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PROCESS TABLES FOR CANNED FISHERY PRODUCTS

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FOREWORD

This paper has been prepared as a guide for the processing of low-acid canned fishery products in metal containers and recommends process schedules for various products under specific conditions.

Any deviation from the conditions or procedures described herein, should be discussed with a Fish Inspection Laboratory in your area.

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INTRODUCTION

Thermal processing of canned food is, without question, the most important step in the canning procedure. (American Can Company).

If the sterilization is not adequate, the raw material and labour put into the finished product are lost.

1. Such losses are an economic waste.
2. They result in a loss of good will (which is very difficult and expensive to regain).
3. They are a hazard to the health of the consumer (last but by no means least).

Importance of a Reliable and Consistent Sterilization Process.

Definitions

Sterilization:-is the freeing of material of all micro-organisms and it is very severe. We couldn't, or wouldn't, eat a product that was subjected to complete sterilization.

Partial Sterilization:-is as the words imply, less severe and less than complete sterilization. There are two common

types of partial sterilization,
namely:

- (a) Pasteurization - which is quite common in the dairy industry, and
- (b) Commercial Sterilization, or commercial sterility - which is very important in the can food industry.

Commercial sterilization is the goal in low acid canned foods and should be fully understood by the canner or retort operator because it is what processing or retorting is all about.

Commercial sterilization may be defined in two ways:

1. To free food of all micro-organisms that will endanger the health of food consumers or cause economically important spoilage of food in storage and distribution.
2. Getting right down to the point - Commercial sterility for low-acid foods may be defined as that process by which all Clostridium botulinum spores and all other Pathogenic bacteria have been destroyed, as well as more heat resistant organisms which if present could produce spoilage under normal conditions of storage and distribution.

pH and its Importance

In determining the sterilization process, it is necessary

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to know the heat resistance of the bacterial spores which may cause spoilage and the rate at which heat penetrates the product during thermal processing.

Among the various factors affecting thermal resistance of bacterial spores or their ability to germinate, one of the most important from the standpoint of canned food sterilization, is pH.

Without getting too technical, basically, what workers in this field found, was that the maximum heat resistance of spores to be in the pH range of 6.3 - 6.9.

The lower the pH value, the lower the process necessary for sterilization.

They also stated that products with a pH value of 4.5 are not subject to botulinum spoilage when packed under the proper sanitary conditions.

It was recommended that all products with pH higher than 4.5 be processed so that all portions of the can are heated sufficiently to destroy the most resistant strains of Cl. botulinum.

Cameron, (1938), states that pH 4.5 is the "upper limit" of acid food.

Classification of canned foods with respect to their pH values

<u>Group No.</u>	<u>Group Description</u>	<u>pH</u>	<u>Example</u>
I	Non acid	7.0 - 5.3	Corn
II	Semi or medium acid	5.3 - 4.5	Beets
III	Acid I	4.5 - 3.7	Apricots
IV	Acid II	3.7 and below	Pickles

Unfortunately, most fishery products, unless altered by adding acid or vinegar are in the pH range of 7.0 or above.

This means the spores are quite resistant to heat and they must receive sufficient heat to destroy the most resistant strains of *Clostridium botulinum*.

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Maximum Water Activity

By definition, the water activity (a_w) of a solution is:

the ratio of its water vapour pressure
vapour pressure of pure water at the same temperature

$$a_w = p/P_o$$

P = vapour pressure of fish

P_o = vapour pressure of pure water
(same temperature)

$$a_w = \text{Rel. Humidity} = \frac{\text{moles of H}_2\text{O}}{\text{moles H}_2\text{O} + \text{moles solute}} = \frac{55.5}{55.5 + X}$$

Standards used: NaOH H₂SO₄ CaCl₂ NaCl

For example, saturated NaCl in water at 25°C has an

a_w of 0.7528.

Similarly, CaCl₂ at the following concentrations has an a_w of:

<u>% Concentration</u>	<u>a_w</u>
9.33	0.95
19.03	0.85
24.95	0.75
29.64	0.65
35.64	0.50

Instruments are available to measure water activity.

Bacteria, in common with all forms of life, require water

for growth. The object in examining their water relations is to determine their minimum water requirements and their responses when water is available in excess of this minimum.

Three traditional methods of food preservation - salt-
ing, syruring and dehydration - achieve a substantial reduction in the activity of the water in food.

Experience and nutritional considerations show that bacteria will not proliferate in pure water. It follows that any substrate, be it liquid or solid which supports growth, is in essence, an aqueous solution.

As was stated earlier, a_w is a measure of free or available water, to be distinguished from unavailable or bound water.

The minimum a_w (water activity) below which most important food bacteria will not grow is of the order of 0.90 or greater, depending on the specific bacterium. Some halophilic bacteria may grow down to an a_w of 0.75, and certain osmophilic yeasts even lower, but these seldom are important causes of food spoilage. Molds are more resistant to dryness than most bacteria, however, at a_w values below 0.65, mold growth is completely inhibited. This level would correspond to total moisture content well below 20% in many foods.

If can foods have an a_w above 0.85, they must receive a

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severe heat treatment, the same as can foods with a pH above 4.5

Most canned fish products have an a_w above 0.96.

F₀ Value - What it means

The F₀, or lethality value designation, is the number of minutes required to destroy a specific number of Clostridium botulinum spores at 250°F.

The F₀ value has been defined as the equivalent number of minutes at 250°F (121.1°C) when no time is required to heat to 250°F or cool to sub lethal temperatures when the thermal death time curve slope (Z) is equal to 18°F.

The minimum period to obtain commercial sterility is considered to be 2.78 minutes at 250°F or its equivalent, or in other words, an F₀ of 2.78.

Retorting times and temperatures

Retorting, or a retort cycle, is called "Processing" or "a Process".

What is a process and how long should it be?

Processing is carried out for two reasons:

1. Processing is carried out to prevent spoilage.
2. The secondary purpose is cooking of the product.

It is the application of heat:

- (a) at a definite temperature
- (b) for a definite time
- (c) under specific conditions

It must assure safety from spoilage by the heat-resistant organism, *Clostridium botulinum*, which if allowed to grow in foods sealed in air tight containers produces a very lethal toxin. This poison is extremely powerful and even a very small taste can be fatal.

Clostridium botulinum

Clostridium botulinum is a very dangerous pathogen and the destruction of the spores of this organism is generally accepted as the minimum standard for processing of low-medium acid canned foods.

It is believed that the natural habitat of all types of *Clostridium botulinum* is in the soil and that those found in the bottom muds of the oceans and other large bodies of water are probably washed down from the land by run-off and rivers into these bodies of water.

Clostridium botulinum exists in two forms - in an actively growing state (vegetative), or in a state of dormancy (spore). The vegetative form of *Clostridium botulinum* does not grow in the presence of oxygen. It belongs to a class

of micro-organisms known as "anaerobes", which grow only in the absence of oxygen. The spores are remarkably resistant to heat and it is because of the survival of heat resistant spores that improperly home-canned foods have been one of the most frequent causes of botulism in America.

The potent botulism neurotoxin that is released into the food causes muscle paralysis, usually starting with the eyes and face and progressing downward to the chest and extremities. The diaphragm and chest muscles become paralyzed and death may result from asphyxiation.

Factors affecting the length of a Process

1. Heat resistance of the organisms.

Spores are not killed as soon as a specific high temperature is reached, but require a certain length of heating at any temperature for their destruction.

2. The acidity or pH of the product.

4.5 and below is the acid group

above 4.5 is the low-acid group

3. Maximum water activity.

4. Rate of heat penetration.

This depends on many factors such as:

- (a) liquid, (b) solid, (c) arrangement, and
- (d) composition etc.

Why use steam for Processing?

1. It is a good means of heat transfer.
2. Its temperature can be easily controlled at the high levels necessary merely by controlling the pressure.
3. Due to its pressure, buckling of the can ends during processing is prevented.
4. It is easily manufactured.

970 BTU's are required to change one pound of boiling water at 212°F to steam.

Water Cook.

Due to the size, construction or material (aluminum for instance) used in certain containers, a "Steam Cook" cannot be used because it is necessary to maintain a counter-pressure on the container during processing. This pressure is necessary to counter-balance the pressure built up in the container during retorting so that the container will maintain its normal shape and there will be no undue strain on the container seams.

This counter-pressure is obtained by using water instead of steam and maintaining the required amount of pressure by superimposing air above the water in the retort.

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What a "Process" must provide

A "Process" must provide two basic things:

1. adequate commercial sterility
2. in addition - a favourable product safety margin.

The F_0 value of 6.0 is commonly suggested for products containing non-cured meats and many fish products (canned tuna).

There are technical reasons for this value based on thermal death time studies of bacterial spores and the influence of food "phosphate" factors. From these studies, there is a confidence that no known pathogenic bacteria, if present, would survive such a canned food process.

Because many products are adversely affected by heat, especially at high temperatures, we try to set our own processes at an F_0 value of 4.

This gives us a safety margin under normal conditions and does not severely harm the product.

Initial temperature

The term, "initial temperature", as used in the following tables, means the average temperature of the can contents at the time the steam is turned on in the retort. Just prior

to the start of the process, the contents of the container used for checking the initial temperature should be shaken or stirred and the initial temperature determined. This container should be representative of the coldest cans in the retort load and should have an initial temperature equal to or greater than the initial temperature specified in these tables. Normally the first can sealed for a retort load should be set aside for this purpose.

Do not confuse, initial temperature, with the closing temperature; they may or may not be the same, depending on how much time has elapsed between can seaming and the start of the process.

The specified initial temperature is to be regarded as a prerequisite minimum of the process suggested. If the initial temperature of the product to be processed is significantly lower than the initial temperature specified in the table, then the process time may have to be lengthened to compensate for the lower initial temperature.

Can Dimensions

Cans are identified by a statement of their dimensions (overall diameter and overall height).

Each dimension is expressed as a number of three digits.

The left-hand digit gives the number of whole inches, and the two right-hand digits give the additional fraction of the dimension expressed as sixteenths of an inch. For example, a 1-lb. tall can designated as 300 X 407 is 3 inches in diameter and 4 and 7/16 inches in height. The first number given in the size of each can is the diameter and, the second number is the height. Oval cans are designated by using a series of 3 numbers.

The dimensions are "overall"; the diameter being measured to the outside of the double seam and the length the same.

Heat Penetration During Product Sterilization

Heat penetration testing is becoming more and more common in the canning industry, and it is not uncommon to see tests being carried out in fish canneries when information is required on the heating rate of a product in order to determine a "safe process."

Heat Penetration Testing

"Heat penetration testing", is defined as the measurement of the temperature at the slowest heating point in a can of food as it is being processed.

There are two types of heating:

- conduction
- convection

For conduction heating, the slowest heating point or area, is the geometric centre of the can.

For convection heating, it is on the can axis at a point near the bottom of the container.

Why Conduct Heat Penetration Tests?

Heat penetration tests are carried out to determine the total amount of heat the slowest heating part of the can contents receives. From this, it is possible to determine whether or not the can contents are commercially sterile.

By heat penetration tests, the rate of heat penetration, or the heating curve, can be obtained and then the processing time and temperature necessary to sterilize the product can be determined by mathematical calculations.

When new can sizes are used, new products are produced, or when changes are made in the formulation of a product, heat penetration testing will enable us to determine the proper time and temperature necessary to sterilize the product. Processes for different initial temperatures may also

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be calculated from the heat penetration data obtained from heat penetration tests.

Equipment Necessary for Conducting Heat Penetration Studies

Briefly, the equipment necessary for testing the heating rate is as follows:

1. Thermocouples - non projecting type
2. Compensated lead wires - no less than 6 recommended.
One wire is copper.
The other is constantan.
3. A stuffing box - to bring the lead wires through the retort wall to the temperature recorder.
4. A multipoint strip chart temperature recorder or select switch potentiometer.

A Word of Caution About the Process Tables

The process times and temperatures indicated in the following Process Tables were compiled after referring to data obtained from heat penetration studies carried out at this laboratory and in canneries throughout the Maritime Provinces, and in the case of "Cod bacala", with the co-op -

eration of the Freshwater Institute, in Winnipeg, Manitoba.

The times and temperatures are specified for normal canning conditions and for products, as specified, packed in the standard or normally accepted manner. Where there is variation in the raw product and lack of standardized packing procedures, the product should not be packed without directions from a Fish Inspection Laboratory connected with the Industry. Any variation in composition or sauce formulation should also be checked out with the above Laboratory before process times and temperatures are decided upon. Unacceptable plant sanitation and unsatisfactory plant operating procedures may render the times and temperatures unsatisfactory for the purpose intended.

Remember, it is always better if there is any doubt at all about the process, to first check it out with a Fish Inspection Laboratory associated with the industry. In this way, potential health hazards, and future problems or economic loss will be avoided.

The temperatures quoted in the Process Tables are the ones normally used by Industry, or temperatures that were checked out by the Fish Inspection Laboratory and found to give the best product quality. The times and temperatures

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quoted provide processes with a minimum F_0 value of around 4, and in situations where it is necessary to give a longer process to soften the bones, or to make the texture more acceptable, the F_0 values obtained are of course, higher.

While the process times and temperatures recommended in this paper are based on scientific studies and wide practical experience, they are not to be considered as creating any assurance or warranty with respect to the production or cost, or any responsibility for damage, spoilage, loss, injury or accident resulting from the use of this information by anyone.

It is the canner's responsibility to ensure that the "Process" he chooses is right for his product and that a commercially sterile product will be produced.

PROCESS TABLES

Table 1: Fish Cakes

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial temp. °F</u>	<u>Process time in minutes</u>	
				<u>@240°F</u>	
No.1 picnic	211 x 400	10	70	80	

Table 2: Chicken Haddie

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial temp. °F</u>	<u>Process time in minutes</u>	
				<u>@240°F</u>	
1/2 lb.flat	307 x 200.25	7	70	60	
1/2 lb.flat (with liner)	307 x 200.25	7	70	65	
1/2 lb.flat	307 x 200.25	7	130	55	
1/2 lb.flat (with liner)	207 x 200.25	7	130	60	
1-lb. flat	404 x 206	14	70	75	
1-lb. flat (with liner)	404 x 206	14	70	85	
1-lb. flat	404 x 206	14	130	70	
1-lb. flat (with liner)	404 x 206	14	130	80	

Table 3: Fish Chowder

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial temp. °F</u>	<u>Process time in minutes</u>	
				<u>@245°F</u>	<u>@240°F</u>
No.1 picnic	211 x 400	10	100	50	70
1-lb. tall	300 x 407	14	100	60	-

Table 4: Cod "Bacala"

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial Temp.°F</u>	<u>Process time in minutes</u> <u>@240°F</u>
1/2 lb.flat (approx.)	307 x 113	7	55	45
1-lb. flat (approx.)	400 x 201	12	55	60

Venting 15 min. to 225°F, come-up 5 min. to 240°F

1/2 lb. flat (approx.)	307 x 113	7	55	40
1-lb. flat (approx.)	400 x 201	12	55	50

Table 5: Clams (Mya arenaria)

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial Temp.°F</u>	<u>Process time in minutes</u> <u>@240°F</u>
No. 1 picnic	211 x 400	5(dr)	70	35

Table 6: Clam (Mya arenaria) Juice

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial Temp.°F</u>	<u>Process time in minutes</u> <u>@240°F</u>
No. 1 picnic	211 x 400	10(net)	130	30

Table 7: Ocean Clams (Arctica islandica)

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial Temp. °F</u>	<u>Process time in minutes</u>	
				@240°F	
1/2 lb.flat (tin)	307 x 200.25	-	70	60-90(80)*	
No.1 Picnic	211 x 400	5(dr)	70	60-90(80)	

*commonly used

Table 8: Minced Ocean Clams (Arctica islandica)

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial Temp. °F</u>	<u>Process time in minutes</u>	
				@240°F	
No.1 Picnic	211 x 400	5 (dr)	70	60	

Table 9: Queen Crab (Chionoecetes opilio) Meat

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial Temp. °F</u>	<u>Process time in minutes</u>	
				@230°F	@240°F
1/4 lb.flat (with liner)	300 x 108.5	3.0	65	70	-
1/2 lb.flat(tin) (with liner)	307 x 200.25	7.0	65	90	60
1/2 lb.flat (aluminum) (with liner)	307 x 111.5	5.75	65	75	-
1-lb.flat(tin) (with liner)	404 x 206	14.0	65	120	-
drawn	307 x 113	-	70	-	55

Table 10: Red Crab (Geryon quinquedens)

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial Temp. °F</u>	<u>Process time in minutes</u>	
				<u>@240°F</u>	<u>@230°F</u>
1/2 lb.flat (with liner)	307 x 200.25	5 (dr)	60	60	90

Table 11: Rock Crab-Comminuted (Cancer irroratus)

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial Temp. °F</u>	<u>Process time in minutes</u>	
				<u>@240°F</u>	_____
1/4 lb.flat (5cc pickle) (no liner)	300 x 108.5	2.5 (dr)	60	30-45*	
1/2 lb.flat (no liner)	307 x 200.25	5	60	60	

*depending on amount of liquid present

Table 12: Skin on Cod Fillets (Gadus morhua)
From frozen storage- raw pack

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial Temp. °F</u>	<u>Process time in minutes</u>	
				<u>@240°F</u>	_____
1-lb.flat	404 x 206	14.5	60	85	

Table 13: Cod (Gadus morhua) Roe

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial Temp. °F</u>	<u>Process time in minutes</u>	
				<u>@240°F</u>	_____
1/2 lb.tuna (no liner)	307 x 113	7	70	60	

Table 14: Gaspereau (*Alosa pseudoharengus*) Fillets
From Frozen Storage - Raw Pack

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial Temp. °F</u>	<u>Process time in minutes</u>	
				@240°F	_____
1-lb.tall	300 x 407	14.5	60	95	
1-lb.flat	404 x 206	14.5	60	85	

Table 15: Herring (*Clupea harengus*) (Natural oil)

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial Temp. °F</u>	<u>Process time in min.</u>	
				@240°F	_____
1-lb.oval	607 x 406 x 108	13	130	80	
1/2 lb.flat	307 x 200.25	7.5	55	70	

Table 16: Herring (*Clupea harengus*) (In oil)

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial Temp. °F</u>	<u>Process time in minutes</u>	
				@240°F	_____
1-lb.oval	607 x 406 x 108	13	130	80	

Table 17: Herring (*Clupea harengus*) (In tomato sauce)

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial Temp. °F</u>	<u>Process time in minutes</u>	
				@240°F	_____
1/2 lb.oval	515 x 309 x 103	7	130	65	
1-lb.oval	607 x 406 x 108	13	130	80	

Table 18: Herring (Clupea harengus) (In Mustard Sauce)

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial Temp. °F</u>	<u>Process Time in minutes</u> @240°F
1-lb. oval	607 x 406 x 108	13	130	80

Table 19: Kippered (Clupea harengus) Snacks

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial Temp. °F</u>	<u>Process Time in minutes</u> @240°F
1/4 narrow drawn	211 x 404 x 100	3.25	130	45

Table 20: Lobster (Homarus americanus)

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial Temp. °F</u>	<u>Process Time in minutes</u> @240°F
1/4 lb.flat (no liner)	300 x 108.5	2.5(dr)	60	32
1/4 lb.flat (liner)	300 x 108.5	2.5(dr)	60	36
1/2 lb.flat (no liner)	307 x 200.25	5(dr)	60	40
1/2 lb.flat (liner)	307 x 200.25	5(dr)	60	45
1-lb. flat (no liner)	404 x 206	10(dr)	60	55
1-lb. flat (liner)	404 x 206	10(dr)	60	60

Table 20: Lobster (Homarus americanus) cont'd

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial Temp. °F</u>	<u>Process time in minutes</u> @240°F
1/2 lb.flat aluminum (no liner)	307 x 111.5	4.75(dr)	60	40
1/2 lb.flat aluminum (liner)	307 x 111.5	4.75(dr)	60	44

Table 21: Lobster (Homarus americanus) Cocktail

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial Temp. °F</u>	<u>Process time in minutes</u> @240°F
1/2 lb. flat (no liner) (1-oz.pickle added)	307 x 200.25	5(dr)	70	52
1/2 lb.flat (liner) 1-oz.pickle added)	307 x 200.25	5(dr)	70	60
1/2 lb.flat (no liner) (2-oz.pickle added)	307 x 200.25	5(dr)	70	45
1/2 lb.flat (liner) (2-oz.pickle added)	307 x 200.25	5(dr)	70	55

Table 22: Deep Sea Lobster (Homarus americanus)

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial temp. °F</u>	<u>Process time in minutes</u>	
				<u>@240°F</u>	_____
1/2 lb.flat (liner)	307 x 200.25	5(dr)	65	55	

Table 23: Lobster (Homarus americanus) Paste and Tomalley

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial Temp. °F</u>	<u>Process time in minutes</u>	
				<u>@240°F</u>	<u>@250°F</u>
Drawn can	211 x 103	2.5	70	37	22
3-oz.lobster paste	211 x 108	3	70	40	
Drawn can	300 x 101	2.5	70	43	
1/4 lb.flat	300 x 108.5	3	70	45	
1/2 lb.flat	307 x 200.25	7	70	60	
1-lb.flat	404 x 206	14.25	70	95	

Table 24: Mackerel (Scomber scombrus) (Salmon Style)

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial Temp. °F</u>	<u>Process time in minutes</u>	
				<u>@240°F</u>	_____
1/2 lb. flat	307 x 200.25	7	70	70	
1/2 lb. flat	307 x 200.25	7	130	65	
1-lb. tall	300 x 407	14	70	100	
1-lb.tall	300 x 407	14	130	90	
1-lb.flat	404 x 206	14	60	95-100 (95)	

Table 25: Mackerel (Scomber scombrus) Fillets

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial temp. °F</u>	<u>Process time in minutes</u> @240°F
1/2 lb. flat	307 x 200.25	7	70	65
1/2 lb. flat	307 x 200.25	7	130	60
1-lb. flat	404 x 206	15	70	85-90
1-lb. flat	404 x 206	15	130	80
1-lb. oval	406 x 607 x 108	14	70	75
1-lb. oval	406 x 607 x 108	14	130	70

Table 26: Mussels (Mytilus edulis)

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial temp. °F</u>	<u>Process time in minutes</u> @240°F
No. 1 picnic	211 x 400	5(dr)	70°F	35

Table 27: Minced Mussel (Mytilus edulis) Paste

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial temp. °F</u>	<u>Process time in minutes</u> @240°F
Drawn	300 x 101	2.5 oz	70	43

Table 28: Pollock Fillets (*Pollochiu s virens*)
From frozen Storage - Raw Pack

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial temp. °F</u>	<u>Process time in minutes</u>
				@240°F
1-lb.tall	300 x 407	14.5	60	95
1-lb.flat	404 x 206	14.5	60	85
1-lb.flat	404 x 206	14.5	27(frozen)	95

Table 29: Red Fish Fillets (*Sebastes marinus*)
(From Frozen Storage -- Raw Pack)

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial temp. °F</u>	<u>Process time in minutes</u>
				@240°F
1-lb.tall	300 x 407	14.5	60	95
1-lb.flat	404 x 206	14.5	60	85
1-lb.oval	607 x 406 x 108	14.5	60	70-75

Table 30: Sardines (*Clupea harengus*) In Mustard Sauce

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial temp. °F</u>	<u>Process time in minutes</u>
				@240°F
3&1/4 oz Dingley	405 x 301 x 014	3&1/4	70	40-45

Table 31: Sardines (Clupea harengus) (In Oil)

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial temp °F</u>	<u>Process time in minutes</u> @240°F
3&1/4 oz Dingley	405 x 301 x 014	3&1/4	70	50

Table 32: Sardines (Clupea harengus) (In Tomato Sauce)

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial temp. °F</u>	<u>Process time in minutes</u> @240°F
3&1/4 oz Dingley	405 x 301 x 014	3&1/4	70	45

Table 33: Scallops (Placopecten magellanicus)

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial temp °F</u>	<u>Process time in minutes</u> @230°F
1/2 lb.flat (with liner)	307 x 200.25	6.5 (pickle)	55	95
1/2 lb. flat (no liner)	307 x 200.25	6.5 (pickle)	55	85
1/2 lb. flat (liner)	307 x 200.25	6.5 (no pickle)	55	103
1/2 lb. flat (no liner)	307 x 200.25	6.5 (no pickle)	55	87

Table 34: Smoked Scallops (Placopecten magellanicus)

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial temp. °F</u>	<u>Process time in minutes</u>
				<u>@261°F</u>
1/4 flat sardine can	405 x 301 x 014	3 (1-oz Soya oil)	70	10
1/4 flat sardine can	405 x 301 x 014	3 (1-oz 2% brine)	70	10

Table 35: Scallop (Placopecten magellanicus) Rings & Roe Paste

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial temp. °F</u>	<u>Process time in minutes</u>
				<u>@240°F</u>
1/2 lb.flat can	307 x 200.25		70	65

Table 36: Scallop (Placopecten magellanicus) Rings & Roe in Brine

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial temp °F</u>	<u>Process time in minutes</u>
				<u>@240°F</u>
No.1 Picnic	211 x 400	5 (dr)	70	40-45

Table 37: Scallop (Placopecten magellanicus) Rings & Roe in Tomato Sauce with Mushrooms

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial temp °F</u>	<u>Process time in minutes</u>
				<u>@240°F</u>
1/2 lb.flat can	307 x 200.25	7	70	60

Table 38: Scallop (*Placopecten magellanicus*) Rings & Roes
in Barbeque Sauce with Mushrooms

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial temp. °F</u>	<u>Process time in minutes</u> @240°F
1/2 lb. flat can	307 x 200.25	7	70	60

Table 39: Scallop (*Placopecten magellanicus*) Rings & Roes
in White Sauce with Mushrooms

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial temp. °F</u>	<u>Process time in minutes</u> @240°F
1/2 lb.flat can	307 x 200.25	7	70	65

Table 40: Scallop (*Placopecten magellanicus*) Roe
With Spices

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial temp. °F</u>	<u>Process time in minutes</u> @240°F
1/4 drawn Sardine Can	405 x 301 x 014	4	120	40

Table 41: Scallop (*Placopecten magellanicus*) Roe
in Olive Oil (With Spices)

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial temp. °F</u>	<u>Process time in minutes</u> @240°F
1/4 drawn Sardine can	405 x 301 x 014	4	120	45-50

Table 42: Sole (*Glyptocephalus cynoglossus* - *Hippoglossoides platessoides*) from Frozen Storage -Raw pack

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial temp. °F</u>	<u>Process time in minutes</u> @240°F
1-lb.flat	404 x 206	14.5	60	88

Table 43: *Tuna, all Styles, in Oil

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial temp. °F</u>	<u>Process time in minutes</u> @240°F
1/2 lb. tuna	307 x 113	solid & flaked 7 & 6	70	75-80

*Yellowfin (*Neothunnus macropterus*)
 Bluefin (*Thunnus thynnus*)
 Skipjack (*Katsuwonus pelamis*)
 Albacore (*Germo alalunga*)
 Bonito (*Sarda chiliensis*)
 Yellowtail (*Seriola dorsalis*)

Table 44: Whelks (*Buccinum undatum*)
 (*Colus stimpsoni*)
 (*Neptunea decemcostata*)

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial temp. °F</u>	<u>Process time in minutes</u> @240°F
No.1 picnic	211 x 400	6	70	90-120 (given extra time to soften up the meat)

Table 45: Smoked Capelin (Mallotus villosus)

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial temp. °F</u>	<u>Process time in Minutes</u>
				<u>@240°F</u>
1-lb. oval	607 x 406 x 108	12	120	75

Table 46: Herring (Clupea harengus) Fillets in Sauce

<u>Can Name</u>	<u>Can Size</u>	<u>Weight (oz)</u>	<u>Initial temp. °F</u>	<u>Process time in minutes</u>
				<u>@245°F</u> <u>@249°F</u>
Drawn German can		7(net)	80	15 12 (depending on the can or type of sauce used) (water cook)

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