampling and examination to determine the compliance with the following specifications:

A. Fishery products should be, to the extent possible in good manufacturing practice, free from objectionable matter and parasites.

B. Fishery products should be free from micro-organisms in amounts harmful to man, free from parasites harmful to man and should not contain any toxic substances produced by micro-organisms in amounts which represent a hazard to health.

C. Fishery products should be free from chemical pollutants in amounts which may represent a hazard to health.

D. Fishery products should comply with the requirements set forth by the Codex Alimentarius Commission on pesticide residues and food additives as contained in permitted lists of Codex commodity standards, or should comply with the requirements on pesticide residues and food additives of the country in which the fish will be sold.

E. Specifications A., B., C., and D. should to the extent possible also apply to fresh fish.

ANNEX I

General principles of fish spoilage

Soon after fish are dead, they begin to spoil, hence fresh caught fish pass through various stages of decay until they become putrid and unfit for human consumption.

Spoilage occurs for two main reasons: firstly, the controlled biochemical processes (digestive enzymes) which occur in all living tissues to assist the digestion of food, continue after death in an uncontrolled manner. These digestive enzymes then begin to attack the surrounding flesh, causing it to become soft.

Secondly, bacteria are present on the gills, in the surface slime and in the intestines of live, healthy fish, but not in the flesh, which is sterile. Soon after death, bacteria on the skin, surface slime and intestines multiply rapidly and can soon be detected in the flesh near the skin and belly walls. The spread into the flesh can be much more rapid if the fish have been damaged in any way. The bacteria continue to multiply inside the flesh, and at the same time begin to break down the tissues into a series of compounds with strong odours and tastes, and thus the fish become spoilt. In some species fat oxidation will also quickly occur and alter the flavour. The rate of chemical change and of bacterial activity depends on temperature. In general, the closer the temperature is to that of melting ice, 0°C (32°F), the slower the rate of chemical and bacteriological spoilage. For this reason, ice in one form or another is used throughout the world to prolong the storage life of fish.

Since bacteria from both intestines and surfaces with which the fish come in contact, play a major part in fish spoilage, high standards of cleanliness at all stages of handling, processing, storage and distribution are essential. This means that strict attention must be given to the efficient cleaning of the fish, the regular cleaning of all surfaces with which the fish come in contact, the provision of an uncontaminated water supply and the hygiene of workers. These factors are all important in order to provide the consumer with good quality wholesome food.

Chemical composition of fish flesh varies from species to species and even within species according to season, maturity, fishing ground, feed, etc. The rate of spoilage can therefore vary, and the spoilage pattern can be influenced by these factors.

- - - - - -

ANNEX II

References to Related Codes and Standards

FAO 1972	Code of Practice for Frozen Fish	CX/FFP 73/5
FAO 1974	Code of Practice for Canned Fish	CX/FFP 75/4
FAO/WHO	Recommended International Code of Practice - General Principles of Food Hygiene	CAC/RCP 1-1969 (to be revised)
WHO	International Standards for Drinking Water	latest edition
FAO/WHO 1974	Fish and Shellfish Hygiene	WHO/TRS/550
FAO 1975	Code of Practice for Shrimps or Prawns	CX/FFP 75/7
FAO 1975	Code of Practice for Smoked Fish	CX/FFP 75/6
	Code of Practice for Lobsters and Related Species	(in process)
	Code of Practice for Minced Fish Blocks	(in process)
	Code of Hygienic Practice for Molluscan Shellfish	ALINORM 76/13A, App. VI

AMENDED DRAFT CODE OF PRACTICE FOR CANNED FISH

CONTENTS

INTRODUCTION

The Code of Practice for Canned Fishery Products has been evolved by combining the code of technological practice developed by the FAO Department of Fisheries, Fishery Products and Marketing Branch assisted by Ad Hoc Consultation with the code of hygienic practice as developed by the FAO/WHO Codex Alimentarius Commission, Codex Committee on Food Hygiene.

The code is intended to assist all those who are concerned with fish and shellfish canning, to produce nutritious products which will be wholesome and attractive to the consumer. It should be helpful in the training of cannery staff and also in giving industrial and fishery managers a good general view of those requirements which are essential to good fish canning practice. It should also provide explanatory support for standards and regulations regarding fish and shellfish canning where these exist, and provide guidelines to good practice where regulations and official standards have not yet been introduced.

It should be emphasized, however, that this code of practice is not intended to replace the advice and guidance of trained and experienced technologists regarding the complex technical problems that arise in planning or operating a cannery.

The canning process was developed over 150 years ago and there has been over 100 years experience in the canning of fish. Canning provided the first method by which fish could be preserved for an extended period without any severe restrictions on the manner in which it was stored or transported.

This made it possible for abundant seasonal fish crops to be harvested and preserved so that they could be utilized throughout the year, and also for fish from remote areas to be transported to markets through the world. In many regions the development of canning made fishing industries practical.

Fatty fish such as tuna, salmon, sardines, herring, pilchards and mackerel make very satisfactory canned fish as do most of the commercial species of molluscs and crustacea. The lean varieties of fish do not usually have a satisfactory flavour if canned alone but are often comminuted and mixed with other ingredients to make very palatable canned products, such as fish balls or fish pudding. In some regions, lean species such as cod and halibut are canned in sauces which enhance their flavour.

There are many kinds of canned fish products on the market. They range from inexpensive but palatable varieties which are an excellent source of protein, through moderately priced convenience foods to rather expensive gourmet products. The provision of such a wide range of attractive products which are so easily transported and stored has resulted in the continued expansion of the fish canning industry. Quite frequently, the volume of canned fish traded is limited by the supply of raw material rather than by the demand for the product.

In recent years, frozen fish has competed with some canned products in urban markets and along the well developed frozen transport routes. Nevertheless, the canning industry continues to grow, wherever the supply of raw material can be economically increased. In some cases, the freezing process and mechanical refrigeration have enabled canneries to increase the range from which they draw their supplies.

Methods of preparing fish and shellfish for canning vary considerably depending on the species, the nature of the product and to some extent the custom in the area where the cannery is located. It is, therefore, not possible to consider each individual preparatory process in detail, in a code of this type, nor is it the intention to provide recipes for particular kinds of canned products. Advice concerning the use of food additives is not given because the subject is complicated by widely diversant and constantly changing national legislations.

Canning processes have been greatly improved over the years and improvements continue as technological advances make new methods, new materials and new equipment available. Some developments are more easily applied to some parts of the industry than to others. Processes, such as aseptic filling and continuous retorting and also the use of flexible pouches which have been successfully introduced into some sections of the canning industry, are not discussed because they have not been used to any extent in the canning of fish.

The recommendations given here are based on well established principles and the most recent technological information available, but the code will need to be revised from time to time to take into account the advances that are being continually made in canning technology.

It should be stressed that in the canning of fish or any other food, failure to perform all processing operations correctly may result in very substantial losses through spoilage of one kind or another, or perhaps in the production of canned food that might be harmful. It is therefore very important that fish canning operations should not be undertaken without the assistance of well qualified technical advisors.

- - - -

CODE OF PRACTICE FOR CANNED FISHERY PRODUCTS

Note

- The hygienic requirements of this Code are partially based on the General Principles of Food Hygiene and the Proposed Draft Codes of Hygienic Practice for Canned Fish (Step 2), Processed Meat Products (ALINORM 72/16, Appendix V) and Fresh Meat (ALINORM 72/15, Appendix II)

- The letter codes and the numbers given in the right hand margin indicate hygienic requirements as taken from the following codes of hygienic practice:

Proposed Draft Code of Hygienic Practice for Canned Fish	- CF
Proposed Draft Code of Hygienic Practice for Processed Meat Products	- MP
Proposed Draft Code of Hygienic Practice for Fresh Meat	- FM

1. SECTION I - SCOPE

This code of practice offers general advice concerning the production of heat processed canned fish and shellfish which have been packed in hermetically sealed rigid or semi-rigid containers.

Excluded are the manufacture of semi-preserves and pasteurized products and processes such as aseptic filling, continuous retorting or use of flexible pouches.

2. SECTION II - DEFINITIONS

For the purpose of this code:

2.1 "bleeders" are very small vents through which steam escapes throughout the entire heat process. Bleeding provides a circulation of steam within the retort and ensures the elimination of any air that enters the retort with the steam;

2.2 "buckle" is a sealed and heat processed metal container of fish that has become permanently distorted by internal pressure during the heat processing or cooling or as a result of the formation of gas in the container;

2.3 "canned fish or shellfish" means fish or shellfish packed in containers which have been hermetically sealed and sufficiently heated to destroy or inactivate all micro-organisms that will grow at any temperature at which the product is normally likely to be held and that will cause spoilage or that might be harmful. In this code the words "canned fish" include canned shellfish unless the context implies otherwise;

2.4 "chilling" is the process of cooling fish or shellfish to a temperature approaching that of melting ice;

2.5 "clean sea water" is sea water which meets the same micro-biological standards as potable water and is free from objectionable substances;

2.6 "cleaning" of surfaces means the removal of objectionable matter; MP FM

2.7 "come-up time" is the time required to bring a loaded retort up to the specified processing temperature;

2.8 "contamination" means direct or indirect transmission of objectionable matters to the fish or shellfish; MP FM

2.9 "disinfection" means the application of hygienically satisfactory chemical or physical agents and processes to clean surfaces with the intention of eliminating microorganisms; MP FM

2.10 "fish" means any of the cold-blooded aquatic vertebrate animals commonly known as such. This includes Pisces, Elasmobrachs and Cyclostomes. Aquatic mammals, invertebrate animals and amphibians are not included;

2.11 "flipper" is a sealed and heat processed container of fish which is normal in appearance but which may have its cover or bottom bulged outward if given a sharp jolt. A light inward pressure will cause the cover or bottom to spring back into its normal flat or slightly concave position;

2.12 "fresh fish or shellfish" are freshly caught fish or shellfish which have received no preservative treatment or which have been preserved only by chilling;

2.13 "headspace" is the space left in a container of canned fish to allow for the expansion of the contents during heat processing;

2.14 "heat process" is the treatment of sealed containers of fish with sufficient heat to destroy or inactivate all micro-organisms that will grow at any temperature at which the product is normally likely to be held and which cause spoilage or might be harmful. A particular heat process is usually described as the length of time the particular product should be exposed to a specified temperature to accomplish the purpose;

2.15 "heat processing time" is the time that the sealed containers of fish are exposed to the specified processing temperature;

2.16 "hermetically sealed" means air-tight; CF

2.17 "leaker" is a sealed and heat processed container of fish which has a defect that allows the passage of water, gas or micro-organisms;

2.18 "panelled container" is a sealed and heat processed cylindrical metal container of fish, the body wall of which has partly collapsed because it is not rigid enough to support the vacuum within or has been subjected to excessive internal pressure during cooling;

2.19 "potable water" is fresh water fit for human consumption. Standards of potability should not be lower than those contained in the "International Standards for Drinking Water", World Health Organization;

2.20 "retort" is a pressure vessel designed for heat processing food packed in hermetically sealed containers either by saturated steam or by heated water with superimposed air pressure;

2.21 "saturated steam" is pure steam in equilibrium with water at the same temperature. Under these conditions the temperature of the steam is entirely dependent on its pressure;

2.22 "shellfish" means those species of molluscs and crustacea including cephalopods that are usually used for food;

2.23 "shelling" is the process of removing meats from molluscs or crustacea either mechanically or by hand;

2.24 "springer" is a sealed and heat processed metal container of fish which has one bulging end. If this end is pushed into place the other will bulge;

2.25 "stack-burn" is a quality fault in canned fish resulting from inadequate cooling after the heat process. This usually occurs in products which have been either stacked closely or cased while still warm;

2.26 "swell" is a sealed metal container of fish which has both ends bulged by internal gas pressure;

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

2.28 "venting" is the process of flushing the air out of steam retorts at the beginning of a heat process. It is done by allowing large volumes of steam to flow through the retort to drive and carry the air out through open vents at the top of the retort.

3. SECTION III - RAW MATERIAL REQUIREMENTS

General Considerations

3.1 NO FISH OR SHELLFISH OR OTHER INGREDIENT SHOULD BE USED FOR THE PROCESSING OF CANNED PRODUCTS WHICH HAS UNDERGONE DETERIORATION OR ANY PROCESS OF DECOMPOSITION OR WHICH HAS BEEN CONTAMINATED WITH FOREIGN MATTER TO AN EXTENT WHICH HAS MADE IT UNFIT FOR HUMAN CONSUMPTION. MP 23

The raw material should be rejected if it is known to contain toxic, decomposed or extraneous substances which will not be removed to acceptable levels by normal procedures of sorting or preparation. CP IV.D(1)

Fish or shellfish in a diseased condition should be discarded or the diseased portion removed. Only clean and sound fish or shellfish should be used for canning. CP IV.D(2)

3.2 FRESH FISH AND SHELLFISH INTENDED FOR CANNING SHOULD RECEIVE THE SAME CARE AND ATTENTION FROM THE TIME OF CAPTURE UNTIL THEY ARE HEAT PROCESSED AS THEY WOULD RECEIVE IF INTENDED FOR MARKETING AS FRESH FISH.

The processes and the principles involved in the preparation of fresh fish for canning are for the most part similar to those that would be involved in preparing them for marketing as fresh fish. Therefore, the recommendations of the "Code of Practice for Fresh Fish" should be used as a guide for the handling and preparation of fresh fish for canning.

3.3 SHELLFISH THAT ARE STORED ALIVE SHOULD BE KEPT ALIVE IN A SANITARY ENVIRONMENT UNTIL THEY ARE PROCESSED. SHELLFISH THAT DIE, BECOME WEAK OR APPEAR ABNORMAL IN ANY WAY, SHOULD BE IMMEDIATELY REMOVED FROM THE LIVE STORE AND DISCARDED.

The meat of some species of crustacea, such as crab or lobster, deteriorates very rapidly after death and so it is often good practice to keep these species as well as some kinds of molluscs (oysters, clams and mussels) alive until they are processed.

Although some species can be kept alive in a dormant condition for long periods if they are kept moist and thoroughly chilled, it is generally more convenient to use ponds or floating cages (live wells) for storage.

It is important that the water in which shellfish are live stored should be maintained at a tolerable temperature and oxygen level and kept free of harmful substances. Since molluscs frequently collect bacteria from overlying water and concentrate them in their digestive systems it is important that the water in which they are stored be of good sanitary quality.

Shellfish that die or become weak or abnormal should be removed from the live store immediately they are discovered to avoid the possibility of their tainting or otherwise harming the remaining stock. Dead, weak or abnormal shellfish taken from live store should not be used for canning or other food purposes. They should be discarded immediately so that they do not spoil good shellfish and in order to avoid the risk of them being processed accidentally and irretrievably mixed with good quality canned products.

3.4 THE STANDARDS FOR HANDLING, PREPARING, FREEZING, STORING AND THAWING FISH, INTENDED FOR CANNING, SHOULD BE JUST AS HIGH AS THOSE APPLIED IN THE PROCESSING OF FISH INTO HIGH QUALITY PRODUCTS FOR THE FROZEN MARKET.

Canning will not correct quality faults in fresh fish. Neither will it correct or obscure faults such as rancidity or denaturation in frozen fish. Therefore, all the processes of freezing, storing and thawing fish to be used in canning should be in accordance with the recommendations of the "Code of Practice for Frozen Fish". The precooking stage may as an acceptable operation simultaneously thaw the product.

3.5 FISH AND SHELLFISH INTENDED FOR CANNING SHOULD BE INSPECTED AS SOON AS IT IS RECEIVED AT THE CANNERY. SPOILED OR CONTAMINATED FISH SHOULD BE DISCARDED IMMEDIATELY. WHEREVER PRACTICAL, THE FISH OR SHELLFISH RECEIVED SHOULD BE SORTED INTO LOTS SIMILAR IN QUALITY AND IN SUCH ATTRIBUTES AS SIZE, COLOUR OR TEXTURE AND THEN STORED APPROPRIATELY.

Material which is not fit for canning should be discarded immediately so that it will not spoil good fish and to avoid the risk that it might be processed accidentally and irretrievably mixed with good quality canned products.

Consumers expect all canned fish sold under the same brand mark to be quite similar in such characteristics as colour, texture, size of piece, as well as in general quality. Therefore, lots of canned fish in which there are large variations in these attributes are more difficult to market and hence less desirable to wholesale buyers.

The raw material should be inspected again if under the applied storage conditions changes in quality can be expected.

3.6 WHERE FISH SUCH AS TUNA ARE BRINE-FROZEN ABOARD THE CATCHING VESSEL, CARE MUST BE TAKEN TO AVOID EXCESSIVELY HIGH SALT PENETRATION OF THE FLESH.

Since it is not always practical to leach the salt out of fish, a high salt content in the raw material accepted for canning may result in unsatisfactory flavours in the final product. If the salt penetration has been excessively high the flesh may be denatured to the extent that fish are not suitable for canning. Assessment of salt content should be made at the time brine-frozen fish are received by the cannery.

Salt penetration into brine-frozen fish can be controlled to some extent by prechilling the fish prior to placing them into freezing brine and by keeping the brine temperature as low as practical during the freezing operation and separating the fish from the brine soon after they are frozen.

3.7 WHERE IT IS CONSIDERED IMPRACTICAL TO ICE FISH ABOARD THE CATCHING VESSEL, THE SHOULD BE BROUGHT TO THE CANNERY QUICKLY AND PROCESSED VERY SOON AFTER THEY ARE LANDED.

Fatty fish used for canning such as herring, mackerel, pilchard, sprat or sardine are often taken fairly close to a cannery and under such conditions icing aboard the vessel may be considered impractical or unnecessary. However, if these fish are feeding the enzymes in their gut will cause very rapid deterioration after death and this will be enhanced if they are crushed and the digestive juices allowed to permeate the flesh.

In such cases the practicability of using refrigerated seawater holds or boxing the fish on the vessel to avoid excessive pressure should be seriously considered.

In any event the fish should be brought to the cannery quickly and processed without delay.

3.8 SMALL FISH THAT HAVE BEEN FEEDING INTENSIVELY AT THE TIME THEY ARE TAKEN FROM THE WATER SHOULD NOT BE CANNED UNLESS THE FEED CAN BE REMOVED.

If the gut of a fish is filled with feed at the time it dies the enzymes present will commence to digest the flesh of the fish as well as the feed.

Small fish are generally gutted by pulling the intestines through the throat cavity when the head is removed. This method is not efficient if the gut is full. However, if feed is left in the fish it will spoil quickly and frequently the flesh next to the body cavity will disintegrate. The appearance and flavour of the canned product will be adversely affected often to the extent that the product will be unmerchantable.

In some instances feedy fish can be impounded and kept alive long enough for their guts to empty before they are taken out of the water.

4. SECTION IV - PLANT FACILITIES AND OPERATING REQUIREMENTS

4.1 Plant Construction and Layout

4.1.1 General Considerations

4.1.1.1 FISH CANNING OPERATIONS SHOULD BE DESIGNED TO CONVERT READILY AVAILABLE FISH SUPPLIES INTO WHOLESOME CANNED PRODUCTS WHICH CAN BE MARKETED ECONOMICALLY

Decision to commence a fish canning operation should be based on reasonable assurances that there will be sufficient fish supplies to sustain the operation and that the canned product will be wholesome, will remain stable and will be attractive to consumers in the intended markets. It is important that the costs of production be carefully assessed and the possible markets studied to ensure that the canning operation will be economically practical.

4.1.1.2 CANNING OPERATIONS SHOULD BE PLANNED, AND CANNERIES DESIGNED TO HAVE SUFFICIENT CAPACITY TO PROCESS SUPPLIES OF FISH AT THE FORESEEABLE AVERAGE RATE OF DAILY DELIVERY, AND SHOULD NOT BE OPERATED BEYOND THEIR FULL RATED CAPACITY FOR ANY EXTENDED PERIOD.

Most fish canning operations are subject to some fluctuations in their supply of raw material and in some fisheries these fluctuations may be very large. Since good quality raw material is essential for the production of good quality canned fish, canneries should not accept more fish than they can handle expeditiously. Supplies of fresh fish should be handled, chilled and stored in accordance with the recommendations of the "Code of Practice for Fresh Fish" and they should not be held for very long before they are processed.

In some instances it may be practical for a cannery to freeze surplus supplies when fish are abundant and hold them in frozen storage for canning at a time when fresh fish are less plentiful. If this is done, losses in quality due to improper freezing or faulty storage should be avoided by following the recommendations of the "Code of Practice for Frozen Fish".

Where supplies of fish are known to fluctuate considerably and particularly where fisheries are seasonal, it may be difficult to decide on what the capacity of a cannery should be. If a cannery is to be self sustaining, provision of a large reserve capacity which is seldom fully used is difficult to justify. On the other hand the reserve capacity should be large enough to quickly process the expected peaks in a fluctuating fish supply without operating the plant above its full rated capacity for any extended period. If a cannery is operated above its designed capacity, operating efficiency will decline and delays in processing, which will have an adverse effect on the quality of the product, are likely to occur. Furthermore, there is a serious risk that shutdowns through failure or overloaded equipment may cause substantial losses of material or product and may even necessitate a lengthy suspension of the canning operation.

4.1.1.3 CANNERIES SHOULD BE ADEQUATELY EQUIPPED TO ENSURE THAT THE CANNING OPERATION CAN BE CARRIED OUT WITHOUT THE PRODUCT BEING DELAYED AT ANY STAGE THROUGH LACK OF PROCESSING CAPACITY.

Fresh fish spoils slowly at chill temperatures and at the higher ambient temperatures which are quite general in canneries the rate of spoilage is greatly increased. It is therefore important that the whole canning operation should be carried out as soon as possible after the fish are received or are taken from frozen storage and there should be no delay in passing the partly prepared products from one stage of processing to the next.

Under normal operating conditions each processing stage should be capable of handling the output of the previous stage without delay and should have some reserve capacity to quickly deal with any backlogs which may occur from time to time. There should be sufficient standby replacements for all processing equipment such as butchering machines, can-filling equipment and sealing machines to allow for servicing and to ensure that no processing operations will be stopped or slowed by breakdown. There should also be a sufficient number of retorts to allow routine maintenance and repair work to be carried out without interfering with the cannery operations.

4.1.1.4 CANNERIES SHOULD BE DESIGNED AND EQUIPPED SO THAT ALL HANDLING AND PROCESSING OPERATIONS CAN BE CARRIED OUT EFFICIENTLY AND ALL MATERIALS AND PRODUCTS CAN PASS FROM ONE STAGE OF PROCESSING TO THE NEXT IN AN ORDERLY MANNER AND WITH MINIMUM DELAY WITHOUT CROWDING OF EQUIPMENT AND PERSONNEL.

To conserve their quality, fish or shellfish should be packed, sealed and heat-stablized as soon as possible after they have been removed from chilled or frozen storage, or in the case of those varieties which are live stored, as soon as possible after they have been shelled or butchered.

A great deal of care should be taken in planning the layout and equipment of a cannery to ensure that there is sufficient space and suitable facilities to carry out each processing operation efficiently and to move products and materials through the various stages in an orderly manner. Use should be made of conveyors and other mechanical moving devices wherever these are economically practical. Bottlenecks in the routing should be avoided and particular care should be taken that the routing to and from the retorts is not such that there is a possibility that unprocessed canned fish will become mixed with processed products and bypass the retorts.

Passageways should have sufficient capacity to carry all necessary traffic and provide easy access to all equipment.

4.1.2 Cannery Construction and Sanitary Design

4.1.2.1 CANNERIES AND SURROUNDING AREA SHOULD BE SUCH AS CAN BE KEPT REASONABLY FREE OF OBJECTIONABLE ODOURS, SMOKE, DUST OR OTHER CONTAMINATION. THE BUILDINGS SHOULD BE SUFFICIENT IN SIZE WITHOUT CROWDING OF EQUIPMENT OR PERSONNEL, WELL CONSTRUCTED AND KEPT IN GOOD REPAIR. THEY SHOULD BE OF SUCH DESIGN AND CONSTRUCTION AS TO PROTECT AGAINST THE ENTRANCE AND HARBOURING OF INSECTS, BIRDS OR OTHER VERMIN AND TO PERMIT READY AND ADEQUATE CLEANING. CF IV.A(i)

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

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

The food handling area should be completely separate from any part of the premises used as living quarters. CF IV.A(2)(a)(i)

4.1.2.2 FLOORS SHOULD BE HARD SURFACED, NON-ABSORBENT AND ADEQUATELY DRAINED CF A(1)(b)

Floors should be constructed of durable, waterproof, non-toxic, non-absorbent material which is easy to clean and disinfect. They should be non-slip and without crevices and should slope evenly and sufficiently for liquids to drain off to trapped outlets fitted with a removable grill. If floors are ribbed or grooved to facilitate traction, any grooving of this nature should always run towards a drainage channel. FM 22(i)

The junctions between the floors and walls should be impervious to water and, if possible, should be coved or rounded for ease of cleaning. MP 27(k)(ii)

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 with a well finished waterproof surface. CF IV.A(1)(b)

4.1.2.3 DRAINS SHOULD BE OF AN ADEQUATE SIZE, SUITABLE TYPE, EQUIPPED WITH TRAPS AND WITH REMOVABLE GRATINGS TO PERMIT CLEANING. CF IV.A(1)

Suitable and adequate drainage facilities are essential for removal of liquid or semiliquid wastes from the plant. There should not be any floor area where water might collect in stagnant pools. Drains should be constructed of smooth and impervious material and should be designed to cope with the maximum flow of liquid without any overflowing and flooding.

Drainage systems should be provided with deep seal traps which are appropriately located and easy to clean.

Drainage line carrying waste effluent except for open drains should be properly vented, have a minimum internal diameter of 10 cm (4 in.) 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 authority having jurisdiction.

CF IV.A(1)
CF IV.2(e)(ii)
FM 26(h)

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

CF IV.A(1)(c)

Acceptable materials 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 be coved or rounded to facilitate cleaning.

FM 22(ii)

Walls should be free from projections and all pipes and cables should be sunk flush with the wall surface or neatly boxed in.

4.1.2.5 WINDOW SILLS SHOULD BE KEPT TO A MINIMUM SIZE, BE SLOPED INWARD AT 45° AND BE AT LEAST 1 METRE (3 FEET) FROM THE FLOOR.

CF IV.A(1)(e)

Window sills and frames should be made of a 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 accummulation of dust and should be constructed to facilitate cleaning.

MP 29(j)

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

FM 26(j)

4.1.2.6 ALL DOORS THROUGH WHICH THE PRODUCT IS MOVED SHOULD BE SUFFICIENTLY WIDE, WELL CONSTRUCTED OF A SUITABLE MATERIAL AND SHOULD BE OF A SELF-CLOSING TYPE.

CF IV.A(1)(f)

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

Both the doors and the frames of the doorways should be of a smooth and readily cleanable surface.

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

4.1.2.7 CEILINGS SHOULD BE DESIGNED AND CONSTRUCTED TO PREVENT ACCUMULATION OF DIRT AND CONDENSATION AND SHOULD BE EASY TO CLEAN

MP 27(k)(iii)

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

CF IV.A(1)(d)

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

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

4.1.2.8 ALL PLUMBING AND WASTE DISPOSAL LINES, INCLUDING SEWER SYSTEM, SHOULD BE LARGE ENOUGH TO CARRY PEAK LOADS AND SHOULD BE PROPERLY CONSTRUCTED. CF IV.2(e)(i)(ii)

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

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

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

4.1.2.9 PREMISES SHOULD BE WELL VENTILATED TO PREVENT EXCESSIVE HEAT, CONDENSATION AND CONTAMINATION WITH OBNOXIOUS ODOURS, DUST, VAPOUR OR SMOKE CF IV.A.2(f)(i)

Special attention should be given to the venting of areas and equipment producing excessive heat, steam, obnoxious fumes, vapours or contaminating aerosols. The air-flow in the premises should be from the more hygienic areas to the less hygienic areas.

Good ventilation is important to prevent condensation and growth of moulds in overhead structures.

Ventilation openings should be screened and, if required, equipped with proper air filters.

Windows which open for ventilation purposes should be screened. The screens should be made easily removable for cleaning.

4.1.2.10 A MINIMUM ILLUMINATION OF 220 LUX (20 FOOT CANDLES) IN GENERAL WORKING AREAS AND NOT LESS THAN 540 LUX (50 FOOT CANDLES) AT POINTS REQUIRING CLOSE EXAMINATION OF THE PRODUCT SHOULD BE PROVIDED AND SHOULD NOT ALTER COLOURS. CF IV.A.2(f)(i)

Light bulbs and fixtures suspended over the working areas where fish or shellfish is handled in any step of preparation, should be of the safety type or otherwise protected to prevent food contamination in case of breakage. MP 29(i)

Sanitary Facilities

4.1.3 AREAS WHERE FISH OR SHELLFISH IS RECEIVED, STORED OR HANDLED SHOULD BE SEPARATED FROM AREAS IN WHICH FINAL PRODUCT PREPARATION IS CONDUCTED TO PREVENT CONTAMINATION OF THE FINISHED PRODUCT. CF IV.A.2(a)(i)

Separate rooms or preferably well defined areas of adequate size should be provided for receiving and storing of raw materials and for operations like thawing, washing, gutting, shelling and cleaning.

Receiving and storage areas should be clean and readily capable of being maintained in a clean condition and should provide protection for the raw products against deterioration and contamination. CF IV.A.2(a)(ii)

4.1.3.1 A SEPARATE REFUSE ROOM OR OTHER EQUALLY ADEQUATE STORAGE FACILITIES SHOULD BE PROVIDED ON THE PREMISES. CF III.A(1)

If offal or other refuse is to be collected and held before removal, adequate precautions should be taken to protect it against rodents, birds, insects and exposure to warm temperatures. CF IV.B(3)(b)

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

Where waste material is held in containers outside the establishment, the containers should be lidded. A separate enclosure should be provided for their storage with easy access for vehicles loading and unloading. Standing for the containers should be of solid, hard and unpervious material which can be easily cleaned and properly drained. If containers are used in large numbers, a mechanical washing plant might be advisable to provide for routine washing. Containers should be capable of withstanding repeated exposure to normal cleaning processes. CF IV.B(1)(b)

4.1.3.2 ANY BY-PRODUCT PLANT SHOULD BE ENTIRELY SEPARATE FROM THE CANNERY WHICH IS PROCESSING FISH AND SHELLFISH FOR HUMAN CONSUMPTION.

The layout and construction of a cannery should be such as to ensure that the areas in which fish and shellfish are held, processed and canned are used for that purpose only. Any processing of by-products or non-fish or shellfish products should be conducted in separate buildings or in areas which are physically separated in such a way that there is no possibility for contamination of fish and shellfish or their products.

4.1.3.3 AN AMPLE SUPPLY OF POTABLE COLD AND HOT WATER UNDER ADEQUATE PRESSURE SHOULD BE AVAILABLE AT NUMEROUS POINTS THROUGHOUT THE PREMISES AND AT ALL TIMES DURING THE WORKING HOURS. CF IV.A.2(b)(i)

All water available for use in those parts of an establishment where fish and shellfish are received, held, processed, packaged and stored should be of potable quality. If sea water is used, it must be clean sea water.

An adequate supply of hot water of potable quality at a minimum temperature of 82°C (180°F) should be available at all times during the plant operation.

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

Water used for washing or conveying raw materials should not be recirculated.

4.1.3.4 WHEN INPLANT CHLORINATION OF WATER IS USED THE RESIDUAL CONTENT OF FREE CHLORINE SHOULD BE MAINTAINED AT NO MORE THAN THE MINIMUM EFFECTIVE LEVEL

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

4.1.3.5 ICE SHOULD BE MADE FROM WATER OF POTABLE QUALITY AND SHOULD BE MANUFACTURED, HANDLED AND STORED SO AS TO PROTECT IT FROM CONTAMINATION. CF IV.A.2(c)(i)

If ice is used in the operation of a cannery or is supplied to the fishermen, it should be made from water of potable quality. When vessels are taking ice to sea, only fresh clean ice should be taken on board at the beginning of each voyage. Ice left from the previous voyage should be discarded and removed from the vessel. CF IV.A.2(c)(ii)

4.1.3.6 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. CF IV.A.2(d)

Non-potable water may be used for such purposes as producing steam, cooling heat exchangers and fire protection. It is very important that both systems of storage and distribution of water are entirely separate and there could be no possibility for cross-contamination or for inadvertant usage of non-potable water in the fish or shellfish processing areas.

4.1.3.7 PROPER FACILITIES FOR WASHING AND DISINFECTION OF EQUIPMENT SHOULD BE PROVIDED. FM 26(p)(iv) MP 29(r)(iv) CF A(1)(g)

Facilities should be present in every cannery 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 workrooms where there is an adequate supply of hot and cold water of potable quality, under good pressure, and where there is proper drainage.

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

4.1.3.8 ADEQUATE AND CONVENIENTLY LOCATED TOILET FACILITIES SHOULD BE PROVIDED. CF IV.A.2(g)

Toilet rooms should have walls and ceilings of a smooth, washable, light coloured surface and floors constructed of impervious and readily cleanable material. Toilet facilities should be well lit, ventilated and kept in a sanitary condition at all times. Adequate supplies of toilet paper should be available in each toilet cubicle.

The doors leading to the toilet rooms should be of a self-closing type and should not open directly into the fish processing areas.

The hand washing facilities in the toilet rooms should be of a type not requiring operation by hand and should have an adequate supply of hot and cold water of potable quality and liquid or powdered soap should be provided. Suitable hygienic means of drying the hands such as single use towels should be available. Where paper towels are used a sufficient number of dispensers and receptacles for used towels should be provided.

Notices should be posted requiring personnel to wash their hands after using the toilets.

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

1 to 9 employees: 1 toilet
10 to 24 employees: 2 toilets
25 to 49 employees: 3 toilets
50 to 100 employees: 5 toilets
for every 30 employees over 100 - 1 toilet

4.1.3.9 FACILITIES SHOULD BE AVAILABLE IN THE PROCESSING AREAS FOR EMPLOYEES TO WASH AND DRY THEIR HANDS AND, IF REQUIRED, FOR DISINFECTION OF PROTECTIVE HAND COVERINGS. CF IV.A.2(h)

In addition to hand washing facilities available in toilet rooms a number of sanitary washbasins with an adequate supply of hot and cold water of potable quality and liquid or powdered soap should be provided wherever the process demands. They should be located in full view of the processing floor and should be of a type not requiring operation by hand or be fed by a continuous flow of potable fresh or clean sea water. Single use towels are recommended, otherwise the method of drying hands should meet the requirements of the official agency having jurisdiction. The facilities should be kept in a sanitary condition at all times.

4.1.3.10 STAFF AMENITIES CONSISTING OF LUNCHROOMS, CHANGING-ROOMS OR ROOMS CONTAINING SHOWER OR WASHING FACILITIES SHOULD BE PROVIDED. CF IV.A.2(i)

Where workers of both sexes are employed, separate facilities should be present for each except that the lunchroom may be shared. As a general guide the lunchrooms should provide seating accommodation for all employees and the changing-rooms should provide enough space for lockers for each employee without causing undue congestion. Clothing and footwear not worn during working hours must not be kept in any processing area. CF IV.A.2(f)

4.2 Equipment and Utensils

4.2.1 ALL WORK SURFACES AND ALL CONTAINERS, TRAYS, TANKS OR OTHER EQUIPMENT USED FOR PROCESSING FISH OR SHELLFISH SHOULD BE OF SMOOTH, IMPERVIOUS, NON-TOXIC MATERIAL WHICH IS CORROSION-RESISTANT AND SHOULD BE DESIGNED AND CONSTRUCTED TO PREVENT HYGIENIC HAZARDS AND PERMIT EASY AND THOROUGH CLEANING.

Contamination of fish or shellfish 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, fish juices or other ingredients used, and capable of withstanding repeated cleaning and disinfecting. Wood could be used for cutting surfaces only when no other suitable material is available. Machines and equipment should be so designed that they can be easily dismantled to facilitate thorough cleaning and disinfection.

Fish boxes used for holding fish should preferably be constructed of plastic or corrosion-resistant metal, and if of wood, they should be treated to prevent moisture entering the wood and coated with a durable, non-toxic paint or other surface coating that is smooth and readily washable. Wicker baskets should not be used.

Stationary equipment should be installed in such a manner as will permit easy access and thorough cleaning and disinfection. FM 29 MP 32

Equipment and utensils used for inedible or contaminated materials should be identified as such and should not be used for handling edible products. FM 30 MP 33

4.2.2 OPERATIONS SUCH AS DRESSING, WASHING, HEADING AND PORTIONING FISH AND FILLING CONTAINERS SHOULD BE DONE BY MACHINES WHEREVER THESE ARE AVAILABLE AND THEIR USE IS ECONOMICALLY PRACTICAL.

Well designed machines are available for many fish processing operations and they often perform the task better, quicker, more cheaply and with less risk of contamination than if the work was done by hand. Where such machines are expensive, careful analyses of the cost of doing the operation by hand and by machine should be made to establish whether or not the cost is justified.

4.2.3 CANNERIES SHOULD HAVE ADEQUATE, CLEAN, DRY, STORAGE SPACE FOR THEIR SUPPLIES OF CONTAINERS AND SUITABLE CONVEYOR SYSTEMS TO TRANSPORT THEM TO FILLING MACHINES OR PACKING TABLES WITHOUT EXPOSURE TO CONTAMINATION.

Storage arrangements should be such that containers are not moved out of their clean, dry storage until just before they are needed for filling. Conveyor systems should be designed and installed in such a way that the containers are not exposed to contamination while being moved from storage to the packing area. Separate facilities for the storage of wrapping material, cartons and labels should be provided where such materials are used or stored on the premises.

4.2.4 IN THE INTEREST OF SAFETY AND TO ENSURE THAT THE CANNERY'S HEAT PROCESSING CAPABILITY IS ADEQUATE, THE DESIGN, SIZE AND EQUIPMENT OF RETORTS AND THEIR OVERALL CAPACITY SHOULD MEET WITH THE APPROVAL OF RECOGNIZED AUTHORITIES ON HEAT PROCESSING AND ALL INSTALLATIONS SHOULD BE MADE UNDER COMPETENT SUPERVISION.

All cannery retorts are pressure vessels and as such must be designed, installed and maintained in accordance with recognized standards developed for the protection of the workers, the plant and the public. In most instances adherence to the safety standards will be required by law and by the insurance underwriters and in most cases the installations will be subject to official inspection.

There are two general methods of heat treating canned fish (see App. I, para 8 "Heat Treatment"), that is by using saturated steam at a controlled pressure or by using water heated under pressure to well above its normal boiling point. The latter method is required for the heat treatment of products in glass or aluminium containers.

Both of these methods can be carried out in either vertical (top loading) or horizontal (end loading) retorts. The choice between vertical and horizontal retorts will usually be made to suit the particular requirements. Vertical retorts take less floor space. Horizontal retorts are particularly suited to larger canning operations. They often have two doors so that they can be loaded at one end and unloaded at the other to avoid congestion.

The length of time required to inactivate or to destroy harmful or spoilage micro-organisms in canned fish depends very critically on the temperature at which it is processed and the time required is greatly increased by lowering the temperature. Therefore, the processing temperature must always be specified along with the processing time and it is vitally important that the surfaces of every container be exposed to that temperature for the whole of the processing period.

Steam gives off a great deal of heat when it condenses and the temperature at which this occurs depends solely on the pressure of the steam itself.

Therefore, the temperature of a retort filled with steam, to the exclusion of all air, can be controlled very precisely with a pressure regulator. However, it is the overall pressure on the retort that is regulated and any air present will contribute to this pressure. Therefore, if air is present the partial pressure and hence the temperature of the condensing steam will be somewhat lower than might be assumed from the pressure. This happens while the retort is being filled with steam, but if the steam inlets, air vents and bleeders are the correct size and in the proper location, the entering steam will soon flush out all the air and this will become apparent from the thermometer and pressure readings. However, there is a danger that, if the retort is not properly designed, equipped, loaded or operated, localized air pockets may form and prevent parts of the load from attaining the proper processing temperature. Such an occurrence would not necessarily be indicated by the thermometer and pressure readings.

When canned products are processed in water under pressure, the temperature control is by a mechanical device which regulates the supply of steam used to heat the water. Uniformity of temperature throughout the retort load is maintained by a forced circulation of the water. The efficiency of this circulation will depend on the design of the retort and the design and location of the water, air and steam inlets.

It should be apparent from the foregoing that the design of retorts and their equipment is a highly technical matter and that technical guidance should be sought in making the decision as to type and detailed specifications of the retorts best suited to a particular operation. It should also follow that the installation and fitting of retorts should always be done by skilled tradesmen under competent direction.

4.2.5 CRACKING BLOCKS, MALLETS AND OTHER MEAT EXTRACTING DEVICES USED IN PROCESSING SHELLFISH SHOULD BE CONSTRUCTED OF NON-ABSORBENT AND CORROSION-RESISTANT MATERIAL

It is important that cracking blocks, mallets or meat extracting rollers be constructed of a non-absorbent and crevice-free material so that they will not become saturated with juices harbouring micro-organisms which would give rise to off-odours and be a source of contamination.

Corrodible material will eventually deteriorate rending proper cleaning impossible and may also contaminate the product.

4.2.6 FISH TRANSPORT VEHICLES SHOULD BE DESIGNED TO ALLOW ADEQUATE ICING OF FISH, TO PROTECT FISH FROM WARMING UP DURING TRANSPORT AND SHOULD BE OF SUCH MATERIAL AND CONSTRUCTION AS TO PERMIT EASY AND THOROUGH CLEANING.

Vehicles used for transporting fresh fish or shellfish should be designed and constructed to provide constant protection to the fish against contamination by dust, exposure to higher temperatures and the drying effects of sun or wind. Even where ice is very cheap and journey times or distances are relatively short, the use of an insulated vehicle provides an additional insurance against inadequate icing or unforseen delays. The insulation should cover completely the walls, roof and the floor of the vehicle. The thickness of insulation employed will depend on the outside temperatures normally encountered. It should be remembered that insulation cannot help to cool the fish but helps to keep it at the temperature at which it was put into the vehicle.

Vehicles used for the transport of frozen fish should be capable of maintaining the fish at a temperature appropriate for the particular product.

For the purpose of cleaning, the vehicles transporting fish should have the walls, floors and roofs made of a suitable corrosion-resistant material with smooth and non absorbent surfaces. Floors should be adequately drained.

4.3 Hygienic Operating Requirements

4.3.1 GENERAL SANITARY REQUIREMENTS FOR AN ESTABLISHMENT WHERE CANNED FISH OR SHELLFISH IS PRODUCED FOR HUMAN CONSUMPTION SHOULD BE SIMILAR TO THOSE RECOMMENDED FOR A FRESH FISH PROCESSING PLANT.

All fish and shellfish, equipment, containers and all surfaces which come in contact with fish should be treated in a sanitary and hygienic manner as in the "Code of Practice for Fresh Fish".

Conveyors, runways and other conveying equipment used in handling canned fish or shellfish should be maintained in good repair and should be kept clean and dry.

4.3.2 THE BUILDING, EQUIPMENT, UTENSILS AND OTHER PHYSICAL FACILITIES OF THE PLANT SHOULD BE KEPT CLEAN, IN GOOD REPAIR AND SHOULD BE MAINTAINED IN AN ORDERLY AND SANITARY CONDITION. CF IV.C(1)

All surfaces with which fish or shellfish come in contact should be cleaned and preferably hosed down with potable water or clean sea water as frequently as necessary to ensure cleanliness of the areas. 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.

The use of cold or hot 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 surface which come into contact with fish should be rinsed thoroughly with potable or clean sea water before use.

Cleansing agents and disinfectants used should be appropriate to 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.

4.3.3 REMOVAL OF SOLID, SEMI-SOLID OR LIQUID WASTES FROM FISH UNLOADING, HOLDING AND PROCESSING AREAS SHOULD BE ON A CONTINUOUS OR NEAR CONTINUOUS BASIS USING WATER AND/OR APPROPRIATE EQUIPMENT SO THAT THESE AREAS ARE KEPT CLEAN AND THERE IS NO DANGER OF CONTAMINATING THE PRODUCT.

All waste materials resulting from the operation of a cannery should be disposed of as soon as possible in a way that they cannot be used for human food and in a manner that they cannot contaminate food and water supplies and offer harbourage or breeding places for rodents, insects or other vermin.

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

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.

Arrangements for the disposal of trade refuse and inedible waste should be approved by the appropriate official agency having jurisdiction.

4.3.4 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. CF IV.C(2)

An effective and continuous programme for the control of insects, rodents, birds or other vermin within the establishment should be maintained. The cannery and surrounding area should be regularly examined for evidence of infestation. Where control measures are necessary, treatment with chemical, biological or physical agents should meet the requirements of the official agency having jurisdiction and should be under the direct supervision of personnel with a thorough understanding of the hazards involved, including the possibility of toxic residues being retained by the fish, shellfish or their products. FM 34(a) FM 34(b) CF III.A(2)

All rodenticides, fumigants, insecticides or other toxic substances should be stored in separate locked rooms or cabinets and handled only by properly trained personnel. CF IV.C(5)

4.3.5 DOGS, CATS AND OTHER ANIMALS SHOULD BE EXCLUDED FROM AREAS WHERE FISH OR SHELLFISH ARE RECEIVED, HANDLED, PROCESSED OR STORED. CF IV.C(3)

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

4.3.6 ALL PERSONS WORKING IN A CANNERY SHOULD MAINTAIN A HIGH DEGREE OF PERSONAL CLEANLINESS WHILE ON DUTY AND SHOULD TAKE ALL NECESSARY PRECAUTIONS TO PREVENT THE CONTAMINATION OF THE FISH, SHELLFISH OR THEIR PRODUCTS OR INGREDIENTS WITH ANY FOREIGN SUBSTANCE. CF IV.C(6)

All employees should wear appropriate to the nature of their work, clean protective clothing including a head covering and footwear all of which articles are either washable or disposable.

Gloves used in the handling of fish should be maintained in a sound, clean and sanitary condition and should be made of an impermeable material except where their usage would be incompatible with the work involved.

Hands should be washed thoroughly with soap or other cleansing agent and warm water before commencing work, on 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 fish handling areas.

4.3.7 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 TRANSPORTING OF FISH OR SHELLFISH.

Plant management should require that any person afflicted with infected wounds, sores, or any illness, notably diarrhoea, should immediately report to management. 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 a disease, or while afflicted with infected wounds, sores or any illness, to work in any area of a cannery in a capacity in which there is a likelihood of such a person contaminating fish or shellfish with pathogenic organisms. CF IV.C(4)

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. CF IV.6(e)

4.3.8 CONVEYANCES USED FOR TRANSPORTING FISH SHOULD BE CLEANED AND DISINFECTED IMMEDIATELY AFTER EACH USE AND SHOULD BE SO MAINTAINED AS NOT TO CONSTITUTE A SOURCE OF CONTAMINATION FOR THE PRODUCT.

The cleaning of vehicles, together with receptacles and equipment thereon, should be planned to a regular routine. Hosing, scrubbing and cleaning with water of potable quality to which a suitable detergent and/or disinfectant has been added is usually necessary.

4.4 Operating Practices and Production Requirements

4.4.1 General Considerations

4.4.1.1 CANNED FISH PRODUCTS SHOULD BE GOOD QUALITY FISH, WELL PREPARED IN SUITABLE SEALED CONTAINERS AND PRESERVED BY HEAT SO THAT THEY WILL REMAIN ATTRACTIVE AND SAFE TO EAT FOR A LONG TIME UNDER NORMAL CONDITIONS.

Canned fish is a convenience food and the user expects that it can be transported and stored under quite ordinary conditions and that it will still be an attractive food which is safe to eat several years after it has been produced. To meet these requirements it is necessary to use good raw materials and suitable containers and to take great care that all the manufacturing processes are carried out properly.

4.4.1.2 ONLY GOOD QUALITY FISH OR SHELLFISH SHOULD BE ACCEPTED FOR CANNING.

The raw material should be rejected if it is known to contain toxic, decomposed or extraneous substances which will not be removed to acceptable levels by normal procedures of sorting or preparation. CF IV.D(1)

It should be kept in mind that, except for the fact that the container protects the product from recontamination which would lead to spoilage, the canning processes are similar in effect to those processes the consumers might use in preparing fresh or frozen fish for their own table. Canning cannot correct faults that are due to the poor physiological condition of the fish, poor handling practices, lengthy storage or storage under inadequate conditions.

Therefore, fish or shellfish which even after preparation are not good enough to be sold as fresh or frozen fish are not good enough to be processed into canned fish.

4.4.1.3 CANNERIES SHOULD REGULATE THE VOLUME OF FRESH FISH OR SHELLFISH THEY RECEIVE SO THAT THEIR SUPPLIES DO NOT BECOME TOO LARGE TO BE PROCESSED WHILE THE FISH ARE IN PRIME CONDITION.

Fresh fish should always be processed as soon as possible after capture. The length of time that fish can be satisfactorily held in chill storage at the cannery before processing will depend on the species and very greatly on the length of time already elapsed since capture, and on the care with which they were handled during transport to the cannery. Canneries should limit the amount of fresh fish or shellfish they accept to the amount that they can process while the fish are still in good condition. The length of time that they will have to be held before they can be canned should be taken into consideration in judging whether fish are of sufficiently high quality to accept for canning.

Where the volume of fresh fish available for canning is subject to large fluctuations, the feasibility of freezing and storing surpluses for canning during slack periods might be considered.

4.4.2 Butchering and Similar Preparatory Processes

4.4.2.1 WHERE FISH ARE GUTTED, HEADED, SKINNED, BONED OR PORTIONED FOR CANNING, THESE OPERATIONS SHOULD BE DONE IN A CLEAN AND SANITARY MANNER AND SHOULD BE CARRIED OUT CAREFULLY TO AVOID SPOILING THE QUALITY OF THE PRODUCT OR WASTING MATERIAL.

Preparatory operations leading to the finished product should be so timed as to permit expeditious handling of consecutive units in production under conditions which would prevent contamination, deterioration, spoilage or the development of infectious or toxigenic microorganisms. CF IV.D(4)

Gutting should be done very thoroughly so that no viscera are left to spoil the appearance or the flavour of the final product. All cuts should be made cleanly and precisely to remove waste and bruised flesh without leaving ragged surfaces or needlessly wasting the edible material.

Mechanical methods of gutting and heading should be used wherever they are practical, particularly in the processing of smaller fish.

4.4.2.2 RAW FISH SHOULD BE THOROUGHLY WASHED IN COOL WATER OF POTABLE QUALITY IMMEDIATELY AFTER THEY HAVE BEEN SUBJECTED TO ANY DRESSING OPERATION SUCH AS GUTTING, HEADING, SCALING, SKINNING OR PORTIONING.

Spoilage micro-organisms are mainly in the intestines and on the skin of fish but may be spread over all surfaces by any cutting operation. Their numbers can be greatly reduced by thoroughly washing the carcase in cool, clean water. This will also remove slime and blood which might otherwise taint or discolour the final product.

If containers are used for washing gutted fish, a continuous flow of cold potable fresh water or clean sea water, sufficient to prevent the accumulation of contaminating materials, should be provided from the inlets at the bottom of the container. CF III.B.4(d)

4.4.2.3 LOBSTER AND CRAB WHICH ARE BROUGHTTO THE CANNERY ALIVE SHOULD BE PROCESSED AS QUICKLY AS POSSIBLE AFTER THEY ARE SLAUGHTERED.

Crabs and lobster deteriorate very quickly after death, particularly if the enzyme producing viscera are not removed or the meat is not chilled. However, lobsters and some kinds of crabs are generally cooked alive, in which case primary enzyme action is halted immediately. In some fisheries, crabs are usually slaughtered, eviscerated and washed before they are cooked. Slaughter and evisceration are usually done in the same operation. It is important that the viscera be completely removed, the carcase washed to remove entrails and blood and passed to the cooker without delay. Thorough removal of blood will avoid blue - discolouration of the meat after it has been canned.

4.4.2.4 BRINING AND SALTING OR SMOKING OF FISH AND SHELLFISH PRIOR TO CANNING SHOULD BE CARRIED OUT AS RECOMMENDED BY THE CODES OF PRACTICE DEALING WITH THESE METHODS OF FISH PROCESSING.

To ensure that such processes are conducted in a sanitary manner and, at the same time, the quality of the product is protected and the wastage, because of improper methods of handling, is eliminated, the recommendations of the codes of practice written for these methods of processing should be used for guidance.

4.4.2.5 OYSTERS AND OTHER BI-VALVE MOLLUSCS SHOULD BE WASHED BEFORE THEY ARE SHELLED AND THE MEATS WASHED AGAIN IMMEDIATELY AFTERWARDS.

When oysters or clams are taken from wet storage they will have mud, sand and their own fecal matter on the exterior and between the lips of their shells. This should be washed away to avoid the contamination of the meats as much as possible when the shells are opened.

Oysters or clams are often opened by steaming for a few minutes. This will cook the meats slightly and make them reasonably firm. In other cases, the live bi-valves are opened with a knife, the meat removed, washed and then blanched.

In either case the meat should be washed immediately to remove any sand, shell or other foreign matter. If containers are used for washing molluscs in the shell or their meats, a continuous flow of cold potable fresh water or clean sea water, sufficient to prevent the accumulation of contaminating materials, should be provided from the inlets at the bottom of the container. Raw meats should not be allowed to stand in fresh water since they will absorb it and become swollen; they will lose the moisture again when cooked. CF III.B.4(d)

4.4.2.6 PARTICULAR CARE SHOULD BE TAKEN TO ENSURE THAT SHELL FRAGMENTS ARE REMOVED FROM SHELLFISH MEAT.

Fragments of shell left in shellfish meats are very objectionable to consumers and in some circumstances they may be dangerous.

Fragments of shell can readily be separated from molluscan meats by washing in clean water. While there seems to be very little trouble with shell fragments in most kinds of crustacea meats, it is difficult to avoid getting some shell mixed with the leg and claw meat during the shucking of some species of crab. These fragments are difficult to see and consequently to separate by hand.

However, separation may be made by passing the meat through a bath of saturated brine. The meat will float but the shell will sink. If this method is used the amount of salt picked up by the meat will have to be taken into consideration when the product is seasoned.

Crab shell fluoresces (glows) under ultraviolet light and this property can be used to find fragments mixed with fresh crab meat. Crab meat in early stages of decomposition also fluoresces under ultraviolet light. If the inspection tables are equipped with ultraviolet light the source should be so located that the rays cannot shine directly into the eyes of the workers.

4.4.3 Precooking and Smoking

4.4.3.1 METHODS USED TO PRECOOK OR SMOKE FISH OR SHELLFISH FOR CANNING SHOULD BE CHOSEN TO BRING ABOUT THE DESIRED EFFECT WITH A MINIMUM DELAY AND A MINIMUM AMOUNT OF HANDLING.

There are several reasons for precooking fish or shellfish prior to canning (see Appendix I, para 2 "Precooking"). In nearly every case, however, one of the desired effects is to rid the flesh of moisture which would otherwise cook out during the final heat process and remain as a free liquid in the sealed container.

Precooking can be carried out in hot water or brine, steam, hot air, radiant heat or in hot oil, but usually the nature of the material and the reason for which the precooking is done will strongly influence the choice of method. For example, live lobsters can be very conveniently cooked in boiling water but it is much more practical to precook large whole fish or crates of oysters in a steam chamber.

Cooking temperature is very easily controlled if boiling water or steam is used but there may be serious mechanical difficulties in cooking large quantities of fish in boiling water. Steam is very convenient because of the ease with which material can be moved in or out of the cooking chamber. Steam delivers large amounts of heat at a controlled temperature right on the surfaces of the product so cooking is done fairly rapidly. However, steam cooking may, in some instances, leave the surfaces too moist. In such cases the product surfaces may be dried off by finishing the cooking in hot air.

Small fish, such as sardines, are often precooked sometimes in hot oil, or smoked to give them a particularly desirable flavour or texture. Other products are also sometimes smoked, barbecued or cooked by radiant heat.

In some cases precooking conditions products, such as oyster meats, crustacea meats and tuna, for handling during the subsequent processing operations. In other cases, the precooking creates problems because the cooked product is very difficult to handle without damage even after it has cooled.

Means should be found to reduce the amount of handling subsequent to precooking wherever practical. Methods have been devised to precook small fish such as sardines after they have been packed in their containers. Equipment is available which will pass them through cooking tunnels, invert them to drain without spilling the fish, continue the cook in the inverted position, upright them, fill them with hot oil, seal them and deliver them for the final heat processing.

4.4.3.2 THE AMOUNT OF PRECOOKING SHOULD BE CONTROLLED TO ATTAIN CONSISTENTLY THE OPTIMUM EFFECT REGARDLESS OF THE SIZE OR INITIAL TEMPERATURE OF THE FISH.

Cooking coagulates the protein in fish 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 fish are not heated sufficiently the desired effect will not be achieved, but too much heat will reduce the quality of the product and also the yield.

Usually the temperature of the precook apparatus is closely controlled and the amount of cooking determined by the length of the cooking period. Since it will take longer to heat larger fish to a given centre temperature, fish precooked together in batches should be very similar in size. It also follows that they should all be at the same temperature when they enter the cooker.

The optimum amount of precooking for particular products can be ascertained from technical literature, technical advisors or by experiment.

The amount of precook can be indicated by the temperature reached at the centre of the fish and this can be related experimentally to cooking times for specific sizes of fish. Precooks can also be controlled directly by monitoring the temperature at the centre of one or more specimens and terminating the process when the proper temperature is reached.

4.4.3.3 ONLY GOOD QUALITY VEGETABLE OILS SHOULD BE USED IN PRECOOKING FISH FOR CANNING. COOKING OILS SHOULD BE CHANGED FREQUENTLY.

Where sardines or other fish are precooked in oil care must be taken that the oil does not impart an undesirable flavour to the product. Only good quality bland edible vegetable oil should be used. It should be changed frequently because it gradually develops flavours if it is heated for long periods.

In some cases the oil may become diluted with oil which cooks out of the fish. If the concentration of this unsaturated fish oil becomes appreciable it may contribute a strong flavour to the product or spoil its appearance. Unsaturated oil has the property of drying like paint oil on exposure to air particularly when it is hot. This may result in fatty layers adhering to the surfaces of the fish.

4.4.3.4 COOLING OF PRECOOKED OR HOT SMOKED FISH OR SHELLFISH SHOULD BE DONE AS QUICKLY AS PRACTICAL AND UNDER CONDITIONS WHERE CONTAMINATION OF THE PRODUCT CAN BE AVOIDED.

Freshly precooked or hot smoked fish or shellfish 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 that are present will multiply rapidly and may cause spoilage and/or possible health hazards.

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 fish have to be held until they cool, they should be held in specially designated, clean, dust-free areas where there is a good circulation of air and from which vermin and other possible sources of contamination can be excluded.

Where water is used to cool crustacea for immediate shucking, it should be of potable quality. The same water should not be used for cooling more than one batch.

4.4.4 Use of Brine and Other Dips

4.4.4.1 WHERE FISH OR SHELLFISH ARE DIPPED OR SOAKED IN BRINE OR IN SOLUTIONS OF OTHER CONDITIONING OR FLAVOURING AGENTS IN PREPARATION FOR CANNING, SOLUTION STRENGTH AND TIME OF IMMERSION SHOULD BOTH BE CAREFULLY CONTROLLED TO BRING ABOUT THE OPTIMUM EFFECT.

Fish or shellfish are frequently dipped or soaked in solutions of salt, organic acids or other agents as part of their preparation for canning (see Appendix I, para 3 "Preparatory dips").

These dips accomplish many purposes. Strong brines toughen surface textures, organic acids bind ammonium and copper ions and other agents contribute to flavour or alter qualities of the product. The effect of these solutions depends not only on their strength, but also on the time they are in contact with the product.

Recommended strengths of dip solution and immersion times for particular products can be obtained from technical literature or from fishery research institutes or they may be determined by experiment. Since consistency in flavour and in other product qualities is very important, the specified strengths of dip solutions and times of immersion should be carefully adhered to.

4.4.4.2 DIP SOLUTIONS SHOULD BE REPLACED AND DIP TANKS AND OTHER DIPPING APPARATUS THOROUGHLY CLEANED AT FREQUENT INTERVALS.

Since the active ingredients in dip solutions become absorbed, exhausted or diluted as they accomplish their purposes, they become less effective with continued use. They also become contaminated by material that washes or dissolves off the product and scraps will collect in the dip tank. The solutions may, therefore, soon contain very large numbers of micro-organisms, particularly if they are not well chilled. Therefore, dip solutions should be checked after each use for their strength and for contamination with micro-organisms and the dip tanks should be emptied, thoroughly cleaned and refilled with fresh solutions frequently or when necessary.

4.4.4.3 CARE SHOULD BE TAKEN TO ASCERTAIN WHETHER OR NOT THE INGREDIENTS USED IN DIPS WILL BE PERMITTED IN CANNED FISH IN THE COUNTRIES WHERE THE PRODUCT WILL BE MARKETED.

The use of some chemicals which are considered harmless in one country may for some reason be prohibited or severely restricted in another. It is, therefore, necessary that information concerning regulations in the countries where products are being marketed should be obtained before deciding on the use of a food chemical in a dip solution or as an additive.

4.4.5 Container Filling and Sealing

4.4.5.1 THE CONTAINERS IN WHICH FISH PRODUCTS ARE CANNED SHOULD BE MADE FROM SUITABLE MATERIAL AND CONSTRUCTED SO THAT THEY CAN BE EASILY CLOSED AND SEALED TO PREVENT THE ENTRY OF ANY CONTAMINATING SUBSTANCE.

Containers for canned fish should meet the following requirements:

(a) they should protect the contents from contamination by micro-organisms or any other substance;

(b) their inner surfaces should not react with the contents in any way that would adversely affect the product or the containers;

(c) their outer surfaces should be resistant to corrosion under any likely conditions of storage;

(d) they should be sufficiently durable to withstand the mechanical and thermal stresses encountered during the canning process and to resist physical damage during distribution;

(e) they should be of convenient size and shape to suit the product and the market;

(f) they should be easy to open and to empty.

Containers for canned fish are usually made from tinplate, aluminium alloy or glass, and each of these materials imposes some particular requirements and limitations on the canning practice. The effect of these must be taken into consideration along with relative costs and consumer preferences in making the decision as to whether to use tinplate, aluminium or glass containers.

4.4.5.2 WHERE BATCHES OF FRESH FISH OR SHELLFISH MUST BE HELD PRIOR TO PACKING INTO CONTAINERS, THEY SHOULD BE THOROUGHLY CHILLED.

There should be no unnecessary delay between the time fish or shellfish enters a cannery and the time the canned product is heat stabilized. However, if a delay in processing becomes necessary any batches that are held up should be thoroughly chilled to conserve their quality.

4.4.5.3 CONTAINERS FOR CANNED FISH SHOULD BE OF A SUITABLE SIZE AND SHAPE FOR THE AMOUNT AND KIND OF PRODUCT BEING PACKED AND SHOULD BE LINED WITH A SUITABLE PROTECTIVE ENAMEL WHERE NECESSARY.

The particular advantages and disadvantages of using tinplate, aluminium or glass containers are dealt with in detail in Appendix I to this code under the "Factors Affecting Quality". It is equally important that the containers should be of the proper shape and size to suit the nature of the product and to hold the proper amount.

Containers of canned fish should be almost completely filled. Shallow metal containers with relatively large flexible covers need little or no headspace but other containers may require up to 6 percent or more empty space by volume to allow for the expansion of the contents during the heat process. The amount necessary will depend partly on the nature of the contents and partly on the shape, flexibility and strength of the container and on whether it will be processed in steam or in water under pressure. It is not generally desirable for the headspace to be any larger than necessary for this will allow the contents to be shaken too much when the container is moved and will also increase the risk of the container being panelled if the vacuum is too high. Furthermore, many countries have fair trade laws which require that containers of food offered for sale must be very well filled.

It, therefore, becomes apparent that in good canning practice, the volume of the container determines, within rather narrow limits, what the weight of the content should be. Therefore, the canner's choice in package weights is quite strictly limited by the size of the available containers.

It is also important that the shape of the container should suit the nature of the product. Shallow containers with wide openings are particularly suitable for packing sardines or other small fish or other products that must be attractively arranged and packed tightly to avoid damage if the package is shaken. Cylindrical containers are more practical for packing portions of large fish, such as salmon or tuna. Care should be taken to ensure that containers have suitable protective enamel coatings where these are required by the nature of the product.

4.4.5.4 CONTAINERS AND COVERS SHOULD BE INSPECTED IMMEDIATELY BEFORE DELIVERY TO THE FILLING MACHINES OR PACKING TABLES TO ENSURE THAT THEY ARE CLEAN, UNDAMAGED AND WITHOUT VISIBLE FLAWS

In most instances containers and covers are clean when they are delivered to canneries in sealed packages and if properly handled and stored they will not usually need to be washed before use. However, containers and covers should be inspected carefully for cleanliness and if any are found not to be clean the whole lot should be washed or effectively cleaned in some other way before they are used. In washing glass containers care must be taken to avoid breakage through rough handling or thermal shock.

It is a wise precaution to have all containers turned upside down to make certain that they do not contain any foreign material before they are used. This is particularly important in the case of glass containers which might possibly contain fragments of glass that are difficult to see and so might otherwise go undetected. If containers are delivered to filling machines or packing tables by conveyor, it is usually possible to have them inverted mechanically during their travel.

Care should also be taken to remove faulty containers. These include containers that have been dented or pierced, containers with defective side or bottom seams or with scratches or flaws in their enamel. If these are filled, material will be wasted and there is always a danger of damaged containers jamming a filling or sealing machine and necessitating a shut-down. Slightly faulty containers may also cause trouble by becoming leakers after they have been filled, heat processed and stored.

Covers for containers which are to be opened with keys or by pull tabs should be examined carefully to ensure that the scoring is evenly done and deep enough for the container to be opened easily but not so deep that the cover will tear during sealing, heat processing or under the mechanical strains the container would normally encounter during distribution.

4.4.5.5 PRECAUTIONS SHOULD BE TAKEN TO ENSURE THAT CONTAINERS FOR CANNED FISH ARE USED ONLY FOR THEIR INTENDED PURPOSE.

Canneries should have strict rules against the use of canned fish containers for any purpose other than packing fish. There is always a temptation to take containers for use as ash trays, small waste containers, receptacles for small machine parts or for other similar purposes. This should be avoided because there is a considerable risk that such containers may accidentally find their way back onto the production line and result in the packing of canned fish in the same container with very objectionable or possibly dangerous material.

4.4.5.6 EMPTY CONTAINERS FOR CANNED FISH SHOULD BE REMOVED FROM THE PACKING ROOM AND FROM CONVEYORS TO THE FILLING MACHINES BEFORE THE CANNERY IS WASHED DOWN BETWEEN SHIFTS AND AT THE END OF A PROCESSING PERIOD.

If containers are left on the packing tables or in conveyor systems during clean-up, they are likely to become splattered with dirty water or debris, particularly if high pressure hoses are used in cleaning.

It is usually possible to anticipate the shutdown and control the flow of containers to the filling machines or packing tables so that few are left in the conveyor lines or in the racks when the operation stops. Those left should be either removed or so shielded that they will not become contaminated or obstruct the cleaning.

4.4.5.7 WHERE CANNED FISH IS PACKED BY HAND THERE SHOULD BE A STEADY SUPPLY OF RAW MATERIAL AND EMPTY CONTAINERS WITHIN CONVENIENT REACH OF EACH PACKER. FILLED CONTAINERS SHOULD BE INSPECTED AND REMOVED TO THE SEALER FREQUENTLY. BUILD-UP OF EITHER RAW MATERIAL OR FILLED CONTAINERS AT THE PACKING TABLE SHOULD BE AVOIDED.

Production should be higher and workmanship better if the packers have comfortable and convenient working facilities. Supplies of raw fish and empty containers should be within easy reach and there should be a convenient way of removing filled containers.

Since any delay in processing will have an adverse effect on quality, there should be no large backlog of raw material or filled containers at the packing table. The packers should use up the raw fish in the order it comes to them.

The output of the can-filling personnel should be inspected regularly so that faults can be corrected and a high standard of workmanship achieved.

Packing should be carried out in a clean and sanitary manner and under conditions that preclude the introduction of contamination into the product. CF IV.D(5)(b)

4.4.5.8 FILLING MACHINES USED TO PACK FISH OR SHELLFISH FOR CANNING SHOULD BE CLOSELY ATTENDED WHEN THEY ARE OPERATING AND THE MACHINE MANUFACTURERS' INSTRUCTIONS CONCERNING THEIR OPERATION, ADJUSTMENT AND MAINTENANCE SHOULD BE CAREFULLY FOLLOWED.

Many different types of fish destined for canning can now be packed by machines which have been especially designed for the particular kind of product. In general, these machines are very satisfactory if they are properly serviced.

However, some operate at very high speeds (some salmon filling machines will fill more than 200 containers per minute) and if they get out of adjustment a large batch of poorly packed containers will be accumulated very quickly. Since these will probably have to be repacked by hand a major bottleneck will occur and the quality of products may suffer because of the resultant delay.

It is, therefore, prudent to follow the manufacturer's operating and maintenance instructions very closely and to have filling machines closely attended so that they can be adjusted or shut down quickly if they start to function badly.

4.4.5.9 THE QUALITY AND THE AMOUNT OF INGREDIENTS USED TO FLAVOUR OR OTHERWISE ENHANCE CANNED FISH OR SHELLFISH SHOULD BE CAREFULLY CONTROLLED TO BRING ABOUT THE OPTIMUM DESIRED EFFECT.

Many kinds of ingredients are used in the manufacture of canned fish products. Salt and many spices are used to improve flavour, fillers to improve texture and food chemicals to adjust acidity, improve texture, act as sequestering agents or for other purposes. Oils, sauces and other packing mediums are used to enhance the product.

Ingredients may be added at various stages in the processing. If dry ingredients are used they should be fully rehydrated before the heat-processing commences. In the case of fish pastes, fish puddings or other comminuted fish products, the ingredients such as salt, oil, spices and fillers, will usually all be added during a blending operation. In other cases, ingredients may sometimes be used as dips but generally they are dispensed into the container just before it is filled with the product or else just before it is closed. In some cases, sauce or oil is dispensed in two stages, part of it into the empty container and the rest after the other contents have been packed. This permits a more rapid and more even absorption of the packing medium by the fish.

Since it is important that a canned fish product should not be variable in its flavour, texture or similar attributes, the quality and amount of added ingredients needs to be carefully controlled. The use of low quality packing oils or other ingredients may give a bad impression which will be damaging to the reputation of the product out of all proportion to the saving in costs.

Organic acids and other food additives are often used in the form of dips as mentioned earlier, but in some circumstances they may be added to the canned product in solution or as an ingredient of a sauce or broth. The advice of canning technologists should always be obtained when the use of food additives is being considered.

If fish has been brine-frozen or stored in refrigerated brine the amount of salt absorbed should be determined and taken into consideration when salt is added to the product for flavouring.

Salt and some other flavouring ingredients can be obtained in the form of pellets having a specific weight. In most cases, however, powdered or liquid ingredients are added as the containers pass under automatic dispensers which deliver a measured volume. These devices should be checked regularly to ensure that they consistently deliver the correct amount.

4.4.5.10 CONTAINERS OF CANNED FISH SHOULD BE CHECKED BEFORE THEY ARE CLOSED TO MAKE CERTAIN THAT THEY HAVE BEEN PROPERLY FILLED AND WILL MEET ACCEPTED STANDARDS FOR WEIGHT OF CONTENTS.

Good canning practice requires that the volume (and hence the weight) of fill be controlled very closely to suit the size of the container (see Appendix I, para 5 on "Filling").

Overfilled containers with too little headspace may be damaged in the heat processing or they may become flippers or springers. In either case they will not be merchantable. Underfilled containers may cause difficulty because they contain less than the usual label declaration or because the slack fill gives the consumer a bad impression even if the weight declaration on the label is correct. Furthermore, the contents of underfilled containers are more likely to have their texture altered by being shaken up if the canned fish is roughly handled.

Weight control is usually not very difficult in the filling of small shallow containers with fish such as sardines. In such cases, little or no headspace is required since the flexible cover permits enough expansion during heat processing if the container has not been very obviously overfilled.

Large containers and in some cases even small containers are more difficult to fill accurately to the correct weight, particularly if the product consists of fish or fish portions which are variable in size and shape. It is not generally practical to weigh each container at the time it is filled. However, very good control can be obtained by passing the filled open containers over an inspection table where experienced staff can remove, weigh and repack containers which look to be overweight or underweight.

Larger containers are more difficult to fill accurately to the correct weight, particularly if the product consists of fish or fish portions which are variable in size and shape. It is not generally practical to weigh each container at the time it is filled. However, very good control can be obtained by passing the filled open containers over an inspection table where experienced staff can remove, weigh and repack containers which look to be overweight or underweight.

The most satisfactory method of checking weights is by the use of a machine set into the conveyor system and which weighs each can and separates those that are under (and/or over) a selected limit. These machines are designed to remove underweights or overweights or both. However, they have to be well attended to see that the weighing surfaces are kept clean and the machine in adjustment.

4.4.5.11 ALL CANNED FISH SHOULD BE INSPECTED FOR QUALITY AND WORKMANSHIP JUST BEFORE THE CONTAINERS ARE CLOSED.

This inspection should take place just before the covers are put on or before the liquid packing medium has been poured over the contents. Containers which contain poor quality material or are unattractively packed or packed in such a way that the contents might possibly prevent a proper seal being made should be removed and repacked. This repacking can usually be done in conjunction with the repacking of containers that have been found to be underweight or overweight.

4.4.5.12 ALL CANNED FISH SHOULD BEAR INDELIBLE CODE MARKINGS FROM WHICH ALL IMPORTANT DETAILS CONCERNING ITS MANUFACTURE CAN BE DISCOVERED.

Markings on the containers in code from which the type of product, the cannery where it was produced and the production date can be determined are usually sufficient to satisfy legislative requirements or trading arrangements, but some countries may require that all or part of this information be clearly legible.

It should be borne in mind that mishaps can occur which will result in the canning of poor quality products. If some poor quality canned fish is mixed with a whole day's production a major loss may occur. Therefore, it may be desirable to use a coding system whereby each day's production can be separated into a number of differently coded lots. If this is done, it will be possible to minimize losses in case of a mishap by removing the affected code lots. The balance of the day's production can then be sent to market.

For smaller canneries a coding system which will indicate the date and the approximate time when the canning was done will usually be quite sufficient. However, larger canneries may find it very useful to have a coding system from which the particular processing line and sealing machine and possibly the particular batch of fish can also be identified. Such a system, supported by adequate cannery records, can be very helpful in any investigation to discover the causes when canned fish is found to be poor in quality.

The best way to ensure that coding is correct is to mark the containers during the actual processing operation. This can be done most conveniently by embossing the code on the covers just as they are fed into the machine which fastens them to the containers. Embossing equipment must be carefully adjusted so that the dies do not press too deeply and damage the container.

4.4.5.13 CANNED FISH SHOULD BE PRODUCED WITH SUFFICIENT VACUUM TO PREVENT THE CONTAINERS FROM BULGING UNDER ANY CONDITION OF HIGH TEMPERATURE OR LOW ATMOSPHERIC PRESSURE LIKELY TO BE ENCOUNTERED DURING THE TRANSPORT, STORAGE OR MARKETING OF THE PRODUCT.

It is difficult and hardly necessary to create a vacuum in shallow containers that have relatively large flexible covers. Usually almost all the air is excluded from such containers when they are sealed so they are unlikely to bulge under ordinary changes in temperature or atmospheric pressure unless they have been overfilled.

In the case of deeper containers, a vacuum of 5 cm (2in.) of mercury is generally acceptable although preferably it should be somewhat higher. On the other hand, a vacuum of more than 25 cm (10 in.) of mercury is not generally desirable, since it may cause the container to panel, particularly if the headspace is large. High vacuum may also cause contaminants to be sucked into the container if there is a slight imperfection in the seam.

Vacuum may be obtained by preheating the contents before sealing either in an exhaust box or by adding hot packing liquid, by displacing the air in the headspace with steam just as the cover is applied, or by sealing the container while it is in an evacuated chamber (see Appendix I, para 6 on "Vacuum"). Any of these methods will be found to be quite suitable. The choice will generally be made on the basis of local preferences and costs and on the availability of various kinds of equipment.

4.4.5.14 SEALING MACHINES SHOULD BE CLOSELY ATTENDED WHILE THEY ARE IN OPERATION AND THEIR OUTPUT INSPECTED FREQUENTLY TO ENSURE THAT GOOD SEALS ARE MADE AND THAT SEAMS ARE WELL FORMED WITH DIMENSIONS WITHIN THE ACCEPTED TOLERANCES FOR THE PARTICULAR CONTAINER.

Sealing the container is one of the most critical processes in canning. If seams are not tight and secure the whole canning effort and all the materials used will be wasted. It is therefore wise to give particular attention to the operation and maintenance of sealing equipment and to the routine inspection of its output.

Sealing machines designed or adjusted for one type of container should not be used to close another type without being modified or readjusted as necessary. Because of differences in the metal the tools required for forming seams in aluminium containers are usually slightly different than those used for closing similar tinplate containers.

Whatever the type of sealing equipment, the manufacturer's instructions concerning its operation, maintenance and adjustment should be followed meticulously. Metal container manufacturers are usually ready to make detailed recommendations not only on the adjustment and operation of the sealing machine, but also for the examination of finished seams. Such examination will include frequent visual inspection of seams, preferably not to exceed 30 minutes, regular measurement of seam dimensions, recording of the results, and the occasional pulling apart of samples to see that they are properly formed. Regular and careful examination of seams will usually lead to the discovery of worn parts or bad adjustment before the fault becomes so serious that the seams are not acceptable (see Annex I, para 7 on "Closures").

4.4.5.15 FILLED AND SEALED METAL CONTAINERS SHOULD BE THOROUGHLY WASHED BEFORE HEAT PROCESSING.

The outside surfaces of containers often become smeared with fish juices or solids during the filling operation. If this is not removed before the heat process, it may become baked onto the container and be very difficult to remove.

Washing may be done with sprays of hot water at about 60°C (140°F) or by conveying the containers through a bath of hot water containing a suitable cleaning agent.

Glass containers of canned fish would be difficult to wash without risk of breaking the seal. However, the washing of glass containers is not necessary because they are heat processed in water.

4.4.6 Heat Processing and Cooling

4.4.6.1 EVERY CANNERY SHOULD DEVELOP PROCEDURES WHICH WILL PREVENT UNPROCESSED CANNED FISH FROM BEING ACCIDENTALLY TAKEN PAST THE RETORTS INTO THE STORAGE AREA WITHOUT BEING HEAT PROCESSED.

Accidents occasionally occur in which trays, baskets or trolleys of unprocessed canned fish bypass the retort and become mixed with properly processed products. The unprocessed product will decompose and eventually burst its containers. This may cause a great deal of damage to other products with which it is stored.

Canneries with horizontal retorts that have doors on each end can usually arrange passages in such a way that canned fish coming from the sealing machines must go through a retort in order to get to the casing and storage area. However, it may be very difficult to avoid some congestion at the retorts, if they are of the single door horizontal or the vertical type.

In such cases, the cannery should develop a procedure suitable to its own particular layout, which will prevent unprocessed canned fish from accidentally bypassing the retort.

Some system of marking trolleys or baskets of unprocessed canned fish may be necessary. Specially treated cards which change colour permanently if they are heated to a specific temperature are available. If these cards are placed with the batches of unprocessed canned fish before they are brought to the retort area they will serve later to indicate which batches have been heat treated. However, they should not be used to indicate whether or not the heat treatment has been sufficient.

4.4.6.2 HEAT PROCESSING SHOULD BE COMMENCED AS SOON AS POSSIBLE, PREFERABLY WITHIN ONE HOUR AFTER THE CONTAINERS HAVE BEEN SEALED.

Spoilage of canned fish in sealed containers can take place fairly quickly at cannery temperatures particularly in temperate and warmer olimates. Even very slight spoilage becomes quite noticeable because any odorous gases produced will be retained in the container and will consequently affect the product.

Therefore, canned fish should be heat processed to inactivate spoilage micro-organisms as soon as possible after the containers are sealed. If production rates are low, the product should be heat processed in partly filled retorts rather than held for the long period it might take to fill completely the retort. In this case the heat process required for adequate sterilization may be changed. Therefore a separate heat process should be established for partly filled retorts.

4.4.6.3 GREAT CARE SHOULD BE TAKEN TO ENSURE THAT ALL HEAT PROCESSING OPERATIONS ARE ADEQUATE TO INACTIVATE ANY HARMFUL ORGANISMS THAT MIGHT BE PRESENT

The heat processing of canned foods is a very critical process; too little heat will make it unsafe whereas too much will affect the quality.

Close supervision of the heat processing operation and careful attention to details are necessary, otherwise failures may occur due to poor organization, carelessness or ignorance of the principles involved.

4.4.6.4 INSPECTIONS SHOULD BE MADE PERIODICALLY TO ENSURE THAT RETORTS ARE EQUIPPED AND OPERATED IN A MANNER THAT WILL PROVIDE THOROUGH AND EFFICIENT HEAT PROCESSING.

Inspections should be made periodically to ensure that each retort is properly equipped, and is being loaded and operated in such a manner that the whole load is brought up to processing temperature quickly and maintained at that temperature throughout the whole of the processing period. These initial tests are made by using thermocouples or other remote thermometers to measure the temperature at various parts of the load during the whole process period. They should be made under the guidance of a canning technologist.

The necessity of flushing all the air out of steam retorts in order to attain the controlled processing temperature has been mentioned earlier. This is done by venting - that is by allowing large volumes of steam to flow through the retort and out through open vents, driving and carrying the air with it. If the vents are too small, too few

or not properly located or if the venting is not carried out long enough, air pockets may remain and parts of the retort will fail to attain the proper processing temperature. Pockets of air may also be left within baskets, crates or trolleys of canned fish and prevent the latter from being properly processed if the sides, dividers or spacers are not sufficiently perforated to allow steam to flow freely throughout the load.

It is therefore important that the flow of steam (and consequently heat) throughout each retort should be studied by an expert and the steam distribution, venting and loading arrangements modified if necessary to reduce the time required to exhaust all air and ensure an even distribution of heat. The minimum safe come-up time should also be determined and reassessed regularly for each retort under all loading conditions (see Appendix I, para 8 on "Heat Treatment").

These studies should be repeated for each size of container and whenever the retort equipment or loading arrangements are changed.

4.4.6.5 RETORTS SHOULD BE OPERATED ONLY BY PROPERLY TRAINED PERSONNEL

It is extremely important that the heat processing of canned fish be done correctly. Therefore it is necessary that retort operators understand the principles involved and realize the need for following the processing instructions closely and for using meticulous care in timing, determining temperatures and pressures and in making records.

Training can often be obtained by attending short courses given by trade associations, food processing institutes or by government or international organizations. Excellent instruction booklets on retort operation have also been published.

4.4.6.6 EVERY STEAM RETORT SHOULD BE EQUIPPED WITH AN ACCURATE MERCURY THERMOMETER, A PRESSURE GAUGE AND, WHERE PRACTICAL, A TIME AND TEMPERATURE RECORDER. AN ACCURATE CLEARLY VISIBLE CLOCK SHOULD BE INSTALLED IN THE RETORTING ROOM. RETORT TEMPERATURES SHOULD ALWAYS BE DETERMINED FROM THE MERCURY THERMOMETER - NEVER FROM THE TEMPERATURE RECORDER OR FROM THE PRESSURE GAUGE.

It is important that retort temperatures should always be accurately known and a standardized mercury thermometer should be installed for this purpose. In steam retorts the thermometer should be installed close to a bleeder which will ensure a steady flow of steam past its bulb during the whole time the retort is in operation. The thermometer should be tested regularly to ensure that it is accurate.

The use of time-temperature recorders is recommended and the temperature diagrams should be kept so that in the event of any claims the records can be consulted.

If a time and temperature recorder is used its bulb should be located in a current of steam close to the mercury thermometer. The pen of the recorder should be kept in adjustment to agree with the mercury thermometer, but the retort temperature should never be read from the recorder pen.

4.4.6.7 THE TEMPERATURE OF HOT WATER RETORTS SHOULD BE CONSTANTLY CONTROLLED. EACH RETORT SHOULD HAVE ACCURATE MERCURY THERMOMETERS TO MONITOR TEMPERATURES IN BOTH THE COOKING AND COOLING RANGES AND, WHERE PRACTICAL, A TIME AND TEMPERATURE RECORDER.

The temperature of retorts which use hot water under pressure is controlled by adjusting the steam and the air pressure and this can be done better by an automatic regulator than by hand. The temperature should be monitored regularly, however, and for this purpose the retort should be equipped with an accurate mercury thermometer reading both in the cooking and cooling ranges.

4.4.6.8 LARGE CANNERIES USING STEAM RETORTS SHOULD CONSIDER INSTALLING AUTOMATIC RETORT CONTROLS WHEREVER THE CAPITAL OUTLAY CAN BE JUSTIFIED.

Automatic control systems are available which take over the control of a retort as soon as the doors are closed. These devices control the steam input, the venting and the duration of the heat process. They have safety devices that ensure that the correct processing temperature is reached before process timing is started and give an alarm if the temperature falls during the process.

Retorts with automatic controls need to have an operator in attendance but are less liable to incur process errors than they would be if they were manually controlled.

4.4.6.9 PERMANENT RECORDS OF THE TIME, TEMPERATURE AND OTHER PERTINENT DETAILS SHOULD BE KEPT CONCERNING EACH RETORT LOAD.

Such records will be very useful in providing management with a check on the heat processing operations and will be invaluable if some question arises as to

whether certain lots had received adequate heat processing.

The record should be made at the time of processing and should indicate the date, the retort number, the kind of product, the code, the size of container, the time the steam was turned on, the time the processing temperature was reached, the time the steam was turned off and appropriate information concerning the water cooling. Temperature and pressure should also be recorded and the record should be cross referenced with the temperature recorder chart.

4.4.6.10 THE WELL TESTED PUBLISHED HEAT PROCESSES FOR STANDARD CANNED FISH PRODUCTS SHOULD BE CAREFULLY FOLLOWED BUT ONLY AFTER COMPETENT EXPERTS HAVE CONFIRMED THAT THE VALUES ARE APPROPRIATE FOR THE PARTICULAR RETORTS TO BE USED. THE ADVICE OF COMPETENT AUTHORITIES SHOULD BE SOUGHT IN DETERMINING PROPER HEAT PROCESSES FOR NEW PRODUCTS OR PRODUCTS IN NEW TYPES OF CONTAINERS.

Optimum heat processes for most standard canned fish products have been worked out by food canning research laboratories and their safety has been well proven by many years experience in the industry. These specified processes should be followed meticulously, for, as has been explained earlier, even a slight reduction in temperature or shortening of the heat treatment time may have very serious consequences.

The published heat processes generally specify the processing times to be used for each type of product, at each of several optional processing temperatures. It should be noted that the length of these specified process times depend also on the size of the container, and on the temperature at which the product is put into the retort. Slightly shorter process times are sometimes specified for products which are to be cooled in air rather than in water.

The methods used to determine the optimum safe heat process for a new product or a new type of container are very complicated and should be undertaken only by well qualified technologists with proper laboratory facilities.

4.4.6.11 THE TIMING OF A HEAT PROCESS SHOULD NOT BE COMMENCED UNTIL THE MINIMUM SAFE VENTING TIME HAS ELAPSED AND THE TEMPERATURE OF THE RETORT HAS BEEN RAISED EXACTLY TO THE SPECIFIED PROCESSING LEVEL.

Process times are based on the premises that the steam or water surrounding the product is kept at the proper temperature for the whole of the timed period. The timing should therefore not be commenced until the specified heat processing temperature has been reached, and the conditions to maintain uniform temperature throughout the retort achieved.

Uniform temperature throughout a steam retort will not be achieved unless the retort is properly vented to remove all air. Proper venting is determined by the minimum safe venting time and the temperature that should be attained in this period. These venting conditions should be established for each retort. A great deal more steam is required during venting than during the processing period and it is general practice to bypass the steam inlet governor during venting. The vents and the bypass should not be closed until both the time and temperature conditions for venting have been satisfied. The pressure guage should also be checked. If the retort has been properly vented its pressure should correspond to that of saturated steam at the temperature indicated by its thermometer.

Thus, the process timing should not be commenced unless the established venting temperature has been reached, minimum venting time has elapsed and unless the thermometer indicates that the specified process temperature has been exactly reached.

4.4.6.12 PRODUCTS IN DIFFERENT SIZE CONTAINERS SHOULD NOT BE PROCESSED TOGETHER IN THE SAME RETORT LOAD.

Heat penetration to the centre of large containers generally takes longer and therefore a longer heat process is required. If products in containers of different sizes are processed together the process time specified for the larger containers will be required for safety. This may result in overcooking and loss in quality of the product in the smaller containers.

4.4.6.13 WHEN PROCESSING PRODUCTS IN GLASS CONTAINERS, CARE MUST BE TAKEN TO ENSURE THAT THE INITIAL TEMPERATURE OF THE WATER IN THE RETORT IS SLIGHTLY LOWER THAN THAT OF THE PRODUCT BEING LOADED. THE AIR PRESSURE SHOULD BE APPLIED BEFORE THE WATER TEMPERATURE IS RAISED.

Closures on glass containers are not generally very strong mechanically and there needs to be a slight vacuum in the headspace to maintain a tight seal. Consequently the product should never be exposed to a temperature that will eliminate

this vacuum, unless it is also subjected to additional external pressure.

Therefore, the initial temperature of the water in the retort should be slightly lower than that of the containers at the time they are sealed. Air pressure should be applied to the retort before the water temperature is raised.

Care must also be taken that the water temperature is not so low that there is danger that the glass will be damaged by thermal shock.

4.4.6.14 AFTER HEAT PROCESSING CANNED FISH SHOULD, WHEREVER PRACTICAL, BE WATER COOLED UNDER PRESSURE. ONLY POTABLE QUALITY CHLORINATED WATER SHOULD BE USED FOR THIS PURPOSE.

The pressure cooling (that is cooling with water in the retort while it is kept under pressure) avoids the strains on the container which would otherwise be caused by the unbalanced pressure in the headspace after the steam pressure has been removed.

Products in glass or aluminium containers are processed in hot water under pressure and are cooled by carefully introducing cooler water in the retort before the air pressure on the retort is removed. The temperature of products in glass must, of course, be reduced to a point where there is a vacuum in the container before the pressure on the retort is removed. It is also desirable to terminate heat processes in steam retorts by pressure cooling. This not only reduces the strains on the containers, but prevents the product from being overcooked by the residual heat and also makes it more quickly available for casing.

Furthermore, problems with struvite will often be avoided if canned fish is cooled rapidly. Struvite, which is magnesium ammonium phosphate, forms from the natural constituents of some fish products during the heat process and crystallizes out of solution and lodges in the flesh when the products cool. The slower the cooling, the larger the crystals will be. Struvite is perfectly harmless nutritionally, but if the crystals are large enough they may feel like grit in the mouth and some consumers may mistake them for glass. However, if cooling is done rapidly the crystals formed will be very small and these problems will usually be avoided.

When water cooling is done solely to prevent overcooking or to hurry the handling it is sometimes done outside the retort in cooling canals. Where this method is used there should be continuous replacement of the cooling water to prevent build-up of organic or microbial contaminants.

Cooling should always be done with potable water because momentary lapses in the seal may occasionally occur during a thermal or mechanical shock and there is risk that non-sanitary water might contaminate the contents of some containers. Water used in cooling should be chlorinated sufficiently to avoid contamination of the product.

Water cooling should not reduce the temperature of the product below the point at which its surfaces will be dried quickly by the residual heat. Cooling to an average product temperature of about 38°C (100°F) is generally satisfactory but slightly higher temperatures may be required in humid weather. Where water for cooling the cans is chlorinated in the plant, there should be a sufficient contact time to reduce the microbial content to a level which will not lead to contamination of the can contents during cooling. In some countries a contact time of 20 minutes is used. Checks should be made to ensure the presence of residual free chlorine at all cooling water outlets. Where water is re-circulated it should be re-chlorinated.

4.4.6.15 WHERE CANNED FISH PRODUCTS ARE NOT COOLED IN WATER AFTER HEAT PROCESSING THEY SHOULD BE STACKED IN SUCH A WAY THAT THEY WILL COOL RAPIDLY IN AIR. THEY SHOULD NOT BE LABELLED, CASED OR HANDLED UNNECESSARILY UNTIL THEY ARE QUITE COOL.

If canned fish is not cooled substantially soon after heat processing it will continue to cook and its texture and flavour may be impaired. This fault, which is known as stackburn, will almost certainly occur if the product is put in cases while it is hot or piled so closely that it retains its heat for a long time.

Rough handling of canned fish while it is hot can be very detrimental to its texture and it may, in some instances, cause leackage at seams or soldered seals of containers.

If canned fish is not water cooled it should be stacked in such a way that there is a good circulation of air through the pile and it should not be labelled or cased until it is quite cool.

4.4.7 Labelling, Casing and Storing

4.4.7.1 HEAT PROCESSED CANNED FISH SHOULD NOT BE TOUCHED BY HAND UNNECESSARILY BEFORE THEY ARE COOLED AND THOROUGHLY DRY. THEY SHOULD NEVER BE HANDLED ROUGHLY OR IN SUCH A WAY THAT ITS SURFACES, PARTICULARLY THEIR SEAMS, ARE EXPOSED TO CONTAMINATION

Canned fish will usually be soft while it is warm and may break up badly if the containers are shaken. Seams may leak momentarily if containers are subjected to thermal or physical shocks. If the seams are wet or dirty when this occurs, microbial contaminants may be drawn into the container. Even slight dents close to a seam are liable to cause leaks, some of which may become resealed after the contents have been contaminated. Therefore, canned products should not be moved unnecessarily until they are cool and dry. If necessary the drying may be hurried by blowing air over the containers. Where runways for the conveyance of cans after heat-processing become wet they should be regularly disinfected throughout the production period.

When canned fish is moved, care should be taken to avoid mechanical shocks that may cause dents or put momentary strains on the seams. Conveyors and other equipment for handling canned fish should be kept clean and dry so that they do not dirty the containers. Cylindrical containers should not be rolled on their double seams.

4.4.7.2 CANNED FISH SHOULD BE INSPECTED FOR FAULTS AND FOR QUALITY ASSESSMENT SOON AFTER IT IS PRODUCED AND BEFORE LABELLING.

Representative samples from each code lot should be examined to ensure that the containers are sound and the product meets the standards for weight of contents, vacuum, workmanship and wholesomeness. Texture, colour, odour, flavour and condition of the packing medium should be assessed.

This examination should be made as soon as practical after the product has been produced so that if there are any faults due to failings on the part of cannery workers or canning equipment these failings can be corrected without delay.

Containers of canned fish or shellfish should be inspected once again before or during the labelling and casing and defective containers withdrawn.

4.4.7.3 THE MATERIALS USED FOR LABELLING AND CASING CANNED FISH SHOULD NOT BE CONDUCIVE TO CORROSION OF THE CONTAINER. CASES SHOULD BE THE CORRECT SIZE AND STRONG ENOUGH TO PROTECT THE PRODUCT DURING DISTRIBUTION.

Tinplate will corrode if it is kept moist for a long time particularly in the presence of mineral salts or substances which are even very weakly alkaline or acidic. Labels or label adhesive which are hygroscopic (that is, capable of attracting moisture out of the air) and therefore liable to promote rusting of tinplate should be avoided as should pastes and adhesives that contain acids or mineral salts.

Cases should be thoroughly dry. If they are made of wood it should be well seasoned. They should be the proper size so that the containers fit snugly and are not subject to damage by movement within the case. They should also be strong enough so that they are not broken or spilled under normal conditions of transport.

4.4.7.4 CODE MARKS APPEARING ON CONTAINERS OF CANNED FISH SHOULD ALSO BE SHOWN ON THE CASES IN WHICH THEY ARE PACKED.

The cases should be marked so that it will not be necessary to pull them open to learn the identity of their contents. This will greatly expedite sampling or the separation of certain codes where this becomes necessary.

Code marks shown on the case will simplify the verification of shipments where code identifications are used on bills of sale or other shipping documents.

4.4.7.5 CANNED FISH SHOULD BE SO STORED THAT IT WILL BE KEPT DRY AND NOT EXPOSED TO EXTREMES OF TEMPERATURE.

Tinplate containers will eventually corrode if they are kept continuously moist or held under conditions of high humidity. Paper labels and fibreboard cartons will also be adversely affected by the dampness.

The quality of canned fish may also be adversely affected by storage at a high temperature. Reactions between canned fish and metal containers are very greatly accelerated by increasing temperature. Some products in which reactions with the container are insignificant even when stored for a year or more at temperatures of 20°C (68°F) or less, could become quite distasteful if stored for a month at a temperature of 40°C (104°F) or higher.

Extremely cold storage conditions should also be avoided. Freezing may burst glass containers or damage the texture of some products packed in metal containers. Furthermore, metal containers, which have become thoroughly chilled in storage, may become badly moistened by condensate and subsequently corroded if they are removed to a warmer storage or shipped to a warm moist climate.

4.4.7.6 CANNED FISH PRODUCTS SHOULD BE ALLOWED TO MATURE BEFORE THEY ARE OFFERED FOR SALE.

It takes a few days or in some cases a few weeks or more for the salt, spices and other ingredients to become evenly distributed and for packing oils or sauces to become absorbed into the solid contents. Only when this equilibrium is reached will the product have its full flavour and in some instances its desired texture. Products should not be offered for sale until this stage is reached.

4.5 Sanitary Control Programme

4.5.1 IT IS DESIRABLE THAT EACH CANNERY IN ITS OWN INTEREST DESIGNATES A SINGLE INDIVIDUAL WHOSE DUTIES ARE PREFERABLY DIVORCED FROM PRODUCTION, TO BE HELD RESPONSIBLE FOR THE CLEANLINESS OF THE ESTABLISHMENT FM 45 MP 52

Such a person or his staff should be a permanent part of the organisation or employed by the organization and should be well trained in the use of special cleaning tools, methods of dismantling equipment for cleaning and in the significance of contamination and the hazards involved.

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

4.6 Laboratory Control

4.6.1 IN ADDITION TO ANY CONTROL BY THE OFFICIAL AGENCY HAVING JURISDICTION, IT IS DESIRABLE THAT EACH CANNERY IN ITS OWN INTEREST SHOULD HAVE ACCESS TO LABORATORY CONTROL TO ESTABLISH SANITARY QUALITY OF THE PRODUCTS PROCESSED. CF IV.F

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

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

5. SECTION V - END PRODUCT SPECIFICATIONS

CF Sect.V

5.1 Appropriate methods should be used for sampling and examination to determine the compliance with the following specifications:

A. To the extent possible in good manufacturing practice the products should be free from objectionable matter;

B. The products should not contain (a) any harmful micro-organisms or any other micro-organisms capable of development under normal storage conditions or (b) any substances originating from micro-organisms in amounts which may represent a hazard to health;

C. The products with an equilibrium pH above 4.6 should have received a processing treatment sufficient to destroy all spores of Clostridium botulinum, unless growth of surviving spores would be permanently prevented by product characteristics other than pH;

D. The products should not contain any chemical substances in amounts which may represent a hazard to health;

E. The products should comply with the requirements set forth by the Codex Alimentarius Commission on pesticide residues and food additives as contained in permitted lists or Codex commodity standards, or should comply with the requirements on pesticide residues and food additives of the country in which the products will be sold.

ANNEX I

FACTORS AFFECTING QUALITY

1. General

The enzymes and micro-organisms which cause fish to spoil are fairly readily destroyed or inactivated by heat. Therefore, fish products which are packed and sealed in containers that will protect them from re-contamination and then heated sufficiently, will remain stable for a long time at any temperature at which the product is likely to be held. Heat stabilization of the product and its protection against re-contamination are the essential conditions that must be achieved in canning. There are also many other processing requirements that must be met to ensure that canned fish products will be wholesome, palatable and otherwise acceptable to the consumer.

The basic requirements for the manufacture of satisfactory canned fish products are as follows:

(a) the fish and other ingredients used should always be of high quality;
(b) all handling and processing operations should be carried out carefully without needless delay and under high standards of sanitation;
(c) the heat process should be sufficient to ensure the destruction or inactivation of all micro-organisms that will grow at any temperature at which the product is normally likely to be held and cause spoilage or might be harmful;
(d) the container should be of suitable construction and should be properly filled and sealed so that the contents are protected from contamination. Its inner surfaces should be resistant to undesirable chemical reactions with the contents and its outer surfaces resistant to corrosion under likely conditions of storage.

The importance of using high quality fish as raw material for canning can hardly be over-emphasized. Canning is essentially a cooking process, the end result of which is much the same as if the fish had been prepared and cooked by the consumer. Therefore, fish with any quality defect which makes it unacceptable or unsatisfactory for direct sale to consumers other than a bruise, discoloration or similar fault that can be trimmed away is also unsuitable for canning. It follows then that the same care is required in the handling of fish on the vessel and on shore whether it is intended for canning or for processing into fresh or frozen fish products. Furthermore, many of the processes used in butchering, portioning and otherwise preparing fish for canning are similar to those used in preparing fresh fish products for market. Consequently, many of the recommendations contained in the "Code of Practice for Fresh Fish" are equally applicable in the preparation of fish for canning.

While the quality of fresh fish can be conserved for some time by careful handling and thorough chilling, it is nevertheless at its best soon after capture and the less delay in canning the better the product will be. Some delays in processing are inevitable and indeed delays are sometimes intentional as in the case where shrimp are held a day or so in ice to allow autolytic action to loosen the meat from the shell so that peeling will be easier, or in keeping a stock of fish in iced buffer storage so that the cannery can operate continuously between deliveries. However, such delays should be kept as short as possible and in no case should they be longer than would be permitted if the fish were being prepared for sale as fresh fish. The fish, of course, should be kept thoroughly chilled during the entire holding period.

In some instances where supplies of fish are seasonal or are subject to large day-by-day variations in the volumes of landings or, as in the tuna fisheries, where the fish are taken long distances at sea, it is necessary for canneries to utilize frozen stocks to keep operating continuously. Frozen fish to be used for canning should meet the same quality criteria as fresh fish - if it is not good enough to be cooked and served immediately to a discriminating consumer it is not good enough to be canned. The same care should be used in preparing, freezing and storing fish whether it be used for canning or marketed as frozen fish. Recommendations concerning the best accepted methods of preparing, freezing, packaging, storing, transporting and thawing fish for market or further processing are contained in the "Code of Practice for Frozen Fish".

Batch lots of canned fish must be as uniform as possible in quality and particularly in appearance, texture and flavour. Regular consumers choose the particular brands or types of product with which they are familiar and they expect the contents of each container they open to be quite similar to the last. Therefore, products which cannot establish and maintain a reputation for consistency in such characteristics as appearance, colour, workmanship, texture, size of piece and flavour are more difficult to sell to the public and are consequently less attractive to the wholesale buyer.

Differences in colour, texture or flavour are often due to natural differences in the raw material. Usually these differences cannot be avoided, but the desirability of keeping the output as uniform as possible should be kept in mind when fish are being acquired for canning. Where notable differences do exist, the raw fish should be segregated into batches which will have fairly uniform characteristics when canned and these batches should be identifiable from the coding on the containers of the final product.

The quality of canned fish can be seriously affected by the way in which the raw material is prepared for canning. Preparatory processes such as brining, precooking, smoking or drying must be very carefully controlled to ensure that the desired effect of the process is uniformly achieved.

The quality of the other ingredients used is also important. Good quality materials used as packing media, sauces, fillers, spices or flavourings will enhance the flavour and appearance of the product and so increase its acceptability. Cheaper but poorer quality ingredients, on the other hand, may create a poor impression of the product and so reduce its acceptability out of all proportion to the saving in cost. Furthermore, low quality ingredients may carry larger numbers of micro-organisms or mould spores and thus create problems in the heat treatment of the product. If the ingredients used are variable in their flavour or physical properties or if the amount added to the product is not carefully controlled, there may be a noticeable variability in the flavour, texture or appearance, which will detract from the general quality of the final product. If fish has been in contact with brine, its salt content should be determined, and taken into account when additional salt is added to the product. It should also be borne in mind that, in some circumstances, the prolonged contact of fish flesh with sea water may lead to the occurrence of struvite crystals in the final product.

Since it is not usually practical to keep fish thoroughly chilled while it is being prepared for canning, delays that take place during the preparatory processing may account for serious reduction in the quality of the finished products. The canning operation should be arranged so that the time lapse between removal of the raw material from chilled or frozen storage and the heat treatment of the final product in sealed containers is as short as possible. When delays in the preparatory processing do become necessary, a special effort should be made to chill the fish as much as possible. Not only will the quality of the product suffer from unnecessarily long exposures to higher temperatures but there may be some risk that the micro-organisms in the product will proliferate to the extent that the normal heat treatment would not be sufficient to stabilize the product. Particular care should be taken to avoid delays between the time the containers have been sealed and the time they are heat processed since stale odours and flavours will develop very readily in the product at this stage. Furthermore, damage to quality after the containers have been closed may not be discovered until they are opened by consumers.

2. Precooking

Fish are very often precooked as part of their preparation for canning and usually for one or more of the following reasons:

(a) to rid the flesh of fluid which would otherwise cook out during the heat process and remain in the container as an undesirable free liquid;
(b) to release body oil if the fish are excessively fat or if the oil has a very strong flavour;
(c) to improve texture or to condition the flesh for further processing;
(d) to obtain specific textural and flavour effects such as by frying in oil;
(e) to make shellfish meat firmer and to loosen it from the shell.

Cooking can be done in a number of ways such as in hot brine, in steam, in hot air, in hot oil or by radiant heat and sometimes two or more of these methods are used in combination or in sequence.

If fish are not precooked sufficiently the desired effect is not achieved but if they are overcooked there will be loss in flavour and the yield will also be greatly reduced. It is therefore necessary to control the amount of cooking very carefully by regulating the cooking time and temperature.

Optimum cooking times and temperatures can be determined experimentally and the time required at a specified temperature can be related to the size of fish. For larger fish the amount of cooking may also be determined by measuring the temperature reached at their centres.

Since the cooking time required will depend on the size and the initial temperature of the fish, care should be taken that batches of fish which are to be cooked together should be similar in size and at approximately the same initial temperature.

Larger fish such as tuna are generally precooked whole in a steam chamber but in some fisheries they are cut into portions and precooked in brine. The precooking of tuna-like fish reduces their moisture content and rids the flesh of rather strongly flavoured oil. It also causes the flesh to separate from the bone and makes it sufficiently friable to be readily separated for canning.

Small fish such as sardines or herring are cooked primarily to rid them of moisture which would otherwise become a free liquid in the container and which would spoil the appearance, texture or flavour of the finished product. Traditionally sardines were cooked in oil but methods utilizing steam or hot air are now commonly used in the

precooking of all varieties of small fish. The fish may be laid out on wire mesh trays called grills or flakes for cooking or they may be cooked after packing in their final container. The latter method has some advantage since it avoids further handling of cooked products which are usually fairly easily damaged. Very often fish are cooked first in steam to raise the temperature quickly and then in hot air to carry away the excess moisture which would otherwise remain on the surfaces.

If fish are precooked after packing, the containers must be inverted and the water and oil which cooks out drained away without spilling the fish. There is equipment for precooking containers of packed fish continuously. In one process the packed containers are steam heated for a period, inverted to drain away the liquid, cooked for a further period, uprighted, filled with hot oil, sealed and then delivered for heat processing.

Lobster and crab are cooked to coagulate the protein and break the adherence between the muscle tissue and the shell so that the meat can be removed easily. Lobsters, and in some cases crabs, are cooked alive in boiling water which may contain about 3 to 5 percent salt. Crabs frequently have the back shell and viscera removed before being cooked either in a light brine or by direct contact with steam. In some fisheries, shrimp are cooked before peeling, but in others they are peeled raw and then cooked to condition the meats and cause them to curl.

Oysters and clam meats are usually precooked to make them firm and rid them of excess moisture. The cooking process is often used as the means of killing the animal and causing the shell to open. Sometimes it is done with boiling water but in larger operations it is usually done with steam. Continuous steam cooking tunnels or columns are sometimes used and these may be equipped to collect the clam juice which may be added back to the canned product or concentrated and sold as clam nectar.

If fish are precooked before packing they will need to be cooled so that the flesh becomes firm enough for them to be handled without damage. During a large part of this cooling period the fish will be within the temperature range where the proliferation of micro-organisms and chemical spoilage can take place very quickly. Cooling should therefore be done as quickly as practical and the next stage of processing commenced immediately. Cooling should take place in an area which is suitable for the purpose, where there is a good circulation of cool air and where the fish can be well protected from contamination by dust, insects or by contact with other unsanitary substances. In some instances it is also necessary to protect the fish from oxidation during cooling.

3. Preparatory Dips

In the course of its preparation for canning, fish is often soaked in solutions containing flavouring or conditioning agents. Brine dips are most common but dips containing other permitted food additives are sometimes used.

To accomplish their purpose, dip solutions must be kept at their proper strength and the length of time the product is soaked must be carefully controlled. Where the use of a dip solution is being considered, the assistance of experienced fisheries technologists should be sought to determine the most suitable formula and dipping procedure. It is important to ascertain that the additive being considered is permitted both in the country where the canning takes place and in the countries where the product will be sold.

Weak brines are often used to adjust the salt content of the product but stronger solutions may also be used to remove blood and to improve the texture of fish surfaces by dehydrating them slightly. Strong brines are also used to separate fragments of shell out of crabmeat (the meat will float and the shell sink).

Other additives are sometimes used to improve the texture of the product, to acidify it slightly, to prevent certain natural ingredients from producing undesirable flavours or discolourations or to suppress the formation of struvite.

Dips will not only become ineffective but they may also become a serious source of contamination if they are not properly attended. With continued use, the solutions will become diluted and will collect debris washed or dissolved off the material being treated, and may soon contain very large numbers of micro-organisms - particularly if they are not kept fairly cool. It is therefore important that dip solutions be changed very frequently and that dip tanks be thoroughly cleaned each time the solution is changed.

The amount of additive a product will pick up in a dip is sometimes difficult to control. Therefore if an additive is being used for the effect it has during or after the heat process it will often be preferable to add it to the product through an accurate dispensing unit just before the containers are sealed rather than by using a dip.

4. Containers

Canned fish containers are most commonly made from either tinplate, aluminium sheet, laminated aluminium foil or glass. While each of these materials imposes some particular requirement on the canning process, any of them will be quite satisfactory if the proper processing practices are followed.

Tinplate, which is mild steel sheet that has been coated with tin on both sides has been used since very early in the development of the canning process and containers of this material are still the kind most commonly used by the industry. It is particularly suitable because of its strength, toughness and malleability and because it can be soldered to make very strong side seams for cylindrical containers. The tin coatings also help protect the container from corrosion by its contents or by the atmosphere.

At one time the coatings of tin were heavy enough to prevent corrosive action with the container from affecting most kinds of fish products for several years. However, in more recent times lighter coatings are used which are supplemented by enamel coatings to prevent undesirable reactions between the container and its contents.

Special enamels have been developed to minimize reactions between the active constituents of canned fish products and their containers. These are usually baked onto the tinplate before it is cut and formed but there are some types which are applied to the finished container. Application of these latter types is more costly but they provide a better protection since the seams are covered and the enamel is not stretched or otherwise damaged during the forming of the container. It is important that for seafood approved enamels are used and also that they are not damaged either during the manufacture of the container or by rough handling during transport or in the cannery.

Abrasions, gaps or thin areas in the enamel will permit reactions between the tinplate and the contents to occur and these may affect quality in several ways. A common type of reaction results in the formation of a black iron sulphide stain on the surface of the food or on the inside wall of the container. These stains are not harmful but they detract from the appearance of the product. Iron sulphide stains are more common in some kinds of fishery products than others and there is some evidence that they occur more frequently if the raw material has commenced to deteriorate before canning. Some of the commonly used enamels contain substances which will reduce the occurrence of these stains by absorbing sulphur to form colourless compounds. Other special enamels are used if the product is acidic or contains substances that might cause particular corrosion problems.

If the canned product contains acidic ingredients, failure of the protective enamel may lead to reactions with the metal in which hydrogen gas is formed. If sufficient gas is generated its pressure will cause the container to become a swell.

In other instances constituents may be present which will react with the tin causing it to dissolve off the container and become incorporated in the food. If this "detinning" is extensive, the product may develop an objectionable flavour and the loss of tin from the container surfaces may lead to other forms of corrosion.

Rigid aluminium containers have become quite widely used by some segments of the canning industry. They are light in weight and attractive in appearance. In some regions and under some circumstances aluminium may be more economical than tinplate. However, aluminium alloys are not as strong as tinplate and are not easily soldered or welded and so it is difficult to form aluminium sheet into the strong side seam required for a cylindrical container intended for heat processing at a high temperature. Therefore, the aluminium containers generally used in fish canning are the shallow drawn type and even these require special procedures to prevent them from being damaged by the internal pressures generated during the heat process.

The exterior surfaces of aluminium containers resist corrosion by the atmosphere very well under normal storage conditions. Interior surfaces are generally treated to create an oxide layer (anodized) and then coated with enamels formulated especially to suit the particular type of product. Slight reactions between aluminium containers and their contents cause little damage because the by-products are not harmful and do not discolour either the product or the container. However, extensive corrosion by the contents may result in the formation of swells or weaken the container to the point that it may leak.

Semi-rigid containers of aluminium foil laminated on the inside with polypropylene are also being used for canned fish. Although this type of container can be purchased, they are usually formed in special presses at the cannery from rolls of sheet aluminium laminate.

These containers are light in weight, attractive in appearance and easy to open. Since they are rather subject to damage if roughly handled, products in these containers are generally distributed in individual paperboard cartons for extra protection.

Semi-rigid containers are filled and handled in much the same way as other metal containers but a different closure is used. They are stacked only two deep in perforated trays in the retorts and are heat processed in super heated water in the same manner as other aluminium or glass containers.

Although they are not used very extensively in the fish canning industry, glass containers do have properties that make them particularly suitable for some products. Since glass does not react with foodstuffs even in the presence of air and since most glass containers can be repeatedly opened and closed they are convenient for fish pastes or similar products where part of the contents may be kept a day or so after the container has been opened.

Some consumers may be attracted to products packed in glass containers that they can later put to other uses. The fact that glass containers are transparent can also be used to promote the sale of attractively packed products. However, glass containers should not be used if there is any risk that the product will be discoloured or otherwise adversely affected by light.

Glass containers are quite easily broken if they are subjected to mechanical or thermal shock and particular care must be taken during the canning process to avoid rough handling or exposure to sudden changes in temperature. Breakages will also occur if products in glass containers are allowed to freeze during transport or storage.

Covers generally consist of metal caps sealed to the glass with resilient gaskets and held in place by a mechanical fastening, by the vacuum in the container or by a combination of both vacuum and a mechanical fastening. In any case the covers are not very strongly held to the containers and special processing methods are required to prevent them from being forced off during the heat process.

It is necessary, of course, to prevent corrosive reaction between the metal container cover and the contents from taking place. This is done either by enamelling the cover or by separating it from the contents with a suitable paper or plastic liner.

It is important that containers of canned fish should not be distorted or damaged in any way during the canning process for, regardless of the quality of the food, the product will not be merchantable if the containers are not quite normal in appearance. This is so because most consumers associate abnormal containers with a risk that the product may be spoiled or even harmful. This attitude is reasonable because it is not possible to tell from a visual examination whether flippers, springers or swells have been caused by overfilling, low vacuum, production of hydrogen by reaction of the contents with the container or by gas evolved from the spoiling contents. Neither is it possible to determine visually whether or not the seams of dented or distorted containers have developed very minute leaks or have been strained to the extent that they may fail before the product is consumed.

During mechanical or thermal shock, seams may sometimes open for just long enough to admit a small amount of contaminating substance and then reseal. In such cases, some time may elapse before spoilage will develop to the extent that the container will become swollen.

The fact that containers do not swell is not a certain indication that there has been no spoilage. There are some micro-organisms which will spoil canned fish without the production of gas.

5. Filling

In filling containers, account must be taken of the fact that the contents will expand or contract in volume more than the container will with changes in temperature. This means that the amount of headspace in containers of canned fish will be decreased as the temperature is raised and increased as the temperature is lowered. Some small shallow containers with relatively large flexible covers can expand to accommodate appreciable changes in the volume of the contents and usually should be adequately filled, but not overfilled. Most containers need some headspace to prevent them from bursting or becoming permanently distorted during the heat process. The amount of headspace required will depend on a number of factors including the size and type of the container and the nature of the product.

On the other hand, there may be difficulties if the headspace is too large. Panelling as a result of too high vacuum or too high external pressure during cooling is likely to be more severe if the headspace is large. Large headspace will also permit freer movement of the contents during handling and this may be detrimental to the appearance and texture of the product. Furthermore, the product may appear to be deceptively packaged if the containers are not filled reasonably close to their capacity. Some countries have regulations governing minimum fills of containers.

6. Vacuum

It is generally desirable to create a partial vacuum in containers of canned fish at the time they are sealed. This serves two purposes; it avoids excessive pressure from entrapped gas during the heat processing and it also reduces the likelihood that internal gas pressure will cause metal containers to swell if stored in warm places or exposed to low atmospheric pressures. Glass containers usually have closures that depend, at least in part, on the vacuum within to hold the cover in place tightly enough to maintain the seal.

Since no headspace is necessary if a container can expand sufficiently to accommodate the contents during the heat process, shallow containers with flexible covers are usually completely filled. In such cases no measurable vacuum is necessary because there will be very little or no air or gas in the container at the time it is sealed.

Very high vacuums are not generally desirable particularly if the headspace in the container is relatively large. A high vacuum may cause the walls of larger metal containers to become partly collapsed or panelled and increases the risk of contaminating material being drawn into the container through weak seams or other closures.

A vacuum is created by removing part of the air when the containers are sealed. The traditional and still one of the most practical ways of doing this consists of heating the container and its contents to about 55°C (130°F) or higher before sealing.

Raising the temperature causes air to be displaced from the container by its own expansion, by the increase in the water vapour pressure and by the expansion of the solid and liquid contents. Since the pressure of the water vapour and the remaining air will be in equilibrium with the atmosphere when the container is sealed it will be less than atmopheric pressure when the container has been cooled to normal ambient temperature (after it has been heat processed). The loss in pressure is due partly to the reduction in water vapour pressure with reduced temperature and partly to the lower pressure of the residual air as a result of its cooling and also its expansion as the volume of headspace is increased at the lower temperature.

The heating of canned fish to achieve a vacuum is usually done by conveying it through a steam filled tunnel or exhaust box. The amount of steam and the length or speed of the conveyor are adjusted to attain the desired amount of heating. Metal containers usually have their covers attached very loosely before entering the exhaust box and they must be sealed immediately after they come out to avoid unnecessary cooling and resultant reduction in the amount of vacuum obtained.

If canned fish products are to contain added brines, sauces or packing oils, a vacuum may be obtained by adding these hot just before the containers are sealed. However, care must be taken to avoid damaging the quality of packing oils or sauces by overheating or by keeping them hot for long periods prior to use.

"Broguing" was once the standard method of obtaining a vacuum in soldered metal containers but has fallen into disuse with the development of the solderless double seam closure. The method is still useful, however, in reclaiming good quality canned fish in metal containers which have no vacuum due to overfilling or some other processing failure.

In broguing, the sealed containers are heated sufficiently to create a substantial internal pressure, then punctured to allow air, steam and some liquid to escape and then resealed with solder and heat processed again. These operations should be carried out quickly and the heat processing should be for the same time and at the same temperature as when the product was being canned.

Vacuum may also be attained in canned products without preheating by using steam to flush the headspace and displace the air around the container while the cover is being applied and sealed in place. This method is widely used in well mechanized canneries and is adaptable to making vacuum closures on high speed canning lines.

Vacuum sealing machines are also quite widely used in some sections of the fish canning industry and some types are capable of vacuum sealing several hundred metal containers a minute. Containers with lids clinched loosely in place are conveyed through an air lock and sealed in a chamber which is kept under substantial vacuum by an exhaust pump. They are then carried out through an exit air lock.

7. Closures

The closing of canned fish containers is a very crucial matter, for if the entry of contaminating substances is not prevented, the product will spoil and both the materials and the canning effort will be wasted. In some instances faulty closures may fail to seal completely the container, in which case recontamination and subsequent spoilage will occur very soon. In other cases poor closures result in seals which either break completely or open momentarily if the container is subjected to thermal shock or rough handling, in which case spoilage may not occur until after the product has been stored or passed into the distribution channels.

The so-called "double seam" closure (see Annex II for a schematic diagram of "Double Seam") is nearly always used to seal metal containers of canned foods which are to be heat processed. The seal is effected in two operations. In the first, the edge of the metal cover which has a coating of rubber-like sealing compound on its underside is folded so that it forms what is called the "cover hook" around the flared lip of the container body. In the second operation, the cover hook and enclosed lip are folded down against the container wall so that an interlocking "body hook" is formed and both hooks are closed so tightly that a strong joint is formed and the edge of the container lip is well embedded in the sealing compound within the fold of the cover hook. Since the cover is recessed slightly within the container wall, the seam consists of five thicknesses of metal, three folds of the cover and two of the body wall.

The equipment used for making double seam closures ranges from simple hand operated devices to power driven machines which can accept, seal and discharge 300 or more containers per minute. While they vary in capacity and other features, seamers all operate by pressing the cover and container lip into the desired folds between very precisely shaped machine parts and, as mentioned earlier, the seam is formed in two stages.

A properly formed double seam makes a very strong closure and a very reliable seal. However, small deviations from the correct size or shape of the folds which can be caused by seamers that are worn or out of adjustment may result in weak or leaky seams. It is therefore very important that the closing equipment be operated and maintained by competent staff and in accordance with the instructions and standards of its supplier and those of the container manufacturer. Since the consequences of poor seaming may be very serious, it is prudent to watch the output of all closing machines very carefully. A thorough examination of sample closures should be made at frequent regular intervals so that any deviations from the proper shape or dimension of seams will be discovered and corrected before any unacceptable seams are produced.

Semi-rigid containers are heat-sealed in special equipment which uses high pressure as well as heat to make the seal. This equipment should be operated and maintained in accordance with the manufacturers instructions.

There are many types of covers for glass containers, and as mentioned earlier several methods are used to hold them in place. In most cases special equipment will be required to fasten the covers to the containers. Manufacturers will provide instructions on how the containers or covers they supply should be sealed. These instructions should be followed carefully.

8. Heat Treatment

Careful control of the amount of heat treatment is extremely important. If the product is not heated sufficiently it may spoil or it might become of potential health hazard; if the heat treatment is too severe, the quality may be reduced by over-cooking.

Fish is a low acid food and as such, supports the growth of spore forming micro-organisms including many that will cause spoilage and some that might be extremely harmful to the consumer. There is an accepted public safety standard that all low acid canned foods that do not contain suitable bacterial inhibitors, shall receive sufficient heat treatment to destroy the spores of Clostridium botulinum which is one of the most heat resistant of the harmful micro-organisms that might be present in the food.

Micro-organisms vary in their sensitivity to heat and this may also be affected by the nature of the medium in which they occur, but many of the spore formers that will grow on fish and cause spoilage or become harmful will survive for a long time at temperatures close to 100°C (212°F), however, the thermal death rates of these types increase very greatly as temperature is raised. Under laboratory conditions the spores of C. botulinum will survive for several hours at the temperature of boiling water, but will die off in a little over half an hour at a temperature of 110°C (230°F), in less than nine minutes at 116°C (240°F) and in less than three minutes at 121°C (250°F).

It must be emphasized that these death times are only valid if the spores are exposed directly to the heat. It will take very much longer to destroy similar spores in canned products by exposure to heat at the temperature in question.

In view of this, it is necessary to heat process canned fish at temperatures in the range 110°-121°C (230°-250°F). The higher temperatures are often preferred because of the saving in time and also because it is found that the texture, colour or flavour of some products may be preserved better by heating for a shorter time at a higher temperature. In other cases processing for a longer time at a lower temperature is better for the quality of the product.

Detailed discussion of the effect of heat on micro-organisms is beyond the scope of this code but it has been illustrated that they die off much more rapidly at higher temperatures. It follows that thermal death rates will change very substantially as the temperature of the medium rises or falls. This means that the effectiveness of a heat process depends on the rate at which heat is absorbed by the product and how quickly the temperature of its coldest part comes up to the desired processing temperature.

A considerable amount of research has been done on the heat processing of canned foods and methods are available whereby canning technologists can assess the effectiveness of a heat process if they have information relating the temperature of the coldest part of the product with time throughout the entire process period. This data can be obtained by using thermo-couples in test containers.

Tables of recommended processing times and temperatures for most well known products packed in standard type containers have been published and are available from can manufacturers or research institutions concerned with the canning industry. The assistance

of experts in canning technology should be obtained when determining the amount of heat treatment required by new products or products in new types or new sizes of containers.

It is very important that the proper combination of processing time and processing temperature be chosen to provide an adequate heat treatment for each particular product and each particular container. However, it is equally important and in practice much more difficult to take all the precautions necessary to ensure that products will always receive the correct amount of heat processing. Errors in timing or in the operation of retorts are by far the most common causes of canned fish being underprocessed. Such errors may be very costly unless the underprocessing is discovered very soon after it occurs, spoilage may commence and the whole batch become a total loss. Indeed, if it has been boxed or otherwise mixed with other batches the loss may be even greater. Even more serious is the possibility that products which are only slightly underprocessed may go undetected and become a health hazard.

The internal pressures which occur during and immediately after heat processing are sufficient to cause serious strains on canned fish containers. During the actual heating period the steam pressure in the retort presses the exterior surfaces of the container, opposing and, in effect, neutralizing the water vapour pressure within the container. Even so, there may still be a very substantial unbalanced internal pressure exerted by the air enclosed in the container. The air which is at atmospheric pressure or lower at the time the container is sealed will greatly increase in pressure not only because its temperature is raised but also because it will be compressed by the expansion of the solid and liquid contents. Obviously this internal pressure will be greater if there is little or no vacuum or if the headspace is very small.

The internal pressure from entrapped gas is sufficient to distort some types of aluminium containers or damage their seams. It will also force the cover off many types of glass containers. To avoid this, canned fish in aluminium or glass containers is heat processed in special retorts using superheated water under sufficient pressure to balance the pressure inside the container. At the end of the heating process cool water is gradually introduced into the retort and the overpressure is reduced slowly as the product is cooled.

In the conventional steam retort, the most critical stresses occur at the moment the steam pressure on the retort is relieved at the end of the process. By this time the canned fish will be thoroughly heated and the pressure of gas and water vapour within the container will be somewhat greater than the opposing steam pressure. If the steam pressure is suddenly released the stress from the internal pressure may become so great that the containers will be permanently distorted or the seams damaged.

Small steel (tinplate) containers are usually capable of withstanding this stress if the steam pressure is reduced slowly, but larger containers should be cooled enough to relieve the internal stresses before the external pressure is removed. During this process, known as pressure cooling, the pressure is maintained either by air or by steam. If steam is used it is introduced at the top of the retort which is gradually flooded with cooling water introduced below a layer of condensate.

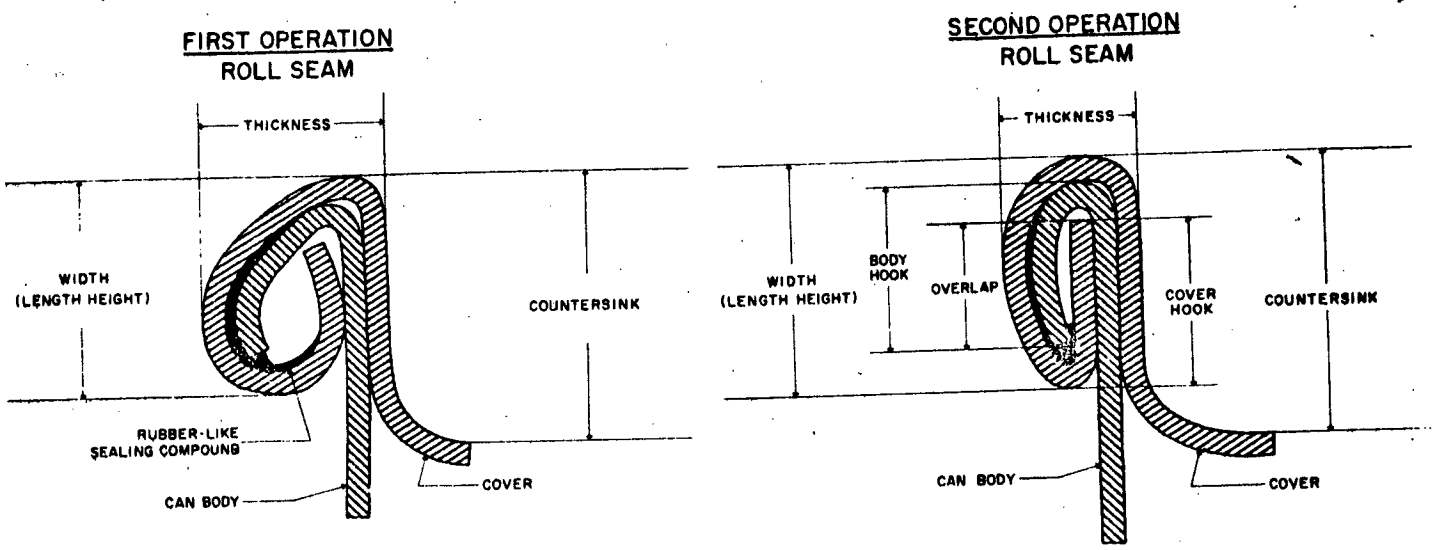
It has been mentioned earlier that the seams or other closures of canned fish containers may sometimes leak momentarily during stress from thermal or mechanical shock such as may occur if cooling is done quickly with water. If there is a partial vacuum in the container at the time this momentary leak occurs a small amount of air or water will enter and there is a risk that the contents may become recontaminated with micro-organisms which will cause spoilage or which may be harmful.

For this reason, it is very important that the water used for cooling heat processed canned foods should be of potable quality. A small free chlorine content should be maintained so that there is no build up of micro-organisms in water which is used for cooling either in retorts or in cooling tanks outside the retort. Water cooling should be stopped while the product is still warm enough for the container surfaces to dry off fairly quickly.

Aside from the necessity of relieving strains by reducing the pressure within the container, reasonably quick cooling is often required to prevent the retained heat from adversely affecting the flavour, colour or texture of the product. This effect, which is called stack-burn may occur if canned products that have not been water-cooled are put into cases while still hot or are stacked close together so that the heat is retained for a long time.

ANNEX II

Schematic Diagram of "Double Seam"



ANNEX III

References to Related Codes and Standards

FAO 1974	Code of Practice for Fresh Fish	CX/FFP 75/3
FAO 1972	Code of Practice for Frozen Fish	CX/FFP 73/5
FAO/WHO	Recommended International Standard for Canned Pacific Salmon	CAC/RS 3-1969
FAO/WHO	Recommended International Standard for Canned Shrimps or Prawns	CAC/RS 37-1970
FAO/WHO	Recommended International Standard for Canned Tuna and Bonito in Water or Oil	CAC/RS 70-1974 (to be issued shortly)
FAO/WHO	Recommended International Code of Practice - General Principles of Food Hygiene	CAC/RCP 1-1969 (to be revised)
FAO/WHO	Food Standards for: - Canned Crab Meat - Canned Mackerel and Jack Mackerel - Canned Sardines and Sardine-type Products	under elaboration
WHO	International Standards for Drinking Water	latest edition
FAO/WHO 1974	Fish and Shellfish Hygiene	WHO/TRS/550
	Code of Practice for Shrimps or Prawns	CX/FFP 75/7
	Code of Practice for Lobsters and Related species	(in process)
	Code of Practice for Smoked Fish	CX/FFP 75/6
	Code of Hygienic Practice for Molluscan Shellfish	ALINORM 76/13A App. V.

Draft Code of Hygienic Practice for Low-acid Canned Foods.

Section I. Scope

This code of practice is concerned with the canning and safe heat processing of low-acid foods packed in hermetically sealed containers. Excluded are those foods which have only been pre-cooked or pasteurized and therefore require refrigeration.

Section II. Definitions

1. Aseptic processing means the filling of a commercially sterilised product into presterilised containers followed by hermetically sealing with a presterilised closure in an atmosphere free of microorganisms.

2. Bleeders means small vents through which steam escapes throughout the entire heat process. Bleeding provides a circulation of steam within the retort and ensures the elimination of any air which may enter with the steam.

3. Broken heating curve - heating data showing that the product changes its heating pattern as shown by two heating curves at different rates when the heat penetration data is plotted against time on semi-log graph paper.

4. Canned means product packed in containers which have been hermetically sealed and sufficiently heated to destroy or inactivate all microorganisms that are able to grow in the product at temperatures at which the canned product is normally likely to be held.

5. Cleaning means the removal of residues from equipment after processing, and of objectionable matter from production surfaces, raw material or product.

6. Coming-up-time means the time which elapses between the introduction of steam into the closed retort and the time when the temperature in the retort equals that of the required processing temperature.

7. Commercial sterility of food means the condition achieved by application of heat which renders such food free of viable forms of microorganisms having public health significance, as well as any microorganisms of non-health

significance capable of reproducing in the food under normal conditions of storage and distribution. Commerical sterility of equipment and containers used for aseptic processing and packaging of food means the condition achieved by application of heat, chemical sterilant(s), or other appropriate treatment which renders such equipment and containers free of viable forms of microorganisms having public health significance as well as any microorganisms of non-health significance capable of reproducing in the food under normal non-refrigerated conditions of storage and distribution.

8. Cooling time means the time necessary to cool the contents of a container from the sterilisation temperature to the temperature at which the product is removed from the retort.

9. Disinfection means the application of effective chemical or physical agents or processes to clean surfaces with the intention of eliminating microorganisms and preventing infection of food products.

10. Flame sterilizer means an apparatus in which hermetically sealed containers are agitated at atmospheric pressure, by either continuous, discontinuous, or reciprocating movement, over gas flames to achieve sterilisation temperatures. A holding period in a heated section may follow the initial heating period.

11. Headspace means the volume in a closed container not occupied by the product.

12. Heat process means the treatment of product with sufficient heat to destroy or inactivate all microorganisms that will grow under normal conditions of storage and distribution. The heat process is defined in terms of time of treatment and a specified temperature.

13. Hermetically sealed container means a container which is designed and intended to be secure against the entry of microorganisms during and after processing.

14. Holding time, see sterilisation time.

15. Incubation tests are tests in which the product is kept at a specific temperature for a specified period of time in order to determine if the outgrowth of microorganisms occurs under these conditions.

16. Initial temperature means the average temperature of the contents of the coldest container to be processed at the time the sterilising cycle begins, as determined after thorough stirring or shaking of the contents.

17. Lot means the product produced during a period of time indicated by a specific code mark.

18. Low acid foods means any foods, other than alcoholic beverages, with a finished equilibrium pH value greater than 4.6.

19. Potable water means fresh water fit for human consumption. Standards of potability should not be lower than those contained in the latest edition of the "International Standards for Drinking Water", World Health Organization.

20. Retort means a pressure vessel designed for heat processing food packed in hermetically sealed containers either by saturated steam or by heated water with superimposed air pressure.

21. Scheduled process means the process selected by the processor as adequate under the conditions of manufacture for a given product to achieve commercial sterility.

22. Simple heating product a product that heats in a continuous pattern as shown by a simple heating curve or straight line curve when heating data is plotted against time or semi-log graph paper.

23. Sterilisation temperature means the temperature at which the retort is kept for a specific time after the coming-up-time. Normally this is the highest temperature in the process indicated by the mercury in glass thermometer.

24. Sterilisation time is the time between the moment that the required sterilisation temperature is achieved and the moment that the cooling is started.

25. Venting means the process of flushing the air out of steam retorts at the beginning of a heat process by the means of openings controlled by adequate valves. It is done by allowing large volumes of steam to flow through the retort

to drive and carry the air out through open vents at the top of the retort.

26. Water activity or a_w means the vapour pressure of the food product divided by the vapour pressure of pure water under identical conditions of pressure and temperature.

Section III. Raw Material Requirements

A. Environmental Sanitation in Growing and Raw Food Material Production Areas

(1) Sanitary disposal of human and animal wastes as in the General Principles of Food Hygiene.

(2) Sanitary quality of irrigation water as in the General Principles of Food Hygiene.

(3) Animal, plant pest and disease control as in the General Principles of Food Hygiene.

B. Sanitary Harvesting and Production of Raw Food Materials

(1) Equipment and product containers as in the General Principles of Food Hygiene.

(2) Sanitary techniques as in the General Principles of Food Hygiene.

(3) Removal of obviously unfit materials as in the General Principles of Food Hygiene.

(4) Protection of product from contamination as in the General Principles of Food Hygiene.

C. Transportation

(1) Facilities as in the General Principles of Food Hygiene.

(2) Handling procedures as in the General Principles of Food Hygiene.

Section IV. Plant Facilities and Operating Requirements.

A. Plant Construction and Layout

(1) Location, size and sanitary design

(a) Location. The building and surrounding area should be such as can be kept reasonably free of objectionable odours, smoke, dust or other contamination.

(b) Size. Canning operations should be planned and designed to have sufficient capacity to process the food at the foreseeable average rate of daily delivery and should not be operated beyond their full rated capacity for any extended period of time. Otherwise it is likely that delays will occur in those areas where the food is vulnerable to contamination, growth of microorganisms or other forms of deterioration.

The design should allow for normal maintenance work to take place without disturbance of normal production and there should be provisions to cope with normal break-downs of machinery without significantly delaying the process.

(2) Sanitary design

(a) The building should be sufficient in size without crowding of equipment or personnel. The production lines should preferably be easily accessible from all sides in order to permit adequate inspection, maintenance and cleaning.

The building should be of sound construction kept in good repair and protect against the entrance and harbouring of insects or birds or vermin.

Wood work should preferably not be used. If its use is unavoidable it should be easy to clean, well painted and tight fitting to the other materials.

(b) Floors in processing areas should be hard surfaced, non-absorbent and adequately drained. They 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 towards a drainage channel.

The junctions between the floors and walls should be

impervious to water and, if possible, should be coved or rounded for ease of cleaning.

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

(c) Drains should be of an adequate size, suitable type, equipped with traps and with removable grating to permit cleaning. Suitable and adequate drainage facilities should be provided for removal of liquid or semiliquid wastes from the plant. There should be no floor areas where water may collect in stagnant pools. Drains should be constructed of smooth and impervious material and should be designed to carry 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 a minimum internal diameter of 10 cm (4 in.) 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 specifications and approved by the authority having jurisdiction.

(d) Internal walls of processing areas should be smooth, waterproof, resistant to fracture, light coloured and readily cleanable. Acceptable materials for finishing inside walls are for instance 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 be coved or rounded to facilitate cleaning.

Walls should be free from projections and all pipes and cables should be sunk flush with the wall surface or neatly boxed in.

(e) Window sills should be kept to a minimum size, be sloped inward at 45° and preferably be at least 1 metre (3 ft) from the floor. They should be made of a 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 so constructed as to facilitate cleaning. Windows should be filled with whole panes and those which open should be screened. The screens should be constructed so as to be easily removable for cleaning and should be made from suitable corrosion-resistant material.

(f) All doors through which the product is moved should be sufficiently wide, well constructed of a suitable material and should be of a self-closing type. They should be either of corrosion-resistant material with adequate impact resistance and unless provided with an effective air screen, should be of a self-closing type. It might be advisable to have a transparent section in the door, by which collisions between personnel or transport vehicles may be avoided.

Both the doors and the frames of the doorways should be of a smooth and readily cleanable surface.

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

(g) Ceilings should be designed and constructed to prevent accumulation of dirt and condensation and should be easy to clean. They should be at least 3 metres (10 ft) in height, free from cracks and open joints and should be of a smooth, waterproof, light coloured finish. In buildings where beams, trusses, pipes or other structural elements are exposed, the fitting of a suspended ceiling below such elements is desirable.

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

(3) Sanitary facilities and controls

(a) Separation of processes

Areas where raw materials are received or stored should be so separated from areas in which final product preparation or packaging is conducted as to preclude contamination of the product ready for filling. Areas and compartments used for storage, manufacture or handling of edible products should be separate and distinct from those used for inedible materials. The food handling area should be completely separated from any part of the premises used as living quarters.

The layout of the factory should be such that the product passes from department to department without the possibility of inter-change of product or production tools from an earlier stage in the process with a later one, i.e. one way system.

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

(b) Water supply

An ample supply of cold water should be available and an adequate supply of hot water at a temperature of 80°C (176°F) should be available at all times during the plant operation. The water should be of potable quality. Standards shall not be less than those contained in the "International Standards for Drinking Water", World Health Organization.

(c) Ice as in the General Principles of Food Hygiene.

(d) Auxiliary water supply as in the General Principles of Food Hygiene.

(e) Plumbing and waste disposal

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

All lines should be watertight and have adequate deep seal traps and vents. Disposal of waste should be effected in such a manner as not to permit contamination of potable water supplies. Sumps or solid matter traps of the drainage system should preferably be located outside the processing area and so designed as to allow them to be emptied and thoroughly cleaned at the end of each working day.

The plumbing and the manner of waste disposal should meet the requirements of the official agency having jurisdiction.

(f) Lighting and ventilation

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

Special attention should be given to the venting of areas and equipment producing excessive heat, steam,

obnoxious fumes, vapours or contaminating aerosols. The air-flow in the premises should be from the more hygienic areas to the less hygienic areas. Good ventilation is important to prevent condensation and growth of moulds in overhead structures.

Ventilation openings should be screened and, if required, equipped with proper air filters.

Windows which open for ventilation purposes should be screened. The screens should be made easily removable for cleaning.

A minimum illumination of 220 Lux (20 foot candles) in general working areas and not less than 540 Lux (50 foot candles) at points requiring close examination of the product should be provided and should not alter colours.

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

(g) Toilet facilities

Toilet rooms should have walls and ceilings of a smooth, washable, light coloured surface and floors constructed of impervious and readily cleanable material. Toilet facilities should be well lit, ventilated and kept in a sanitary condition at all times. Adequate supplies of toilet paper should be available in each toilet cubicle.

The doors leading to the toilet rooms should be of a self-closing type and should not open directly into the food processing areas. The hand washing facilities in the toilet rooms should be a type not requiring operation by hand and should have an adequate supply of hot and cold water of potable quality and liquid and powdered soap should be provided.

Notices should be posted requiring personnel to wash their hands after using the toilets.

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

1 to 9 employees: 1 toilet

10 to 24 employees: 2 toilets

25 to 49 employees: 3 toilets

50 to 100 employees: 5 toilets
for every 30 employees over 100 - 1 toilet

Modifications may be necessary where employees include both males and females.

(h) Hand-washing facilities

In addition to hand washing facilities available in toilet rooms a number of sanitary washbasins with an adequate supply of hot and cold water of potable quality and liquid or powdered soap should be provided wherever the process demands. They should be located in full view of the processing floor and should be of a type not requiring operation by hand or be fed by a continuous flow of potable fresh water. Single use towels are recommended, otherwise the method of drying hands should be acceptable to the official agency having jurisdiction. The facilities should be kept in a sanitary condition at all times.

(i) Accommodation for clothing and footwear

Suitable and sufficient accommodation for keeping clothing and footwear not worn during working hours should be provided. Such accommodation should be separate from any processing room.

B. Equipment and Utensils

(1) Materials as in the General Principles of Food Hygiene.

(2) Sanitary design, construction and installation

Equipment and utensils should be so designed and constructed as will prevent hygienic hazards and permit easy and thorough cleaning and disinfecting. Stationary equipment should be installed in such a manner as will permit easy and thorough cleaning.

Canneries should have suitable conveyor systems to transport empty containers to the filling stations, without exposure to contamination. Storage arrangements should be such that containers are not moved out of their clean, dry storage until just before they are needed for filling.

Wrapping material, cartons and labels should be stored separately from the containers.

(3) Equipment and utensils

(a) Equipment for inedible materials as in the General Principles of Food Hygiene.

(b) Facilities for washing and disinfection of equipment

Facilities should be present in every cannery for cleaning and disinfection of trays, cutting boards, containers and other similar equipment and working implements. Such facilities should be located in a separate room or in a designated area where there is an adequate supply of hot and cold water of potable quality, under good pressure, and where there is proper drainage. Any containers and equipment used for offal or contaminated materials should not be washed in the same area.

(c) Retort

The essential part of the process in each cannery is the heat treatment given to the product, which should make it safe and shelfstable. Although this preservation technique is widely applied successfully, it is a very critical operation, which should only be carried out with approved equipment, by well-trained operators and under supervision of experts. Moreover retorts are pressure vessels and as such must be designed, installed, operated and maintained in accordance with the local safety standards for pressure vessels. To ensure the safe heat processing of the product every retort should be fitted with an easily readable mercury-in-glass thermometer whose accuracy is checked on installation and at least once a year or as necessary thereafter and which should be the reference instrument for the process; a temperature recording device that makes a permanent record and whose accuracy is checked regularly; a pressure gauge; a steam controller which may be a recording-controlling instrument when combined with a recording device; a steam inlet to provide sufficient

steam for the proper operation of the retort; crate supports; steam spreaders; bleeders; stacking equipment for crates etc. holding containers; vents of dimensions adequate to ensure removal of air in the retort prior to processing. Retort equipment should meet the requirements of the agency having jurisdiction.

C. Hygienic Operating Requirements

While additional and more specific requirements may be established for certain products, the following should apply as minimal in all canneries.

1. Sanitary maintenance of plant, facilities and premises

The building, equipment, utensils and all other physical facilities of the plant should be kept in good repair and should be kept clean and maintained in an orderly, sanitary condition. Waste materials should be frequently removed from the working area during plant operation and adequate waste receptacles should be provided. Detergents and disinfectants employed should be appropriate to the purpose and approved by the agency having jurisdiction.

2. Vermin control

An effective and continuous programme for the control of insects, rodents, birds or other vermin within the establishment should be maintained. The cannery and surrounding area should be regularly examined for evidence of infestation. Where control measures are necessary, treatment which chemical, biological or physical agents should be undertaken only in accordance with the recommendations of the appropriate official agency having jurisdiction and by or under the direct supervision of personnel with a thorough understanding of the hazards involved, including the possibility of toxic residues being retained by the products.

3. Exclusion of domestic animals as in the General Principles of Food Hygiene.

4. Personnel health as in the General Principles of Food Hygiene.

5. Toxic substances as in the General Principles of Food Hygiene.

6. Personnel hygiene and food handling practices as in the General Principles of Food Hygiene.

D. Operating Practices and Production Requirements

(1) Raw material handling

(a) Acceptance criteria as in the General Principles of Food Hygiene.

(b) Storage as in the General Principles of Food Hygiene.

(c) Water as in the General Principles of Food Hygiene.

(2) Inspection and sorting as in the General Principles of Food Hygiene.

(3) Washing or other preparation as in the General Principles of Food Hygiene.

(4) Preparation and processing as in the General Principles of Food Hygiene.

(5) Packaging of finished product

(a) Materials

(i) Packaging materials. These should be stored in a clean and sanitary manner and should not transmit to the product objectionable substances beyond limits acceptable to the official agency having jurisdiction and should provide appropriate protection from contamination.

(ii) Containers. The main functions of a container is the protection of the contents against spoilage. Containers should therefore meet the following general requirements.
They should protect the contents from contamination by microorganisms or any other substance;
Their inner surfaces should not react with the contents in any way that would adversely affect the product or the containers under normal storage conditions;
The outer surfaces should be resistant to corrosion under any likely conditions of storage;

They should be sufficiently durable to withstand the mechanical and thermal stresses encountered during the canning process and to resist physical damage during distribution;

(b) Techniques

(i) Inspection of empty containers

In most instances containers are clean when they are delivered to canneries and if properly handled and stored they will not usually need to be washed before use. However, all containers and covers should be inspected carefully for cleanliness and if any are found not to be clean the whole lot should be washed or effectively cleaned in some other way before they are used. In washing glass containers care must be taken to avoid breakage through rough handling or thermal shock.

It is advisable to have all containers turned upside down to make certain that they do not contain any foreign material before they are used. This is particularly important in the case of glass containers which might possibly contain fragments of glass which are difficult to see and so might otherwise go undetected. If containers are delivered to filling machines or packing tables by conveyor, it is usually possible to have them inverted mechanically during their travel.

Care should also be taken to remove faulty containers. These include containers that have been dented or pierced, containers with defective side or bottom seams or with scratches or flaws in their enamel. If these are filled, material will be wasted and there is always a danger of damaged containers jamming a filling or sealing machine and necessitating a shut-down. Slightly faulty containers may also cause trouble by becoming leakers during or after they have been filled, heat processed and stored.

Covers for containers which are to be opened with keys or by pull tabs should be examined carefully to ensure that the scoring is evenly done and deep enough for the container to be opened easily but not so deep that the cover will tear during sealing, heat processing or under the mechanical strains the container would normally encounter during distribution.

(ii) Precautions should be taken to ensure that containers for canned food are used only for their intended purpose.

Containers should not be used for any purpose other than packing food. There is always a temptation to take containers for use as ash trays, small waste containers, receptacles for small machine parts or for other similar purposes. This should be avoided because there is a considerable risk that such containers may accidentally find their way back onto the production line and result in the packing of food in the same container with very objectionable or possibly dangerous material.

(iii) Empty containers should be removed from the packing room and from conveyors to the filling machines before the cannery is washed down between shifts and at the end of a processing period

If containers are left on the packing tables or in conveyor systems during clean-up, they are likely to become splattered with dirty water or debris, particularly if high pressure hoses are used in cleaning.

It is usually possible to anticipate the shutdown and control the flow of containers to the filling machines or packing tables so that few are left in the conveyor lines or in the racks when the operation stops. Those left should be either removed or so shielded that they will not become contaminated or obstruct the cleaning.

(iv) Filling of containers

Food products are natural products and considerable differences in shape, weight or volume of the same product may occur. The filling of such a product into a container of fixed dimensions may often cause problems, because also net weight, drained weight or number of individual items contained must be specified on the label. It is important to achieve a constancy of filling not only for economical reasons, but also for reasons that heat penetration and headspace may be adversely affected. A minimum headspace volume is necessary to compensate for the difference in thermal expansion between container and contents. Too big a headspace will cause dented and stressed cans and may also affect the product due to oxidation reactions or relative movement inside the container during transport.

In rotationally processed containers the headspace should be accurately controlled and sufficient to ensure consistent and adequate mixing of contents.

(v) Sealing

Sealing the container is one of the most critical processes in canning. Seams should be tight and secure and meet requirements of agency having jurisdiction. Improperly seamed product may become contaminated with spoilage or disease causing microorganisms during storage. It is therefore necessary to give particular attention to the operation and maintenance of sealing equipment and to the routine inspection of containers after sealing.

Sealing machines designed or adjusted for one type of container should not be used to close another type without being modified or readjusted as necessary. Because of differences in the metal the tools required for forming seams in aluminium

containers are usually slightly different than those used for closing similar tinplate containers. Whatever the type of sealing equipment, the manufacturer's instructions concerning its operation, maintenance and adjustment should be followed meticulously. Metal container manufacturers are usually ready to make detailed recommendations not only on the adjustment and operation of the sealing machine, but also for the examination of finished seams.

Such examination will include: frequent visual inspection of seams and also immediately following a jam in closure machines; regular measurement of seam dimensions and the stripping of seams should be carried out to see that they are properly formed.

Regular and careful examination of seams will usually lead to the discovery of worn parts or bad adjustment of closing machines before the fault becomes so serious that the seams are not acceptable. See Appendix I.

(vi) Coding

Each container should be marked with an identifying code which should be permanently visible to the naked eye. Where the container does not permit the code to be embossed or inked, the label can be legibly perforated or otherwise marked, provided that the label is securely affixed to the product container. The code should identify the establishment where packed, the day packed and the period of the day during which the product was filled into the container. The filling period code should be changed with sufficient frequency to enable ready identification of lots during their sale and distribution. Codes may be changed on the basis of one of the following: intervals of every 4 to 5 hours, personnel shift changes or new production batches.

Large canneries may find it useful to have a coding from which the particular processing line or sealing machine can be identified. Such a system, supported by adequate cannery records, can be very helpful in any investigation to discover the causes when a canned product is found to be poor in quality.

(vii) Washing

Where necessary, pressurized water sprays at adequate temperatures will remove the product which is adhering to the outside of the container after filling and closing. After sterilisation it may be much more difficult to clean the containers and in cases of recirculated cooling water it will help to reduce the chlorine consumption and solid waste removal.

(6) Preservation of finished products

(a) General considerations

Low-acid foods with pH values above 4.6 may be able to support the growth of many kinds of microorganisms including the heat resistant sporeforming bacteria such as Clostridium botulinum. The degree of heat treatment required to make such foods commercial sterile depends on the storage temperature, the presence of various preservatives and composition of the product. It is absolutely necessary to establish the required heat treatment with accepted scientific methods.

It should be emphasized that the adequate heat processing of low-acid foods is a very critical operation, where great risks are involved with respect to public health and where also appreciable losses of finished product may occur due to under-sterilisation.

Scheduled processes for low-acid foods should be established by qualified persons having expert knowledge of thermal processing and having adequate facilities for making such determinations.

(b) Establishing scheduled processes

The procedure to establish the required heat treatment for a product can be divided into two steps.

First the required sterilisation treatment should be established on the basis of the following information:

- pH of the product;
- Levels and types of preservatives;
- Water activity;
- Maximum storage temperature of the product.

In the second step, the heat penetration into the product has to be determined under those adverse conditions that are likely to be met in production. For that purpose the temperature in the coldest spot in the product in the container should be followed during a heat process and from the obtained temperature-time graph the scheduled process can be determined. It is necessary to carry out a sufficient number of heat penetration experiments to determine accurately the sterilisation treatment.

If this heat penetration data has been obtained from experiments in so called laboratory simulators, it is necessary to check the results in the production retort, because there may be unexpected deviations in the heating-up time, temperature distribution and cooling time in the production retort.

In the cases where only the size of the container or steriiisation temperature or initial temperature will have to be changed in an existing process, the heat penetration data of the original product can be used to calculate the process parameters of the new situation.

The result of the thermal process determinations should be translated into a scheduled thermal process containing as a minimum the following data:

- Product code
- Can size
- Retort number
- Initial temperature

Sterilisation temperature

Heating-up time

Sterilisation time

Cooling time

Rotations per min. (for rotational sterilisation only)

Venting procedure.

The product code should, without any misunderstanding, correspond with a complete and accurate product specification containing at least the following data: weight, headspace, drained weight, number and maximal dimensions of particles larger than 0.5 cm, temperature of product at filling, consistency, product formulation. Small deviations from the product specification which may seem negligible to the processing people can cause serious deviations in the heat penetration properties of the product. Thus, any changes in product specifications will require re-establishment of the process.

Complete records concerning all aspects of the establishment of the process and associated incubation tests should be permanently retained by the person or organisation making the determination.

Scheduled processes and venting procedures to be used for each product and container size being packed should be posted in a conspicuous place near the processing equipment or should be made readily available to the retort or processing system operator and to the agency having jurisdiction.

(c) Operations in the thermal processing room

Properly established heat processes must be used. Retorts should be operated only by properly trained personnel.

It is extremely important that the heat processing is carried out by operators under the supervision of personnel who understand the principles of sterilisation and who realise the need to follow thermal processing instructions closely.

Heat processing should be commenced as soon as possible after closing to avoid contamination or growth of microorganisms. If during breakdowns the production rate is low, the product should be processed in partly filled retorts, rather than kept for a long period until a complete retort load is prepared. In this case the scheduled process required for adequate sterilization may be changed. Therefore, where necessary, a separate scheduled process should be established for partly filled retorts.

All retort baskets, trucks, cars, or crates containing unretorted food product or some of the containers on the top of each basket should be plainly and conspicuously marked with a heat sensitive indicator, or by other effective means, which will visually indicate to thermal processing personnel whether or not each such unit has been retorted.

The initial temperature of the contents of the coldest containers to be processed should be determined and recorded with sufficient frequency to ensure that the temperature of the product is no lower than the minimum initial temperature specified in the scheduled process.

A clearly visible clock should be installed in the retorting room and times should be read from this instrument and not from wrist watches etc.

Permanent records of time, temperature, code mark and other pertinent details should be kept concerning each load.

Such records would be very useful in providing management with a check on processing operations and will be invaluable if some question arises as to whether certain lots had received adequate heat processing. These records should be made by the retort or processing system operator or other designated person, on form which should include:

the code number, the retort or processing system number, the container size, the approximate number of containers per coding interval, the minimum initial temperature, the

actual processing time and temperature, the mercury-in-glass and recorder thermometer readings, and other appropriate processing data (see below). Closing machine vacuum (in vacuum-packed products),

or other critical factors specified in the scheduled process should also be recorded. In addition the following records should be maintained:

(1) Still retorts: Time steam on venting time and/or temperature to which vented (as applicable); time for temperature to attain processing temperature level; processing temperature level and time steam off;

(2) Agitating retorts: As for still retorts with additions of functioning of condensate bleeder; retort speed. It is important to also record headspace, consistency, maximum drained weight, minimum net weight, and percent solids.

(3) Hydrostatic retorts: The temperature in the steam chamber between the steam-water interface and the lowest container position; speed of the container conveyor chain; and, where the scheduled process specifies maintenance of particular temperatures in the hydrostatic water legs, the temperatures near the top and the bottom of each hydrostatic water leg.

(4) Aseptic processing and packaging systems: Product temperature in the holding tube outlet as indicated by the temperature indicating device and the temperature recorder; product temperature in the final heater outlet as indicated by the temperature recorder-controller; differential pressure as indicated by the differential pressure recorder-controller, if a product-to-product regenerator is used; product flow rate, as determined by the metering pump or by filling and closing rates; sterilization media flow rate and/or temperature; retention time of containers and closures where applicable, in the sterilizing environment; and, where a batch system is used for container and/or closure sterilization, sterilization cycle times and temperatures.

(5) Flame sterilizers: Container conveyor speed; surface temperature at the end of the holding period; nature of container.

(d) Cooling

Only with relatively small mild steel cans is it possible to cool the cans with water under atmospheric pressure. For larger mild steel cans and all other type of containers it is necessary to apply an extra pressure to compensate for the internal pressure inside the can at the beginning of cooling, otherwise the containers may deform or leak. This extra pressure may be achieved by introducing water or air into the retort under pressure.

Glass containers are very sensitive to temperature shocks so that at the beginning of cooling, either water with a temperature slightly lower than the contents is introduced into the retort, or cold water is pumped into the bottom part of the retort at such a rate that a slightly colder zone of water gradually moves towards the top of the retort.

Although the containers normally may be considered as hermetically tight, a small number of containers may leak during the cooling period due to mechanical stresses. The vacuum inside the can will promote the penetration of minute amounts of cooling water into the container. This is the reason that cooling water should be at least of potable quality, and preferably should be chlorinated. Where cooling water is chlorinated in the plant, there should be a sufficient contact time to reduce the microbial content of the water to a level which will not lead to contamination of the can contents during cooling. In many parts of the world a 20 minute time is considered adequate. Checks should be made to ensure the presence of free chlorine at all cooling water outlets. Where the water is recirculated, it should be filtered to remove organic matter and re-chlorinated.

Other safe chemical or physical treatment which are equivalent to chlorination in its bactericidal effect may be used.

To avoid the growth of themophylic microorganisms, it is necessary to cool containers in such a way that the temperature of the contents passes the range 60° - 30°C as fast as possible. In practice , the containers are cooled in water to an average temperature of the contents

of 40°C and then in air. At this temperature the adhering waterfilm evaporates sufficiently fast to prevent corrosion and to allow labelling without problems.

(7) Storage and transport of finished product

Heat processed canned products should be handled with care and preferably not by hand as long as the seams are still wet. Mechanical shocks may cause the container momentarily to leak and the vacuum in the can may allow infected liquid in the seam area to be sucked into the container. Conveyors and other equipment for handling the containers should therefore be kept clean, disinfected and dry. Cylindrical cans should preferably not be rolled on their double seams.

The materials used for labelling and casing canned products should not be conducive to corrosion of the container. Tinplate may corrode if it is kept moist for a long time particularly in the presence of mineral salts or substances which are even very weakly alkaline or acidic. Labels or label adhesive which are hygroscopic and therefore liable to promote rusting of tinplate should be avoided as should pastes and adhesives that contain acids or mineral salts. Cases should be thoroughly dry. If they are made of wood it should be well seasoned. They should be the proper size so that the containers fit snugly and are not subject to damage from movement within the case. They should be strong enough to withstand normal transport.

Canned products should be stored so that they will be kept dry to prevent the containers from corrosion. Also the mechanical properties of outer cartons etc. are adversely affected by moisture and the protection of the containers against transport damage may become insufficient.

The storage temperature should be such as to prevent deterioration of the product. Rapid temperature changes during storage should be avoided as this may cause the condensation of moist air inside the pack, and thus lead to container corrosion.

E. Sanitation Control Programme as in the General Principles of Food Hygiene.

F. Laboratory Control Procedures

In addition to any control by the official agency having jurisdiction, it is desirable that each plant in its own interest should have access to laboratory control of the sanitary quality of the products processed. The amount and type of such control will vary with the food product as well as the needs of management. Such control should reject all foods that are unfit for human consumption. Analytical procedures used should follow recognised or standard methods in order that the results may be readily interpreted. They should include provisions for can seam examination; see Annex I).

Section V. End Product Specification

Appropriate methods should be used for sampling and examination to determine the compliance with the following specifications:

a. To the extent possible in good manufacturing practice the products should be free from objectionable matter;

b. The products should not contain (a) any harmful micro-organisms or any other microorganisms capable of development under normal storage conditions or (b) any substances originating from microorganisms in amounts which may represent a hazard to health;

c. The products with an equilibrium pH above 4.6 should have received a processing treatment sufficient to destroy all spores of Clostridium botulinum, unless growth of surviving spores is permanently prevented by product characteristics other than pH;

d. The products should not contain any chemical pollutants in amounts which may represent a hazard to health;

e. The products should comply with the requirements set forth by the Codex Alimentarius Commission on pesticide residues and food additives as contained in permitted lists or Codex commodity standards, or should comply with the requirements on pesticide residues and food additives of the country in which the products will be sold.

ANNEX I

Inspection of can seams.

Regular observations should be made during production runs for gross closure defects; these should be done by qualified container closure inspection personnel. Such measurements and recordings should be made at regular intervals at each seaming station of each seaming machine. The frequency of determination depends on the throughput of the seaming machines in question. Additional inspections should be made immediately following a jam in a closure machine, after adjustment or after start up of a machine following a prolonged shut down.

In addition to visual inspections, teardown inspections shall be carried out and the results recorded. Any of the two following systems may be used:

(a) Micrometer measurement system:

At three points approximately 120° apart (excluding the side seam) the following dimensions should be determined (see diagram): cover hook, body hook, width (length, height) and tightness (observation for wrinkle). Also overlap, countersink and thickness may be measured.

(b) Seamscope projection system:

Body hook, overlap and tightness (observation for wrinkle) should be determined at two different locations, excluding the side seam. The overlap length can be calculated by the following formula:

CH + BH + T - W = Overlap

CH = cover hook

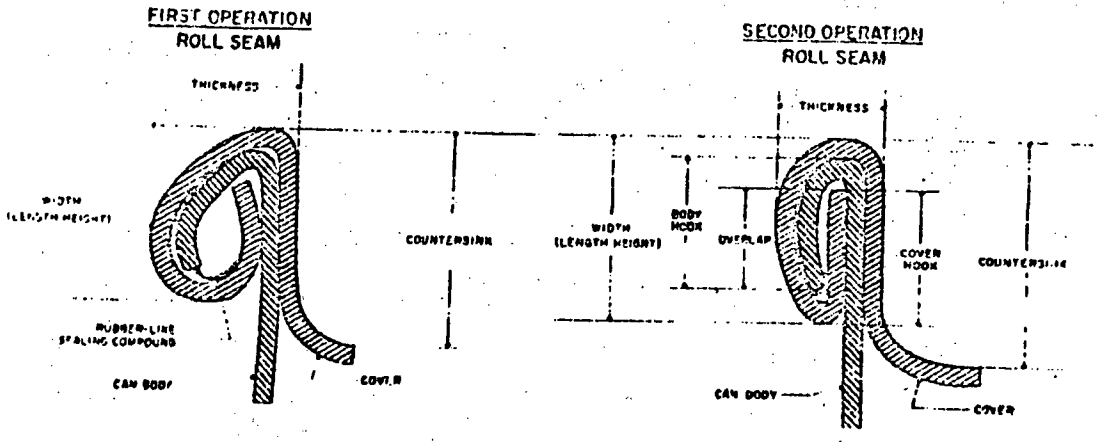
BH = body hook

T = cover thickness

W = seam width

The instructions of the container and seaming machine manufacturer should be accurately followed in the assessment of the results.

Schematic Diagram of "Double Seam"



ALINORM 76/13A
APPENDIX V

CODE OF HYGIENIC PRACTICE FOR FOODS FOR INFANTS AND CHILDREN

To be read in conjunction with the international code of practice "General Principles of Food Hygiene". Side-line positions indicate material which is particular to this Code of Hygiene Practice and therefore does not appear in the "General Principles of Food Hygiene"

Index

Section I - SCOPE

This Code of Hygienic Practice applies to all special food for infants and/or children.

It contains the minimum requirements of hygiene in the production, handling, packing, storage, transportation and preparation of special food for infants and/or children to ensure a healthful and wholesome supply of it.

Section II - DEFINITIONS

At present, a definition of the following terms appears to be necessary.

1. Child
2. Clean Area
3. Cleaning
4. Contamination
5. Controlling Authority
6. Disinfection
7. Edible Product
8. Establishment
9. Infant
10. Inspector
11. Manager
12. Potable Water
13. Protective Clothing
14. Residues

Section III - RAW MATERIAL REQUIREMENTS

A. General

All raw materials used for the manufacture of food for infants and/or children should, where applicable, comply with their appropriate Codes of Hygienic Practice. If no appropriate Code of Hygienic Practice exists, the "General Principles of Food Hygiene" should apply.

B. Environmental Sanitation in Growing and Raw Food Material Production Areas

1. Sanitary disposal of human and animal waste

Adequate precautions should be taken to ensure that human and animal wastes are disposed of in such a manner as not to constitute a public health or hygienic hazard and extreme

care should be taken to protect food from contamination with these wastes, particularly those food that may be consumed without heat treatment.

2. Sanitary quality of irrigation water

Water used for irrigation should not constitute a public health hazard to the consumer through the food.

3. Animal, plant pest and disease control

Treatment with chemical, physical or pharmaceutical agents should be carried out only in accordance with the recommendations of the controlling authority, by or under the direct supervision of personnel with a thorough understanding of the hazards involved, including the possibility of unwanted or even harmful residues being retained by the raw material.

C. Sanitary Harvesting and Production of Raw Food Material

1. Unwanted Substances

For the production of food for infants and children, no raw materials should be taken which contain residues or other objectionable substances in a concentration believed to constitute a health hazard for infants and children.

2. Health of food producing animals

Food of animal origin should only be derived from healthy stock.

3. Equipment and containers

Equipment and containers should not constitute a hazard to health. Containers which are re-used should be of such material and construction as will facilitate thorough cleaning, and should be so cleaned and maintained as not to constitute a source of contamination to the food.

4. Sanitary techniques

Harvesting and production operations, methods and procedures should be clean and sanitary.

5. Removal of obviously unfit raw material

Unfit materials should be segregated during harvesting and production to the fullest extent practicable and should be disposed of in such a place and in such a manner that they cannot result in contamination of the food and water supplies or other crops.

6. Protection of food from contamination

Suitable precautions should be taken to protect the raw material from being contaminated by animals, insects, vermin, birds, chemical or microbiological contaminants or other objectionable substances during handling and storage. The nature of the raw material and the methods of harvesting will indicate the type and degree of protection required.

7. Storage at the place of production

Raw material should be stored as the nature of the product requires it. The time of storage for perishable food should be as short as possible.

8. Quality

For the production of food for infants and children only raw materials should be used which are of the highest attainable hygienic quality.

9. Laboratory tests

Laboratory tests should be carried out on the raw materials prior to their being accepted by the establishment.

D. Transportation

1. Facilities

Conveyance for transporting the harvested crop or raw material from the production area, place of harvest or storage should be adequate for the purpose intended and should be of

such material and construction as will permit thorough cleaning and should be so cleaned and maintained as not to constitute a source of contamination to the food.

2. Handling procedures

All handling procedures should be such as will prevent the food from being contaminated. Extreme care should be taken in transporting perishable food to prevent spoilage or deterioration. Special equipment - such as refrigeration equipment - should be used if the nature of the food or distances involved so indicate. If ice is used in contact with food, it should be of sanitary quality as required in Section IV. A (3.5).

Section IV - ESTABLISHMENT FACILITIES AND OPERATING REQUIREMENTS

A. Establishment Registration, Construction and Layout

1. Registration

Establishments should be approved and registered by the controlling authorities. Approval and registration should only be given to those establishments which comply with the requirements of this code.

2. Localisation, size and sanitary design

2.1 Establishments should be located in areas not subject to regular and frequent flooding and free from objectionable odours, smoke, dust or other contaminants.

2.2 If the establishment is not in its own building or buildings, the layout should be as such that there is a strict separation between the establishment and the surrounding facilities.

2.3 Establishments should provide adequate working space for the satisfactory performance of all operations.

2.4 The construction should be sound and ensure adequate ventilation, good natural or artificial lighting and easy cleaning.

2.5 The buildings and facilities of the establishment should be kept in good repair at all times.

2.6 The establishment should be laid out and equipped so as to facilitate proper supervision of hygiene including performance of inspection and control.

2.7 The establishment should be of such construction as to protect against the entrance and harbouring of insects, birds, rodents or other vermin.

2.8 In every establishment there should be physical separations or other suitable arrangements so as to ensure a segregation in handling inedible and edible materials. The layout and construction should be of such nature that cross-contaminations between raw materials, semi finished food and finished food are impossible. The food handling area should be completely separated from any part of the premises used as living quarters.

2.9 In all clean areas:

(a) Floors should be of water-proof, non-toxic, non-absorbent materials, easy to clean and disinfect. They should be non-slip and without crevices and, except in the case of rooms where food is frozen, should slope sufficiently for liquids to be drained off to trapped outlets protected by a grill.

(b) Walls should be of water-proof, non-toxic, non-absorbent materials, which are easy to clean and disinfect, smooth and at a height appropriate to the operation conducted, they should be light coloured and washable. The angles between the walls and the angles at the wall floor junctions should be coved.

(c) Ceilings should be so designed and constructed as to prevent the accumulation of dirt and condensation and should be easy to clean.

(d) Windows should have no sills, but where they are unavoidable, these should be splayed at such an angle as to prevent collecting of dust and their use as shelves.

(e) Window frames and doors should be made of steel, aluminium or plastic instead of wood.

(f) Overhead steel platforms and stairs should not be equipped with grids but with welded non-slipping steel plates to prevent dirt from falling down and to facilitate cleaning.

2.10 Establishments should, if necessary, have a sufficient capacity in cooling and freezing space. The construction and layout of any cooling room or freezer should satisfy the requirements of this Code.

3. Sanitary facilities and controls

3.1 Separate rooms or areas should be provided for unpacking, washing or peeling of raw materials, as the case may be.

3.2 An always separate room should be used for that time only for the purpose of boning and trimming of meat, meat products and poultry, fish and game.

3.3 An always separate room should be used for that time only for the purpose of thawing of frozen meat, poultry, fish or game.

3.4 Water supply

An ample supply of /potable/ water under adequate pressure should be provided with adequate facilities for its storage and distribution and with adequate protection against contamination and pollution. The water supply should be of potable quality. An adequate supply of hot potable water not less than +82°C should be available at all times during the working hours.

3.5 Ice

Ice should be made from water of potable quality and should be manufactured, handled, stored and used, so as to protect it from contamination.

3.6 Auxiliary water supply

Non-potable water may be used for such purposes as producing steam, refrigeration and fire control. Such water should be carried in completely separate lines, identified preferably by colour and with no cross-connection or back siphonage with the lines carrying potable water.

3.7 All inedible materials resulting from the preparations and processing of food, refuse and rubbish should be removed promptly and in such a manner as to avoid contamination of edible products, potable water, equipment, floors or walls.

3.8 Plumbing and waste disposal

All plumbing and waste disposal lines (including sewer systems) must be large enough to carry peak loads. All lines must be watertight and have adequate traps and vents. Disposal of waste should be effected in such a manner as not to permit contamination of potable water supplies. The plumbing and the manner of waste disposal should be approved by the controlling authority. Drainage systems which include solid matter traps should be designed so as to allow them to be emptied. When located within or immediately outside the plant, solid matter traps should be emptied and cleaned as necessary and in accordance with the controlling authority.

3.9 Lighting

Premises should be well lit. Light bulbs and fixtures suspended over food in any step of preparation should be of the safety type or otherwise protected to prevent food contamination in the case of breakage. The illumination in any part of a workroom should be not less than 325 lux units (30 foot candles), and at points requiring close examination of the product they should be illuminated at an intensity of not less than 540 lux units (50 foot candles). Reflector filaments should be designed to allow easy dismantling, cleaning, and reassembling.

3.10 Ventilation

Adequate ventilation should be provided to prevent excessive heat, steam and condensation and ensure that the air of premises is not contaminated with odours, dust, vapour or smoke. Ventilation openings should be screened. Windows should be fitted with whole panes and those which open should be screened. The screens should be made so as to be easily removable for cleaning.

Where dry powdered raw materials are handled, special provisions such as suction hoods or room partitions should be used to prevent the spreading of dust.

3.11 Hand-washing facilities

All rooms used for handling of unpacked edible materials should be equipped with adequate facilities for washing hands, furnished with waste pipes leading to drains and conveniently located for the use of personnel during operations. The water used for the washing of hands should be warm. Taps of hand-washing facilities should be of a type not allowing operation by hand. An adequate supply of odourless liquid soap or other cleansing agents and suitable hygienic means of drying the hands should be provided. Where paper towels are used, a sufficient number of dispensers with paper towels and receptables for used towels should be provided adjacent to each washing facility.

3.12 Disinfection facilities

All clean areas should be equipped with adequate facilities for cleaning and disinfecting of working implements and equipment.

These facilities should be of such nature as to permit proper cleaning and disinfection. They should be constructed of corrosion-resistant materials and should be capable of being easily cleaned. Facilities for cleaning and disinfection of implements should be fitted with suitable means of supplying water in sufficient quantity at a temperature of not less than +82°C at all times while food is being handled in that part of the establishment.

3.13 Facilities for employees

Adequate changing room accommodation, drying room, lunch room, toilets with flushing water closets, showers and handwashing facilities should have adequate lighting, ventilation and heating, and should not open directly to any work areas. Waste from these facilities should not join the plant effluent system prior to the final save-all.

B. Equipment and Utensils

1. Materials

All food-contact-surfaces should be smooth, free from pits, crevices and loose scale, non-toxic, unaffected by food products, not transmitting odour or taste and capable of withstanding repeated exposure to normal cleaning and disinfection, non absorbent unless the nature of a particular and otherwise acceptable process renders the use of a surface, such as wood, necessary.

2. Sanitary design, construction and installation

Equipment and utensils should be so designed and constructed as will prevent hygienic hazards and permit easy and thorough cleaning. Stationary equipment should be installed in such a manner as will permit easy and thorough cleaning.

3. Equipment and utensils

Equipment and utensils used for inedible or contaminated materials should be so identified and should not be used for handling edible products.

3.1 Tanks and vessels

All surfaces in contact with food must be visible for inspection and readily accessible for manual cleaning. Bottoms may be of the cone type or may be even but angled by about 3-5° towards the front of the vessels. At their lowest point a drain cock should be provided.

Choosing mixing, blending and homogenizing equipment designs should be selected where it is unlikely for the food to come in direct contact with glands and bearings, which are often a serious source of contamination.

3.2 Piping

The design of the piping system should be such that stagnation of product residues in pipes, joints, valves and gauges cannot occur; these are some of the places where contamination is most likely to develop.

Pipe runs should be kept as short as possible, avoiding right-angled joints in order to facilitate cleaning; they should never run completely horizontal, but always slope towards a venting point with a recommended fall of 1 inch in 10 feet.

Cocks, valves and gauges should be accessible and easily disassembled for inspection and cleaning.

3.3 Pumps

Pumps should be so designed as to be readily disassembled for cleaning.

Shaft seals must be of the mechanical type and accessible for inspection, adjustment and maintenance.

Bearings should be located outside the food zone and be of sealed or self-lubricating type.

C. Hygienic Operating Requirements

1. Sanitary maintenance of plant, facilities and premises

1.1 The building, equipment, utensils and all other physical facilities of the plant should be kept in good repair and should be kept clean and maintained in an orderly, sanitary condition. Waste materials should be frequently removed from the working area during plant operation and adequate waste receptables should be provided.

1.2 All equipment, implements, tables, utensils should be cleaned at frequent intervals during the day and immediately and thoroughly cleaned and disinfected whenever they become contaminated. They should also be cleaned and disinfected at the conclusion of each work shift.

1.3 The manager should ensure that washing down, cleaning and disinfection are carried out in compliance with this Code.

/1.4 Food should not be contaminated during cleaning or disinfection of rooms, equipment, or utensils./

1.5 Where any container used in a clean area enters an area where inedible material is handled it should be cleaned and disinfected immediately before re-entering any clean area.

1.6 Any cooking or sterilisation of food should be carried out in separate areas suitably equipped for this purpose.

1.7 Detergents, sanitizing agents and disinfectants should conform to public health requirements and should not be allowed to come into contact with food. Any residues of these cleaning agents used for the washing of floors, walls or edible product equipment should be removed by thorough rinsing with potable water before the area or equipment is again used for handling food.

1.8 No cleaning preparation or material, or any paint likely to contaminate edible products should be used in any establishment where any food is or may be prepared, handled, packed or stored.

1.9 Except as required for purposes of hygiene no substance which may contaminate food should be handled or stored in any part of any establishment in which edible food is prepared, handled, packed or stored. However, materials employed in the construction or maintenance of an establishment may be used at any time when the inspector is satisfied that there would be no danger of contamination of food.

2. Pest Control

2.1 An effective and continuous programme for the control of insects, birds, rodents or other vermin within the establishment should be maintained.

2.2 Establishments and surrounding areas should be regularly examined for evidence of infestation with insects, birds, rodents or other vermin.

2.3 Should pests gain access to establishments, approved eradication measures should be instituted. The eradication of pests should always be carried out under skilled supervision and with the full knowledge of the inspector.

2.4 Only pesticides approved for use in an establishment by the controlling authority should be used in an establishment and the greatest care should be exercised to prevent any contamination of food. Pesticdes should only be employed if other precautionary methods cannot be used effectively.

2.5 Before pesticides are applied all food should be removed from the room and all equipment and utensils covered. After application the equipment and utensils should be thoroughly washed prior to being used again.

2.6 Pesticides or other toxic substances should be stored in separate rooms or locked cabinets and dispensed or handled only by authorized and properly trained personnel. Every precaution should be taken to avoid contamination of food.

3. Exclusion of domestic animals

Dogs, cats and other domestic animals, should be excluded from areas where food is handled or stored.

4. Personnel Health

4.1 Plant management should advise personnel that any person, afflicted with infected wounds, sores, or any illness, notably diarrhoea, should immediately report to management. Management should take care of ensure that no person, while known to be affected with a disease capable of being transmitted through food, or known to be a carrier of such disease-causing microorganisms, or while afflicted with infected wounds, sores, or any illness, is permitted to work in any area of a food plant in a capacity in which there is a likelihood of such person contaminating food or food-contact-surfaces with pathogenic organisms or objectionable matter.

4.2 No person who is suffering from any cut or injury should be engaged in any establishment in the preparation, processing, handling, packing or transportation of any food unless and until the cut or injury has been so treated or dressed that the discharge or blood into the food has been prevented.

4.3 It is recommended that national legislation should provide for a medical examination of food handlers, inspectors and other persons who have access to and come into contact with food in an establishment.

5. Personnel hygiene and food handling practices

5.1 Every employee should be taught the principles of hygiene and the relevant parts of this Code so as to be able to take the necessary precautions to prevent contamination of food.

5.2 Every person engaged in an establishment should wash his hands frequently and thoroughly with soap or detergents under running warm potable water while on duty. In each instance, hands should be washed before commencing work, immediately after using lavatory, after handling contaminated material, and whenever necessary. Notices requiring hand-washing should be displayed.

5.3 Every person engaged in an establishment should maintain a high degree of personal cleanliness while on duty, and should at all times while so engaged wear suitable protective clothing, including a head covering and footwear, all of which articles should be washable unless capable of being disposed of and which should be maintained in a clean condition consistent with the nature of the work in which the person is engaged. Aprons and similar items should not be washed on the floor.

5.4 Every person who visits an establishment should wear clean protective clothing.

5.5 No clothing or personal effects other than protective clothing should be deposited in any part of an establishment used for the preparation, processing, handling, storing, packing or transportation of edible products.

5.6 Protective clothing, and working implements may be left in a place provided for the purpose in such a manner that they will not contaminate any edible product.

5.7 Eating, use of tobacco or chewing gum, and spitting should be prohibited in any part of an establishment used for the preparation, processing, handling, storing, packing or preservation of food.

5.8 Gloves, if used in handling food, should be maintained in a sound, clean and sanitary condition; the wearing of gloves does not exempt the operator from having thoroughly washed hands. Gloves should be made of an impermeable material except where the use of such material would be inappropriate or incompatible with the work involved.

5.9 No person working in any establishment should wear any exposed bandage unless it is completely protected by a waterproof covering which is conspicuous in colour and is of such a nature that it cannot become accidentally detached.

5.10 Staff handling raw materials or semi-processed food should not come in contact with any finished products unless and until they discard all such protective clothing worn by them during the handling of raw materials and semi-processed food. Hands and arms, should always be washed thoroughly and disinfected after handling raw materials and semi-processed food prior to handling finished products.

5.11 If rapidly deteriorating food of animal origin has to be stored for any time longer than 30 minutes, the temperature of this food should never exceed +7°C, neither on the outside nor in the centre of the food.

D. Operating Practices and Production Requirements

1. General

Where the inspector considers that the manner under which food is being prepared, processed, handled, packed or stored, will adversely affect

(i) the safety of the food or
(ii) the cleanliness of the food or
(iii) the hygiene of production or
(iv) the efficiency of inspection.

he may require the manager to take action to correct the deficiency or to reduce the rate of production or to suspend operations for the time being in any specified section of the establishment.

2. Handling of Raw Material

2.1 Acceptance criteria

The raw material should not be accepted by the plant if known to contain decomposed, toxic or extraneous substances which will not be removed to acceptable levels by normal plant procedures of sorting or preparation.

2.2 Storage

Raw materials stored in the establishment should be maintained under conditions that will protect against contamination and infestation and minimize loss of quality.

/2.3 Water

Water used for conveying raw materials, including sea water for the conveyance of fish and other marine products into the plant should be from such a source or suitably treated as not to constitute a public health hazard and should be used only by permission of the controlling authority./

3. Inspection and sorting

Prior to introduction into the processing line, or at a convenient point within it, raw materials should be inspected, sorted or culled as required to remove unfit materials. Such operations should be carried out in a clean and sanitary manner. Only clean, sound materials should be used in further processing.

4. Washing or other preparations

Raw materials should be washed as needed to remove soil or other contamination. Water used for such purposes should not be recirculated unless suitably treated to maintain it in a condition as will not constitute a public health hazard. Water used for washing, rinsing or conveying final food products should be of potable quality.

5. Preparation and processing

Preparatory operations leading to the finished product and the packing operations should be so timed as to permit expeditious handling of consecutive units in production under conditions which would prevent contamination, deterioration, spoilage, or the proliferation of microorganisms. Rapidly deteriorating products, e.g. those of animal origin, may not be stored together with other edible products.

6. Packing of finished products

6.1 All food for infants and/or children has to be packed in appropriate containers, using appropriate methods, which protect the food from being contaminated and against deterioration.

6.2 Packing materials should not transmit to the food objectionable substances beyond limits acceptable to the controlling authority. Packing material should be stored in a clean and sanitary manner.

6.3 Packing should be carried out under conditions that preclude the introduction of contaminants into the product.

6.4 In case of vacuum packed containers sealed with quick-twist, screw-on or snap-on lids /or closures/, which have an annular space between the inner edge of the lid's rim /lip, shirt/ and the container itself should have such space eliminated by lid or container design and construction or be made inaccessible by sealing.

6.5 Containers should be inspected before filling and any defective container should be rejected.

6.6 All containersshould be permanently marked, in order to identify the establishment, country and date of production or minimum shelflife.

6.7 The requirement of para D 6.1 does not apply to food which is eaten immediately after production or preparation at the place of production or preparation.

6.8 In case of hermetically sealed containers, suitable gases which do not react with the product may be used as packing media.

7. Preservation of finished products

7.1 All food which is not eaten immediately after production or preparation has to be processed in such a manner so that it presents no health hazard and withstands deterioration and spoilage during subsequent storage, transport and sale.

7.2 Processing should be supervised in the establishment by technically competent personnel and be subject to check by the inspector. Seam measurements should be carried out regularly during production and these, with processing records adequate to identify the processing and history of each batch of product should be kept by the management and made available to the inspector.

7.3 No water, other than potable water, should be used for washing of empty containers or for the cooking or cooling of any hermetically sealed container. Where heat processed containers are cooled in water, the water should be potable.

7.4 Rough treatment of containers must be avoided to prevent the possibility of contamination of the processed product. If essential to handle wet cans, personnel should do so exercising hygienic precautions. Belts, runways and other conveying equipment should be maintained in a clean condition and good repair.

8. Examination of the preserved food for infants and children

8.1 In case of vacuum packed containers, the vacuum should be checked immediately after processing and a second time after a storage period of at least 30 days.

8.2 Containers should be checked after filling. Containers showing any defects should be rejected.

8.3 Representative random samples of food for infants and/or children with intrinsic parameters (e.g. a_w, pH, etc.) still permitting microbial proliferation should be incubated for 30 days at +30°C.

In case of production of food for infants and children for countries with hot climates, parallel to the +30°C incubation, a +50°C incubation should be added.

9. Storage and transport of finished food for infants and children

The finished food should be stored and transported under such conditions as will preclude the contamination with, or development of microorganisms or infestation and protect against deterioration of the product or of the container.

E. Sanitation Control Programme

It is desirable that each establishment in its own interest designates a single individual, whose duties are preferably divorced from production, to be held responsible for the cleanliness of the establishment. His staff should be a permanent part of the organization or employed by the organization and should be well trained in the use of special cleaning tools, methods of dismantling equipment for cleaning and in the significance of contamination and the hazards involved. A permanent cleaning and disinfection schedule should be drawn up to ensure that all parts of the establishment are cleaned appropriately and that critical areas, equipment and material are designated for cleaning and/or disinfection daily or more frequently if required.

F. Laboratory Control Procedures

In addition to any control by the controlling authority, it is desirable that each plant in its own interest should have access to laboratory control of the sanitary quality of the products processed. The amount and type of such control will vary with the food product as well as the needs of management. Such control should reject all food that is unfit for human consumption. Analytical procedures used should follow recognized or standard methods in order that the results may be readily interpreted.

Section V - END PRODUCT SPECIFICATION

A. The food for infants and/or children should be free from foreign and other objectionable matter to the extent possible in good manufacturing practice, as well as free from toxic substances in a concentration believed to constitute a health hazard for infants and children.

B. The food for infants and/or children should comply with the requirements for pesticide residues and food additives laid down by the Codex Alimentarius Commission.

C. Using the microbiological methods of analysis as described in Annex A, the food should comply with the following microbiological specifications.

ANNEX A

MICROBIOLOGICAL STANDARDS FOR FOODS FOR INFANTS AND CHILDREN

	a	b	c	d
	Ready-to-use products as far as not covered by b, c or d	Dried or instant products to be consumed after the addition of liquid	Products requiring cooking 1/ prior to consumption	Products preserved by thermal treatment in sealed containers, and preparations canned under sterile conditions
Aerobic plate count 2/	no more than 10.000 in 1 g	no more than 50.000 in 1 g	no more than 200.000 in 1 g	After 14 days' incubation at 30°C no abnormal physical chemical or organoleptic changes shall be observed. 1 g of the substance shall not contain more than 100 non-pathogenic, non toxin forming aerobic germs. Products intended for tropical climates shall be incubated 14 days at 55°C.
Coliform bacteria	no more than 1 in 0.1 g	no more than 1 in 0.01 g	no more than 1 in 0.001 g	
Escherichia coli	no more than 1 in 1 g	no more than 1 in 1 g	no more than 1 in 0.1 g	
Yeasts and moulds	no more than 300 in 1 g	no more than 300 in 1 g	no more than 1000 in 1 g	
Anaerobic spore-forming organisms (Clostridia)	no more than 1 in 0.1 g	no more than 1 in 0.1 g	no more than 1 in 0.01 g	
Salmonellae and Schigellae	no more than 1 in 30 g	no more than 1 in 30 g	no more than 1 in 30 g	
Coagulase-positive Staphylococci	no more than 1 in 1 g	no more than 1 in 1 g	no more than 1 in 1 g	

1/ "Cooking means heating the product to at least 100°C for a period of at least 3 minutes.
2/ Not applicable to products acidified by lactic acid-forming bacteria.

CULTURE MEDIA FOR THE MICROBIOLOGICAL CONTROL OF FOODS FOR INFANTS AND CHILDREN

Determination of	Culture media and techniques	Literature 1/
Aerobic plate count	Tryptone-glucose-yeast extract Agar	Milchw. 16, 650 (1961); Die Fleischwirtschaft 47, 1313 (1967)
Coliform bacteria	Brilliant green-lactose-bile bouillon	American standard method for the examination of dairy products, 9th Ed. APHA 1948; Netherlands Standard Specification NEN 955, Neth. Milk Dairy J. 16, 302 (1962)
Escherichia coli	As under 2, in addition test for gas and indol formation at 44°C	Zbl. Bakt. I. Orig. 208
Yeasts and moulds	Brewers' wort-peptone-agar-Sabouraud-agar	
Clostridia	Differential-reinforced clostridial-medium (DRCM) according to Gibbs and Frame	J. Appl. Bact. 28, 95 (1965)
	Sulfite-acid-thioglycolate-culture medium (SAT) according to Levetzow	Arch. Lebensmittelhyg. 18, 217 (1962)
Salmonellae and Shigellae	According to usual methods using liquid enrichment culture media	
Coagulase-positive Staphylococci	Biard-Parker-medium	J. App. Bacteriol. 25, 12-19 (1962)

1/ The United States of America recommended the methodology of F.S. Thatcher and D.S. Clark in "Micro-organisms in Food; Their significance and Methods of Enumeration", Toronto, 1968.

ALINORM 76/13A
APPENDIX VI

PROPOSED DRAFT CODE OF HYGIENIC PRACTICE FOR MOLLUSCAN SHELLFISH
(Returned to Step 3)

To be read in conjunction with the Recommended General Principles of Food Hygiene. Side-lined portions indicate material which is particular to this Code of Hygienic Practice and therefore does not appear in the General Principles of Food Hygiene (CAC/RCP 1-1969)

SECTION I - SCOPE

This Code applies only to those bivalve molluscan shellfish commonly known as oysters (Ostreidae), clams (Veneridae, Mactridae, Cooperellidae and Arcidae), mussels (Mytilidae), and cockles (Cardiidae). These species are filter feeders, may be eaten raw or cooked, and are normally consumed whole including the viscera. The Code is concerned with sanitary requirements for the named species of shellfish intended for human consumption whether in the raw condition or destined for further processing.

SECTION II - DEFINITIONS

For the purpose of this Code:

1. Accepted means accepted by the official agency having jurisdiction.

2. Clean sea water means estuarine or marine waters which are free of pollution and toxic marine algae in amounts which will adversely affect the quality and/or safety of shellfish.

3. Growing areas means all estuarine and marine areas used for the commercial production or the sports harvesting of shellfish either by natural growth or by aquaculture.

3 (a) Disinfected (sanitized) means ... (to be taken from General Principles of Food Hygiene after revision).

4. Heat shucking means the process of subjecting shellfish in the shell to any form of heat treatment, such as steam, hot water, or dry heat for a short period of time prior to shucking, to facilitate rapid removal of meat from the shell. Such treatment should not be considered as any part of a cooking process.

5. Pollution means agricultural, domestic, industrial and naturally occurring contaminants adversely affecting sea water quality. Thermal changes in sea water quality may also be considered as pollution.

6. Process shellfish means shellfish which have been subjected to heat treatment and/or preservation by salt, acid, smoking, pickling, jellying or canning.

7. Purification (depuration) means the process of holding live, initially polluted shellstock for a period of time under approved, controlled conditions in natural or artificial sea water, which may be treated or untreated, in tanks, floats or rafts, thereby rendering the shellfish suitable for human consumption without further treatment.

8. Shucked shellfish means fresh or fresh frozen shellfish, which have not been subjected to any form of processing other than shucking, sorting, washing, packing and/or freezing before shipment to market.

9. Relaying means the removal of shellfish from a polluted growing area to an acceptable growing or holding area under the supervision of the agency having jurisdiction.

10. Shellfish means only those bivalve molluscs commonly known as oysters, clams, mussels and cockles.

11. Shellstock means live shellfish in the shell after harvesting.

SECTION III - RAW MATERIAL REQUIREMENTS

A. Environmental Sanitation in Growing Areas

(1) Sanitary disposal of human and animal wastes. Adequate precautions should be taken to ensure that shellfish growing areas are free from pollution capable of causing pollution of the shellfish and extreme care should be taken to protect the shellfish from contamination by any wastes. A clean area surrounding the shellfish growing areas should be established and the dumping of all wastes of agricultural, domestic or industrial origin, including wastes from private residences or boats should be prohibited. Precautions of this kind should be particularly strict when protecting from such sources of contamination, shellfish which are not intended for purification or heat processing. In moderately polluted zones, pollution may be controlled and shellfish harvested for purification processes or heat processing according to the standard of the official agency having jurisdiction.

(2) Sanitary quality of water in shellfish growing areas

(a) Water over shellfish growing areas should conform to acceptable requirements as judged by tests for microorganisms, chemicals, toxins, and parasites.

(b) The health hazard potential to consumers of shellfish harvested from waters affected by sewage outfalls will vary according to the degree of sewage treatment, disease carrier rate within the population, tidal dilution and dispersion and other hydrographic or meteorological factors.

(3) Surveys of shellfish growing areas

(a) Surveys of shellfish growing areas should be carried out at suitable intervals. They should take into account variations which may affect the level of pollution during the most unfavourable hydrographic and climatic conditions as influenced by rainfall, tides, winds, methods of sewage discharge, population variations and other local factors, since shellfish respond rapidly to an increase in the number of bacteria or viruses in their environment by accumulating these agents.

(b) Surveys should be conducted to detect concentrations of toxic chemicals including agricultural chemicals, heavy metals, radioactive wastes, and other industrial chemicals and marine biotoxins such as paralytic shellfish poison in growing areas. In the evaluation of such data, the official agency having jurisdiction should take into account the ability of shellfish to accumulate toxic chemicals in their tissue in concentrations greater than the levels found in the surrounding water. FAO, WHO, or other international or national food standards may be used as a guide to acceptable levels.

(c) Areas known to be affected by blooms of toxic dinoflagellates should be monitored at appropriate seasons for the presence of marine biotoxins such as paralytic shellfish poison. The official agency having jurisdiction should have legal authority to close immediately and effectively patrol affected areas when acceptable levels are exceeded in edible portions of shellfish meats.

(4) Animal, plant, pest and disease control

Where control measures are undertaken, treatment with chemical, biological or physical agents should be done only in accordance with the recommendations of the appropriate official agency, by or under the direct supervision of personnel with a thorough understanding of the hazards involved, including the possibility of toxic residues being retained by the shellfish.

B. Sanitary Harvesting and Food Protection

(1) Equipment and product containers

(a) Equipment and product containers should not constitute a hazard to health. Containers which are re-used should be of such material and construction as will facilitate thorough cleaning, and should be so cleaned and maintained as not to constitute a source of contamination to the product.

(b) Dredges and other harvesting equipment, decks, holds and containers which come into contact with shellstock should be capable of being well drained and easily cleaned.

(c) Dredges and other harvesting equipment, decks, holds and containers which are contaminated from use in a polluted area should be cleaned and if applicable disinfected (sanitized) as recommended by the official agency having jurisdiction before being used for shellfish from an unpolluted area.

(d) Holds for washed shellstock should be well ventilated. Containers (i.e baskets, barrels and boxes) made of properly treated wood, plastic or metal should be in sound condition.

(e) Holds in which shellstock is held or containers should be so constructed that the shellstock is held above the floor level and drained so that the shellstock is not in contact with wash-down or bilge water, or shell fluid.

(2) Sanitary techniques

(a) Shellstock to be stored in sea water tanks, floats or rafts should be harvested from and stored in an area acceptable to the official agency having jurisdiction.

(b) Shellstock should be freed from excessive mud and weed soon after being harvested by washing it with clean sea water or approved fresh water under suitable pressure. Wash water should not be allowed to flow over shellfish already cleaned. The water should not be re-circulated.

(c) Shellstock held on boats should not come into contact with accumulated wash-down water or shellfluid.

(d) On removal from water, shellstock should not be subjected to extremes of heat or cold, nor should it be damaged as a result of excessive abrasion. This is particularly important for those shellstock which are to be subjected to purification. Whenever possible, storage at temperatures above 10°C (50°F) or below 2°C (35°F) and direct contact with ice or other cold surfaces should be avoided.

(e) If shellstock is to be re-immersed after harvest, the sea water quality should comply with the standards of the official agency having jurisdiction.

(f) Sea water or fresh water used for washing shellstock, equipment, decks, holds and containers should comply with standards of the official agency having jurisdiction.

(3) Removal of obviously unfit materials

(a) Shellfish which are dead, dying, permanently gaping or tainted should be removed from the catch as soon as possible.

(b) Shellfish which do not conform to acceptable sanitary standards and shellfish which are found in areas where the water quality does not conform to these standards should be segregated and condemned as unfit for human consumption unless they can be subjected to a process which renders them fit for human consumption to the satisfaction of the official agency. Such processes may include relaying into an area of approved water quality and/or purification in a tank, float or raft.

(4) Protection of product from contamination

(a) Suitable precautions should be taken to protect shellstock and those parts of the harvesting boat, harvesting equipment, containers and other equipment likely to come into contact with shellstock from being contaminated by polluted water, droppings from sea birds, footwear which has been in conract with faecal matter or by other polluted material.

(b) No animals should be permitted to live on any harvesting boats or to enter any part of any establishment where shellstock is prepared, handled, packed or stored.

(c) Fuel, lubricating oils, chemicals used for the control of pests and other noxious chemicals should not be stored near shellstock or containers and equipment likely to come into contact with shellstock.

(d) Wash-down pumps should draw water only from non-contaminated sea water and should not be connected directly or indirectly to the bilge or the toilet facilities.

(e) Effective measures should be taken to protect against the entrance of rodents and other vermin into harvesting boats.

C. Transportation

(1) Conveyances. Conveyances for transporting the harvested shellstock from the growing area, place of harvest or storage should be adequate for the purpose intended and should be of such material and construction as will permit proper drainage and thorough cleaning. They should be so cleaned and maintained as not to constitute a source of contamination to the shellstock.

(2) Handling procedures

(a) General

(i) During handling and transportation, shellstock should be held under hygienic conditions and should not come into contact with [toxic and other] substances which may render the meats unfit for human consumption. Shell washings should be drained from the shellstock containers.

(ii) During handling and transportation, shellstock should not be subjected to extremes of heat or cold or sudden excessive drops in temperature. Special equipment, such as insulated containers and refrigeration equipment, should be used if prevailing temperatures and the time involved so require. For shipping, over extended periods of time, shellstock should be cooled to temperatures below 10°C (50°F); at no time should the temperature fall below 2°C (35°F). Shellstock should not be exposed to full sun or surfaces heated by the sun or come into direct contact with ice and other freezing surfaces, nor should it be held in closed containers with solid carbon dioxide.

(b) Shellstock for relaying, storage in water and purification

(i) At all times, shellstock [intended for relaying, storage in water and purification] should be handled and transported carefully to avoid damage to the shells and under conditions which will prevent death of the shellfish. Containers should not be dropped or subjected to excessive weights where there is a danger of damage occurring to the shells in the course of normal handling. The use of shallow rigid boxes, trays or baskets will minimize damage. The handling of shellstock in large bulk containers should be avoided.

(ii) The interval between harvesting and immersion in water for relaying, storage or purification should be kept as short as possible.

(c) Shellstock for processing (excluding relaying, storage in water and purification)

The interval between final harvesting and processing should be kept as short as possible.

SECTION IV - PLANT FACILITIES AND OTHER OPERATING REQUIREMENTS

A. Plant Construction and Layout

(1) Location, size and sanitary design. The building and surrounding area should be such as can be kept reasonably free of objectionable odours, smoke, dust, or other contamination; of sufficient size for the purpose intended without crowing of equipment or personnel; of sound construction and kept in good repair; of such construction as to protect against the entrance and harbouring of insects or birds or vermin; and so designed as to permit easy and adequate cleaning. The plant and particularly clean storage tanks and purification tanks should be located above the level of extreme spring tides and storm tides.

(2) Sanitary facilities and controls

(a) Separation of processes. Areas where raw materials are received or stored should be so separated from areas in which final product preparation or packaging is conducted as to preclude contamination of the finished product. The shucking area should be physically separated from other processing areas. Areas and compartments used for storage, manufacture or handling of edible products should be separate and distinct from those used for inedible materials. The food handling area should be completely separated from any part of the premises used as living quarters.

(b) Water supply. An ample supply of cold water should be available and an adequate supply of hot water where necessary. The water supply should be of potable quality. Standards of potability shall not be less than those contained in the latest edition of "International Standards for Drinking Water", World Health Organization.

(c) Ice. Ice should be made from water of potable quality and should be manufactured, handled, stored and used, so as to protect it from contamination.

(d) Auxiliary water supply. Where non-potable water is used - for such purposes as fire control - it must be carried in completely separate lines, identified preferably by colour and with no cross-connection or back-siphonage with the lines carrying potable water.

(e) Plumbing and waste disposal. All plumbing and waste disposal lines (including sewer systems) must be large enough to carry peak loads. All lines must be watertight and have adequate traps and vents. Disposal of waste should be effected in such a manner as not to permit contamination of potable water supplies, clean sea water, purification tanks or approaches to the plant.

(f) Lighting and ventilation. Premises should be well lit and ventilated. Special attention should be given to the venting of areas and equipment producing excessive heat, steam, obnoxious fumes or vapours, or contaminating aerosols. Good ventilation is important to prevent both condensation (which may drip into the product) and mould growth in overhead structures - which growth may fallinto the food. Light bulbs and fixtures suspended over food in any step of preparation should be of the safety type or otherwise protected to prevent food contamination in the case of breakage.

(g) Toilet-rooms and facilities. Adequate and convenient toilets should be provided and toilet areas should be equipped with self-closing doors. Toilet rooms should be well lit and ventilated and should not open directly into a food handling area. They should be kept in a sanitary condition at all times. There should be associated hand-washing facilities within the toilet area and notices should be posted requiring personnel to wash their hands after using the toilet.

(h) Hand-washing facilities. Adequate and convenient facilities for employees to wash and dry their hands should be provided wherever the process demands. They should be in full view of the processing floor. Single-use towels are recommended, where practicable, but otherwise the method of drying should be accepted by the official agency having jurisdiction.

(i) Establishments used only for receiving, packing, and shipping shellstock may not need all of the requirements listed in (a) through (h); however, such establishments should meet the requirements of the official agency having jurisdiction.

B. Equipment and utensils

(1) Materials. All food contact surfaces should be smooth; free from pits, crevices and loose scale; non-toxic; unaffected by food products; capable of withstanding repeated exposure to normal cleaning; and non-absorbent.

(2) Sanitary design, construction and installation. Equipment and utensils should be so designed and constructed as will prevent hygienic hazards and permit easy and thorough cleaning. Stationary equipment should be installed in such a manner as will permit easy and thorough cleaning.

(3) Equipment and Utensils. Equipment and utensils used for inedible or contaminating materials should be so identified and should not be used for handling edible products. Equipment in contact with sea water including tanks, pumps, and circulating systems should be constructed of non-corrodible and non-toxic materials.

C. Hygienic Operating Requirements

(1) (a) Sanitary maintenance of plant, facilities and premises. The building, equipment, utensils and all other physical facilities of the plant should be kept in good repair and should be kept clean and maintained in an orderly, sanitary condition. Waste materials should be frequently removed from the working area during plant operation and adequate waste receptables should be provided. Detergents and disinfectants employed should be appropriate to the purpose and should be so used as to present no hazard to public health.

(b) Tables, bowls, mincers, scales and other equipment used in the process of extracting and preparing the meats from shellfish should be scrub-washed or cleaned by an efficient mechanical process with /hot/ water containing a suitable cleaning agent, rinsed with potable hot water and disinfected (sanitized) with a suitable disinfectant. Acceptable detergents and disinfectants should be employed and so used as to present no hazard to public health.

(2) Vermin control. 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.

(3) Exclusion of domestic animals. Dogs, cats and other domestic animals, should be excluded from areas where food is processed or stored.

(4) Personnel health. Plant management should advise personnel that any person afflicted with infected wounds, sores, or any illness, notably diarrhoea, should immediately report to management. Management should take care to ensure that no person, while known to be affected with a disease capable of being transmitted through food, or known to be a carrier of such disease microorganisms, or while afflicted with infected wounds, sores, or any illness, is permitted to work in any area of a food plant in a capacity in which there is a likelihood of such person contaminating food or food-contact surfaces with pathogenic organisms.

(5) Toxic substances. All rodenticides, fumigants, insecticides or other toxic substances should be stored in separate locked rooms or cabinets and handled only by properly trained personnel. They should be used only by or under the direct supervision of personnel with a thorough understanding of the hazards involved, including the possibility of contamination of the product.

(6) Personnel hygiene and food handling practices

(a) All persons working in a food plant should maintain a high degree of personal cleanliness while on duty. Clothing, including suitable headdress, should be appropriate to the duties being performed and should be kept clean.

(b) Hands should be washed as often as necessary to conform to hygienic operating practices.

(c) Spitting, eating, chewing and the use of tobacco should be prohibited in food handling areas.

(d) All necessary precautions should be taken to prevent the contamination of the food product or ingredients with any foreign substance.

(e) Minor cuts and abrasions on the hands should be appropriately treated and covered with a suitable waterproof dressing. Adequate first-aid facilities should be provided to meet these contingencies so that there is no contamination of the food. Personnel wearing dressing on wounds should not be permitted to work in direct contact with the product or food product surfaces.

(f) Gloves used in food handling should be maintained in a sound, clean and sanitary condition; gloves should be made of an impermeable material except where their usage would be inappropriate or incompatible with the work involved.

D. Operating Practices and Production Requirements

(1) Acceptance criteria. Shellstock should not be accepted if they are contaminated with microorganisms or substances not removed by normal plant procedure.

(2) Relaying and purification (depuration) of shellstock in tanks, floats, and rafts

(a) Shellstock subjected to the purification process should not contain metallic ions, pesticides, or industrial wastes, in such quantities that it presents a health hazard to the consumer.

(b) The process and the equipment used for purification should be acceptable to the official agency having jurisdiction.

(c) Sea water for the tanks, or sea water where floats or rafts are used in purification should be clean and of a salinity acceptable to the official agency having jurisdiction. Where clean sea water is not available, a method of sanitizing the water which should be approved by the official agency having jurisdiction should be employed. Water used in purification tanks should be changed continuously or at suitable intervals.

(d) Shellfish should not be weak or dead when submitted to the purification process. Surfaces of shells should be free from mud and soft commensal organisms.

(e) Shellstock should be laid out at a density which will permit them to open and undergo natural purification. There should be no toxic substances in the water at levels that will prevent the shellfish from functioning properly.

(f) The oxygen content of the water should be maintained at an adequate level by aeration, or by intermittent or continuous replacement.

(g) During the process of purification, the water temperatures should not be allowed to fall below the minimum at which shellfish remain physiologically active: high water temperature which adversely affects the pumping rate and the purification process should be avoided: and tanks should be protected from the direct rays of the sun when necessary.

(h) Equipment in contact with water, i.e. tanks, pumps, pipes or piping; other equipment should be constructed of non-porous, non-toxic materials. Copper, zinc, lead and their alloys should preferably not be used in tanks, pumps or piping systems used in purification (depuration) processing.

(i) To avoid recontamination of shellstock undergoing purification, unpurified shellstock should not be placed in the same tank as shellstock which are already undergoing purification.

(j) Shellstock undergoing purification should remain immersed in approved, clean, sea water until it satisfies the sanitary requirements of the official agency having jurisdiction.

(k) On removal from the purification system, shellstock should be washed with running fresh water or sea water meeting the standards of the official agency having jurisdiction, and handled in the same manner as clean, raw shellstock taken directly from a non-polluted area. Dead, dying, permanently gaping, or otherwise unwholesome shellfish should be removed.

(l) When biologically feasible (some species such as the soft shell clam (Mya arenaria)can not be relayed) shellstock may be relayed from polluted growing areas to areas approved for harvesting. Relaying operations should be strictly supervised by the official agency having jurisdiction to prevent contaminated shellstock from being diverted directly to the consumer market. Holding time in the accepted area prior to harvest will be determined by the official agency according to species involved and local geographic or hydrographic conditions.

(3) Storage of shellstock in sea water

(a) The process of storing shellstock in sea water tanks, basins, floats or rafts should be acceptable to the official agency having jurisdiction and a record of the origin of each lot of shellstock should be maintained.

(b) Sea water in the tanks, floats or rafts should be of a sanitary quality acceptable to the official agency having jurisdiction and should be of an adequate salinity to permit the shellfish to function normally. Optimum salinity will vary with species.

(c) During storage shellstock should be laid out at a density and under such conditions that will permit them to open and function normally.

(d) The oxygen content in sea water tanks should be maintained at an adequate level at all times.

(e) The temperature of the water in storage tanks should not be allowed to rise to such levels as to cause weakness of the shellstock. If ambient temperatures are high, tanks should be placed in a well ventilated building or away from the direct rays of the sun.

(f) Shellfish should be stored in sea water only for such time as they remain sound and active.

(4) Washing, grading and packing of shellstock

(a) The outsides of the shells should be washed free of mud, and all soft adhering organisms should also be removed. Hard adhering organisms should be removed when possible, care being taken not to chip lips of shells by vigorous washing.

(b) Bivalved shellfish having one cupped shell should, when packed in wooden or other rigid containers, be placed with the concave shell downwards and the flat surface at top to prevent dehydration from loss of shell liquor.

(c) Shellfish to be eaten raw on the shell should be landed and packed for onward transmission as quickly as possible, so permitting them to reach the consumer in a sound, live condition.

(d) Shellfish which are dead, dying, permanently gaping, with broken shells, or otherwise unwholesome should not be passed on for human consumption.

(e) Containers used for packing shellstock should be free from any materials which may contaminate the product. They should be cleaned and disinfected as recommended by the official agency having jurisdiction.

(5) Washing, heat-shucking, and packing of shellstock

(a) Shellstock intended for heat-shucking should be sound and practically free from adhering organisms; the outside of the shell should be thoroughly washed free from mud before processing.

(b) After heat-shucking, the removal of the shells and the washing of the meats should be carried out under hygienic conditions. Washing should be conducted under conditions which avoid soaking of the meats, minimizing water uptake. Consequently, washing or flowing time should not exceed the maximum time needed to cleanse adequately the shellfish meats. Unnecessary addition of water to the finished product reduces flavour and quality and should be avoided. Immediately after heat-shucking the meats should be cooled rapidly to prevent spoilage. The water used for this purpose should be of potable quality, flowing continuously or frequently changed to maintain the meats at the lowest possible temperature.

(c) To prevent subsequent spoilage, washed meats should be refrigerated, preserved in salt, pickled, or immediately canned. Meats intended for human consumption soon after heat-shucking should be held under cool conditions suitable for the period between processing and consumption; meats not intended for early consumption should be stored at a temperature not exceeding 3°C (37°F).

E. Laboratory Control Procedures

(1) Laboratory facilities and technical personnel should be readily available to the official agency having jurisdiction for the sanitary control of the industry and should be capable of providing adequate laboratory support to the control agency.

(2) The official agency having jurisdiction should take water and shellfish samples from the growing area and samples of shellstock and processed shellfish from processing plants at suitable intervals. Tests should be performed to assure that water and shellfish samples conform to the standards of the official agency having jurisdiction.

(3) Tests of the waters from growing areas should, where necessary, include bacteriological, biological, physical, and chemical tests for evidence of faecal and chemical pollutants.

(4) Tests of shellfish should include microbiological tests for faecal pollution and, where applicable, for spoilage. Biological tests should be made for biotoxins and faecal parasites and chemical and physical tests for other pollutants.

(5) Laboratory procedures should be developed and standardized and microbiological and other criteria promulgated to ensure that shellfish are free from pathogenic organisms and do not contain toxins or toxic chemicals at levels that constitute a hazard to health.

F. Lot Identification

1. Shellstock

Each container (bag, basket or box) should be labelled according to shipper or processor, harvest area and date of harvest before shipment to market. Complete records of harvest area and date of harvest and length of time of relaying or purification of each lot should be maintained by the establishment for a period designated by the official agency having jurisdiction.

2. Shucked Shellfish

Each container should be embossed or otherwise permanently marked in code or in clear prior to shipment to market so that information regarding harvest area, date of harvest and shipper can be established if necessary.

SECTION V - END PRODUCT SPECIFICATIONS

A. The products should comply with the requirements set forth by the Codex Commission on pesticide residues and food additives as contained in permitted lists of Codex Commodity Standards.

B. When tested by appropriate methods of sampling and analysis, the products should meet the requirements of the official agency having jurisdiction with regard to the content of extraneous matter.

ANNEX TO APPENDIX VI

PROPOSED ANNEX TO THE MOLLUSCAN SHELLFISH CODE - CURRENT LABORATORY PROCEDURES AND STANDARDS

A. Denmark

Ten oysters sampled at random are examined individually:

(1) Average of total plate count at 20°C for 5 days should not exceed 100,000/g.

(2) E. coli Type I must not be present in any of the 10 samples. The inoculation dose must be a minimum of 1/5 of a gramme. Plating and identification take place in violet red-bile agar incubated 48 hours at 45°C. Verification by IMVIC tests is recommended.

(3) Salmonella must not be present in any of the 10 samples. The inoculation dose must be a minimum of 1/5 of a gramme. Enrichment for 24 and 48 hours followed by streaking on brilliant green agar or any other specific substrate.

The figures are tentative limits and apply to live oysters only.

B. France

1. Bacteriological Control at the Production Sites

Bacteriological quality of shellfish is determined by the MPN of E. coli found in the flesh and fluid from a sample of 5-10 shellfish according to individual size.

2. Bacteriological Control at the Sales Points

Control depends essentially on determination of E. coli and detection of Salmonella.

Preparation of Test Samples

Five to 10 samples are drawn at random from each lot of shellfish. After washing, brushing and surface rinsing with alcohol, then drying, the meats are separated from the shells aseptically. The flesh and fluid of the mollusc are transferred to a sterile flask where they are finely and uniformly macerated. In the case of shellfish with little liquid, maceration is accomplished after mixing with equal parts of sterile peptone water diluent.

E. coli determination

Presumptive test is conducted in brilliant green lactose bile broth distributed in fermentation tubes. The inocula represent 1.0 ml, 0.5 ml, 0.2 ml, and 0.1 ml of the macerated mollusc. Incubation is conducted at 30° C for 24-48 hours. Identification of E. coli is made according to Mackenzie, Taylor and Gilbert for each primary culture fermenting lactose with production of gas.

Proposed Bacteriological Standards of Quality

- oysters and molluscs ordinarily eaten raw: less than 1 E. coli per ml.
- mussels and molluscs ordinarily eaten cooked: number of E. coli does not exceed 2 per ml.

Note: In order to determine the most probable number of E. coli, it is advisable not to limit inoculation to a single level.

Detection of Salmonella

Twenty-five ml of macerated mollusc are transferred to a flask containing 100 ml of peptone water (40 g/litre). After incubation for 6 hours at 37°C for pre-enrichment, two aliquots of 25 ml are transferred to two flasks containing 225 ml of an enrichment mixture for Salmonella (Selenite or Tetrathionate); one is incubated at 43°C, the other at 37°C for 24-48 hours.

Isolation of Salmonellae is conducted according to the classical method.

- Proposed standard of safety: absence of Salmonella in 25 ml of sample (flesh plus fluid).

Note: It is planned to investigate the presence of Streptococci D.

C. Italy

Microbiological Control

Representative samples of growing area water or shellfish are collected at different points in the growing area. If the sample cannot be examined within 6 hours from time of sampling, it is quick frozen and held at -20°C until examined. Unfrozen samples should be stored at 4°C until examined. Shellfish meats and shell liquor are combined for the examination. The total volume of the molluscs, consisting of 10 molluscs should be specified. The total volume of sample of shellfish is diluted to 200 ml using a sterile physiological solution.

Laboratory Procedure

The sample is homogenized in a mechanical mixer for 3 to 5 minutes at 10,000 RPM and filtered through sterile gauze. A 3 tube 3 dilution MPN procedure is used. Samples are inoculated into lactose broth and incubated at 37° for 48 hours.

All gas positive tubes are transferred to brilliant green lactose bile broth and tryptone broth. All subcultures are incubated at 44°C for 48 hours. The E. coli results are based upon gas positive tubes of BGLB and a positive test for indole production. Results are reported as E. coli MPN per 100 ml of sample.

Bacteriological Standards

Approved Water.

An E. coli MPN of 2/100 ml shall not be exceeded in 90% of samples taken during one year. An E. coli MPN of 6/100 ml shall not be exceeded by more than 10% of samples taken during one year.

Shellfish from Acceptable Areas

An E. coli MPN of 160/100 ml of sample shall not be exceeded in 90% of samples during one year. An E. coli MPN of 500/100 ml sample shall not be exceeded in 10% of samples taken during one year.

Market Standard

E. coli MPN shall not exceed 600/100 g of sample.

Chemical Requirements

Edible marine invertebrates must not contain substances of any nature or origin making them dangerous to public health or substances which may produce abnormal organoleptic characteristics, in greater quantity than that permitted for drinking water.

D. Netherlands

The control method of analysis and recommendations used in the Netherlands is identical to the controls, methods and recommendations used in the United Kingdom.

E. United Kingdom

Control - An order made under the Public Health (Shellfish) Regulations may prohibit removal for sale for human consumption of all, or certain species of shellfish or may permit removal pending treatment in an acceptable manner, i.e. relaying in pure water, heat sterilization, purification in an acceptable installation.

Methods of Analysis

Shellfish growing water - Methods in current use for the examination of waters are the MacConkey Broth, 15 tube, three dilution MPN test (Department of Health 1957) and the membrane filtration technique using teepol lactose broth (Department of Health 1969). Counts of faecal coli in waters are made under various hydrographic conditions and seasons and the information obtained is used, in conjunction with observations on shellfish to make assessments about the degree of faecal contamination. There are no standards used to assess the sanitary quality of shellfish growing waters.

Shellfish - Samples of 10 shellfish are taken at random and examined individually or pooled together. Dilutions equal to twice the volume of shellfish tissue are made with 0.1 percent peptone water and 1 ml aliquots of the resulting extract inoculated into roll tubes of the MacConkey Agar No. 3 (Reynolds and Wood, J. Appl. Bact. 19(1) 1956). Results are expressed as mean number of E. coli per ml of tissue based on the count of 10 replicate tubes.

The recommendations of Sherwood and Scott Thompson (1953), made after comparing the 44°C roll tube method with the Fishmonger's Company test, have been generally accepted by examining authorities.

E. coli/ml tissue	Action taken
0-2 3-4	Sale permitted
5 6-15	Temporary prohibition
16	Sale prohibited

At the present time, standards in current use are more stringent and shellfish from a particular source consistently containing more than 2 E. coli/ml are regarded with suspicion pending further samples or investigation.

F. United States

Laboratory procedures used by the official agencies responsible for the sanitary control of shellfish in the United States are based upon the procedures outlined in Recommended Procedures for the Examination of Sea Water and Shellfish, 4th Edition, American Public Health Association, 1970. Current standards are as follows:

Growing area bacteriological standard

The coliform median MPN of the water does not exceed 70 per 100 ml., and not more than 10 percent of the samples ordinarily exceed an MPN at 230 per 100 ml for a 5-tube decimal dilution test (or 330 per 100 ml, where the 3-tube decimal dilution test is used) in those portions of the area most probably exposed to faecal contamination during the most unfavourable hydrographic and pollution conditions.

Wholesale Market Standard

Satisfactory. Faecal coliform density of not more than 230 MPN per 100g and 35°C plate count of not more than 500,000 per gramme will be acceptable without question. This standard applies only to shellfish "certified" under the auspices of the National Shellfish Sanitation Program.

Conditional. Faecal coliform density of more than 230 MPN per 100 grammes and/or 35°C plate count of more than 500,000 per gramme will constitute a conditional sample and may be subject to rejection by the States shellfish regulatory authority.

Growing Area Standard for Paralytic Shellfish Poison

If the paralytic shellfish poison content reaches 80 microgrammes/100 grammes of edible portions of raw shellfish meat, the area shall be closed to taking of the species of shellfish in which the poison has been found.

ALINORM 76/13A
APPENDIX VII

PROPOSED DRAFT CODE OF HYGIENIC PRACTICE FOR PEANUTS (GROUND NUTS)
(Step 3)

To be read in conjunction with the Recommended International Code of Practice - General Principles of Food Hygiene. Side-lined portions indicate material which is particular to this Code of Hygienic Practice and therefore does not appear in the General Principles of Food Hygiene.

SECTION I - SCOPE

This code of hygienic practice applies to peanuts, also known as ground nuts, (Arachis hypogaea).

It contains the minimum requirements of hygiene for farm handling, transportation, storage, in-shell operations and commercial shelling.

It covers all types and forms of raw, dried, in-shell and shelled peanuts.

SECTION II - DEFINITIONS

"Blows", (pops) means in-shell nuts which are unusually light-weight due to extensive damage from physiological, fungous, insect, or other causes and which can be removed mechanically, for example, by air flow.

"Curing" means drying of in-shell peanuts to a safe moisture level whether by natural or mechanical means, or a combination of both.

"Farmer's stock peanuts" - means in-shell peanuts as they come from the field, after separation from the vines by hand and/or mechanical means.

"Safe moisture level" means one that will prevent growth of microorganisms normal to the nut harvesting, processing and storage environment. The maximum safe moisture level for peanuts is established by its water activity (a_w). Water activity is defined as the quotient of the water vapor pressure of the substance (peanut) divided by the vapor pressure of pure water at the same temperature. An a_w exceeding 0.70 at 25°C (77°F) is unsafe. This is approximately the water activity of cured peanuts at 7% total moisture.

SECTION III - RAW MATERIAL SANITATION REQUIREMENTS

A. Environmental Sanitation in Growing, Harvesting and Food Production Areas

(1) Sanitary disposal of human, animal and plant wastes. Adequate precaution should be taken to ensure that human and animal wastes are disposed of in such a manner as not to constitute a public health or hygienic hazard, and extreme care should be taken to protect the products from contamination with these wastes. Vine and peanut waste should not be permitted to accumulate in such a manner as to attract rodents or insects.

(2) and (3) As in the General Principles of Food Hygiene.

B. Sanitary Harvesting and Production

(1) Curing. After digging pods should be exposed for maximum rate of drying. This may be accomplished by turning the vines to leave the pods uppermost where they are away from the ground and exposed to sun and wind. Curing, whether by natural or mechanical means or a combination of both, should be completed as rapidly as possible to a safe moisture level (reduction of peanut kernel moisture below 7%), so as to prevent growth of microorganisms, particularly molds that produce aflatoxins. When using mechanical drying, excessive heat should be avoided since this causes some kernels to split after shelling. Close checks of moisture content or water activity of lots of farmers' stock peanuts should be maintained.

(2) Equipment and product containers. As in the General Principles of Food Hygiene.

(3) Sanitary techniques. Harvesting and production operations, methods and procedures should be clean and sanitary. Drying equipment should be so constructed as to be easily cleaned and maintained and should contain no pockets in which debris may become lodged.

(4) Removal of obviously unfit materials. Damaged or imperfect peanuts and lots that contain any obvious contamination with human or animal wastes, insect infestation, decomposition, broken shells, embedded dirt, blows, or other defects to an extent which would render them unfit for human consumption.

should be segregated during harvesting and production to the fullest extent practicable. Such segregated unfit peanuts should be disposed of in such place and manner to prevent contamination of sound nuts, water supplies, or other crops.

(5) Protection of peanuts from contamination. Suitable precautions should be taken to protect the nuts from contamination by domestic animals, rodents, birds, insects, mites and other arthropods, or other biological agents, or with chemical or other objectionable substances during handling and storage. The nuts should be moved to suitable storage, or to the processing area for immediate processing, as soon as possible after harvesting or drying. Where nuts are likely to become infested with insects, mites (and other arthropods) during or after harvesting, suitable treatment such as fumigation or application of an insecticide spray should be carried out as a preventive measure. Nuts held for processing should be stored in covered containers, buildings, or under covering. Fumigation or spray methods and chemicals used should be approved by the official agency having jurisdiction. High humidities which are conductive to proliferation of mould and elaboration of mycotoxins should be avoided in storage areas in order to maintain peanuts at a safe moisture level. Recommended storage conditions are specified in Section IV D. (1)(b).

C. Transportation

(1) Facilities. Conveyances for transporting the harvested crop from the place of harvest or storage should be adequate for the purpose intended and should be of such material and construction as will permit thorough cleaning and should be so cleaned and maintained as not to constitute a source of contamination to the product. In addition, bulk transport such as ship or rail car should be well ventilated with dry air to remove moisture resulting from respiration of the peanuts and to prevent moisture

condensation as the vehicle moves from warm to cool regions or from day to night.

(2) Handling procedures. All handling procedures should be such as will prevent the product from being contaminated. Extreme care should be taken in transporting peanuts with an unsafe moisture level to prevent spoilage or deterioration. Special equipment - such as refrigerated transport - should be used if the nature of the product or distances involved so indicate.

D. Shelling Plant

The peanut shelling operation should be recognized as a food processing stage whether shelling is carried out on a grower's property or as a commercial operation. The shelling plant should comply with the provisions of Section IV of this code as are applicable and in particular with the following requirements:

(1) Purchasing of farmers stock. Most of the damage may have already been done to the peanuts during growing, harvesting, drying, handling, and storage. A buyer for a shelling plant, whether located at the plant or at an outlying commission buying point, should know (a) the capabilities of his suppliers, (b) the cultural, harvesting, drying, handling and storage practices they used, and (c) the quality of peanuts produced by their practices. He should monitor the quality of peanut lots offered to him, and with the cooperative extension service assist suppliers in eliminating improper practices. Buyers should encourage suppliers of farmers stock peanuts to follow food production practices as described herein.

(2) Receiving and inspection. Farmers stock peanuts received at the shelling plant should be inspected on arrival. It is advisable to know the origin and history of each lot of peanuts. The transport vehicle should be

examined for cleanliness, insect infestation, dampness or unusual odours. If the vehicle is not an enclosed van-type, it should have available a covering such as a tarpaulin to keep out the rain or moisture.

The general appearance of the peanuts should be observed during the process of unloading. If the peanuts are wet to the touch, insect infested, or contain an unusual amount of dirt, debris or other foreign material, they should not be co-mingled with known good peanuts in a bulk warehouse. The vehicle should be set aside until a decision is made for its disposition. If possible, remove a sample from each lot and shell it for peanut grade observation before an acceptance decision is made. Split all kernels and observe for possible presence of mould. A magnifying lens or microscope should be used to determine whether any mould observed resembles Aspergillus flavus. Excessive mould or presence of mould resembling A. flavus warrants a chemical test for aflatoxin.

If the peanuts are to be stored in a bulk warehouse or storage bin, the warehouse or bin should be thoroughly cleaned of all static material and fumigated before use. Peanuts should not be stored in a warehouse containing any openings which may permit entrance of rodents or birds or which may have leaks in the roof or walls that can allow the rain to enter. The warehouses should be checked frequently for leaks or infestation, both before and after filling. To prevent condensation drippage, warehouses should be ventilated as, for example, by screening around tops or eaves.

(3) Unloading equipment and area. Unloading equipment such as dumping pit, conveyor belt, bucket elevator, and dirt removing equipment should be so designed as to prevent accumulation of debris. A programme of periodic cleaning, together with preventive pest control measures, should be

carried out. Peanuts should be handled so as to avoid cracking or tearing of hulls which may permit damage to the kernels.

(4) Precleaning. As much dust and dirt as possible should be removed from the farmers stock peanuts before they enter the shelling plant. Sand screens and aspirators will take out much of the dust and dirt and improve the overall sanitation of the shelling plant.

As much foreign material, loose shell, loose kernels, and pops as possible should be removed. Foreign material not removed by the cleaner can cause mechanical problems by clogging the sheller, as well as by requiring more picking and sorting of the shelled peanuts. Removal of loose kernels and blows before shelling will improve the quality of the peanuts as well as the sheller and plant performance.

(5) Shelling and sizing. All foreign material should be removed from the shelled peanuts (using stoners, magnets, sorters, etc.). The shelled peanuts should be continuously inspected to determine whether the plant equipment is performing properly and the peanuts are free of foreign material, damage, and contamination. Any equipment adjustments indicated by the inspection should be made promptly.

Once the shelled peanuts are size graded, additional stoning should be done in order to remove small light stones, dirt balls and other foreign material which could not be removed in the farm stock stoners. Special care should be taken to avoid overloading size grading equipment.

(6) Sorting. Sorting is the final step for removing debris and defective kernels. It can be done by hand picking or photoelectric sorting machines or a combination of both. Sorting belts should be well lighted, loaded no more than one layer deep, and operated at a speed and with the number of sorters to assure removal of foreign material and defective

kernels. Photoelectric sorting machines should be adjusted against standards selected to assure removal of foreign material and defective kernels. Adjustment should be checked on a frequent periodic basis. One contaminated kernel may contain sufficient aflatoxin to endanger as many as 10,000 comingled kernels. Foreign material and defective kernels (mouldy, discoloured, rancid, decayed, shriveled, damaged) should be separately bagged and red tagged as unsuitable for human or animal consumption. Bags of sorted out peanuts should be removed as soon as practicable from the processing room.

(7) Cleaning of special areas

(a) Boots of elevators accumulate peanuts and peanut material. They should be cleaned out and sprayed regularly to prevent insect and rodent infestation. Fumigation or spray methods and chemicals used should be approved by the official agency having jurisdiction.

(b) Canvas conveyor belts will accumulate product between belt and conveyor pan. Pulleys can accumulate crushed material. Undersides of moulding on conveyors can accumulate particles of peanuts. These areas should be cleaned and sprayed on regular schedule to prevent insect and rodent infestation.

(c) Storage and surge hoppers should be cleaned and sprayed between runs.

(d) Areas which can accumulate peanuts and debris and are difficult to inspect and clean regularly should not be used.

(e) Every piece of machinery whether open or enclosed should be cleaned of lodged material on a regular schedule.

(f) The area immediately surrounding the plant should be kept clean of all debris that might attract rodents or birds.

(g) Dry clean-up procedures should be utilized to avoid wet spots in which microorganisms can propagate and contaminate contacted peanut

kernels. Even though water may not be used directly on equipment, spray and elevated humidity from continuous use can increase moisture in organic matter trapped in crevices in equipment, such as conveyors, to the point where microorganisms can proliferate.

SECTION IV - PLANT FACILITIES AND OPERATING REQUIREMENTS

A. Plant Construction and Layout

(1) Location, size, and sanitary design. As in the General Principles of Food Hygiene.

(2) Sanitary facilities and controls. (a), (b), (d), (e), (f), (g) and (h) as in the General Principles of Food Hygiene.

B. Equipment and Utensils

(1), (2) and (3) as in the General Principles of Food Hygiene.

C. Hygienic Operating Requirements

(1), (2), (3), (4), (5), (6) as in the General Principles of Food Hygiene (with the deletion of the introductory paragraph).

C. Operating Practices and Production Requirements

(1) Raw material handling

(a) Acceptance criteria. Peanuts should not be accepted by the plant if known to contain decomposed, toxic, or extraneous substances which will not be reduced to acceptable levels by normal plant procedures, sorting or preparation. Particular care should be taken to avoid contaminating in-shell peanuts or nut meats with animal or human faecal material; nuts suspected of being contaminated, should be rejected for human consumption. Special precautions must be taken to reject nuts showing signs of mould growth because of the danger of their containing mycotoxins such as aflatoxins. Aflatoxin test results should be known before allowing lots of raw peanuts to be processed. Peanuts with aflatoxins that cannot be reduced to permitted levels by the available sorting equipment should not be accepted.

(b) Storage. Raw materials stored on the plant premises should be maintained under conditions that will protect against contamination and infestation and minimize deterioration. Peanuts not scheduled for immediate use should be stored under conditions that prevent mould growth and infestation. See Section D, (7)(b).

The warehouse should be of sound construction, in good repair and built and equipped so that it will provide suitable storage and adequate protection for peanuts. All breaks or openings in the walls, floors, or roof shall have been repaired. Any breaks or openings around doors, windows and eaves shall have been repaired or screened. The use of screens should be restricted to areas of the building not subject to moisture entry. The building should have sufficient ventilation so as to prevent the build-up of condensation.

New concrete floors or walls should not be used for storage until it is absolutely certain that the new concrete is well-cured and free of excess water. For the first year on new concrete, it is safest to use a plastic cover spread over the entire new floor prior to filling with peanuts. The plastic can then be discarded when the warehouse is emptied. This system will ensure against sweating of the new concrete and possible moulding of the peanuts.

Products which affect the storage life, quality or flavour of peanuts should not be stored in the same room or compartment with peanuts. For example, such items as fertilizer, gasoline or lubricating oils should not be stored with peanuts, and some fruits or vegetables contribute objectionable odors or flavors.

(2) Inspection and sorting. Prior to introduction into the processing line, or at a convenient point within it, raw materials should be inspected, sorted or culled as required to remove unfit materials. See Section III, D, (2) and (6).

Experience has shown that aflatoxin is most frequently associated with mouldy, discoloured, shriveled, or otherwise damaged peanuts. Mould contaminated peanuts may exhibit some of the following characteristics:

1. Darker skin colouring before and/or after roasting.
2. Darker flesh (after blanching) before and/or after roasting.
3. Resistance to splitting and/or blanching.

To remove effectively mould contaminated nuts, sorting should be performed before and after blanching and roasting. Where splitting is part of the processing operation, nuts that resist splitting should be removed. The effectiveness of sorting techniques should be checked by regular aflatoxin analyses of the sorted peanut stream or of the finished product, or both. This should be done frequently enough to give assurance that the product is completely acceptable.

Rejected peanuts from the sorting procedure (pickouts) should be destroyed or segregated from edible products. If they are to be used for crushing, they should be separately bagged and red tagged as unsuitable for human or animal consumption.

(3) and (4) as (4) and (5) in the General Principles of Food Hygiene.

(5) Preservation of product. In-shell nuts or nut meats should be dried to a moisture level low enough so that the product can be held under normal storage conditions without development of mold or significant deterioration by oxidative or enzymatic changes. Finished roasted products may be (a) treated with antioxidants at levels approved by the

Codex Committee on Food Additives as referenced in the Commodity Standard; and (b) heat processed and/or packed in gas tight containers under nitrogen or vacuum, so that the product will not spoil under normal storage conditions.

(6) Storage and transport of product. Peanuts should be stored and transported under such conditions as will maintain the integrity of the container and the product within it. Carriers should be clean, dry weatherproof, free from infestation and sealed to prevent water, rodents or insects from reaching the peanuts. Peanuts should be loaded and unloaded in a manner that protects from damage or water. Mechanically refrigerated vehicles are recommended for transport during summer months and unusually hot periods. Peanuts from cold storage should either be shipped in mechanically refrigerated vehicles or allowed to warm for 24 hours before loading into unrefrigerated vehicles so that condensation will not form in warm weather during transit. Peanuts that have been spilled are vulnerable to contamination and should not be used for edible products.

(a) All products should be stored in clean, dry buildings, protected from insects, mites and other arthropods, rodents, birds, or other vermin, chemical or microbiological contaminants, debris and dust.

(b) Optimum storage conditions:

(i) Optimum storage conditions are 0-6^{o}C (32-42^{o}F) with a relative humidity between 55% to 65%. In temperate areas, in-shell and shelled peanuts may be stored in sound, dry warehouses at ambient temperatures. A dry environment should be maintained to protect quality and prevent mould growth. No peanuts should be stored closer than 0.5 metres (1 1/2 feet) from any

outside wall. An active programme should be maintained to detect and control hazards from damp pallets, damp floors and walls, overhead moisture, condensation, wet unloading and loading out conditions - all conducive to moisture pick-up and mould. Growth of toxigenic molds may be prevented by packing nut products that have been dried to a "safe moisture level" or by storing at a temperature sufficiently low to reduce both water activity and mold viability to a point that mold growth is prevented. Exposed nut products in storage may be maintained at or dried to a "safe moisture level" by control of the relative humidity of the circulating air. Those who use refrigerated storage should be aware that the water activity of nut meats increases with increased temperature; this fact should be taken into account when changing storage temperatures.

(ii) Where peanuts are stored under conditions in which they may become infested by insects and/or mites, appropriate fumigation methods should be used regularly. Peanuts should be stored in such a manner that they can be fumigated in situ or alternatively they can be removed for fumigation in special facilities (e.g. fumigation chambers, steel barges). In the latter situation, the storage area should be separately sanitized. Cold storage can be used, either to prevent infestation in localities where insects are likely to be present in ordinary storage or to prevent insects already present from damaging the peanuts.

E. Sanitary Control Procedures

As in the General Principles of Food Hygiene.

F. Laboratory Control Procedures

In addition to any control by the official agency having jurisdiction, it is desirable that each plant should have its own or contracted laboratory control of the sanitary quality of the nut products processed. The amount and type of such control will vary with the different nut products as well as the needs of management. Such control should provide for rejection of all nuts that are unfit for human consumption and monitoring of the quality of the finished products. Analytical procedures used should follow recognized or standard methods so that the results may be readily interpreted.

SECTION V - END-PRODUCTS SPECIFICATIONS

Standard methods should be used for sampling, analysis and other determinations to meet the following specifications:

A. To the extent possible in good manufacturing practice, the products should be free from objectionable matter.

B. When tested by appropriate methods of sampling and examination, the products:

(a) should be free from pathogenic microorganisms; and

(b) should not contain any substances originating from microorganisms in amounts which may represent a hazard to health in accordance with the standards of the official agency having jurisdiction, particularly mycotoxins, such as aflatoxins, formed by moulds.

C. The products should comply with the provisions for food additives and contaminants laid down in Codex Commodity Standards and with maximum levels for pesticide residues recommended by the Codex Alimentarius Commission.

ALINORM 76/13A
APPENDIX VIII

Draft - Code of Hygienic Practice for Processing of Froglegs

(Step 3)

SECTION I - SCOPE

This code of practice is designed to:

Prevent deterioration in the quality of froglegs intended for human consumption.

Prescribe a code of hygienic practices relating to premises, plant, equipment, handling, transportation, storage and personnel used or engaged in the processing of these products.

SECTION II - DEFINITION

"Fresh Froglegs" means the skinless hind legs of the freshly killed frogs preserved by chilling.

"Frozen Froglegs" means the skinless hind legs of the freshly killed frogs prepared by quick freezing.

"Sanitize (disinfect)" means adequate treatment of surfaces by a process that is effective in destroying vegetative cells of pathogenic bacteria and in substantially reducing other microorganisms. Such treatment shall not adversely affect the product and shall be safe for the consumer.

SECTION III - RAW MATERIAL REQUIREMENTS

A. Environmental Sanitation in Production Areas

(1) Sanitary disposal of all human and animal wastes. Adequate precautions should be taken to ensure that human and animal wastes are disposed of in such a manner as not to constitute a public health or hygienic hazard and extreme care should be taken to protect products from contamination with these wastes.

(2) Animal, plant pest and disease control. Control measures that are undertaken by treatment with chemical, biological or physical agents should be done only in accordance with the recommendations of the appropriate official agency, by or under the direct supervision of personnel with a thorough understanding of the hazards involved, including the possibilities of toxic residues being retained by the product.

(3) Sanitary quality of water. Water used for culture of frogs and waters of the areas where frogs are caught or collected should not constitute a public health hazard to the consumer through the product.

B. Sanitary Production of Raw Materials

(1) Equipment and product containers. Equipment and product containers should not constitute a hazard to health. Containers which are reused should be of such material and construction as will facilitate thorough cleaning, and should be so cleaned and maintained as not to constitute a source of contamination to the product.

(2) Sanitary techniques.

(a) Frogs obtained from habitats which may be polluted should be subjected to cleansing and sanitizing in running potable water for at least 24 hours. For this purpose a cleaned and sanitized cemented tank, or preferably stainless steel or non-corrosive metal tank, with an outlet at the bottom, may be employed.

(b) To prevent deterioration in the quality of froglegs, it is essential that steps should be taken to prevent:

(i) Injury or bruising of the flesh of frogs during catching, for example, from use of unsuitable gear.

(ii) Contamination of the froglegs with dirt or any other extraneous matter.

(iii) Exposures to unfavourable temperatures.

(iv) Rough handling, such as improper stacking of full containers.

(3) Removal of obviously unfit materials. Unfit froglegs, for example, froglegs originating from less active live frogs that are injured or have blood clots or parasites in the flesh, should be segregated during collection to the fullest extent practicable and should be disposed of in a manner that will prevent contamination of other froglegs or water supplies.

(4) Protection of product from contamination. Suitable precautions should be taken to protect the raw product from being contaminated by animals, insects, vermin, birds, chemicals or microbiological contaminants or other objectionable substances during handling and storage.

C. Transportation

(1) Facilities. Conveyances for transporting the raw product from the production area or storage should be adequate for the purpose intended and should be of such material and construction as will permit thorough cleaning and should be so cleaned and maintained as not to constitute a source of contamination to the product.

(2) Handling procedures. All handling procedures should be such as will prevent the product from being contaminated. Extreme care should be taken in transporting the product to prevent spoilage or deterioration. Refrigerated or insulated vans should always be used for transportation. Ice used should be of sanitary quality.

SECTION IV - PLANT, FACILITIES AND OPERATING REQUIREMENTS

A. Plant Construction and Lay-out

(1) Location, size and sanitary design. The building and surrounding areas should be such as can be kept reasonably free from objectionable odors, smoke, dust, or other contaminations; should be of sufficient size for the purpose intended without crowding of equipment or personnel; should be of sound construction and kept in good repair; should be of such construction as to prevent the entrance and harbouring of insects or birds or vermin; and should be so designed as to permit easy and adequate cleaning. The working premises, walls, floors and ceiling should be constructed of such a material and be so finished as to allow them to be effectively cleaned and drained and should be kept in good repair and prevent as far as practicable any risk of infestation.

(2) Sanitary facilities and controls.

(a) Separation of processes. Areas where raw materials are received or stored should be so separated from areas in which final product preparation or packaging is conducted as to preclude contamination of the finished product. Areas and compartments used for storage, processing and handling of the product should be separated and distinct from those used for inedible materials. The processing area should be completely separated from any part of the premises used as living quarters.

(b) Water supply. An ample supply of potable water should be available. Standards of potability should not be less than those contained in the "International Standards for Drinking-Water," World Health Organization, 1971, 3rd Ed., Geneva.

(c) Ice. Ice should be made from water of potable quality and should be manufactured, handled, stored and used so as to protect it from contamination.

(d) Auxiliary water supply. Where non-potable water is used--for such purposes as fire control--it must be carried in completely separate lines, identified preferably by color and with no cross-connection or back-siphonage with the lines carrying potable water.

(e) Plumbing and waste disposal. All plumbing and waste disposal lines (including sewer systems) must be large enough to carry peak loads. All lines must be water-tight and have adequate traps and vents. Disposal of waste should

be affected in such a manner as not to permit contamination of potable water supplies. The plumbing and the manner of waste disposal should be approved by the official agency having jurisdiction.

(f) Lighting and ventilation. Premises should be well lit and ventilated. Special attention should be given to the venting of areas and equipment producing excessive heat, steam, obnoxious fumes or vapors or contaminating aerosoles. Good ventilation is important to prevent both condensation (which may drip into the product) and mold growth in overhead structures--which growth may fall into the product. Light bulbs and fixtures suspended over the product in any step of preparation should be of the safety type or otherwise protected to prevent product contamination in the case of breakage. The illumination in any part of a working room should not be less than 325 lux units (30 foot candles) and at points requiring close examination of the product they should be illuminated at an intensity of not less than 540 lux units (50 foot candles). Reflector filaments should be designed to allow easy dismantling, cleaning and reassembling. Ventilation should be planned to allow for adequate circulation or changes of air and to ensure that the direction of air flow is never from a dirty area to clean one.

(g) Toilet rooms and facilities. Adequate and convenient toilets should be provided and toilet areas should be equipped with self-closing doors. Toilet rooms should be well lit and ventilated and should not open directly into the product handling area. Toilets should be at least 50 meters away from the processing hall. They should be kept in a sanitary condition at all times. There should be associated hand-washing facilities within the toilet area and notices should be posted requiring personnel to wash their hands after using the toilet.

(h) Hand-washing facilities. Adequate and convenient facilities for employees to wash and dry their hands should be provided wherever the process demands. They should be in full view of the processing floor. Single-use towels are recommended, where practicable, but otherwise the method of drying should be approved by the official agency having jurisdiction. The facilities should be kept in a sanitary condition at all times.

(i) Cleaning. All the utensils, trays and table surfaces which come in contact with the product should be washed initially with a cleaning agent to remove all organic material and/or product debris and finally with water having a minimum concentration of 50 ppm. of chlorine. This should be done before the day's work starts and then at the end of each working shift.

B. Equipment and Utensils

(1) Materials. All product-contact surfaces should be smooth; free from pits, crevices and loose scale; non-toxic; unaffected by the product; capable of withstanding repeated exposure to normal cleaning; and non-absorbent.

(2) Sanitary design, construction and installation. Equipment and utensils should be so designed and constructed as will prevent hygienic hazards and permit easy and thorough cleaning. Stationary equipment should be installed in such a manner as will permit easy and thorough cleaning. All contact surfaces should be of stainless steel or any other non-corroding, non-reacting materials. Approved plastic materials used should be free from cracks and scratches and should be capable of withstanding the regular cleaning and disinfection process.

(3) Equipment and utensils. Equipment and utensils used for inedible or contaminating materials should be so identified and should not be used for handling edible products.

C. Hygienic Operating Requirements

(1) Sanitary maintenance of plant, facilities and premises.

(a) The building, equipment, utensils and all other physical facilities of the plant should be kept in good repair and should be kept clean and maintained in an orderly, sanitary condition at all times. Waste materials should be frequently removed from the working area during plant operation and adequate waste receptacles should be provided. Detergents

and disinfectants employed should be appropriate to the purpose and should be so used as to present no hazard to public health.

(b) All equipment should be thoroughly cleaned and disinfection should always be carried out before commencement of the day's work. The equipment should also be washed thoroughly with detergent after the day's work is over.

(c) Waste materials should be stored in such a manner as not to cause nuisance from offensive odors or flies or other vermin. They should be removed from the premises at least once daily. Immediately after emptying, the receptacles should be thoroughly wased out with hot water and detergent and paved area used for storage of water receptacles should be thoroughly cleaned and disinfected.

(2) Vermin control. Effective measures should be taken to protect against the entrance into the premises and the harborage on the premises of insects, rodents, birds or other vermin. The processing halls should be adequately fly-proofed and provided with self-closing doors.

(3) Exclusion of domestic animals. Dogs, cats and other domestic animals should be excluded from areas from where the product is processed or stored.

(4) Personnel health. Plant management should advise personnel that any person afflicted with infected wounds, sores, or any illness, notably diarrhoea, should immediately report to management. The plant

management should take care to ensure that no person, while 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, is permited to work in any area of a food plant in a capacity in which there is a likelihood of such person contaminating product or products-contact surfaces with pathogenic organisms.

(5) Toxic substances. All rodenticides, fumigants, insecticides or other toxic substances should be stored in separate locked rooms or cabinets and handled only by or under the direct supervision of personnel with a thorough understanding of the hazards involved, including the possibility of contamination of the products.

(6) Personnel hygienic and product handling practices.

(a) All persons working in the plant should maintain a high degree of personal cleanliness while on duty. Clothing, including suitable headdress should be appropriate to the duties being performed and should be kept clean.

(b) Hands should be washed as often as necessary to conform to hygienic operating practices.

(c) Spitting, eating and the use of tobacco or chewing gum should be prohibited in the product handling areas.

(d) All necessary precautions should be taken to prevent the contamination of the product with any foreign substances.

(e) Minor cuts and abrasions on the hands should be appropriately treated and covered with a suitable water-proof dressing. Adequate first aid facilities should be provided to meet these contingencies so that there is no contamination of the product.

(f) Gloves used in product handling should be maintained in a sound, clean and sanitary condition. Gloves should be made of an impermeable material.

(7) Drainage. There should be adequate drainage facilities for carrying away water used in the plant premises and to discharge it into a channel at least 3 metres from the plant. The drainage system inside the premises should be properly covered. The sewage from the toilet should be disposed of in such manner that it cannot contaminate the water supply to the plant. Water, including waste or rain water, should not be allowed to accumulate inside the premises.

(8) Floor. The floor of the plant should be smooth and cemented and should be sloping so that the water always runs into the drain.

D. Operating Practice and Production Requirements

(1) Raw-material handling.

(a) Acceptance criteria. The raw material should not be accepted by the plant if known to contain decomposed, toxic or extraneous matter which will not be removed to acceptable levels by normal plant procedures of sorting or preparation.

(b) Storage. Raw materials stored in the plant premises should be maintained under conditions that will protect them against contamination and infestation and minimize deterioration.

(c) Water. Water used should be from such a source or suitably treated as not to constitute a public health hazard and should be used only by permission of the official agency having jurisdiction.

(2) Inspection and sorting. Prior to introduction into the processing line or at a convenient point within it, the raw materials should be inspected, sorted or culled as required to remove unfit materials. Such operation should be carried out in a clean and sanitary manner. Only clean sound materials should be used in further processing.

(3) Washing or other preparation. Raw materials should be washed as needed to remove any contamination. Water used for washing and rinsing should be of potable quality. Water used for such purpose should not be re-circulated unless suitably treated to maintain in a condition as will not constitute a public health hazard.

(4) Preparation and processing.

(a) Preparation. The live frogs should be put into 10% solution of common salt for 10 minutes. By treatment in brine solution the live frogs become almost completely paralyzed and thus are relieved from pain during cutting. When the frogs are completely paralyzed, the hind legs should be cut

at the abdomen not more than 2.5 cm above the waist. Immediately after cutting, the legs should be deskinned and put into 5% chilled brine for proper bleeding and to prevent clotting of blood inside. The deskinned legs should be washed and further cleaned by trimming of the claws. Hanging pieces of flesh should also be removed. The dressed material should be washed (3-4 times) in chilled potable water to remove bacteria coming from broken viscera or from contamination during cutting or handling and preserved in sufficient quantity of ice until it is further processed.

(b) Grading. The material should be given a final wash in clean water and graded in different sizes on the basis of count per kg. The legs should be either wrapped individually in polyethylene film or other suitable covering.

(c) Freezing. The material should be quick frozen at or below -40°C. in the minimum possible time. Bruised, squeezed or broken legs should not be used for freezing. The material may also be frozen in blocks. The frozen material should be shifted immediately to the cold storage, the temperature of which should not exceed -18°C.

(5) Packing of finished products.

(a) Materials. Packaging materials should be stored in a clean and sanitary manner and should not transmit to the product objectionable substances beyond limits acceptable to the official agency having jurisdiction and should provide appropriate protection from contamination.

(b) Techniques. Packaging should be done under conditions that preclude the introduction of contamination into the product.

(6) Storage of finished products. The following provisions should apply where the product is placed in chilling room and cold storage:

(a) The product should be stored under such conditions as will preclude the contamination with, or growth of pathogenic or toxigenic microorganisms or infestation and protect against deterioration of the product or of the containers. Special care should be taken to ensure that the air circulation in between the stacked product is proper and adequate;

(b) Entry should be restricted to personnel necessary to carry out operations efficiently;

(c) Doors should not be left open for extended periods and should be closed immediately after use;

(d) No chilling room and cold storage should be loaded beyond its designed capacity;

(e) If no automatic device is installed, temperatures should be read at regular intervals and the readings recorded in a log book.

(7) Transport of finished products. The finished products should be transported under such conditions as will preclude the contamination with, or growth of pathogenic or toxigenic microorganisms or infestation and protect against deterioration of the product or of the containers.

E. Sanitation Control Programme

It is desirable that each plant in its own interest designate a single individual, whose duties are preferably divorced from production, to be held responsible for the cleanliness of the plant. His staff should be a permanent part of the organization and should be well trained in the use of special cleaning tools, methods of disassembling equipment for cleaning, and in the significance of contamination and the hazards involved. Critical areas, equipment and materials should be designated for specific attention as part of a permanent sanitation schedule.

F. Laboratory Control Procedures

In addition to any control by the official agency having jurisdiction, it is desirable that each plant in its own interest should have access to laboratory control of the sanitary quality of the product processed. Such control should reject all products that are unfit for human consumption. Analytical procedures used should follow recognized or standard methods in order that the results may be readily interpreted.

SECTION V - END PRODUCT SPECIFICATION

A. To the extent possible in good manufacturing practice the froglegs should be free from objectionable matter.

B. The products should comply with the requirements set forth by the Codex Alimentarius Commission Committees on Pesticide Residues and Food Additives contained in permitted lists or relevant Codex commodity standards.

C. The froglegs should be completely free from skin and any foreign matter. They should be well-trimmed, should be reasonably free from blood clots and should not have black discoloration due to spoilage.

D. The froglegs should not show any signs of spoilage and should not have any off-odor when thawed and they should have a soft and firm texture.

E. When tested by appropriate methods of sampling and analysis, the frozen froglegs should comply with the following requirements:

1. Total bacterial count at 37°C, per gram, maximum	500,000
2. E. Coli, count per gram, maximum	10
3. Coagulase positive Staphylococcus, count per gram, maximum	100
4. Salmonella or Arizona, per 25 gram analytical units	zero