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SITE SELECTION, PLANT LAYOUT AND CONSTRUCTION OF INDUSTRIAL MEAT PROCESSING PLANTS 1/

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INTRODUCTION

The consumption of processed meat products is rapidly increasing with the industrialization of slaughterhouses and processed meat factories. The development of modern distribution systems for perishable foods, mainly through intensive application of refrigeration, new protective packing materials, and introduction of container traffic, contributes to the fact that there are to-day hardly any limits as regards the distances between producer and consumer. This fact is naturally widening the scope for export of processed meat products from developing countries with potential livestock resources, primarely in South America and Africa, to the potential consumer markets in other parts of the world, primarely in U.S.A., Europe, and Japan.

There is a great deal of knowledge about planning and construction of industrial slaughterhouses and meat processing plants in the developed countries. However, the system of livestock supply, quality of raw material, local customs, climatic conditions, work patterns, etc. vary so much between the different countries, that a detailed study of these factors is required to make efficient use of existing experience at places where industrial meat processing is to be introduced, or the existing industry is to be reconstructed.

Attention must also be paid to the special requirements of the domestic as well as the potential export markets, since these effect the selection of processes and the choice of equipment, plant layout, and methods of operation.

This paper deals with the subject of planning new industrial meat processing plants in developing countries for the purpose of obtaining a better, and for these countries more profitable, utilization of the various kinds of meat products and slaughterhouse by-products to the benefit of both domestic and export markets.

SELECTION OF SITE

It is assumed that reliable country-wide surveys of both the livestock and the meat market situation in the country, where a new meat industry is going to be developed, is available as basis for planning of such industries. In other words, it is assumed that a private or public company wishing to establish a new plant of this kind in a developing country, can get the necessary information for setting up a realistic production programme and for selecting the geographical area most suitable for the purpose.

The feasibility of a project depends on many factors, one being the capacity and degree of utilization of the plant. In the developed countries, it is generally recognized that the optimum capacity in modern meat industries is related to the degree of mechanization. However, when starting a new industry of this kind in developing countries, there are so many other factors to consider that it is not possible to generalize by stating an optimum capacity to be aimed at in all instances. The individual circumstances in each project must be carefully studied and evaluated by the experts responsible for the conclusions of a feasibility study.

Industrial meat processing plants in developed countries are very often located close to the consumer areas and they draw their raw materials from slaughterhouses in the producer areas. This can very well be a dangerous procedure to follow for developing countries because of the great risk to start the processing with inferior quality of raw materials caused by transportation under different climatic and sanitary conditions. Furthermore, the stringent requirements to keeping quality of products to be exported to overseas countries have to be considered.

The more safe approach to the development of meat processing industries exporting to developed countries is to plan such industries in conjunction with the slaughterhouse providing fresh raw material for processing.

As the labour savings through plant mechanization are problematic in developing countries, the optimum capacity of a plant will usually turn out to be lower, due to the lower capacity of less sophisticated equipment.

The fact that exporting meat processing plants should be operated in connection with a slaughterhouse also has influence on the optimum capacity. The quantity of products to be economically disposed of on the domestic market is more or less determing the slaughtering capacity and thereby the quantities available for export purpose.

The present relatively few exporting meat industries to-day operating in developing countries concentrate on export of frozen boneless beef, cooked frozen beef, corned beef, and other sorts of canned beef and pork products. The best quality raw materials are used for export purpose, leaving lower grades and by-products to be disposed of on the domestic markets.

To-day, it is realistic to believe that improvements in quantity and quality of livestock production and processing methods can lead to production of bigger quantities of traditional products as well as acceptance of new types of products, e.g. cryovac packed chilled meats being available for export. The balance between exported quantities and the quantities for the local market may thus change to the advantage of an increasing export trade without neglecting the local requirements. These possibilities should be carefully surveyed and considered in each individual project before a decision is taken regarding the optimum production programme and capacity for which the plant shall be designed.

The realization of projects of this kind needs, from the very beginning, the assistance of specialist consultants with the necessary experience to provide the project promoter with technical and economical information in the form of an outline layout as basis for a feasibility study. Such a study is generally also required to obtain the necessary financing of the plant and its operation.

Appendix I illustrates a typical outline layout elaborated for a South American beef slaughterhouse combined with a meat processing factory and cold store, 50 per cent for export and 50 per cent for home market.

The purpose of an outline layout is to give the project promoter an idea about the layout size and cost of the plant required at an early stage of the project. He may for instance ask the specialist consultant to elaborate an outline layout for a plant capable of slaughtering 400 heads of cattle per day over 5 days per week or 100,000 heads per year; the average live-weight of the animals being 396 kgs and the carcase weight 200 kgs per head. Half the boned-out meat to be processed for export of various products. The other half to be prepared for the home consumption. All by-products to be utilized industrially in the most efficient way, partly for export, partly for the home market. The type and quantities of all end products for export as well as for home market to be specified in more details according to available market surveys.

On this basis the consultant will estimate the quantities of the many different raw materials deriving from the animals and illustrate the complete break down in a general production flow diagram.
The estimated quantities of various categories of raw material are used for a specification of the necessary process equipment in the different process departments and for dimensioning these departments.

An outline layout can now be designed and placed on an idealized site (not selected at this stage).

The consultant will - based on his experience - state the approximate quantities of water, steam, electricity, etc. required for the operation with a view to dimensioning the necessary service facilities such as boiler house, engine rooms, waste water disposal plants, electric power stations or transformer stations. He will also from his experience specify the necessary personnel required with a view to planning all social facilities in- and outside the plant.

The consultant will finally give a rough estimation of the costs of the plant. All this information will then be used by the project promoter and his financial adviser for the preparation of a proper feasibility study including cash flow during planning and construction and during operation, which is usually required for financing purposes.

The project promoter will furthermore at this stage, on the basis of the outline layout and the preliminary feasibility study, evaluate the profitableness of the various production lines, and he may want to adjust the quantities and other details of his first production programme if he finds such adjustment motivated.

Having made his final decision regarding the type and quantity of production and having organized the financing of the project, the time has come for him to decide on the geographical location and thereafter the most suitable site within this location. The outline layout gives him the dimensions of the site and information about the services to the site which he shall try to obtain.

Location

The geographical location which offers the best opportunities for accomplishing the desired optimum production with possibilities for future expansions should be chosen for the project. The first requirement of this location is the availability of suitable livestock in quantities and qualities for securing a steady supply within a reasonable distance from the plant.

It has already been mentioned that the quality of raw material for processed meat products is of utmost importance for the success of an export trade, and the keeping quality of meat depends on the health conditions of the livestock immediately before slaughter. The duration of transport, the means of transportation, the climatic conditions under which the animals are transported, - all this plays an important role for the quality of the meat.
This is generally recognized in modern meat industries with the result that slaughtering is gradually transferred from the public abattoirs in large cities to industrial slaughterhouses in the rural areas where livestock in good condition is readily available. This trend will no doubt sooner or later also be experienced in developing countries, although the tradition of giving preference to fresh slaughtered meat instead of refrigerated meat is difficult to abandon. However, when thinking of developing ar export trade, the meat which comes from exhausted animals slaughtered in public abattoirs, cannot be accepted under the prevailing conditions.

In other words, a meat processing plant for export from developing countries should be located in combination with an industrial slaughterhouse in a livestock producing area. It is not advisable to separate the operations of slaughtering and meat processing for export purpose before the standard of slaughterhouses and distribution systems has reached a much higher level of health and quality control than is the case to-day in developing countries.
Separation of slaughterhouses and meat processing factories is found in developed countries, however, this is mostly where the processed meat products are manufactured for domestic consumption and under strict health control within the same country.

Another requirement to the geographical location to be chosen for the project is that it should be located at an acceptable distance from export harbours and from consumer areas in order to find a local market for such products and by-products which cannot be exported.

The location should preferably be developed with roads and railway services and be inhabited with a population from which suitable skilled and unskilled labour can be recruited. Public services for supply of electricity and potable water as well as waste water disposal are of course also advantages to be considered, but not always a condition, as these facilities can be established privately.

There are many, more or less important, factors to be considered when choosing a location e.g. climatic conditions, local ordinances and taxation systems, building codes, and restrictions, availability of materials for the plant construction and of skilled and unskilled construction labour, and, not to forget, cost of land, local labour and other costs in relation to the figures on which the feasibility study is based.

The Site

After having chosen the most desirable geographical location for the project, the problem of finding a suitable site for the plant within this location arises. Most likely the location chosen for the project will, as recommended above, be in a rural district but not too far from inhabited areas like provincial towns or villages which can supply some of the above mentioned services.

First of all the most desirable size and shape of the site should be determined. Normally the outline layout includes information about the approximate areas required for the various slaughtering and processing departments of the plant, as well as for auxiliary departments such as power- and boiler house, compressor rooms, offices, canteens, and social rooms for employees, workshops, lairages, and stores of all kinds. The study includes information about the approximate requirements for supply of electric power, potable and nonpotable water, as well as waste water disposal.

The outline layout will also include recommendations regarding one- or multifloor layouts, necessary provisions for expansion, whether railway siding is required and whether areas for car parking, management- and employee housing quarters should be foreseen.

Most of this information is contained in the layouts of the plant itself and in a plotplan, showing an ideally dimensioned site providing space for traffic areas and green areas for expected expansion and unforeseen activities.

The task is now to find a site within the geographical location which will satisfy all or most of the above mentioned requirements. The site should not be located close to any other industry, giving off unpleasant or perhaps noxious odour, smoke and dirt objectionable to a food industry. Nor should it be so located that it can cause disturbance for instance to a nearby housing quarter.

Even if the ideal site plan in the outline layout includes areas for expected expansion and unforeseen activities, it will be wise, if at all possible, to select a site which is not beforehand totally enclosed by other factory sites or unobtainable sites. It is impossible to know what the future production requirements will be. It has often been seen that new factories built in open space far outside towns or villages, 25 years later are completely surrounded by new housing or industrial developments hindering further expansion.

It may well be an advantage to find a site close to country streams, springs or wells from which either water can be supplied or waste water can be disposed of in its present form or after appropriate treatment. Even if the water from such sources cannot be used inside the plant, it may well be a saving to use it for outside purposes such as for cooling towers (refrigeration condensers) for lairage, car and truck washing and similar purposes.

The ideal site should be flat, having a rectangular shape of a length of $1\frac{1}{2}$ times the width. It should be located reasonably close to good public roads and if possible with facilities to establish a railway siding without too high a cost. However, it is not a condition that the site is flat. Under some circumstances it may even be an advantage if it has a moderate slope which can be utilized in the layout so that two floors can be served from vehicles. On the other hand, the site should not be so hilly or rocky that it will be costly to level it out.

Before a final decision is taken, it is most important to obtain soil tests from experts giving reliable reports on the composition of the soil and its bearing quality. Negligence in this respect has very often been a costly affair if building constructions have to be supported by piling or other expensive foundations or if rocks have to be removed.

The most important requirements to the geographical location and the specific site for a combined industrial slaughterhouse and meat processing factory have now been mentioned, but normally, it is not possible to find a site which will satisfy all these requirements.

Compromises will mostly be necessary and it will be important for this purpose to have a consultant's advice in the evaluation of the many factors to be considered. This evaluation should be thoroughly discussed between the project promoter and the consultant for the purpose of finding the site rendering the best obtainable conditions. It can be a costly and time wasting affair if the wrong geographical location for the project, or the unsuitable site for the plant is selected.

PLANT LAYOUT

Having settled the question of site location, the design of the plant layout may be started.

Whereas the outline layout is prepared for the specific purpose of getting a first idea of the size and cost of the plant for use in the feasibility study, it is now a question of considering the layout from a technical and operational point of view for the purpose of obtaining the most efficient and economic operation and adaption of the layout to the particular features of the site.

An industrial slaughterhouse with full by-product utilization and meat processing for various purposes, must to-day be looked upon as a single factory unit consisting of buildings, machinery, land, tools, materials, labour, management and services utilized for the production of the finished goods ready for marketing.
The planning of a factory must take all these items into consideration and provide for them as well as for the mental and physical well-being of the working personnel.

The days of designing a building and then fitting the production processes into it are rapidly passing, having given way to a more orderly and logical series of procedures. The manufacture of products is the objective. Naturally, then, the products determine the equipment necessary for its own manufacture. The volume of products determines the number and size of equipment units in the different processing lines, which in turn determine the auxilliary services and floor space required.

The combination of the sequence of operations, the volume by weight and units and the floor space requirements will largely determine the design of the buildings that house the factory.

When provisions for the physical and mental well-being of the workers, the services required, the facilities for carrying out the business and possibilities of expansion are included, the factory plan or layout has begun to take shape.

The first expression in this direction is the Preliminary Layout. It is usually elaborated with plans, typical section and front views in a small scale of 1:200, and a site plan in 1:500. The drawings are accompanied by brief technical descriptions and cost estimates.
This serves the purpose of giving the project promoter as well as the appropriate authorities, who may have to approve the plant, a first picture of the layout incorporated on the site.

The preliminary layout is submitted as a proposal for discussions about its principal features between the designer, the project promoter and the appropriate authorities. It is wise to hold such discussions at this early stage of the project, so that personal opinions and alternative proposals can be considered before the next stage, which is:-

The Final Layout

This layout usually includes plans, sections and front views of all buildings in a scale of 1:100 and site plans in 1:500 or bigger, as well as plans in 1:100 indicating arrangement of the proposed processing machinery, equipment and conveyor system, the systems of refrigeration, of services supplying cold, warm and hot water, heating and ventilation, air-conditioning, steam, compressed air, electric power and lighting, sewage treatment and other services required.

These drawings are accompanied by a complete room specification, giving the requirements for temperature and air-conditions, type of lighting as well as quantities of supply of water, steam, compressed air, and type of floor drains, of floor and wall materials, etc. The machinery and equipment to be installed in each room are also listed in the room specification.

The final layout, comprising all the above mentioned plans with the room specification, serves the purpose of illustrating and describing in more detail all features of the project of importance to the operation and to the final approval by the owner and the appropriate authorities.

The construction of the plant should under no circumstances be started before such approval has been obtained from all parties concerned. It is to be recommended that the owner at this stage appoints the future factory manager, who shal be responsible for the operation of the plant, so that also he can give his approval to the final layout.

Any alteration to the layout after this stage may be very costly and time wasting during construction and still more costly after construction. The layout of the plant must on the one hand be "tailor-made" to the specific production required and on the other hand be so flexible that it allows for future expansion as the production grows or that new production lines can be added without too much disturbance to the daily operation.

The layout must comply with all rules from the veterinarian authorities, not only in the home country but also in the countries to which its products shall be exported. Unfortunately these veterinarian requirements are not all the same in the different countries, but it is wise to design the main features of the layout so that it can be accepted by the veterinarian inspectors of the countries having the most strict requirements such as U.S.A. and the European Common Market countries.

It would be longwinded in this paper to go into details, but one of the most important requirements is a proper separation between areas and departments for "clean" and "unclean" operations.

The layout determines the size, shape and construction of all buildings as well as the placing of the individual building blocks in relation to each other. It determines the flow of production, and therefore is responsible for a great part of the economy in construction as well as in operation.

The sitework and the buildings with services usually represent more than 2/3 of the total cost of the project leaving 1/3 to process equipment and special refrigeration. Any savings in unproductive building areas are consequently of importance to the cost of the project.

It is generally claimed that 1/4 or more of the labour in a plant of this kind is spent on handling from one point of operation to another. It is therefore of the utmost importance to keep such unproductive handling at a minimum. Mechanical conveyors are one of the means to reduce labour in handling, but equipment adds to the cost, whereas a proper layout, providing for a smooth flow of the products without excessive handling, can save considerable costs in operation without extra investment in equipment. Reduction in labour is, however, not entirely an economical advantage. It is also a sanitary problem. The less man-handling, the less danger of contamination through spreading of bacteria on the surface of the meat. This fact should also be considered when weighing cheap labour against expensive mechanical handling.

One of the typical ways to solve the handling problem in moving the products from one department of operation to another by means of the layout is the multifloor solution, in which the products may be dropped from one department to another by gravity through chutes. This solution is of special advantage where a separation between "unclean" and "clean" departments is required, of course provided that sanitary designs and proper ventilation of the chutes are established. The multifloor solution may be seen in almost all meat packing plants of older design, particularly those located in urban districts, where land is expensive.

It is nevertheless a fact, that practically all modern layouts of industrial meat plants are one-floor layouts or partly two-floor layouts, whereas multifloor layouts are only maintained as the last solution on restricted site areas.

The reasons for this development are as follows:-

1. Modern industrial meat plants are, as mentioned before, placed in rural or suburban areas where cost of land is of less importance.

2. Multifloor plants must have staircases and lifts, which are bottlenecks in the movement between floors, and they require extra building area not necessary in one-floor layouts.

3. Multifloor plants impose the expensive and difficult task of keeping the floor insulation membrane intact. The constant wetting, temperature fluctuations, and bearing loads, to which the average floor in meat plants are subjected, give the membrane a short troublefree life. The single-level factory unit eliminates this costly need of maintenance.

   A single floor supported on soil provides flexibility, permitting installation of any available modern equipment in future regardless of weight or height.

4. The application of modern building structures, using standard prefabricated elements, can be utilized to a much greater extent in a single floor unit than in multifloor units, being more dependent on traditional in situ reinforced concrete structures.
   This fact can not only be an important economic but also a timesaving factor during construction.

5. A multifloor construction is generally much more difficult and uneconomical to expand and alter when required in case of unforeseen developments.

6. It is generally more difficult and costly to supervise the production efficiently in a multifloor factory operation.

7. Modern technique to-day offers so many new satisfactory means of sanitary and economical mechanical conveyance between various points of operation in a processing line, that the application of gravity no longer is the determining factor in layout solutions. For example, Pneumatic transport systems provide excellent solutions to cheap and sanitary transport of a great variety of products through tubes in all directions and over all distances within a factory unit.

These are some of the many factors to be considered in the layout stage of the project. The great variety of combinations of production, questions regarding the joint operation of slaughtering and by-product utilization on the one hand and type of meat processing for the home market and/or for export on the other hand, are of utmost importance to the design of the layout.

It is not indifferent to the layout which categories of animals are going to provide the raw material, in which form and in which quantities. Should the processing cover the full variety of home market products from fresh meats to cured and smoked meats to all sorts of sausages and other cooked meat products? Should the processing for export be concentrated on chilled and/or frozen fresh meats or cooked frozen meats or canned meats, and if so of which sort and in which quantities?

The designer of the layout must have a thorough knowledge of the technology in all the different processes required, so that he can select the right type of processing machinery and equipment as well as the technical services for covering the particular combination in the production required.

The differences between the various geographical locations regarding availability of skilled and unskilled labour as well as building material and local traditions, must also be taken into consideration in the layout stage. This means that the designer of the layout must beforehand make himself acquainted with the local possibilities both from a technical and an economical point of view, otherwise the risk of planning a layout which has to then be adapted to the local conditions afterwards is very real. Such risk should definitely be avoided, as all changes and amendments to the final layout, after its approval, will cause extra costs and delays in the construction phase of the project.

It is evident that the incorporation of all the above mentioned considerations in the final layout requires the services of a specialist consultant with the experience in designing industrial meat processing plants under the various conditions found in the various parts of the world.

Standard layouts of this kind are impossible to prepare.
Each particular project requires its own particular layout prepared on the basis of expert studies of the required production, the special local conditions, and environments prevailing in the geographical area, where the plant is going to be established.

Appendix II shows a layout as an example of a project in Asia, with a very specific production and under rather special local conditions.

It is a project for a combined slaughterhouse and meat processing plant in Goa, India for 93,000 heads of bullocks and buffaloes per year for the export production of frozen cooked meats, canned corned beef, and corned buffalo, petfood, meat extract, inedible tallow, hides, bone and meat meal, blood meal and casings.

The information included in this appendix is limited to the preliminary layout of the main factory building, the inedible building and a site plan indicating the location of the plant in the particular geographical area.

Furthermore it includes a brief description of the processes and procedure at the plant, of the building site, building construction and cost estimates, as well as a brief description of the operation and a summary of the equipment cost.
The total investment required for this project in 1967 was U.S.$ 4,000,000.- made up of $ 1,820,000.- for buildings and services, $ 810,000.- for process equipment, and $ 1,370,000.- for working capital. It was expected to generate $ 882,000.- per year of income over and above the costs of buying cattle and plant operation, amortization and management as can be seen from the summary included in the appendix.

Appendix III shows a different type of layout, i.e. a pig slaughterhouse in Africa for 1,200 pigs per week as basis for a wide range of products for domestic markets as well as for export mainly to neighbouring African countries and some Near East countries. The appendix includes a technological description of the operation, a list of products and a summary cost estimate of the plant.

CONSTRUCTION

When the final layout has been definitely approved by all parties concerned, the detail design documents necessary for tendering and construction may be prepared.

The Detail Design

is based on the final layout and includes all drawings and specifications as well as technical descriptions and conditions necessary for illustrating and explaining the complete works so explicitly that competitive tenders can be obtained from suppliers and contractors and so that the construction can be carried out according to the detail requirements of the owner.

The detail design documents are generally prepared separately for the various trades, as f.inst.

1) Builders' works comprising site works, sewage works, foundations, structures and all architectural details of the buildings.

2) Specialist equipment including all plant and machinery for processing as well as overhead rails, conveyors and other items to be supplied by specialist suppliers.

3) Refrigeration machinery and equipment including air conditioning.

4) Technical services such as
   a. Boiler plant, steam- and condense piping.
   b. Heating and ventilation.
   c. Plumbing for cold, warm and hot water including sanitary installations.
   d. Electric power and lighting.
   e. Compressed air, vacuum, gas or any other service systems.

The proper integration of building structure, processing equipment and technical services is of major importance to the approval of the plant and to the efficient operation of the plants as one unit. It is therefore to be recommended that the detail design for the various trades is carried out under the responsibility of the specialist consultant as coordinator of the individual designs carried out by consultants in the various trades.

The specialist consultant chosen for this job as coordinator should naturally be the one who has been responsible for the final layout. He must have thorough experience in the technique required in modern meat processing industries and be well acquainted with all the detailed requirements of the various authorities, especially the health authorities represented in most countries by the veterinarian directorate in the Ministry of Agriculture.

This authority has in many countries issued guides to construction, equipment and layout of plants under their control. These guides often deal with many construction details, prescribing minimum requirements which must be incorporated in the construction in order to obtaining final approval for operation.

It is outside the scope of this paper to go into details of the veterinarian requirements as they not only deal with separation of "clean" and "unclean" layout areas, but with type of applicable design, and materials for floors, walls, ceilings, floor drains, windows, doors, machines, tools, technical services, lighting, ventilation, refrigeration, etc. as well as cleaning facilities, change-rooms for personnel. In other words, they deal with practically all details of the whole plant.

This fact is another indication of the necessity to employ a specialist consultant to be responsible for the construction of the entire plant in compliance with the veterinarian requirements not only of the home country but also of the countries to which the plant is going to export.

Negligence to take these factors seriously has hindered many new plants in developing countries in obtaining import licence from countries enforcing the strict requirements of their own veterinarian authorities.

Whereas the specialist consultant is expected to have the necessary experience in modern planning and construction of industrial meat processing plants, he may in certain developing countries have to seek assistance from local architects or engineers, regarding the local building traditions and public building regulations, as well as regarding available building materials, so that he can design the details of the plants in accordance herewith.

The specialist consultant should also collaborate with the local technicians regarding the preparation of tender documents and method of tendering which can be somewhat different from country to country. The best results through tendering are mostly obtained when the experience of the specialists is combined with the experience of local technicians, and when the traditional construction procedure can be followed without reducing the essential features and qualities of the plant.

It will normally be appreciated by the owner if local materials, skill and experience, as well as local labour can be utilized in the construction as much as it is advisable and economical to do so, thus contributing to a reduction of foreign currency required.

Provided that all the tender documents have been prepared with due regard to local conditions, the procedure of tendering should be so arranged, that a fair and useful competition between qualified local or foreign contractors and suppliers can be obtained. The best procedure is usually to select a certain number of contractors - minimum three - in each sector of the different trades, some of whom may be foreign, others local contractors, but all considered to be qualified to do the job properly.

If the tender documents are technically in order, the competition can center on price, condition of payments and time of completion only. This procedure is in most cases efficient if properly supervised by the specialist consultant, and it is the procedure generally prescribed if the financing is obtained through Government loans or international aid organizations.

In case of financing through private loans or credits, various interests can arise which require other procedures of tendering. If, f.inst. the project promoter beforehand selects a specialist supplier or a building contractor who is prepared to establish the plant on a "turnkey" contract based on rate payments over a number of years or through Government export credits, then there might not be any need for tendering as far as the owner is concerned. In such cases the price might be negotiated directly between the owner and the main contractor who then in turn can base his price on tenders submitted by competing subcontractors.

This procedure is mostly an expensive solution for the owner but he on the other hand obtains a credit without which he might not be able to accomplish his project.

Turnkey contractors may also be selected through competitive tenders after the individual contractors have solicitated tenders from subcontractors and added their profit for covering the cost of administration and co-ordination. Even if this type of contracting may lead to higher overall costs for the owner, he may find compensation in the advantage of having one main contractor responsible for all subcontractors and for the best possible completion time of the project. An early completion time of a project is naturally of greatest value to the owner as he saves interests on building loans and is able to start production with profits at an earlier date. It may in this way prove to be economical for him to pay a reliable main contractor extra for this advantage.

In some countries the practice is to engage a quantity surveyor for preparing bills of quantities in addition to the detail design prepared by the specialist consultant. The contractors are thereby able to bid on basis of uniformly specified quantities of materials and services to be rendered and the unit prices included in such bids can be used for adjustment of the total price in case the project is altered during construction. This form of bidding can also be used with advantage if the contract should be carried out on a running cost account for materials and services actually rendered.

It is not possible to specify one particular procedure of tendering which under all circumstances is advantageous. It has to be studied and discussed between the specialist consultant and the owner of each project and determined after proper consideration of all factors such as local traditions, financial conditions, time for completion, capacity and qualifications of local and foreign suppliers and contractors and several other factors.

The construction of the plant can start as soon as contracts with suppliers and contractors have been negotiated and duly signed by the owner on the one hand, and the supplier or contractor on the other hand.

The responsible specialist consultant shall now, in collaboration with his local colleagues, appoint a clerk of works. His job is to work on the site in the construction period for checking all materials arriving on the site, taking samples of materials for testing, when requested by the consultants, to regularly report on progress of all contracts to the consultants and the owner, and to watch the general activity on the site with a view to maintaining good order.

The consultants who are responsible for the detail design and tender documents have to supervise the construction on the site through their site architects and engineers. They should regularly inspect the quality and progress of the works and hold site meetings with the contractors, e.g. every week or every fortnight or once a month as considered necessary in the various stages of the construction. The consultants have to request working drawings from the suppliers and contractors showing erection details of all special equipment being part of the plant for which they are responsible. These erection details may require certain adjustments to the detail design drawings for bringing these up to date, and the consultants must check the co-ordination of all installation, as they are carried out by suppliers and contractors of the project with a view to avoiding undesirable interference in the smooth running.

The site architects and engineers will also check the progress of all works for issuing orders of part payments to the contractors in agreement with the conditions of the contracts. They will especially watch that the progress of all contracts is following the time schedule stipulated at the signing of the contracts, so that no contractor is causing unnecessary disturbance or delays to the progress of other contractors.

Furthermore they shall see to it that no extra work is carried out for payments without the acceptance of the consultant on behalf of the owner, and they shall last but not least check that the execution of the works is up to the standard in all details to that prescribed in the tender documents and contracts.

The consultants shall at completion of a contract inspect and test the works, for acceptance by the owner, and when all possible defects have been corrected by the contractor, they shall issue a certificate of acceptance.

The consultants shall, when all contracts have been completed and accepted, assist the owner in setting up a true account of all expenses in connection with the construction of the plant and they shall submit to him a complete set of drawings and pertaining documents illustrating and describing the plant in details as it has been executed.

It is usually a part of every contract that the contractor is obliged to assist the owner in the running-in of the plant and they shall give a bank guarantee of at least 10 per cent for at least one year against any defects caused by faulty design or manufacture or installation of their work.

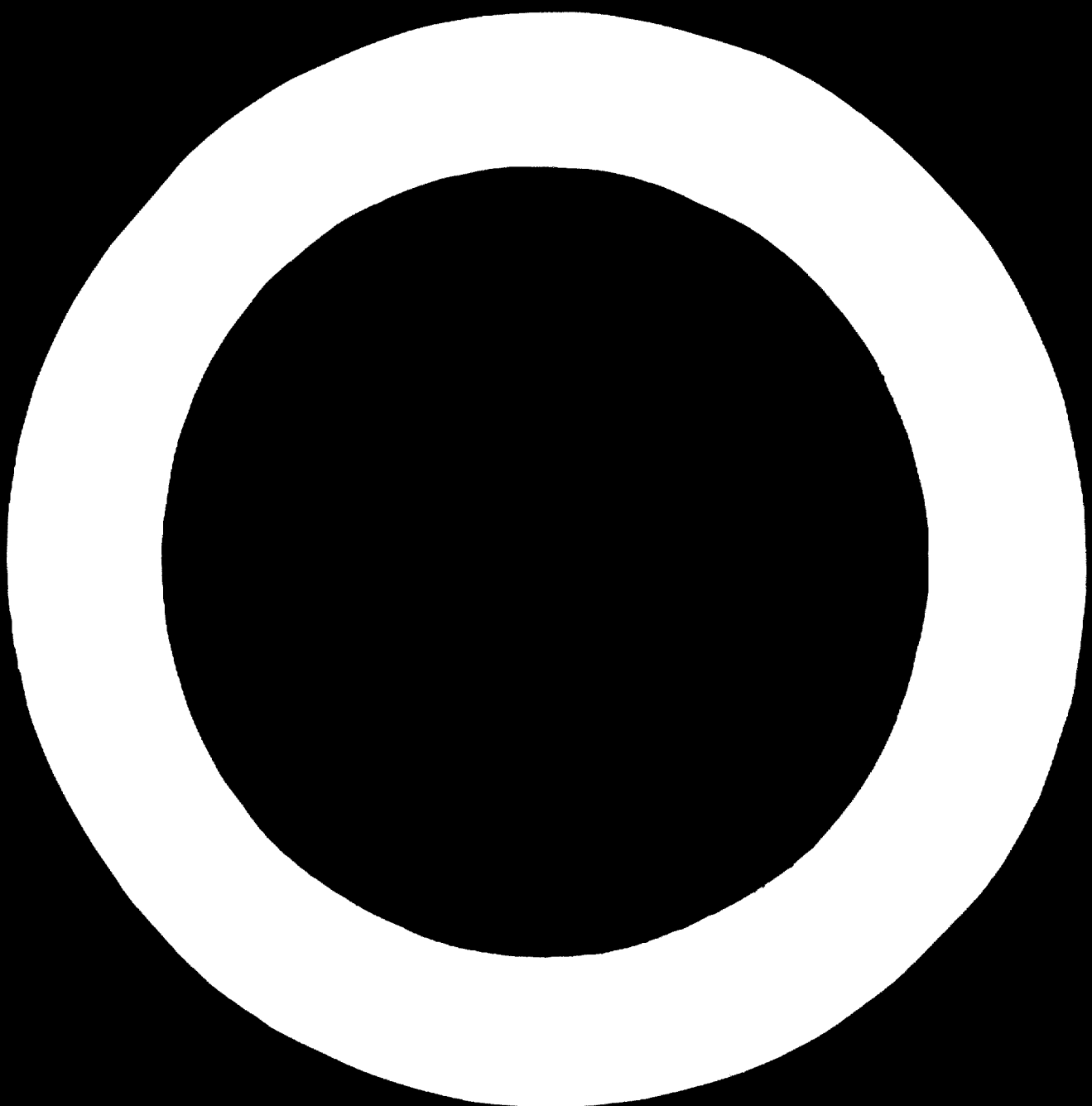
It is sometimes by more sophisticated processing equipment, required that the specialist supplier is maintaining expert personnel at the plant for assisting the owner in training his personnel in proper operation for a period of 6 to 12 months. Such extra services are, however, subject to separate contracts.

The specialist consultants and their colleague consultants in the country where the plant is erected, are working together in collaboration during the whole planning and construction period. They are only responsible to the owner for their work and are usually paid a fee in relation to size and character of the project.

Fees to the consultants can be estimated as a percentage of the cost of the works, or it can be a lump sum agreed beforehand, or it can be wholly or partly based on the time spent on the job. All depending on local circumstances, on size and character of the project, the total cost of fees to all consultants will generally vary from 8 to 12 per cent of the cost of the works.

In most cases the cost of fees will be more than compensated for, through the efficiency of professional layouts and detail designs, through savings achieved by competitive tendering on the basis of detailed tender documents, and through the savings achieved by careful construction administration so avoiding delays, for checking quality and of all services offered and agreed to in the contracts.

The professional technical consultants are, when members of national and international consultants organizations, obliged to work impartially and in every respect independent of all suppliers and contractors. They receive no other compensation than the fees paid to them by the owner or his financial institute. Their work, obligations, and rights, are laid down in ethical rules acknowledged and respected by international organizations, so as to create an atmosphere of full confidence between the owner and the consultants which is basic for a good and economic result of their collaboration in realization of the project.



APPENDIX 1

OUTLINE LAYOUT PLUS DRAWINGS

of a Latin American

BEEF SLAUGHTERHOUSE WITH MEAT

PROCESSING FACTORY AND COLD STORE

50% of the production for export
50% of the production for domestic markets

based on 400 heads of beef per day.

INTRODUCTION.

The design principles adopted for the elaboration of enclosed outline layout are based on the need of complying both to veterinarian regulations of the exporting country as well as sanitary and hygienic requirements applicable to abattoirs and meat processing factories of the importing countries.

As the site location for the new industrial slaughterhouse with meat processing plant and cold store has not been selected, the level and soil conditions and dimensions of the site are at this stage unknown.

The lairage is separated from the main building.

In the main building slaughtering, by-products treatment and meat products processing take place.

On the proposed outline layout the slaughterhall is arranged on the first floor and the by-products processing is foreseen on the ground floor below the slaughterhall. The other main divisions of the plant such as carcase chillrooms, meat processing departments, meat products stores, dispatches, etc. are arranged on one floor at ground level (ramp height).

Separation of clean and unclean working and storing areas is established both in- and externally.

Facilities for future production of corned beef have been foreseen in the layout plan as indicated.

The inedible materials rendering plant and the sanitary slaughterhouse are arranged in a separate building, where also the boilers, water plant and workshop are located.

Administration offices, personnel changerooms, canteen are provided for in a separate section of the main building.

TECHNOLOGICAL DESCRIPTION

Livestock Holding

Lairage is arranged according to Brazilian regulations and divided into three sections.

Reception and selection	-	Holding capacity: 400 units
Observation	-	" " : 20 "
Slaughtering section	-	" " : 400 "

Livestock is foreseen arriving at reception by truck and on foot.
A number of positions for livestock trucks unloading at the same time are provided for. A washing and sterilizing area with sufficient facilities is arranged for cleaning of livestock trucks.
Sick or suspected livestock are taken directly to the sanitary (emergency) slaughterhouse.
The raceway from the lairage to the stunning area is equipped with prescribed water showers. (- Banho de aspensão - and - Seringa - chuveiro.)

Slaughtering Processes

The raceway leads the cattle to the killing area on the first floor where two stunning pens are installed. Stunning is performed by captive bolt pistol. The operator is positioned on a platform located alongside the stunning pens to obtain correct working height.
Stunned cattle are discharged from the stunning pen through the revolving side door opening to the shackling area.
Another operator fastens a bleeding shackle to one hindleg of the cattle and by means of an electric hoist the cattle is hoisted to the bleeding rail, where the bleeding shackle roller hook automatically is securely positioned on the pipe rail. The cattle is then pushed forward to the sticking position. The operator performing the sticking operation stands on a grating above the bleeding passage floor. The bleeding passage is provided with blood collecting gulley arranged by a partition wall so that vomit will not be mixed with blood. The blood gulley is equipped with an electrically driven pump by means of which the blood is pumped to the blood treatment plant in the inedible materials rendering department.
The cattle are moved through the bleeding passage by an overhead rail conveyor. The length and speed of the conveyor is adjusted to allow for satisfactory bleeding of the cattle.
The overhead rail conveyor moves the cattle carcase on to the position, where heads are dehided and removed.

After removal from the carcase, the cattle head is dehorned by means of a powerdriven circular saw and washed and cleaned in a washing cabinet. The head is then placed on a hook on a rail conveyor which takes the head forward to the veterinarian inspection position.
The cattle carcase is moved forward to the position, where feet are skinned and removed. The feet are collected and chuted to the leg treatment department at ground floor level.
The cattle carcase is then transferred from bleeding shackle to roller hooks. The first operation for this purpose consists of skinning and cutting-off of the free hindleg. This cutting is made by powered handtool. A roller hook is fastened in the free hindleg and the roller hook is then placed on an inclined transfer conveyor which elevates the carcase to the dressing rail. In this way the weight of the carcase is moved away from the bleeding shackle, which is removed from the second hindleg. The bleeding shackle is returned by rail to the shackling area.
The second hindleg is skinned and cut off and another roller hook is fastened in the hindleg.
The hindlegs are chuted to the leg treatment department.
The carcase is then moved forward to the next inclined rail conveyor, which elevates the second roller hook suspended hindleg to the dressing rail.
From the transfer position the cattle carcase is now moved forward to the de-hiding and dressing working positions by means of a sliderail conveyor.

The operators transferring the carcase from bleeding shackle to roller hooks are standing on a platform in order to obtain convenient working height.

After transfer the bung is dropped, udder or pizzle is removed. The aitch bone is split by powered handtool. Udders are placed on hooks on conveyor and moved forward for veterinarian inspection together with the heads.
The tail is then pulled by pneumatically operated tong.
The hide is removed from the carcase by means of a mechanically driven hide-puller, and the hide is then chuted into the hide room which is located at ground level.
The brisket is opened by means of powerdriven saw.

The carcase is then moved on to the viscerating position, where the abdominal viscera consisting of paunch and casing set is removed and placed on the moving top inspection table. Also the thoracic viscera consisting of heart, liver, lungs, etc., is removed and placed on the moving top inspection table.

The carcase is split by means of powered saw.
The veterinarian inspection is centralized so that the carcase, abdominal and thoracic viscera, head and tongue, and udder of the cattle of the same animal are brought forward for examination simultaneously.

N.B. According to EEC regulations all parts of the cattle must remain in close nearness until the veterinarian inspection of these parts has taken place.

After veterinarian approval the carcase is moved to the washing position and thereafter it is weighed on a sliderail scale, classified and marked before taken into the chillroom for cooling.

Sanitary Slaughtering of Sick Animals

A separate slaughterhall for slaughtering of sick animals is provided for. Crippled animals can be stunned outside and brought into the slaughterhall by a travel hoist. The slaughterhall is provided with slaughterhoist and sliderails for dehiding and dressing of cattle. Working- and inspection table is installed for treatment of viscera. The cattle carcases slaughtered in the sanitary slaughterhall are brought into a separate chillroom awaiting veterinarian approval. An incinerator is installed in connection with the sanitary slaughterhouse for disposal of diseased parts of sick animals.

Adjacent to the sanitary slaughterhall a collecting room is arranged for condemned materials provided with crusher and blowtank unit to take the condemned materials to the inedible materials rendering plant for processing.

For the personnel working in the sanitary slaughterhouse separate change room, toilet, etc. are established.

Blood Treatment

Blood is pumped to a blood receiving tank in the inedible materials rendering department. By means of compressed air the raw blood is charged into a blood dryer, which is equipped for pressure cooking with steam jacket and steam-heated agitator. After being dried the blood is discharged into a hopper which is suspended from a travel hoist by means of which it is taken to the mill. The mill is equipped with outlet for bagging of blood meal.

Cattle Feet Treatment

Cattle feet are flushed and thereafter scalded in a water tank with inserted perforated basket. The hooves are removed by a hoof-pulling apparatus. Hooves are then drained and collected in bins ready for dispatch.
The forelegs (feet) after scalding are flushed in cold water and scraped manually on working tables. After scraping the forelegs (feet) are packed and taken to chillroom awaiting dispatch.

Hides Treatment

The hide is spread upon a table where excess fat and flesh are trimmed off. The hide is then trimmed, the tail is cut off leaving about 8 inches on the body of the hide, the ears, snout, and lips trimmed off. Thereafter the hide is inspected, weighed and graded. As no curing will take place at the abattoir, the hides must be dispatched directly in order to avoid decomposition from bacterial action.

Gut Cleaning

The paunches and casing set is chuted into the paunch emptying room. On a working table the paunches are separated from the casing set. The casing set is then passed on to the casing cleaning department. The paunches are elevated from the table by a hoist and opened. The contents fall into a basin with outlet leading to a blow tank which takes the paunch contents to silos located outside the slaughterhouse building. Paunches are then flushed in a water tank before they are charged into a scalding and scraping machine, where they are properly cleaned. After cleaning the paunches are chilled by cold water in a tank.

The paunches are then taken to the chillroom, before they are weighed and dispatched.

The casing set is treated in the casing cleaning department on the ground floor. On a working table the rounds are separated from bungs, middles and ruffle fat.
The rounds are then pulled onto the pan of the beef casing cleaning machine line and hooked on the conveyor. The cleaning process then follows automatically. The casings are turned for efficient cleaning.
The beef middles and bungs are deslimed on a separate machine.

After cleaning the casings are taken to the measuring and testing tables in movable vats. A machine for salting and bundling of casings is foreseen. The casings are packed in drums and taken to the chillroom ready for dispatch.

Heads Treatment

After veterinarian inspection cattle heads are chuted to the head cutting room. The jaw of the head is pulled by means of tool and the skull is then cloven by a head splitting machine. The knife of the head splitting machine made not to damage the brain. All head meat is trimmed off and is then packed. After weighing the head meat packs are taken to the freezer room and are ready for dispatch.

Headbones are chuted to a mincer where they are crushed. The mincer discharges the crushed bones directly into a blow tank, which takes the bones to a receiving tank in the inedible materials rendering department for further treatment.

Edible Fat Treatment

Edible fat for processing originates from the slaughtering and cutting-boning operations.

Abdominal fat is chuted from the paunch emptying room and from the casing cleaning department into flush tank in the raw fat chillroom.

Thoracic fat is collected in movable tanks in the slaughterhall where the thoracic organs are separated. Kidney fat is pulled off the carcase after veterinarian inspection, collected in movable tanks and chuted to the raw fat chillroom.

Edible fat from the cutting-boning department is collected in movable tanks and wheeled to the raw fat chillroom.

Only intestinal fats are washed before processing.

The movable tanks are emptied by a tilt-lift into a hopper which is provided with a screw conveyor taking the fat to the continuously working fat rendering plant.

The continuous rendering plant is arranged for working at low temperature to obtain high quality product. The plant is provided with a mincer, which is equipped with heating discharge pipe. The fat is further heated in tank provided with agitator. The solids are then separated from the liquid fat in a horizontal type centrifuge. Remaining solid particles and water is

removed from the fat in a refining centrifuge. Glue water from the refining centrifuge is returned to the agitator tank. The finished fat is taken to an intermediate fat tank. From the tanks fat is pumped through a water cooled heat exchanger into drums. The weights of the content of the drums are controlled during the filling. Edible fat is dispatched in drums.

Inedible Materials Treatment

All inedible materials are transported to the inedible materials rendering plant by means of the blow tank system. Four blow tank units are installed in the plant. Each unit consists of a mincer for crushing of bones, etc., which discharges the inedible material directly into the blow tank which has a pipe connection to receiving tank in the inedible materials rendering department. By means of compressed air the materials are transported from the blow tank through the pipe to the receiving tanks.

One blow tank unit is located in the head cutting department. This blow tank unit transports head bones, etc. to the rendering plant. Another blow tank unit is installed adjacent to the slaughterhall and paunch emptying and gut cleaning department and is intended for transport of inedible materials from these departments. For transport of bones and other inedible materials originating from the cutting and boning department a blow tank unit is installed adjacent to the cutting-boning room. One blow tank is installed in the sanitary slaughterhouse for transport of condemned materials to the rendering plant.

From the receiving tanks the inedible material is charged into dry-melters by compressed air.

In the dry-melters the material is cooked and sterilized under pressure. After pressure-cooking the vapour is evaporated and the material is dried so that after the dry-melting process only meal and fat remain.

The material is then discharged from the dry-melter into a percolator where fat is drained off. After drainage in the percolator the cracklings still have a substantial content of fat. Therefore the cracklings are filled into a centrifuge basket which is moved to a centrifuge by means of an overhead travel hoist. The basket is lowered into the centrifuge for processing. Alternatively the fat is removed by an expeller press. Fat from both percolator and centrifuge is collected in a blow tank from where it is taken to intermediate tanks. The fat is then refined in a centrifuge before it is filled in drums and stored before dispatch.

The cracklings after centrifuging are taken to areas for cooling, before they are charged into a mill. The mill is equipped with bagging and weighing apparatus, and the meal is filled in bags for storage and dispatch.

Chilling of Cattle Carcases

After slaughtering the cattle carcases are taken to the chillrooms. Each chillroom holds approx. 260 cattle units corresponding to approx. 520 half carcases. The chillrooms are equipped with highlevel sliderails. The temperature of the cattle carcases is lowered quickly during the first six hours after slaughtering so as to bring down the surface temperature, thereby reducing the bacterial growth. Thereafter the remaining heat of the carcase is extracted over the next 10 to 12 hours to bring down the temperature of the carcase to approx. 4°C. The chillrooms should hold approx. 800 beef carcases corresponding to two days' killing.

Edible Offals Treatment

After veterinarian inspection and approval the edible offals are separated and hearts, livers, tongues, kidneys, etc. are placed on trucks provided with hooks or pans and taken to the chillroom for cooling. After cooling edible offals are packed in cartons internally lined with plastic foil and weighed. The cartons are stacked on pallets and taken to the freezing tunnel and thereafter stored in the freeze store ready for delivery.

Cutting and Boning Operations

Cattle carcases are quartered on the rail immediately after removal from the chillrooms and thereafter slided to the cutting positions.
The cutting and boning equipment consists of three arrangements intended for processing of:

Arrangement a) Forequarters for export
" b) Hindquarters for export
" c) Fore- and hindquarters for home market.

A separate arrangement is provided for trimming of bones originating from the cutting and boning tables.

The quartered carcases are brought forward to the positions where they are divided into primal cuts. The primal cuts are placed in plastic trays, which are moved on a powered roller table to the cutting table positioned

along both sides of the roller table. Each cutting table is provided with stands for plastic trays for primal cuts and finished products. Furthermore each cutting table is provided with cutting board and stainless steel table top with chutes to the plastic trays.
All products from cutting and boning positions are sorted and placed in plastic trays and brought forward to the controlling position by roller table conveyor.
At the controlling position finished meat cuts, trimmings, and bones are weighed and the quality of the products is controlled. The work performed by each operator this way is controlled and possible adjustments to the cutting operations can immediately be implemented.
The tray containing approved meat cuts is then repositioned on the roller table conveyor, which takes it to the packing department.
Meat cuts intended for cooking are taken by another roller table conveyor to the cooking department.
Bones are charged onto a band conveyor leading to the bone crusher and blow tank unit by means of which they are transported to the inedible materials rendering plant for processing.
Finished meat cuts and meat trimmings are packed in cartons internally lined with plastic foil. The cartons are weighed, marked and placed on pallets. The pallets are taken by fork lift truck either to the freezer rooms or chillroom for storing and delivery.

Cooked - Frozen Meat Production

The meat arriving in the cooking department in plastic trays is filled into perforated meat baskets, which are hoisted into open water cooking kettles. After cooking the meat baskets are taken into the filling department, where the meat is filled into artificial casings. The weight of each unit is approx. five kilograms. The meat packs are placed on trucks with racks and moved into a chill-freeze tunnel for freezing.
The frozen meat packs are then taken into the packing department and placed in cartons. The cartons are closed, marked and placed on pallets. The pallets are taken by fork lift truck to the freezer store and the products are ready for dispatch.
The department for processing of cooked-frozen meat products is entirely separated from other parts of the factory and is provided with its own entrance, personnel facilities, change rooms, etc.

ESTIMATED PRODUCTION.

Slaughtering.

	Daily	Hourly
Cattle (Average slaughtered weight each carcase: 200 kgs)	400 units	max. 60 units
Cattle carcases	80.000 kgs	12.000 kgs

By-products (from slaughtering process)

Blood	5.600 kgs
Hides	9.600 kgs.
Edible tallow (Thoracic, abdominal, kidney fat)	3.680 kgs.
Casings	3.600 kgs.
Paunches	3.440 kgs.
Tails	380 kgs.
Brains	160 kgs.
Head meat	1.400 kgs.
Tongues	440 kgs.;
Livers	2.400 kgs.
Kidneys	400 kgs.
Fore-legs with hooves	4.000 kgs.
Inedible materials	12.400 kgs.
Paunch content	25.040 kgs.
Casings content	4.160 kgs.

Cutting and Boning.

Exportation (50%)

Yield of 200 cattle carcases daily:-

Hindquarters, weight each 98 kgs	19.600 kgs.
Meat cuts 75,2% of 19.600 kgs	14.700 kgs.
Bones 17,4% of 19.600 kgs	3.400 kgs.
Trimmings, fat etc. 6.9%	1.350 kgs.
Loss 0.9%	150 kgs.

Forequarters, weight each 102 kgs		20.400 kgs
Meat cuts,	75,9 % of 20.400 kgs	15.500 -
Bones	16,7 % of 20.400 kgs	3.400 -
Trimmings, fat, etc.	6,9 %	1.400 -
Loss	0,5 %	100 -

Home market (50 %)

Of 200 cattle carcases daily:-

65 cattle carcases are dispatched in quarters
65 " " " " " primal cuts
70 " " " boned out.

Yield of 70 cattle carcases boned out daily:-

Hindquarters, weight each 98,4 kgs		6.890 kgs
Meat cuts,	75,2 % of 6.890 kgs	5.180 -
Bones	17,4 % of 6.890 -	1.200 -
Trimmings, fat, etc.	6,9 %	475 -
Loss	0,5 %	35 -
Forequarters, weight each 75,8 kgs		5.310 kgs
Meat cuts,	74,5 % of 5.310 kgs	3.955 -
Bones	19,9 % of 5.310 kgs	1.060 -
Trimmings, fat, etc.	5,1 %	270 -
Loss	0,5 %	35 -
Pontas de Agulha, weight each 25,8 kgs		1.810 kgs
Meat cuts,	86,9 % of 1.810 kgs	1.553 -
Bones	13,8 % of 1.810 kgs	250 -
Loss	0,3 %	7 -

SUMMARY OF PROCESS EQUIPMENT.

Cattle Slaughter Line.

Max. capacity: 60 units per hour corresponding to 400 units daily in one shift and 8 hours' working day.

The slaughter line in general provided with the following equipment:-

- Stunning pens
- Bleeding hoists with automatic landers
- Bleeding passage rails
- Shackel return rails
- Transfer platform
- Transfer rail elevator(s)
- Empty hook hoist
- De-hiding platform
- Hide puller(s)
- Dressing conveyor
- Cattle head conveyor
- Moving top inspection table for paunches and edible offals
- Inspection platforms
- Splitting platform
- Mechanized, modern, labour-saving handtools
- Sliderail scale
- Washand basins and tool sterilizers.

Gut Cleaning Equipment.

Max. capacity: 60 sets per hour.

Gut cleaning equipment in general consisting of:-

- Paunch- and casings separation table
- Paunch emptying basin
- Paunch flushing tank
- Paunch washing- and scalding machine(s)
- Paunch chill tank
- Casing separation table
- Automatic casing stripping and cleaning machine line
- Stainless steel casing vats

Casing sorting and calibrating tables
Casing salting table
Casing salting and bundling machine
Scale

Cattle Fore-legs Treatment

Max. capacity: 240 legs per hour.
Cattle fore-legs cleaning equipment in general consisting of:-

Cattle fore-leg scalding and flushing tank
Hoof puller
Scraping tables with flush basins.

Hides Treatment

Max. capacity: 60 units per hour.
Hides treatment equipment in general consisting of:-

Hides chute from slaughterhall
Hides trim and wash tables
Scale.

Cattle Heads Treatment

Max. capacity: 60 units per hour.
Heads treatment equipment in general consisting of:-

Head splitting machine
Jaw puller
Cutting tables.

Edible Fat Rendering

Max. capacity: 900 kgs per hour, corresponding to 7.150 kgs daily, in one shift equal to approx. 8 hours' working day.

The fat rendering equipment in general consisting of:-

Screw conveyor with truck lift
Continuously working rendering plant with mincer, cooking pipe and kettle, horizontal centrifuge, refining centrifuge, fat tanks and water cooler.
Scale.

Inedible Materials Treatment

Max. capacity: 1.450 kgs per hour, corresponding to 21.650 kgs daily in two shifts equal to approx. 16 hours' working day.

The inedible materials rendering plant in general consisting of:-

Receiving tanks for crushed raw material
Dry melters with percolators and fat tanks
Centrifuge with baskets
Fat settling tanks (alternative expeller press)
Fat refining centrifuge
Meal milling and bagging machine
Scale.

Blood Treatment

Max. capacity: 400 kgs per hour, corresponding to 5.600 kgs daily in two shifts equal to approx. 16 hours' working day.

The blood treatment plant generally consisting of:-

Blood pump
Blood receiving tank
Dry melter with hopper
Milling and bagging machine.

Meat Cutting and Packing

Export

Max. capacity: 200 cattle carcases deboned per 8 hours.

The cutting and packing equipment in general consisting of:-

On-the-rail primal cuts equipment
Roller conveyor table for plastic trays for meat products
Separate one-man cutting and boning tables connected to roller conveyor table.
Roller table scale
Packing tables with scales
Packing roller tables
Carton closing machines
Bone conveyor
Fat and trimmings conveyor.

Home Market

Max. capacity: 70 cattle carcases deboned per 8 hours.

Equipment same type as mentioned for export.

Cooked - Frozen Meat Processing

Max. capacity: 10,000 kgs per 8 hours.

Equipment for processing of cooked - frozen meat generally consisting of:-

Open cooking kettles
Perforated meat baskets
Travel hoist
Meat receiving tables
Filling machines.

The above equipment is based on traditional procedure. A more advanced procedure may be advantageous and this alternative is at present being examined.

Blow-tank System

Inedible materials are transported to the inedible rendering plant by means of blow-tanks. Four collecting areas are located in the plant and each is equipped with a crusher-blow-tank unit. Two of these areas are located in the slaughterhouse and one adjacent to the cutting and boning department. One collecting room is located at the sanitary slaughterhouse intended for materials originating from this department.

Various Equipment

Overhead slide rails:-

Overhead slide rails are provided for in slaughterhalls and carcase chill-rooms. Furthermore in the cutting department:

Washing and sterilizing:-

Washing machine for plastic trays (cutting and boning department)
Portable high-pressure washing units for machinery, etc.
Handwash basins and tool sterilizers at operating positions.
Mixing fitting (hot - cold water) with hose and nozzles.

Internal transport:-

Roller hooks with stainless steel hooks for cattle carcases.
Trucks with trays and (or) stainless steel hooks for edible offals.
Trucks for cooked - frozen meat.
Pallets for frozen and chilled meat in cartons.
Fork-lift truck serving packing and dispatch area and cold store.

Refrigeration Machinery

Centralized compressor and control room. Automatic regulation. Refrigerant: ammonia. Pump circulation system. Serving the following rooms:-

Chillrooms,	cattle carcases
"	edible offals
"	retained carcases (detention)
Freezing room,	head meat
Chillroom,	cattle fore-legs
"	paunches and casings
"	edible raw fat
Chillrooms,	boned, packed meat
Blast chill,	cooked meat
Freezing tunnel,	boned, packed meat
Freezing store,	boned, packed meat

Air Conditioning Machinery

Central compressor unit with water cooler.

Cooled water circulation system to air conditioning units, serving the following rooms:-

Cutting and boning department
Packing department
Dispatch

ESTIMATED CONSUMPTION

Daily water consumption, approx.	800 m^3
Max. hourly water consumption, approx.	200 m^3
Daily steam consumption, approx.	45.000 kgs
Max. hourly steam consumption, approx.	7.000 kgs.

Note: The inedible materials rendering and blood drying plant is proposed to operate in two shifts.

Daily electricity consumption, approx.	3.100 kWh
Max. hourly electricity consumption, app.	1.000 kWh.

ESTIMATED PERSONNEL REQUIREMENTS

	Number of persons
Unloading live cattle and lairage	4
Slaughtering	24
Legs treatment	5
Hides treatment	2
Heads treatment	5
Cleaning of paunches	3
Gut cleaning	12
Edible fat rendering	2
Emergency slaughtering	2
Carcase handling	4
Inedible materials rendering	3
Cutting and boning	70
Packing of meat products	10
Processing of cooked meat	8
Dispatch	5
Technical personnel	8
Internal transport, etc.	12
	179

Not included in the list:-

- Administration personnel
- Management staff
- Veterinarians
- Laboratory personnel, etc.

ESTIMATED INVESTMENT

Technological Machinery	U.S. Dollar
Cattle slaughtering machinery	77,665
Gut cleaning machinery	25,400
Cattle legs treatment equipment	2,800
Hides treatment equipment	1,995
Cattle heads treatment equipment	3,125
Edible fat rendering machinery	57,680
Emergency slaughtering equipment	5,365
Inedible materials rendering machinery	75,860
Blood treatment machinery	16,315
Meat cutting and boning equipment	83,630
Cooked - frozen meat processing equipment	49,060
Blow tank system	59,780
Overhead rails, and various equipment	103,885
Total	562,540
Refrigeration machinery	570,000
Erection of machinery	170,000

Building Works

Including all installation for drainage, steam, steam boilers, water treatment, electricity, lighting, etc. exclusive of site preparation works and sewage disposal plant	3,120,000
Total investment	4,422,540

Expenses not included in the above estimate:-

- Site purchase cost
- Contingencies
- Project planning fees
- Construction administration fees
- Interest of construction loans, etc.

All costs in this appendix are based on 1972 price level.

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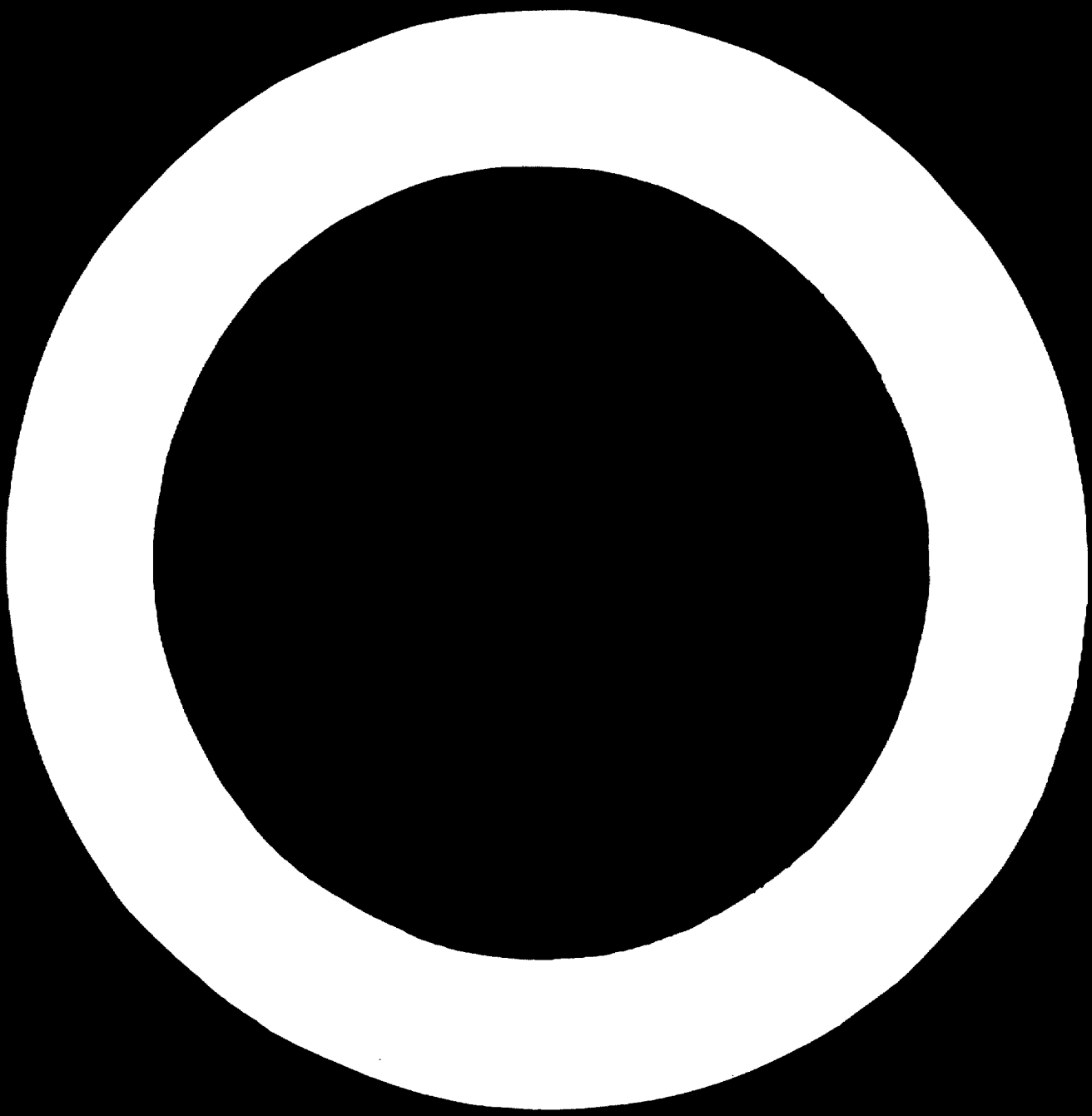
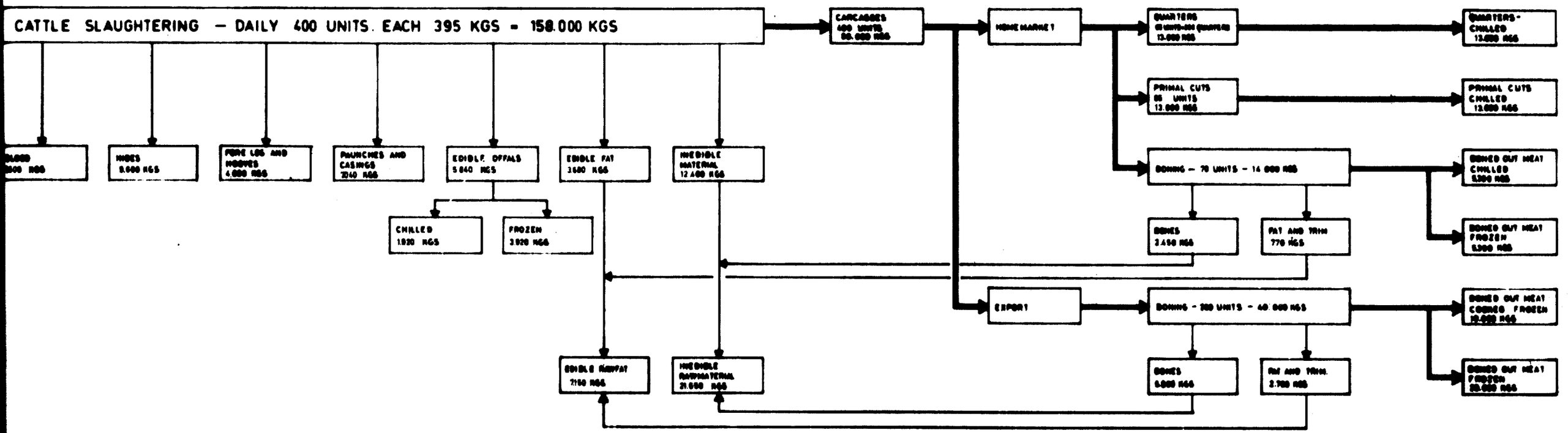
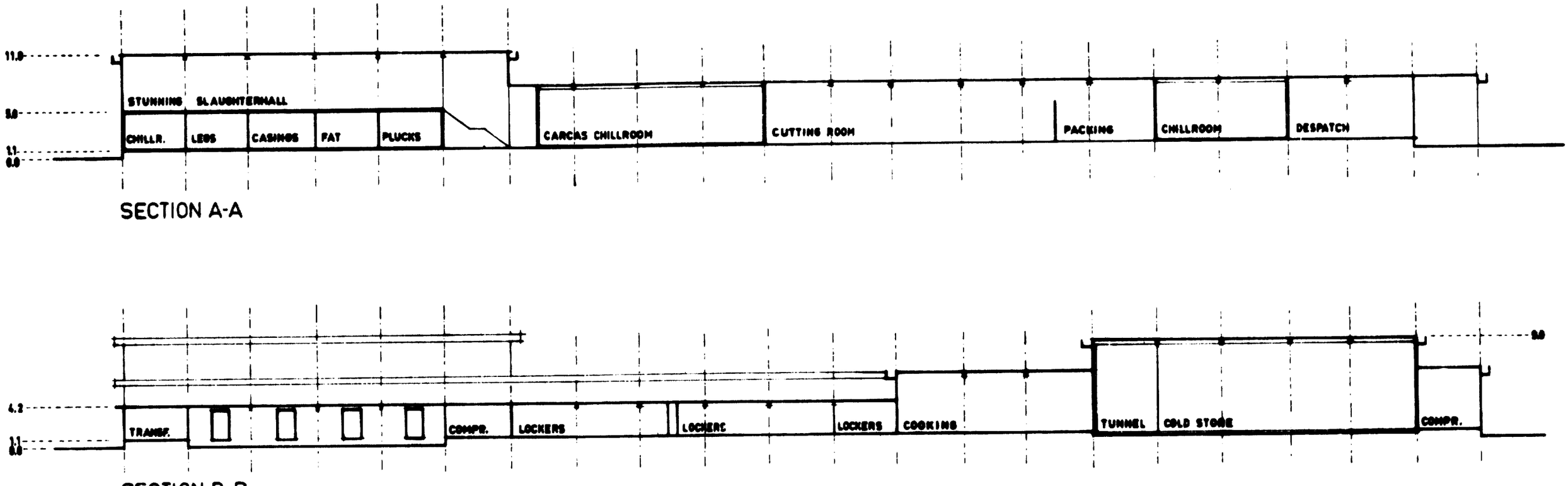




CATTLE SLAUGHTERHOUSE & COLD STORE
GENERAL PRODUCTION SCHEME

N. E. WERNBERG CONSULTING ENGINEERS AND ARCHITECTS
37, TEGLVAERKSGADE, DK 2100 COPENHAGEN Ø. TELEPH. 20.33 44

SCALE: ~ DRAWN: ASB
DATE: 3.1.70 DRWG. NO. 2088-3



SECTION A-A

SECTION B-B

FRONT VIEW

CATTLE SLAUGHTERHOUSE & COLD STORE

SECTIONS & FRONT VIEW

N. E. WERNBERG CONSULTING ENGINEERS AND ARCHITECTS
37, TEGLVAERKSGADE, DK 2100 COPENHAGEN Ø. TELEPH. 29 22 44

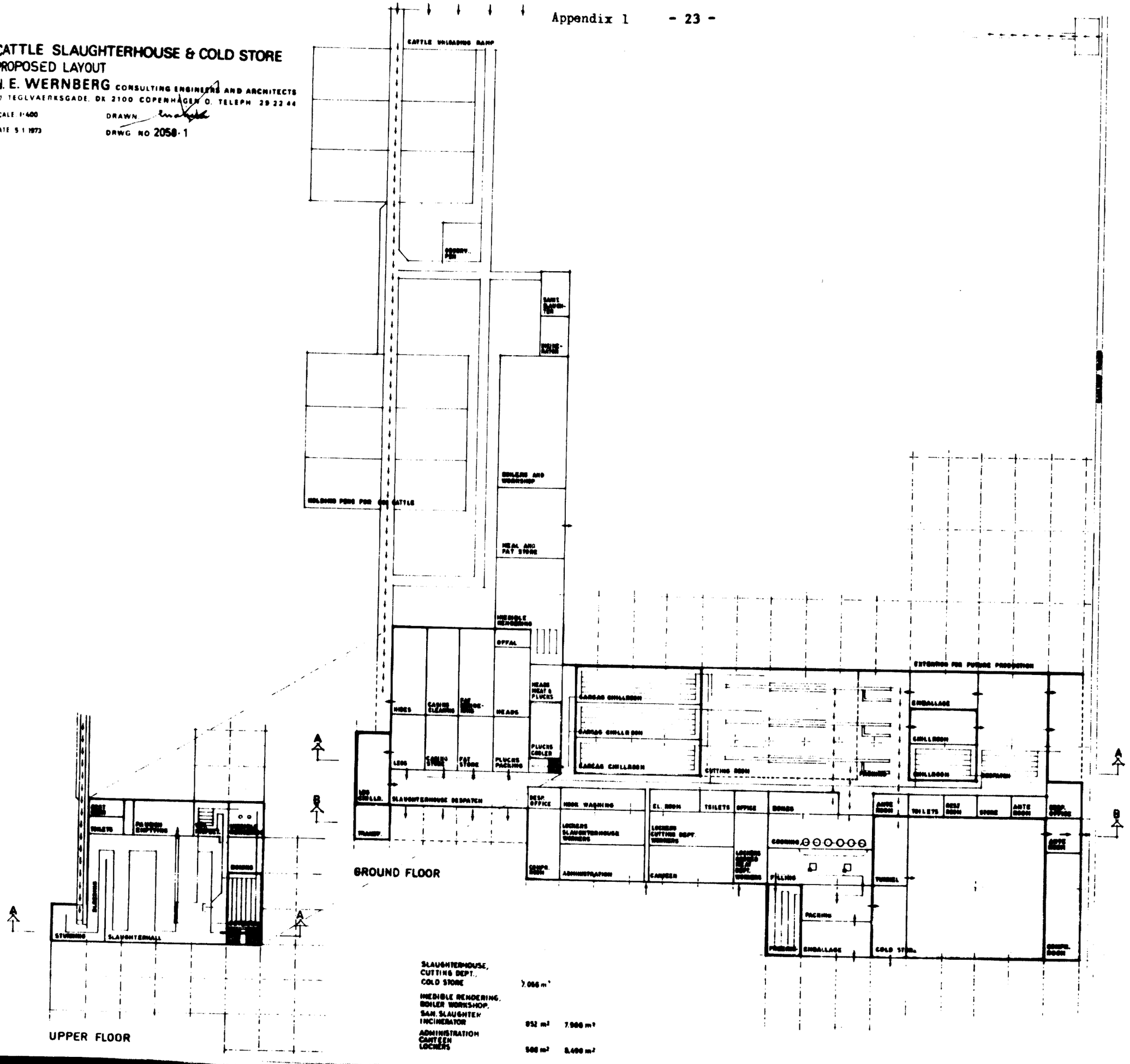
SCALE: 1:400 DRAWN:

DATE: 5.1.1973 DRWG. NO. 2058-2

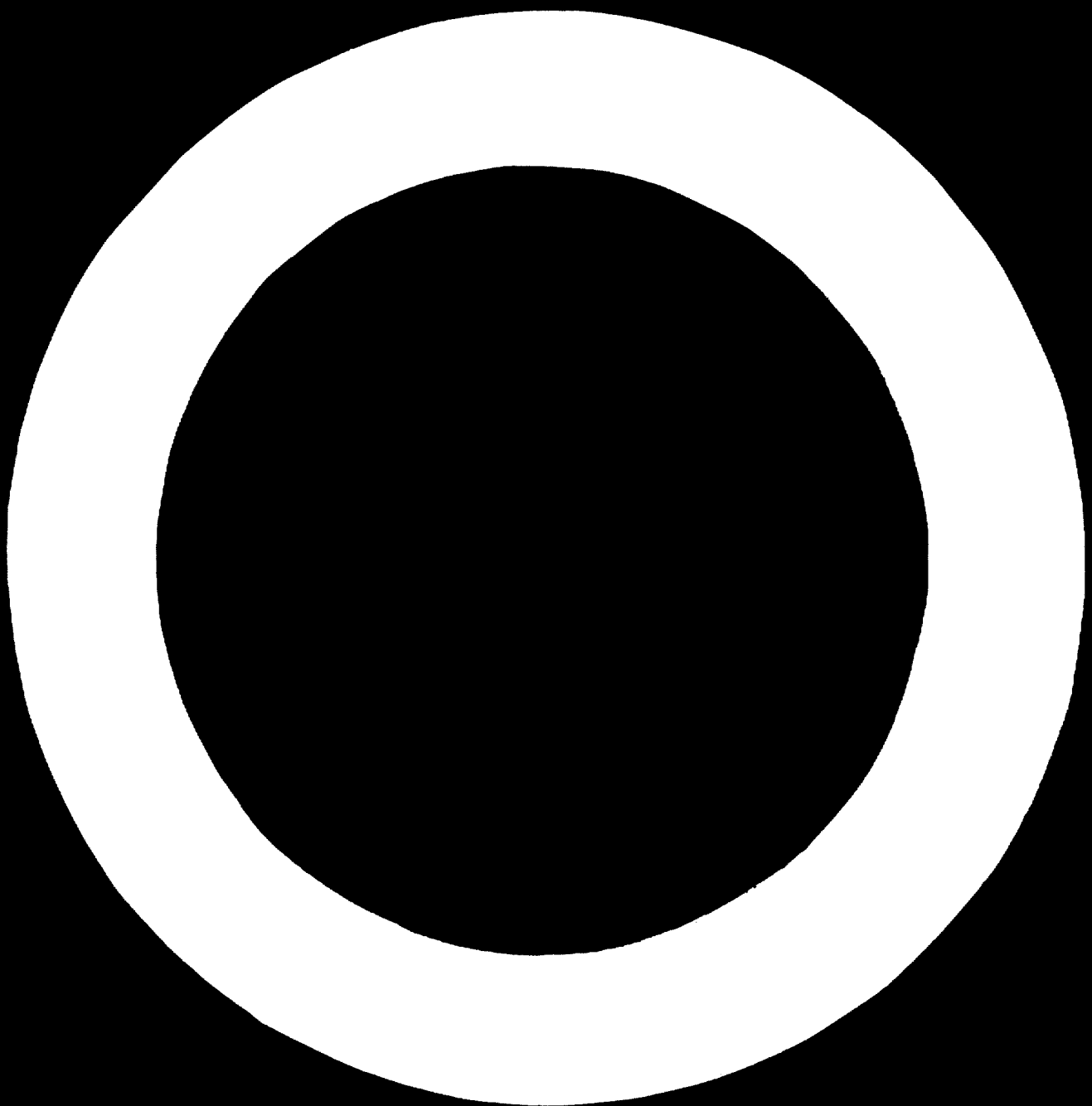
CATTLE SLAUGHTERHOUSE & COLD STORE
PROPOSED LAYOUT

N. E. WERNBERG CONSULTING ENGINEERS AND ARCHITECTS
37 TEGLVAERKSGADE, DK 2100 COPENHAGEN O. TELEPH 29 22 44

SCALE 1:400 DRAWN
DATE 5 1 1973 DRWG NO 2058-1



SLAUGHTERHOUSE, CUTTING DEPT., COLD STORE		7.056 m²
EDIBLE RENDERING, BOILER WORKSHOP, SAN. SLAUGHTER INCINERATOR	952 m²	7.906 m²
ADMINISTRATION CANTEEN LOCKERS	566 m²	8.496 m²



APPENDIX 2

PRELIMINARY LAYOUT PLUS DRAWING

of an Indian

CATTLE SLAUGHTERHOUSE WITH

MEAT PROCESSING FACTORY

based on 300 bullocks and buffalos per day

100% for export.

74.10.1

2 OF 2

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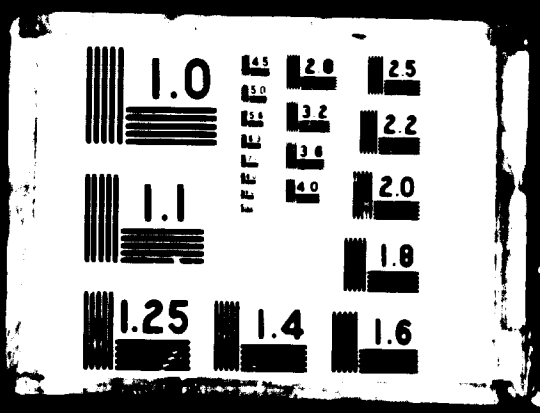


PROCESSES AND PROCEDURES AT THE PLANT: A GENERAL DESCRIPTION.

A. SLAUGHTER.

We were originally under the impression that substantial numbers of Indian cattle would be subject to ante-mortem condemnation and that a separate slaughtering layout would be needed for this purpose. We have seen little evidence of such need, and would provide only a minimal space adjacent to rendering operations for that purpose.

Cattle and buffalo would be slaughtered at a projected rate of 300 per day (40 per hour), the particular system to be described in a later section. Approximately 1/3 of this number would be buffalos. We would expect post-mortem rejection of perhaps 5% (with 10% perhaps in the March-June period), the carcasses and viscera of which would be conveyed directly to inedible processing.

Slaughter would be in conformance with Moslem practice. A hide puller will be used. Gravity flow rail dressing will follow, with workmanship and inspection practices in conformance to American standard, with all inedible byproducts being channeled to inedible area to further process. Provision will be made for conservation of pharmaceutical raw materials. Hides will be brine cured, lightly salted, packed and sold to interim buyers or to the export market.

Livers will be sold fresh for local consumption to the degree local demand warrants. Beyond that, they will be diverted to pet food.

Edible offal having no local market will be processed either into sausage products or into pet food, or as a final disposition, to rendering.

Provision will be made for diverting to local trade carcass meat to satisfy local demand.

B. PROCESSING: EDIBLE.

All products to be sold abroad will be in sterile form, the nature and volume of which will be detailed later. It is intended that hot carcasses from the slaughtering section will be moved directly into boning, the boned meat will be trimmed and channeled directly into chopping equipment and into cooking process. The cooked meat, in turn, will then be moved into various channels, depending on the ultimate product form.

Rendered products (meat and bone meal and inedible tallow) will go to the domestic market to firms like Hindustan-Lever, who presently import tallow and who are developing a livestock and poultry feed business. Supplies of meat and bone meal that exceed local demand can be moved into export channels.

BUILDING SITE, BUILDING CONSTRUCTION AND ESTIMATES.

The size of the available area of land at USGAO is much larger than required. It has been considered in the first instance more feasible to feed the cattle with hay cut in the neighbouring areas and therefore an area of approximately 180 acres only will be required.

Foundation, excavation and levelling of the site are expected to be extremely difficult because of the high content of iron ore in the ground. The bearing capacity of the ground is on the other hand very high.

The buildings for the plant are consisting of main factory building, lairage building, office, canteen and cloakroom building, boiler house, inedible rendering plant building and pacific separator. The latter needs not to be inside a building. It may be considered to join the buildings for Inedible Rendering and the Main Factory depending on the regulations in the countries receiving the products.

The water consumption for the plant is estimated to be in the region of 100.000 Imperial Gallons per day. Several wells have been sunk by Mr. Sapre on the site near the river, but all these wells are giving percolation water. It is considered more economical, if water can be found closer to the plant, to drill a deep well, which can procure spring water. We have not been able to get copies of geological maps for the area and are therefore not able to evaluate these possibilities.

Our estimate has been based on such a deep well with pump and water storage for one day's consumption only.

All sewage water has to run to the Mandovi river. We recommend that as much of the blood as possible is collected to avoid blood in the sewage water and bad discolouring because of blood. We also recommend removal of manure, paunch content and grease. Manure and paunch content can be used as fertilizer on the neighbouring fields. The grease will be removed in a pacific separator.

The main pipe to the Mandovi river is approximately 1.2 km long and has to cross the steep bank of Mandovi river and be laid into the river to some distance from the river bank. We have been told, that no further treatment of the sewage is necessary for discharging into the Mandovi river.

Electricity is available from a main power line not far from the site. The Electricity Board will provide the supply to a transformer on site, which has to be purchased by the plant. Exact power cost was not available because certain duties and taxes had to be decided by the Delhi Government, but an approximate price of 14 Paise plus tax - the magnitude of which is not known, - was mentioned.

From the labor commissioner in Panjim it has been stated that it is not necessary to provide housing for the labourers on site. If it is found difficult to find sufficient number of labourers in neighbouring districts, we would recommend that a bus service, possibly to Panjim, is provided by the Plant. For the foreign executive staff it will no doubt be necessary to provide housing. We have not included this housing in our overall estimate. If for instance 5 houses should be provided, these would cost approximately 130.000 U.S. $.

To the north side of the plant we have allowed for an area for cattle holding. This will be devided in pens and shall mainly be used during the rainy season. The cattle, we recommend, are fed in these pens and not depending on the grass in the area only.

All the buildings we suggest shall be of very simple construction consisting of reinforced concrete foundation and floors , walls constructed of the local ore blocks, partitions in bricks, roof construction in the best possible ventilation and cross winds to the rooms, we suggest to leave a 3' high gap at the eaves closed with fly netting only. This opening must be covered by the roof or special louver constructions to keep the Monsoon rain out. At the ridge of the roof we suggest a similar ventilation opening.

It is generally important that the quality of the inside finishes comply with all the veterinary and hygienic requirements all over the world, or anyway, in the countries which may become a market for the products from this factory. We recommend that floors are made in non-skid granolitic floor finish and walls are tiled with the local type of tile to

rail height, or at least two meters above floor level in all production rooms. The local glazed tile is equivalent to a European bath-room tile, and is therefore not very strong and will not be able to withstand much abuse To import an industrial type of tile is considered far too expensive.

The building cost estimate has been based on the above specified building construction and on the assumption that the GOA Government provides land for plant and holding grounds, a water well or wells giving a supply of 300.000 Imperial Gallons of potable water per day, a substation on site from which the power is supplied, Tarmac roads and yards throughout the plant and permission to dispose of effluents into the Mandovi river.

BUILDING COSTS:	Nos of Bays	Sq. Meters	Price/m^2 U.S. $	Total U.S. $.
Killing Floor, Sticking Area, Blood Room, Detention & Condemned Material Room	16	592	140	83000
Hide Room & Salt Store	8	296	90	26600
Casing Store	1	37	250	9250
Casing Department	6	222	140	31000
Carcass Chillroom	4	148	250	37000
Edible Tallow Room	3	111	90	10000
Cutting Room	14	518	120	62000
Engine Room, Toilets & Lavatory	7	259	180	46600
Room for special cuts & Washing	10	370	120	44400
Canning Department	18	666	120	80000
Blast Freezer	6	222	330	73500
Holding Freezer	6	222	290	64500
Shipping & Product Storage	37	1369	80	109500
Can [illegible]ore	10	370	80	29500
Pet [illegible]ood	7	259	120	31000
	153	5661		737850
Add for Hide & Blood Tank				8000
Add for Loading Ramps 108 m^2 at 7 $ per m^2				760
Total Cost of building work for Factory Building				746610
Piped Services 15% of 746610				111990
Electrical Installation 10% of 746610				74661
Refrigeration Plant				83500
Drainage outside buildings				16000
Sitework including pens for 3000 animals				52000
Water supply (Water storage and Pipework)				30300
				1115061
Office and Welfare Building 1100 m^2 at 140 $/$m^2$				154000
Pacific Separator and Manure Collection				29000
Boiler House and Workshop 290 m^2 at 90 $/$m^2$				26100
Inedible Rendering Building 1000 m^2 at 90 $/$m^2$				90000
Boiler				110000
Lairage 950 m^2 at 70 $/$m^2$				66500
Total Building Cost U.S. $				1590661

TECHNICAL ADMINISTRATION.

The cost of the technical administration including Consulting Engineers' and Architects' fees for preparation of plans, specifications, tender documents and supervision of erection will be approximately 10% of the total cost of buildings, installations and equipment i.e. 230.000 U.S. $.

OPERATING, EQUIPMENT COST.

In the operation of this plant it is anticipated that all bullocks and buffalos will be slaughtered according to Moslem rites. The animal would be hoisted to a gravity rail, and skinning and dressing will be performed while suspended from this rail. The designed rate of speed is 40 heads per hour or 300 heads in eight hours. It is estimated that approximately 40 operators will be required to perform these operations. A Johnson hide-puller has been included in the layout, and the skinning operators will use air-driven Jarvis or equivalent flaying knives in performing their work. Of the variety meat it is intended to save cheeks and head meat, tongues, hearts, livers, lungs, milts and both beef rounds and middles to the extent permissible.

Paunch manure will be emptied from the paunches and pneumatically transported to a yard area where it will be mixed with manure from the holding area and used as fertiliser in the pasture area. Hides will be conveyed from the dressing floor to the hide room where they will be trimmed and then cured in brine in an immersion vat where they will be cured for a minimum of 14 hours in a saturated brine solution. The hides will be kept in continuous agitation by mechanical paddles during the curing period.

After cure the hides are to be drained over night, graded, bundled, tied and placed on pallets for storage and shipping.

The boning of cattle will be carried out while the warm carcass is suspended from a rail. Trimming of bones and meat will be performed on special conveyorized trimming tables.

For the production of special cuts a special trimming and packing arrangement is located in the Cutting Room. The meat will be taken off a conveyor, trimmed, filled into fibrous casing, pulled tight and closed with a tipper clipper closer. The meat in fibrous casing is then transferred to racks and on rail pushed into the cooking department, where the racks are lowered into the cooking tank. After the cooking is completed, the

rack is taken to a chill tank where the meat is submerged in chilled water.

After chilling the meat packets are tightened and placed on shelf trucks and pushed into the freezing tunnel. After freezing the packets are packed in cases, weighed, stencilled for identification, placed on pallets and stacked in the Holding Freezer.

Production of corned beef is carried out as follows:

The boneless meat is taken through a hasher with a 2" eliptical plate and from there transferred to a jacketed cooking kettle for cooking where cure and spices are added. When the cooking is completed the meat is emptied out of the cooking kettle onto a perforated conveyor with a tray under for collecting the soup. The meat is conveyed to an inspection table and is transferred to a corned beef stuffer for filling into cans. On a conveyor the cans are transported to the closing machine. The cans are falling out of the closing machine into a retort basket standing in a water cushion. The full basket is hoisted into a vertical retort. After sterilizing the basket is transported to the labelling table for hand labelling, packing and palletizing. The loaded pallet is transported into the shipping area for storage.

The soup collected in the cooking room is pumped into a vacuum cooking kettle and in an evaporator brought down to 20% moisture content. The extract is filled into cans.

The all meat pet food would be produced from cheek and head meat, hearts, lungs, tripe, meat and bone scrap and blood in the most suitable product mix.

To assure the correct mix, the products are weighed on a batch conveyor, which fills the raw material into a grinder discharging into a cooking kettle. After cooking the pet food is filled into cans in a filling machine and the cans are closed in a can closer. After a labelling machine, the cans are packed in cases, palletized and stored in the shipping area.

Edible tallow is rendered in a small melter discharged into a percolating tank and from there pumped over a 100 mesh screen into a storage tank. From the storage tank the tallow is filled into drums.

COST OF EQUIPMENT.

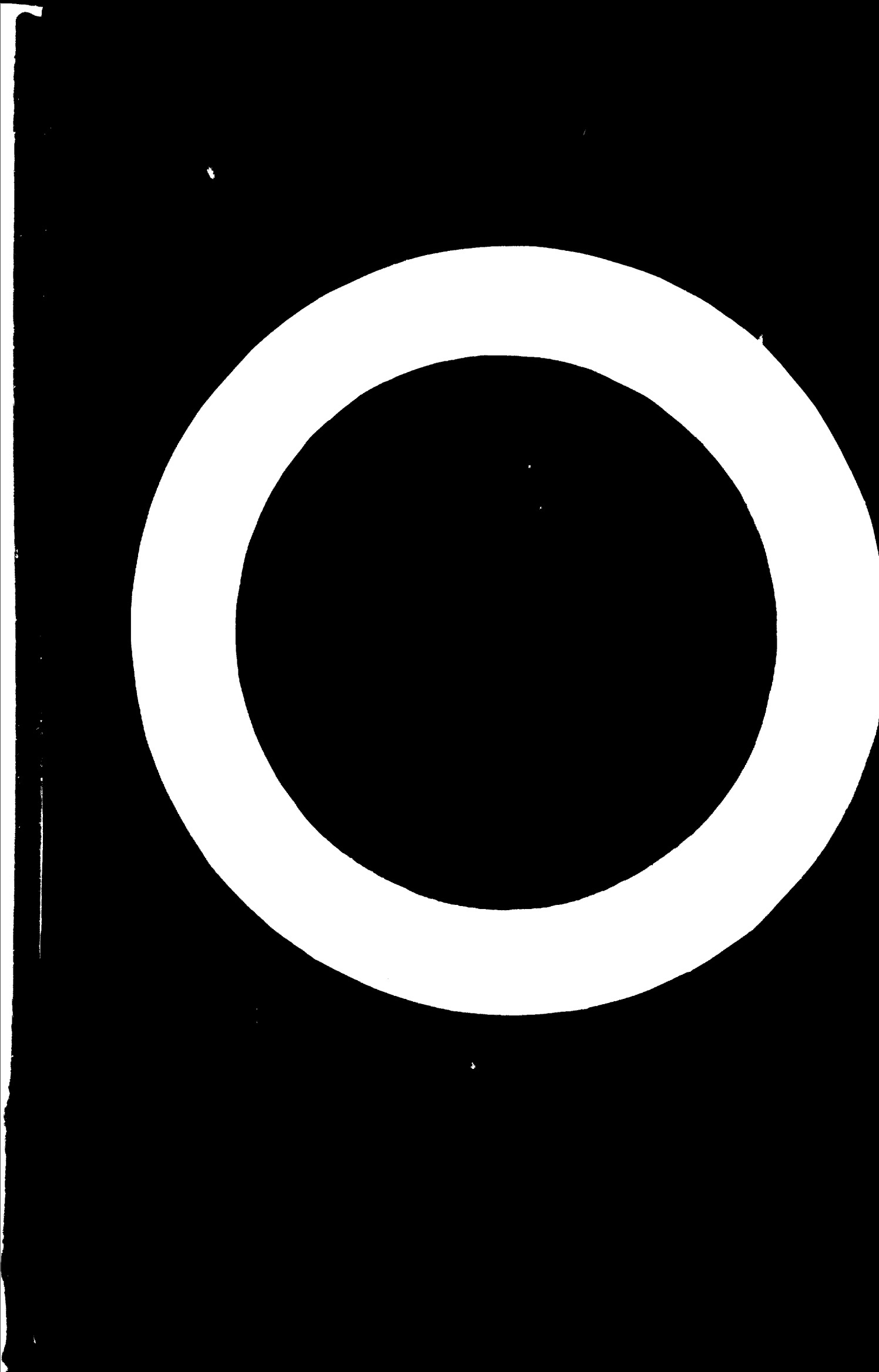
Sticking Area:	U.S. $	18.720,-
Killing Floor:	U.S. $	89.220,-
Hide Room:	U.S. $	22.800,-
Casing Department:	U.S. $	34.830,-
Detention & Condemned Material Room:	U.S. $	32.100,-
Killing Floor, Grading Area and Carcass Chill Room:	U.S. $	18.850,-
Cutting Room:	U.S. $	81.600,-
Room for Special Cuts:	U.S. $	34.400,-
Washing Area:	U.S. $	2.000,-
Canning Department:	U.S. $	98.000.-
Pet Food Department:	U.S. $	44.400,-
Edible Tallow:	U.S. $	10.680,-
Shipping:	U.S. $	49.350,-

INEDIBLE RENDERING BUILDING.

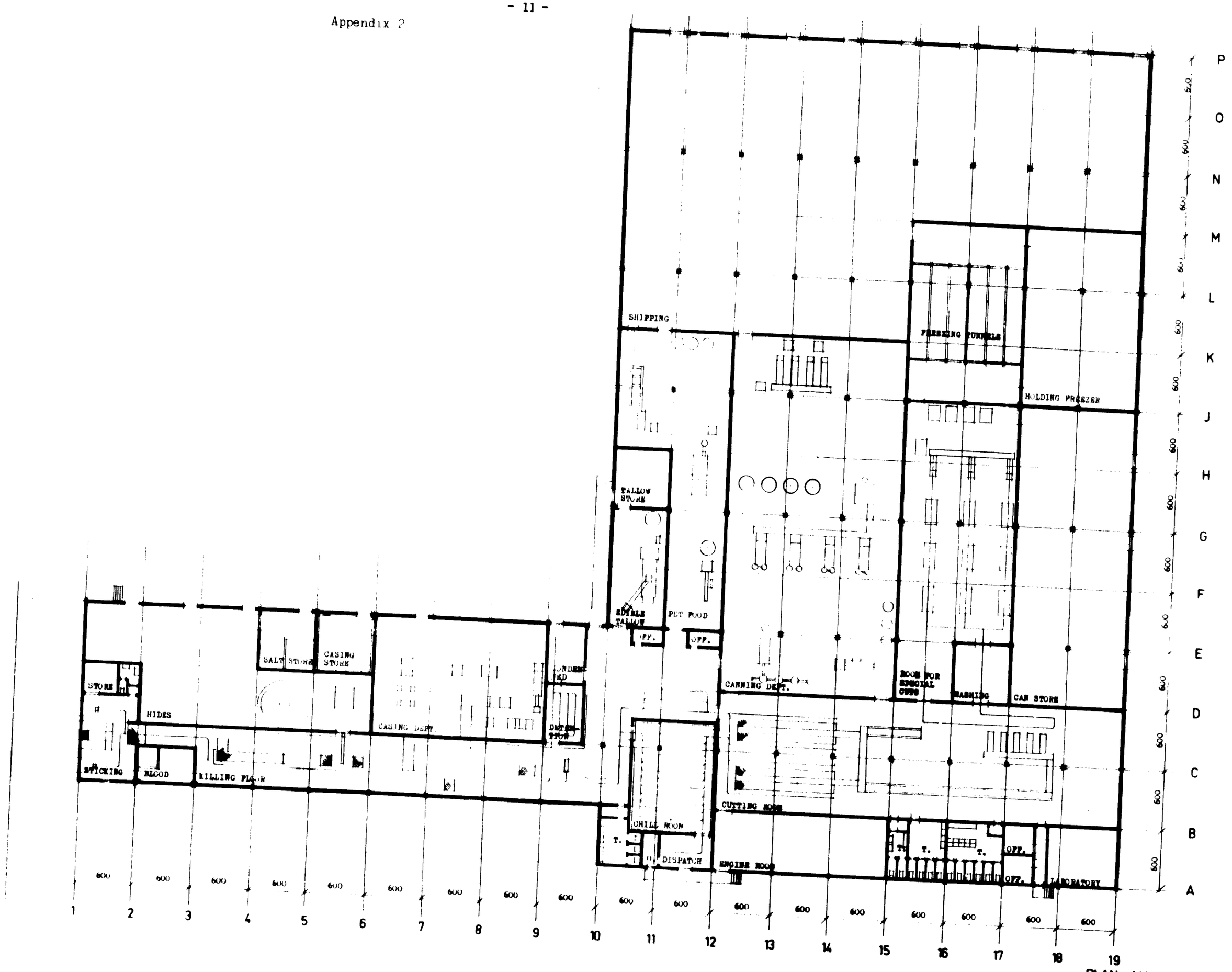
Slaughter Hall:	U.S. $	5.825,-
Raw Material Room:	U.S. $	13.100,-
Rendering Room:	U.S. $	123.700,-
Lairage:	U.S. $	9.300,-
Additional Items:	U.S. $	10.000,-
Total	U.S. $	698.875,-
Contingencies:	U.S. $	111.125,-
Total cost of Equipment including Freight and installation:	U.S. $	910.000,-

SUMMARY.	U.S. $
Dollars paid for Animals:	2.151.400
Dollars paid Labour:	70.637
Dollars paid local Supplies:	1.342.532
Net Foreign Exchange Generated:	4.600.000
Investment Buildings + Technical Administration:	1.818.000
Working Capital required (1/4 of total sales):	1.370.000
Investment Equipment:	810.000
Total Capital required:	3.998.000
Return after Expense before Tax:	882.513
Depreciation added back:.....	171.100
Cash Flow before Tax:	1.053.613
Percentage to Investment:	26,4%

All costs in this appendix are based on 1967 price level.



Appendix 2



PLAN MAIN FACTORY

SCALE : 1:200

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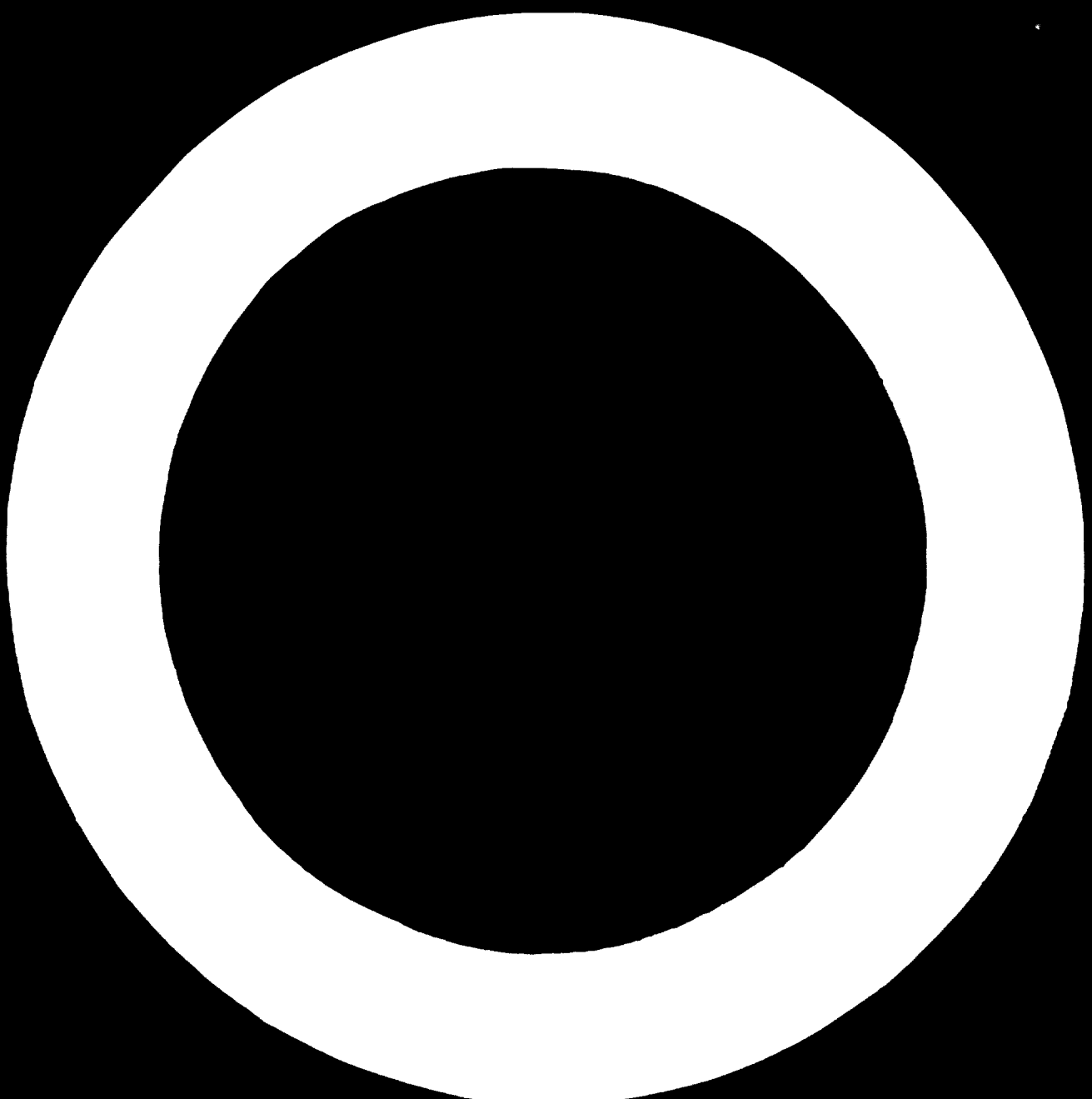


APPENDIX 3

PRELIMINARY LAYOUT PLUS DRAWING

of an African

PIG SLAUGHTERHOUSE WITH

BACON/SAUSAGE AND CANNING FACTORY

50% of the production for export
50% of the production for domestic markets

based on 1200 pigs per week.

GENERAL DESCRIPTION OF THE LAYOUT.

The layout has been shown on the attached drawing No. 916-4. The suggested plant is a one-storey factory block with the same distance between the grid lines and the same ceiling height all over. This way of construction gives a very economical building which can be either pre-fabricated with great advantage or cast in situ with nearly the same advantage as the same shuttering can be used again and again. The estimated building time is 18 months.
A very light building shall be constructed to hold the live pigs with two sections, one for "clean" pigs and one for "unclean" pigs.

From the lairage the pigs are taken to the factory building to the sticking room where they are electrically stunned and hoisted onto the bleeding rail.

The sticker will stand close to the blood room and through a hollow knife provided with a natural casing, the blood will run into a milk can in stainless steel inside the blood room when the collection of edible blood is required. The blood will be stored in the room in batches with blood from about 10 pigs which will be awaiting that the pigs from which the blood stems will have passed the veterinary inspection without any comments.

From the bleeding rail, the pigs will go through the scalding tank and dehairer, flame oven and brushing machine onto the evisceration table which is directly connected with the gut cleaning department by a hatch through the wall. The dressing line is separated from the unclean part of killing line by a wall. The set of plucks will after inspection be transported to the plucks chillroom adjacent to the killing floor where the separation can take place and after chilling packing into boxes for freezing and transport through the door into the Freezer can be easily managed, and the parts needed in the production are taken into the adjacent production rooms. The leaf-lard can go into the lard rendering department and fat from the gut cleaning department can be transferred to the lard rendering department through a hatch in the wall. For the packing and storage of the lard, a small cooler has been allowed for. From this cooler the distance to the dispatch area is very small.

When the set of guts has been inspected it will be pushed into the gut department where it is separated and cleaned. A special room has been provided for salting and calibration of casings produced within the plant and for taking in casings from the outside. The finished casing is stored in a separate cold room.

All condemned parts of the carcass or parts which are not utilized for the production of products for human consumption are brought into a separate room where all the materials which can be used for the manufacture of dog bisquits are taken into the dog biscuit manufacture room and the remainder thrown into containers which can be easily picked up by a lorry for transport to the inedible rendering plant.

After weighing and grading the pig is pushed on to the pre-cooler conveyor and taken to the pre-cooler. The carcass will remain here for approximately three hours and cooled completely down before bringing into the carcass cooler where the temperature will be equalized over the night. The pre-cooler can also be switched over and used as an after-cooler for the last pigs of the day's kill. If pigs are required immediately at the cutting department they can be taken directly out of the pre-cooler, if necessary.

The cutting department is arranged for complete boning of the pigs and only a very small room has been arranged for beef brought in from outside.

After completed cutting, the hams and middles can be brought in for curing, the sausage meat stored in the sausage meat coolers for fresh or cured sausage meat. In the centre a washing room is positioned where all the meat containers holding a fixed batch of meat will pass on their way back from the production rooms to the cutting department. Hooks and gambrels can be washed in this area as well.

The sausage manufacture has been separated into two parts, one for fresh sausages and one for continental sausages. The latter department is provided with a central cooking area with a hood above to remove the vapour from the room. After completed production and packing, sausages are put on pallets and stacked in the dispatch cooler.

Cured meat which is being smoked is taken direct from the curing room into the smoke room where the smoking will be carried out in smoking cabinets. Bacon middles which are being sliced will be taken to bacon coolers in order to bring down the temperature of the bacon to the right

slicing temperature. The handling is facilitated by using the same trucks as those used in the smoke cabinets inside the bacon coolers. On the other side of the bacon coolers the bacon can be taken out into the slicing department for slicing and packing. After packing the bacon is put on pallets and transferred to the dispatch cooler.

The products which are being canned are transferred to a separate canning department which is positioned adjacent to the general store. In this way the cans can easily be transferred from this store to the canning department. The canning department is provided with a separate cooler and incubator.

In the bottom corner to the right, a pie department has been incorporated with a separate room for dough mixing, a separate one for baking and packing, and a small pie cooler to bring down the temperature of the pies before they are transferred to the dispatch cooler. A separate dispatch area is positioned centrally and adjacent to the freezer. In this department the orders will be sorted out ready for loading onto delivery vans.

All transport is based on fork-lift transport, and all finished goods will be transported on pallets and stacked on pallets in the chill-rooms and the freezer in order to give the best efficiency of the rooms.

In the bottom right corner, changing rooms, washing rooms and toilets for the workers have been centralized. A door to the outside will be the workers' entrance, and at this point one guard will control entry and departure from the factory as well as workers going to the cloak-rooms and the toilets. In the same corner, closely connected to the dispatch area, the administrative offices have been positioned. Laboratory and changing rooms for the veterinary officers have been located in this area as well.

In addition to the two buildings shown on the plan, a special building for boiler plant may be necessary, depending on the position of the plant.

A camp for the labour force, sewage disposal plant and purification plant may also be required in connection with this plant.

ESTIMATED PRODUCTION PER WEEK.

Product:	kg/week.
Sliced Bacon:	14.000
Fresh Pork Sausage:	10.900
Beef Sausage:	1.400
Chipolata:	4.500
Pork Sausage Meat:	430
Polony Sausage:	3.200
Liver Sausage:	600
Garlic Sausage:	500
Vienna Sausage:	1.000
Frankfurters:	1.500
Cooked Picnic Hams:	1.400
Cooked Gammons:	2.600
Canned Hams:	6.600
Lunch Tongue:	80
Liver Paté:	430
Block Brawn:	600
Pie Snack:	1.000
Pork Pie:	800
Veal Ham Pie:	500
Steak and Kidney Pie:	300
Melton Mowbray Pie:	200
Canned Luncheon Meat:	5.100
Bone & Meat Meal:	3.750
Technical Fat	1.950
Blood Meal	600
Lard	4.500
Loins (boneless)	3.800
Canned Shoulders	4.000
In total	76.240

COST OF NEW PLANT.

		U.S. $
Building Work, Area 7.318 m^2		827.108
Piped Services	221.686	
Electrical Installation	156.627	
Refrigeration Plant	153.012	
Sewage Treatment	19.277	
Water Storage	12.048	
	562.650	562.650
Equipment	301.204	301.204
Labour Housing	54.216	54.216
Total in U.S. $		1.745.178

To the above the cost of the site must be added, or if there are special conditions on the site which require special foundation work, levelling or extremely long supply, pipes of cables.

RELATION TO INVESTMENT.

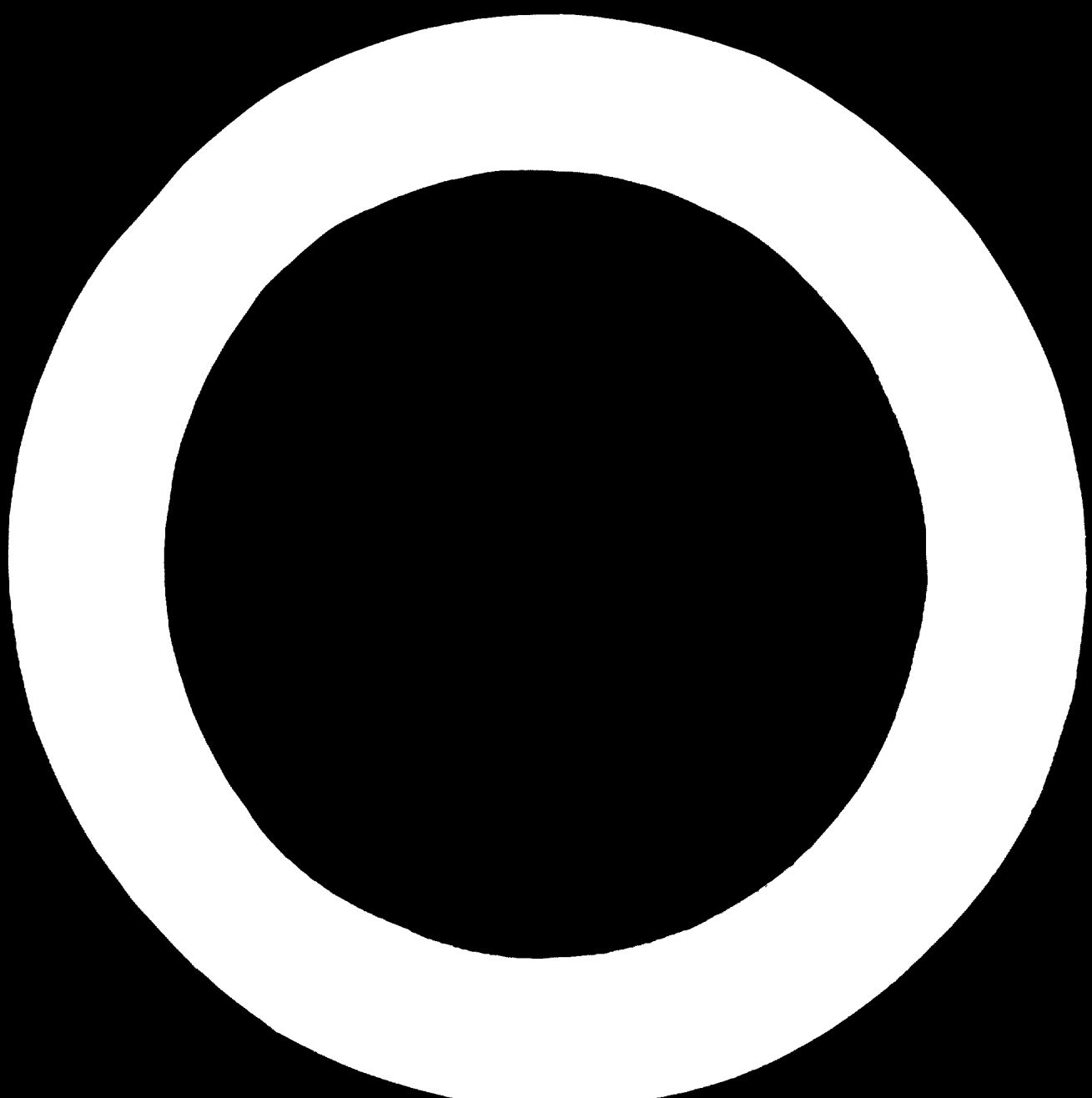
For this plant, the depreciations should be changed to a total of U.S. $ 95.180.

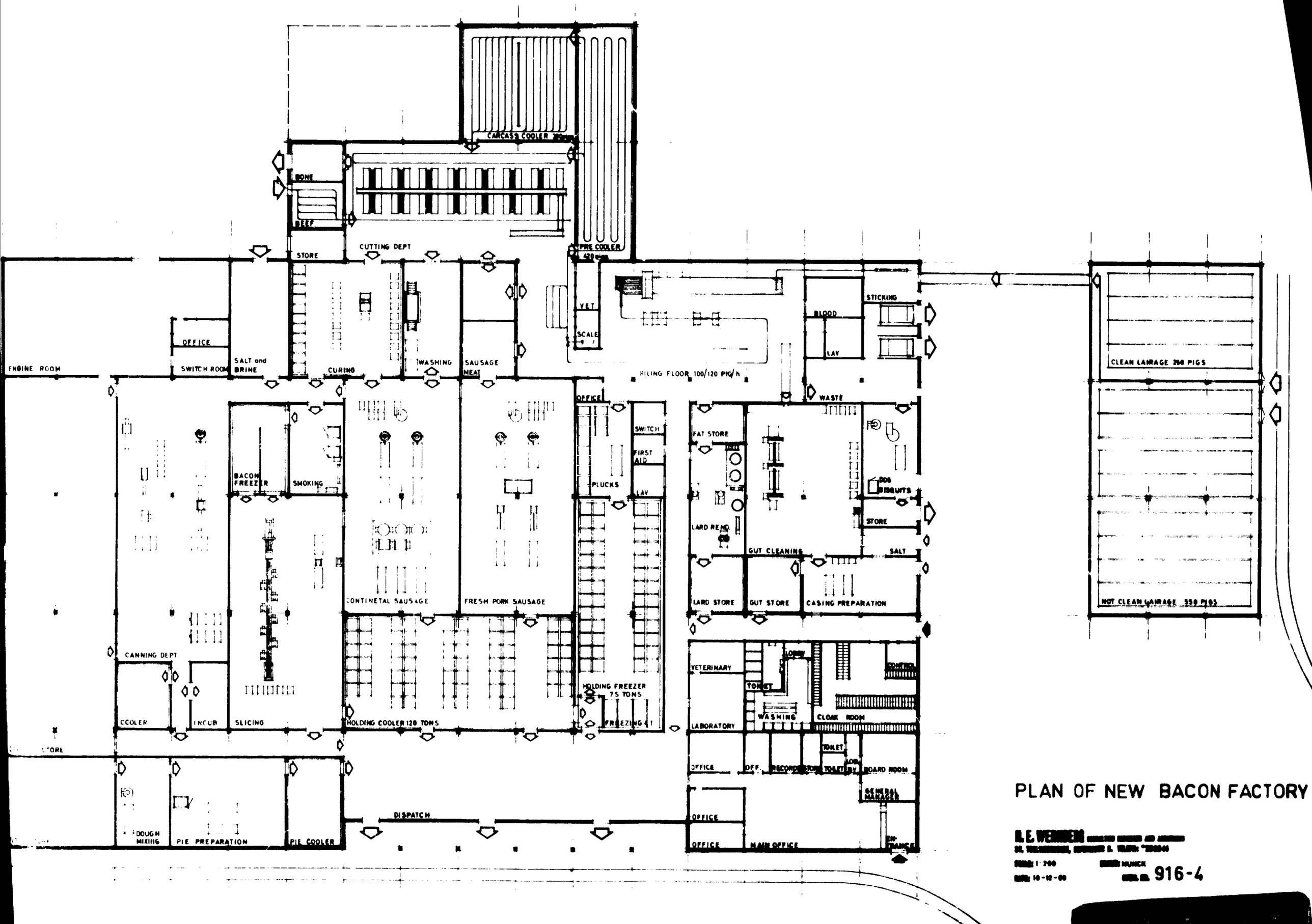
This means that the operating profit will be reduced to U.S. $ 298.370

If the depreciation is added back, the cash flow in relation to the investment is before tax 22½%.

This means that a new plant is feasible, provided that the marketing of the product can be secured.

All costs in this appendix are based on 1969 price level.





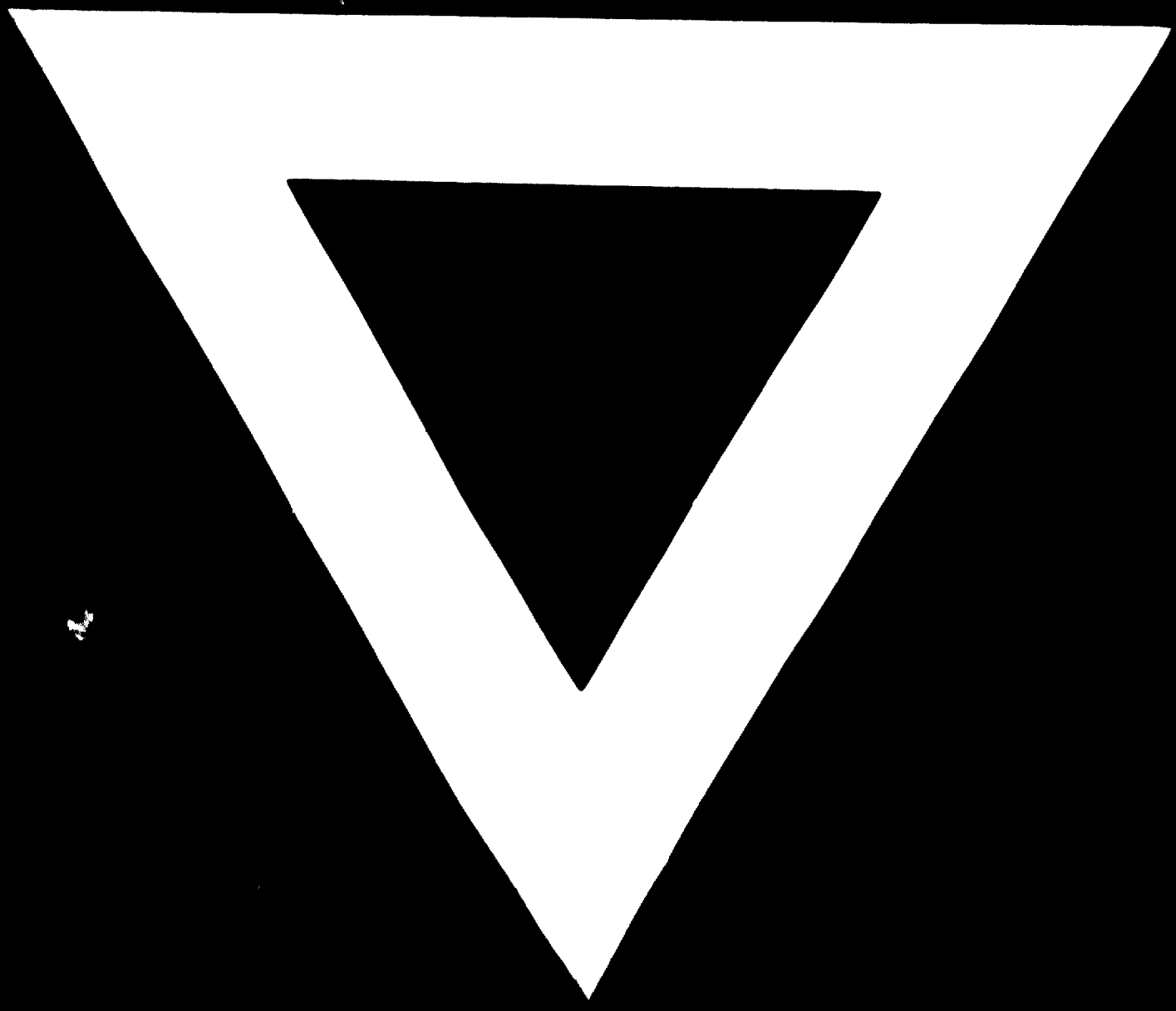
PLAN OF NEW BACON FACTORY

H. E. WEBBERS

SCALE 1:200

DATE 10-12-66

DRG. No. 916-4



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