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THE STEP-BY-STEP APPROACH TO MODERN FISH AND SHRIMP PROCESSING[1/]

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I N T R O D U C T I O N

Various investigations have shown that certain African waters have substantial fish resources. These natural resources are still today only to a limited extent utilized by the African countries, although some industries are presently being built up. However, these industries consist principally of cold stores or fishery terminals, where the fish can be frozen and packed for resale. More advanced processing industries, for which there might be a good basis in future, exist only to a very limited extent. The supplies of fish to these terminals are, however, not consistent on account of the still insufficient fishing fleet. By expanding the latter and organizing necessary education and control functions, many African countries may count on a profitable export in future.

In order to create as wide a development as possible for the small coastal villages, a gradual change of the existing traditions for handling and sale of the captured fish is required. This change could be made easier by establishing well organized co-operatives, which might also facilitate the supply of raw materials to centralized processing factories.

The large amounts of capital involved, in order to build up a country's fishing industry, should be properly invested, so that the industry may form the basis for employment of many people and for an export activity, both of great importance for the national economy in the various countries.

It is for instance vital that the right facilities and a proper organization for handling of raw materials are used in order to create sufficiant supply of high quality products to the processing plants. This means that the fish from the moment it is caught till it is finished in one way or another, is as optimally as possible treated, partly to avoid loss of tonnage, partly to avoid a deterioration of quality, which in both cases costs money and would, thus, carry a low rate of interest on the invested capital.

I will in the following describe the necessity of correct handling of catch, - some kinds of processing, - and try to emphasize, to some extent, factors to observe when planning and constructing a processing plant.

C O N S E R V A T I O N O F C A T C H

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The Necessity of Correct Handling of the Catch

The captured fish represents a value, which can be turned into ready money - either it applies to quality fish, which when fresh or processed can be sold for human consumption - or, being transformed into fish meal, can be used as additional feed stuff for animals.

The price obtained depends highly on the species of fish, the demand, and the quality.

- The species are dependent on the availability in the area and the fishing method used.
- The demand can be increased the further away the fish can be transported, by reaching a larger number of population and, possibly, processing factories.
- The quality at the selling stage is almost exclusively dependent on the manner in which the fish is being handled from the moment it was caught.

Depending of the species of fish it can generally be said that the spoilage process of the fish starts shortly after catch in the form of enzyme activity, bacterial action and fat oxidation. These actions on the fish can have different effects, which, however, have in common that the product at a shorter or longer rate will reach the condemnation level and become inedible.

By chilling the fish to approx. $0^{o}C$ as rapidly as possible after catch, one can, nevertheless, reduce this rate, at which the fish for the above stated reasons is being spoiled.

In an experiment with cod (NOTEVARP)* which was gutted just after catch, in order to avoid the damaging effects, caused by the very fast bacterial action on the guts, one had measured at different temperatures the time taken from the fish being caught until it had reached the condemnation level. The experiment indicated:

at 24°C	(75°F)	1 day (24 hours)
at 18°C	(64°F)	2 days
at 12°C	(54°F)	4 days
at 6°C	(43°F)	7-8 days
at 0°C	(32°F)	14-16 days

The fish will in other words, stored at 24°C be spoiled in the course of 24 hours, whereas it by a preservation at 0°C will only be spoiled within 14 days.

Another experiment (F.F)* Fig. 1, was based on herring in which the oxidation is an important cause for spoilage. The experiment shows an assessment of quality and durability of the fish during a period under which it was kept in ice in a cold store after the catch. The Peroxide values (the upper three charts) indicate at least 96 hours delay before the fat oxidation starts in a portion of herring which had been packed in ice straight after catch. Another portion of herring, which was not ice-packed until 4 to 6 hours after catch, indicated almost no delay as far as a tendency to fat oxidation concerns. The assessment of the taste (the three charts from the bottom) shows that the herring which was being iced directly after catch, had a durability of up to 12 days in iced condition in a cold store, whereas the herrings which were not iced until 4 to 6 hours after catch, only had a durability of up to 7 days in iced condition in a cold store. In other words, the rapidly chilled fish had almost twice as long durability as the others.

As it will appear from the two above experiments, one can thus with an appropriate chilling of fish after catch prolong the storage time, or in other words extend the time for the fish to be prepared and eaten - or further treated, for example by freezing. Hereby one has, consequently, achieved greater sales possibilities, as the fish in accurately chilled condition can be transported further away without any noticeable deteroriation of quality.

A third experiment (T.E.P.)*, based on fish raw material for fish meal production, shows the considerable loss of quality one may get from an inadequate handling of the raw materials.

The experiment was as follows:

Shortly after catch a number of plastic bags were being filled up with fish and then closed. Part of the bags were stored at +15°C and another part were by utilization of ice chilled to 0°C. After 6 days under these conditions the bags were drained of blood water, and the subsequent measurements indicated the following tolerances in loss of weight, oil and protein at the two different temperatures:

Loss of weight	(per cent of original weight):	
	6.8% at 0°C	26.3% at 15°C
Loss of oil	(per cent of original contents):	
	6.8% at 0°C	73.6% at 15°C
Loss of protein	(per cent of original contents):	
	2.3% at 0°C	13.4% at 15°C

It clearly appears from these results that through chilling/icing we can avoid great losses and deterioration of quality. This means that an effective chilling will give a considerably better economy, even when the price for the ice utilized is taken into consideration.

Type and Production of Ice

In the fishery various types of ice are used. Several tests*, which have been published (ref. f.inst. I.I.R.), have, however, proved that the type Slice Ice (also called Flake Ice) is particularly suitable for use within the fishery. Among the advantages with the slice ice I may mention:

- The slice ice is produced sub-cooled to minus 8°C.
- Since the slice ice can be closely packed around the fish and will get the optimal surface contact with the fish, it will rapidly chill the fish - which is - of course, the purpose.

- The slice ice does not harm the fish, even being packed in thick layers.
- The ice production machinery does not demand much space and can easily be installed both ashore or aboard a vessel. Furthermore, the functioning of the machine is simple and it is easy to operate.
- The slice ice can be used in the form it is produced and can be both in a manual and mechanical way transported to its destination.
- The slice ice is relatively cheap to produce.

The slice ice is produced on a machine as shown in Fig. 2. The ice may be made in desirable thicknesses between 1 and 3 mm outside on a rotating hard chronium-plated steel drum. The drum is inside specially designed for direct evaporation of liquid refrigerant applied. The formed ice is harvested from the drum by means of a specially designed and attached knife, which makes the ice crush into slices or flakes. The machine can be installed, so that it stands right over the ice store. The ice can thus by itself fall from the drum down in the ice store, and thereby the transport costs from the production spot to the store are eliminated. These slice ice machines can be connected to a central refrigeration plant and operated either flooded or with pump circulating system. A machine may also be connected to a specially designed compact refrigeration unit, as shown in Fig. 3 and 4, if desired. The slice ice machines operate with evaporating temperatures that normally lie between minus 20 and minus 30^{o}C. The machines are available in different sizes, which from the smallest to the biggest cover a production capacity of between 1.5 to 60 tons per 24 hours.

Design of Ice Factories with Storage Facilities

As said before, the slice ice can fall directly from the production machinery to the ice store. The production and storage facilities should therefore be so designed that this advantage will be profitted. The slice ice can be stored during unlimited

time at a temperature of minus 7 to minus 8°C. The ice can be removed from the store both in a manual and mechanical way. In particular through mechanical removal from store it is important that the above mentioned temperature is observed.

Fig. 5 shows some very simple small ice factories with storage capacities from 5 to 15 tons. The buildings shown may be constructed in wood or other building materials available. The storage room, however, must be properly insulated in order to minimize the loss by thermal conduction.

The ice storage room may be cooled by a refrigeration unit as the one shown in Fig. 3, but in certain cases where the daily ice production will be used within approx. 24 hours an effective insulation of the room may be enough for the preservation of the ice. This simple, but effective form for small slice ice factories can with a relatively modest investment create a background for a from the start correct treatment of fish raw materials in many small African coastal villages.

For large slice ice factories with a necessary storage capacity of up to 100 tons, Fig. 6, is presenting a solution which is applied in many places in Europe, South America, and the Far East. On the drawing the ice machines are seen standing at the upper floor in the building. The slice ice produced falls down in the steel silo shown. The whole silo room is to be chilled to minus 7 to minus 8°C.

By means of a specially designed agitator, which is started when the ice is to be taken out, the ice falls from the silo through a funnel down in a screw conveyor, which leads the ice out of the building, where it may be weighed out and loaded into containers or trucks or by a conveyor belt can be taken direct on board a vessel. This solution will save a lot of work and is very effective, and can be applied where an accurate portioning or weighing out is required.

Fig. 7 shows a frequently used lay-out for large slice ice factories with a storage capacity of between 200 and 800 tons. A number of slice ice machines are placed right over the store, which should be kept chilled at minus 7 to minus 8°C. The automatic ice extraction is effected by a screw conveyor which works horizontally backwards and forwards in the ice mass. The ice which the screw conveyor takes out is delivered on a conveyor belt on which it will be brought out from the building where it can be weighed out and loaded in containers, trucks or by means of conveyor belt is taken direct on board a vessel.

Handling and Utilization of Slice Ice

The slice ice can as earlier mentioned be transported in containers, trucks or by conveyor belts to its destination. The means of transport depend highly on the quantities required and the working routine in each individual case.

For the utilization of ice in small vessels an interesting system (ISIBOX F.F.)* has been introduced. The method implies on the whole that a number of plastic boxes with a perforated bottom and conical sides are stacked in one another as shown in Fig. 8.

The stacked boxes, which may be palletted, are being filled up with slice ice so that the whole stack of boxes is filled with ice. The conical box walls have the effect that the boxes can overlap one another, whereby the ice is protected by double box walls, which in return will give a relatively good insulation. The stack of boxes with ice are loaded on board to be used during the trip. When the caught fish is now to be chilled by packing in ice, the boxes are taken from the stacks. Each of the boxes, taken from here, will, owing to the way they have been stacked and filled with ice, be about half filled. The fish is packed in this ice and then the box with the fish and ice is stored in an insulated hold on board.

Large vessels that have no ice production of their own can be furnished with an insulated store room for slice ice, which will be filled in the port before each trip, for instance as shown in Fig. 9. The caught fish can be ice-packed in boxes or containers either manually or by means of a pneumatic ice portioning system on board ship.

When packing the ice and the fish, either in boxes or containers, it is important that the ice and the fish are appropriately apportioned between themselves, in order to obtain the optimal chilling of the fish. As schematically outlined in Fig. 8, the bottom of the box or the container should first be covered by a layer of ice, on which is put a layer of fish and then again a layer of ice and fish, etc., etc.
The ratio required between the amount of fish and the amount of ice in kilos, which is to be packed, is to a great extent depending on the storage facilities where the ice-packed fish is kept. As a main rule, it can, however, be said that for ice-packed fish, which is kept in a unchilled, non insulated store room, the ratio between fish and ice ought to be 1:1. For ice-packed fish that is kept in an insulated unchilled store room the ratio should be about 1:0.6. For ice-packed fish kept in an insulated and chilled store room the advisable ratio between ice and fish is about 1:0.3.

For the ratios mentioned above, I moreover refer to the (FAO Report No. 59)*.

PROCESSING OF THE FISH RAW MATERIAL FOR LOCAL MARKET OR EXPORT

Generally

I have earlier described how the catch has to be handled in order to keep its quality. This handling is a necessity for any kind of processing, to reach a quality product.

There are various ways to process fish. While some partly or wholly prepare the products for direct consumption others will only preserve the products in order to prolong their duration - or a combination of these ways can be effected.

Somewellknown kinds of processing are:

- drying of fish (dehydration)
- smoking of fish
- canning of fish
- fish meal
- freezing of whole fish - individually or in blocks
- filleting, freezing and packing of fish
- various ways to process fish meat into different kinds of ready dinner dishes.

In the following I will by means of an example, Fig. 10, briefly describe a processing factory. In this example the factory is designed for processing of both fish and shell fish products. The factory has moreover been designed for a high sanitary standard.

It has been assumed that all supply of raw material will be received iced in boxes and stored in a cold storage room. The continuity of the process operation depends highly on the size of this store and, of course, the supply of raw material to same.

The raw material will be taken in boxes from above store to Pos. 1. Hereafter at Pos. 2 and Pos. 3 the fish is separated from ice and washed. The boxes are washed in Pos. 10. At the grading table Pos. 4 the fish are graded out in sorts, sizes, and quality. An inspection here will also separate inedible fish. The graded raw material in boxes at Pos. 5 will be weighed at Pos. 6. It is normally at this Pos. - after the weight registered here - the fish is paid for. Pos. 7 and 8 is a station where the fish will be re-iced before the boxes from Pos. 9 will be moved to an intermediate cold store waiting for further process. In this store pallets with boxes are marked and stacked systematically grouping separately the sort and quality of the raw material.

Description of Fish and Lobster Line

The fish or lobster processing line start at Pos. 11 where pallets with boxes from the intermediate store are placed. A crane lifts the boxes to the roller-conveyor Pos. 12 where a number of boxes can be accumulated. At Pos. 13 fish and boxes will be separated. In section 14 - 15 - 16 - 17 the empty boxes will be washed and stacked, ready for out-going transport. At Pos. 18 and 19 the fish will be separated from ice and washed. The cleaned fish are delivered in the chute Pos.20 and pushed to the scale Pos. 21 where they will be weighed out in equal portions in standard plastic boxes. These boxes are placed on a roller-conveyor, bringing them to the upper part of a specially designed conveyor belt placed between the working tables Pos. 23. The conveyor belt functions in such a way that there will always be a filled box in front of each operator.

At these tables many kinds of manual fish and shell fish processing work can be done, e.g. de-heading, cutting, filleting, etc. After the work the operator places the product in another box or freezing tray which is put on the lower part of the conveyor belt mentioned before and then brought to Pos. 66.

At the station 24 the products are placed on freezing racks, which are brought to one of the two freezing tunnels. Sections 26 are hand grading tables for lobsters. After freezing the racks are taken out of the tunnel and placed at the glasing section Pos. 28 and 29, where the frozen products are separated from freezing trays and glased by dipping them in water for a short time. By doing so, all the surface of the frozen product will become covered by a thin layer of ice which protects it against dehydration and weight loss during a possible long cold storage period.

At section 30 and 31 the products will be packed, ready for dispatch to the cold store.

In case of lobster processing the frozen products will be packed in inners and mastercartons at the section 32 - 33 - 34 - 35 and dispatched to the cold store.

Description of Shrimp Line

As previously mentioned this plant, Fig. 10, was also designed so that shrimp processing could take place. The various operations are described below.

Boxes with graded and iced shrimps from the intermediate cold store will be placed at Pos. 38 from where the crane will lift them to the roller conveyor Pos. 39. The boxes are emptied in the basin Pos. 40 where ice and shrimps are separated from each other. The shrimps are washed in the machine Pos. 41. The cleaned shrimps are delivered to the inspection tables Pos. 42, where inspection of quality is taking place. The inspected and accepted shrimps pass to the belt Pos. 43 which will deliver them to a silo Pos. 44. The length of the conveyor Pos. 43 makes it possible to arrange working tables along this conveyor, and here add other operations to the shrimps, e.g. diveining and peeling. At the scale Pos. 45 the shrimps will be weighed out in portions. The conveyor Pos. 46 will

deliver the shrimp portions to the operators at the packing table Pos. 47. The shrimps packed, in this case in 5 lbs. cartons, will at Pos. 48 receive a light water spray so that their surface becomes wet. The cartons will be closed and placed in freezing frames which will be transported to the platefreezer section Pos. 50.

After freezing the frames and cartons are separated at the tables Pos. 51. The cartons are opened and the shrimps are spray-glazed at Pos. 52, and the cartons are closed again and packed in mastercartons at Pos. 53. The conveyor 35 will bring the mastercartons on pallets for stacking and dispatch to the cold store.

Necessity of Correct Freezing of Fish Products

In the above, freezing has been mentioned as a part of the process. As it is, however, a very important part of the process which often can be done in many different ways, I would like to describe briefly the necessity of freezing and some of the methods which can be used.

The purpose of freezing the fish is to lower its temperature and thus slow down the spoilage so much that when the product is thawed - after several months in a cold store - it is almost indistinguishable from the fresh fish. However, in order to obtain this quality the product must be QUICK FROZEN which usually means that the temperature in the whole product is reduced from $0^{\circ}C$ to minus $5^{\circ}C$ in less than two hours, depending on the thickness, and further the temperature in the warmest part of the product must be reduced to about minus $20^{\circ}C$ before the freezing period is completely finished.

It is of great importance that the freezing period - as mentioned before - from $0^{o}C$ to minus $5^{o}C$ takes place in a minimum of time due to for instance the formation of ice crystals in the product. As the temperature of the fish muscle falls below $0^{o}C$, ice crystals begin to form throughout the tissue, their size depending upon the rate of freezing. In the fish muscle that is cooled rapidly from $0^{o}C$ to minus $5^{o}C$ very small ice crystals are formed within the structure of the microscopic cells of the flesh; when the products is thawed very little fluid, or drip, oozes out. But when the fish is cooled slowly, much larger ice crystals form in the space between the cells, disrupting the muscle structure. The texture of very slowly frozen fish muscle is much poorer after thawing as a result of damage of this kind.

Some Freezing Methods

The choice of freezing methods depends highly on the requirements to the individual products such as the usage after freezing, extent of processing, the sanitary standard required, individual quick freezing (I.Q.F.), or freezing in blocks, etc.

Freezing by dipping the products into brine solution is often used on board ships in order to freeze whole fish and preserve them until landing. Cryogenic freezing by means of spraying the products with for instance nitrogene is also in some countries frequently used to freeze various products.
I will briefly below describe the freezing tunnel, the plate contact freezer, and the drum freezer.

Fig. 11 shows an arrangement for a freezing tunnel - also called an air blast freezer. As it appears from the figure, the room in which the tunnel is placed, is divided into two sections. In the upper part the air cooler and a powerful

fan are placed and in the lower part the products are placed. In this case the products are shelved, otherwise the products can be for instance hung on hooks. The way of placing the products depends naturally on the kind of product to be frozen. The arrows show the air current through the freezing tunnel. The freezing tunnel has the advantage productwise of being very flexible, i.e. it can be used for long or small products as well as for I.Q.F. freezing or block freezing.

On Fig. 12 a plate contact freezer is shown. The products are placed between the freezing plates shown. These can be moved by means of for instance a hydraulic system, so that the products in between will be pressed closely to the freezing plates, whereas the heat from the products will be removed by means of the liquid refrigerant inside the freezing plates. The plate contact freezer is used for products as for instance fish fillets or shrimps to be frozen in blocks of equal sizes, either packed or unpacked. The plate contact freezer shown on Fig. 12 is a horizontal type. Vertical types are also available. The latter is often used when freezing whole fish in blocks.

The drum freezer on Fig. 13 is an I.Q.F. freezing machine of a rather new design.
Products to be frozen are placed on the feeding belt conveyor (the dotted lines) which will apply the product to the rotating drum which operates with a temperature of minus 40 to minus 50°C. The product will immediately - when touching the surface of the cold drum - be fastened on same. Depending on the thickness of the product the rotating speed can be adjusted so that the products after one turn on the drum is frozen and released by a knife.
When freezing fish fillets with a thickness of 1.0 to 1.5 cm the freezing period or the time for one turn of the drum will be about 10 minutes.

The drum freezer is available in a sanitary construction with the arrangement of freezing drum, frame and knife made in acid-resisting stainless steel, and the feeding belt conveyor made of a synthetic material, approved for foods. The drum is inside cooled by a brine solution (secondary refrigerant).

PLANNING AND ENGINEERING OF PROCESSING PLANT

When planning a processing plant, a number of important economic and technical factors have to be taken into consideration.
Having made a market survey for the products in question, a preliminary project - or a budget project - and a feasibility study should be made. Based on these the financial set up for buildings, equipments and working capital etc. must be carefully arranged.

When starting more detailed planning of the project, companies usually contact either a consulting firm in order to let them work out the project, or contact a contracting firm directly to work out the project and quotation. In the first case the consulting engineers will be paid for the calculation and designing work, based on which one or more contracting firms will make their quotation. The body responsible to the client for the elaboration of the project in this case will usually be the consulting firm.

In case one or more specialized contracting firms are asked to work out the project and quotation, the client can choose between contracting with one main contractor (turn-key) or contracting with more firms, each with their special part of the project. By choosing a main contractor, he will be responsible to the client for the elaboration of the project according to the contract conluded.

Regardless, however, which of the above ways are chosen, the functioning, by all means, of the finished processing plant depends highly on the information originally given by the client and/or his adviser, to the projecting party. Fig. 14 shows an example of a typical QUESTIONNAIRE for a fish processing plant. These questions should be carefully answered before starting the projecting work.

Fig. 15 shows the flow diagram for the fish processing line previously described and shown on Fig. 10. When planning the process lines, each individual operation with the product is outlined in this flow diagram which completely will explain all the process operations.

Based on the flow diagram all the arrangements for machines, conveyors, tables, etc. as shown on Fig. 10, can be made. Hereafter the space requirements for the processing will be known, and after the various storage sizes have been decided, the building lay-out - as shown on Fig. 16 - can be made.

As a processing plant consists of many different machines, each with their special function - but all necessary for the function of the plant as a whole - each machine must be carefully selected in order to avoid any "weak link" in the processing line , which can cause a lot of trouble and delay in the processing line.

When selecting the machineries high attention must also be given to possible standardization, which among other things could minimize the capital invested in the necessary stock hold and spare parts.

As prices and availability of electricity, water, and oil can vary from place to place, it is important that these factors are taken into consideration when projecting, as these have a great influence on the running costs of the entire plant.

When projecting, possibilities for a certain extension should always be given, which means that for instance a building has to be arranged in such a way that certain facilities should originally be prepared for an extension, and the building must be placed in such a way that it opens up possibilities for future extension.

Finnaly I have shown two proposals for fish terminals. The one shown on Fig. 17 is a small terminal for fresh fish. The construction can be made in concrete or wood and traditionally insulated, - or it can be made in prefabricated insulated panels, covered by a simple roof construction. The advantages by using insulated panels are the easy mounting of the cold room sections and the possibilities for dismounting same, if for one reason or another the terminal is moved to another place. The terminal has facilities for slice ice production and storage, a handling room where landed fish can be graded into sorts and packed in ice, and a cold store where the ice-packed fish can be kept for some days waiting for a collecting truck to bring it to distribution or to a processing plant. This small terminal could be realized for a relatively small investment and facilitate a development in many coastal villages.

The fish terminal shown on Fig. 18 is designed for more sizeable fishing ports as a base for a great number of fishing vessels and maybe a number of small fresh fish terminals as described above.
The construction can be made either traditionally or it can be prefabricated.

As it can be seen from the lay-out the terminal has facilities for ice, handling of fresh fish, freezing of fish, and for storage of frozen products.

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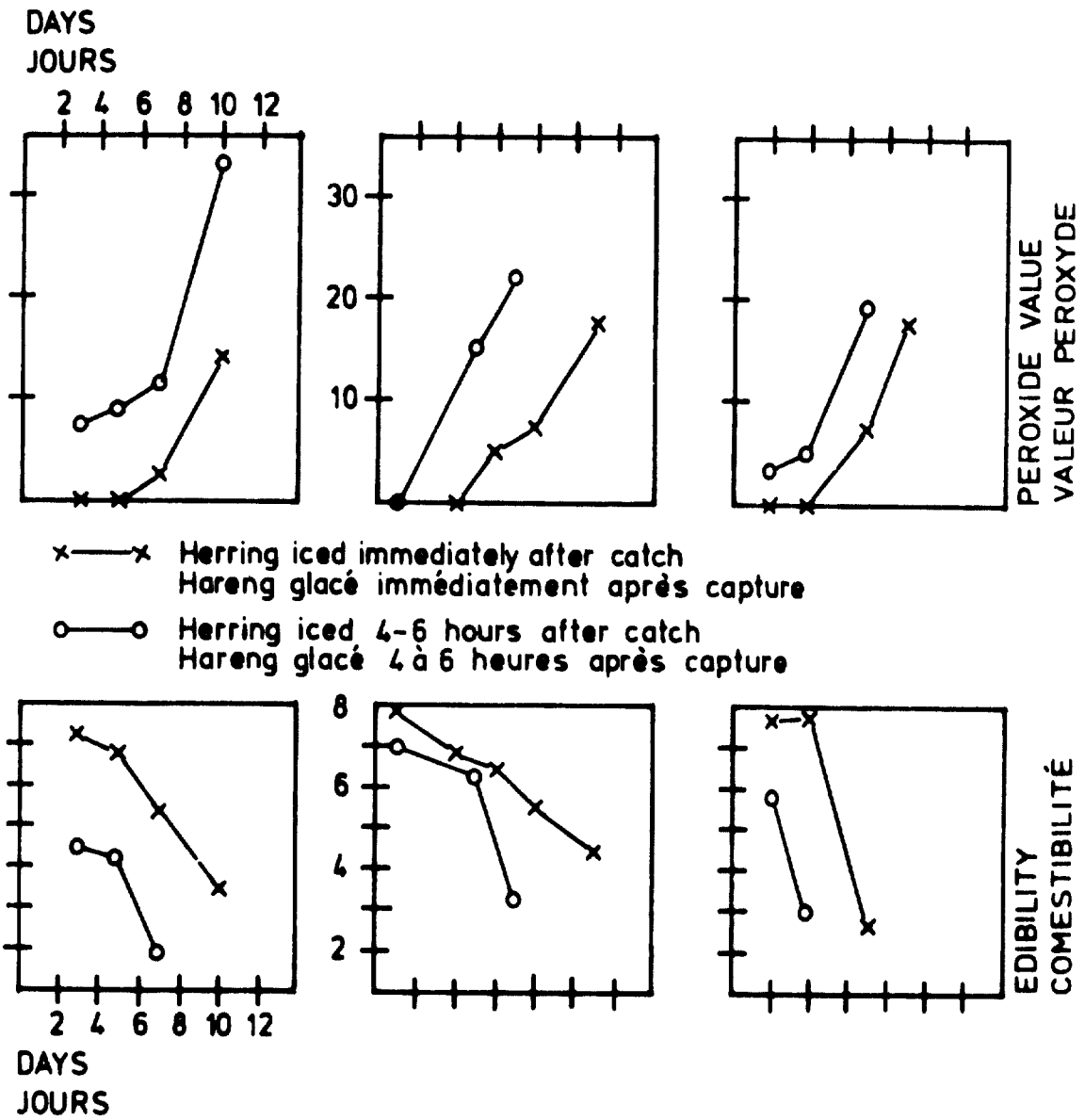
FIG. 1



Quality and storage life of herring.
Herring promptly iced has a storage life of 7-12 days.
Herring iced 4-6 hours after catch has a storage life of only 4-7 days because of rancidity developping quickly.

Qualité et durabilité du hareng stocké.
Glacé immédiatement aprés capture, la qualité du hareng peut étre maintenue 7 à 12 jours.

Dú au rancissement trés rapide, le hareng glacé 4 à 6 heures aprés capture, a une durabilité de 4 à 7 jours seulement.

FIG. 2

SLICE ICE MACHINE
MACHINE GLACE ECAILLE

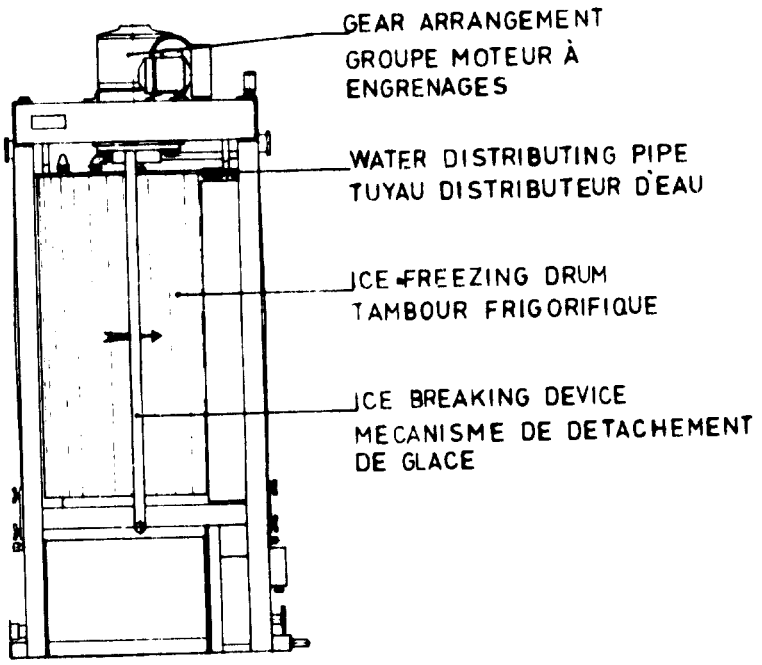


FIG. 3

AIR COOLED CONDENSING UNIT TYPE PSU
GROUPE COMPRESSEUR CONDENSATEUR REFROIDI À AIR TYPE PSU

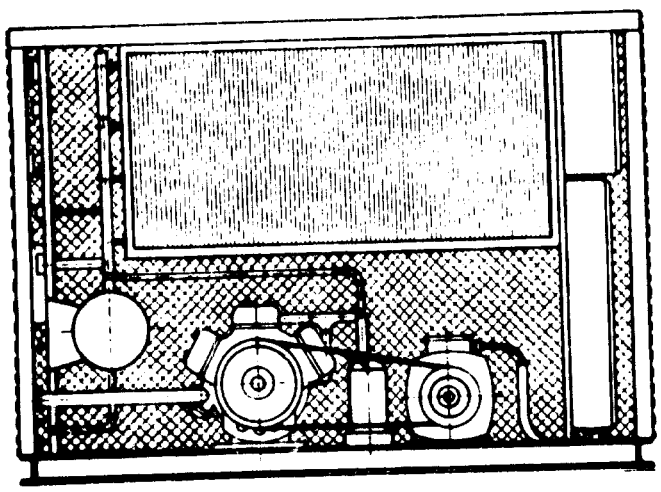
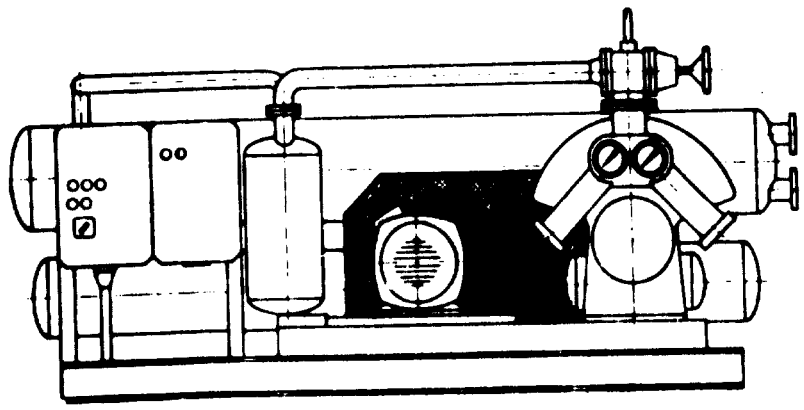
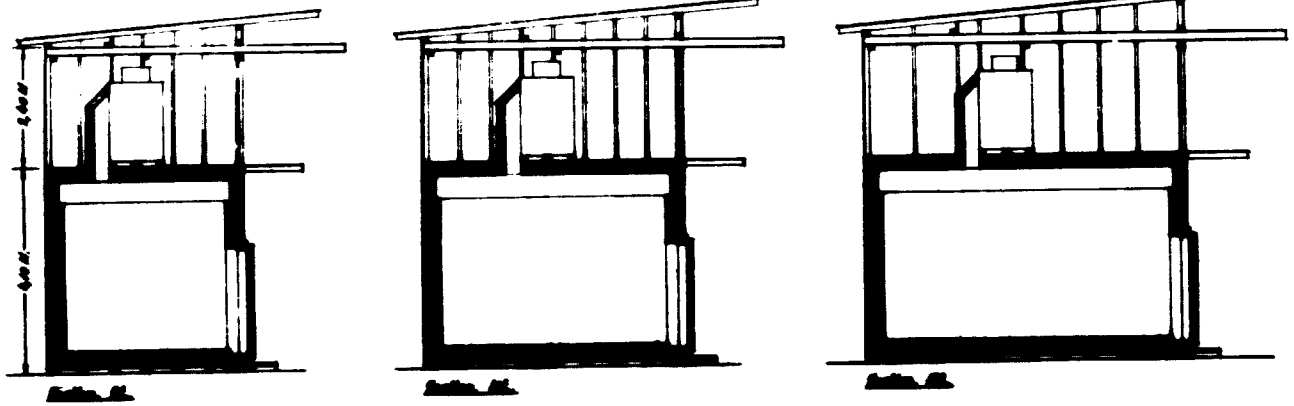
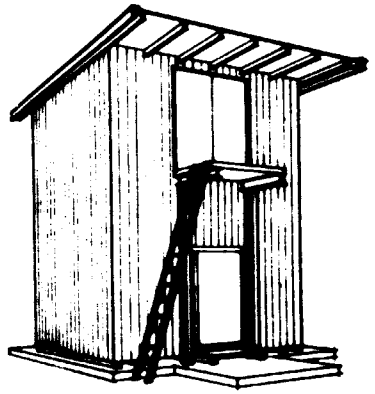


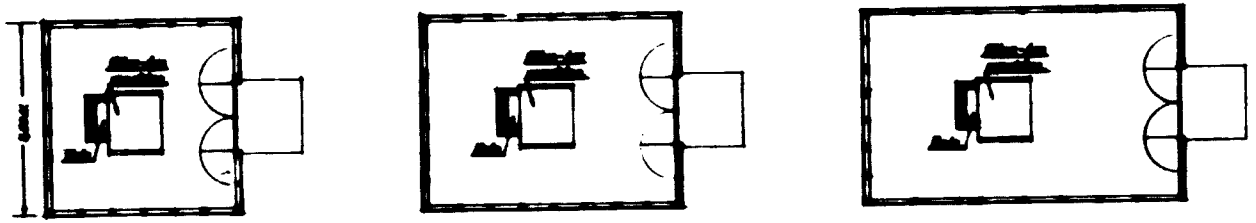
FIG. 4

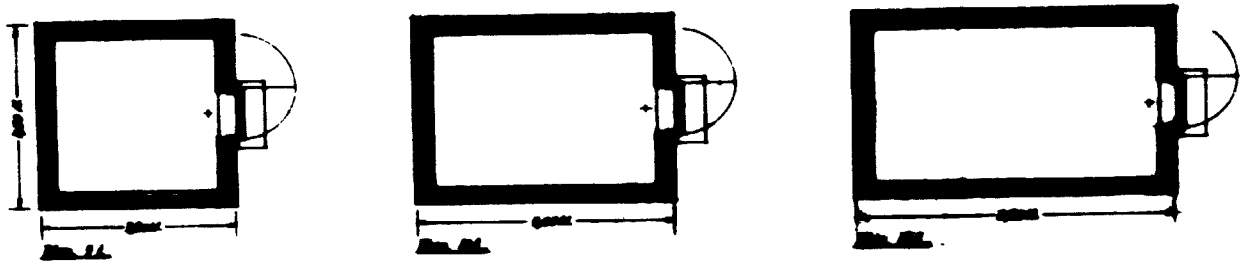
WATER COOLED CONDENSING UNIT TYPE PSU
GROUPE COMPRESSEUR CONDENSATEUR REFROIDI À EAU TYPE PSU











The proposal for this simple but well working store has been made for the guidance of those of our customers who want to build with locally obtained buildings materials.

For storage periods of several days we recommend the store to be furnished with a refrigeration unit, big enough to keep a storage temperature between - 6° C and - 8° C at which temperature the ice can be kept " free-flowing " for months.

More detailed drawings can be supplied when ordering the ice-making equipment.

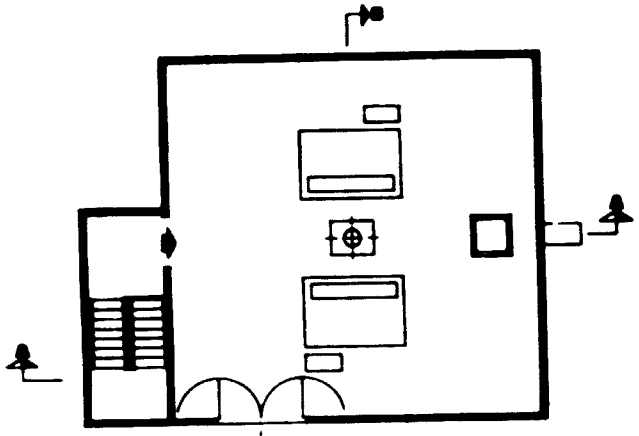
La proposition pour cet dépot de glace simple mais bien fonctionnant a été faite pour guidage de ceux de nos clients qui désirent batir avec des materiaux obtenus sur place.

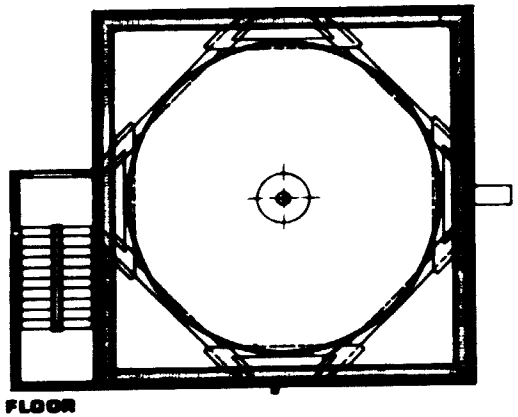
Pour périodes d'entreposage de quelques jours nous recommandons que l'entrepôt soit fourni d'une installation frigorifique assez grande pour maintenir une température d'entreposage entre - 6° C et - 8° C, temperature à laquelle la glace peut être maintenue flottant librement " free-flowing " pendant plusieurs mois.

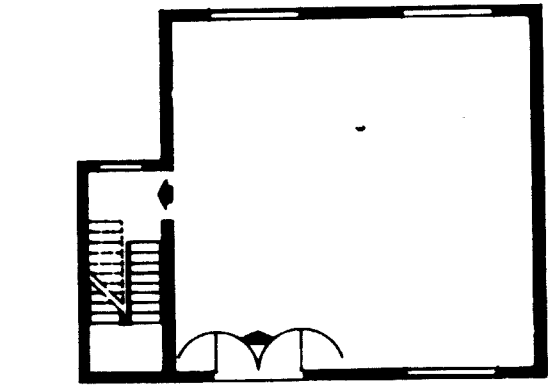
Des plans de construction plus détaillés peuvent être fournis à la passition de commande pour l'équipement à glace.

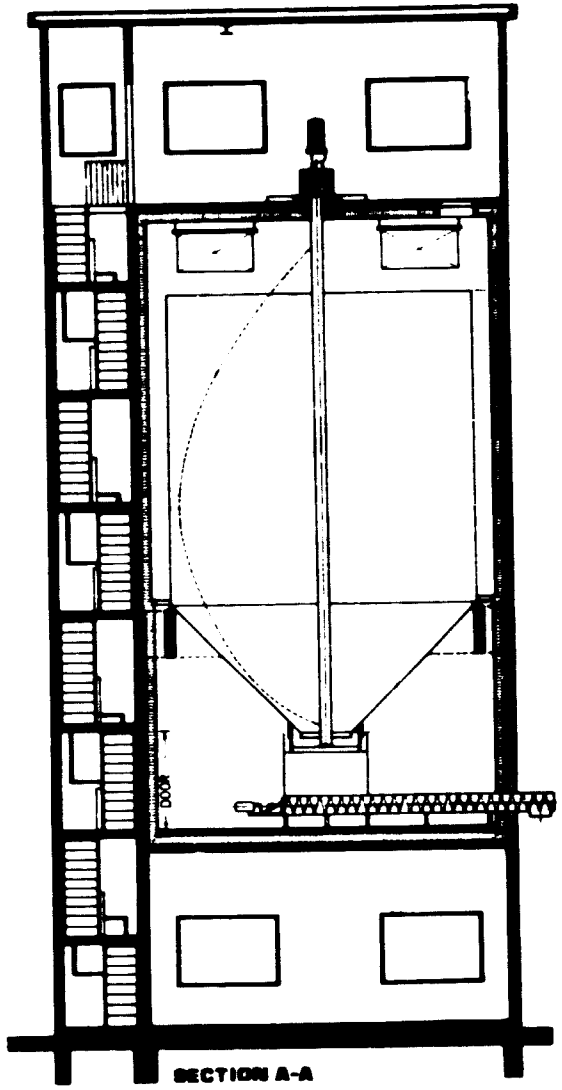
SLICE ICE PLANT
INSTALLATION GLACE ECAILLÉ

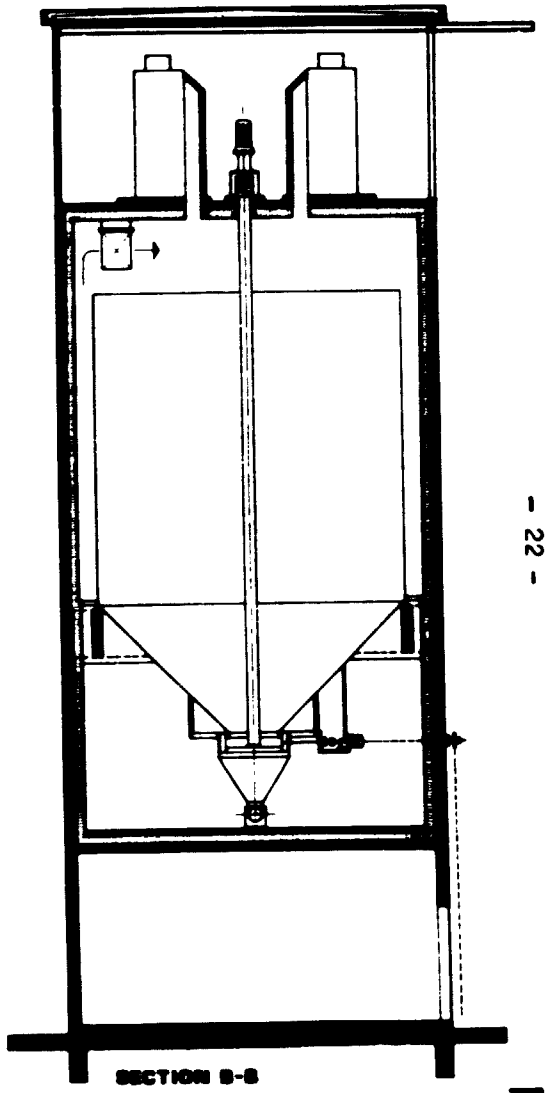
FIG. 5





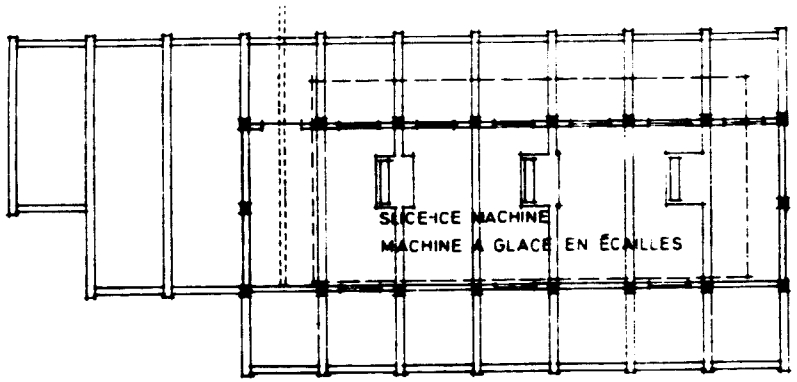




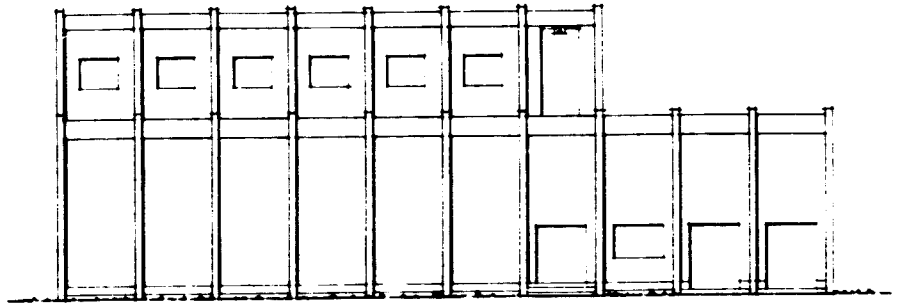


SLICE ICE FACTORY WITH STORAGE CAPACITY UP TO 100 TONS.
USINE PRODUCTION GLACE ECAILLÉ AVEC CAPACITÉ DE STOCKAGE JUSQU'A 100 TONNES.

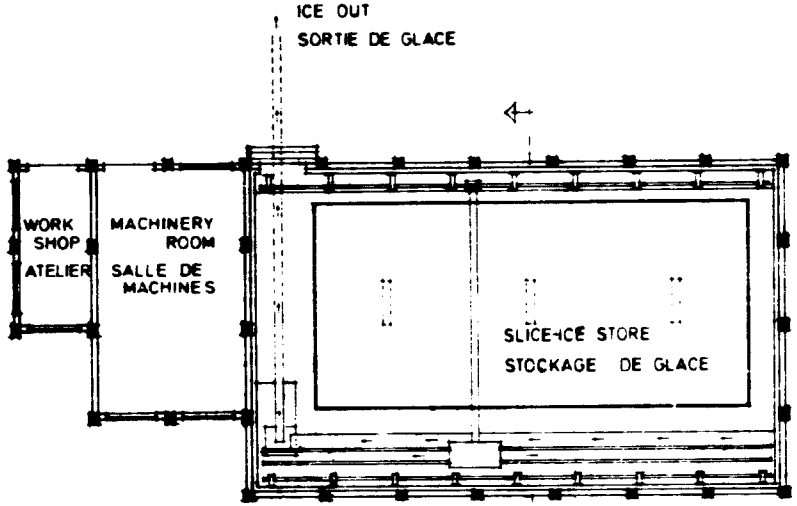
FIG. 6



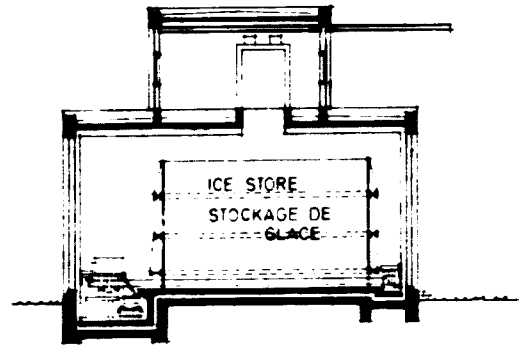
1 FLOOR
1er ETAGE



FRONT
FACADE



GROUND FLOOR
REZ DE CHAUSSE

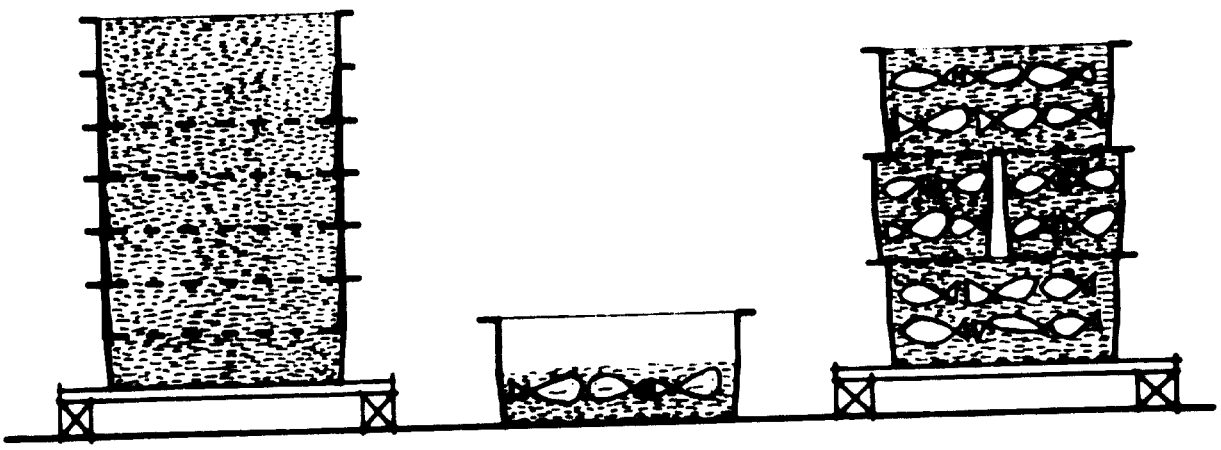


SECTION
COUPE

SLICE ICE FACTORY WITH STORAGE CAPACITY UP TO 800 TONS.
USINE PRODUCTION GLACE ECAILLÉ AVEC CAPACITÉ DE STOCKAGE JUSQU'A 800 TONNES.

FIG. 7

FIG. 8

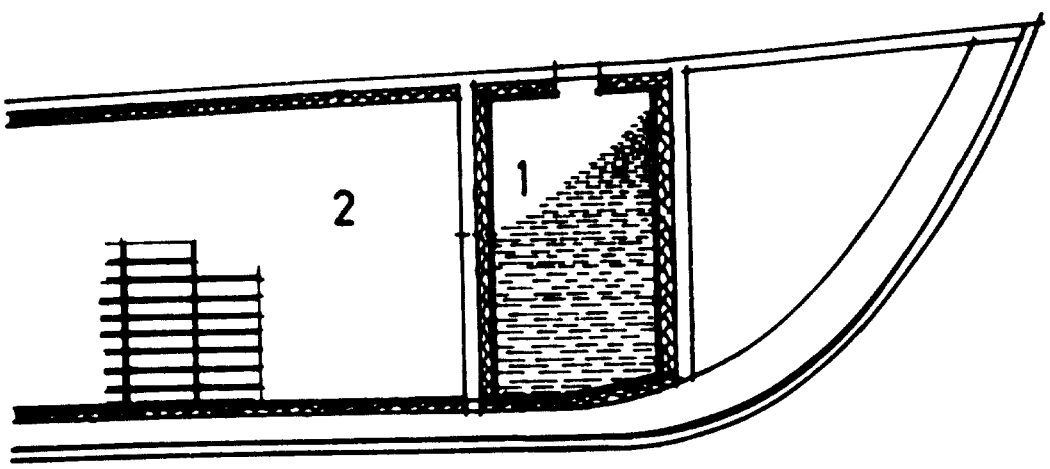


STACKED BOXES WITH ICE
CAISSES EMPILÉES AVEC GLACE

ICE-PACKING OF FISH
CONDITIONNEMENT DU POISSON EN GLACE

STACKING OF BOXES WITH ICE-PACKED FISH
EMPILAGE DE CAISSES AVEC DU POISSON EN GLACE

FIG. 9



2 INSULATED STORAGE FOR ICE PACKED FISH
DEPOT ISOLÉ POUR POISSON EN GLACE

1 INSULATED STORAGE FOR SLICE ICE
DEPOT ISOLÉ POUR GLACE ECAILLE

FIG. 10

FISH, LOBSTER AND SHRIMPS PROCESSING LINE.
LIGNE DE TRAITEMENT DE POISSON, CREVETTES ET HOMARDS.

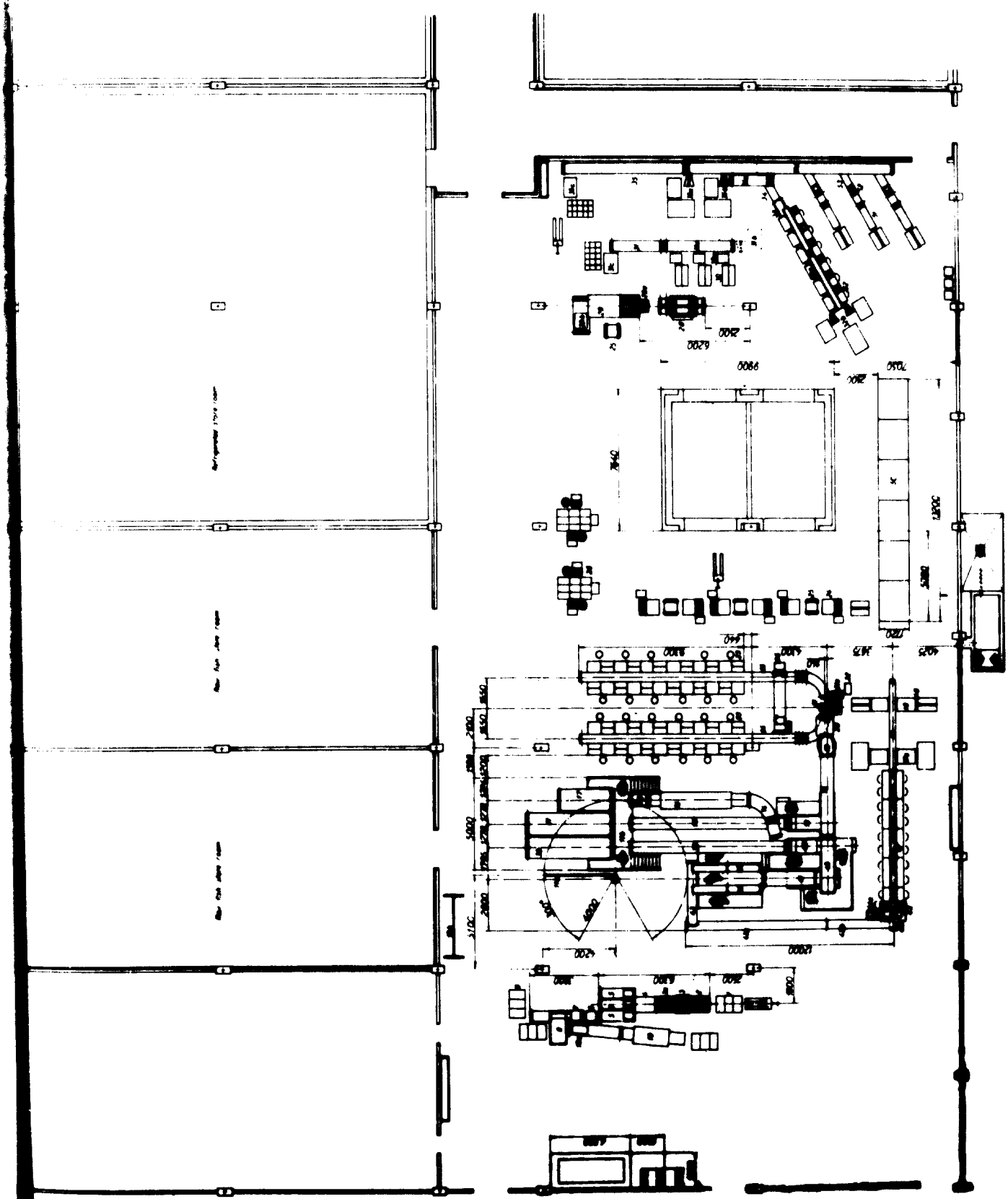
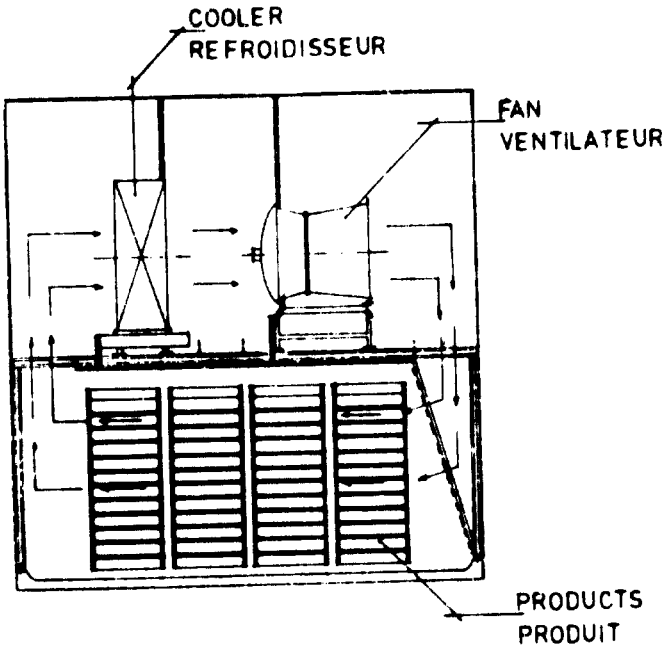


FIG. 11



ARRANGEMENT FOR FREEZING TUNNEL
ARRANGEMENT POUR TUNNEL CONGÉLATION

FIG. 12

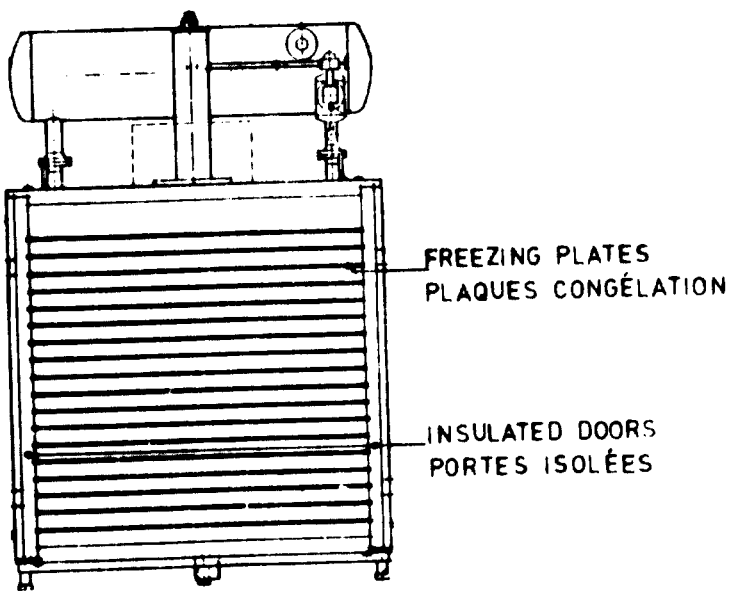
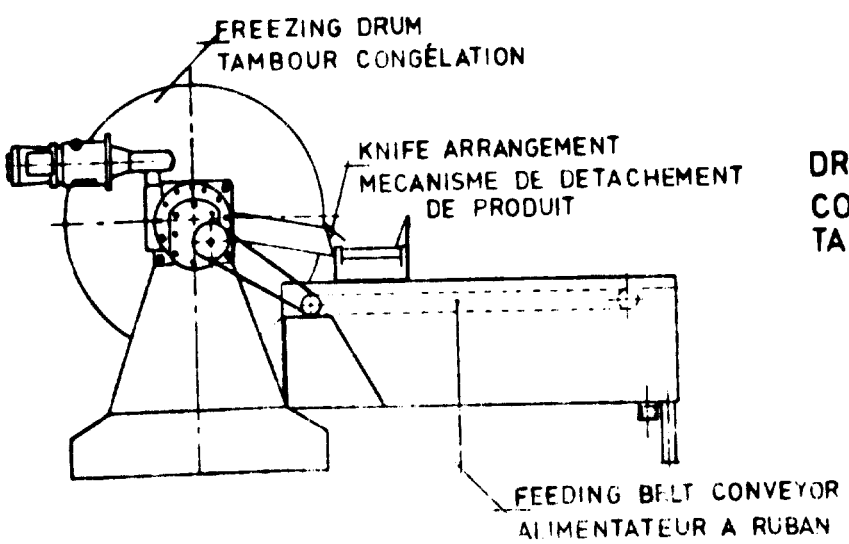


PLATE CONTACT FREEZER
CONGÉLATEUR DE PLAQUES

FIG. 13



DRUM FREEZER
CONGÉLATEUR À TAMBOUR

FIG. 14

Q U E S T I O N N A I R E

for

Fish Processing Plant

For elaboration of projects and quotation for fish processing plants, the below mentioned information is required.
In case it is not possible to give a positive answer to all questions, we kindly ask you to answer as many as possible.

Name of client:

Address:

Location for project:

Species of fish to be processed:

1:
2:
3:
4:

Please fill in the enclosure - one for each species - to present questionnaire.

Fishing fleet:

Small boats (under 21 feet): yes/no, number:
Long liners: yes/no , " :
Purse seiners: yes/no , " :
Groundfish trawlers , " :

Landing facilities

Is quay available: yes/no

Approximate distance from quay
to process plant:

Envisaged means of transportation of
raw material from quay to processing plant:

(Please present map - if available - of
harbour and relative site plant for project)

Working days a week:

Number of shift per day:

Number of hours per shift:

Power supply

Voltage:

Cycles:

If you want ATLAS to include complete electrical installations, please fill in the enclosed questionnaire nr. 219

Water recourses

Fresh water

Quantity available: m^3/h

Max./min. temp.: ^oC

Is the water to be purified and/or to be
clorinated:

Seawater

Is the project so located that seawater in ample quantities can be made available for use where sanitary considerations do not forbid it, e.g. for offal fluming: yes/no

---

How are the drainage facilities for about 25 m^3 of waste water per ton of finished goods, plus cooling water:

Is waste water to be purified: yes/no

Are existing buildings going to be used: yes/no

In the affirmative, please submit drawings.

Questionnaire
filled in by:

Date:

FIG. 14

Enclosure to Questionnaire No. 220

Fish Species

Name of fish: _____ Latin name: _____

Max. size : _____

Min. size : _____

Max. weight : _____

Min. weight : _____

The dominating sizes catched: from_____kgs, to_____kgs
Approx. percentage of catches being
upper extreme sizes:_____%

Approx. percentage of catches being
lower extreme sizes:_____%

Fishing methods:

How long time, approx. passes from the catching starts
until the whole catch is landed:_____days

Daily landing in ton: _____

Fishing month throughout the year: _____

Treatment of fish onboard:

Does gutting take place: yes/no

Does grading according to sizes take place: yes/no

Does grading according to quality take place: yes/no

Means of chilling: _____

Means of chill storing: _____

Stored in: bulk/boxes/tanks

Kind of finished processed products:

1) Whole fish:_____tons processing capacity per day, hereof
_____% to be frozen

_____% unfrozen for local consumption

Gutted fish:_____tons processing capacity per day, hereof
_____% to be frozen

_____% unfrozen for local consumption

Is glazing required for frozen fish: yes/no

Frost storing in bulk: yes/no

Frost storing in boxes or crates: yes/no
If yes, please specify kind and envisaged size:

2) Is filletting required: yes/no, if yes: machine/hand?

_____tons raw material to be processed per day, hereof

_____% fillet to be frozen

_____% fillet unfrozen for local consumption

Fillet to be frozen in blocks: yes/no

a) Size:
Weight:

b) Size:
Weight:

c) Size:
Weight:

Kind of individual packing or wrapping of blocks:

Are the blocks to be packed in "Master cartons": yes/no

Fillets to be frozen in retail packages: yes/no

a) Size:
Weight:

b) Size:
Weight:

c) Size:
Weight:

Kind of retail packing:

Kind of master cartons:

Contents of retail packings, a):_____pieces

b):_____ "

c):_____ "

Size: a)_____

b)_____

c)_____

Material:_____

3) Other products, please specify:

Is the collected waste and production offal, if any, to be utilized: yes/no. If yes, specify purpose:

What means of transportation of collected waste/offal - utilized or not utilized - away from the processing plant is to be considered:

Storing

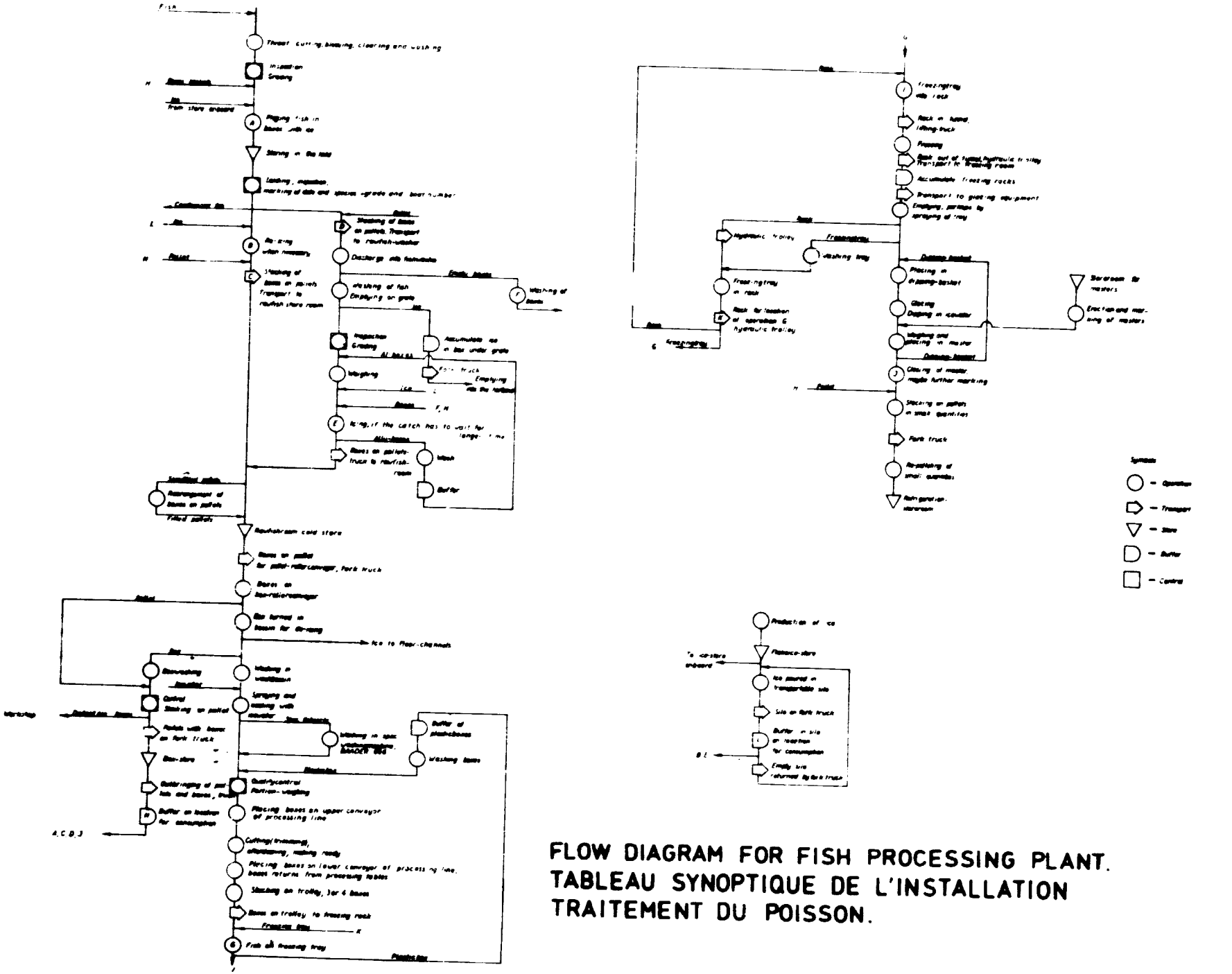
Required capacity of freezing store: _____tons

Approx. storing time for the product:_____month(s)

Other information:

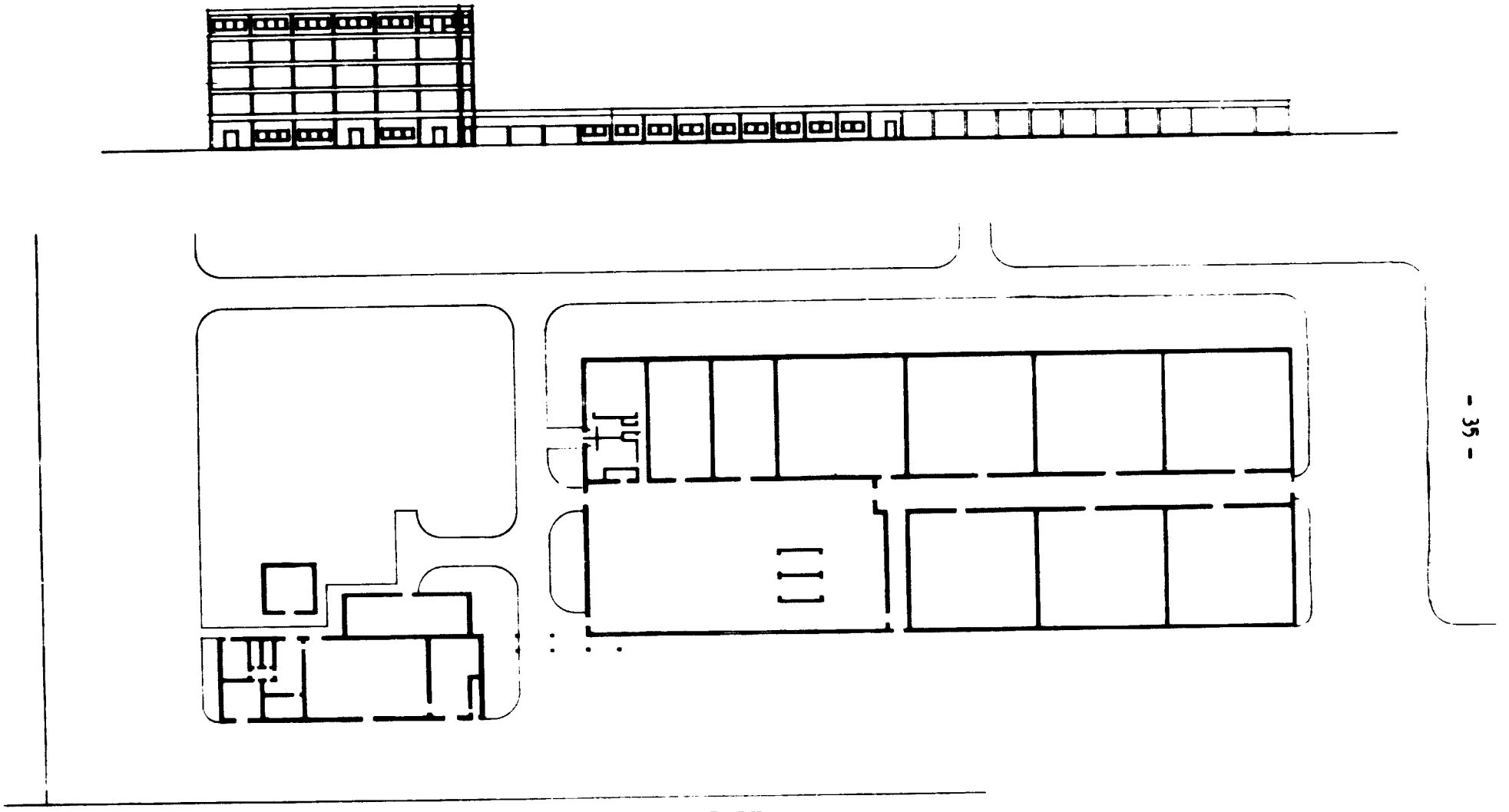
Questionnaire
filled in by:_____

Date:_____



FLOW DIAGRAM FOR FISH PROCESSING PLANT.
TABLEAU SYNOPTIQUE DE L'INSTALLATION
TRAITEMENT DU POISSON.

FIG. 15

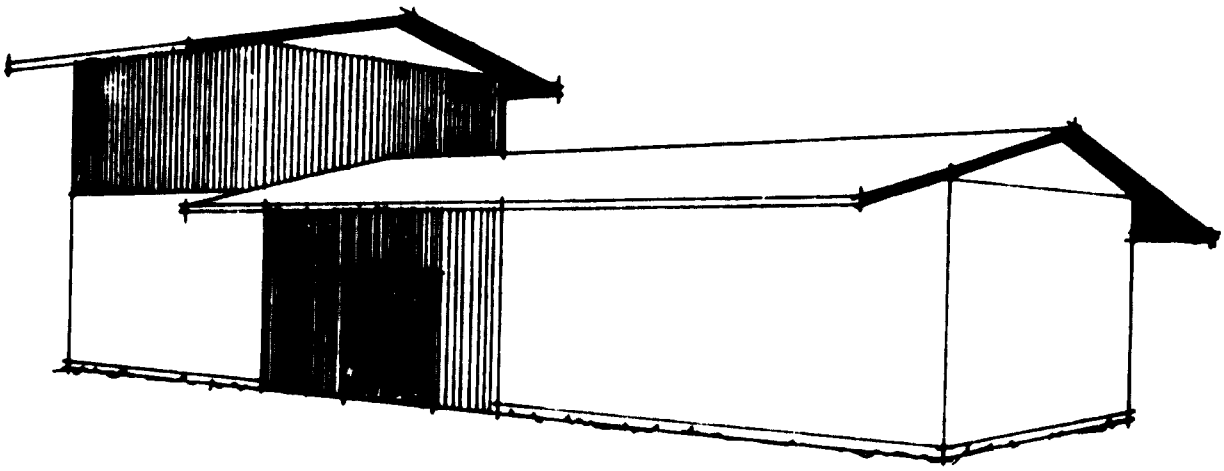


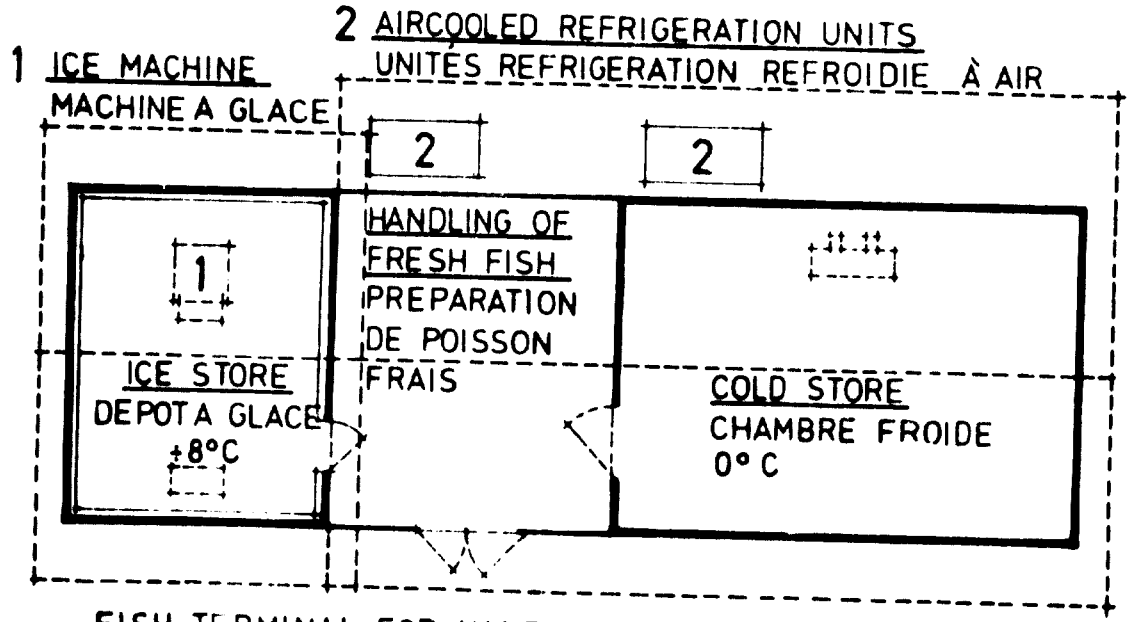
FISH PROCESSING PLANT WITH
3500 TONS COLD STORE AND
240 TONS/24H SLICE ICE PRODUCTION

INSTALLATION TRAITEMENT POISSON AVEC
STOCKAGE FRIGORIFIQUE DE 3500 TONNES ET
PRODUCTION GLACE ECAILLE DE 240 TONNES/24H.

FIG. 16

FIG. 17





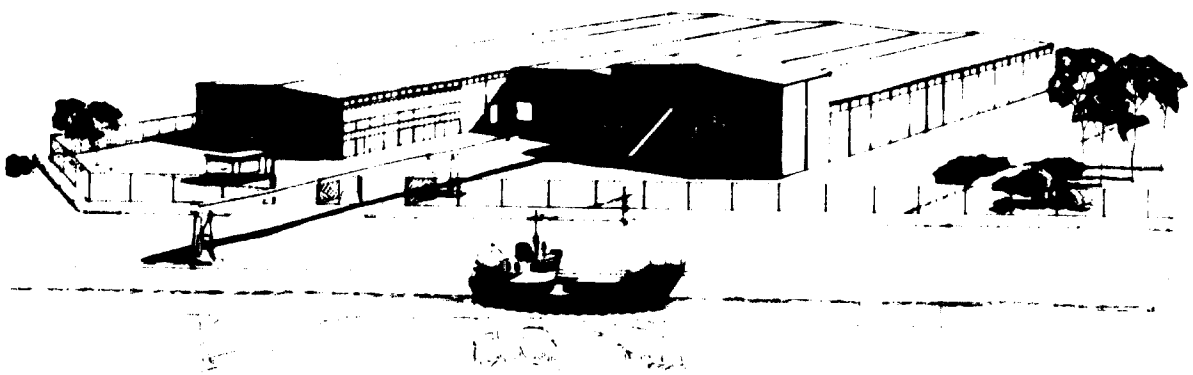
FISH TERMINAL FOR HANDLING OF FRESH FISH

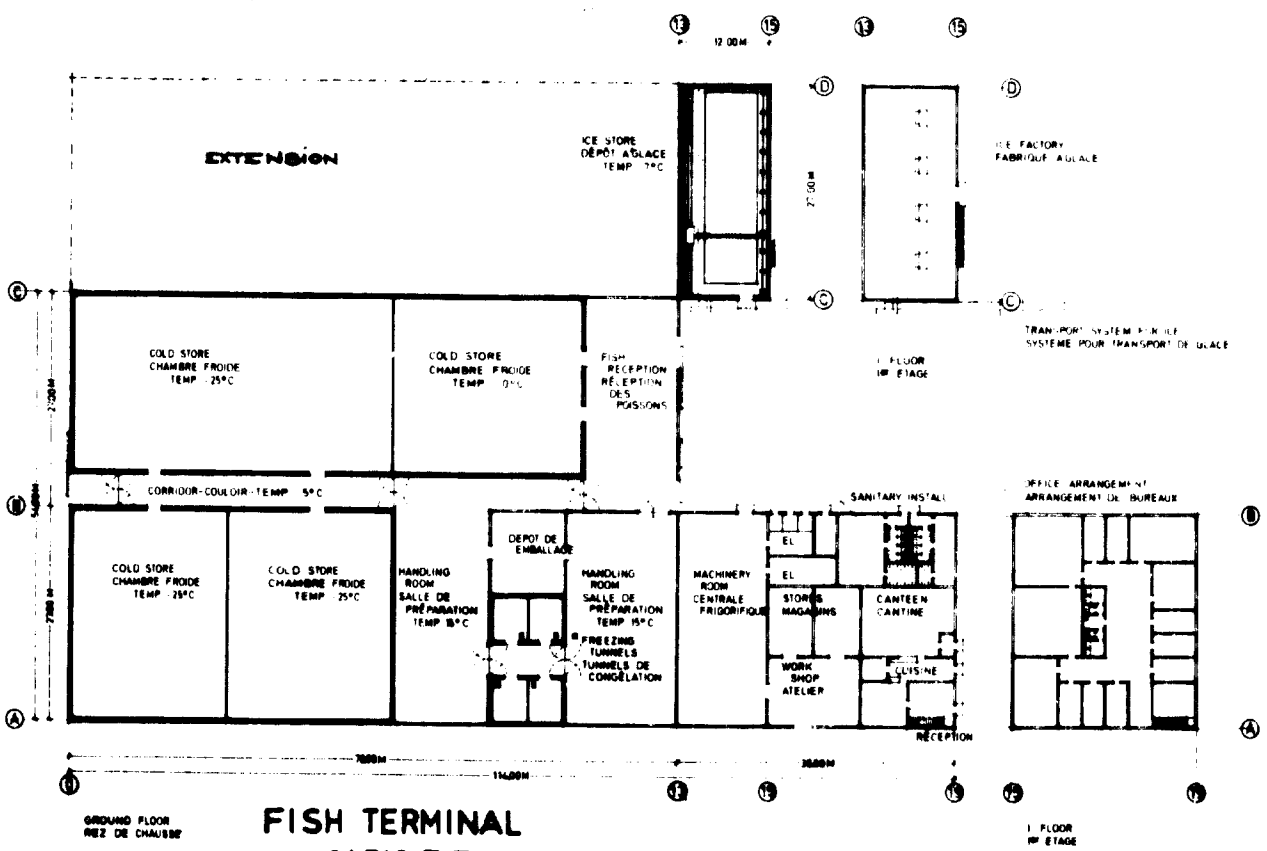
CAPACITIES: 10 TONS COLD STORE
2,5TONS/24H SLICE ICE PRODUCTION
10 TONS ICE STORE

TERMINAL DE POISSON

CAPACITÉS : 10 TONNES STOCKAGE FRIGORIFIQUE
2,5 TONNES/24H PRODUCTION GLACE ECAILLE
10 TONNES STOCKAGE DE GLACE

FIG. 18



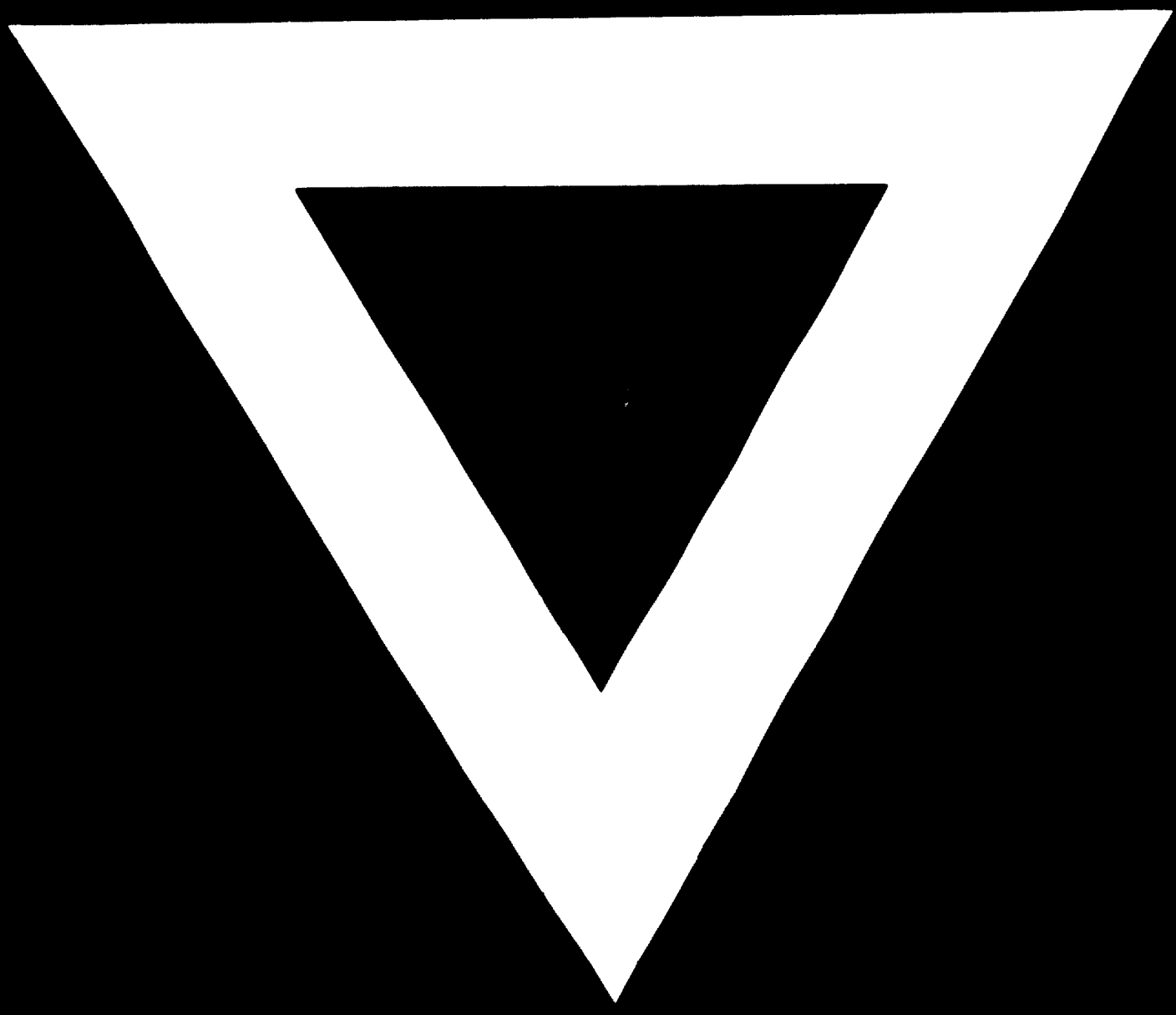


FISH TERMINAL

CAPICITIES : 5000 TONS COLD STORE
60 —"— /24H FREEZING
100 ——"—— SLICE ICE PRODUCTION
400 TONS ICE STORE

TERMINAL DE POISSON

CAPACITÉS : 5000 TONNES STOCKAGE FRIGORIFIQUE
60 —"—/24H CONGÉLATION
100 ——"—— PRODUCTION GLACE ECAILLE
400 TONNES STOCKAGE DE GLACE



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