codex alimentarius commission

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

WORLD HEALTH ORGANIZATION

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Agenda Item 4(a) **CX/PFV 02/8**
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JOINT FAO/WHO FOOD STANDARDS PROGRAMME

CODEX COMMITTEE ON PROCESSED FRUITS AND VEGETABLES

21st Session,
San Antonio, Texas, U.S.A., 23-27 September 2002

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

(At Step 4 of the Codex Procedure)

BACKGROUND

1. At its 23rd session, the Codex Alimentarius Commission abolished the Joint UNECE/Codex Alimentarius Group of Experts on Quick Frozen Foods and transferred the work of the Joint Group of Experts to the Codex Committee on Processed Fruits and Vegetables.[1] Although the Commission decided that any revision of the *Recommended International Code of Practice for the Processing and Handling of Quick Frozen Foods* (CAC-RCP 8-1976) that might be required should be undertaken by the Codex Committee on Food Hygiene, the Executive Committee of the Commission at its 47th Session agreed to start the revision of the Code as new work for the CCPFV[2] according to Rule III.2 of the Procedural Manual. In addition, the Executive Committee proposed that the International Institute of Refrigeration (IIR), an Intergovernmental Organization with an Observer Status in the Codex Alimentarius Commission, prepare the Proposed Draft Revised Recommended Code of Practice for Quick Frozen Foods.

2. Following the decision of the Executive Committee, the IIR set up a Drafting Group of government-appointed experts[3] to revise the Code. The Drafting Group met twice in December 2000 and March 2001 respectively. After its first meeting, the revised text was circulated for comments at Step 3 under CL 2001/01-PFV. At its second meeting, the IIR Drafting Group revised the text in light of the comments submitted at Step 3 and agreed to forward the Proposed Draft Revised Recommended Code to the 24th Session of the Codex Alimentarius Commission for adoption at Step 5.[4]

3. The 49th Session of the Executive Committee returned the Proposed Draft Revised Recommended International Code of Practice for the Processing and Handling of Quick Frozen Foods to Step 4. The Executive Committee noted several comments received in relation to the procedure used for the revision of the Proposed Draft Revised Code of Practice for the Processing and Handling of Quick Frozen Foods.

4. The Executive Committee was of the opinion that significant progress had been made on the technical content of the Code but that it should be discussed by the concerned Codex committees prior to its consideration at Step 5. In this regard, the Executive Committee referred the proposed draft Code to the Committees on Processed Fruits and Vegetables, Fish and Fishery Products and Meat and Poultry Hygiene for their technical input and the Committee on Food Hygiene for the finalization of the draft.[5]

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1 ALINORM 99/37 para. 219
2 ALINORM 01/3 paras. 43-44
3 Australia, China, Czech Republic, Denmark, France, Italy, Japan, New Zealand, United Kingdom and the United States of America.
4 ALINORM 01/27-Add.1 para. 14
5 ALINORM 01/41, para. 31.

5. The 8th Session of the Codex Committee on Meat and Poultry Hygiene noted the request of the 49th CCEXEC for technical inputs on the Proposed Draft Revised Recommended International Code of Practice for the Processing and Handling of Quick Frozen Foods and agreed that specific inputs related to the aforesaid document should be referred by governments and international organizations directly to the Codex Committee on Food Hygiene.[6]

6. The 25th Session of the Codex Committee on Fish and Fishery Products noted the decisions of the 49th Session of the Executive Committee on the above Code and the work in this area carried out in other Codex Committees. The Committee was of the view that the provisions of the above code were well applicable to the Proposed Draft Code of Practice for Fish and Fishery Products from the general point of view and decided to reference it in the relevant sections of the Proposed Draft Code for Fish and Fishery Products. The Committee also noted that the Proposed Draft Code for the Processing and Handling of Quick Frozen Foods referred to "traceability" and that the use of this term might need further consideration to ensure consistency with other Codex texts. The Committee agreed that the Proposed Draft Code of Practice for the Processing and Handling of Quick Frozen Foods could be recommended for adoption at Step 5 and encouraged Member States to submit their specific comments directly to the Committee on Food Hygiene.[7]

7. The 50th Session of the Executive Committee noted the outcome of the discussions on this matter in the CCMPH and CCFFP. The Member from Asia reiterated the concerns expressed at the 24th Session of the Commission concerning the initial draft of the Code developed by the IIR, especially as some provisions in the Code were too restrictive and would cause difficulties in developing countries; further elaboration of the Code should therefore take these aspects into account. The Executive Committee noted that the Code was now under consideration in the Step Procedure and that member countries had the opportunity to comment and propose amendments as required in the framework of the Committees concerned.

8. The Executive Committee recalled that the Proposed Draft Code was not only a code of hygienic practice addressing food safety issues, but a code of practice that covered also essential quality aspects and product stability. It encouraged other concerned Committees to provide concrete input to the development of the Code and in particular the Committee on Processed Fruits and Vegetables.[8]

9. The Proposed Draft Revised Recommended International Code of Practice for the Processing and Handling of Quick Frozen Foods is attached to this document as Appendix II. It will be considered by the forthcoming session of the Codex Committee on Processed Fruits and Vegetables under Agenda Item 4(a). The text as revised by the Committee will be forwarded to the Codex Alimentarius Commission for adoption at Step 5 and finalization by the Codex Committee on Food Hygiene.

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6 ALINORM 03/16, para. 5
7 ALINORM 03/18, para. 9
8 ALINORM 03/3A, paras. 81-83

APPENDIX I

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

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

INTRODUCTION

This *Code of Practice for Processing and Handling of Quick Frozen Foods* is a revised version of the Recommended International Code of Practice for the Processing and Handling of Quick Frozen Foods (CAC/RCP 8-1976), including Annex I-1978: Method for Checking Product Temperature, and Annex II-1983: Recommended International Code of Practice for the Handling of Quick Frozen Foods during Transport.

This Code of Practice has been modified to incorporate the Hazard Analysis and Critical Control Point (HACCP) approach described in the *Recommended International Code of Practice: General Principles of Food Hygiene* (CAC/RCP 1-1969, Rev. 3 (1997)) and its Annex: *HACCP System and Guidelines for its Application*, which are designated hereinafter as GPFH. A prerequisite programme is described in the Code covering technological guidelines and the essential requirements of hygiene in the production of quick frozen food products, which are safe for human consumption, and otherwise meet the requirements of the appropriate Codex product standards. The Code also contains guidance on the use of HACCP, which is recommended to ensure the hygienic production of quick frozen food products to meet health and safety requirements.

Within this Code a similar systematic approach to HACCP has been applied to ensure essential quality, composition and labelling provisions of the appropriate Codex product standards. Throughout the Code this is referred to as "Defect Action Point (DAP) Analysis".

This Code will assist all those who are engaged in the processing and handling of quick frozen foods or are concerned with their storage, transportation, retailing, export, import and sale in attaining safe and wholesome products which can be sold on national or international markets and meet the requirements of the Codex Standards. Where no Codex Standard exists, regard should be made to national regulations and/or commercial specifications.

The Code only covers quick frozen foods. Quick frozen foods should have undergone the appropriate quick freezing process, and should be maintained at –18°C or colder at all points in the cold chain. Tolerances to this temperature may apply in accordance with national legislation.

SECTION 1: OBJECTIVE

The aim of this Code is to provide background information and guidance for the elaboration of quick frozen food production and cold chain management systems that incorporate Good Manufacturing Practices (GMPs) as well as the application of HACCP. In addition, the Code may be used for training of employees of the quick frozen food industry. The national application of this Code requires modifications and amendments, taking into account local conditions and specific consumer requirements.

SECTION 2: SCOPE AND DEFINITIONS

2.1 SCOPE

This Code of Practice applies to the processing, handling, storage, transportation, and retailing of quick frozen foods.

2.2 DEFINITIONS

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

ATP	"Agreement on the International Carriage of Perishable Foods and on the Special Equipment to be Used for Such Carriage". *Economic Commission for Europe of the United Nations-Transport Division*; 1970, Revised in 2000; Geneva; Switzerland.
Blanching	A heat treatment sufficient to inactivate certain enzymes.
Chilling	The process of cooling food to an appropriate temperature, often 5°C or colder, but avoiding any formation of ice crystals.
Cold chain	A term embracing the continuity of successively employed means to maintain the temperature of quick frozen foods from production to the final user.
Cold store	A building used for the preservation of quick frozen foods under refrigerated conditions.

Defect	A condition found in a product which fails to meet essential quality, composition and/or labelling provisions of the appropriate Codex product standard.
Defect Action Point (DAP)	A step at which control can be applied and a defect can be prevented, eliminated or reduced to an acceptable level, or the risk of mislabelling can be eliminated.
Defrost cycle	An operation intended to eliminate the frost deposit from the surface of a cooling coil.
Dehydration	Loss of moisture from quick frozen food products through sublimation.
FIFO "First in-First out"	The first to arrive is the first taken out.
Freezer	Equipment designed for freezing food products by lowering the temperature quickly.
Ice glazing	The application of a protective layer of ice formed at the surface of a frozen product by spraying it with, or dipping it into, potable water, or potable water with approved additives, as appropriate.
IIR/IIF	International Institute of Refrigeration / Institut International du Froid.
ISO	International Standardization Organization.
K coefficient	The overall coefficient of heat transfer which represents the insulating capacity of the equipment.
Potable water	Water fit for human consumption. Standards of potability should not be lower than those contained in the latest edition of the *Guidelines for Drinking Water Quality* of the World Health Organization.
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 Codex *Recommended International Code of Practice: General Principles of Food Hygiene*, the appropriate Code of Practice and appropriate food safety legislation.
Processing facility	Any premises where quick frozen food products are prepared, processed, frozen, packaged or stored.
Quick freezing process	A process which is carried out in such a way that the range of temperature of maximum ice crystallisation is passed [as] quickly [as possible]. The quick freezing process shall not be regarded as complete until and unless the product temperature has reached –18°C or lower at the thermal centre, after thermal stabilisation.
Quick frozen food	Food which has been subjected to a quick freezing process, and maintained at –18°C or lower in the cold chain, subject to permitted temperature tolerances, and labelled as such.
Raw material	Fresh or processed food which may be utilized to produce quick frozen food products intended for human consumption.
Refrigeration system (unit, plant)	Equipment which supplies a source of cold to reduce the temperature of food or maintain food at frozen temperature.
Return air	Air returning to the air cooler.
Temperature abuse	Warming of quick frozen food to a temperature outside any permitted **[**national**]** tolerance, **[**so that it may affect quality or safety of the food**]**.
Temperature monitoring	The act of conducting a planned sequence of observations or measurements of the temperature of the refrigerated systems and/or quick frozen foods.
Temperature Indicator (TI)	A device which on activation exploits a physical or physico-chemical reaction to produce an observable and irreversible change once a predetermined threshold temperature has been reached.
Thermal centre	The point within a piece of food which has the highest temperature at the end of a quick freezing process.

Time-Temperature Indicator (TTI)	A device which indicates the time-temperature history experienced from its point of initial activation.
[Tolerances**]**	**[**Short term fluctuations of temperature of the product in the cold chain, within limits required by national legislation, and which do not affect safety.**]**
[Traceability/ Traceback**]**	**[**A system which permits retrieval of information on the history and the origin of a product at any point of the cold chain.**]**
Transfer point	Point at which the food is transferred between two cold volumes, while its temperature is maintained at regulation levels.

SECTION 3: PREREQUISITE PROGRAMME

Prior to 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) or as required by the competent authority. Prerequisite programmes should be specific within an individual establishment, and should require monitoring and evaluation to ensure their continued effectiveness.

Reference should be made to other Codex Codes of Practice[1] for further information to assist with the design of the prerequisite programmes for a processing facility.

It should be noted that some of the issues listed below are designed to maintain quality rather than food safety and are not always essential to a prerequisite programme for a food safety HACCP system.

In addition to the GPFH, the following specific prerequisite provisions shall apply:

3.1 LOCATION

For quick frozen foods with [perishable] raw materials, processing facilities should be located as to minimize quality changes prior to freezing.

3.2 FACILITY DESIGN AND CONSTRUCTION

3.2.1 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 which could result in reduction in food 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.

3.2.2 COLD STORE DESIGN

Advice on appropriate cold store design is given in the *Cold Store Guide*, IIR/IIF, 3rd edition, 1993. The cold store walls, floor, ceiling, and doors should be properly insulated in order to reduce energy consumption and help maintaining product temperatures. It is important that the design of the cold store ensures that:

- adequate refrigerating capacity provides and maintains a product temperature of –18°C or colder;
- air is distributed uniformly around the stored foods;
- temperatures are controlled and recorded on a regular basis;
- loss of cold air and introduction of warm and humid air are avoided;
- measures are in place to prevent leaks of any refrigerant.

3.2.3 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. Freezers should be designed and constructed so that, when properly operated, they meet the requirements of a quick freezing process.

3.3 FACILITIES

In addition to the recommendations of the GPFH, the following provisions shall apply :

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1 Codex Code of Practice for Fish and Fishery Products, the Codex Code of Hygienic Practice for the Primary Production and Packing of Fresh Fruits and Vegetables and its Annex on Ready-to-Eat Fresh Pre-cut Fruits and Vegetables, and the Codex Recommended Code of Hygienic Practice for Milk and Milk Products

3.3.1 PROVISION OF SERVICES

3.3.1.1 Electricity

In the case of power losses, the facility should have a contingency plan to maintain the temperature of the quick frozen foods.

The electrical supply should be such that fluctuations in voltage that may cause damage to refrigeration equipment do not occur.

3.3.2 CLEANING PROGRAMMES

The recommendations of the relevant sections of the GPFH apply.

3.3.3 PEST CONTROL SYSTEMS

The recommendations of the relevant sections of the GPFH apply.

3.4 PERSONAL HYGIENE AND HEALTH

The recommendations of the relevant sections of the GPFH apply.

3.5 TRAINING

Food hygiene training is fundamentally important, and staff should also be aware about the importance of good temperature control and maintaining quality.

3.6 RECALL PROCEDURES AND [TRACEABILITY/TRACEBACK]

3.6.1 RECALL PROCEDURES

Effective documented procedures should be in place to enable rapid recall of any lot of quick frozen foods from the retail establishment.

The recommendations of the relevant sections of the GPFH apply.

3.6.2 [TRACEABILITY/TRACEBACK

Traceability/Traceback is essential to an effective recall procedure and is a necessary component of a prerequisite programme because no process is fail-safe.

The traceability system should:

enable withdrawal of products that may pose a risk to consumer health by appropriate recall procedures;

facilitate the identification of the producing/manufacturing history of the product to identify the source of the problem and apply corrective measures.**]**

SECTION 4: COLD CHAIN CONTROL: SAFETY ASPECTS

Each operation in the cold chain, where appropriate, should develop its own HACCP plan. This plan should be developed in accordance with the recommendations of the Annex to the GPFH.

An example on the use of CCPs in production and distribution of a quick frozen product, i.e. quick frozen chicken nuggets, is given in Annex 1 for illustration purposes only.

4.1 RAW MATERIALS

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.

The raw materials used should be safe and wholesome and therefore inspection and microbiological criteria are often considered as CCPs. For highly perishable products, such as in the example in Annex 1, temperature control at reception may also be considered as a CCP.

The recommendations of the relevant sections of the GPFH apply.

4.2 PROCESSING BEFORE FREEZING

Raw materials may be processed in many ways before freezing, e.g. cleaning, sorting, cutting, slicing, conditioning, ageing, filleting, and heating. Whether or not such processes should be regarded as CCPs depends on the actual conditions, especially on how much time the food spends in the critical temperature zone, i.e. between 10°C and 60°C.

If storage of foodstuffs (raw material or intermediates) prior to further processing is necessary, the storage conditions, especially temperature, should be appropriate to the foodstuff concerned.

The heat treatment of many pre-cooked foods, e.g. prepared meals, should be sufficient to ensure inactivation of pathogens of most concern. In such cases, the time-temperature treatment and subsequent cooling may be considered as CCPs, see Annex 1.

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 time/temperature and food temperature critical limits should be selected so as to control the development of microorganisms. Thawing time and temperature parameters may be a CCP.

4.3 QUICK FREEZING PROCESS

When large lots of food are frozen or where the food consists of large pieces e.g. whole turkeys, it is necessary to provide spaces or channels permitting air circulation between the food or the cartons. If such air channels are not provided, the very 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 growth of pathogenic microorganisms or the production of microbial toxins. Freezing time may be a CCP.

SECTION 5: COLD CHAIN CONTROL: QUALITY ASPECTS

The Code is intended to cover not only safety aspects of quick frozen foods but also other aspects of production including the essential product quality, composition and labelling provisions as described in product standards developed by the Codex Alimentarius Commission. Therefore, Defect Action Points (DAPs) are included in the Code. In the determination of DAPs, quality parameters are considered at the various steps by applying a systematic approach.

An illustrative example on the use of DAPs in production and distribution of a quick frozen product, i.e. quick frozen chicken nuggets, is given in Annex 2. The approach for DAP analysis is optional and other techniques, which achieve the same objective, may be considered.

5.1 RAW MATERIALS

Freezing cannot improve quality, and it is necessary to use sound and wholesome raw materials at the optimum level of freshness and maturity. Products to be frozen should be selected according to their freezing suitability.

Possible chemical or biochemical changes should be minimized by appropriate temperature control. 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 time and temperature parameters may be a DAP.

5.1.1 MICROBIOLOGICAL ASPECTS

Initial microbial numbers in products to be frozen should be kept as low as possible as this helps to obtain an appropriate storage life, by reducing problems with, for instance, off-taste, flavours or colours during frozen storage.

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

5.1.2 OTHER RAW MATERIALS QUALITY ASPECTS

5.1.2.1 Contamination

Producers of quick frozen food should as far as practicable implement measures to control contaminants, fertilizers, veterinary drugs, pesticide residues, industrial contaminants, etc. in raw materials according to the recommendations of the relevant sections of the GPFH.

Food product manufacturers should work with raw material producers to limit such contamination by developing documented control programmes.

5.1.2.2 Other Quality Measures

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.

Procedures should be in place to ensure quality of incoming materials.

Producers should have procedures in place to sort and segregate foods and food ingredients, which are evidently unsuitable for further processing.

5.2 PROCESSING BEFORE FREEZING

Raw materials may be processed in many ways before freezing, e.g. cleaning, sorting, cutting, slicing, conditioning, ageing, filleting, and heating. Consideration should be given with regard to any of these processes whether or not they should be regarded as DAPs.

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 is a DAP.

If storage of intermediate ingredients prior to further processing is necessary, the storage conditions, especially temperature, should be appropriate to the foodstuff concerned.

If frozen intermediate materials are used in processing, temperature control and monitoring should be applied as appropriate.

5.3 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 freezing apparatus and its capacity, nature of the product (conductivity, thickness, form, initial temperature) and volume of production. With most products this is best achieved by ensuring that the product passes quickly through the temperature range of maximum ice crystallization, usually -1°C to -5°C at the thermal centre of the product.

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 thermal equilibration. On exit from the freezing apparatus, the product should not be exposed to high humidity and/or warm temperatures, and should be moved to a cold store as quickly as possible. The same applies to products that are retail packed after the quick freezing process.

5.4 PACKAGING AND LABELLING

In general, the packaging should:

- protect the sensory and other quality characteristics of the food;
- protect the product against dehydration;
- protect the food against microbial and other contamination;
- not add to the food any substance which may influence the quality of the food.

The packaging or re-packing of quick frozen foods should be carried out in such a manner that the increase in temperature of the quick frozen foods does not affect the quality of the product.

Packed quick frozen foods should comply with the requirements of the *Codex General Standard for the Labelling of Prepackaged Food* (CODEX STAN 1-1985, Rev. 1-1991).

5.5 FROZEN STORAGE

Cold stores should be designed and operated so as to maintain a product temperature of -18°C or lower with a minimum of fluctuation, see section 3.2.2. The temperature of the cold store may be a DAP.

Stocks should be rotated to ensure that the products leave the cold store on a "First in-First out" basis (FIFO).

5.6 TRANSPORT AND DISTRIBUTION

The transport of quick frozen foods should be carried out in suitably insulated equipment, which maintains a product temperature of -18°C or lower. The product temperature during transport and distribution will be a DAP.

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

The user of the vehicle or container should ensure[2]:

- adequate supervision of product temperatures at the moment of loading;
- effective tight 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.

A brief temperature rise of the product during transport may be tolerated as permitted by national legislation. However, any product with a temperature higher than -18°C should be cooled to -18°C as soon as possible either during transport or immediately after delivery.

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

Distribution of quick frozen foods to retailers should be carried out in such a way that any rise in product temperature above -18°C is kept to a minimum. After delivery, the product temperature should be cooled to -18°C as soon as possible.

5.7 RETAIL SALE

Quick frozen foods should be offered for sale from refrigerated 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 in a range of temperature as defined by national legislation. Temperature in the cabinet will be a DAP.

Display cabinets should be equipped with a temperature measuring device, see Annex 3, section 1.4.

Cabinets should 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 heaters).

Defrost cycles should be programmed in such a way that, as far as possible, defrosting takes place outside peak shopping periods.

The content of the cabinet should never be stocked outside the load line.

Stocks should be rotated to ensure that the products are sold on a "First in-First out" basis (FIFO).

The shop should have a back-up storage room for quick frozen foods.

5.8 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 (ownership) occurs at the same time.

- Quick frozen foods should not be left for any significant length of time at ambient temperature and humidity. It is recommended to use a temperature controlled area (dock, loading and unloading platform) for all external handling of quick frozen foods.

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2 Detailed in *Guide to Refrigerated Transport*, IIR/IIF, 1995

- 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 ensured that all personnel are following such procedures.
- It is recommended to check the temperature of quick frozen food that is received or dispatched, and to retain a record of these measurements for as long as is legally or commercially appropriate.
- Operations (such as casing, order assembly, palletizing, etc.) should be carried out in the cold store or in a suitably temperature controlled area.

SECTION 6: TEMPERATURE MANAGEMENT IN THE COLD CHAIN

6.1 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 that quick frozen foods are maintained at -18°C or colder. National tolerances may apply.

Records of these measurements should be kept as long as it is legally or commercially appropriate.

Technical advice is given in Annex 3.

6.2 TEMPERATURE VIOLATION

When quick frozen foods are inspected a stepwise approach is recommended, see Annex 3.

Loads or parts of loads that are warmer than the temperature required for quick frozen food should be identified and sorted immediately. Delivery, removal 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 that its temperature is brought down immediately, and, more generally, to take any necessary measures for preserving the food.

In such cases, the supplier should be informed immediately by the person in possession of the food that an incident may have occurred. The buyer, if his or her identity is known, should be informed that an incident may have occurred since even if not responsible for loading the goods, in the eyes of the law the buyer is the receiver of the goods and must therefore be notified of any incident affecting him or her.

ANNEX 1:
ILLUSTRATIVE EXAMPLE ON THE APPLICATION OF CCPs IN A QUICK FROZEN FOOD INDUSTRY

Each step should be analyzed in order to decide if it is necessary with a CCP.

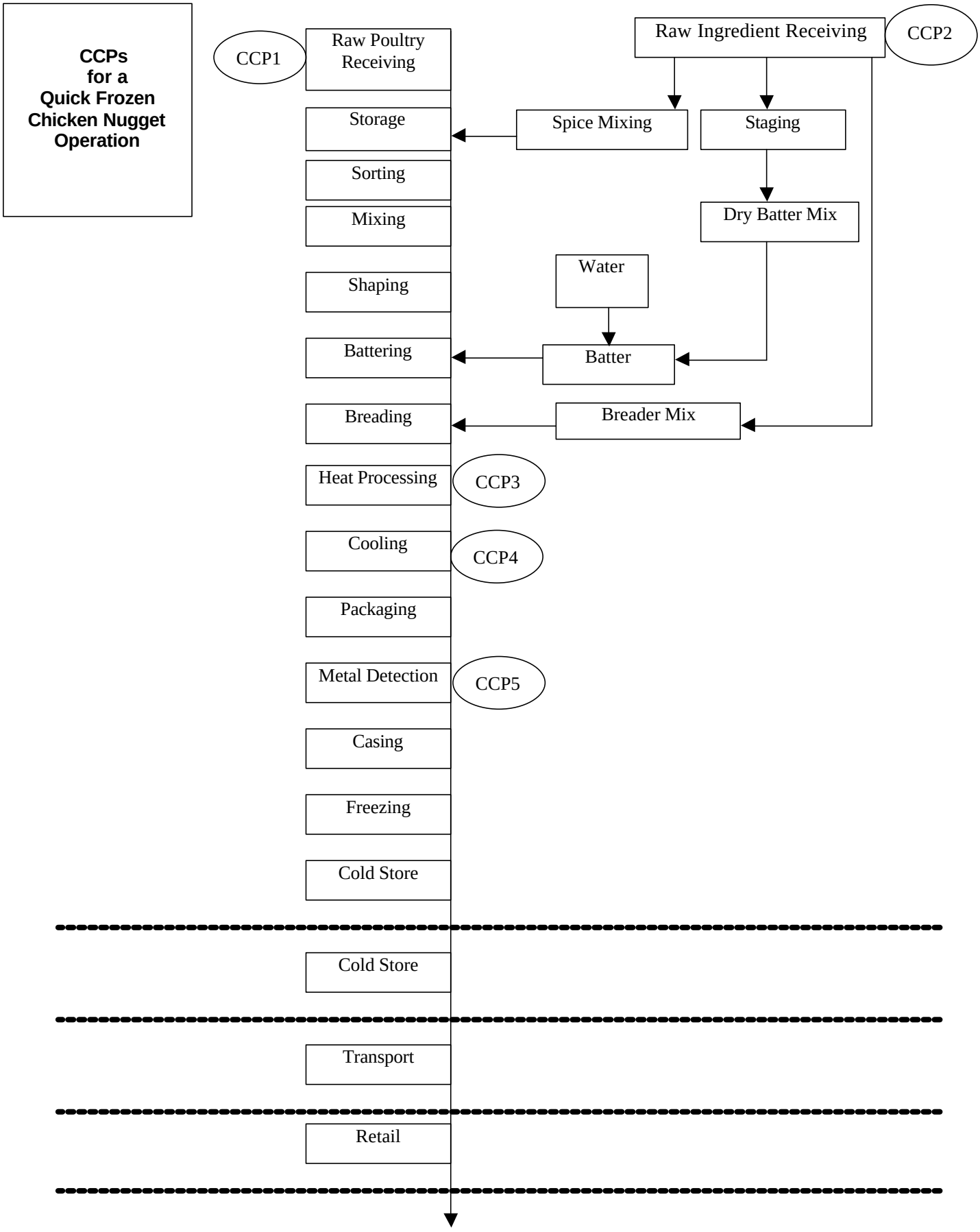


Table 1. *CCPs description sheet*

CCP Number	Process Step	Hazard Description	CCP Limit (if any)	Monitoring Procedure	Corrective Actions	Records
1 Temperature monitoring	Raw poultry Receiving	Biological – proper receiving temperatures of uncooked poultry.	Trucks must meet maximum specified temperature.	Incoming truck temperatures monitored for each received shipment of poultry. Outrun reports from vendor meet company specifications.	Evaluate product: hold, release or reject. Receiving clerk, supervisor and QA.	Incoming materials inspection form. Receiving clerk.
2 Physical inspection	Receiving of other sensitive ingredients.	Acceptable physical hazard levels including bone level in chicken and foreign material in coating ingredients.	Specified maximum bone level in received chicken. Coatings conform to specifications for foreign materials.	Outrun reports from each vendor show product meets specifications. Must be with each shipment.	Evaluate product: hold, release or reject. Receiving clerk, supervisor and QA.	Incoming materials inspection form. Receiving clerk.
3 Fryer and oven temperatures	Heat processing (fryer/oven).	Biological hazards in cooked chicken.	Chicken must be cooked to a specified minimum core temperature for specified time period.	Temperature record to monitor temperature of oven. Oven and product temperatures checked at specified intervals.	If limits exceeded hold production for biological evaluation: release, reprocess or destroy. Investigate causal factors and correct. Supervisor and QA.	Temperature record must be initialled by operator. Product log to be initialled by QA personnel.
4. Cooling	Cooling to chill temperature.	Biological hazards in finished product.	Product must be cooled to specified temperature within specified time.	Monitoring the cooling system, e.g. temperature record, checking stacking method. Product temperature checked at specified intervals.	If cooled too slowly, hold production for biological evaluation: release, reprocess or destroy. Investigate causal factors and correct. Supervisor and QA.	Temperature record must be initialled by operator. Product log to be initialled by QA personnel.
5 Metal detector	Metal detection.	Physical hazard in finished product.	Detection of metal to specified size and type.	Continuous operation. Line checked at specified intervals using defined standard.	Line stopped until corrected. Product from last line check must be passed through second operating detector. Supervisor and QA.	QA metal detector record. QA personnel.

ANNEX 2: ILLUSTRATIVE EXAMPLE ON THE APPLICATION OF DAPS IN A QUICK FROZEN FOOD INDUSTRY

Each step should be analyzed in order to decide if it is necessary with a DAP.

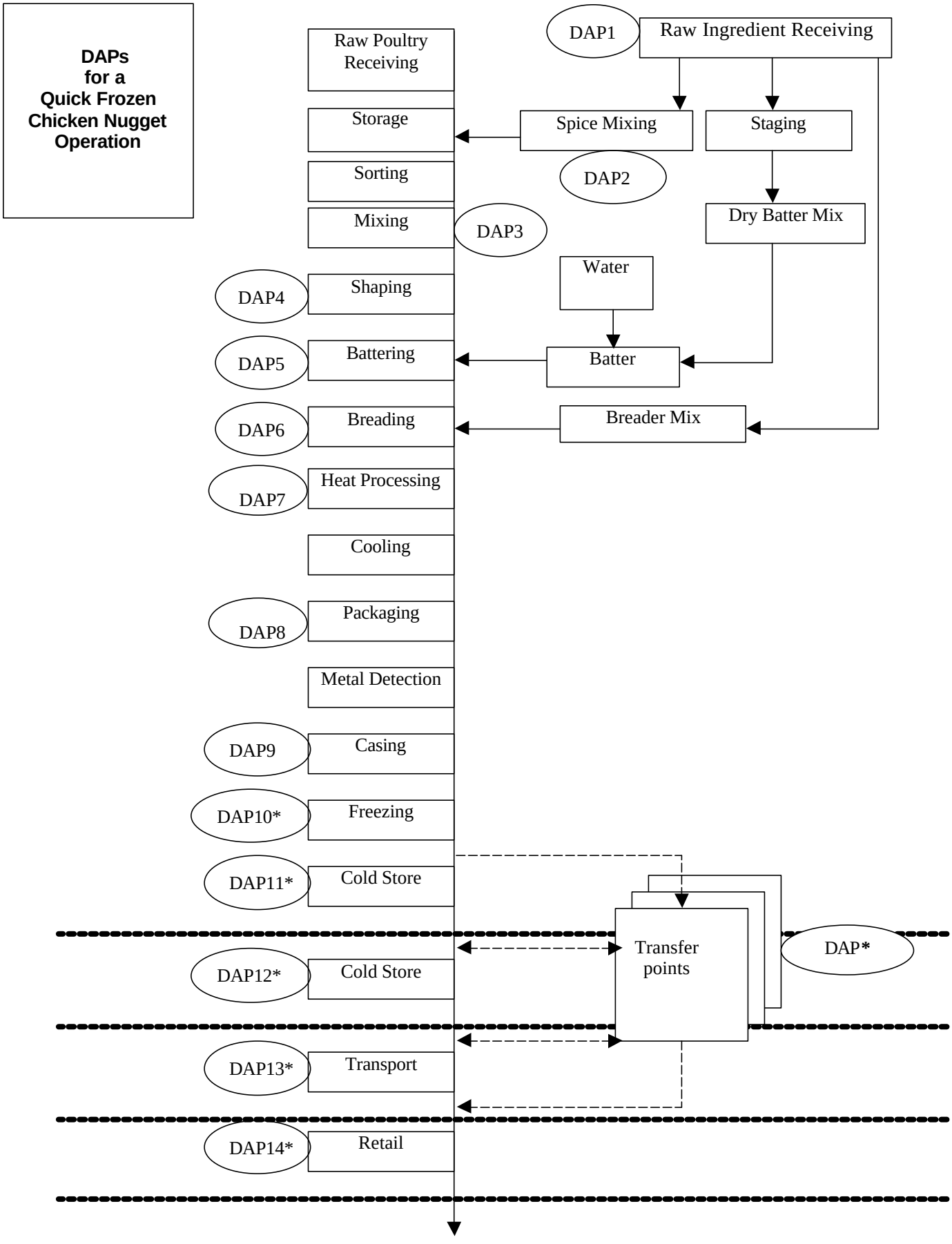


Table 2. *DAPs description sheet*

DAP Number	Defect Description	DAP Limit (if any)	Monitoring Procedure	Corrective Actions	Records
1 Receiving of sensitive ingredients	Check identity and wholesomeness.	Non-conformance for identity or wholesomeness.	Visual and sensory inspection. Outrun reports from each vendor meets specifications.	Evaluate product: hold, release or reject. Receiving clerk, supervisor and QA.	Incoming materials inspection form. Receiving clerk.
2 Spice mixing	Non-uniform spice mix.	Obvious non-uniform distribution of components.	Visual check for uniform distribution of component spices.	Evaluate product: remix if needed. Line operator and QA.	Production record completed.
3 Mixing	Non-uniform mix of components.	Obvious non-uniform distribution of components.	Visual check for uniform distribution of components.	Evaluate product: remix if needed. Line operator and QA.	Production record completed.
4 Shaping or forming	Non-conformity to specified shape and weight.	Misshapen form. Weight within specified limits.	Visual assessment for shape. Formed product weighed (e.g. 5 samples per 30 min).	Evaluate product: return product for rework. Line operator and QA.	Production record completed.
5 Battering	Incomplete coverage.	Incomplete coverage.	Visual assessment.	Evaluate product: investigate causal factors and correct. Line operator and QA.	Production record completed.
6 Breading	Incomplete coverage.	Incomplete coverage.	Visual assessment.	Evaluate product: investigate causal factors and correct. Line operator and QA.	Production record completed.
7 Heat processing	Overcooked colour and blow-out (loss of coating).	Colour darker than specified. Product greater than specified percentage with non-continuous coating.	Visual assessment against colour standards and detection of blow-out.	Evaluate product: investigate causal factors and correct. Line operator and QA.	Production record completed.
8 Packaging	Product does not conform to label weight.	Product weight less than label weight.	Product weight checked (e.g. 5 samples per 30 min).	Evaluate product: hold, release or reject. Supervisor and QA.	Production record completed.
9 Casing	Incorrect number of packs per outer. Ineffective carton closure.	Pack number conforms to label. Ineffective pack closure.	Physical check for closure and number of packs per carton.	Evaluate product: hold, release or reject. Supervisor and QA.	Production record completed.
10 Freezing*	Not frozen to –18°C within specified time.	Outside specified time.	Measure product temperature after freezing.	Evaluate product: hold, release or reject. Supervisor and QA.	Production record completed.
11 Cold store at the processing facility*	Excessive quality loss due to high storage temperature.	Product temperature above –18°C.	Temperature record to monitor temperature of cold store.	If limits exceeded hold production for biological evaluation and sensory evaluation: release or destroy. Investigate causal factors and correct. Cold-store supervisor and QA.	Temperature record must be initialled by supervisor.

12 Cold store*	Excessive quality loss due to high storage temperature.	Product temperature above –18°C.	Temperature record to monitor temperature of cold store.	If limits exceeded hold production for biological evaluation and sensory evaluation: release or destroy. Investigate causal factors and correct. Supervisor and QA.	Temperature record must be initialled by supervisor.
13 Transport*	Excessive quality loss due to high storage temperature.	Product temperature above –18°C.	Temperature record to monitor temperature of vehicle/container.	If limits exceeded hold production for biological evaluation and sensory evaluation: release or destroy. Driver and QA.	Temperature record to be initialled by driver.
14 Retail storage*	Excessive quality loss due to high storage temperature.	Product temperature above –18°C.	Temperature monitored at regular intervals.	If limits exceeded hold production for biological evaluation and sensory evaluation: release or destroy. Supervisor.	Temperature record completed by supervisor.

(*) Note: Each transfer point between DAPs 10 to 14 could also be considered as a DAP with similar defect description, DAP limit, monitoring procedure, corrective actions, and record keeping as in each of these DAPs.

ANNEX 3.

TEMPERATURE MONITORING AND CONTROL IN THE COLD CHAIN

INTRODUCTION

Temperature monitoring is an integral part of the management of the cold chain. In general operators have a choice of monitoring systems for quick frozen products, which includes measurement of operating air temperatures of the refrigerating systems, or direct/indirect measurement of product temperature **[**or a simulated product temperature**]**.

In air temperature monitoring fixed temperature sensors are used to monitor the air temperature in the refrigerated system. 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 that temperature requirements are being complied with, this approach is often not practical during busy production and distribution period.

1. AIR TEMPERATURE MONITORING

Air temperature monitoring permits:

- the use of fixed temperature sensors, which are normally protected from damage during commercial activity;
- problems occurring in the system to be diagnosed;
- process management using data storage on computers, and can be linked to other operating information such as defrost cycles, door openings, energy consumption and even production batch codes;

1.1 AIR TEMPERATURE MONITORING EQUIPMENT

Electronic thermometers 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 thermometers should be accurate to within $\pm 2°C$ and have a resolution of $\pm 1°C$. 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. Normally, accuracy of the electronic component of the recorder is less than $\pm 0.3°C$.
- The sensor can consist of a thermocouple (Type K or Type T), thermistor or platinum resistance. All of these will give a 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.

1.2 AIR TEMPERATURE OF COLD STORES

Sensors should be placed in the chamber in the warmest positions, and the recorders can be placed more conveniently outside the cold store or in control offices.

Sensors should be located high up and well away from the cooler fans and well away from the entry and exit doors, to avoid exaggeratedly low temperatures or wide fluctuations.

Small stores (less than 500 m^3) may need only one sensor, whereas, those with a volume of less than 30,000 m^3 will require two sensors. Stores with a volume from 30,000 m^3 to 60,000 m^3 will require 4 sensors, and those with a volume above 60,000 m^3 will require 6 sensors.

Retail stores with a volume of less than 10 m^3 can be equipped with a visible thermometer only.

1.3 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 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 be indicating 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.

1.4 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.

2. PRODUCT TEMPERATURE MONITORING

2.1. DIRECT TEMPERATURE MEASUREMENT

2.1.1 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 specification is 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 must not change by more than 0.3°C during operation in the ambient range –20°C to +30°C;
- the accuracy of the system should be checked at regular intervals;
- the system should have a current certificate of calibration from an accredited laboratory;
- the system should be robust and shock proof;
- the electrical components of the system should be protected against undesirable effects due to condensation of moisture.

2.1.2 PRE-COOLING OF THE PROBE

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

2.1.3 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 pack or carton is being measured this may give rise 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 packs inside a carton;
- use sufficient pressure to give good thermal contact, and sufficient length of probe inserted to minimize conductivity errors;
- use a probe with a flat surface to give good surface thermal contact, low thermal mass, and high thermal conductivity.

2.1.4 DESTRUCTIVE TEMPERATURE MEASUREMENT

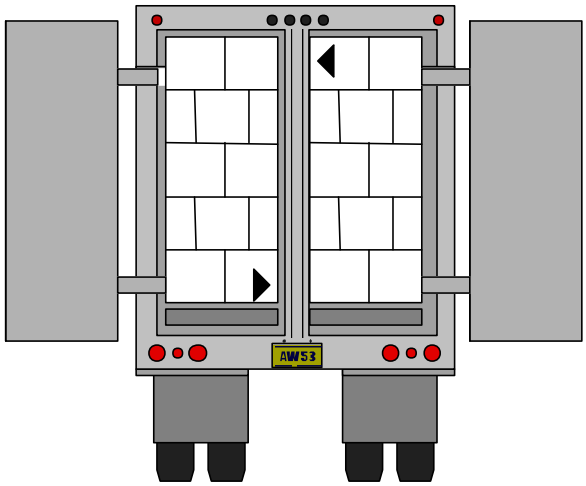
Temperature probes are not designed to penetrate quick frozen foods. Therefore it is necessary to make a hole in the product in which to insert the probe. The hole is made by using a pre-cooled sharp pointed metallic device such as an ice punch, hand drill or an auger. The diameter of the hole should 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 pack to measure the temperature in contact with the food.
- In order to measure the centre temperature in large products after the quick freeing process it may be necessary to insert the probe to a depth of more than 2.5 cm.

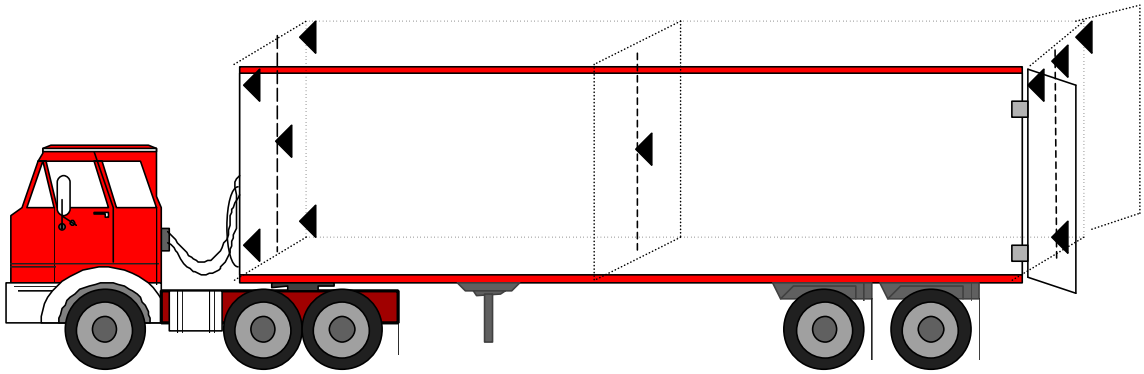
2.2 SAMPLING OF PRODUCTS FOR TEMPERATURE MEASUREMENT

2.2.1 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 product temperature measurement is required if there appears to be a problem, see Annex 3, section 4. 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.
- Similarly, if product temperature measurement is necessary, when the vehicle is unloaded, and the cargo is placed in refrigerated environments, four samples should be selected from amongst the following points:



Sampling positions for a loaded vehicle



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).

- When samples are selected a non-destructive temperature measurement should be carried out first. **[**A total tolerance of 2.8°C should be applied (2°C for limitations of methodology and 0.8°C tolerance for the system) before deciding whether a destructive measurement is necessary.**]**

2.2.2 AT RETAIL

- If it is necessary to measure the temperature of quick frozen foods in retail display cabinets, then 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.

[3 OPTIONAL AIDS TO TEMPERATURE MONITORING: INDIRECT TEMPERATURE MEASUREMENT

3.1 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 which 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 similar thermal properties to most 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.

3.2 RECORDERS BETWEEN PACKAGES

Small robust 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 a computer.

3.3 NON-CONTACT THERMOMETERS

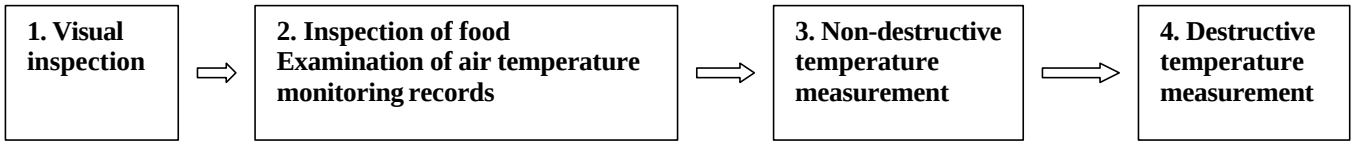
These devices measure the temperature of the food by sensing the infrared radiation emitted by the food. The amount of radiation varies with different materials, which absorb and reflect and transmit radiation differently. Infrared thermometers can be portable and are usually "pistol shaped" sometimes 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. There are some newer 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.

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

Many patents have been taken out on mechanisms, which 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. There has been a reluctance to use TIs and TTIs on retail packs for a number of reasons, in particular because they are on the surface of packs not inside the food, and their possible conflict with durability dates. However, TIs and TTIs may be used on the outside of cartons or pallets to detect if temperature abuse has occurred 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.**]**

4. TEMPERATURE CONTROL - STEPWISE APPROACH



When quick frozen foods are being inspected in the cold chain either before loading or during unloading, a stepwise approach is recommended. When this approach indicates a temperature violation, the procedure in Section 6.2 should be followed.

1. Before loading and during unloading, a visual inspection is recommended in order to verify the condition of the foods.

2. In the first instance, 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, then no further action need be taken.

3. If there is a doubt about any of the above aspects or no records are available then a non-destructive product temperature measurement could be carried out. This should involve a between carton or between pack temperature reading, see Annex 3, Section 2.1.3. If the non-destructive measurement indicates that the food temperature is inside the legal tolerance the inspection may stop at this point.

4. Only if the non-destructive product measurement is outside the tolerance or legal limit should a destructive temperature measurement be undertaken, see Annex 3, section 2.1.4. This operation must be carried out after placing the cargo in refrigerated environments or after protecting the load in order to avoid reheating the foods. Destructive temperature measurements are time consuming, disruptive to the flow of foods along the chain, and expensive in that the foods tested must be destroyed, or otherwise disposed of.