

CHAPTER 5, SUBJECT 2
CONSTRUCTION AND EQUIPMENT - CANNERIES

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CANNING EQUIPMENT

1.1 APPLICATIONS GENERAL

FIR, SCHEDULE II, SECTION 27

Canneries and all equipment and utensils used in the operations of a cannery shall be kept in good repair and in a clean and sanitary condition.

Reason

The condition of the equipment used to prepare the product, and fill and seal the containers, is one of the most important factors in determining the success or failure of the sterilization process. If the equipment is not well maintained, cleaned and sanitized, it will contribute to the contamination of the product, or cause it to be non-sterile.

In order to be effectively sanitized, equipment must be simply designed, easily cleaned and made of non-corrosive material.

Compliance

Equipment must be designed and constructed so that it can be easily cleaned and sanitized. The functioning and contact parts must be easily dismantled or easily opened to facilitate cleaning and servicing.

All welded equipment, including tables, bins and support brackets must have continuous, smooth and uniformly welded joints. Wherever possible, junctions and corners must be coved with a minimum radius of 0.6 cm (1/4 inch) for ease of cleaning.

Drip pans must be properly designed and located to prevent contamination by drippings from bearings, gears, belt drives, overhead motors, etc. They must be accessible for inspection and easily removed for cleaning.

All equipment and services must be installed in order to provide sufficient access for inspection, maintenance, cleaning and sanitizing.

All utensils and equipment must be made of smooth, non-absorbent, non-corrosive material, kept in good repair, and maintained in a clean and sanitary condition.

CANNING EQUIPMENT**1.1 APPLICATIONS GENERAL (cont'd)**

All fixed equipment must be installed either sufficiently high off the floor to facilitate cleaning and sanitizing underneath, or be otherwise installed so that water, dirt and other debris cannot get under the equipment.

Electrical connections, cabinets and control panels must be completely sealed, to allow cleaning of equipment with water or steam.

Where there is food contact or a contamination hazard exists, painted surfaces must not be used.

All equipment must be maintained in good repair and kept properly adjusted.

Verification

Inspect all of the equipment and utensils used in preparing the product, and ensure compliance requirements are met.

CANNING EQUIPMENT**1.2 BUTCHERING, GUTTING, CLEANING AND PACKING EQUIPMENT****Reason**

All fish cleaning and packing must be done in an area and on surfaces easily cleaned and sanitized. If these conditions are not met the product may be contaminated.

The use of wood in processing equipment is not acceptable. Bacteria may become "seeded" in the pores of the wood, and once established, may contaminate food materials.

Compliance

Fish cleaning and packing must be done in a clean and sanitary area. All tables, pans, cleaning surfaces and equipment must be made of non-porous, non-corrodible materials (i.e. no wood or galvanized metals), which are easily cleaned and sanitized. All surface joints must be smooth and watertight.

Verification

Inspect all equipment used in butchering, gutting, cleaning and packing and determine if it meets the requirements for contact surfaces and is constructed for ease of cleaning and sanitizing.

CANNING EQUIPMENT

1.3 CONTAINER WASHERS

Reason

Extraneous material adhering to the surfaces of filled containers is a potential source of contamination to the contents should any leakage into the container occur in subsequent stages of processing, handling, storage or distribution.

Compliance

When required, sealed containers shall be washed prior to retorting to remove any organic material adhering to the containers. Sealed containers should be rinsed to remove the protein residues and any packing media prior to being washed with hot water and detergent. Washing containers with hot water without pre-rinsing may coagulate soluble proteins making them difficult to remove.

The detergents used must be approved for use in food-processing establishments. The chosen detergent and all brushes used must not react with or affect the container enamel or plate.

Verification

Examine containers to determine if surface is free from any product/oil or adhering protein.

Confirm that detergents approved for food contact are used for container washing.

Verify that neither the brushes nor the chosen detergent react with or affect the container enamel or plate.

CANNING EQUIPMENT**1.4 CODING****FIR, GENERAL, SECTION 32**

- 1) Every can of fish that is packed in an establishment for which a registration certificate has been issued shall be embossed with code markings that:
 - a) identify the establishment;
 - b) indicate the day, month and year of processing; and
 - c) identify the product contained therein in accordance with the table to this subsection (see TABLE in regulations).
- 2) A copy of the key to every code marking required by this section shall be sent to the Minister each year before the commencement of processing operations.

Reason

Products must be coded to identify the establishment and packing date to facilitate the segregation of lots because of potential problems with safety or quality and if necessary to initiate a complete and rapid recall of any lot. It is also common practice to code batch/retort load and/or shift period/sub-period.

Compliance

Appropriate equipment must be in place to legibly emboss or otherwise permanently mark all containers at the time of container closing, with a code indicating the establishment, the day, month and year of processing and, where required, the product code.

The equipment must be maintained in good condition and be clean and sanitary.

Verification

Determine that coding is clear and legible and is not affecting the hermeticity of the container.

Inspect coding equipment to verify that it is constructed and functioning properly.

CANNING EQUIPMENT

1.5 CONVEYORS

Reason

Conveyor systems used in handling containers must be designed, constructed and operated so as to preserve the container integrity.

Compliance

Conveyors should be constructed of smooth, non-porous, non-corrosive material and designed so as to minimize contact with the double seam, i.e. containers should not be rolled on the double seams. All worn and frayed belting, container retarders and cushions should be replaced with non-porous material.

Conveyor systems which handle containers must be smooth and free of abrasive sections. Staples must not be used to join belt ends together.

Belts and conveyor systems must not contribute to container integrity problems due to abrasion or impact at the transfer sections of the conveyor system.

All mechanical conveyance systems must be designed, constructed, and operated so as to ensure that retort pouches, containers and ends are not subjected to physical abuse. All such conveyances must be free from sharp corners or projections that may damage the containers or ends.

Verification

Determine that containers are not being damaged or abused by the conveyor systems. Check that staples are not used to join conveyor belts.

Confirm that conveyor systems are properly constructed.

Inspect all equipment used for handling empty containers, when it is not in operation.

Inspect for sharp bends and long drop sections where empty containers could be damaged due to the momentum of those coming down the conveyor or chute.

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CANNING EQUIPMENT

1.5 CONVEYORS (cont'd)

Confirm that there are no sharp points on welds, at junction points of conveyors and guide rails. Check for obstacles to the smooth free flow of containers, such as nuts, bolts and rivets protruding into the path that the containers travel.

CANNING EQUIPMENT**1.6 DISPENSING MACHINES****Reason**

The equipment which dispenses additional ingredients such as salt, oil or water into the container must be properly constructed, functioning correctly and maintained in a clean and sanitary condition; otherwise the amount dispensed will not be accurate or the product could be contaminated.

If the amount of ingredients dispensed is not as per specifications, it could have a detrimental effect on the integrity of the seal, the adequacy of the thermal process and/or the quality of the product. Improper filling (over or under fill) may result in an inadequate thermal process or may interfere with seal and vacuum formation.

Compliance

The dispensing machines must be constructed of acceptable material, kept in good repair, dispense accurately and be maintained in a clean and sanitary condition.

Verification

Inspect the dispenser for proper construction, cleanliness, sanitation, and signs of corrosion.

Review the company quality control program, the control procedures, the records and product specifications.

Check the frequency of verification of accuracy of the dispensing equipment and associated instrumentation.

CANNING EQUIPMENT

1.7 FILLING MACHINES

Reason

It is essential that container-filling operations, either mechanical or manual, function such that they meet the requirements specified in the scheduled process for the package being produced. Improper container filling (i.e. underfilling or overfilling) may adversely affect the safety and shelf life of a product. Improper filling or overfilling may result in product being deposited on the flanges where it interferes with the double-seam formation during the seaming operation. Overfilling may lead to a high proportion of containers being produced with seam defects or with inadequate vacuum due to insufficient head space.

Similarly, with retort pouches, product or moisture deposited on the sealing area could result in an inadequate seal.

Filling machines may be contaminated with spoilage bacteria when the filler is maintained for long periods at temperatures within the thermophilic growth range. This might occur during operation from contact with a heated product, or during shutdown periods from leakage of steam valves. To prevent the growth of thermophilic bacteria, fillers must be dismantled, cleaned and sanitized as frequently as practicable.

Compliance

The filling machine knives must be kept sharp and nick free.

The filling machines must be constructed so as to be easily dismantled for thorough cleaning and sanitizing.

The filling machines must function so as to fill to specifications without depositing product on container flanges.

CANNING EQUIPMENT**1.7 FILLING MACHINES (cont'd)****Verification**

Check the container-filling operation to determine the adequacy of the following:

- a) shielding is in place to prevent filled containers from being contaminated during transfer to the seamer;
- b) the filling machines must be constructed so as to facilitate ease of dismantling for cleaning and sanitizing;
- c) the filling machines are adequate to ensure filling is within specifications.

CANNING EQUIPMENT

1.8 PACKING AND PATCHING TABLES

Reason

Potentially defective containers must be detected and removed during inspection at the patching table to prevent serious problems later in the process.

Seam interference problems, such as bone, skin or product on the flange must be detected and removed to ensure that a properly formed double seam will be made when the container is closed.

Patching underweight containers can lead to excessively overweight containers unless all patched containers are re-weighed prior to being returned to the line.

The scale used for measuring container weights at the patching table must be routinely cleaned since any product adhering to the scale will affect its accuracy.

Compliance

This area on the production line must have adequate lighting and must be able to accommodate the number of people necessary to carefully check and correct or remove deficient containers.

The accuracy of the weigh scale used for measuring container weights at the patching table must be checked regularly.

Verification

Inspect patching/inspection tables to ensure that adequate lighting is available for inspection.

Determine that adequate table space is available to enable company personnel to inspect all containers.

Confirm that the weigh scales are constructed and functioning properly.

Check the weigh scales for accuracy.

CANNING EQUIPMENT

1.9 PRE-COOKERS

Reason

The pre-cooking units, cooking racks and pre-cookers must be of sanitary design that can be easily cleaned at all times. All pre-cooking surfaces and materials coming into contact with the fish must be easily cleaned and sanitized. Where tuna is processed, no copper alloys or brass can be used on any surface which comes into contact with the fish, as it will cause contamination.

It is necessary to ensure that equipment and utensils do not become a source of bacteriological or other contamination of the product, and to prevent the greening and other discoloration of the fish flesh caused by contact with copper alloys or brass.

Examples of acceptable construction materials for cooking racks, trays, or pans, are stainless steel, saltwater-resistant aluminum alloys, high-density plastics and fibreglass-reinforced plastics.

The pre-cookers should be constructed of durable, non-absorbent, sound materials which are capable of withstanding high temperatures and repeated cleaning and disinfecting. As an example, mild steel is acceptable.

Compliance

All equipment and utensils must be constructed of acceptable materials and designed so that all places requiring cleaning and sanitizing are easily accessible.

In the case of tuna processing, copper alloys or brass must not be used on any surface which comes into contact with the fish.

Verification

The conditions as stated under compliance are the minimum requirements to meet this regulation.

CANNING EQUIPMENT

1.10 SEALING EQUIPMENT

FIR, SCHEDULE I, PART II - SECTION 28

Every cannery shall be equipped with one or more:

- a) sealing machines of a type approved by the Minister.

Reason - Sealing, Headspace and Vacuum

The sealing machine is one of the most important pieces of equipment in the canning process as this operation, when done correctly, closes the containers with an hermetic seal.

Removal of air prior to closing minimizes the strain on the container from the expansion of air during thermal processing, and removes oxygen which may cause product degradation or internal container corrosion.

Hermetically sealed containers protect the thermally processed contents from recontamination with microorganisms, thus container integrity is critical for the safety and shelf stability of canned foods.

Headspace is vital for vacuum control in some sealing machines, and may influence the adequacy of the thermal process. It is generally controlled at 8 mm (approx. 10/32") to 12 mm (approx. 15/32") in containers.

As the container vacuum absorbs trapped gases, initial vacuum is always higher than the finished vacuum.

In jars, it is usual to have a higher vacuum and more headspace than in metal containers. In most cases, headspace volume should be not less than 6% of the container volume at the sealing temperature.

For retort pouches, residual air in the container must be closely controlled to prevent excessive "ballooning" and possible damage to the seal. This is particularly true for pure steam processes, as the residual air content is a critical factor of the scheduled process.

CANNING EQUIPMENT

1.10 SEALING EQUIPMENT (cont'd)

Compliance - Headspace and Vacuum

The equipment must be adjusted for the removal of air from the containers. The usual procedures are:

- a) preheat and/or thermal exhaust closures: This involves heating the container contents just prior to filling, after filling or a combination of both. The heat causes the product to expand, reduces entrapped, occluded and dissolved air (gases) and increases the vapour tension in the headspace, dispelling the air before closure. A vacuum forms as the contents of the container cool and contract after closure.
- b) mechanical vacuum closures: The product when placed in the container is slightly warm. The container then passes into a clincher which attaches the lid loosely but not air tight. From there the container goes into a vacuum chamber which draws a vacuum and firmly seals the lid (air tight).
- c) steam-vac closures (steam flow, vapour vac): At the time of closure, steam is projected into the headspace which dispels the air and after closure, the steam condenses and creates a vacuum.
- d) for retort pouches, the container is placed in a vacuum chamber for a pre-set time before the seal is made. Sealers designed especially for retort pouches are used. This requires both bottom and top sealing elements, good adjustment mechanisms on the bars and adjustable pressure controls.

Once the relationship of headspace volume for a specific product is established for a given container, the headspace may be measured with a depth or headspace gauge.

Sealing machines of a proven design must be properly installed and maintained in good condition.

CANNING EQUIPMENT**1.10 SEALING EQUIPMENT (cont'd)****Compliance - Sealing**

The container seam measurements and inspection procedures followed must meet, as a minimum, those recommended in the by the can manufacturer, or, where not available, from the Government of Canada Metal Can Defects Manual.

The retort pouch seal measurement and inspection procedures followed must meet, as a minimum, those recommended in the Canadian General Standards Board standard, "Use of Flexible Laminated Pouches for Thermally Processed Foods".

Verification - Sealing Machines

Examine the container closing operations and determine:

- a) the manufacturer and model number of the seaming unit and the recommended maximum speed (i.e. cans per minute). Compare this speed with that used in actual operation, as speeds above the maximum recommended may cause sealing defects;
- b) whether the manufacturer's instructions concerning the operation, maintenance and adjustment of the seamer are properly followed.

Verify that visual closure inspections are made after a jam in a capper, after adjustment, or after a prolonged shutdown.

Examine the maintenance log book and find the dates and details of the latest repairs and overhauls.

If there is any doubt about the adequate maintenance of the sealing machine or the suitability for the application, consult the qualified Canadian Food Inspection Agency (CFIA) technical personnel in the region.

CANNING EQUIPMENT**1.11 WEIGHING MACHINES****Reason**

It is essential that container contents meet the product specifications and net weight requirements, so that the scheduled thermal process will be adequate.

If the amounts are not weighed accurately, it could have a detrimental effect on the container integrity and/or the scheduled process.

Compliance

Prior to production the establishment must provide the CFIA with the product specifications for each type of product and style of pack to be produced.

Verification

Inspect the weighing machine for cleanliness, sanitation and signs of corrosion.

Review the company quality control program. Check the control procedures, the records and the product specifications.

Check the frequency of verification of the accuracy of the weighing equipment and associated instrumentation.

Check the accuracy of the weighing equipment.

EMPTY CONTAINER-HANDLING EQUIPMENT**2.1 APPLICATIONS GENERAL****FIR, PART I - GENERAL SECTION 7**

Unless otherwise permitted by the Minister, fish shall be placed in new, clean, sound containers.

FIR, SCHEDULE II, SECTION 27

Canneries and all equipment and utensils used in the operations of a cannery shall be kept in good repair and in a clean and sanitary condition.

Reason

The careful handling of empty containers and ends is very important as improper handling will damage them and certainly precipitate problems later in the canning process.

Product containers which are not sound, clean and sanitary are a source of contamination to the final product. Defective containers and/or ends frequently cause defective seals on the closed container, and thereby compromise the safety of the product.

Compliance

All mechanical conveyance systems must be designed, constructed, and operated so as to ensure that containers and ends are not subjected to physical abuse. All such conveyances must be free from sharp corners or projections that may damage the containers or ends. The equipment must be maintained in a clean and sanitary condition.

Container-cleaning equipment must perform the following operations for cleaning and handling empty containers:

- a) where appropriate, invert the containers to dump out dust and foreign matter; and
- b) blast the inside of the containers to loosen and remove dust and foreign matter, using air, vacuum or steam; and/or
- c) mechanically or manually wash containers with approved water.

EMPTY CONTAINER-HANDLING EQUIPMENT**2.1 APPLICATIONS GENERAL (cont'd)****Verification**

Observe the empty container handling in operation from beginning to end and assess the effectiveness of each and every section.

Verify that the water used in container washing actually comes from the approved water source and that container washing is done with non-recirculated running water.

Check the pressure used for air or steam cleaning, and ensure it is high enough to give adequate results.

RETORT CONTROLS AND INSTRUMENTATION

3.1 APPLICATIONS GENERAL

FIR, SCHEDULE I, PART II - Section 28

Every cannery shall be equipped with one or more:

- a) sealing machines of a type approved by the Minister; and
- b) retorts equipped with properly installed
 - i) mercury-in-glass thermometer,
 - ii) pressure gauge,
 - iii) steam spreader, and
 - iv) venting valves.

FIR, GENERAL, SECTION 34

Canned fish shall be sterilized by a method approved by the Minister.

RETORT CONTROLS AND INSTRUMENTATION

3.2 PRESSURE GAUGES

Reason

An accurate pressure gauge is required at the retort to determine if there is a correct temperature/pressure equilibrium in the steam in the retort. When this equilibrium exists, it indicates that venting of all air has been completed and it is a confirmation of the accuracy of the thermometer reading.

A pressure gauge is also required on the steam supply line to ensure that the minimum pressure specified by the scheduled process is achieved.

A compound vacuum and pressure gauge is often required to indicate when the retort is under pressure or vacuum. Under some conditions when cooling water is introduced, the steam is condensed quickly and a vacuum is created. It is necessary to know if a vacuum is being drawn as containers may expand and even explode if the vacuum becomes too high.

Compliance

Every retort must be equipped with an accurate pressure gauge which has a range of 0-30 psi (0-200 kPa) pressure or a compound gauge with a range of 0 to 15 in. Hg vacuum in addition to the pressure range of 0-30 psi. The dial must be 11 cm (4 1/2 inches) or more in diameter.

The retort pressure gauges must be graduated in divisions of 2 psi (0.1 kg/cm²) or less.

The gauges must be installed with a gauge siphon or a loop (goose-neck) in a short connecting pipe, to protect the gauge. The gauges shall not be more than 4 inches (10 cm) higher than the top of the goose-neck.

A pressure gauge must be installed in the main steam-supply line to the retorts.

Pressure gauges must be tested for accuracy against a known accurate standard upon installation and at least once a year thereafter, or more frequently if necessary, to ensure their accuracy. Each pressure gauge must have a tag or other method of identification that indicates the date of the last accuracy check.

RETORT CONTROLS AND INSTRUMENTATION

3.2 PRESSURE GAUGES (cont'd)

Records must be maintained showing the dates of the pressure gauge accuracy checks, the standard used, the method used, the results of each check and any adjustments made, and the name of the person who performed the test.

Verification

Inspect all of the gauges to ensure that they are operational and meet the requirements of the Compliance section.

Determine that the gauge can be easily read by the operator and that no bleeder is installed in the pressure line from the retort to the gauge. Inspect the tag on the gauge and determine the most recent date of calibration. Ensure that the required time span, for frequency of calibration, has not been exceeded.

Review the maintenance and calibration records to determine that the gauges are in good repair and are accurate.

See Appendix A, Table A.1 for temperature/pressure table.

RETORT CONTROLS AND INSTRUMENTATION

3.3 TEMPERATURE MEASURING DEVICES

Reason

The devices used for measuring, controlling and recording the time, temperature and pressure during the scheduled process are of critical importance in ensuring that a product is rendered commercially sterile.

The thermal process must meet minimum limits for time and temperature in order to obtain commercial sterility of the product and uniformity of quality.

Mercury-in-glass thermometers and RTD's (resistance-temperature devices) are the best known types of temperature-measuring equipment (thermometer) for accuracy and dependability. It is the official instrument for indicating temperatures during retorting. An automatic temperature recording device provides charts whereby the process can be audited.

Bleeders provide a flow of steam past the thermometer bulb and the sensor for the temperature recording devices. Bleeders also remove air which enters the retort with the steam and enhances the circulation of steam in the retort.

The temperature recorder may be combined with the steam controller as a recording/controlling instrument.

Compliance

Every retort is equipped with at least one calibrated mercury-in-glass thermometer having a range of about 53 C degrees (100 F degrees), approximately 77°C to 130°C (170°F to 270°F) on a scale at least 18 cm (7 inches) in length, subdivided in 1 or 2 degree divisions. An alternative instrument having equal accuracy, precision and reliability may be used subject to approval by a thermal process specialist.

The official temperature-measuring device must be tested for accuracy and calibrated against an accurate standard when installed and at least once a year thereafter, or more frequently if necessary, to ensure the accuracy is maintained. Each thermometer must have a tag or other method of indicating the date on which it was last checked for accuracy. Records must be maintained showing the thermometer

RETORT CONTROLS AND INSTRUMENTATION

3.3 TEMPERATURE MEASURING DEVICES (cont'd)

accuracy checks, date, standard used, method used, the results of the test and any adjustments made, and the name of the person who performed the test. When a thermometer has a divided-mercury column, it is removed immediately upon discovery, repaired and standardized, or replaced.

The mercury-in-glass thermometer - not the recorder chart - is the official reference for the process temperature. Thermometers must be installed where they can be read easily and accurately by the operator.

Bulbs of all thermometers must be installed either within the retort shell or in external wells attached to the retort and not in the lid or door. External wells or pipes must be connected to the retort through at least a 19 mm (3/4 inch) diameter opening and equipped with a 1.6 mm (1/16 inch) or larger bleeder, so located as to provide a full flow of steam past the length of the thermometer bulb. The bleeders for external wells must be designed to emit steam continuously during the entire processing period.

All aspects of a retort process must utilize only one temperature scale (either Celsius or Fahrenheit). The process specifications must utilize Celsius or Fahrenheit, but not both.

Verification

Inspect the mercury-in-glass thermometer and the installation. Look for breaks in the column, improper installation, lack of a bleeder, the field of view to the operator and any other aspect which would require corrective action. Check the physical size of the thermometer as well as the range and divisions on the scale.

Verify that the thermometer has been checked against an accurate standard, calibrated, certified and tagged showing the date, standard used, and the person who performed the test.

RETORT CONTROLS AND INSTRUMENTATION

3.3 TEMPERATURE MEASURING DEVICES (cont'd)

If the mercury column is broken or the thermometer is inoperative or has not been certified, it must be removed and replaced with a certified and fully operative thermometer before any further processing occurs. Determine if the product safety has been jeopardized by the use of the faulty or uncertified thermometer.

Confirm from log books, temperature charts and operating or maintenance personnel, if the pressure gauges have been kept in good condition and that the pressures shown during the operating cycles equate to the temperatures.

See Appendix A for temperature/pressure tables.

Check the retort operator's log to ensure that entries of temperatures from the thermometer are being made and assess their reliability.

Confirm that all aspects of the processing system uses only one temperature scale (either Celsius or Fahrenheit).

RETORT CONTROLS AND INSTRUMENTATION

3.4 TEMPERATURE RECORDERS AND CONTROLLERS

Reason

Accurate temperature recorders are necessary in order to provide an adequate record of the temperatures applied during the process.

Compliance

Each retort must have a temperature-recording device.

Temperature-recording devices must be installed where they can be read easily, are free from heat and vibration, with a minimum number of bends in the thermal tube (coils are not considered to be bends) and protected against damage. The manufacturer's instructions for operation and maintenance must be followed.

If a temperature-recording steam-controlling instrument is used and the temperature recorder bulb is mounted within an external well, the well should have a 1.6 mm (1/16 inch) or larger bleeder opening, emitting steam continuously during the processing period.

The temperature recorder is adjusted so it agrees with or reads lower than the mercury-in-glass thermometer in the range of 0.5°C (1°F). The temperature recorder must never read higher than the mercury-in-glass thermometer.

Temperature recording chart graduations do not exceed 1 C degree (2 F degrees) within a range of 10°C or 20°F of the processing temperature. The working scale is not more than 12 C degrees per cm or 55 F degrees per inch within a range of 10 C degrees or 20 F degrees of the processing temperature.

The time on the recorder chart must be adjusted to agree with the actual time of day on the official wall clock at the start of each shift.

The temperature recorder chart must identify retort number, date, product, batch, and other data as necessary so the chart can be correlated with the retort record of lots processed. The date and retort and chart number shall be recorded on the chart during placement in the recorder. The retort operator's signature or initials will mark each record and after the record has been reviewed the reviewer's signature or initials shall be added to the record.

RETORT CONTROLS AND INSTRUMENTATION

3.4 TEMPERATURE RECORDERS AND CONTROLLERS (cont'd)

The recorder charts used must be those specified by the instrument manufacturer. Recorder charts are also required to have ink available at all times.

A means of preventing unauthorized changes in adjustment must be provided. A notice from management is posted at or near the recording device as a warning that only authorized persons are permitted to make adjustments, or a lock is affixed to the instrument, to provide a satisfactory means for preventing unauthorized changes.

Air-operated temperature controllers require an adequate filtering system to ensure a supply of clean, dry, and oil-free air.

All aspects of a retort process must utilize only one temperature scale (either Celsius or Fahrenheit). The process specifications and temperature-measuring devices must utilize Celsius or Fahrenheit, but not both. Errors in conversion could result in improper processing.

Verification

Inspect the temperature recorder or recorder controller and confirm that it is properly installed and maintained. Check the retort operator's log book and ensure that the temperatures from the recorder charts are within .5 C degree or 1 F degree of the mercury-in-glass thermometer and also if these temperatures have ever been higher than the mercury-in-glass thermometer readings.

Determine if there is a means of preventing unauthorized changes in adjustment of the recorder and/or controller. Search for a lock, or a notice from management posted at or near the recording device warning against unauthorized adjustment. If there is no obvious lock or notice, discuss the importance of this factor with the processor and ensure that appropriate action is taken without delay.

Confirm that the temperature scale used, i.e. Celsius or Fahrenheit, is consistent with all other aspects of the processing system.

RETORT CONTROLS AND INSTRUMENTATION

3.5 TIMERS, CLOCKS

Reason

A reliable timing mechanism is a basic requirement and a critical factor in the scheduled process.

Compliance

Each retort area must be equipped with a large, readable, timing device. It must be installed where it can be easily read by the retort operator from the retort operating positions.

Each clock must have a backup, to ensure timing continuity in the event of a power interruption. Clocks must have sweep second hands or numbers on digital timers indicating both minutes and seconds in order to avoid a potential 2 minute timing error.

A wrist-watch, recorder or any other timing device, is not considered to be satisfactory for the timing process.

If more than one timer is required in the retort area due to the area's size or configuration, the timers must be checked for accuracy and synchronized at least once every 24 hours of operation.

Verification

Observe the timing device to ensure that it can be easily read by the retort operator from the operating position, and determine if it is this timing device that is used for timing the process.

Determine the accuracy of those timing devices that have hands, and ensure that the second and minute hands coincide accurately. Confirm that, if multiple timing devices are used, they are synchronized.

RETORT EQUIPMENT

4.1 APPLICATIONS GENERAL

FIR, SCHEDULE I, PART II - SECTION 28

Every cannery shall be equipped with one or more:

- a) sealing machines of a type approved by the Minister; and
- b) retorts equipped with properly installed
 - i) mercury-in-glass thermometer,
 - ii) pressure gauge,
 - iii) steam spreader, and
 - iv) venting valves.

FIR, GENERAL, SECTION 34

Canned fish shall be sterilized by a method approved by the Minister.

Reason

Proper thermal processing of canned food is the most important step in the canning procedure. This section covers the equipment commonly used in processing low-acid canned fish products and the proper installation of this equipment to assist canners to properly equip their plants and safely carry out thermal-processing operations.

A temperature distribution study is carried out to determine the distribution of temperatures throughout a loaded retort, under the most demanding normal operating conditions. The retort plumbing configuration and container loading arrangement will influence how the steam flow is delivered to the containers in the retort load. The most important information obtained from this study is the location in the retort of the lowest temperature. A temperature distribution study will determine the ability of a steam supply to completely purge all air from a retort, with a specific plumbing configuration and a particular loading arrangement, and the time required for this to be accomplished. This determines the venting schedule required.

Results of temperature distribution studies must be interpreted and evaluated by a thermal process specialist.

RETORT EQUIPMENT

4.1 APPLICATIONS GENERAL (cont'd)

Temperature distribution studies must be conducted when there are changes in retort plumbing or in the arrangement of the containers in the retort or when there is an introduction of dividers. As stated above, the distribution of temperatures and the lethality delivered may be affected as a result of these changes.

Compliance

Retorts must be installed to meet the minimum requirements. One set of specifications is set forth in the Recommended Canadian Code of Hygienic Practice for Low-Acid and Acidified Low-Acid Foods in Hermetically Sealed Containers (Canned Foods).

A construction inspection of each retort installation is conducted annually to confirm that piping and retort layout has not been altered or has been done in accordance with the minimum requirements.

Temperature distribution tests or other documentation from the thermal process specialist is available for each retort installation, each container size and loading arrangement, to confirm that the venting schedules are adequate (see section 4.9).

The scheduled process to be followed for sterilizing canned fish must be submitted to the CFIA for filing prior to any commercial production.

For all applicable retorts in the facility, the company must have available temperature distribution data to support the adequacy of the vent schedule.

Verification

Inspect the records of temperature distribution tests for each retort and determine that the last study conducted refers to the current retort configuration.

Determine the frequency of temperature distribution studies (as specified by the thermal process specialist) carried out on each retort and the thermal process specialist who evaluated the results.

RETORT EQUIPMENT

4.1 APPLICATIONS GENERAL (cont'd)

In the case of "still" retorting, when using air pressure while processing in water, the adequacy of the water circulation to provide uniform heat distribution within the retort must be established in accordance with procedures recognized by a competent thermal process specialist.

In the case of "still" retorting, when using steam with air over-pressure for processing retort pouches or semi-rigid containers, the adequacy of the circulation system to provide uniform heat distribution in the retort must be established, by a thermal process specialist, using the racking system designed for these containers.

In the case of steam retorting using agitation and continuous container movement, temperature distribution data from the manufacturer or a thermal process specialist demonstrating that adequate venting is achieved must be obtained and kept on file by the processor for reference by the CFIA.

Confirm filing of the scheduled process with the CFIA.

RETORT EQUIPMENT

4.2 BLEEDERS

Reason

In retorts which use steam alone as the heating medium, bleeders must be used to continuously remove any air entering the retort with the steam and to provide circulation of steam in the retort, particularly around temperature-sensing elements.

Bleeders allow for a full flow of steam past the thermometer and the temperature recorder/controller sensing elements to ensure accurate readings of the temperature in the retort are obtained.

Compliance

Bleeders must be installed to meet specifications set forth in the Recommended Canadian Code of Hygienic Practice for Low-Acid and Acidified Low-Acid Foods in Hermetically Sealed Containers.

Bleeders (except those in retorts that use air over-pressure during the processing) must be kept fully open and emit steam during the entire process, including venting. All bleeders must be located so that the operator can observe that steam and air are escaping during processing. A 1.6 mm (1/16 in.) or larger opening is used to bleed wells for mercury thermometers or temperature recorder bulbs. All other bleeders must be 3 mm (1/8 in.) or larger.

In horizontal retorts, bleeders must be located along the top of the retort within approximately 0.3 m (1 ft.) of the outermost locations of containers at each end. Additional bleeders are located not more than 2.4 m (8 ft.) apart along the top.

Vertical retorts must have at least one bleeder located in that portion of the retort opposite the steam inlet.

In retorts utilizing top steam inlet and bottom venting, an adequately sized condensate bleeder is installed in the bottom of the retort to indicate and assist in the complete and continuous removal of condensation. Its discharge is located so its operations can be observed.

RETORT EQUIPMENT

4.2 BLEEDERS (cont'd)

For crateless retorts with top steam entry, there is one or more 9.5 mm (3/8 in.) or larger condensation bleeder at the lowest point at the bottom. When a false bottom is employed in a crateless retort, it must have a 3 mm (1/8 in.) or larger condensate bleeder with its opening just below the false bottom, but at a point higher than the condensation bleeder.

When bleeders are equipped with mufflers or a noise suppressor to reduce their noise level, evidence that air removal is not significantly impeded by the mufflers is kept on file. This may be in the form of temperature distribution data, a letter from the manufacturer, the designer, or a thermal process specialist.

Bleeder mufflers must be periodically checked for proper operation. If clogged or in disrepair, they must be repaired or replaced.

Verification

Verify the location of all bleeders and determine if they would be easily seen to be emitting steam from the operator's position, are operative and kept in good repair.

RETORT EQUIPMENT

4.3 COMPRESSED AIR LINES

Reason

Compressed air is used on retorts for control systems, to provide air for pressure cooling, and in retorts used for flexible or semi-rigid containers to provide over-pressure during the cooking process. Proper design of equipment, piping and valves is essential to ensure the unrestricted operation of the control systems and to prevent any air leaking into the retort during the cooking cycle, which could result in inadequate processing.

Compliance

When air pressure is used during the cooking or cooling of containers in a retort, a globe valve, ball valve or equivalent must be used on the air-supply line to prevent any air from leaking into the retort when it is not required.

The air compressor used for pressure cooling on processing systems is separate from that used to supply air for controlling the instruments, and is suitably designed to provide oil-free air at sufficient pressure and capacity for the process being used, and has an adequate filter system. An alternative to a separate compressor would be an installation with an adequate air supply which could ensure no drop in pressure to the instruments, and could also provide clean air for pressure cooling.

When air is used for over-pressure during cooking, the proper pressure is controlled by an automatic pressure control unit and a pressure recorder is provided. A check valve is provided in the air-supply line to prevent water from entering the air system.

If air is used to promote circulation in retorts it must be introduced into the steam line at a point between the bottom of the retort and the steam-control valve.

Verification

Determine if there were any changes or modifications in the air lines to the retort since the last construction and equipment inspection.

RETORT EQUIPMENT**4.3 COMPRESSED AIR LINES (cont'd)**

Check, with the compressed-air system pressurized, if there is any leakage of air from the closed shut-off valves which could result in inadequate venting or underprocessing due to air entering the processing steam.

Ensure that any air used in the retorts is from an oil-free, filtered supply and that a compressor, separate from that used for the control systems, is used for retort pressurizing or air circulation.

RETORT EQUIPMENT**4.4 CRATES, BASKETS, TRAYS AND STACKING RACKS****Reason**

Insufficiently perforated bottoms and sides in crates, baskets and trays, may prevent adequate temperature distribution in the retort.

Rough projections or sharp corners may damage the containers.

Compliance

All crates, baskets, trays, stacking racks and false bottoms in crateless retorts must be made from approved material and adequately perforated.

All rough projections, weld beads, sharp corners or edges, and wire ends in baskets must be ground smooth to prevent any possible damage to the containers.

For water-cook systems, the crates, baskets, and trays are equipped with a cover to secure containers below the cook water level.

When perforated sheet metal is used for the bottoms and sides, perforations shall be approximately 2.5 cm (1 in.) holes on 5.0 cm (2 in.) centres or the equivalent in size and/or arrangement.

Verification

Inspect and verify that crates, baskets and trays, gondolas and other equipment used to hold containers in retorts are made of adequately perforated strap iron, sheet metal, or other suitable material, and that there are no rough or sharp projections that could damage containers.

Ensure that there are sufficient perforations for adequate distribution of the heating and cooling medium, as per temperature distribution tests (see section 4.9).

RETORT EQUIPMENT

4.5 DIVIDERS/SEPARATORS

Reason

Insufficiently perforated dividers prevent adequate distribution of the steam throughout the retort. The steam must be distributed uniformly throughout the retort to ensure that all containers receive the required exposure to heat.

Use of plastic spacers as dividers is preferred to metal as they cause less container abrasion.

Compliance

In still retorts, unless the scheduled thermal process is designed to take into account the effect of container nesting, containers that can nest must be placed in baskets with an adequate divider between each layer to prevent nesting.

Where dividers are used, they shall have 2.5 cm (1 in.) holes on 5.0 cm (2 in.) centres or the equivalent in size and/or arrangement, to allow the adequate circulation of steam during the process.

For retort pouches, special racks must be used to restrict the maximum thickness of the pouch and to allow the free flow of the heating medium (i.e., steam, hot water) on both sides of the containers. Racks incorporating false bottoms can be used for this purpose.

The use of baffles is not permitted as they restrict venting and steam distribution, except when used to prevent splashing-in-water cooling, below the steam spreader.

Use of burlap sacks, boards, sugar sacks, towels, or other similar materials for separators is not acceptable.

See Appendix A, Table A.2 for Divider Plate Perforation specifications.

Verification

Compare the design of dividers/separators against the specifications set forth in the Recommended Canadian Code of Hygienic Practice for Low-Acid and Acidified Low-Acid Foods in Hermetically Sealed Containers.

RETORT EQUIPMENT**4.5 DIVIDERS/SEPARATORS (cont'd)**

Verify that the dividers fit the baskets adequately in order to prevent can nesting at the outer edges of the dividers.

Check and record the size and arrangement of the holes in the dividers. Confirm that they meet minimum requirements.

Determine if the configuration of the containers allows nesting. If so, check the scheduled process to see if it specifies that nesting is allowed. If not, dividers must be used. If baffles are used, determine if they are located and used properly.

For retort-pouch processing, check that the racks being used restrict the thickness of the retort pouch to no more than the thickness specified in the scheduled process.

RETORT EQUIPMENT

4.6 DRAINS

Reason

Drains are required in retorts for rapid removal of water after cooling. They may also be used to ensure the removal of all condensate during the venting and cooking cycles. In vertical retorts, when steam is admitted at the top, the drain may also be used as a vent.

A large proportion of the air in a retort is absorbed into the condensate, which is continuously removed via the drain during venting.

Compliance

All retorts must ensure continuous removal of condensate throughout the venting process. A steam trap or "cracked drain" may be used for condensate removal from the retort during cooking.

In a vertical retort with top-steam entry, the drain must be open to the atmosphere when it is used as a vent.

Where there exists the potential for a can to enter or block the drain, screens or grates must be installed over the drain to prevent such an occurrence.

The drain should be large enough to permit rapid removal of water after cooling.

If drains are used to remove condensate, the drain opening must be visible to the retort operator.

Verification

Confirm that drains meet the specifications set forth in the company's retort drawings.

Confirm that the drain is able to remove all of the cooling water from the retort quickly. A drain at least as large as the inlet water pipe is the minimum size which will ensure this requirement.

RETORT EQUIPMENT

4.7 SAFETY AND PRESSURE-RELIEF VALVES (Retorts, Pre-Cookers and other pressure vessels)

Reason

A pressure-relief valve, approved by the agency having jurisdiction, of a capacity sufficient to prevent undesired increases in pressure, must be fitted to every pressure vessel, namely retorts and pre-cookers, for the safety of all personnel.

To avoid the danger of excessive pressure, retorts and pre-cookers must be equipped with safety valves with adequate capacity. These valves should be constructed, located and installed so that they cannot be rendered inoperative. Most pressure codes require that the relieving capacity of safety valves be such as to prevent a rise of pressure in the retort of more than 10% above the maximum allowable working pressure. Their discharge must face away from the operator's working area.

Pressure-relief valves protect against undesirable increases in pressure. Such valves automatically prevent the pressure from rising too high during the manual operation of the pressure cooling cycle. For retorts, they are typically set at 4-5 psi above the processing pressure.

Compliance

Any vessel which is used under pressure must meet certain safety standards. This may be a boiler code which is covered under ASME Code for boilers, or if it is unfired, it may be covered by the ASME Unified Pressure Vessel Code.

There are many special types of cookers, sterilizers, and pressure-treatment vessels used in the food industry, and even if the jacket alone is under pressure, it must meet certain specifications.

Verification

No inspector is to start or carry out the inspection of a pressure vessel which is not properly protected with a pressure-relief safety valve in good operating condition. If the inspector has any question as to the adequacy or reliability of the safety valves, the company is to supply information from the local boiler inspection service or other

RETORT EQUIPMENT**4.7 SAFETY AND PRESSURE-RELIEF VALVES (cont'd)**

competent source, to prove that the safety valves have been tested recently and that they are in working order.

Inspect and ensure safety valves are installed on all retorts, are serviced annually (or when necessary) and checked during processing to ensure that they are not encumbered in any way such as being closed and secured with a wire to prevent blow off. The frequency of these safety-valve checks will depend on the retort usage. Usually the safety valves are checked once or twice per operating season if it is a short season.

RETORT EQUIPMENT

4.8 STEAM SPREADERS

Reason

Steam spreaders which are properly designed and installed ensure that the steam is distributed to all areas in the retort for effective and uniform venting and heating.

Compliance

Effective steam spreaders must be installed in horizontal retorts, running the full length of the retort.

The perforations are along the top 90 degrees of the pipe, within 45 degrees of either side of top dead centre.

In vertical retorts, bottom-steam spreaders, if present, are in the form of a cross or straight pipe with the perforations along the top or sides of the pipes.

In crateless retorts with top-steam entry, steam enters through a circular steam spreader.

The number and size of holes in the steam spreader is such that there is a minimum of back pressure and a uniform flow of steam.

See Appendix A, Table A.3, for minimum hole requirements in steam spreaders.

Verification

Confirm that steam spreaders are installed to meet specifications set forth in the Recommended Canadian Code of Hygienic Practice for Low-Acid and Acidified Low-Acid Foods in Hermetically Sealed Containers.

Inspect the steam spreader's installation and verify that the piping is secure and the original integrity of the piping, as documented on the retort diagram, has been maintained. Check the location, size, spacing and number of holes in the spreader and determine if the total cross-sectional area of the perforations is equal to 1.5 to 2 times the cross-sectional area of the smallest restriction in the steam-inlet pipe. Hole sizes may be measured using drill bits of known size.

RETORT EQUIPMENT**4.8 STEAM SPREADERS (cont'd)**

Confirm that bottom-steam spreaders, if present in vertical retorts, are in the shape of a cross or straight pipe with the perforations along the top or side of the pipes. In crateless retorts with top-steam entry, steam should enter through a circular steam spreader.

RETORT EQUIPMENT

4.9 TEMPERATURE DISTRIBUTION TESTS

Reason

A temperature distribution test shall be conducted to establish an adequate venting schedule for each retort process. Temperature distribution tests must be carried out on each container size and configuration of loading or the venting schedule for the most difficult container size and loading configuration to vent must be determined and used as the standard.

Thermocouples should be located throughout the retort so that the processor has identified the location where the air removal from the retort system is the most difficult. Each retort system has an established venting schedule which will depend on such factors as the type and size of the retort shell, the size and configuration of the steam and vent piping, the quantity of steam supply, size and configuration of the valves, type of loading system in the retort, and the size and style of container being processed.

Having completed sufficient temperature distribution tests to establish the venting schedule for the particular retort installation, the processor must specify in the venting schedule, both a time and a temperature which will ensure that a saturated-steam environment is provided throughout the entire retort. Other factors, where deemed critical as a result of information gained from the distribution tests, must be specified in the venting schedule. Critical factors for a vent schedule can include minimum steam-supply pressure, maximum number of retorts which could be vented at one time, vent valve and supply-steam valve operation during the venting procedure, retort basket loading or partial loading of retorts.

Compliance

Temperature distribution tests must be available for review by the CFIA.

Verification

Determine from documented temperature distribution tests, that the processor has information available to verify that the venting schedule is adequate.

RETORT EQUIPMENT

4.10 VENT PIPING

Reason

Vents are large outlets, controlled by valves. They are required to ensure that all air is removed from the retort before the process timing is started.

Compliance

Every retort must be equipped with sufficient vent openings, controlled by fully opening valves such as gate or plug-cock type valves, to permit rapid discharge of air from the retort during the venting period.

Good quality, fully operational valves are required to ensure the unrestricted flow of air and steam through the vent piping during this short period.

All manifolds in vent piping must be constructed such that there is a minimum of restriction to the steam/air flow during the venting process. The piping must be properly designed and sized to ensure minimum restrictions to flow and minimum friction loss.

The vent is located in the opposite portion of the retort from which the steam is admitted. The vents and all external lines and manifolds are short and as free from bends as possible. There are no additional valves or check valves installed in the vent piping or vent manifolds as these impede proper venting.

Vents must not be connected directly to any closed drain system. There must be an atmospheric break in all vent lines which are connected to a drain.

If a vent manifold connects several vent pipes from a single retort, the cross-sectional area of the manifold pipe must be greater than the total cross-sectioned areas of all the connecting vent pipes (use as a guide Appendix A, Table A.4). The temperature distribution test is used to verify the effectiveness of the vent schedule.

RETORT EQUIPMENT

4.10 VENT PIPING (cont'd)

Verification

If a manifold header connects vents or manifolds from several retorts it must lead to the atmosphere within as short a distance as practicable and with as few bends as possible. No valves may be present. The cross-sectional area of the manifold header is at least equal to the total of the cross-sectional areas of all connecting pipes from the retorts which vent simultaneously.

Confirm that vent piping is designed to meet specifications set forth in the Recommended Canadian Code of Hygienic Practice for Low-Acid and Acidified Low-Acid Foods in Hermetically Sealed Containers.

Refer to vent-piping schematic drawings during the construction and equipment inspection to determine if changes were made to any component of the venting system.

Inspect the vent piping from each retort to ensure that there is only one valve in the vent line. Vent valves must be shut-off valves (gate valves) and not a throttling type valve.

Record the type of valves used on the vent pipe or manifold. Determine if they are suitable valves, such as a gate or ball, which open fully to permit the rapid discharge of air from the retort during venting. Globe or similar type valves are not recommended due to the high internal friction which produces a high pressure loss.

Record vent valve size and the sizes and lengths of the vent pipe and manifold. Determine if the quantity of fittings, bends, and headers has been kept to a minimum.

Where the retort vents to the drain, verify that there are no direct connections from the retort to the drain which could allow back-siphoning from the drain into the retort. Confirm that the vent is in the opposite side of the retort from the steam spreader.

Determine how many retorts are brought up to temperature at any one time and that the available steam is sufficient when the venting of all retorts occurs simultaneously. This is especially critical when a number of retorts are running at the same time, either cooking or venting, as steam availability must be ensured.

RETORT EQUIPMENT

4.11 WATER PIPING AND CONTROLS

Reason

Some water lines are used as vents, as well as for circulating water during water cooks and for cooling containers in the retort after cooking. They must be properly designed and equipped with appropriate valves to ensure adequate venting as well as good heat transfer during cooking and cooling cycles.

The installation of back-flow prevention devices or vacuum breakers on the water-supply piping to the retort prevents the plant water supply from becoming contaminated from retort cooling water due to back-siphoning.

Dripping from the water spreader could cause underprocessing of any containers that may be located directly under the drip. Therefore the valves on the water-supply line must be maintained in good operating condition.

Both top and bottom water inlets to the retort may be desirable to provide for the most efficient cooling procedure.

Compliance

Water valves for throttling should be globe or equivalent valves with replaceable seals, which are maintained in good condition. For fully open or fully closed operations, gate or ball valves or equivalent are recommended.

If containers are to be cooled by flooding in the retort, the pressure and size of the water-supply line and inlet must be adequate to ensure rapid filling of the retort.

For spray cooling in the horizontal retorts, water enters at the top, through a full length water spreader inside the shell. The distribution of the water by the spreader must be uniform to ensure effective cooling.

A sufficient quantity of holes are made in the water spreader to provide adequate water distribution for proper cooling of the containers. It is suggested that there be at least three rows of holes in the lower 90° quadrant of the water spreader, to ensure that water is distributed uniformly. Alternately,

RETORT EQUIPMENT

4.11 WATER PIPING AND CONTROLS (cont'd)

there are at least two rows of holes facing upward to provide water splashing off the top of the retort for uniform coverage of the containers.

If the retort is to be vented through the water spreader, the total cross-sectional area of the holes is equal to, or greater than the cross-sectional area of the vent pipe. See Appendix A, Table A.5 for number and size of holes to be used when venting from the water spreader.

In horizontal "still" retorts, the water spreaders may be designed so that the header pipe extends past the location of the last retort basket. As an example, a single 6 mm (1/4 in.) diameter hole is drilled in the bottom of the header pipe, so that water will empty out of the header away from any product in the retort baskets. If a water valve is leaking, this hole will provide visual indication of this condition and if the water valve leaks during retorting the header will not fill up and the leaking water will drip away from any product being processed.

The overflow line is located near the top of the retort above the top layers of containers. Gate, or other suitable valves are used to permit unrestricted flow.

In retorts using water as the heating medium through circulation systems, the systems are installed in such a manner that:

- a) the water is drawn from the bottom of the retort through a suction manifold and discharged through a spreader that extends across the top length of the retort;
- b) recirculating pumps are equipped with a bleed petcock in the pump casing that is used at daily start-up to assure that the pump is free of air; and
- c) the pump must be equipped with a pilot light or other signalling device to warn the operator if it is not running.

RETORT EQUIPMENT

4.11 WATER PIPING AND CONTROLS (cont'd)

Verification

During the annual construction and equipment inspection of each retort installation, record any changes that have been made to the retort (piping, valves, pumps, etc.) and if a critical change has been made to the system, a temperature distribution test must have been carried out to revalidate the vent schedule.

In retorts which vent through the water spreaders, check that the number and size of the holes in the water spreader are as specified in the compliance table. The holes may be measured using drill bits of known size.

Inspect the water spreader installation and look for secure piping and clean holes in the pipes. For water spreaders with upward facing holes, confirm that the spreader pipe extends past the last retort basket and that a 6 mm (1/4 in.) is drilled in the bottom cap for drainage.

Confirm that there is no dripping from the water spreader when the valve on the water-supply line is closed.

Follow the routing of the water-supply lines to the retorts, to determine that there are no bypasses after the water-treatment system.

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RETORT EQUIPMENT

4.12 WATER RETENTION TANK FOR COOLING WATER

TO BE ISSUED AT A LATER DATE

STEAM SUPPLY AND BOILERS

5.1 APPLICATIONS GENERAL

FIR, SCHEDULE I, PART II - Section 27

An adequate supply of steam shall be maintained at a sufficient pressure for the operations of the cannery.

Reason

Steam, which is vaporized water, is the most extensively used heat-transfer medium in food plants. Steam can be generated at a central point and piped to many locations. The pressure is related to temperature in approximately the same ratio inside and outside containers when it is used for sterilization in retorts.

Dry, saturated steam is an ideal vapour, free from suspended droplets of water.

Wet steam contains unvaporized water in suspension, which may result from condensation after the steam has left the boiler. The quality of wet steam is expressed in terms of the percentage of the total weight which is vaporized. For example, 90% quality steam has 10% of the water left in it.

The scheduled thermal process is based on very strict limits for both time and temperature, in order to obtain commercial sterility.

A sufficient supply of steam is necessary to ensure complete venting of the air from the retort during the venting cycle. Inadequate steam pressure or quantity could delay the completion of the venting of the air in the retort and subsequently cause a deviation from the scheduled process.

If the steam pressure in the supply line or the quantity of the steam flow is inadequate to hold the required temperature for the required time, the scheduled process will not be achieved.

Compliance

The capacity of the steam producing equipment and the capacity of the pipes and valves supplying steam to the retort are such that the steam pressure to the retort is maintained at 90 psi (6.3 kg/cm², 620 kPa) or greater with the majority of the vents fully open, and the retorts being vented according to the filed process. Or where the steam

STEAM SUPPLY AND BOILERS

5.1 APPLICATIONS GENERAL (cont'd)

pressure to the retort is less than 90 psi, the adequacy of the steam supply is validated by the temperature distribution data and the minimum steam pressure - under specified operating conditions - is listed as a critical factor of the filed process.

Each retort must be equipped with an automatic steam controller to maintain retort temperature accurately, activated by air or electricity, and responsive to either temperature or pressure. If the controller valve is smaller than the steam-inlet pipe, an optional steam-bypass valve can be installed for use during the venting period when the steam demand is higher than the capacity of the automatic temperature control valve.

Steam lines are used to deliver adequate volumes of steam, at adequate quality and pressure, to each point of application, throughout the processing plant. Long lines must be provided with adequate condensate traps, to ensure that condensate is removed promptly in order to maintain acceptable steam quality.

Steam used directly for food processing must be free from contaminants, such as suspended alkalis or acids, that may contaminate the product. Rust or scale may clog lines or interfere with the operation of valves or instruments. Any impurity which will adversely affect the food must be kept out of the steam.

The steam supply system should:

- a) be insulated to minimize the formation of condensation; and
- b) have sufficient quantity of efficient steam traps to remove all the condensate properly; and
- c) have adequate strainers to ensure the removal of all scale rust or other foreign materials in the lines.

STEAM SUPPLY AND BOILERS

5.1 APPLICATIONS GENERAL (cont'd)

The bypass valve at the steam control valve allows delivery of steam in case of problems with the regulating valve. In some installations, the steam bypass may be used regularly during the venting or come-up, if the steam demand is greater than that of the capacity of the control valve. This is particularly true if a small control valve is used. Since uncontrolled excessive pressure in the retort might lead to equipment damage and personal injury, the operator must never leave the retort while the bypass valve is open.

Verification

Confirm that the steam supply meets those specifications set forth in the Recommended Canadian Code of Hygienic Practice for Low-Acid and Acidified Low-Acid Foods in Hermetically Sealed Containers.

Refer to steam-supply schematic drawings or the schematic of the system, to verify that no changes were made to any component of the steam-supply system since the last annual construction and equipment inspection. The following information should be maintained on file:

- a) number of boilers and capacity (as noted on the manufacturer's nameplate, in hp) which supply steam to the retort(s) ;
- b) header pipe sizes for the main steam supply;
- c) size and capacity of the steam-control valve and associated bypass valves on each retort;
- d) pipe size, its length to the retort and the quantity and sizes of branch lines off the main header.

Determine the maximum number of retorts that are brought up to process temperature at one time and if the available steam is sufficient when the venting of this maximum quantity of retorts occurs simultaneously.

During retort operation, watch for the following which could indicate that the steam supply may be insufficient:

STEAM SUPPLY AND BOILERS

5.1 APPLICATIONS GENERAL (cont'd)

- a) excessive pressure dropping when retorts are vented;
- b) inability to meet venting requirements;
- c) extended come up time; and
- d) temperature fluctuations.

Check on the possibility of contamination from steam condensate which accumulates on the steam line during shutdown. Check also for carry-over of boiler additives in the steam used to exhaust air from the containers. Such carry-over will leave a powdery film on the containers. A water-bath cook heated with live steam will show detinning of the containers.

The quantity of steam which a pipe will carry without an excessive drop in pressure depends on the pipe diameter, the quantity of bends, valves and other flow restrictions which are involved in the system.

POST-PROCESS HANDLING EQUIPMENT**6.1 APPLICATIONS GENERAL****FIR, PART IV - SECTION 34**

Canned fish shall be sterilized by a method approved by the Minister.

FIR, SCHEDULE II, SECTION 27

Canneries and all equipment and utensils used in the operations of a cannery shall be kept in good repair and in a clean and sanitary condition.

FIR, GENERAL, SECTION 24

No person shall export or import or attempt to export or import cans of fish

- a) that have not been properly sealed;
- b) the tops or bottoms of which have been distorted outwards; or
- c) that are otherwise defective.

Reason

The safeguarding of our food products against bacterial spoilage is dependent upon three conditions:

- a) the application of heat to the product for a time and at a temperature sufficient to produce commercial sterility;
- b) the sealing of the container in such a manner that microorganisms cannot re-enter and contaminate the sterilized product;
- c) the proper post-process handling procedures which protect the finished closures from damage, which can cause leakage or post-process contamination.

The microbial load on the container-handling lines and resultant contamination transferred to the containers are related to the amount of moisture present. Moisture facilitates the transfer of bacteria to the container closure and also increases the ability of bacteria to move through the closure into the container.

The drying belt can be a potent inoculator. The use of the drying belt should be discouraged.

POST-PROCESS HANDLING EQUIPMENT

6.1 APPLICATIONS GENERAL (cont'd)

Procedures such as running containers at high speed into dead ends, sharp turns in line direction, excessive bumping or jamming, may cause small deformations and strains on the seams. Even a momentary break in the seal may pull bacteria into the container.

Compliance

Handling of hot and wet containers after retorting must be prevented. Only containers that are cool (less than 110 °F, 43 °C), not distended and preferably dry may be handled by employees or equipment, since the handling of hot, wet containers will aid the transfer of bacteria into the container (i.e., unloaded from baskets).

The containers must be protected from contamination while cooling. Potential sources of contamination include dust, dirt, debris, condensation, and pooled water.

The containers must not be subjected to rough handling or to shocks which would cause the containers to leak.

The conveyors and equipment must be maintained in good repair and be kept in a clean and sanitary condition. Wherever possible, equipment must be kept dry.

The area where baskets are tipped to drain off excess water must have restricted access to prevent contact of personnel and clothing, aprons, gloves, and other foreign objects with the hot and wet containers.

There must be perimeter barriers around the cooling areas which prevent the entry of unauthorized personnel.

The equipment used for post-process handling must be kept clean and sanitary.

With respect to all conveyors, container runs, junctions, diverters, turns and all micro switches, there are no sharp corners, sharp objects, abrupt reversals, collisions, very sudden stops or similar conditions that could cause damage to the containers.

The belts do not have any staples or broken sections which could cause damage to the containers.

POST-PROCESS HANDLING EQUIPMENT

6.1 APPLICATIONS GENERAL (cont'd)

Verification

Temperature abuse in storage areas must be prevented.

Determine what post-processing practices and procedures are followed to ensure that the heat-processed containers remain commercially sterile.

Inspect container-handling systems in the post-process area to ensure that systems meet requirements and prevent damage to containers.

Inspect the container cooling and drying procedure. If a drying belt is used, it must be properly maintained.

Observe the post-process handling procedures for rough or unsanitary practises. Determine the storage procedures and whether the containers are stored labelled or unlabelled (called "bright" when referring to metal containers).

Determine if there is any temperature abuse as well as the type of temperature control in the warehouse.

Check for the presence of rust on containers which could be an indication of improper temperatures and humidity levels in the warehouse.

POST-PROCESS HANDLING EQUIPMENT

6.2 COOLING AND INTERIM STORAGE

Reason

Hot and wet containers are very susceptible to contamination because the sealing compound has not yet hardened, and the container cooling will facilitate the movement of bacteria into the container, as a vacuum is drawn.

Since moisture on the double seam or container facilitates the transfer of bacteria and increases the ability of bacteria to pass through the closure into the container, the interim storage area is required to be constructed so that it can be maintained in a clean and sanitary condition free from sources of contamination. All workers in the cooling and interim storage area must be aware of the proper handling procedures for containers in this area.

Compliance

Entry to the post-process and container-cooling area must be restricted to authorized personnel only. Workers in the area must ensure that hot, wet containers are not touched by hand and that no impact damage occurs in the moving, or tipping for draining, of the crates, baskets or trays. Clean gloves, dipped in disinfecting solution, must be worn when handling the crates or baskets. Any sudden movements or sharp impacts must be avoided. The cooling area must be clean and sanitary and free from sources of contamination, such as dust, dirt, debris and condensed or pooled water which could contact the cooling containers.

The area where baskets are tipped, to remove excess water after exit from the retort, is designed for drainage of all water.

The interim storage area is a dry-working area and is constructed so that it can be maintained in a dry, clean and sanitary condition. Due to the nature of the operation, it is accepted that floors are level and drains are not considered mandatory providing their absence does not hinder sanitation.

Air for the forced-air cooling system is drawn from a source which is clean and free from dust and other contamination.

The use of foot baths is recommended for personnel entering the post-process area.

POST-PROCESS HANDLING EQUIPMENT**6.2 COOLING AND INTERIM STORAGE (cont'd)**

The post-process and container-cooling area is separate and restricted to only those personnel authorized to be in the area. All people entering this area must be aware of the requirement that hot/wet containers are not to be handled.

Glove-dip facilities and rubber gloves must be available so that anyone handling baskets of containers which are cooling, must wear gloves which have been properly sanitized in a disinfectant solution.

Verification

Determine that any interim storage area used for post-process storage or handling of containers after retorting, meets the above compliance requirements.

POST-PROCESS HANDLING EQUIPMENT

6.3 HANDLING SYSTEMS

Reason

Proper hygienic design of container-handling equipment is a major factor in prevention of post-process contamination of canned foods. Poor hygienic design will create conditions which may encourage the growth of microorganisms on wet surfaces resulting in potential sources of contamination.

Protection of the canned food must extend to the post-cooling container-handling systems. Studies have indicated that excessive bacterial contamination may develop on wet and soiled post-cooling container-handling equipment, even though the cooling water is chlorinated and of good sanitary quality. Bacterial contamination may be transferred, in varying degrees, to the seam areas of the containers and may lead to contamination of the product.

Containers should be handled gently. If the containers are roughly handled after processing, the seams may be damaged and the container bodies dented. Dents may fracture the lacquer coating inside the container. Leaks caused by dents or by damaged seams can result in the contamination of the product. Containers are also very susceptible to loss of vacuum, due to rough handling. This loss of vacuum may also lead to contamination of the product.

Compliance

The palletizing machine, or bright stacker, must be designed so that it can be kept clean and sanitary at all times. Container runs are designed so that surfaces and runways are dry where they contact the seams of the containers.

The handling systems at all post-process stages must be designed, constructed and operated in such a manner that they can be easily cleaned. Rough handling, drops, collisions, and abrupt reversals must be prevented. All systems must be free of sharp projections, which may cause damage to containers. These systems must be inspected periodically and where rough handling is apparent, the operation or equipment must be adjusted to eliminate problems. Continuous belts are used in container-handling systems.

POST-PROCESS HANDLING EQUIPMENT

6.3 HANDLING SYSTEMS (cont'd)

Verification

Inspect all equipment used for handling filled containers to ensure that unnecessary contact between container double seams and conveying surfaces is avoided.

Inspect for sharp bends and long drop sections where containers could be damaged due to the momentum of those coming later and hitting them.

Determine that there are no sharp points on welds, at junction points on conveyors or guide rails. Check for obstacles such as nuts, bolts and rivets protruding into the path of the containers, which would prevent the smooth, free flow of containers.

APPENDIX A - TABLES**A.1 TEMPERATURE/PRESSURE TABLE**

The following table shows the gauge pressure corresponding to a specified process temperature, at various altitudes:

Temp Deg. F	Sea Level	<u>FEET ABOVE SEA LEVEL</u>							Temp Deg. C
		500	1000	2000	3000	4000	5000	6000	
200	---	---	----	----	----	----	----	----	93.3
205	---	---	----	----	----	----	0.5	0.9	96.1
210	---	---	----	0.4	0.9	1.4	1.8	2.3	98.9
212	0.0	0.2	0.5	1.0	1.5	2.0	2.4	2.9	100.0
215	0.9	1.1	1.4	1.9	2.4	2.9	3.3	3.8	101.7
220	2.5	2.7	3.0	3.4	3.9	4.4	4.9	5.3	104.4
225	4.2	4.5	4.7	5.2	5.7	6.2	6.6	7.1	107.2
230	6.1	6.3	6.6	7.1	7.6	8.0	8.5	9.0	110.0
235	8.1	8.3	8.6	9.1	9.6	10.0	10.5	11.0	112.8
240	10.3	10.5	10.8	11.3	11.7	12.2	12.7	13.1	115.6
242	11.2	11.4	11.7	12.2	12.7	13.1	13.6	14.1	116.7
245	12.6	12.9	13.1	13.6	14.1	14.6	15.0	15.5	118.3
248	14.1	14.3	14.6	15.1	15.6	16.0	16.5	17.0	120.0
250	15.1	15.4	15.6	16.1	16.6	17.1	17.5	18.0	121.1
252	16.2	16.4	16.7	17.2	17.7	18.1	18.6	19.1	122.2
255	17.8	18.1	18.3	18.8	19.3	19.8	20.2	20.7	123.9
260	20.7	21.0	21.2	21.7	22.2	22.7	23.1	23.6	126.7
265	23.8	24.0	24.3	24.8	25.3	25.8	26.3	26.8	129.4
270	27.3	27.5	27.8	28.3	28.8	29.3	29.8	30.3	132.2
275	30.9	31.2	31.5	32.0	32.5	33.0	33.5	34.0	135.0

A.2 DIVIDER PERFORATIONS

SPECIFICATIONS FOR DIVIDER-PLATE PERFORATIONS		
Hole Size	Distance Between Hole Centres	% Effective Open Area
9mm (3/8")	20mm (3/4")	20%
13mm (1/2")	25mm (1")	20%
20mm (3/4")	38mm (1 1/2")	20%
25mm (1")	50mm (2")	20%
38mm (1 1/2")	76mm (3")	20%
45mm (1 3/4")	88mm (3 1/2")	20%
9mm (3/8")	14mm (9/16") staggered	40%
13mm (1/2")	25mm (1") staggered	23%
16mm (5/8")	21mm (13/16") staggered	54%
25mm (1")	44 mm (1 3/4") staggered	30%

A.3 HOLES IN STEAM SPREADERS

NUMBER OF HOLES FOR STEAM SPREADERS					
Size of Holes (inches)	Number of Holes Steam Inlet Size - Standard Pipe (inches)				
	1	1 1/4	1 1/2	2	2 1/2
3/16	47-63	82-109	111-148	183-244	261-347
7/32	35-46	60-80	82-109	134-179	192-255
1/4	27-36	46-61	63-83	103-137	147-196
5/16	17-23	30-40	40-54	66-88	94-125
3/8	12-16	21-28	28-37	46-61	66-87
7/16	-	-	21-28	33-45	48-64
1/2	-	12-16	16-21	26-35	37-49

A.4 GUIDELINE - PIPE SIZES FOR VENTING

MANIFOLD PIPE SIZE (inches)	CONNECTING PIPE SIZE (inches)										
	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6
1	2										
1 1/4	[5]	[3]									
1 1/2		[4]	2								
2	6	4	2								
2 1/2	9	5	3	2							
3		8	5	3	2						
4			8	6	4	2					
5				10	6	4	2				
6					8	6	4	2			
8						10	6	4	2		
10							11	6	4	2	

Note: Numbers in [] exceed the area of manifold; all installations validated through a temperature distribution test.

A.5 HOLES IN WATER SPREADERS**VENTING THROUGH WATER SPREADERS**

MINIMUM NUMBER OF HOLES IN WATER SPREADERS WHEN USED FOR VENTING						
Hole Size (inches)	SMALLEST RESTRICTION IN VENT OUTLET (inches)					
	1 1/4	1 1/2	2	2 1/2	3	3 1/2
3/16	55	74	122	174	268	359
7/32	40	55	90	128	197	264
1/4	31	42	69	98	151	202
5/16	20	27	44	63	97	129
3/8	14	19	31	44	67	90
1/2	--	11	18	25	38	51