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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

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MEAT PROCESSING IN AFRICA
THE PROJECT FROM IDEA TO IMPLEMENTATION
AN ACTUAL CASE STORY AND PRACTICAL GUIDELINES[1/]

Arild Holm*

* Manager of African Division, ATLAS, Copenhagen, Denmark

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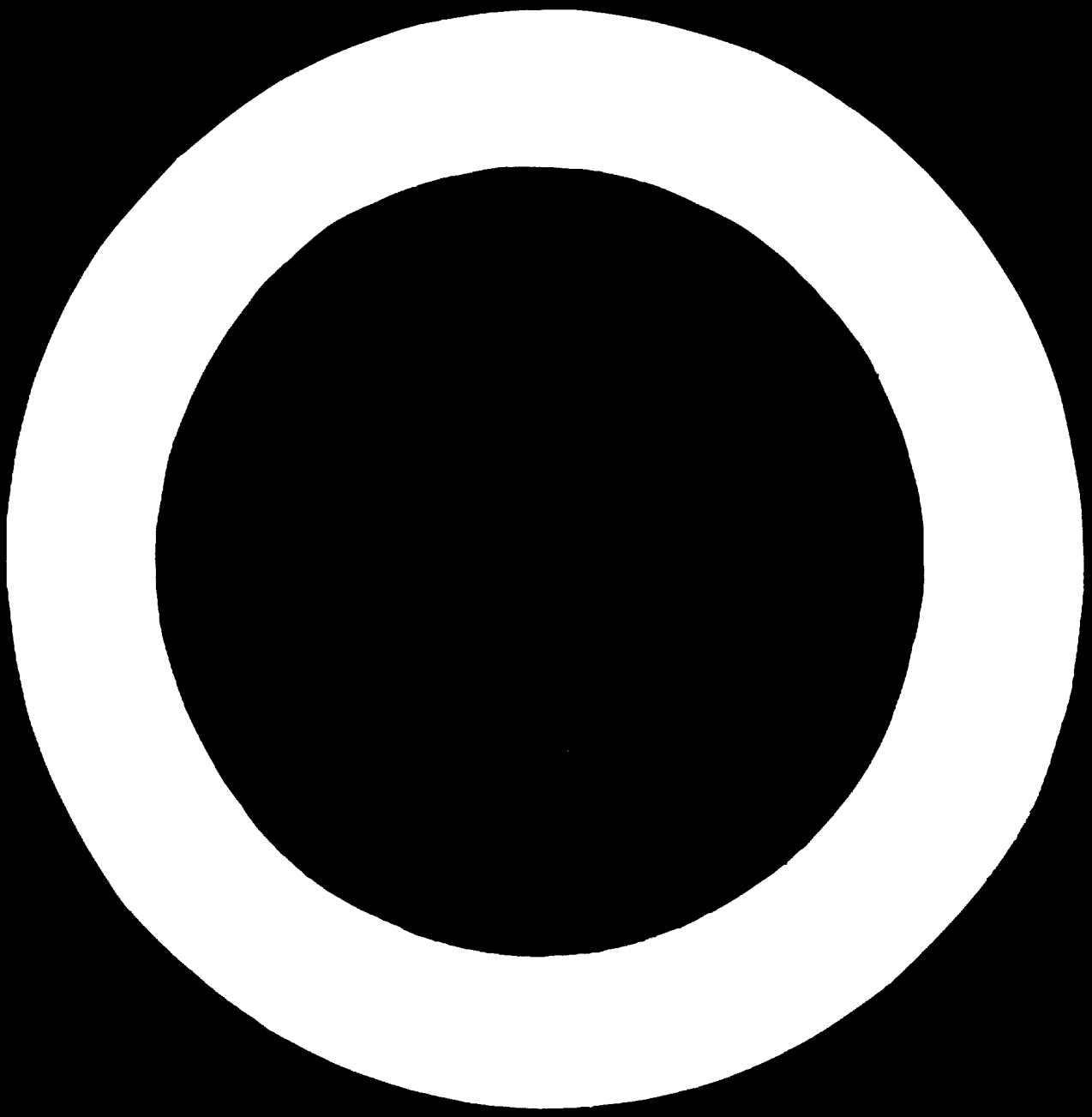

I N D E X

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1. IDEA AND THE PRESENT CONDITIONS AND ENVIRONMENT

Need of Protein

The idea of constructing a meat processing plant in Africa today will naturally present itself for many reasons, primarily the crying want of protein, which may very well in the near future act as an even greater shock on the world population than the recently arisen energy crisis.

Resources

Consequently it would be natural to investigate where the world has the resources to build up and increase its stock of proteins, and here the African continent seems an obvious possibility.

Africa's Alternative

Africa as a continent is traditionally an agricultural area, whether we are on the subject of nomadic tribes in the northern and north-western part of Africa or more traditional African tribes. It must also be realized that Africa's alternative to the industrialization of the West must be its capacity as protein supplier.

Change in Farming

It is also necessary in the developing areas to create an independent economic development which may prepare the way for a change from traditional tribal agriculture into more industrialized farming. This change will primarily require a supply of capital, but also to a very great extent a change in the traditional way of thinking and living.

Project Basis

We who are occupied with the projecting and supply of slaughterhouse and meat processing plants are inclined to make very elementary mistakes because we overlook the enormous variations in the climatic

conditions in Africa, from baking desert areas to highland regions, where the temperature of the air may fall below the freezing point.

Religion

Another thing to be considered is that most world religions, including Christianity, Islam, Hinduism and Judaism, can be found in Africa. All these religions require that special considerations should be given in the slaughtering processes, and the planning of a slaughterhouse should therefore also consider the religion of the people living in the area.

Appendix

The actual case on which this lecture is given, and which is presented as an appendix to the lecture, is dealing with a traditional African area, in which cattle breeding is the main income source.

Livestock Breeding

The main characteristic of the livestock industry in the area is low productivity owing to unimproved breeds, shortage of adequate feed, and inadequate farm management. The majority of stock owners possess small herds of stock, from 1 to 3 head of cattle and 1 to 10 sheep.

Grading

Another characteristic is that owing to the lack of a system of grading the animals, the individual farmers are generally not so interested in supplying beef cattle as the price of the meat is usually only determined by the weight of the animal and not by a combined weight and quality valuation.

Tradition

Traditionally a large herd of cattle is a sign of prosperity, and it is evident that the enormous

information work which is in progress in most areas in Africa must be continued in order to create a change in the way of looking upon animal breeding as a necessity/status symbol and introduce more commercial views

Slaughter Output

It can be seen time after time that although a certain area is densely populated with animals, and although the output from the slaughtering is only estimated at 20-25% of the normal output from industrialized slaughtering, it is impossible to reach the necessary capacity.

Existing Slaughterhouses

The existing slaughterhouses are largely old-fashioned and do not meet the veterinary demands which are made today. It can also be seen that most of the export slaughterhouses that have been constructed in Africa during late years have either started thorough modernizations, or they are about to lose their export licence because the veterinary conditions in the slaughterhouse do not comply with the veterinary demands of the consumer countries.

Distribution of Meat

In general the distribution of meat in Africa is acceptable in the major towns, whereas home slaughtering is dominant in the enormous rural areas, where the existing local slaughterhouses are without refrigeration facilities, which means that the risk of food poisoning is permanently present.

2. FORMATION OF OBJECTIVE - FUTURE REQUIREMENTS AND DEMANDS

Meat Export

In the actual case the government was of the opinion that the country should have reasonable possibilities of starting an industrialized meat processing based on export of meat to European or Arab markets.

Investigations

The practical implementation of a plan of exporting meat involves a large number of investigations of the potential market and especially of the local conditions, including primarily the question whether the livestock population is large enough and whether it is practicable to establish a meat processing plant.

Prerequisites

The necessary conditions of establishing a meat processing plant can be summed up into 3 questions:

a) Are financial resources available for the financing of the plant?

b) Is a sufficient livestock population available?

c) Are there prospective buyers of the products?

Financing

Generally these three points can be said to be equally important, but it should be realized that the first question that any consultant will ask is unquestionably whether the project is financially viable, which does not only mean whether the plant will be economically healthy, but also whether financial resources in the form of local funds or loans etc. are available.

In the actual case a bilateral loan had been granted, so that the financial side was settled.

Possibilities of Export

Further the local authorities had been contacted for quite a long time by overseas channels regarding import of meat, in particular frozen beef, and consequently they were of the opinion that it would be no problem either to find importer channels for the goods to be produced.

Production Basis

The thing left to be done was then to find out whether there was a sufficient basis for establishing a meat processing plant, including also whether the plant should exclusively be based on export, or whether there would also be a local demand for meat cuts and processed meat products.

Local Investigations

Until this moment the investigations mentioned have been more theoretical ones, which may very well be arranged through correspondence between the parties involved, but when the investigations come to the point where it should be established whether the necessary practical conditions of establishing a meat processing plant are available, it will be necessary to make local investigations.

Information Sources

The fundamental question for a slaughterhouse is of course whether there are enough animals in the natural consumer area. This question can usually be answered by contacting the local statistical department, but although the statistics will give information about the livestock population, slaughter offtake, and animals lost by diseases and starvation etc., the figures may be unreliable for many reasons, usually because it is extremely difficult for the authorities to make a correct census of the animals.

Livestock

In the actual case there were about half a million cattle and 2 1/2 to 3 million smallstock animals available in the area, but from the statistical material it could be established that only about 4 per cent of the livestock population had been officially slaughtered, whereas about 12 per cent had been exchanged on a yearly basis owing to diseases, starvation, etc. etc. On closer examination the official slaughter figure was actually found to be 4 per cent. The remaining 8 per cent loss represented to a great extent also slaughter products, but it appeared that these animals had been slaughtered by necessity owing to starvation and partly also diseases.

Objective

Consequently it seemed natural to us to try to find out what could be done to reduce the number of animals slaughtered owing to diseases and starvation to a more commercial number.

Holding Grounds

In this case we found that the solution must be three or four holding grounds in the area. These holding grounds should serve as a buffer store for the slaughterhouse, but their main purpose should be to act as feedlots, where the animals should be examined by a veterinarian before being taken into the holding ground area. This system will only require very few veterinarians, that is one for each holding ground, and will make it possible to find out from which area in the district diseases etc. should originate.

Livestock Improvement

The holding grounds will also make it possible to improve the conditions for the animals, in this case cattle in particular, as all animals entering the holding grounds will be dipped in order to remove lice and bugs etc.

Fattening All this means that the holding grounds will actually serve as combined quarantine stations and feedlots, where the local low-graded beef can be up-graded during a period of 80 to 90 days. Experiments have shown that an intensive fattening for 80-90 days will increase the weight of the animals by appr. 1.5 kg per day, and consequently also the total value of the carcass.

Security against Starvation Another important advantage of the holding grounds is that in this area, where starvation has occurred in the winter time, the farmers who have earlier been forced to kill their animals may instead sell them at a normal price to the slaughterhouse organization which is in charge of the holding grounds.

Training of Farmers Further it may be expected that the individual farmer in the area will comparatively quickly realize the improvement of the livestock quality which the intensive fattening will produce, and consequently the slaughterhouse organization is of the opinion that the individual farmer will take up the feedlot idea, in which case the slaughterhouse is prepared to support the farmers by training and technical assistance etc.

Grading The slaughterhouse organization will also try to build up a grading system based on the quality of the animals in order to make the farmers take a greater interest in improving their livestock.

Transport of Cattle Another important purpose of the holding ground system is to terminate the present senseless way of driving cattle on the hoof to the slaughterhouse across long distances and replace it by transporting the daily slaughtering capacity from the holding grounds to the slaughterhouse by trucks.

Slaughter Output

It applies to most African slaughterhouses that the animals are driven to the plant across long distances, often at a very quick pace owing to lack of water, which means that the animals arriving at the slaughterhouse will have lost about 10-20% of their live weight. It also appears that the meat to be processed in the plant is very tough and of poor quality owing to this mode of transport.

Future Slaughter Offtake

After the above local investigations and various discussions with relevant persons and organizations in the meat trade, the parties reached the conclusion that it would be realistic to expect a slaughter offtake of 12 per cent in 1985, that is conversion of the main part of the losses from starvation and diseases into normal slaughter products during the next 10-year period based on the introduction of the holding ground system. In this connection it should be noted, however, that the livestock in the area in question is free from major diseases problems.

Export Capacity

Another conclusion was that a local slaughterhouse would make it possible to double the present slaughtering capacity immediately, provided that acceptable local facilities were established for the urban areas, hotels and schools etc. Consequently it was decided that the main part of the meat, that is 75 per cent of the slaughtering capacity, should be exported as boxed and frozen boneless meat, and in order to obtain all the advantages which an export of frozen steaks would offer, it was decided that all kinds of trimmings, fat, cheek meat and other edible offal material should be utilized for production of a selection of meat products to be sold from shops in five major towns in the area.

Urban Facilities

These towns already had some butcher's shops, and in order not to force a monopolistic competition on the local butchers it was decided that the above five shops should also act as local wholesalers to the existing butchers, and in addition they should be equipped with walk-in coolers so that each area would have a certain meat storage capacity.

Reduced Home Slaughter

The purpose of these provisions was to suppress the traditional home slaughtering by offering fresh meat in small portions, so that the proteins in the meat would be utilized better than by home slaughtering as home slaughtering presupposes consumption of larger portions within a comparatively short time after the slaughtering.

Future Demands

As the general purpose of investing in an industrial meat processing plant must be to raise the standard of living and control the industrialization in the area via the plant, all parties agreed that besides meeting veterinary requirements the projected slaughterhouse should also have facilities to promote other industries to be established in the area in future.

Social Facilities

Besides technical aspects, the project in question also gives consideration to an improvement of the social sector of the slaughterhouse. In practice this means that the plant will be equipped with modern bathroom facilities, so that each worker will dispose of a locker for his private clothes, after which he will pass through bathroom facilities and finally receive a complete set of working clothes, that is cap, shirt, trousers, boots and apron etc., from the slaughterhouse. These working clothes should be changed every night and delivered to the laundry of the slaughterhouse for washing and cleaning overnight.

Further the slaughterhouse will dispose of acceptable canteen facilities so that each worker will receive at least one nourishing meal every day.

The slaughterhouse will also include suitable areas where the workers can stay during the intervals of rest.

Foreign Consumer Requirements

As the slaughterhouse is based on export of frozen deboned meat, it is of the greatest importance that the standard of the plant should meet the demands made by the consumer countries. In practice this means that the veterinary conditions in the slaughterhouse should be in accordance with US and EEC norms if the meat is intended for overseas export. If the meat is to be exported to Arab markets, it is absolutely necessary to slaughter the animals as laid down by the Koran.

Commercial Utilization

An export of frozen deboned meat will offer several advantages in connection with the sale and transport of the products. The bones from the deboning of the meat will remain inside the slaughterhouse area, where they can be utilized for production of meat and bone meal, which is of a very great nutritive value owing to its high content of digestible proteins.

Local Consumer Requirements

As already mentioned, trimmings and fat etc. will be utilized in the local meat processing plant. The machinery offered to such a plant should primarily be very flexible for the reason that although the various African areas are often importers of overseas canned goods etc., the taste and demands of the local consumers are so varying that it is absolutely recommendable to build up a range of products on the spot which in taste and composition will appeal to the local consumers.

Evaluation Panel

In this connection it can be extremely valuable to form an evaluation panel composed by local inhabitants, who will be able to determine exactly which products will be suitable for the local area.

Meat Handling

It is also necessary to know the market for the exported meat as the way of cutting up the meat varies from country to country, which means that "wrong" meat cuts can make it impossible for the slaughterhouse to obtain top prices of a high-quality product because this will be classified under another cut.

3. PROJECT HANDLING

Site

After establishing that the facilities and resources needed for a continuous operation of the slaughterhouse are available, it is necessary to settle the more practical matters, first of all the question where the slaughterhouse should be located.

Demands

In this connection there are some elementary demands which a slaughterhouse site should cover, such as

Road

access to adequate roads for heavy truck traffic if the animals are to be transported to the slaughterhouse in trucks, and if the meat products are transported away from the plant by refrigerated trucks etc. In the actual case, where the plant is based on export of frozen deboned meat, it is absolutely

Railway

necessary to have a railway track close to the slaughterhouse, which should preferably be laid so that the frozen boxes can be loaded direct into the refrigerated waggons. A railway track to the slaughterhouse will also make it possible to transport live animals to the plant by waggons.

Airstrip

An African meat processing plant will usually also have possibilities of exporting meat to neighbouring countries, and while the road and railway communication nets are not always equally suitable for this transport, it will often prove advantageous to utilize airplanes for the export if a suitable airstrip is available in the neighbourhood.

Purified Water

One of the elementary necessities of a slaughterhouse is water, which should be of such a quality that it can be accepted by the authorities. In practice this means that a sufficient supply of corporation water should be available, or if the slaughterhouse is to utilize river water, it will have to invest in a freshwater plant.

Waste Water

In this connection it should be mentioned that the disposal of the waste water may present great problems as waste water from slaughterhouses has a high content of BOD. It is completely unjustifyable to lead waste water from a slaughterhouse into a river as it may always be expected that there will be local villages a few miles away which are utilizing the river water as drinking water. It is therefore absolutely necessary that the slaughterhouse should have possibilities of connection to a local sewage system, or the local authorities must lay down norms for a mechanical, biological and/or chemical purification of the waste water before it is led out of the slaughterhouse area.

Electricity

Another elementary necessity is electricity. The slaughterhouse should therefore have possibilities of high-tension connection to a transformer station, or it will be necessary to invest in comparatively expensive Diesel generators for supply of electricity.

Chosen Site

In the actual case we were fortunate enough to find a suitable site in an area that was ripe for industrial development, so that roads and railway track were practically on the site. The plant had been planned so early that it could be included in local plans of a new waste water treatment plant for the whole area, and also high-tension electricity was available. Further the distance to a local airstrip was only a few miles.

Limitation of Extension

The area would consequently meet all the necessary requirements of a slaughterhouse site, but we also realize that it will be built up in comparatively few years so that the possibilities of extension are limited. In this connection we wish to stress the necessity of contacting all relevant authorities in the foreseen area in order to make sure that the facilities needed are not only available, but also that the slaughterhouse will be permitted to utilize them for its production.

Air Pollution

It will also be necessary to investigate whether there are any special demands regarding air pollution and demands made by the local electricity corporation in connection with start of motors etc.

Site Conditions

Besides satisfying the above demands, a slaughterhouse site should of course be sufficiently large. Further it should be flat and without rocks so that the foundation work will not necessitate blastings, but on the other hand the ground should not be so soft either that the foundations will require piling. Immediately after the site has been chosen, it will also be necessary to make soil investigations in order to establish its carrying capacity.

Flow

The chosen site and the pre-set capacity should form the basis of a pre-study which should establish the profitableness of the plant and fix the flow of the project. Based on the flow, that is after the elaboration of a site plan, project layouts and sectional drawings, the building drawings and equipment drawings should be elaborated.

4. ADAPTED TECHNOLOGY AND INFLUX ON TECHNICAL ASPECTS

Technical Demands

The layout sketches should be based on a technology which is well-suited for the area in question and should consider the technical equipment that is deemed adequate.

Technological Basis

The technology is chosen according to the set capacities as the processes, for example in connection with the inspection of the animals, vary very much according to the capacities. The choice of technology should also be determined by the market on which the products are to be sold. If the meat is only intended for the local market, the technology should comply with local veterinary requirements as a minimum, whereas the technology of a plant based on export to overseas markets should be in strict accordance with the demands of the importing countries. A new meat processing plant should generally be projected for a higher standard than the standard set by the demands made in the home country as it may be expected that the veterinary requirements of any country will gradually be developed and tightened up, and it will be disproportionately expensive and in some cases almost impossible to make changes at a later stage.

In the actual case, where the meat is to be exported to overseas markets, we have tried to comply with all the demands that will be made in this connection. The cattle will thus be kept in quarantine for quite a long period on the holding grounds, so that only healthy animals will be supplied to the slaughterhouse, and immediately before the arrival they will be examined by a veterinarian.

Site Size

In order to create a clear division between the various functions in the slaughterhouse we have marked out a rectangular site based on the fixed points, that is railway and road, on the site. In order to give natural light to the individual buildings and obtain a division of the functions inside the buildings we have separated them by a central transport corridor, which may also act as service corridor in connection with the installation of cables and pipes for water, steam and air.

Distribution of Buildings

As will appear from the enclosed site plan, the central corridor is forming a clear division of the slaughterhouse block into two zones, one for production and one for storage and dispatch.

Advantages

By this division the stables have also been placed as far as possible from the dispatch ramps, and the by-products plant together with the boiler plant and workshop have been located so on the site that there will be no smell problems etc.

Access

The administration building and the social building have been located as close as possible to the main gate, both in order to prevent visitors from entering the slaughterhouse alone and also in order that the workers may take off their clothes and have a shower immediately after they arrive at the site, after which clean clothes will be delivered to them from the laundry of the slaughterhouse.

Mechanization — The choice of equipment should to a great extent be determined by possibilities of service in the area. It would be inexpedient to over-mechanize and automatize a processing plant in an area without other industries and consequently also without service facilities and workers who are used to handling mechanized equipment.

Employment — Another aspect to be considered is that when the authorities in a certain area are investing in or permitting the construction of a meat processing plant, the main purpose is often to offer possibilities of employment to people in this area, and consequently a high degree of mechanization would act in the opposite direction.

Conclusion — The correct choice of equipment should aim at a hygienical production and an adequate process flow.

5. ADMINISTRATION AND ORGANOGRAM

Management — The organization is built up traditionally with a managing director to be administratively responsible for the plant.

In the same way we have also separated the production and the technical side, which are headed by a production manager and a chief engineer.

Production — The production manager should be administratively responsible for all production matters via a number of foremen, who should be responsible for the individual production departments.

Engineering — The chief engineer should have a thorough knowledge of slaughterhouses and refrigeration plants as well as other technical installations. As this position

will be of an administrative character, we find it absolutely necessary that the slaughterhouse should have a plant engineer, who should be trained and experienced in refrigeration technique.

Administration The daily administration of the plant should be placed under a chief accountant, who should be in charge of the administrative functions, whereas marketing functions including export of meat and purchase of live animals etc. should be placed under a marketing manager.

Marketing As will appear from the organogram, we have assumed that the marketing manager will have a livestock marketing organization placed under him, which should be in charge of the purchase of wool and hides from the whole area and should run the holding grounds, including purchase of livestock and transport of the daily slaughtering capacity to the slaughterhouse. This means in practice that the marketing manager will control all matters concerning export and sale of the products of the plant, and that the supply of raw material will be in accordance with the export and sales contracts he makes.

Organogram For further information we refer to the attached organogram, which is showing in detail how the organization is built up.

6. ECONOMY STUDY - FINANCE AND AVAILABLE SOURCES

Economy Study It is of the greatest importance that the possibilities of financing a project of this size should be clarified, and that a project analysis report on the profitableness of the plant should be made.

Investment — In this connection it would be practical to use a balance sheet formula, which should consist of a summary of the items elaborated in the actual report. For each item of the balance sheet there should be numbers of reference to the paragraph containing the calculations and description of the subject in question.

Calculation of Profits — For the calculation of profits another formula should be used, so that the individual items should be extracted from the paragraphs of the report, and also there should be numbers of reference for identification.

Liquidity Balance — The liquidity balance account is to show the capital needed at various stages before the plant is put into operation, based on which it will be possible to calculate the amount of "pre-operational expenses", which should be entered under fixed assets if it is possible legally to write off the amount for depreciation.

Financing — A financing paragraph should describe the whole debit side of the balance sheet, stating first the necessary share capital and its distribution among the partners. Further this paragraph should describe the possibilities of raising loans for the remaining necessary capital. A separate paragraph should state the calculation of interest corresponding to the capital borrowed, and this annual amount should be entered as a separate item in the profit and loss account.

Partners and Agreement — Another paragraph should outline such agreements as may be made between the partners regarding the division of special duties and the corresponding compensation (technical know-how, administration, sales etc.).

Taxes A tax paragraph should outline the rules for company taxation and other conditions regarding return of dividend, taxation on royalty etc. A separate paragraph should give a calculation of tax to be paid on the estimated profit stated in the profit and loss account.

Pioneer Status Another paragraph should describe all such advantages as may be obtained if it will be possible to obtain recognition for pioneer status, or if similar advantages can be obtained by negotiation with the authorities.

Import Duties The report should also contain a general description of the conditions regarding restrictions and taxes on raw material and machinery and equipment to be imported.

Political Conditions In order to judge the general political and economic situation it would be practical to consider the political and economic conditions in the home area/country as any kind of foreign financing will be very much determined by the question whether the political and economic conditions in the area are stable.

Price of Property The report should also give a brief description of the building land available for the project, including information about area, price, conditions related to the property, location in relation to the market, access conditions etc. This paragraph should conclude in a price of the site to be entered in the balance sheet.

Construction Prices

Another paragraph should give a brief description of the various building constructions under the project, based on which it should be possible to make an estimate of the price. The amount of building costs should be entered in the balance sheet. In a separate paragraph the necessary depreciation of the buildings should be calculated without considering legal tax allowances and by use of a rate based on an estimate of wear and tear, political risks etc. This amount should be entered in the profit and loss account.

Equipment Prices

A separate paragraph should give a brief description of the machinery and equipment to be installed together with any other information that may be of interest, such as suppliers etc. Besides the price of the actual machinery, the paragraph should also include an estimate of the erection costs and costs of electrical installations, ending up in a total sum of machinery installed. Another paragraph should include a calculation of the annual depreciation according to the lines indicated above.

Raw Material

The report should also contain information about all the raw materials and packing materials to be used for the production of the finished goods, including whether these raw materials are of local or foreign origin as well as prices and annual consumption, concluding in a total amount for this group to be entered in the profit and loss account.

Production Costs

The report should give a brief description of the production process, including a calculation of the total cost of auxiliary materials, electricity, water, gas, oil, waste water etc. It would also be

practical to make a calculation and list of all capacity figures needed in the project, that is tables showing the product outputs. The total amount of production expenses should be entered in the profit and loss account under various variable costs.

Market Analysis A market analysis or evaluation is in a way the basis of the whole project as it will make it possible to work out a sales prognosis, including local and export consumption, which in itself forms the basis for the size of the plant. The final figure of the total annual sales should be entered in the profit and loss account.

Competition A separate paragraph should give the best possible description of competing companies and their turnover, effectiveness etc. As these conditions are actually an integral part of the market and sales prognosis, the paragraph should not conclude in any real figures.

Stock in Trade Based on the figures produced under the paragraphs dealing with raw material, production and market description it should be possible to make an estimate of the quantities of raw material (animals) and end products (deboned and processed meat) as well as products in progress which may be expected to be in stock constantly, corresponding to the estimated sales and production capacity. On this basis it will be possible to calculate the total value of these stocks, which will require payment of interest. This figure should be entered in the balance sheet and should also form the basis of the final calculation of the necessary foreign capital.

Administration/ Marketing

A separate paragraph should outline how the administration and sales are to be organized and should further include an estimate of the necessary office expenses as well as advertising and insurance expenses etc. This amount should be entered in the profit and loss account under various fixed costs. The paragraph should also lay down the sales structure, that is sales via wholesalers, butchers, etc.

Technical Management

The report should also deal with the problems of procuring the technical staff needed for a satisfactory production management. The paragraph should not conclude in any real figures.

Salary Budget

A paragraph should sum up all the salaried and wage-earning employees of the plant with indication of their yearly salary and wages as well as the benefits they may have, and should conclude in a total amount of salaries and wages.

Housing Conditions

The question of housing conditions should also be dealt with in cases where it will be necessary to provide free housing for certain employees or workers.

Financial Sources

As regards available sources of financing we wish to point out that besides possibilities of local financing, most developing countries will have the possibility of obtaining bilateral or multilateral loans. In this connection we refer to the plenary session dealing with problems of financing food processing projects and organizing joint ventures from the standpoint of the World Bank.

Appendix Study The practical guidelines outlined in this lecture are forming the basis of a study, concluding in the project attached to this paper for your information.

A P P E N D I X

Stables

Project Basis

Cattle: 160/day.
Smallstock: 265/day.
Pigs: 40/day.

Description

The stables should be constructed as open stables, which should receive the daily slaughtering capacity transported by trucks from the holding grounds.

As these holding grounds should also serve as quarantine stations, we have only calculated with supply of healthy animals to the slaughterhouse, and consequently there should not be any special stable area for sick animals or any special bridge for inspection of dead animals.

The stables for cattle should be roofed at the reception end as this should include a small forage area and a storage room for necessary tools, such as brooms and shovels etc., as well as facilities for the workers who take care of the stables.

This area should also be equipped with a manure vibrator to separate the solids in the stomach and casing contents from the water, after which the solids should be collected on trucks and transported away for manuring.

The stable construction should consist of welded iron with swing gates at the entrance and exit of the individual stable sections, which should be divided into suitable areas for a certain number of animals and should include necessary drinking water facilities.

The floor should be of mass concrete cast in bays with sanitary curbs around the pens.

Cattle Slaughtering

Project Basis	
Capacity	25/30 head per hour.
Live Weight	Average 431 kgs/head. Max. 600 kgs/head.
Dressed Weight	Average 216 kgs/head.
Bleeding Rail	2" pipe rail. Rail height 4.7 m.
Dressing Rail	2 1/2" x 1/2" flat bar rail. Rail height 3.7 m.
Dispatch Rail	2 1/2" x 1/2" flat bar rail. Rail Height 2.3 m.

Description

After a short rest in the stables the animals should be led direct to the stunning box on the killing floor via a water basin.

In the box they should be stunned with a bolt pistol, after which they should be tilted out on the floor.

A shackle chain trolley should be taken from a storage rail for trolleys, and the chain should be tied round the hind leg of the animal above the knee, after which the trolley should be fastened to a hoisting plate and landed on the bleeding rail by means of a landing section activated by an electric beef hoist.

On the bleeding rail the animals should be transported by gravity to a rail stop, where they should be stuck, and still by gravity they should be transported on to the individual working places where forelegs and horns should be cut off with an electric saw and dropped into separate trucks.

Next the heads should be cut off, cleaned in a washing cabinet and placed in trucks for inspection and further transport to the dispatch area or to a splitting block. After the splitting the cheek meat should be collected in meat trucks, and the tongues should be trimmed and placed in other meat trucks for transport to the cold rooms.

The skulls should be placed in trucks for condemned products and transported to the collection area for condemned material.

The headless carcasses should be transported by gravity to the transfer section, where the first hind leg can be dehided and cut off, after which a trolley hook should be inserted into the sinew.

The trolley with the free hind leg should be placed on a transfer hoist and transferred from the high level bleeding rail to a lower dressing rail.

The second hind leg should be released in the same way and placed on the dressing rail by another transfer hoist.

The shackle trolley should be placed on a rail opposite the transfer platform and transported by gravity to a lowering device for shackles in the bleeding area, by which the trolley should be lowered from high level down to the storage rail.

From the transfer platform the dressing operations should be started with cutting of the aitchbone and tying and dropping of the rectum, after which the dehiding should start with rumping.

On the dressing rail the carcasses should be transported by gravity to the dehiding area, where they should be dehided from 2 two-level platforms. From the first platform and from the floor they should be marked and flanked, and the complete backing should take place from the second platform.

The hides should be dropped on the floor and placed on a hide truck for transport to the hide cleaning and storage area.

The dehided carcasses should be transported by gravity to a platform for cutting of breastbones. After this operation they should proceed to a lowering device equipped with a built-in spreader to secure the right spreading of the hind legs for evisceration, after which they should be lowered to a convenient position for evisceration.

The casings and stomachs should be placed in a truck, and the plucks sets should be placed on a tray fixed to the truck so that the meat inspector will be able to inspect the carcass, all intestines and the head at the same time.

After the evisceration the carcasses should be transported by gravity to a pneumatic platform for splitting.

The above working places for evisceration and splitting should be equipped with spreaders in order to secure the right position of the hind legs for the individual operations and different animal sizes.

A separate rail should be installed for inspection of suspect carcasses. Condemned carcasses should be cut down and transported in trucks for condemned products to the collection area.

Further the dressing line should be equipped with a combined trimming and washing platform, including high-pressure washer and overhead scale.

After final trimming, the carcasses should be quartered on a quartering rail and transported to a hanging hall for weighing and dispatch.

At all the above working places the rail should be equipped with easily releasing rail stops, and the rail and working system should be based on the gravity principle.

All trucks transported out of the building should be properly cleaned and sterilized in the sterilizing area.

All trolleys which are released from the carcasses at the delivery ramp should pass the sterilizing area for sterilization and oiling, after which they should be transported by gravity to the slaughterhall, where they should be placed on a standing rail at the transfer platform.

According to veterinary rules and regulations of most countries every working position should be equipped with sterilizing and washing facilities for tools, equipment and carcasses as well as for the workers' aprons, boots and hands.

Hog Slaughtering

Project Basis

Capacity	20/25 hogs per hour.
Live Weight	Average 86.5 kgs.
	Max. 150 kgs.
Dressed Weight	Average 52 kgs.
Bleeding Rail	1 1/2" pipe rail.
	Rail Height 3.7 m.
Dressing Rail	2 1/2" x 1/2" flat bar rail.
	Rail height 2.7 m.
Dispatch Rail	2 1/2" x 1/2" flat bar rail.
	Rail height 2.3 m.

Description

From the stables the hogs should be driven to a waiting area, from where they should be led one by one to the stunning area for electrical stunning. After that, they should be shackled in one hind leg and automatically hoisted to the bleeding rail for sticking and bleeding.

The blood should flow to a concrete basin with blood and water drain and run by gravity to a concrete pit, where a common blow tank for blood from hogs and smallstock animals can be placed.

After bleeding, the hogs should be lowered from the bleeding rail to a receiving table in front of a scalding tub. Here the shackles should be released, and the hogs should be pushed into the scalding tub and scalded for about 6 minutes at a water temperature of about 60°C.

The scalded hogs should be led semi-automatically into a dehairing machine for automatic dehairing,

after which they should be tilted out on a gambrelling table for after-scraping, especially around ears, eyes and feet.

Now the sinews of the hind legs should be loosened and a trolley with gambrel should be placed between the hind legs, after which the carcass should automatically be hoisted to the dressing rail by means of a gambrelling hoist.

While the carcasses are hanging on the dressing rail, they should be singed with a hand-singeing torch, black-scraped and clean-scraped, after which the abdomen should be opened for evisceration. Most of these operations should be carried out from platforms.

In front of a circular inspection table the intestines and plucks should be cut free and placed in one section of the table for veterinary inspection together with the carcass. In case diseases are found in intestines, plucks or carcass, all parts of the animal must be retained in a separate refrigerated department for further examination before approval or condemnation.

Approved carcasses should proceed to the dressing rail, where they should be split, trimmed and inspected, after which they are ready for dispatch to the cooling rooms.

Approved plucks should be transported to a separate room for final trimming and washing.

In order to comply with veterinary rules and regulations every working position should be equipped with sterilizing and washing facilities for tools, equipment and carcasses and for the workers' aprons, boots and hands.

Sheep and Goat Slaughtering

Project Basis

Capacity	50/60 animals per hour.
Live Weight	Average 36.9 kgs.
	Max. 50 kgs.
Dressed Weight	Average 18.5 kgs.
Bleeding Rail	1 1/2" pipe rail.
	Rail height 3.2 m.
Dressing Rail	2 1/2" x 1/2" flat bar rail.
	Rail height 2.7 m.
Dispatch Rail	2 1/2" x 1/2" flat bar rail.
	Rail height 2.3 m.

Description

The animals should be driven from the stables to a waiting area, where they should be stunned with electric low-voltage stunning tongs.

After the stunning a trolley shackle should be tied round the hind leg of the animal, and the trolley should be placed on a tiltable rail activated by an electric hoist.

The trolley with the animal should be transported by gravity to a rail stop at the sticking position, where the animal should be stuck for bleeding on the rail.

After the bleeding the free hind leg should be skinned, and a gambrel should be inserted into the sinew of the leg and placed on the dressing rail. The other hind leg should be skinned and placed on the gambrel in the same way.

The actual skinning should take place when the carcass is hanging on the rail in the gambrel.

The skins should be placed on a skin truck and transported to the skin cleaning and storage area.

The skinned carcasses should be transported by gravity to the opening area, where the viscera should be taken out and placed on a moving top inspection table with separate trays for white intestines and plucks, which should be inspected together with the carcass.

The approved intestines should be tilted from the moving top table on a table, where a pre-separation of the white intestines should take place, after which they should be chuted into the department for cleaning of casings and stomachs.

After the pre-separation the plucks sets should be chuted into the plucks cleaning department.

Waste material should be transported in trucks for condemned products to the collection area.

Suspect carcasses should be transported to a chilled holding room for further inspection. Approved carcasses should be transported back to the dressing rail, whereas rejected carcasses should be cut down into trucks for condemned products.

After the inspection the approved carcasses should be trimmed, cleaned and transported to the cold block.

In order to comply with veterinary rules and regulations every working position should be equipped with sterilizing and washing facilities for tools, equipment and carcasses and for the workers' aprons, boots and hands.

Viscera Treatment

Project Basis

Capacity — Treatment of 25/30 sets of cattle viscera per hour.
Treatment of 50/60 sets of smallstock viscera per hour.
Treatment of 20/25 sets of hog viscera per hour.

Average Tripe Weight — 14 kgs per set of cattle tripes.
2 kgs per set of smallstock tripes.
0,6 kg per set of hog tripes.

Average Casing Weight — 13 kgs per set of cattle casings.
3 kgs per set of smallstock casings.
3.2 kgs per set of hog casings.

Average Plucks Weight — 14 kgs per set of cattle plucks.
1 kg per set of smallstock plucks.
3 kgs per set of hog plucks.

Cattle Casings

Description — Approved cattle casings should be chuted to a receiving table, where they should be emptied of their contents and defatted.

Part of the casings should be turned inside out in a tub and cleaned, and the rest should be cleaned roughly in a basin, turned and hung on hooks over the basin.

The cleaned casings should be transported in stainless steel trucks into the holding rooms before dispatch to local consumers.

Cattle Stomachs

Approved cattle stomachs should be chuted direct to a stomach receiving table, after which they should be opened and emptied over a grid, flushed and turned over a cone for cleaning.

The cleaned stomachs should be hung on hooks to drip off, after which they should be placed in stainless steel trucks and transported to the holding rooms before dispatch to local consumers.

Cattle Plucks

Approved cattle plucks should be separated on the moving top inspection table, and edible parts, such as heart, liver, kidneys and lungs should be chuted to a receiving table in the plucks cleaning department for final trimming and washing, after which they should be transported in stainless steel trucks to the holding rooms before dispatch to local consumers.

Cattle Heads

Cattle heads should be transported on special trucks to the inspection area for inspection together with the respective intestines and carcass, after which approved heads should be transported into the plucks department for splitting.

After the splitting the cheek meat should be collected in stainless steel trucks and taken to the holding rooms, after which it can be used in the meat processing department.

Skulls and condemned heads should be transported by trucks into the hashing and blowing station for processing into meat and bone meal.

Cattle Feet

Forefeet and hind feet should be properly skinned during the transfer operation, and approved feet should be taken to the feet department, where they should be scalded in a scalding tub, after which the nails should be pulled off the hooves.

Cattle Horns

The horns should be collected in trucks, after which they may either be transported to the hashing and blowing station to be crushed for processing into meat and bone meal, or they may be transported away to be used for handcraft articles or the like.

Hog and Smallstock Casings

Approved casings should be chuted to a receiving table, where they should be hand-stripped over a basin, after which they should be thoroughly stripped in a stripping machine.

The emptied casings should be kept in a water basin, after which they should be crushed and defatted in a finishing machine.

The finished casings should be put into a truck with brine to be whitened, after which they can be used as sausage casings in the meat processing plant or exported.

Casings for export should be measured and calibrated on a special table, after which they should be salted in drums and dispatched.

Casings used for the meat processing should be kept in brine or in the cold store.

Hog and Smallstock Stomachs

Approved stomachs should be chuted to a receiving table, where they should be emptied over a grate, turned inside out, cleaned in hot water, and transported to a tub for scalding at a temperature of about 80°C.

The cleaned and scalded stomachs should be hung on hooks, where the meaty and fatty membrane should be removed and transported to cold rooms for utilization in the meat processing.

Hog and Smallstock Plucks

Approved plucks sets are chuted direct to a receiving table, where the edible parts, such as heart, liver, kidneys and lungs from sheep, but not hog lungs, which are normally filled with dirty water from the scalding tub, should be cleaned, trimmed, washed, and transported in stainless steel trucks to the holding rooms.

Waste material, such as trachea, hog lungs, etc. should be transported to the hashing station and utilized for production of meat and bone meal.

Rail and Transport System

Project Basis

Chill & Holding Room Rails for Cattle	2 1/2" x 1/2" flat bar rail. Rail height 3.3 m. Average rail load 250 kgs/m.
Chill & Holding Room Rails for Smallstock/Pigs	2 1/2" x 1/2" flat bar rail. Rail height 2.3 m. Average rail load 150 kgs/m.
Freezing Tunnel Rails	2 1/2" x 1/2" flat bar rail. Rail height 2.3 m. Average rail load 150 kgs/m.
Transport and Dispatch Rails	2 1/2" x 1/2" flat bar rail. Rail height 2.3 m. Average rail load 150 kgs/m.

Description

The rail system should consist of an overhead beam system based on normal sections in accordance with DIN norms.

The secondary beam system should be fitted to the primary beams by welding.

The primary beams in the cold rooms, that is plus rooms, should be supported by brackets mounted on reinforced concrete columns, which is sufficient owing to the limited heat transmission.

The primary beams in the frost rooms should be supported by columns resting on baseplates which should be mounted on a special floor insulation capable of transferring the load.

The flat bar rails should be fastened to the beam system by means of special hangers.

In order to facilitate the transfer from one rail to another, the rails should be equipped with special rail switches secured by rail stops, which will prevent the carcasses from being pushed down on the floor.

The corridor should be equipped with double quartering sections for easy emptying of holding rooms and quick quartering before the dispatch.

The rail systems, especially in the corridor, should be interconnected to facilitate max. transport when filling the freezing tunnels and emptying the rooms.

All quarters on the rail should be weighed before dispatch, and all frozen quarters should be transported from the frost store in special trucks and weighed on a platform scale.

Treatment of Hides and Skins

Project Basis

Capacity

Washing and Trimming of 25/30 cattle hides per hour.

Washing and trimming of 50/60 skins per hour.

Description

Hides and skins should be transported on trucks from the slaughterhalls to a storage room, where they should be pre-washed and trimmed, after which they should be collected and transported to the salting and storage area.

Hashing and Blowing

Project Basis

Capacity	Blood:	Collection and blowing of max. 3000 kgs of raw blood per day.
	Inedible Material:	Hashing and blowing of max. 16000 kgs of waste, condemned materials and bones per day.

Description

The blood from the bleeding area should be collected in a blood blow tank with a charge capacity corresponding to the charge capacity of each combined blood drier and dry rendering cooker, that is appr. 2000 kgs.

The blood charge should be blown direct from the blood blow tank into a drier, in which it can be processed into blood meal within appr. 4.5 hours.

The waste and condemned material, such as condemned intestines and carcasses, trimmings and bones etc., should either be chuted or transported by trucks to the hashing station.

Condemned carcasses should be cut into suitable pieces and chuted into the hashing station.

Bones from the cutting and deboning department should be transported on a belt conveyor into the hashing room at the end of the deboning department and tilted direct into the hashing machine.

In the hashing machine the condemned parts are cut into small pieces, which should continuously be transported by a screw conveyor to one of the blow tanks.

The blow tanks should be equipped with gamma cells to secure that they will be charged with the correct quantity equal to the charging capacity of the dry rendering cooker.

The charge of appr. 3000 kgs should be blown direct into the cooker by compressed air in a closed pipe system.

The blow system should be controlled and operated from the by-products department in order to provide against wrong operation by unskilled workers.

The changing facilities for the worker operating the hashing and blowing station for condemned material should be located next to the hashing room so that this worker will not come into contact with other workers in the plant, and as the waste and condemned parts are to be collected in a separate hashing station and processed in a closed system, the plant will be effectively protected against spread of bacteria etc.

Another small, but important detail is that every person or truck entering the hashing and blowing station should pass a "foot bath" filled with sterilizing liquid to protect against transfer of bacteria.

Rendering of Inedible Material

Project Basis

Capacity

Blood: Processing of appr. 3000 kgs of raw blood per day.

Inedible Material: Processing of appr. 16000 kgs of waste, condemned materials and bones per day.

Output

Appr. 5500 kgs of meat and bone meal per day with a water content of appr. 7% and a fat content of appr. 11%.

Appr. 600 kgs of blood meal per day.

Appr. 4000 kgs of technical fat per day.

A) Processing of Offal

Description

The raw material should be blown from the hashing stations direct into the cookers.

When the cooker has been charged with a quantity of raw material equal to the charge capacity of 3200 kgs, the top valve should be closed, and steam (about 6 kgs/cm2) should be led to the steam jacket and the agitator, after which the temperature in the cooking room will rise to 100°C.

Then the vapour exhaust valve should be closed, and consequently the pressure and temperature in the cooking room will rise.

In order to sterilize the material a temperature of min. 125°C - corresponding to a pressure of about 2.4 kgs/cm2 - should be maintained for at least 15 minutes. Then the pressure should be released, and under atmospheric conditions - possibly a slight vacuum created by a jet condenser - the charge should be dried to a water content of about 7 per cent.

By reversal of the agitator the dried material (cracklings) and the free fat should automatically be discharged into a percolating tank placed in front of each cooker. The percolating tank should be equipped with a screen plate, through which the free fat should be drained and led to a fat blow tank, from where it should be transported into a fat settling tank by means of steam.

Each percolating tank should be equipped with a hydraulic cylinder, by which the material should be tilted out of the tank into a screw conveyor. This screw conveyor should transport the material from the individual percolating tanks to another screw conveyor, by which the material should be transported from ground floor level to an overlying belt conveyor equipped with metal detector for separation of metal pieces in the craklings.

From the belt conveyor the cracklings should be tilted into a centrifuge basket, which should be lifted by a hoist and inserted into one of two centrifuges, in which fat is extracted until the fat content of the cracklings is about 10-12%.

The fat extracted in the centrifuges should be pumped to fat settling tanks, and after settling the fat can either be filled into drums or pumped into a fat storage tank to be placed outside the building.

The basket with de defatted cracklings should be hoisted, and the cracklings should be emptied into a pre-breaking screw conveyor and transported direct into a grinder.

After the meal has been ground, it should be transported to a combined mixing and collecting hopper, from where it should be taken to a sacking device for bagging of meat and bone meal.

The bags should be check-weighed on a platform scale and sealed by a bag sewing machine, after which they should be stored.

B) Blood Drying

The combined cooker and drier should be charged with a quantity of blood equal to the charge capacity of 2200 kgs. By direct steam injection into the cooking room (no steam on jacket and agitator) the temperature will rise to 100°C. After this, the vapour exhaust line should be closed, and consequently the pressure and the temperature in the cooking room will rise. In order to sterilize the blood a temperature of min. 115°C - corresponding to a pressure of about 1.7 kgs/cm2 - should be maintained for at least 15 minutes.

Then the pressure should be released, and when atmospheric conditions have been obtained, the vacuum plant should be connected to the drier, and by self-evaporation the temperature will fall to about 45°C, corresponding to about 90% vacuum. Now steam (about 1 kg/cm2) should be led to the steam jacket and the agitator, and under vacuum conditions the blood should finally be dried to a water content of about 7 per cent.

By reversal of the agitator the dried blood should automatically be discharged into a suction

head and sucked into a hopper placed above a small grinder. The ground meal should be transported to a bagging device, after which the procedure is the same as described under meat and bone meal.

Refrigeration Facilities

Project Basis:

Room No.	Room Description	Air temp. °C	Storage Capacity Met. tons	Chilling Freezing tons/24h
1	Chill Room Cattle	-2/0	17.3	17.3
2	Chill Room Cattle	-2/0	17.3	17.3
3	Chill Room Cattle	-2/0	17.3	17.3
4	Chill Room Cattle	-2/0	17.3	17.3
5	Chill Room Sheep	0	5.0	5.0
6	Chill Room Sheep	0	5.0	5.0
7	Chill Room Hogs	0	4.0	4.0
8	Frost Store	-25	300.0	-
9	Freezing Tunnel	-40	5.0	5.0
10	Freezing Tunnel	-40	5.0	5.0
11	Freezing Tunnel	-40	5.0	5.0
12	Freezing Tunnel	-40	5.0	5.0
13	Ante-Room-Freezing Tunnel	+5	-	-
14	White Intestines	+2	3.0	2.0
15	Stomachs	+2	2.0	2.0
16	Plucks	+2	5.0	5.0
17	Available Room	+2	-	2.0
18	Dispatch Railway	-	-	-
19	Corridor-Chill Room	+10	-	-
20	Deboning Cattle	+10	-	-
21	Packing	+10	-	-
22	Deboning Pigs	+10	-	-
23	Cold Store-Buffer	0/+2	2.0	2.0
24	Salting Room	+10	-	-
25	Holding Room	+4/+6	2.0	2.0
26	Meat Processing	+10	-	-
27	Chill Room-Maturization	0/+2	3.0	2.0
28	Packing	+10	-	-
29	Cold Store	+2	10.0	-
30	Dispatch, Processed Goods	-	-	-

Description

The refrigeration plant should be for ammonia (NH_3) as refrigerant and should be designed on modern principles in a sturdy, industrial design, easy to operate and maintain.

Compressors:

The compressor plant should be designed as a booster plant with two compressors working in the low-pressure system and two compressors working in the high-pressure system.

The two booster compressors should operate in the four freezing tunnels and the frost store.

The two high-stage compressors should operate in chill and holding rooms, together with cooling of ice water for circulation in the processing rooms.

The above four compressors should be direct coupled to squirrel-cage motors. Max. speed of the compressor for the freezing tunnel should be 1470 rpm and 960 rpm for the high-stage compressors and the compressor for the frost store. The electric motors should be wound for 3 x 400 V, 50 cycles.

There should be one intermediate cooler between the low-stage and high-stage compressors. The intermediate cooler should be provided with an internal coil for sub-cooling of liquid. Further the intermediate cooler should act as liquid pump separator for the -10°C system.

The liquid for the -10°C system should be circulated to the air coolers by an ammonia pump. The low temperature systems should be for natural gravity circulation in the air coolers with separators for each room.

2 OF 2

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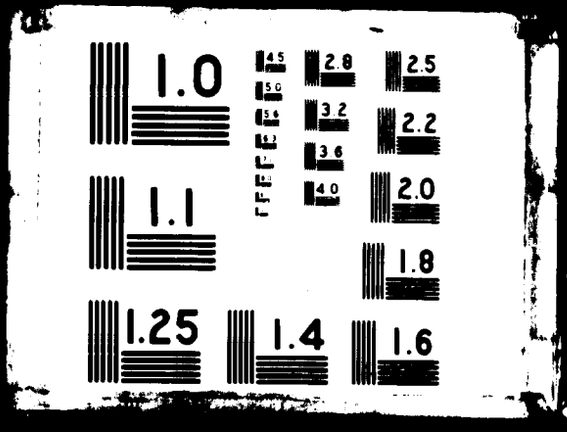


The condenser should be of the evaporative water-saving type, for mounting on the roof. The refrigeration machinery should be connected to an automatic air purger.

Freezing Tunnels:

The freezing tunnels should be designed for a capacity of 5 tons each based on meat in boxes frozen from about +7°C to -25°C in 18 hours.

No room thermostat should be used in the freezing tunnel as the temperature is to be kept as low as possible. The compressors should work until the suction temperature falls to the permitted level and should start again when the temperature rises.

The air coolers should be manually defrosted by hot gas, which should take place during the emptying and filling of the tunnel.

The defrosting should be operated manually from valves placed outside the tunnel.

The freezing tunnels should be equipped with axial fans giving high air velocity of the product.

Frost Store:

The frost store, air temperature about -23°C, should have a storage capacity of about 300 tons of frozen goods stacked on pallets to a height of about 3 m.

Laboratory Equipment

Description

In connection with the slaughterhouse there should be a laboratory for normal bacteriological routine tests, especially in relation to the sanitary operation of the slaughterhouse.

The laboratory should be equipped with all the necessary basic instruments and tables with acid-resisting surfaces as well as a special slop sink, which should also be made of material resistant to chemical attacks etc.

The laboratory should also include facilities to keep both refrigerated and frozen samples.

Bacon Production

The drained bacon sides should be hung up on smoke sticks on the smoking trucks and wheeled into the oven for hot-smoking.

Capacity of smoke truck: 48 bacon sides of appr. 8 lbs each.

Processing time for one charge appr. 3 1/2 to 4 hours, that is 2 1/2 to 3 hours for smoking and 1 hour for cooking.

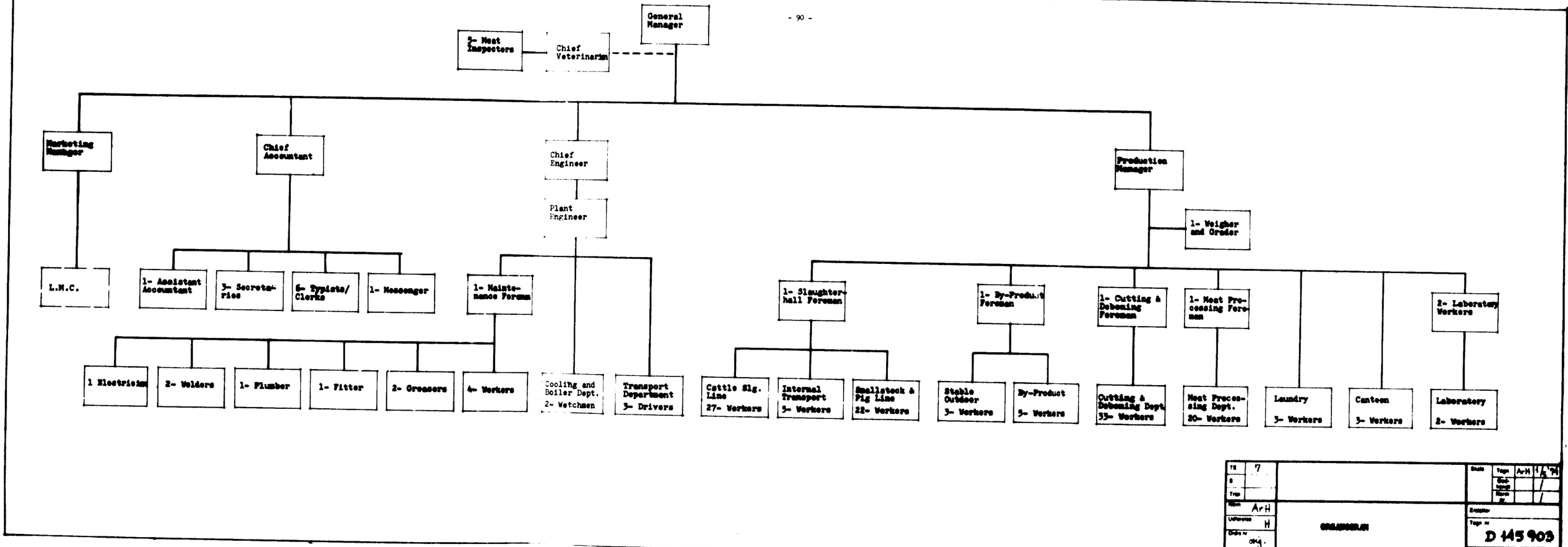
The finished bacon sides must be kept in a cold room before slicing. Sliced bacon can either be vacuum-sealed in polyethylene bags or canned.

Boneless Ham

In order to obtain the same shape and size of the hams we propose that they should be cooked in ham moulds equipped with spring lid.

The hams in the moulds should be cooked at a temperature of 84°C in the smoking oven. The processing time should be based on the weight of the ham, which means that the processing time in hours should be equal to the weight in kilos.

After the cooking process the hams should be cooled overnight, packed in polyethylene bags, vacuum-sealed, and finally cold-stored before dispatch.



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Cooling Water System:

A pump with necessary valves should be supplied for circulation of water for the condenser. The pump should start when one of the compressors is working. The cooling water for the compressors should be taken from the water tank of the condenser and circulated by a pump through the cover of the compressors. In order to protect the compressors against damage in case the pump is not working, the water pipe should be equipped with a flow switch, which should stop the compressors of the supply of cooling water stops.

Room Insulation and Insulated Doors

Description

In order to obtain an effective refrigeration of the individual working rooms and storage rooms it is necessary that the rooms should be insulated with material which should be white, have low water absorption, be resistant to attack by insects, fungi and backteria, be chemically inert, non-toxic and odourless.

Further the calculation of the plant is based on the assumption that the refrigerated rooms will be insulated with 10 cm for each 22°C of temperature difference between inside and outside temperatures.

Physical Properties of Polystyrene

			Polystyrene 20 kg/m3 = 1 1/4 lb/ft3	Polystyrene 30 kg/m3 = 2 lb/ft3
Cross breaking strength	lbf/in^2		23	30
Compressive strength - stress to give 10% compression	-		14	22
Water vapour transmission at 100°F - 90% r.h.	gr in/ft^2 h hg 50 mm thick	max	4.2	2.8
Thermal conductivity at 50°F	Btu in/ft^{2}h °F	max	0.25	0.23
Dimensional stability at 176°F	%	max	0.5	0.5
Modulus of elasticity	lbf/in^2	min	1.5	3
Modulus of rigidity	lbf/in^2	min	600	1,200
Operation temp.	°F	max	175	175
		min	no limit	no limit
Coefficient of linear expansion	in/in °F		4 x 10^{-5}	4 x 10^{-5}
Water absorption 7 days total immersion room temp.	% by vol.	max	2	2

The values mentioned are in accordance with British Standard Specification 3837 : 1965.

Standard board sizes for low temperature insulation:

width	500 mm
length	1000 mm
thickness	50-200 mm.

Tolerances approved:

on weight ± 10%
on length, width and thickness ± max. 2 mm
max. shrinking after 200 days (before cooling) 2 mm per m
deviation from straight on sides max. 1.5 mm
deviation from straight on surface max. 2 mm
all boards cut to right angles.

Execution of the Insulation Work:

A. Vapour Barrier

1. Cold Room:
   a) Walls and ceiling:
      1 x cold bitumen + 1 x hot bitumen

   b) Floor:
      1 x cold bitumen + 2 x hot bitumen

2. Frost Room:
   a) Walls and ceiling:
      1 x cold bitumen + 2 x hot bitumen

   b) Floor:
      1 x cold bitumen + Alu-sicoral.

B. Fixing Bolts and Laths:

a) Walls:
Expansion bolts to be used for fixing 3 horizontal 1 1/2" x 2" battens, which are for carrying the plastering reinforcement.

b) Ceiling:
As above, but the battens placed at a distance of 50 cm.

C. Thermal Insulation

a) Walls and ceiling:
Expanded polystyrene (density 20 kgs/m3) glued with hot bitumen. Thickness more than 5 cm in min. 2 layers.

b) Floor:
Expanded polystyrene (density 30 kgs/m3) laid in hot bitumen in min. 2 layers.

D. Finishes:

a) Walls and ceiling:
The finish should consist of a plastering reinforcement by galvanized round steels, dia. 5 mm, per 50 cm in both directions and a galvanized wire mesh laid between the steels. Reinforcing materials to be delivered by the Equipment Contractor.

b) Floor:
Polystyrene insulation covered with bitumen-impregnated felt with bitumen glued overlappings, 8-10 cm.

Additional Material:

Timber:	Pressure impregnated Swedish pine. Wooden skewers impregnated beech.
Bitumen Products:	Cold asphalt. Blown asphalt. 3 mm bitumen damp course. Asphalt impregnated felt. All delivered in non-toxic, odourless qualities.
Reinforced Material:	Galvanized round steel, 5 mm. Galvanized netting. Installation equipment.

Refrigeration Room Doors:

Cold Room Doors:
The cold room doors should be constructed as single winged, side mounted doors with door plate of white, glass fibre reinforced polyester.
The doors should be provided with contact list and window. The frame should be made of glass fibre reinforced white polyester with hinges and fasteners of hot galvanized iron.

Frost Room Doors:
The frost room doors should be made as ext. mounted slide doors with door frame and door plate of glass fibre reinforced white polyester. Hinges etc. to be made of corrosion-resistant metal with a smooth, steel-grey surface. The door frame should be provided with electric hot wire including a 42 V low-voltage transformer.

Industrial Services

Project Basis — Technical facilities in accordance with the items of the enclosed specification.

Boiler

Description — The boiler should be delivered as a unit of the modern combined three-passage flue and fire tube type.

The boiler unit should be fitted with all the necessary equipment for control of burner and pump.

The capacity of the burner should be regulated by means of a pressurestat in order to maintain a continuous and economical operation.

A water gauge control should regulate the automatic feed pump from start to stop in order to maintain a constant head of water. There should be an alarm, which is set into function if the water level should drop, and for further safety the boiler should be fitted with a device which will cut off the burner immediately in case of shortage of feed water.

All the control devices should be situated in a common control and steering panel.

In order to provide a sufficient amount of Diesel oil, the plant should be equipped with a Diesel oil tank with sufficient capacity, for example 50 m3, and with pipe connection between the oil tank and the boiler plant.

We can inform that most oil suppliers will supply Diesel oil tanks to their customers, provided that they get a contract for the oil.

Cold Water Pipe System

Complete pipe installation for cold water based on the installation of a main pipe with main stop valve according to an average water consumption of 60-90 m3/h at a pressure of 4-5 kgs/cm2 in the boiler room.

Hot Water Pipe System (82°C)

Complete pipe system for hot water of 82°C for the sterilizing facilities.

The hot water system should be a ring system in which the water is circulated by a pump to keep the same water temperature in the system.

The water temperature should be raised from 25°C to 82°C by a heat exchanger with a storage capacity of 500 ltrs.

The whole system should be completely insulated.

Hot Water Pipe System (40°C)

Complete pipe system for hot water of about 40°C for the casing cleaning and stomach cleaning department.

The hot water system should be a ring system in which the water is circulated by a pump to keep the same water temperature in the system.

The water temperature should be raised from 25°C to about 40°C by a heat exchanger with a storage capacity of 500 ltrs.

The whole hot water system should be completely insulated.

Air Compressor Plant

In order to secure a continuous operation, as most of the slaughtering equipment including blow system is based on a steady consumption of air, the compressor plant should be equipped with two air compressors to be full-automatically controlled by a manoeuvring cabinet and equipped with automatic capacity control and loaded start control.

Further the plant should be equipped with two after-coolers, and the complete pipe installation should include necessary reduction valves, filters and lubricators.

The plant should also include four air receivers in order to maintain the necessary air pressure for all the slaughtering equipment during blowing of condemned material.

Electrical Supply

Project Basis

Electric power and lighting equipment in accordance with the items of the specified installation for 3 x 380/220 V, 50cycles.

Description

The electric distribution switchboards, power cables and lighting equipment for the various buildings should be complete, including high-tension isolating switch, grounding system, main switchboard and feeding cables to the distribution switchboards, but the actual transformer station is to be delivered by Lesotho Electricity Corporation.

The lighting installation should be carried out as a surface cable installation. Where several cables run in parallel, they should be installed on cable trays.

The lighting should be controlled from the respective entrances of the individual rooms except for the necessary passage light.

A sufficient number of 220 V and 380 V socket outlets with earth connection should be installed.

All fluorescent lighting fittings should be power factor compensated.

The lighting installation should be supplied from the distribution switchboard.

Outdoor lighting installations should be placed on walls near all the respective entrances.

The illumination in the work rooms should be from 100 up to 300 lux at the inspection area.

Dimensions and Construction of Switchboards

The boards should be built together of frames with a width of 700 or 350 mm. The depth is normally 380 mm, but dependent on the size of the components to be mounted in the board.

By mounting of bars the frame should be divided into sections in a modular system of 700 or 350 mm.

The frames should be constructed with closed backs and tops so that there will be access to the components from the front only.

The boards should be supplied in normal tight design, made of 2 and 3 mm double decapering iron sheet with base frame of 3 and 5 mm sectional iron.

The mounting plates should be fastened on cross iron and movable in the depth. The lower sections should be reserved for inlets and outlets. An unloading rail should be mounted for unloading of the cables.

The frames should be fastened to the floor with expansion bolts.

After degreasing, the frames should be metallized and painted with two layers of primer, thickness totally 4 microns, after which they should be painted twice. Total thickness of layer: appr. 40 microns.

Design

Front

All operation devices, such as push-buttons, switches and change-over switches etc., should be mounted in the front plates.

In connection with the operation devices lamps of different colours should be mounted, dependent on their purpose. The lamps should be mounted to the extent necessary for safety and functional reasons.

The instruments should be mounted in the front plate at a suitable height for correct reading, considering also the total impression of the design of the board.

Name plates describing the functioning of the components should be mounted in the immediate vicinity of the components in the front plate.

Inside Design

Terminal strips for cable outlets should be mounted at the bottom of the board. The terminals should be numbered according to a clear system to facilitate the cable mounting and subsequent service and maintenance.

The wiring in the board should be carried in PVC ducts provided with grooves at the side to lead in the wires to the components. The PVC ducts should be equipped with covers providing easy access to the wires.

The pilot voltage for all electrically operated components should be supplied via pilot voltage fuses in the board.

The board should be fitted with necessary sectional switches, fuses, motor starters, switches, change-over switches and other components necessary for functional reasons.

For great electrical loads of the board it should be provided with strong copper busbars mounted at the top of the board. The busbars should be dimensioned for both electrical and physical influence at short-circuit. The busbars should be colour-coded.

Switch-Gear, Control and Distribution Equipment

Contactors

The series 1-10 amp. to 1-250 amp. contactors should be of block-type design, corresponding to IEC specifications as well as BS, ASC, ASE, VDE, SEN, Lloyd's and CSA.

All contactors with overload protection should be relieved in case of overloading and a voltage drop of at least 30 per cent of rated voltage.

Power Cables

The power installation should be made as a surface cable installation, partly in cable trays and partly on the walls.

Small motors etc. should be connected by means of flexible connections. Larger motors should be connected directly by means of cables.

Unarmoured Cables

Construction

The construction should be solid or stranded copper conductor, PVC bedding, and PVC oversheath.

Electrical Testing

4000 Volts between each conductor for 15 min.

Voltage Designation: 750 Volts.

Colour: Black.

Slaughtering Handtools

Description

The equipment supply should include a set of normal slaughtering handtools with special knives for slaughtering of cattle, pigs and sheep/goats.

Further the handtools should include special cutting and deboning knives and other special tools for the meat processing section.

For the various operations in the plant each worker in the production section should have a belt with side chain from which sheaths for knives and round steels are hanging.

For special emergency cases of failure of the electricity supply the handtool supply should also include hand-operated saws and axes so that any initiated slaughtering can be finished.

The storage should be equipped with 3- air coolers for ceiling mounting and one separator.

The room temperature should be controlled by a room thermostat.

The defrosting should be semi-automatic, operated from push buttons on the electric switchboard, and should proceed as follows:

Step one should switch on the electric heating cable for the drain pipe for a period of about 10 min. Step two should close the solenoid valves in the liquid and suction lines and should open the solenoid valves in the hot gas line.

The hot gas will force the liquid out of the cooler and separator, and the heat from the hot gas will defrost the cooler. The liquid return to the receiver should be controlled by a high-pressure float valve.

The coolers in the freezing tunnels and the frost store should be equipped with hot gas defrosting in drip trays, insulation of the drip trays, and electric heating of the drain pipes from drip tray to sewer.

In order to avoid cold loss when the doors are opened, air curtains should be mounted above the dispatch door and above the door to the ante-room at the freezing tunnels. The ante-room should be equipped with one air cooler for dehumidifying of the air when the warm product is introduced.

Workshop Equipment

Description

In connection with the slaughterhouse there should be a small workshop equipped with basic tools for normal repairs and maintenance of the machinery in the plant and also to some extent of the truck-park of the slaughterhouse.

The workshop equipment should include special erection and maintenance tools, including necessary tools for the room and pipe insulation works.

The workshop should also be equipped with all sorts of welding equipment and a sufficient number of special pipe cutters and pipe drivers, including drilling machines etc. for the pipe and beam works.

Laundry Equipment

Description

In connection with the bath and canteen facilities of the social section there should also be a laundry for the working clothes of the slaughterhouse workers so that the clothes delivered by the slaughterhouse can be kept in good repair and be delivered to the workers every day in a clean and hygienically acceptable state.

The laundry should be equipped with washing machines with built-in or separate centrifuges, tumblers and presses as well as tables for the clothes.

Cutting and Deboning

Project Basis

Capacity — Deboning and boxing of 16.8 tons of beef per day.

Description — The chilled cattle quarters should be transported from the cold block to the refrigerated cutting and deboning room on a flat bar rail with a height of 2.3 m, after which they should be taken down manually on a reception table and cut into suitable pieces with a band saw.

The coarse meat cuts should be placed on an endless conveyor band of stainless steel passing a number of workers, who should cut the meat into smaller pieces with hand-operated circular saws and knives, for example into the retail cuts shown on enclosure No. 10.2.7.

The retail cuts should be transported on and canalized to the sides of the above conveyor by a distribution device, after which a line of workers standing at the sides of the endless band should debone the steaks, so that the prepared and trimmed steaks are placed on the middle third of the band and transported to the end of it, where they are collected by a rotating Lazy Susan.

Bones from the deboning should be placed on a conveyor band over the endless band and transported direct into a hashing station placed at the end of the cutting and deboning room.

Sinews and trimmings from the deboning and trimming of the steaks should be pushed down through a cut-out slit in the cutting boards and transported in the opposite direction of the steaks by two endless odourless rubber bands, one on each side of the endless band, after which they should be collected in stainless steel trucks and transported to the cold store.

All bands, that is the stainless steel conveyor band, the conveyor for bones and the two rubber bands for trimmings, should be equipped with effective washing devices, so that the individual bands are continuously cleaned after they have been emptied.

The teflon cutting boards on the sides of the stainless steel band should also be mounted so that it will be easy to remove and clean them.

The frame of the conveyor should be made of galvanized steel and constructed without any sharp corners or other spots where dirt may collect.

After the deboned steaks have been delivered on the rotating Lazy Susan, a worker should sort them and put them into plastic trays placed at the end of a roller table, so that each tray contains appr. 25 kgs of meat, after which the trays should be transported on the table to the refrigerated packing section, where they should be placed on a table.

From the storage room for packing material open boxes with denominations corresponding to the meat qualities produced, together with polyethylene bags, should be transported by a roller conveyor under the roller table transporting the meat cuts, after which a worker in the packing section should pull the empty carton out on a scale, open the polyethylene bag, empty the contents of the plastic tray, totally appr. 25 kgs, into the bag, and control on the plus-minus scale that the carton contains the quantity stamped on it.

The empty plastic trays should be turned upside down and transported on the roller conveyor through a washing arrangement, so that they are perfectly clean before they are transported out of the packing section and back to the Lazy Susan, where they should be turned, after which they are ready to be used again.

The polyethylene bags of the weighed cartons should be closed, and the lids of the boxes should be folded up, after which the boxes should be transported on a roller table through a strapping machine. From the machine they should be transported by another roller table and distributed into separate trucks according to their contents, after which they should be transported direct to the freezing tunnel for freezing overnight and transport to the frost store the next day.

The boxes should be taken to cooling rooms/ freezing tunnel before the temperature of the meat exceeds $7^{o}C$.

Meat Processing

Project Basis

Capacity

Meat cuts in polyethylene bags:	1100 kgs.
Smoked ham and bacon:	400 kgs.
Smoked sausages:	600 kgs.
Luncheon meat and chopped meat:	2000 kgs.

The plant is calculated for production of a wide selection of processed meat products from pork, beef and lamb.

The equipment supply should be so flexible that the following can be produced in the plant:

Fresh Meat Cuts, either as wholesale cuts, retail cuts or steaks of pork, beef or lamb to be vacuum-packed in polyethylene bags.

Bacon to be cured, hot-smoked, cooled, sliced and vacuum-packed or canned.

Ham with Bones to be cured, cold-smoked, and ripened.

Ham without Bones to be cured, cooked, smoked, cooled, wrapped in polyethylene and vacuum-packed.

Sausages: Various sausages for hot smoking and/or cooking, such as vienna sausages, frankfurters, breakfast sausages, mortadellas, etc.

Canned Products, pasteurized and sterilized, such as luncheon meat, corned beef and various chopped meat products.

Deboning

Description

Cattle quarters, pig halves or sheep carcasses should be transported from the chill rooms to a special cutting and deboning department, where they should be cut into suitable pieces with a band saw.

The individual meat cuts can be deboned and trimmed on a cutting and trimming table or be prepared on separate trimming tables as special cuts of beef, pork and lamb to be sold in local butcher's shops.

The finished meat cuts should either be taken to the cold store or to the packing room, whereas trimmings and other unmarketable meat products should be transported to a curing and pickling room, where they should be dry-cured or pickled depending on the subsequent sequence of operations.

Dry-Curing

Bags of salt are transported from the salt store to the holding room, after which the individual pieces of meat are packed in the salt in stainless steel trucks, where they should remain for some hours or days, depending on the product to be obtained.

Pickling

Pickle with a suitable concentration of salt should be made in a storage tank, after which the meat should be pumped up with pickle by means of an injection needle and a pumping arrangement. The pumped-up meat pieces should be put into a stainless steel truck with a suitable quantity of pickle, where they should soak for some time according to the final product desired.

The truck with the pickled meat should be transported to a funnel, where the drain plug of the truck should be removed, after which the pickle can be pumped back to the storage tank.

Bacon sides, hams and similar products should be hung on stainless steel hooks for drainage, whereas the trucks with the finished pickled products should be transported to the meat processing department or to the cooking and smoking section.

The individual processes are as follows:

Bacon and Boneless Ham

The meat cuts for these productions should be trimmed, deboned, and transported to the curing and pickling room, where pickle should be injected by means of a multi-needle injection device, after which the products should be stored in stainless steel trucks with pickle for 24-36 hours.

Capacity per truck: appr. 60 bacon sides of appr. 8 lbs each.
appr. 100 hams of appr. 5 lbs each.

The cured products should drain on pipe rails for at least 4 hours.

We have calculated with a one-truck capacity hot smoke oven, in which the products can also be cooked.

Ham with Bone

Hams with bones should be trimmed, injected with pickle, cured in a curing truck for appr. 72 to 80 hours, and drained, after which they should be smoked for appr. 10 to 14 days in a cold smoking cabinet, for which we have calculated with 4 trucks.

Capacity per truck: 30 hams of appr. 7 kgs each = 210 kgs = totally appr. 800 kgs.

A large variety of other meat cuts, such as smoked loins or shoulder rolls, can be produced in the hot-smoking cabinet.

The charge per smoking truck can vary from 200 to 400 kgs - processing time appr. 3 hours, that is 2 hours for smoking and 1 hour for cooking.

Sausage Production

In order to utilize all small meat cuts, such as trimmings and uneven cuts, it is important to include a sausage production.

The small meat cuts should be dry-cured and stored in the curing room overnight, after which they should be chopped in a bowl chopper, into which water, spices and other ingredients should be added according to the product wanted.

The final chopped product should be filled into a sausage filler, which presses the product into casings, after which the sausages are ready for further treatment, that is either smoking or for some sorts cooking only.

Chill Rooms:

There should be four chill rooms for cattle, corresponding to two days' slaughtering. The air coolers should be designed for each of the rooms used as chillers, whereas the compressors should be dimensioned for two rooms used as chillers and two rooms used as holding rooms.

The room temperature, about 0°C, should be controlled by room thermostats. The fans should be of the 2-speed type, for manual change-over between full and half speed. The low speed should be used when the rooms are being filled with cattle, and when the rooms are used as holding rooms.

The air coolers should be defrosted when the room is emptied, when the solenoid valves in the liquid and suction lines are closed, but the fans still working. The air temperature should rise to about +5°C and defrost the coolers. For supplementary defrosting, a hot gas pipe should be connected to the coolers, with stop valve for manual operation.

The air coolers should be mounted above the rail system, blowing horizontally out in two directions.

The chill rooms for the sheep should be designed in the same way, with the compressors calculated for one room as chiller and one room as holding room.

The chill room for hogs should have two air coolers for ceiling mounting, and the air temperature should be controlled by a room thermostat. The air coolers should be semi-automatically defrosted from the switchboard.

Vienna Sausages - to be hot smoked

Capacity per truck: 52 sticks for 2 kgs each = 100 kgs.

Processing time: 1 hour, that is 45 minutes for smoking and 15 minutes for cooking.

Frankfurters - to be hot smoked

Capacity per truck: 52 sticks for 2.5 kgs each = 125 kgs.

Processing time: 1 hour (as for Vienna Sausages).

Breakfast Sausages - to be cooked only

Cooking time in vat: appr. 10 minutes.

Luncheon Meat, Corned Beef etc.

The sausage stuffer should be equipped with a special charging device, so that it can also serve to fill cans with luncheon meat (preparation almost the same as for sausages) and corned beef, which is cooked, as well as cubed beef pieces.

Canning

A canning plant should be included for the luncheon meat and corned beef production. Also sliced bacon and vienna sausages can be canned.

After the cans have been filled, they should be closed in a vacuum-closing machine.

The vacuum-closed cans should be pasteurized/sterilized in a vertical autoclave equipped with two baskets.

Charge capacity: 100-?00 cans per batch, depending on can size.

Processing time: Varying from 2 to 5 hours depending on product.

Semi-pasteurized/sterilized products should be stored under cold conditions, whereas fully pasteurized/sterilized products can be stored under normal conditions.

The cooked, smoked and autoclaved products should be transported to a chill room, where the core temperature should be reduced to 3-5°C. The product surfaces should be dry.

From the chill room the products should be transported to a packing room, where they can be weighed and packed into plastic bags for rather small quantities and/or direct into larger cartons. For the packing room we have also calculated with a double chamber vacuum-sealing machine for polyethylene bags. The machine is intended for bags of up to 180-200 mm.

Various Equipment

Description

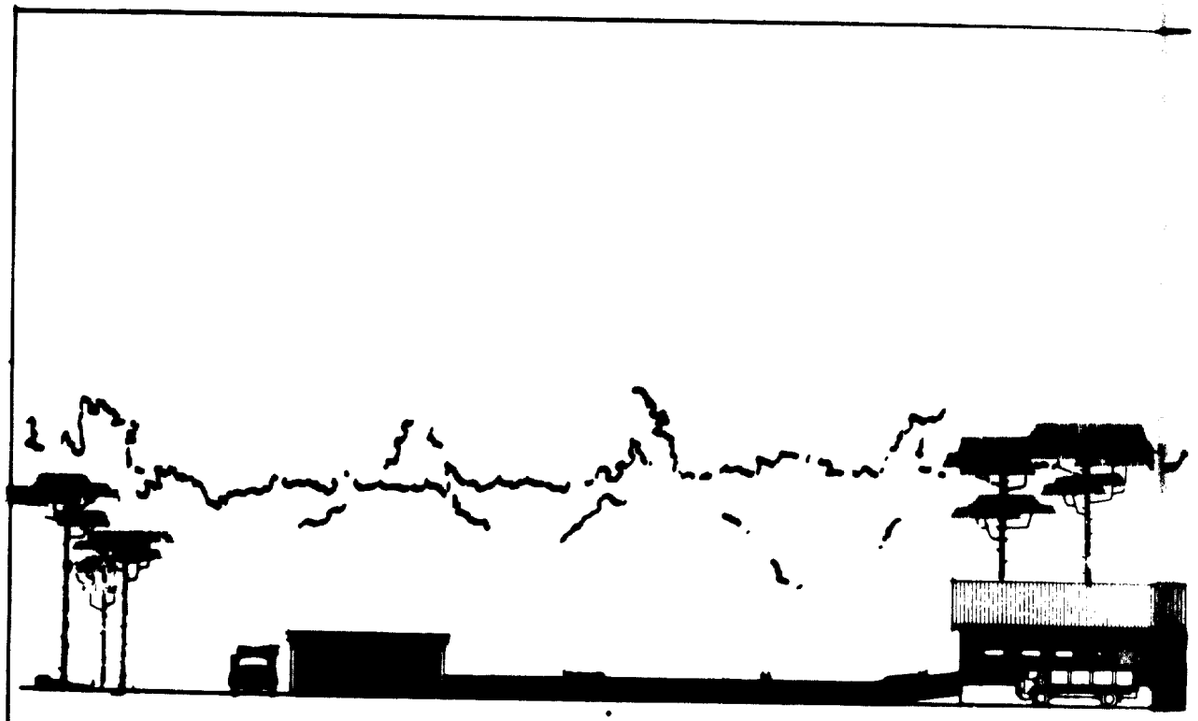
This section should include equipment that does not naturally come within the other sections.

In order to complete the installations of the plant, the section should include sanitary equipment for social rooms, consisting of wash basins, toilets, etc., including batteries, necessary fittings, and connecting installations. Furthermore equipment like air conditioning units, refrigerators and electric cookers should be included for the social building and laboratory. Lockers for changing rooms, intercommunication equipment and furniture, however, should not be included.

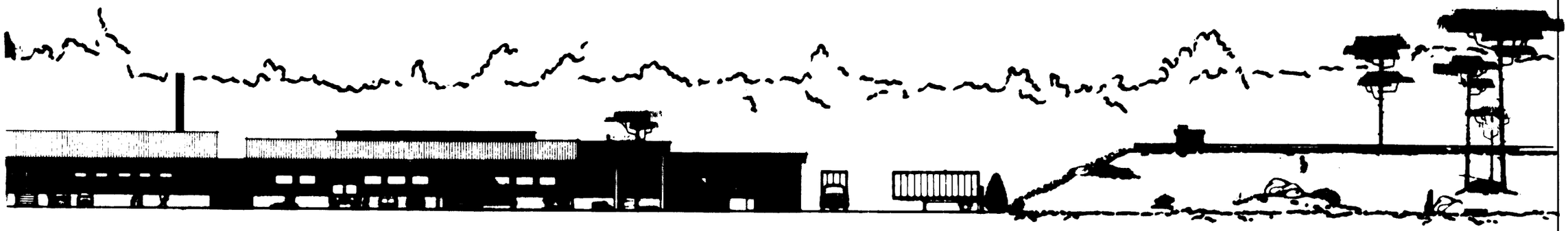
There should be two refrigerated trucks, each with a load-carrying capacity of 5 to 10 tons of suspended meat. Each truck should consist of a semi-trailer chassis with driver's cabin, motor and gearbox, a semi-trailer with insulated refrigerator box, and refrigeration plant with air-cooled two-cylinder Diesel engine.

Spare Parts

Description In order to prevent any interruptions of operation arising from breakdown of individual machines etc., the equipment supply should include an extended set of spare parts covering at least two years of normal consumption.

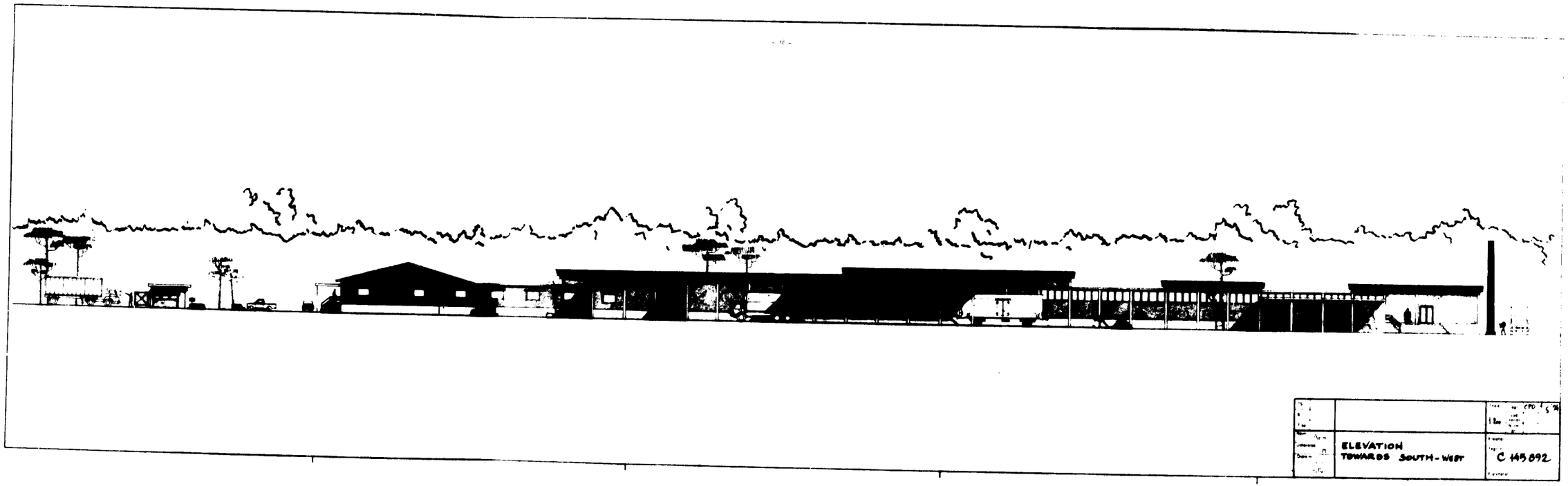


SECTION I

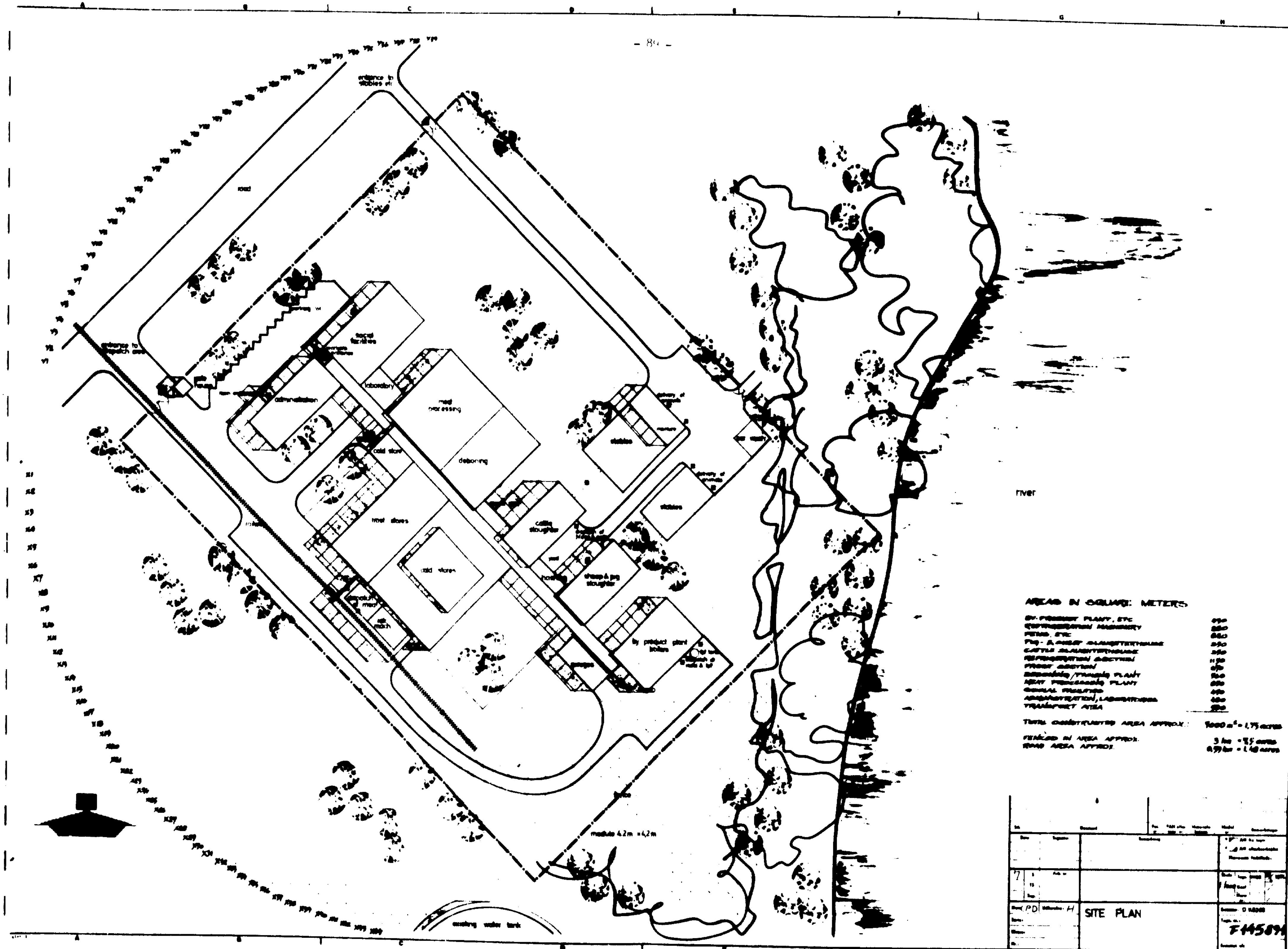


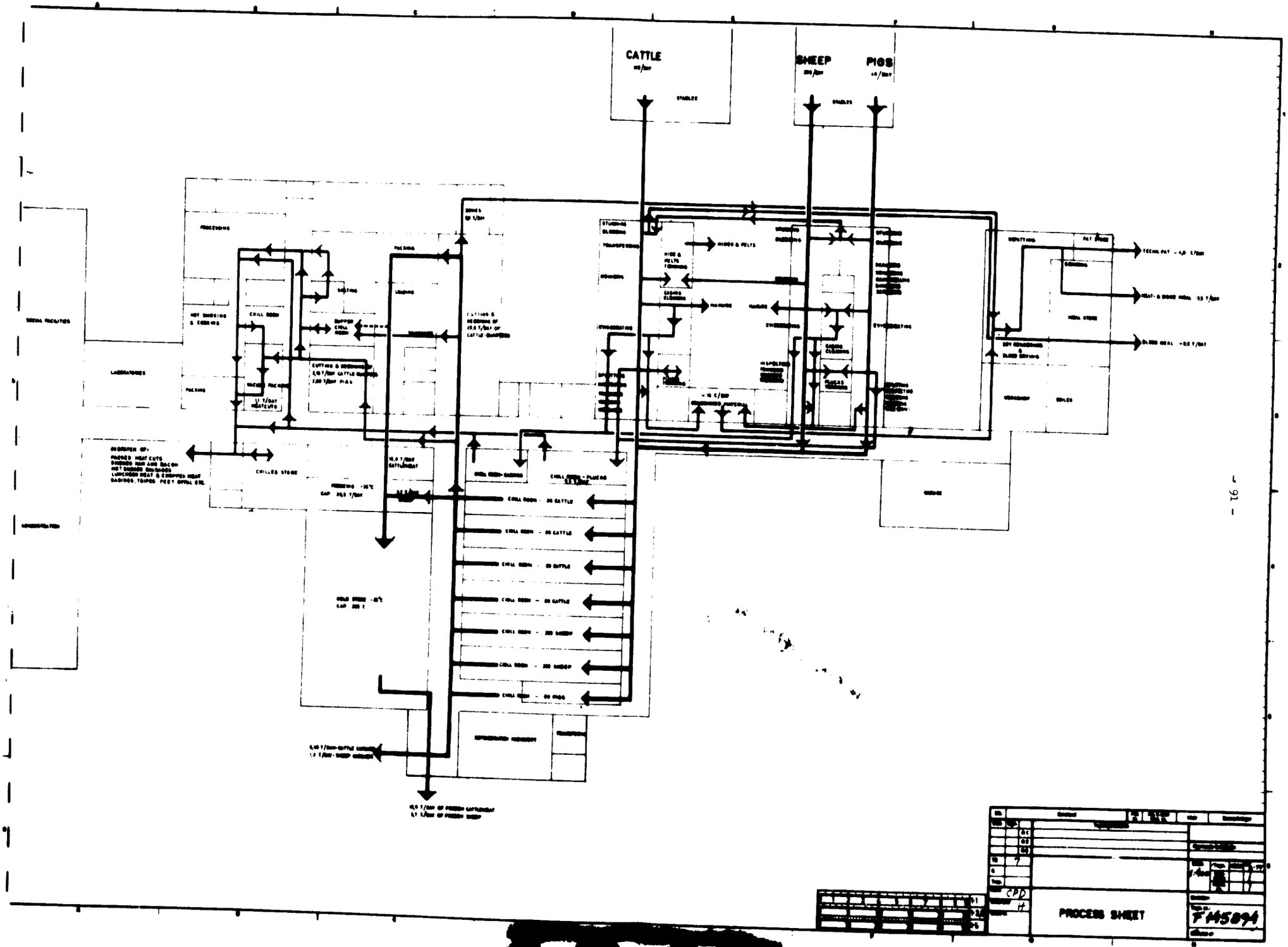
	ELEVATION TOWARDS NORTH-WEST	C 145 040

SECTION 2



	ELEVATION TOWARDS SOUTH-WEST	C 145892


entrance to stables etc
road
social facilities
administration
laboratory
meat processing
deboning
cold store
frost stores
cold stores
cattle slaughter
sheep & pig slaughter
stables
by product plant boilers
garages
river
AREAS IN SQUARE METERS
module 4,2m x 4,2m
existing water tank
SITE PLAN


CATTLE
SHEEP
PIGS
PROCESS SHEET
FH5894

The chill rooms for the intestines, air temperature about +2°C, should be equipped with air coolers for ceiling mounting, with insulated drip trays, and for natural defrosting by circulation of the air with the solenoid valves in liquid and suction lines closed. The room temperature should be controlled by a room thermostat.

Dispatch Rooms:

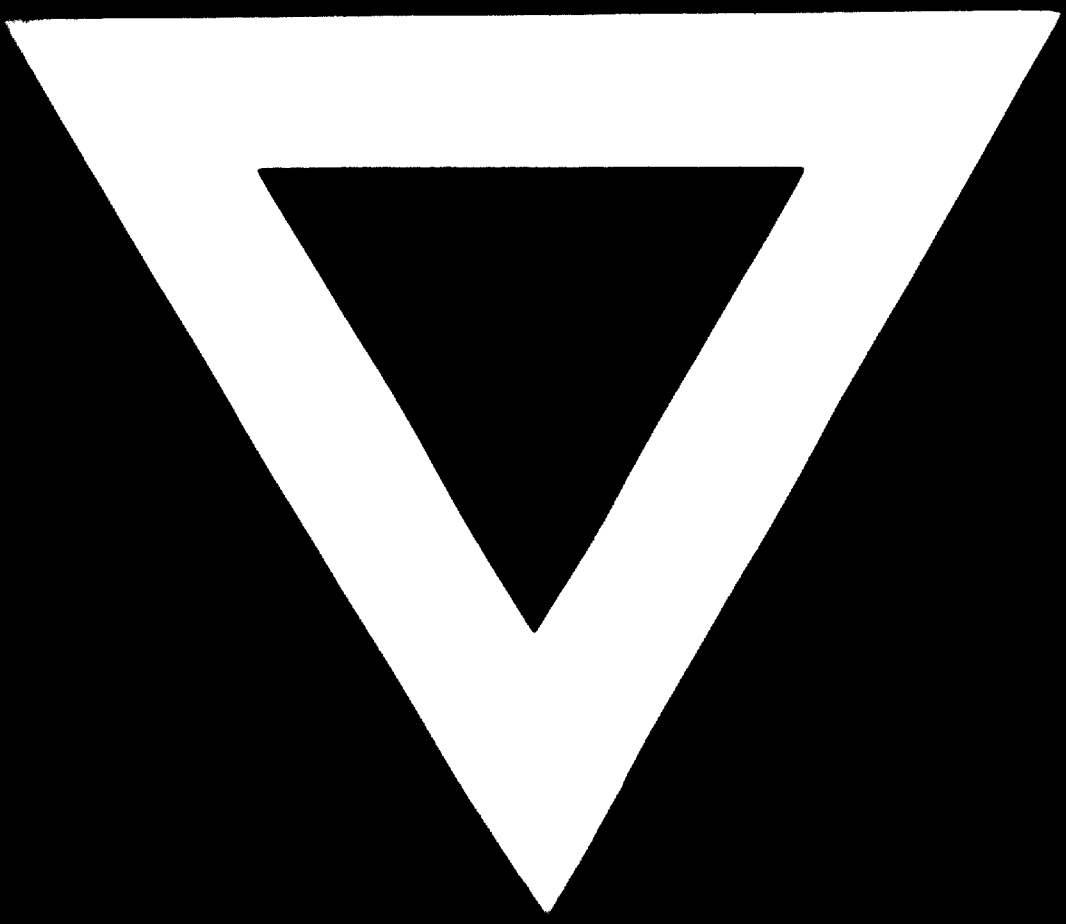
The dispatch rooms to the railway and for the processed goods should be equipped with air coolers for dehumidifying of the incoming air and for keeping a suitable air temperature. The corridor in front of the chill rooms should be equipped with air coolers for keeping the temperature about +10°C.

Chill and Holding Rooms in the Processing Factory:

The frost stores, salting room, holding room and chill room should be equipped with air coolers for ceiling mounting, connected to the -10°C system. The room temperatures should be controlled by room thermostats.

Processing Rooms:

Deboning rooms, packing rooms, and the meat processing room should be equipped with air coolers for ceiling mounting, cooled by circulation of ice water and with reduced fan speed. The room temperatures, about +10°C, should be controlled by room thermostats opening and closing solenoid valves in the ice water line. The fresh air supply should be provided by a duct system leading fresh air to the air coolers, and a duct system with fan should remove the used air from the rooms.



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