codex alimentarius commission

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

WORLD HEALTH ORGANIZATION

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ALINORM 08/31/25

March 2008

JOINT FAO/WHO FOOD STANDARDS PROGRAMME

CODEX ALIMENTARIUS COMMISSION
31st Session

Geneva, Switzerland, 30 June – 4 July 2008

REPORT OF THE FIRST SESSION OF THE *AD HOC* CODEX INTERGOVERNMENTAL TASK FORCE ON THE PROCESSING AND HANDLING OF QUICK FROZEN FOODS

Bangkok, Thailand, 25 - 29 February 2008

NOTE: This report contains Codex Circular Letter CL 2008/06-QFF.

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CX 5/105.2 **CL 2008/06-QFF**
March 2008

TO : - Codex Contact Points
- Interested International Organizations in Observer Status with Codex

FROM : Secretary, Codex Alimentarius Commission,
Joint FAO/WHO Food Standards Programme,
Viale delle Terme di Caracalla 00153,
Rome, Italy

SUBJECT : **REPORT OF THE 1ST SESSION OF THE *AD HOC* CODEX INTERGOVERNMENTAL TASK FORCE ON THE PROCESSING AND HANDLING OF QUICK FROZEN FOODS (ALINORM 08/31/25)**

MATTERS FOR ADOPTION BY THE 31st SESSION OF THE CODEX ALIMENTARIUS COMMISSION

PROPOSED DRAFT RECOMMENDED INTERNATIONAL CODE OF PRACTICE FOR THE PROCESSING AND HANDLING OF QUICK FROZEN FOODS (ALINORM 08/31/25, para. 62 and Appendix II)

The Code has been advanced to the 31st Session of the Codex Alimentarius Commission for adoption at Step 5/8 with the recommendation to omit Steps 6 and 7.

Governments and interested international organizations in observer status with Codex wishing to submit comments on the above document should do so in writing in conformity with the *Guide to the Consideration of Standards at Step 8 of the Procedure for the Elaboration of Codex Standards including Consideration of any Statements relating to Economic Impact* (Procedural Manual of the Codex Alimentarius Commission) to the above address, PREFERABLY BY E-MAIL, **before 30 April 2008**.

SUMMARY AND CONCLUSIONS

The 1st Session of the *Ad Hoc Codex Intergovernmental Task Force on the Processing and Handling of Quick Frozen Foods* reached the following conclusions:

MATTERS FOR ADOPTION BY THE CODEX ALIMENTARIUS COMMISSION

The Task Force agreed to forward the *proposed draft Recommended International Code of Practice for the Processing and Handling of Quick Frozen Foods* to the 31st Session of the Commission for adoption at Step 5/8 with the recommendation for omission of Steps 6/7 (ALINORM 08/31/25, para. 62 and Appendix II).

MATTERS OF INTEREST TO THE CODEX ALIMENTARIUS COMMISSION

The Task Force finalized the revision of the *Recommended International Code of Practice for the Processing and Handling of Quick Frozen Foods* (CAC/RCP 8-1976) and noted that there were no other matters to discuss and that it had completed the task assigned to it by the Commission (ALINORM 08/31/25, paras. 63-64)

TABLE OF CONTENTS

INTRODUCTION

1. The *Ad Hoc* Codex Intergovernmental Task Force on the Processing and Handling of Quick Frozen Foods held its First Session in Bangkok, Thailand from 25-29 February 2008, at the kind invitation of the Government of Thailand. Dr Kraisid Tontisirin, Senior Adviser, Institute of Nutrition, Mahidol University, Thailand, presided over the Session. The Session was attended by delegates from 17 Member countries and 1 Member Organization. The list of participants is attached to this report as Appendix I.

Opening of the Session

2. The Session was opened by Mr Pinit Korsieporn, Deputy-Permanent Secretary, Ministry of Agriculture and Cooperatives. He stressed the growing importance of quick frozen foods in international trade and thus the need to finalize the *proposed draft Recommended International Code of Practice for the Processing and Handling of Quick Frozen* Foods to facilitate trade in these products.

Division of Competence

3. The Task Force noted the division of competence[1] between the European Community and its Member States, according to paragraph 5, Rule II of the Procedure of the Codex Alimentarius Commission.

ADOPTION OF THE AGENDA (Agenda Item 1)[2]

4. The Task Force adopted the Provisional Agenda as its Agenda for the Session.

MATTERS REFERRED TO THE TASK FORCE BY THE CODEX ALIMENTARIUS COMMISSION AND/OR ITS SUBSIDIARY BODIES (Agenda Item 2)[3]

5. The Task Force acknowledged that the document was presented for information only and that no action needed to be taken on the matters contained therein.

PROPOSED DRAFT RECOMMENDED INTERNATIONAL CODE OF PRACTICE FOR THE PROCESSING AND HANDLING OF QUICK FROZEN FOODS (Agenda Item 3)[4]

6. The Delegations of the United States and Thailand briefly reminded the Task Force of the history of the development of the current proposed draft Code and indicated that the most controversial concepts such as of Defect Action Point Analysis had been taken out from the document. They thanked those delegations which had contributed to the process by sending comments and encouraged the Task Force to finalize all outstanding issues at this only meeting, as agreed during the 29th Session of the Commission.

General comments

7. The Committee expressed its appreciation to the Delegations of United States of America and Thailand for their hard work in preparing the current meeting and the most recent version of the Code.

8. Some delegations indicated that the current Code was clearer, shorter and more focused and that there did not appear to be substantial issues of a highly controversial nature any more and were of the view that technical comments could be incorporated into the Code during the current meeting.

9. The Committee agreed to start consideration of technical issues made on the draft in Appendix I to CL 2007/35-QFF with the understanding that formatting and presentation aspects of the Code could be addressed later (see para. 16).

10. The Task Force considered the proposed draft Code section by section and agreed to apply the following terms, among others, across the text for consistency: competent authority instead of national legislation/regulation, permitted tolerances instead of acceptable/authorized tolerances and similars, etc. In addition, the Task Force made a number of editorial amendments and agreed on the following changes:

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1 CRD 1.
2 CX/QFF 08/01/1.
3 CX/QFF 08/01/2.
4 CL 2007/35-QFF and comments from Brazil, European Community, Japan, Kenya, Thailand, United States of America and EuroCommerce (CX/QFF 08/1/3); Philippines (CRD 2); France (CRD 3) and Malaysia (CRD 4). Proposal of the Codex Secretariat (CRD 5).

Introduction (new Section 1 – Scope and Objective)

11. The Task Force deleted the first sentence from the Introduction as currently the revision history of all Codex texts was being moved to a footnote.

12. The Committee noted that during earlier development of the Code there were proposals to delete an Annex and incorporate its content into the body of the document; however the Task Force decided to keep an Annex separated and insert additional wording to the second paragraph to emphasize that the Code and its Annex were intended to assist all those engaged in the processing and handling of quick frozen foods.

Section 1 - Scope and Objective

13. The Task Force discussed what products should be covered by the scope and what products should be left outside its scope. After some discussion it agreed to amend the first paragraph to emphasize that all quick frozen products including cereals, bakery and pastry products were covered by the Code and that ice-cream and milk were not included. Any products produced using a quick freezing process as defined in the Code were to be covered by this Code.

14. The Task Force also agreed to amend the second paragraph to refer to “essential quality provisions” instead of “essential product quality”.

15. The Task Force noted written comments submitted by Kenya suggesting expanding the Scope to cover production and transportation of raw materials because of their significance for quality and safety for quick frozen foods, however the Task Force was of the view that this proposal went beyond of the Terms of Reference for this Task Force and that significant amount of information on this matter existed in other codes and standards, therefore did not agree to this proposal.

Formatting and Presentation

16. In the light of the amendments made above, the Task Force agreed to the proposal of the Codex Secretariat to merge Sections on Introduction and Scope as proposed in CRD 5 in order to avoid repetitions and improve the flow of paragraphs.

Section 2 - Definitions

17. The Task Force noted that definitions should be as short and precise as possible and that provisions for their applications should be stated in the relevant sections of the Code rather than as part of definitions, therefore decided to delete the second sentence containing provisions for the application of quick freezing process from the definition of “quick freezing process”, recognizing that these provisions were already covered in Section 4.3. Consequently, the Task Force agreed to include a separate definition for “thermal centre” (originally footnote 1) as this concept was further used in the document.

18. It was proposed to better define the meaning of “as quickly as possible” in the definition of “quick freezing process”, however the Committee noted that it was difficult to make the phrase more specific because of the diversity of products and range of temperatures.

19. The Task Force noted that “blanching” was mentioned several times in the Code and agreed to include a new definition for this term, referring to inactivation of enzymes and fixing product colour.

20. The definition of “cold chain” was amended to explicitly include transport and storage as these steps were very important for quality and safety of quick frozen foods.

21. The definition on “quick frozen foods” was amended to emphasize that the maximum temperature should be observed at all points of the cold chain. The Task Force also deleted the reference to labelling at the end of this definition as it was considered that this issue could be better addressed in the labelling section.

Section 3 - Prerequisite Programme

22. The Task Force noted the proposal to add an additional paragraph to the first paragraph to emphasize that all prerequisite programmes must be initially validated and appropriate preventive measures and a monitoring system should be in place, however it also noted that the Guidelines for Validation of Food Safety Control Measures developed by the Committee on Food Hygiene and forwarded to the 31st Session of the Commission for final adoption already covered this concept in more detail and therefore agreed to amend the third paragraph of this section by including reference to the above guidelines to emphasize the importance of validation of food safety control measures for quick frozen foods.

Section 3.1.3 - Cold Store Design

23. The Task Force deleted the square brackets from first bullet to emphasize that product temperature should be maintained at minus 18° C or colder. Consequential changes in this regard were also made elsewhere in the document for consistency.

24. The second bullet was amended to emphasize that instead of uniform air distribution there should be an adequate air flow.

25. It was proposed to delete or to revise the third bullet regarding the temperatures control and record, which could better be addressed in Section 4. However, after some discussion, the Task Force noted that it was an important concept that should be considered in the cold store design and therefore agreed to substitute it with the following wording: "that storage areas are provided with a capability to control and record temperatures on a regular basis".

Section 3.1.4 - Equipment and Design

26. The Task Force noted that equipment design and construction should prevent the introduction of physical hazards as well as chemical and microbiological hazards and therefore amended the first sentence of this section to that effect. The Task Force noted the comments submitted by Kenya on the inclusion of stainless steel equipments, however, the Task Force did not agree with this proposal as too prescriptive and as it might prevent future technology development.

Section 3.1.5 - Facilities

27. The Task Force clarified that a contingency plan should be in place and cover not only electrical power losses but also in cases of equipment failure, and therefore decided to amend this provision to read: "*In the case of power losses or equipment failure a contingency plan should be in place in order to maintain the product temperature*". As a consequence, the Task Force agreed to delete subheading "3.1.5.1 Electricity".

Section 3.2.1.1 - Traceability/Product Tracing

28. The Task Force noted that the first bullet was already covered by the preceding paragraph 3.2.1 and the following bullet containing the reference to the *Principles for Traceability/Product Tracing as a Tool within a Food Inspection and Certification System (CAC/GL 60-2006)* and therefore agreed to delete it and combine the introductory sentence with the second bullet. The Task Force also agreed to insert additional wording at the end of this modified paragraph to emphasize that traceability/product tracing should be designed especially to enable withdrawal process, where necessary.

Section 4 – Cold Chain Control

Introductory statement

29. The Task Force had an exchange of views on the use of the terms "food hygiene" and "food safety" under the second paragraph. Some delegations pointed out that the separation between "hygiene" and "safety" provisions was confusing as food safety encompassed food hygiene. The Task Force noted that issues relating to food hygiene provisions were already covered in the Introduction of the Code and therefore, it agreed to delete the first sentence of this paragraph and referred only to food safety, for clarity.

30. The Task Force agreed, in footnote on the definition of "essential quality provisions", to delete the reference to "temperature control" as an example of essential quality provision since this parameter applied to both quality and safety issues.

Section 4.1 – Raw Material

31. The Task Force agreed that temperature and duration of storage should be appropriately but also regularly controlled to minimize adverse microbial effects. It therefore agreed to include the term "and regularly" in the third paragraph.

Section 4.2 – Processing before Freezing

32. The Task Force noted that the glazing process, described in the third paragraph, was conducted after freezing and before packing. Therefore, it agreed to create a separate Section on “Processing after Freezing” (new Section 4.4) and to transfer the provisions for glazing under this Section. In addition, the provision was amended to ensure fair trade practices by preventing excessive addition of water to the product through the proper application of glazing.

Section 4.3 – Quick Freezing Process

33. In the first paragraph, the Task Force agreed to refer to “thermal conductivity”, for accuracy. In addition, the Task Force had an extensive discussion on the feasibility to set numerical values for a temperature range of maximum ice crystallization. It was noted that the scope of the Code applied to a wide variety of products and thus the range might vary according to the type of product. Some delegations favoured the indication of ranges for some examples of products, to provide for some guidance on the implementation of provisions in the Code. Other delegations supported a general approach to ensure inclusiveness and provide for flexibility. In view of this, the Task Force agreed to delete the reference to the specific numerical range of temperature at the thermal centre of the product from this section and to recognize that the temperature ranges varied between different types of products.. One delegation indicated that the control of the temperature should be done at the thermal centre of the product to ensure reliability and accuracy of the measure and thus food quality and safety. This delegation stressed the importance of this concept as temperature measurements might lead to different results depending on the type of product.

34. In addition to the above, the Task Force agreed to refer to “essential quality provision” as opposed to “essential quality factor” for consistency throughout the text.

35. In the second paragraph, the Task Force agreed that it was more appropriate to refer to the “mass of the product” and therefore, the reference to “very” was deleted.

36. In the third paragraph, the Task Force agreed to replace the first sentence of the paragraph with the requirements for quick freezing process that were previously stated in the definition of the process (Section 2). The last part of the second sentence was reworded for clarity and, in addition to exposure to warm temperatures, it was recognized that exposure to high humidity environment should also be minimized as this was a factor leading to excessive condensation.

37. A Delegation expressed concern as to whether this additional wording regarding humidity might lead to supplementary systems to control and monitor the humidity. It was clarified that the additional wording was intended to minimize exposure time of the product to high humidity and that supplementary systems to control and monitor the humidity would not be required.

Section 4.3.1 – Impact of Quick Freezing on Microorganisms

38. The Task Force agreed to amend the title of the Section by including a reference to “parasites” as provisions in this Section covered both microorganisms and parasites.

39. In the first paragraph, the Task Force noted some inconsistencies in the use of the term “hazard” in relation to the presence of some parasites and thus the first sentence was amended accordingly. It also agreed to delete the examples of combination of certain live helminth parasites and commodities for inclusiveness. It further agreed to change the term “host species” by “type of commodity” as the latter was more accurate.

40. The Task Force noted the written comments submitted by Kenya in relation to the reorganization of this Section in two separate sub-sections to address quick frozen foods arising from raw or semi-cooked raw materials and their impact on the safety of the final product. The Task Force however decided to keep the original text noting that this proposal would require major changes in the current format and content.

Section 4.4 – Packaging and Labelling (new Section 4.5)

41. The Task Force agreed to reorganize this Section into two separates sub-sections to address provisions for labelling and packaging separately, in line with the written comments submitted by Kenya.

42. As regards provisions concerning packaging, the Task Force recognized that, although the packaging provisions contained in the four bullet points were already covered by the *General Principles of Food Hygiene* and other Codex texts, there was a merit in retaining them in the Code due to their particular relevance to quick frozen foods. Furthermore, the Task Force noted that provisions on preservation of food quality and safety in the second and fourth bullets referred to two different situations namely contamination by biological and/or chemical hazards arising from e.g. migration of substances from the packaging into the food (fourth bullet), as opposed to other types of situations e.g. adulteration (second bullet).

Section 4.5 – Frozen Storage (new Section 4.6)

43. The Task Force agreed to amend the last paragraph to link the provision on rotation of stocks in cold stores with the shelf life (durability date) of the product and made consequential amendments to the corresponding provision in Section 4.8 – Retail Sale (new Section 4.9).

Section 4.6 – Transport and Distribution (new Section 4.7)

44. The fourth paragraph was amended to ensure proper temperature of quick frozen foods at the beginning of transport. In addition, the term “retailers” was deleted to clarify that the cold chain also encompassed other stakeholders who received and used quick frozen foods, e.g. restaurants, catering services.

Section 4.7 – Transfer Points (new Section 4.8)

45. The Task Force agreed to amend the 4th bullet to allow for certain flexibility of temperature checks at the receiving/dispatching points, as appropriate to circumstances.

Section 5 – Temperature Management in the Cold Chain

46. The Task Force agreed to amend the introductory paragraph to clarify the purpose of the Annex to the Code. It also agreed to introduce an amendment in the Spanish version to better qualify the temperature control.

Section 5.1 – Temperature Monitoring

47. In the first paragraph, the Task Force agreed to delete the reference to “*tamper-proof*” systems to provide for flexibility as there were other systems in place to monitor air temperatures along the cold chain. In addition, the Task Force agreed to specify the product temperature for accuracy and to introduce temperature tolerances in accordance with the permitted tolerances, set by the competent authorities.

Section 5.2 – Stepwise Approach to Temperature Control

48. As regards non-destructive temperature measurements, it was noted that this type of measurement should be an integral part of the control system, however, the way the provision was written gave the impression that it was carried out only when problems were identified during the first two steps. The Task Force therefore agreed to amend some bullet points to improve clarity and logics in the stepwise sequence.

Section 5.3 – Temperature Violation

49. Several delegations noted that corrective actions to ensure safety and quality of quick frozen foods in case of temperature violation should not be limited to reducing the product temperature as there might be other more appropriate measures according to the type and condition of the product. The third sentence was therefore amended accordingly. In addition, it was agreed that in cases of compromised safety and quality, information should be provided not only to suppliers and buyers but to those relevant parties in the supply chain, with the understanding that relevant parties did not include consumers.

Annex – Specific Information on Temperature Monitoring and Control in the Cold Chain

50. The Task Force agreed to add an introductory section in the Annex with a view to clarifying that in addition to guidance and explanation on currently available technologies in the cold chain, new temperature measuring and recording devices may be developed and used in the future.

Section 1 – Air Temperature Monitoring (new Section 2)

51. The Task Force noted that devices other than electronic thermometers were also used to measure and record the temperature, therefore clarified the first sentence of the first paragraph and the first bullet in order to include other types temperature measuring and recording devices.

52. The Task Force agreed to delete the last sentence of the first bullet as it was too restrictive.

53. The Task Force was of the view that other types of thermocouples could be used, therefore agreed to indicate Types K and T as examples in the second bullet.

Section 1.2 - Air Temperature Monitoring of Cold Stores (new Section 2.2)

54. Many delegations supported an alternative language provided in square brackets in this section as it provided more precision and flexibility; therefore the Task Force agreed to delete square brackets around this wording and deleted the first four paragraphs of this Section. Some editorial amendments were made in the new wording of the first paragraph for clarification purposes.

55. The Task Force also agreed to delete, in the first sentence of the new second paragraph, the reference to "component of the validation of the HACCP plan".

Section 1.4 - Air Temperature Monitoring and Display Cabinets (new Section 2.4)

56. The Task Force noted that there was no introductory sentence before the two bullets in this section and Sections 2.1.2 and 2.2.1, therefore agreed to convert bullets into paragraphs.

Section 2.1.1 - Specification of Measuring System (new Section 3.1.1)

57. The Task Force amended the 4th bullet to make it less restrictive.

58. The Task Force clarified the 7th bullet to the effect that the system should be robust and the device should be shock proof.

Section 2.2.1 - During Transport (new Section 3.2.1)

59. The Task Force agreed that the second and third bullets should refer to Figures 1 and 2, instead of "top" and "bottom" of the figures.

60. The Task Force also agreed to put the pictures in the frame to improve its presentation.

Section 3.4 – Temperature Indicators (TIs) and Time-Temperature Indicators (TTIs) (new Section 4.4)

61. The Task Force amended the second sentence of this section to include, as a reason for reference, the current limitations arising from the use of TIs and TTIs for packaging.

Status of the proposed draft Recommended International Code of Practice for the Processing and Handling of Quick Frozen Foods

62. The Task Force agreed to forward the amended *proposed draft Recommended International Code of Practice for the Processing and Handling of Quick Frozen Foods* to the 31st Session of the Commission for adoption at Step 5/8 with the recommendation to omit Steps 6 and 7 (see Appendix II).

OTHER BUSINESS (Agenda Item 4)

63. The Task Force congratulated Thailand and the US for the excellent work done in preparing the final draft of the Code which had greatly facilitated discussions at the plenary meeting. The Task Force also complimented Thailand for the organization of this Session and in particular, Dr Kraisid Tontisirin for his excellent chairmanship which allowed building up decisions on a consensus basis. Dr Tontisin thanked all delegates for their spirit of collegiality that had been instrumental for the smooth conclusion of the work by the Task Force.

64. The Task Force noted that there were no other matters to discuss under this Agenda Item. It further noted that the Task Force had completed the task assigned to it by the Commission.

STATUS OF WORK

Subject	Step	Action by	Document Reference ALINORM 08/31/25
Proposed draft Recommended International Code of Practice for the Processing and Handling of Quick Frozen Foods (CAC/RCP 8-1976)	5/8	31st CAC	Para. 62 and Appendix II

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PROPOSED DRAFT RECOMMENDED INTERNATIONAL CODE OF PRACTICE FOR THE PROCESSING AND HANDLING OF QUICK FROZEN FOODS

(AT STEP 5/8)

1. SCOPE AND OBJECTIVE

This Code applies to the receiving, preparation, processing, handling, storage, transport, distribution, and retailing of all quick frozen foods such as cereals, fruits and vegetables, fish, meat, poultry and their products, bakery and pastry products. The Code does not apply to edible ices, ice creams and milk.

The objective of this Code is to provide guidance for the processing and handling of quick frozen food to help ensure product safety and other aspects of the production of quick frozen foods including, as appropriate, essential quality provisions, composition and labelling provisions of pertinent Codex commodity standards. The guidance, emphasizing proper cold chain management, incorporates good hygienic and good manufacturing practices and the application of the Hazard Analysis and Critical Control Point (HACCP) approach described in the HACCP Annex to the *Recommended International Code of Practice: General Principles of Food Hygiene* (CAC/RCP 1-1969). A prerequisite programme is described in the Code, covering essential requirements of hygiene in the production of quick frozen foods that should be in place prior to the application of HACCP.

The food hygiene provisions of this document are supplemental to, and must be used in conjunction with the *General Principles of Food Hygiene*. The Code should also, as appropriate, be used in conjunction with other Codex texts, including the *General Standard for the Labelling of Prepackaged Foods* (CODEX STAN 1-1985), codes of hygienic practice (e.g. *Code of Hygienic Practice for the Transport of Food in Bulk and Semi-Packed Food* (CAC/RCP 47-2001), *Code of Hygienic Practice for Meat* (CAC/RCP 58-2005)), codes of practice (e.g. *Code of Practice for Fish and Fishery Products* (CAC/RCP 52-2003)) as well as the *Guidelines for the Validation of Food Safety Control Measures*[1]. Reference can also be made, as appropriate, to Codex quick frozen food standards and/or provisions in relevant Codex texts.

This Code including its Annex is intended to assist all those who are engaged in the processing and handling of quick frozen foods and/or are concerned with their storage, transportation, export, import and sale in attaining safe food products of appropriate quality.

In addition, the Code may be used for training of employees of the quick frozen food industry. The application of this Code by countries is likely to require modifications and amendments, taking into account local conditions and specific consumer requirements.

2. DEFINITIONS

The definitions listed below are for the purpose of this Code only:

Blanching	A heat process typically applied to a food for the purpose of inactivating enzymes and/or fixing the product colour.
Cold chain	A term embracing the continuity of successively employed means to maintain the temperature of foods, as appropriate, from receiving through processing, transport, storage and retailing.
Prerequisite programme	Programme required prior to the application of the HACCP system to ensure that any component of the cold chain is operating according to the *Recommended International Code of Practice: General Principles of Food Hygiene* appropriate Codex codes of practice, and other appropriate food safety legislation.
Quick freezing process	A process which is carried out in such a way that the range of temperature of maximum ice crystallization is passed as quickly as possible.

[1] At Step 5/8 of Procedure for final adoption by the 31st Session of the Commission.

Quick frozen food	Food which has been subjected to a quick freezing process, and maintained at -18°C or colder at all points in the cold chain, subject to permitted temperature tolerances.
Thermal centre	The point within a piece of food which has the highest temperature at the end of a quick freezing process.
Tolerances	Short term fluctuations of temperature of the product in the cold chain, within limits permitted in this Code and which do not affect safety and quality.

3. PREREQUISITE PROGRAMME

In conjunction with the application of HACCP to any segment of the quick frozen food chain, that segment should be supported by prerequisite programmes based on good hygienic practice and good manufacturing practice. Prerequisite programmes should be specific within an individual establishment, and should be periodically evaluated to ensure their continued effectiveness.

While prerequisite programmes are usually associated with food safety, properly operating prerequisite programmes will also contribute to product quality.

Reference should be made to the *Recommended International Code of Practice: General Principles of Food Hygiene* and relevant Codex codes of hygienic practice and codes of practice including the *Guidelines for the Validation of Food Safety Control Measures* for further information to assist with the design of the prerequisite programmes for a processing facility.

In addition to the provisions of the *Recommended International Code of Practice: General Principles of Food Hygiene* following additional prerequisite provisions should apply:

3.1 ESTABLISHMENT: DESIGN AND FACILITIES

3.1.1 Location

Processing facilities should, to the extent possible, be located close to the source of raw materials so as to minimize changes that might lead to quality or safety concerns for raw materials of quick frozen foods prior to freezing.

3.1.2 Process Plant Design

The food processing facility should be designed for the rapid processing, freezing and storage of food products. The processing facility should include a product flow that is designed to minimize process delays and prevent cross-contamination that could affect food quality and safety.

3.1.3 Cold Store Design

The cold store walls, floor, ceiling, and doors should be properly insulated in order to help maintain appropriate product temperatures. It is important that the design of the cold store ensures that:

- adequate refrigeration capacity provides and maintains a product temperature of -18°C or colder;
- there is adequate air flow around the stored foods;
- storage areas are provided with a capability to control and record temperatures on a regular basis;
- loss of cold air and introduction of warm and humid air are avoided; and
- leaks of any refrigerant are prevented. In case of a leak, immediate corrective action ought to be applied in order to eliminate the problem.

3.1.4 Equipment Design and Construction

The equipment should be designed and constructed in such a manner that physical damage to the raw materials and product is minimized, e.g. by ensuring there are no sharp inside corners or projections and that physical, chemical or biological hazards are not introduced into the product. Freezers should be designed and constructed so that, when properly operated, they meet the requirements of a quick freezing process.

3.1.5 Facilities

In the case of power losses or equipment failure, a contingency plan should be in place in order to maintain the product temperature.

3.2 CONTROL OF OPERATION

3.2.1 Recall Procedures

Recall procedures should be in place to ensure timely withdrawal of products that may pose a risk to human health.

3.2.1.1 *Traceability/Product Tracing*[2]

The traceability/product tracing system should be designed and implemented according to the *Principles for Traceability/Product Tracing as a Tool within a Food Inspection and Certification System* (CAC/GL 60-2006), especially to enable the withdrawal of the product, where necessary.

3.3 ESTABLISHMENT: MAINTENANCE AND SANITATION

3.3.1 Maintenance Regimes

Proper maintenance and repair of any damage to the cold store and its infrastructure (e.g. prevention of rust, water leaks, ice accumulation, etc.) should be ensured so that insulation and refrigeration performance is maintained.

3.4 TRAINING

Staff should have the skills and knowledge appropriate to their work to ensure that safety and quality of foods is not adversely affected during handling. Staff should also be aware of the importance of maintaining temperature control for frozen foods to maintain the quality and safety of the foods. Training programs should be in place (either formal training courses or training provided whilst working) to ensure that staff have these skills and knowledge.

4. COLD CHAIN CONTROL

As appropriate, both safety and quality aspects should be considered for each operation of the cold chain.

With respect to food safety, a HACCP plan should be developed, as appropriate, for each operation in the cold chain.

Cold chain control is also important with respect to food quality. Essential quality provisions[3] can apply at various points in the processing and handling system. While control of essential quality provisions may be considered optional, control of food safety hazards through prerequisite programs and a HACCP plan should be used, as appropriate, to ensure safety.

4.1 RAW MATERIALS

Raw materials used should be safe, sound and suitable for further processing.

Procedures should be in place to ensure quality and safety of incoming materials. Freezing cannot improve quality, and it is necessary to use raw materials of optimum quality. Many raw materials and food products are highly perishable and should be handled carefully to maintain their quality until the freezing process is initiated.

Initial microbial levels in raw materials to be frozen should be kept as low as possible, both for food safety and quality reasons. Temperatures and duration of storage should be appropriately and regularly controlled to minimize adverse microbial effects. Most quality deterioration, including the development of off odours and flavours and changes in colours and texture are due to microbial growth or enzymatic activity.

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2 See Definitions for the Purposes of the Codex Alimentarius, Procedural Manual of the Codex Alimentarius Commission.

3 Essential quality provision is a provision which should be applied to ensure the specified quality of the product.

Producers of quick frozen food should as far as practicable implement measures to control physical, biological and chemical hazards in raw materials to levels that do not present a threat to human health according to the recommendations of the relevant sections of the *Recommended International Code of Practice: General Principles of Food Hygiene* and other relevant Codex texts.

Appropriate procedures should be in place for sorting and segregating raw materials that are unsuitable for further processing. Raw materials for processing and quick freezing should be prepared without delay and appropriate temperature control should be applied in order to minimize possible microbiological, chemical or biochemical changes that might affect safety and quality. To minimize deterioration, raw materials should be cooled and stored under appropriate conditions (e.g. pre-cooling) or transported and frozen in the shortest time possible.

For highly perishable products, product temperature control at receiving may be considered a critical control point (CCP)[4]. Additionally, the receipt temperature may also be considered an essential quality provision.

4.2 PROCESSING BEFORE FREEZING

Raw materials may be processed in many ways before freezing, e.g. cleaning, sorting, cutting, slicing, blanching, conditioning, ageing, scalding, filleting and heating. Whether such processes should be regarded as CCPs depends on the type of raw materials and the actual conditions, especially on how much time the raw materials and the resulting product spend at temperatures that could result in pathogen growth. It is particularly important that the time spent in the critical temperature zone (i.e. between 10°C and 60°C) be as short as possible. Consideration should also be given to any of these processes as to whether or not they should be regarded as an essential quality provision.

Blanching is often used in the production of frozen vegetables and other products to inactivate enzymes that would cause quality problems (taste, colour) during frozen storage. The blanching schedule should be determined to ensure the desired quality outcome, and may be an essential quality provision.

If storage of intermediate ingredients (e.g. a quick frozen vegetable that is to be combined with other quick frozen vegetables or other ingredients into a final product) is necessary prior to further processing, the storage conditions, especially temperature, should be appropriate to the foodstuff concerned and if necessary, take into account future use or further processing of the food.

The heat treatment of many pre-cooked foods, e.g. prepared meals, should be sufficient to ensure inactivation of pathogens of concern. In certain cases, based on the hazards and controls specified for an operation, the time-temperature treatment and subsequent cooling may be considered as CCPs.

If frozen raw materials are used and a thawing process is included, the thawing method should be clearly defined and the thawing schedule (time and temperature parameters) should be carefully monitored. Selection of the thawing method should take into account the thickness and uniformity of size of the products in particular. Thawing should be done in such a manner that the growth of microorganisms is controlled. Thawing time and temperature parameters may be a CCP and/or an essential quality provision.

4.3 QUICK FREEZING PROCESS

The quick freezing process should be performed in such a manner as to minimize physical, biochemical and microbiological changes, by taking into account the freezing system or process and its capacity, nature of the product (thermal conductivity, thickness, form, initial temperature) and volume of production. This is best achieved by ensuring that the product passes quickly through the temperature range of maximum ice crystallization. This temperature range varies among different types of products. The quick freezing process step may be considered an essential quality provision.

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[4] See HACCP Annex to the Recommended International Code of Practice: General Principles of Food Hygiene (CAC/RCP 1-1969)

During freezing operation it is important to provide spaces or channels permitting air circulation between the cartons or the pieces of food, respectively. This is especially the case when large lots of food are frozen or where the food consists of large pieces (e.g. whole turkeys). If such air channels are not provided, the mass of the food may be such that in spite of rapid air blast and low air temperatures, the inner parts of the lot chill and freeze slowly. It is important that the thermal centre of the product is chilled as quickly as possible to prevent the outgrowth of pathogenic microorganisms or the production of microbial toxins. Freezing may be a CCP.

The quick freezing process should not be regarded as complete until and unless the product temperature has reached -18°C or colder at the thermal centre, after the stabilization of the temperature. On exit from the freezing apparatus, the product should be moved to a cold store as quickly as possible in order to minimise exposure to warm temperatures and high humidity and to maintain the product temperature at -18°C or colder. The same applies to products that are retail packed after the quick freezing process (see Section 4.8).

4.3.1 Impact of Quick Freezing on Microorganisms and Parasites

Freezing should not be considered as a lethal treatment for microbiological contamination in foods. However, freezing may result in the death of certain microorganisms and will inhibit the growth of others.

In products intended for raw consumption or not fully cooked prior to consumption, freezing can be used to control live helminth parasites, such as *Anisakis* spp. and *Trichinella*. Freezing may serve as a control mechanism when developing HACCP plans for marinating, pickling, or other final preparations which do not supply sufficient heat from cooking to inactivate any potentially harmful parasites. The conditions required for effective parasite control using freezing include the final temperature and time of holding in the frozen state. These parameters vary depending on a number of factors which may include the type of commodity, species of parasite, thickness of the product, and arrangement of product in the freezer. The use of freezing as a food safety control measure should, as with all food safety control measures, be appropriately validated to ensure that the measure is capable of controlling the hazard[5].

4.4 PROCESSING AFTER FREEZING

Glazing[6] may be used to limit dehydration during frozen storage. Such dehydration may affect the appearance and other quality parameters of the food. The application of glazing should be properly controlled.

4.5 PACKAGING AND LABELLING

4.5.1 Packaging

In general, the packaging should:

- protect the food against dehydration;
- protect the food against microbial and other contamination that could adversely affect safety and quality;
- protect the sensory and other quality characteristics of the food; and
- not add to the food any substance that may influence the safety and quality of the food.

The packaging or re-packing of quick frozen foods should be carried out in such a manner that an increase in temperature, within the permitted tolerances of the quick frozen foods, does not adversely affect the safety and quality of the product.

4.5.2 Labelling

The labelling of packaged quick frozen foods should comply with the requirements of the *General Standard for the Labelling of Prepackaged Foods* (CODEX STAN 1-1985) and the relevant Codex standards for quick frozen foods.

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5 See *Guidelines for the Validation of Food Safety Control Measures* (currently at Step 5/8 of Procedure).

6 The application of a protective layer of ice formed on the surface of a frozen product by spraying it with, or dipping it into, potable water, or potable water with additives adopted by the Codex Alimentarius Commission, as appropriate.

4.6 FROZEN STORAGE

Cold stores should be designed and operated so as to maintain a product temperature of -18°C or colder with a minimum of fluctuation (see Section 3.1.3). The temperature of the cold store may be an essential quality provision and/or a CCP to avoid a critical temperature abuse situation that may jeopardize food safety.

Stock should be placed in the cold room in such a manner that the circulation of cold air is not impeded to the extent that the product temperature is adversely affected.

Stocks should be rotated to ensure that the products leave the cold store on a "First in-First out" basis or shortest durability date. In no case, should products be stored beyond their specified shelf-life.

4.7 TRANSPORT AND DISTRIBUTION

The product temperature during transport and distribution may be an essential quality provision and/or a CCP to avoid a critical temperature abuse situation that may jeopardize food safety. The transport of quick frozen foods (e.g. from cold storage warehouse to cold storage warehouse) should be carried out in suitably insulated equipment that ideally maintains a product temperature of -18°C or colder. The product temperature should be at -18°C or colder at the beginning of the transport.

Vehicle compartments or containers should be pre-cooled prior to loading. Care should be taken not to impair the efficiency of temperature control or reduce the refrigeration capacity.

The user of the vehicle or container should ensure:

- adequate supervision of product temperatures at the moment of loading;
- effective stowage of the load in the vehicle or the container to protect the cargo against heat entering from outside;
- efficient operation of the refrigerating unit during transit, including the correct thermostat setting;
- an appropriate method of unloading at the points of arrival (particularly the frequency and duration of door openings);
- proper maintenance of the insulated body and the refrigeration system; and
- proper cleaning of the vehicle or container.

Distribution of quick frozen foods should be carried out in such a way that any rise in product temperature warmer than -18ºC be kept to a minimum within, as appropriate, the limit set by competent authorities and should not in any case be warmer than -12ºC in the warmest package to ensure quality of the products. After delivery, the product temperature should be reduced to -18°C as soon as possible.

Loading into and unloading from vehicles and loading into and unloading from cold stores should be as fast as practicable and the methods used should minimize product temperature rise.

4.8 TRANSFER POINTS

Attention should be paid to moving quick frozen foods as rapidly as is reasonably practicable from cold store to vehicle/container or from vehicle/container to holding store or from holding store to display cabinets. Often, transfer of responsibility occurs at the same time.

- Quick frozen foods should not be left for any significant length of time at ambient temperature.
- Procedures should be established for dispatching loads and for immediate storage of food upon arrival, in order to minimize exposure to humidity, elevated temperatures or other adverse conditions.
- It should be established that all personnel are following such procedures.
- The product temperature should be checked as necessary, as the product is received or dispatched and a record of these measurements retained for a period that exceeds the shelf-life of the product.
- Operations (such as casing, order assembly, palletizing, etc.) should be carried out in the cold store or in a suitably temperature-controlled area.

4.9 RETAIL SALE

Quick frozen foods should be offered for sale from freezer cabinets designed for the purpose. Cabinets should be capable of maintaining and be so operated as to maintain a product temperature of -18°C. A rise in product temperature may be tolerated for short periods, with any rise warmer than -18ºC kept to a minimum, within, as appropriate, the limit set by competent authorities, and should not in any case be warmer than -12ºC in the warmest package.

Temperature in the cabinet may be an essential quality provision and/or a CCP to avoid a critical temperature abuse situation that may jeopardize food safety.

Display cabinets should:

- be equipped with an appropriate temperature measuring device (see Annex, Section 2.4);
- be located so that the open display area is not subject to draughts or abnormal radiant heat (e.g. direct sunlight, strong artificial light or in direct line with heat sources); and
- never be stocked beyond the load line.

Cabinets requiring defrosting should have the defrost cycle programmed in such a way that, to the extent possible, defrosting takes place outside peak shopping periods. If necessary to avoid detrimental effects due to warming or thawing, quick frozen foods should be moved during defrost cycles to a suitable cold store.

Stocks should be rotated to ensure that the products are sold on a “First in-First out” basis or shortest durability date. In no case, should products be stored beyond their specified shelf-life.

The retail establishment should have an appropriate back-up storage for quick frozen foods that allows products to be kept at a temperature of -18ºC.

5. TEMPERATURE MANAGEMENT IN THE COLD CHAIN

Inadequate food temperature control is one of the most common causes of food borne illness. Inadequate food temperature control may also result in an adverse effect on product quality, including food spoilage. Temperature management systems should be in place to ensure that the temperature along the cold chain is controlled and monitored effectively. Details on temperature control and temperature monitoring are provided below and in the Annex, which provides additional guidance and explanation on currently available technology on temperature monitoring and control in the cold chain.

5.1 TEMPERATURE MONITORING

Operators should ensure that appropriate systems are in place to monitor air temperatures during the freezing process and to monitor temperature along the cold chain in order to ensure that the product temperature is maintained at -18ºC or colder within the permitted tolerances set by competent authorities.

In general, operators have a choice of monitoring systems for quick frozen products, which either include measurement of operating air temperatures of the refrigerating systems or direct/indirect measurement of product temperature. Additional approaches also exist (see Section 5.1.3).

5.1.1 Air Temperature Monitoring

In air temperature monitoring, fixed temperature sensors are used to monitor the air temperature in the refrigerated system. The sensors are normally protected from damage during commercial activity.

Air temperature monitoring permits:

- diagnosis of problems occurring in the system; and
- process management using data storage on computers, which can be linked to other operating information such as defrost cycles, door openings, energy consumption and production batch codes.

5.1.2 Product Temperature Monitoring

Product temperature may be measured directly or indirectly. Direct measurements of product temperature may be undertaken destructively or non-destructively.

Although product temperature measurement can give more confidence than air temperature monitoring that temperature requirements are being complied with, this approach is often not practical during busy production and distribution periods.

5.1.3 Additional Approaches

Additional approaches to temperature monitoring include:

- use of a simulated food product;
- use of temperature probes and/or recorders, as appropriate, placed between packages or in a load;
- use of a non-contact thermometer; and
- use of temperature indicators and time-temperature indicators.

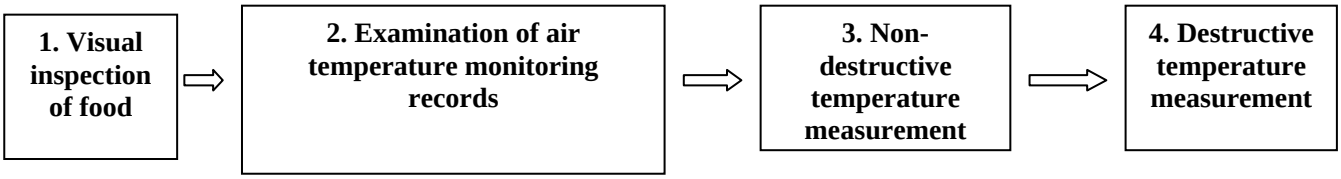
5.1.4 Temperature monitoring equipment

The selection of temperature monitoring equipment should take into account:

- appropriate accuracy and resolution (depends on the construction of the equipment and its use);
- ability to withstand vibrations, shocks or movement (for mobile system);
- coverage of temperature range adequate for quick frozen foods; and
- need for calibration and periodic checks to ensure proper functioning.

5.2 STEPWISE APPROACH TO TEMPERATURE CONTROL

When quick frozen foods are being inspected in the cold chain, either before loading or during unloading, a stepwise approach is recommended.



1. First, before loading and during unloading, a visual inspection is recommended in order to verify the condition of the foods (e.g. for signs of damage, abuse, defrosting).
2. Second, the air temperature monitoring records and other temperature readings noted in the documentation following the foods should be examined. If the loading temperature was correct and the refrigeration system functioning correctly, and there are no irregularities in the temperature difference between the air leaving the refrigeration unit and the air return, no further action need be taken.
3. A non-destructive product temperature measurement should be carried out ,especially if there is a doubt about any of the above aspects or no records are available . This should involve a between carton or between package temperature reading (see Annex, Section 3.1.3). If the non-destructive measurement indicates that the product temperature is within the permitted tolerances set by competent authorities, the inspection may stop at this point.
4. If the non-destructive product measurement indicates that the product temperature is outside the permitted tolerances, a destructive temperature measurement should be undertaken (see Annex, Section 3.1.4). This operation must be carried out after placing the cargo in refrigerated environments or after protecting the load in order to avoid increasing the temperature of the food.

Whenever this stepwise approach indicates a temperature violation, the procedure in Section 5.3 should be followed.

5.3 TEMPERATURE VIOLATION

Loads or parts of loads that are warmer than the temperature required for quick frozen food should be identified and sorted immediately. Delivery, and sale of these loads or parts of loads should be suspended. It is the responsibility of the person in possession of the food to ensure the food safety of the product. Any measures necessary for preserving the food should be taken, including bringing down the temperature immediately. An assessment should be made as to whether the safety or the quality of the product has been compromised and action taken accordingly. Destruction of the product may be necessary, especially if safety provisions are compromised. In cases of compromised safety or quality, the supplier, as well as other relevant parties in the supply chain should be informed of the incident. In the case of compromised safety the competent authorities should also be notified.

5.4 RECORD KEEPING

Records of these measurements should be kept for a period that exceeds the shelf-life of the product or as required by competent authorities.

ANNEX

SPECIFIC INFORMATION ON TEMPERATURE MONITORING AND CONTROL IN THE COLD CHAIN

1. INTRODUCTION

This Annex provides additional guidance and explanation on currently available technology on temperature monitoring in the cold chain. New temperature measuring and recording devices may be developed and should be used as appropriate.

2. AIR TEMPERATURE MONITORING

2.1 AIR TEMPERATURE MONITORING EQUIPMENT

Temperature measurement and recording devices consist of a sensor (placed in the cold air), and a read-out or recording system. The sensor can be located far from the read-out or recording system or incorporated in it. A recorder is able to store the data, usually electronically, although chart recorders are still widely used for cold stores and containers.

- Air temperature measurement and recording devices should be accurate to within ± 2°C and have a resolution of 1°C. The response time, i.e. the time taken for readings to stabilize, depends on the construction of the equipment and its use. Also if the system is mobile, it should be able to withstand vibrations, shocks or movement.
- The sensor may consist of a thermocouple (e.g. Type K, Type T), thermistor or platinum resistance device. All of these will provide an acceptable performance and cover a temperature range adequate for quick frozen foods.
- Systems are checked and calibrated during manufacture. It is important that once installed, periodic checks are carried out to ensure proper functioning. This is normally undertaken by checking against a calibrated thermometer placed in an equilibrated ice bath.

2.2 AIR TEMPERATURE MONITORING OF COLD STORES

Sensors should be placed high up, in relevant locations within the cold store, away from all positions causing uncontrolled temperature fluctuations such as cooler fans, the entrance or the exit (if different from the entrance) in order to enable precise recording. The position of the sensors should be chosen taking into account the cold air circulation and in such a manner to give an accurate recording of the temperature conditions. Recorders are recommended to be placed outside the cold stores in a convenient location selected for this purpose.

As far as the number of sensors concerned, each food business operator should evaluate its processes and make a documented decision on the number of sensors required. As indicative figures, small cold stores (less than 500 m^3) may need only one sensor, those with a volume of less than 30,000 m^3 may require two sensors, those with a volume from 30,000 m^3-60,000 m^3 may require four sensors, and those with a volume greater than 60,000 m^3 may require 6 sensors. Retail stores with a volume less than 10 m^3 can be equipped with only a visible thermometer.

2.3 AIR TEMPERATURE MONITORING DURING TRANSPORT

Measurement of the return air temperature to the cooling unit will give a good indication of the load temperature, provided adequate air flow is achieved throughout the length of the vehicle.

In long vehicles (above 6 m), air ducting is recommended to ensure that sufficient cold air reaches the rear of the vehicle. Two sensors are recommended to be fitted in the compartment: one measures the return air temperature, and the other is placed two thirds to three quarters the length of the vehicle mounted in the ceiling ducts. The difference between these two temperatures should be an indication of how well the refrigeration is functioning. If the difference is large or variable it may indicate insufficient pre-cooling, incorrect stowage of pallets, or unnecessary delay in closing the doors.

The recorder can be placed in the vehicle cabin or mounted on the outside, usually near the refrigeration controls.

2.4 AIR TEMPERATURE MONITORING IN DISPLAY CABINETS

Display cabinets should be equipped with an accurate thermometer or temperature measuring device that is easily readable. In open cabinets, the temperature should be measured in the return air, at the load line level, or at the warmest place.

3. PRODUCT TEMPERATURE MONITORING

3.1 DIRECT TEMPERATURE MEASUREMENT

3.1.1 Specification of Measuring System

The temperature measuring device used to measure product temperature should be of better accuracy than that used for air temperature monitoring. The following specifications are recommended for the system, i.e. sensor and read-out:

- the system should have an accuracy of ± 0.5°C within the measuring range -20°C to +30°C;
- the response time should achieve 90% of the difference between initial and final readings within three minutes;
- the display resolution of the read-out should be 0.1°C;
- the measuring accuracy should not change by more than 0.3°C during operation in the ambient range -20°C to +30°C;
- the system should be calibrated or otherwise verified prior to use and at specified intervals against measurement standards traceable to international or national measurement standards;
- the accuracy of the system should be checked at regular intervals;
- the system should be robust and the device and equipment should be shock-proof; and
- the electrical components of the system should be protected against undesirable effects due to condensation of moisture.

3.1.2 Pre-cooling of the Probe

The probe should be pre-cooled to a temperature as close to the product temperature as possible before measurement. After inserting the probe, the temperature should be read when it has reached a stable value.

3.1.3 Non-destructive Temperature Measurement

Non-destructive testing is rapid and can be done without unduly disturbing the load. However, because the outside temperature of the package or carton is being measured this may result in up to 2°C difference between the true product temperature and the reading obtained.

Product surface temperature measurement undertaken non-destructively should:

- measure the temperature between cases on a pallet or between packages inside a carton;
- use sufficient pressure to give good thermal contact, and sufficient length of probe inserted to minimize conductivity errors; and
- use a probe with a flat surface to give good surface thermal contact, low thermal mass, and high thermal conductivity.

3.1.4 Destructive Temperature Measurement

Temperature probes are not designed to penetrate quick frozen foods. Therefore it is necessary to make a hole in the product in which to insert the probe. The hole is made by using a pre-cooled sharp pointed metallic device such as an ice punch, hand drill or an auger. The diameter of the hole should provide a close fit to that of the probe. The depth to which the probe is inserted will depend on the type of product:

- where product dimensions allow, insert the probe to a minimum depth of 2.5 cm from the surface of the product.
- where this is not possible because of the size of the product, the probe should be inserted to a minimum depth from the surface of 3 or 4 times the diameter of the probe.

- where it is not possible or practical to make a hole in certain foods because of their size or composition, e.g. diced vegetables, the internal temperature of the food package should be determined by insertion of a suitable sharp-stemmed probe to the centre of the package to measure the temperature in contact with the food.
- in order to measure the centre temperature in large products after the quick freezing process it may be necessary to insert the probe to a depth of more than 2.5 cm.

3.2 SAMPLING OF PRODUCTS FOR TEMPERATURE MEASUREMENT

3.2.1 During Transport

A non-destructive temperature measurement should be taken of the product being loaded into the vehicle and a record entered in the documents.

A destructive product temperature measurement should be made if there appears to be a problem. If it is necessary to measure product temperatures during transport whilst the vehicle is loaded, samples should be selected from the top and bottom of the consignment adjacent to the opening edge of each door or pair of doors (see Figure 1).

If product temperature measurement is necessary, after the vehicle is unloaded and the cargo placed in a properly cooled environment, four samples should be selected from within the transport vehicle from amongst the following points, carefully noting the location of the load within the transport vehicle (see Figure 2).

When samples are selected, a non-destructive temperature measurement should in general be carried out first before deciding whether a destructive measurement should be carried out. A total tolerance of 2.8°C should be applied (2°C for limitations of methodology and 0.8°C tolerance for the system). If a destructive measurement is carried out, the tolerance of 2.8°C is not applicable.

3.2.2 At Retail

If it is necessary to measure the temperature of quick frozen foods in retail display cabinets, one sample should be selected from each of three locations representative of the warmest points in the cabinets. The positions will vary with the different types of retail display cabinets used.

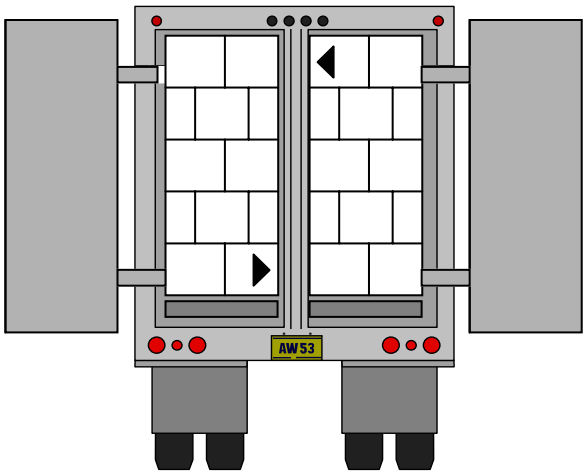


Figure 1 - Sampling positions for a loaded vehicle (◀)

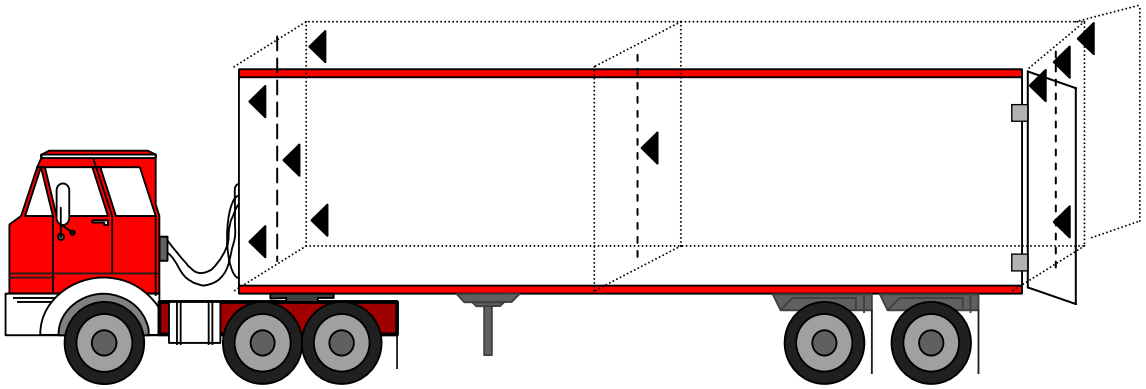


Figure 2 - Sampling positions for an unloaded vehicle (◀)

- top and bottom of the consignment adjacent to the opening edge of the doors;
- top and far corners of the consignment (as far from the refrigeration unit as possible);
- centre of the consignment;
- centre of the front surface of the consignment (as close to the refrigeration unit as possible);
- top and bottom corners of the front surface of the consignment (as close as possible to the air return inlet).

4. OPTIONAL APPROACHES TO TEMPERATURE MONITORING: Indirect Temperature Measurement

4.1 SIMULATED PRODUCT

When air temperature monitoring is difficult, e.g. during the freezing process, it is possible to use a simulated food sample. This is a device that has a similar shape and is made of a material that has similar thermal properties and gives a similar cooling factor to the food being monitored. Materials such as nylon, polystyrene, polyvinyl chloride, perspex and polytetrafluorethylene have thermal properties similar to certain foods. Sensors can be embedded permanently into such a device and it can be packed along with the food packages and measured when required. The simulant may also be incorporated into a temperature recording device.

4.2 RECORDERS BETWEEN PACKAGES

Small temperature recorders may be placed between packages or in a load, e.g. in cartons, in order to record the temperature over long periods. Such recorders may be programmed and the measurements retrieved by means of computerized devices.

4.3 NON-CONTACT THERMOMETERS

These devices measure the temperature of the food by sensing the infrared radiation emitted by the food. The amount of radiation varies with different materials, which absorb and reflect and transmit radiation differently. Infrared thermometers can be portable and are usually “pistol shaped” sometimes with a laser sighting aid. Target size can be important, since the instrument averages all the radiation in its field of vision. Care must be taken in interpreting results from these devices with quick frozen foods because a package rapidly picks up radiation from its surroundings, there can be a difference between surface temperature and interior temperature. In addition the type of packaging will affect the radiation. Laminated foil packaging in particular can give large errors because it reflects radiation more efficiently than cardboard. Also available are devices which compensate for this type of error and measure the radiation through a window.

Fixed video camera-type infrared thermometers are also used. These can give thermal images, which permit industrial control of heating or cooling processes to ensure even processing. This is also true of the freezing process. Therefore it is possible to scan large numbers of products and pick out “hot-spots”, followed up by more accurate temperature measurements.

4.4 TEMPERATURE INDICATORS (TIS) AND TIME-TEMPERATURE INDICATORS (TTIS)

These devices give a colour change, either when a specific temperature has been exceeded (TIs), or when the integrated exposure to a temperature over a period of time has been exceeded (TTIs). There has been a reluctance to use TIs and TTIs on retail packages for a number of reasons, in particular because of their current limitations and because they are on the surface of packages and not inside the package, and because of their possible conflict with durability dates. However, TIs and TTIs may be used on the outside of cartons or pallets to detect temperature abuse during distribution from cold stores to holding stores at retail, and they can monitor transfer of quick frozen foods where monitoring records may not be available.