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RESTRICTED

ASSISTANCE IN THE ESTABLISHMENT OF A PHARMACEUTICAL PLANT.

SI/YEM/78/802.

YEMEN.

Terminal report.

Prepared for the Government of Yemen
by the United Nations Industrial Development Organization,
executing agency for the United Nations Development Programme

Based on the work of Fritz Brennig, expert in the construction of pharmaceutical plants

26 JUN 1979

United Nations Industrial Development Organization
Vienna

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Explanatory notes

The monetary unit in Yemen is the rial, which is divided into 100 fils. During the period covered by this report the value of the rial in relation to the United States dollar was $US 1 = YRls 4.55. The weights and measures used in Yemen vary according to localities and to the type of commodity. The metric system is officially used and accepted by most of the population.

YEDCO is the Yemen Drug Company.

Mention of firm names and commercial products does not imply the endorsement of the United Nations Industrial Development Organization.

ABSTRACT

The project entitled "Assistance in the establishment of a pharmaceutical plant" (SI/YEM/78/802) arose from a request submitted in February 1978 by the Government of Yemen to the United Nations Development Programme (UNDP) to assist the Yemen Drug Company (YEDCO) in the preparation of the layout and design for the building of a new pharmaceutical factory at Sana'a. The request was approved on 20 March 1978 and the expert in the construction of pharmaceutical plants took up his assignment in October 1978. The duration of his stay, originally planned for six months, was subsequently, following a request of the Government, shortened to three months.

After a study of the future production programme, the expert examined the plot of land available for the construction of the factory, made investigations regarding supply of water, electricity and sewage disposal and prepared layout drawings for the various factory buildings, which are: production block, warehouse, administration building, waterhouse, maintenance and workshop building and the stand-by generator.

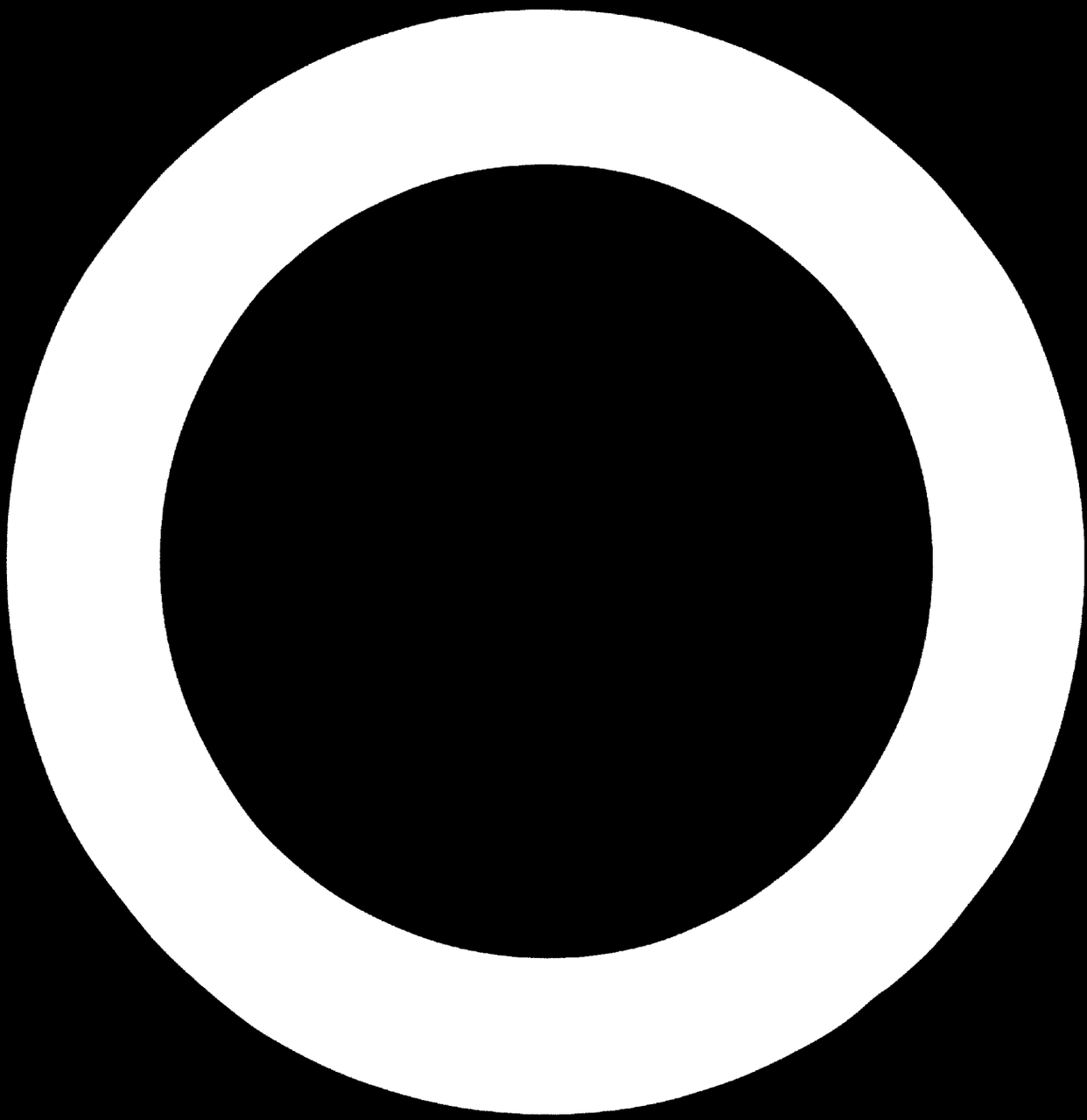
He concluded that the existing piece of land was too small for a future expansion of the factory and made the following recommendations:

(a) A neighbouring plot of 6,992 m^2 should be bought by YEDCO for future extension of the factory;

(b) The basic construction of all buildings should be reinforced concrete frame structures;

(c) Detailed drawings should be prepared without further delay should the Government wish to begin construction early in 1979;

(d) An expert should be appointed to assist in supervising the construction work, in preparing the tenders and in following up until the factory can start to operate.



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INTRODUCTION

Project background

At present about 180 different foreign companies supply the local market with pharmaceuticals. This means that an amount of some million Yemeni rials in the form of foreign exchange has to be spent each year to cover local requirements. About 75 per cent of these pharmaceuticals could be produced by the new factory in its first step of operation. Later on up to 90 per cent of all drugs which are imported at the moment could be made locally. This shows clearly that by setting up a pharmaceutical factory a considerable amount of foreign exchange could be saved which could be used for further development of the country.

In 1977 a pharmaceutical expert was sent by the United Nations Industrial Development Organization (UNIDO) on a six month mission (project RP/YEM/77/001) in order to assist the Government of Yemen in determining the appropriate technology, in selecting the suitable equipment and in establishing a manpower training programme for the local production of quality drugs in adequate quantities.

The Government of Yemen decided to implement the expert's recommendations contained in his final report (UNIDO/IOD.155) and consequently requested in February 1978 further assistance by a UNIDO expert who would have to prepare the layout and design for the building of a new pharmaceutical factory. This new project, entitled "Assistance in the establishment of a pharmaceutical plant" (SI/YEM/78/802) was approved by UNIDO on 20 March 1978 and the expert in the construction of pharmaceutical plants took up his assignment in October 1978. The duration of his stay, originally planned for six months, was subsequently and following a request of the Government, shortened to three months.

The purpose of the mission, as set out in the expert's job description (annex I) was to advise the local architect and engineers on the setting up of a pharmaceutical factory in Sana'a. The capacity of the proposed factory should take into consideration also the future need for pharmaceuticals which meant that the layout had to be designed in such a way that, for the next ten years no extension of the buildings would be necessary even if the consumption of pharmaceuticals should increase three or four times.

Official arrangements

After the expert's arrival at Sana'a he met with Dr. Albabily, General Director of the Supreme Board of Drugs and with the General Manager of YEDCO, Farouke Hassan. Based on a previous report by R. Data (UNIDO/IOD.155) the expected requirement of tablets and capsules as well as that of creams, ointments and solutions was briefly discussed. The production of ampoules was also debated but because of the lack of experience in this particular field it was decided to start production of this line only at a later time and after the return of Yemeni pharmacists from abroad, where they would have received training in this particular field. It was stressed that one of the most important sections of the factory is the quality control. It is therefore important that the equipment of this laboratory is always up-to-date and that the laboratory assistants are well informed about the latest developments in order to guarantee a high quality of the pharmaceuticals produced.

After these discussions the proposed site was visited, which is located about 5 km outside of Sana'a on a main road. The size of the site is 16.444 m^2 and the compound is level. In the immediate neighbourhood there is a well which is about 30 m deep and yields sufficient water, all year round, according to the information of the neighbours. It has to be checked if there exists a well on the compound which would yield enough water to keep the factory going, or if it would be necessary to search for another well in the immediate surrounding. A general water supply would solve this problem; however, at the moment the capital, Sana'a, faces so many problems in connection with water supply that it will take some time until a general water supply system reaches this area.

After visiting the plot, the expert met the chairman of YEDCO, Abdulla Mohammed Al-Tahami, and discussed with him the above-mentioned possibilities. Mr. Al-Tahami had a site plan drawn which was given to the expert two days later when he met the responsible persons again at YEDCO. In the meantime, the expert prepared some sketches to situate the buildings on the site plan. It was found that the existing plot was just large enough to put the buildings on; the area would, however, be crowded with no space left for future extensions. The chairman of YEDCO therefore decided to buy the neighbouring land of 6.992 m^2 to provide an adequate compound for the proposed factory.

The expert also met the Minister of Health, Dr. Ahmed Abdul Malik Al Asbahi to whom a resume of the previous discussions was presented. The Minister agreed to buy the neighbouring compound according to the ideas expressed.

The expert then began to draw the plans for the new pharmaceutical factory at Sana'a and was assisted in his task by one engineer from the Ministry of Public Works.

On 13 November, Abdalla Abdel Wahab, SIDFA from UNIDO, Kuwait, visited the country and the expert had several occasions to discuss the project with him. On 28 November, there was a meeting with Hizam Ash-Showhati, Minister of Economy. This meeting was joined by the chairman of YEDCO, Al-Tahami and by Abdel Halim, UNIDO co-ordinator. The drawings and descriptions of the buildings were presented to the Minister and the other persons taking part in the meeting in order to give them an impression of what the factory would look like.

The production facilities, the storage in the warehouse, the supply of water and electricity, the telephone connections and the sewage disposal were discussed. The Minister of Economy and the Chairman of YEDCO showed great interest in the project and promised its realization by the beginning of 1979.

I. TECHNICAL INFORMATION FOR THE PROPOSED LAYOUT

The planned pharmaceutical factory at Sana'a will consist of six major units:

Production unit
Warehouse
Administration building
Waterhouse
Maintenance and workshop
Stand-by generator

The production unit will include four different production lines and the quality control section. The production lines are:

(a) Unit for tablet production;
(b) Unit for capsule filling and polishing;
(c) Unit for creams, ointments and solutions;
(d) Ampoule Section.

The tablet production area will contain 13 compressing units for different kinds of tablets. The output of one unit with single-shift production, six working hours per day and six days per week will be about 2,160,000 tablets a week. This will bring a total production of 1,404 million tablets a year for 50 working weeks. The output of each compressing unit will therefore be 108 million tablets per year using a compressing machine of medium size.

The capsule filling and polishing unit will be able to produce about 3.5 million capsules a week. Under the same conditions as mentioned for the tablet unit, the yearly output will be 175 million capsules a year. It is also possible, if necessary, to fit an additional capsule filling and polishing machine in one of the tablet compressing compartments, which would double the capsule production.

The creams and ointments section contains three major units: production, filling and sealing, and packing. The output of this section will depend completely on the kind of machinery purchased and on the production lines chosen.

An ampoule section is planned for future extension. Technical details will depend on the expertise of the ampoule expert who will advise about suitable equipment.

The most important unit in the whole factory, apart from the production unit, is the quality control section. According to British Pharmacopia the new directions will be more strict and for this reason a special laboratory for biological essay of antibiotics was already included in the quality control department.

Cleanliness is of utmost importance in a pharmaceutical factory. The ablution block is therefore situated more or less in the middle of the production block. This should guarantee, as much as possible, the cleanliness of the workers before they enter the working areas. Supervision by a responsible person will be required to ensure that none of the workers enter the production units without washing themselves and changing their clothing. The working clothes have to be changed daily after work and sterile ones must be issued for the next working day.

II. DESCRIPTION OF THE BUILDINGS

All buildings are designed as reinforced concrete frame constructions with either block work or wall panels. Thus it is possible to use either the kind of building which is common in Yemen or to choose a prefabricated system which would considerably cut down the time of construction and also be cheaper. Detailed plans are contained in annex II.

Production unit

The production unit is a two-storey building of a total size of 105.50 m x 15.6 m. Each storey has a height of 5 m. On the main floor the machinery and the whole production area will be situated. The second floor is designed with a false ceiling, behind which the channel for the air-conditioning and the filter system will be accommodated. The reinforced concrete frame structure provides for easy expansion in the future. All partitions inside the building are movable, to allow for changes as required by future developments in the pharmaceutical industry.

The windows are fixed with tinted glass to assist the air-conditioning system and to save power. All main doors should be provided with rubber sealing to protect the production units against dust and heat. For easy cleaning all floors in the production unit as well as in the ablution block are tiled. The floors of the offices and the quality control section should be covered with PVC. The building is also equipped with two elevators for the transportation of raw materials up to the creams and ointments section and to bring the finished products down from this section to the store.

The front of the building, on the ground floor, has a covered walkway with one main entrance to protect the factory against dust and dirt. This covered walkway is extended to connect the production unit with the warehouse.

The sewage disposal will be by two main systems. One system, which contains the sewage from the ablution block and the toilets, will go right through the compound to the main road where a sewage tank will take all the suspect sewage. This tank will have to be emptied periodically. The second

system, which contains the water from the production unit and therefore carries some chemicals, has to pass through a special sewage filter system and is then collected in a special sewage tank. It will depend on the results of a water test, whether this water may be used for watering the plants in the compound.

Warehouse

The size of the warehouse is 50.40 m x 30.30 m and the inside height from the floor to the bottom edge of the beams will be 47.00 m. This height guarantees efficient use of the forklifts and easy storage of raw materials which are mostly in drums, as well as that of the finished goods in cartons. A cool room is provided to keep special raw materials at the required temperature.

The windows are fixed, with ordinary glass, and they are positioned right under the bottom edge of the beams on both sides of the building. The whole building is air-conditioned to keep the temperature inside the building as stable as possible. The two main doors are large sliding doors that incorporate two small hinged doors for easy access by personnel.

Administration building

The administration building has a surface of 30.20 m x 10.30 m and is a one-storey building. It is also a reinforced concrete frame construction with fixed windows, full air-conditioning and will house the management of the pharmaceutical factory.

Water house

The water house which constitutes one of the most important parts of the factory, is a reinforced concrete frame construction of 10.50 m x 10.50 m. It will supply the production block as well as the other buildings with water.

The water will come from the well in the compound of the factory and later from the general water supply of Sana'a. Because of the different kinds and qualities of the water and different pressures, all incoming water will have to pass through the water house to guarantee a uniform quality. For the machinery in the production unit it is important to have the required water

pressure at all times to prevent standstill or breakdown. A 500,000-litre tank on the top of the water house should protect the factory from standstills in the event of a defective water supply or in the case of temporary breakdown of the supply. The 500,000 litres from the tank should keep the factory going for at least one week.

Maintenance and workshop building

The maintenance and workshop building has a size of 10.20 m x 5.40 m. It is a one-storey, reinforced concrete frame construction. It contains three rooms - a workshop, an office and a store for all kinds of tools - and is intended for repair of machinery from the production unit but not for vehicles. Since the workshop should maintain not only all machinery from the production unit but also the pumps and filters from the water house, this building has to be situated close to the water house.

III. ROADS AND PARKING AREAS

All the roads and parking areas in the compound are raised up to a level of 30-50 cm above the ground. The reason for this is first to keep the roads as clean as possible and to prevent flooding during the rainy season. The second point is, that the general water supply, electricity and telephone cables and sewage disposal will be in a channel system which is situated at one side of the roads. In this case it is very easy to locate defects in one of the systems and to repair them.

IV. COST OF BUILDINGS

	YRls
Production unit (105.40 m x 15.60 m at YRls 2,500/m^2)	8,250,000
Warehouse (50.40 m x 30.80 m at YRls 3,500/m^2)	5,500,000
Administration Buildings (30.20 m x 10.80 m at YRls 2,500 m^2)	850,000
Water house (10.50 m x 10.50 m at YRls 3,000/m^2)	350,000
Maintenance and workshop (10.20 m x 5.40 m at YRls 2,500 m^2)	150,000
	15,100,000
Roads and channel system, sewage tanks	4,900,000
	20,000,000
	= $US 4,400,000

V. RECOMMENDATIONS

1. If the Government of the Yemen decides to start the construction of the factory buildings at the beginning of 1979, all the detailed drawings should be prepared without further delay.

2. An expert should be appointed to assist the Government in supervising the construction work, in evaluating the tenders and in following up until the factory starts working.

3. In addition to the land of 16,444 m^2 already belonging to YEDCO, the neighbouring plot of 6,992 m^2 should be bought for future extension of the pharmaceutical factory.

4. The basic construction of all proposed buildings should be reinforced concrete frame structures according to the designs prepared by the expert (see annex II).

Annex I

JOB DESCRIPTION

Post title: Construction Expert in Pharmaceutical Industry

Duration: Six months

Date required: As soon as possible

Duty station: Sana'a

Duties: The expert will assist the Pharmaceutical Division in the country in the preparation of the layout and designs for building a Pharmaceutical Unit. Specifically, the expert will be expected to:

1. Study the production programme prepared by a UNIDO expert and prepare the required designs accordingly.
2. Examine the possibility of using existing spaces for such a unit.
3. Determine the production space needs for installation of a new unit and warehouse.
4. Plan in detail the machine installations including the supply of water, electricity, gas, etc.
5. Design central fire detection and extinguishing system.
6. Study the most suitable construction techniques according to the conditions and budget.
7. Select appropriate floor and wall materials.
8. Determine required room ventilation systems which will include air-conditioning where required.
9. Ensure the conception and implementation of flexible yet adequate design to not only meet existing requirements but also the future needs.

The expert will also be expected to prepare a final report, setting out the findings of his mission and his recommendations to the Government on further action which might be taken.

Qualifications: Civil Engineer with extensive experience in the field of industrial construction design and implementation of industrial projects. Familiarity with organization of reconstruction works for industrial needs.

Language: English

Background information:

During the UNIDO/Hungarian Meeting on establishment of a pharmaceutical industry, the representative of the country, Mr. Akabat discussed with the UNIDO representative the needs and technical assistance required for developing the pharmaceutical industry. The Government has given high priority to the development of this industry, which is relevant to the Health Programme. The UNIDO pharmaceutical expert will examine the existing facilities and programmes, and will then prepare a programme for establishing a new unit or expanding the existing ones.

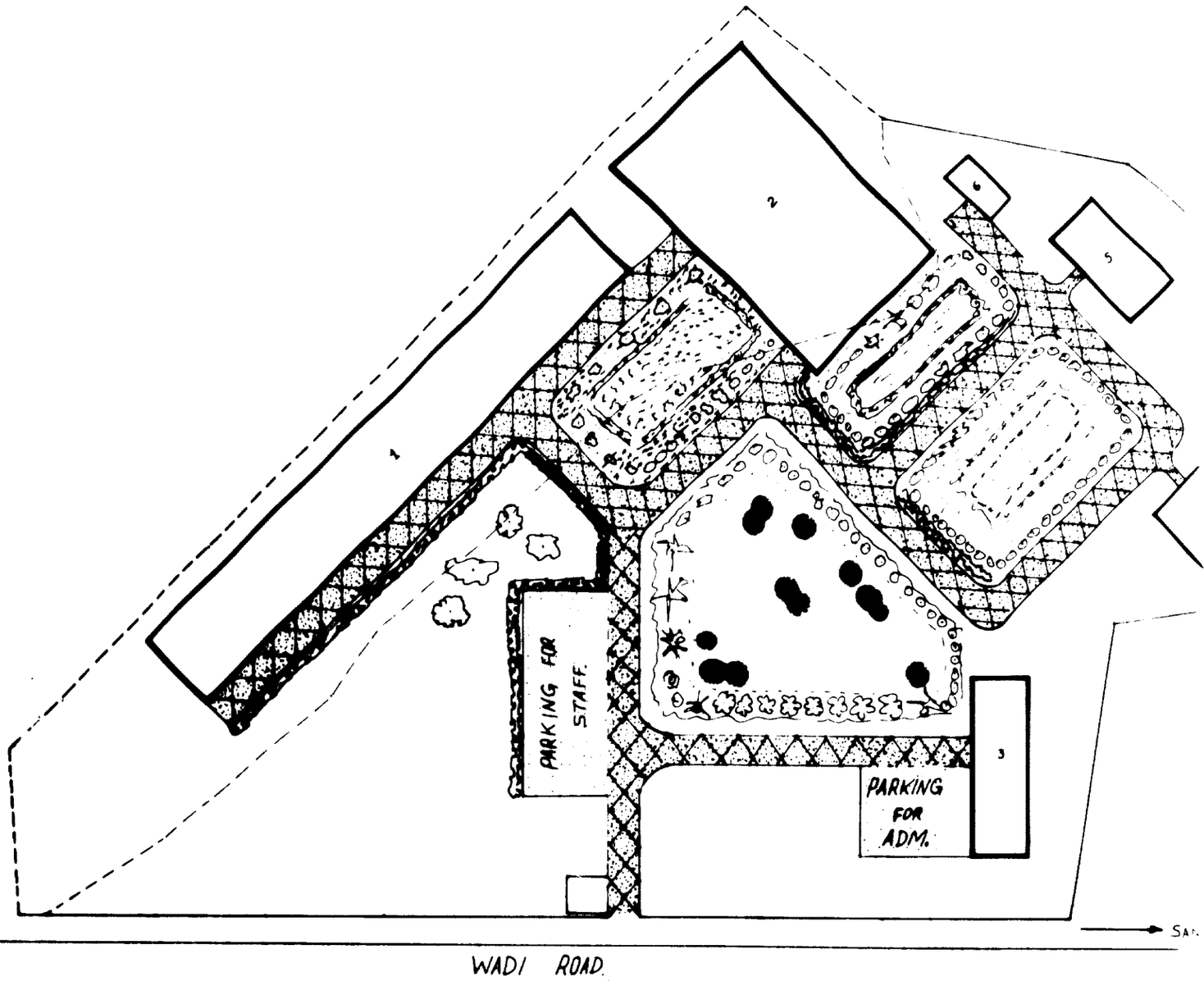
The dependence on imported pharmaceutical products, even tablets which are consumed in considerable quantities makes it necessary to consider the possibility of establishing a pharmaceutical industry in the country to save some of the valuable foreign exchange and to reach a degree of self-sufficiency in certain pharmaceutical products. The statistical data of imports and consumption of pharmaceutical products is an indication of the need and viability which will meet the growing need of the Health Services.

The work of the expert will be the preliminary ground for bringing the project into existence.

As the first phase of the project has been carried out successfully, the Government has now requested UNIDO for assistance in establishing a pharmaceutical industry, implementing the recommendations suggested by the UNIDO pharmaceutical expert during the first phase.

Annex II

LAYOUT DRAWINGS FOR THE
NEW FACTORY BUILDINGS



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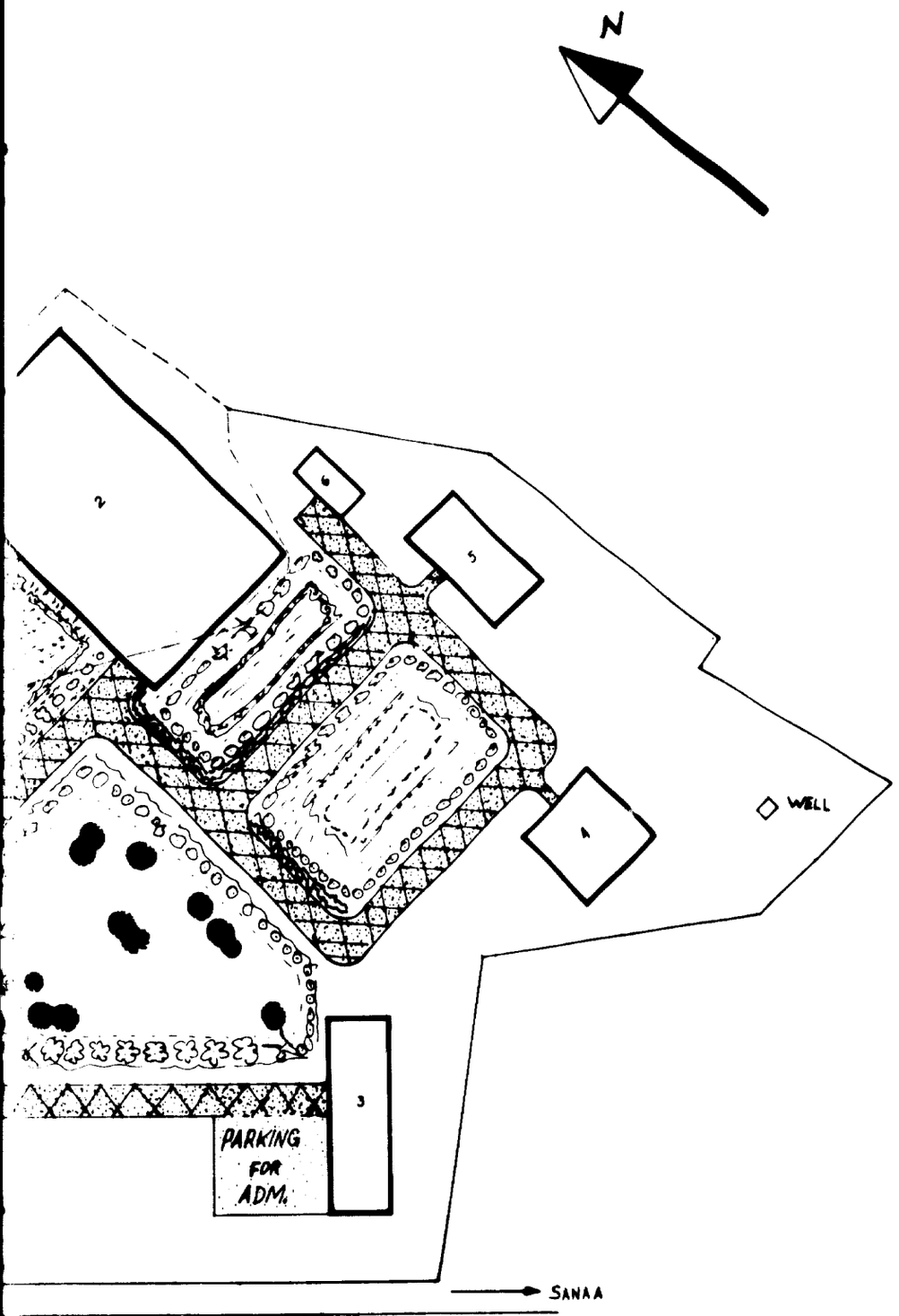


1- PRODUCTION BLOCK
2- WARE HOUSE
3- ADMINISTRATION
4- WATER HOUSE
5- MAINTENANCE
6- STANDBY GENERATOR

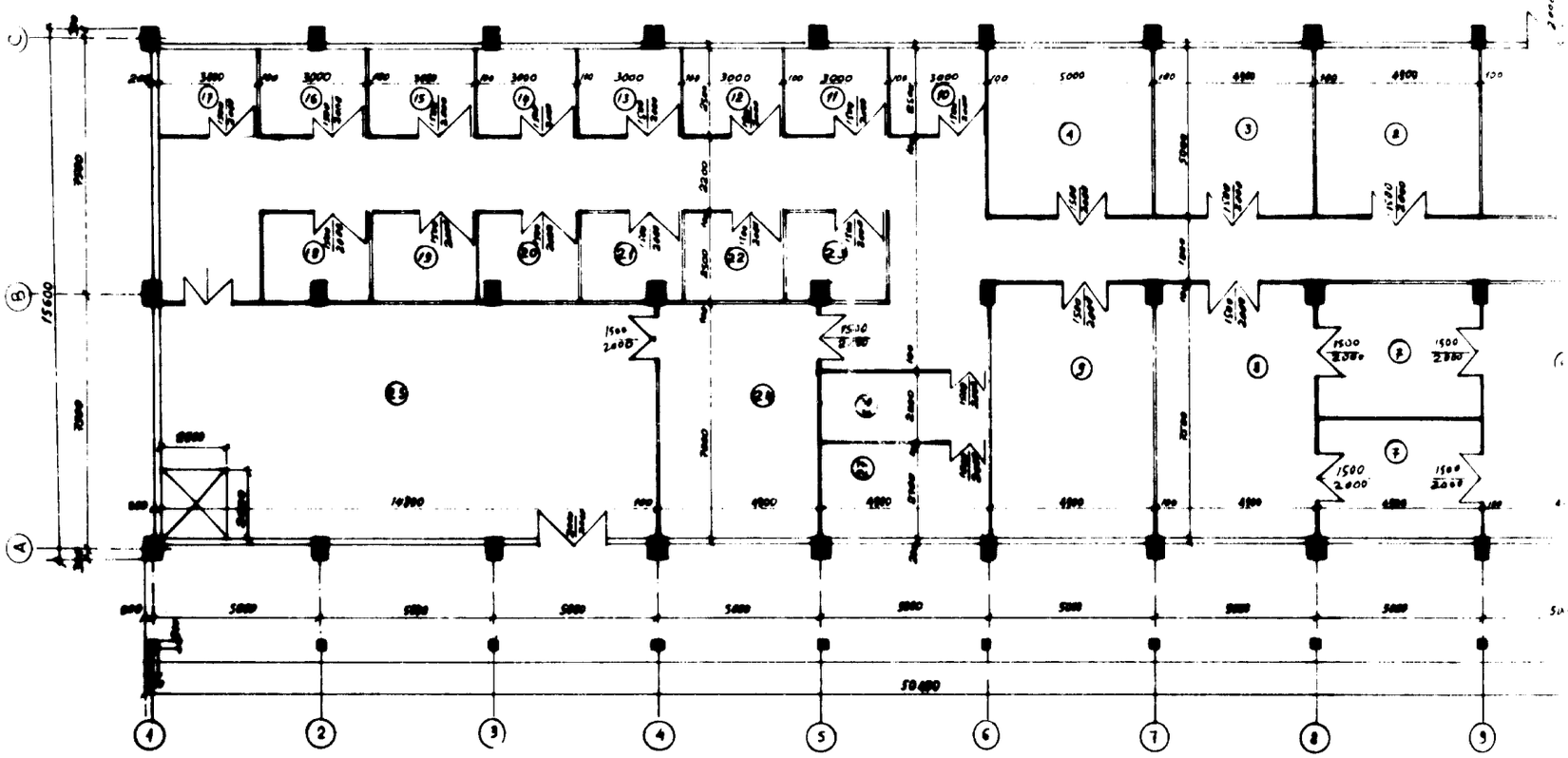
SECTION 2

YEMEN ARAB REPUBLIC
MINISTRY OF PUBLIC WORKS
TECHNICAL DEPARTMENT

PHARMACEUTICAL FACTORY

SITE PLAN

GROUND FLOOR



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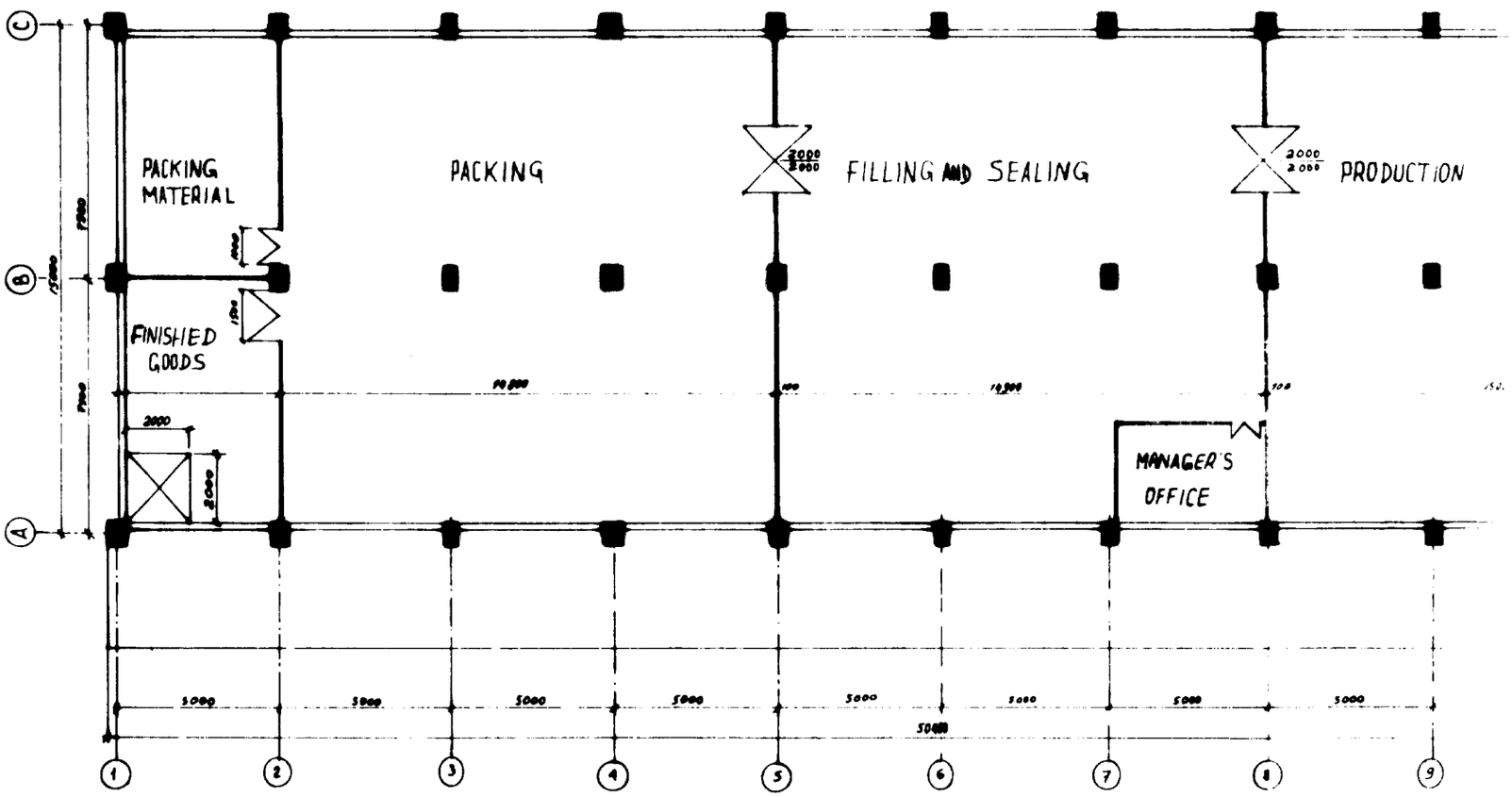

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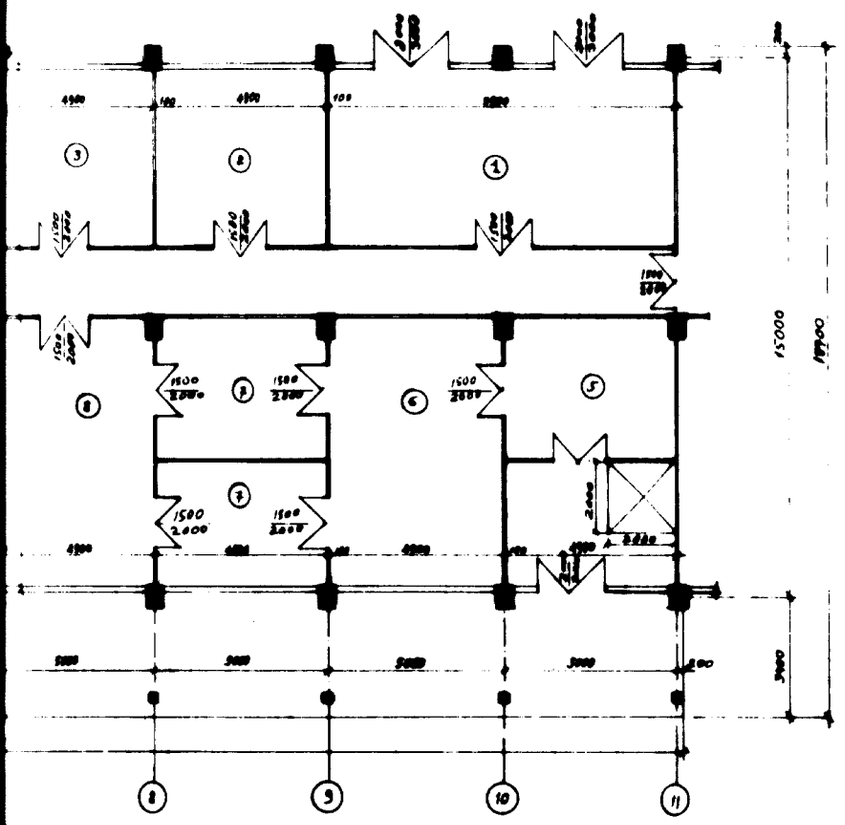
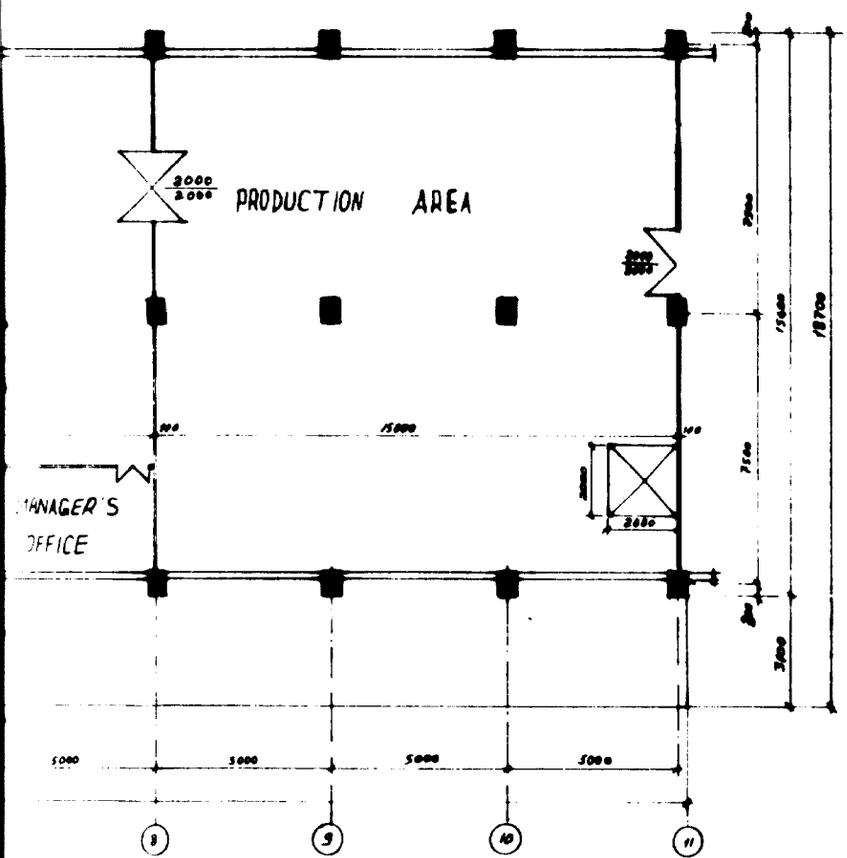


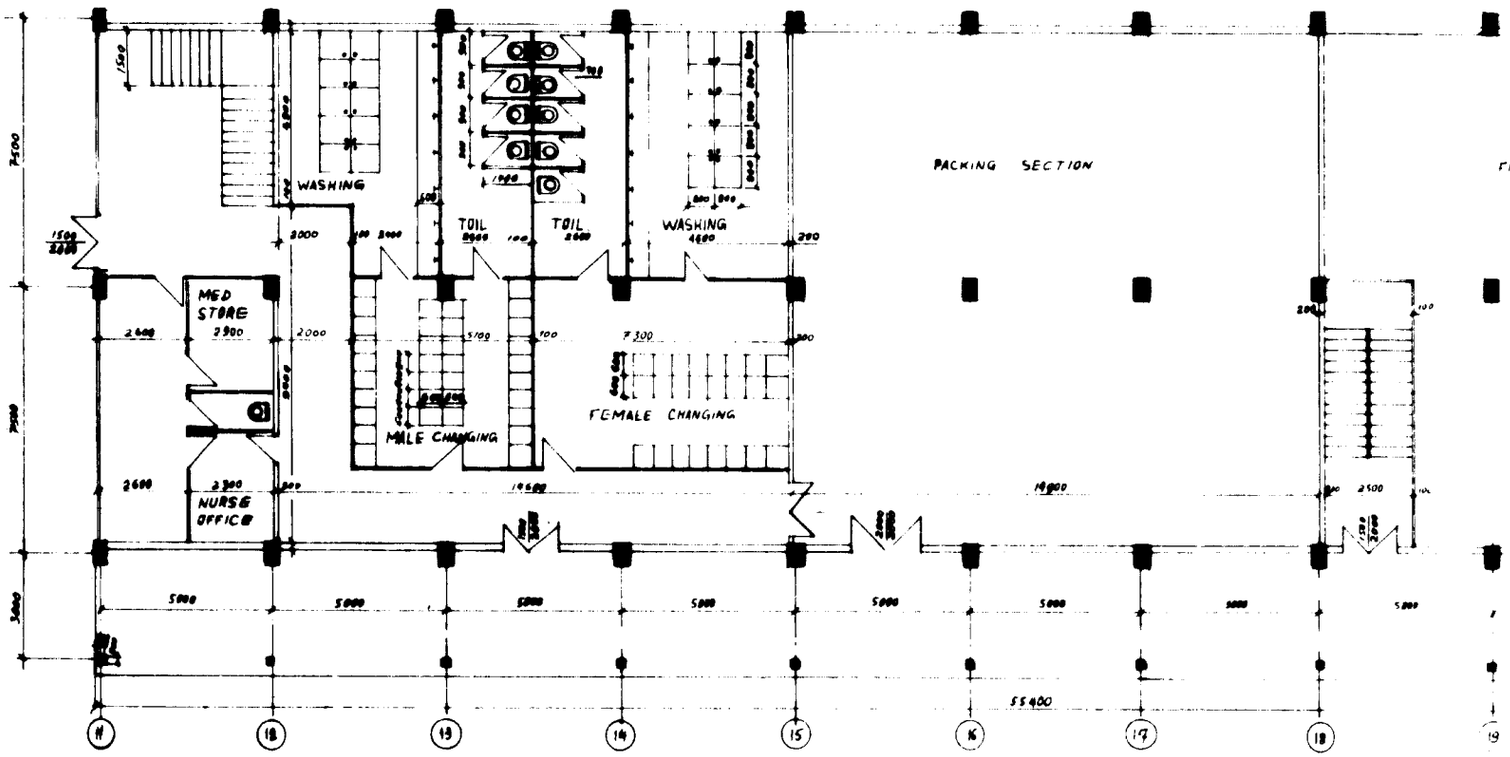
1. AEROMATIC
2. HOMOGENIZER
3. COMMUNITY MACH.
4. STORAGE.
5. RAW MATERIAL.
6. SIEVING ROOM.
7. KNEADING
8. DRYING ROOM.
9. WASHING
10-23. TABL COMPRESSING.
24. CAPSULE FILLING & POLISHING ROOM.
25. FINISHED TABLETS STORE
26. SECRETARY OFFICE.
27. TABL. MANAGER OFFICE



YEMEN ARAB REPUBLIC
MINISTRY OF PUBLIC WORKS
TECHNICAL DEPARTMENT
PHARMACEUTICAL FACTORY
PRODUCTION UNIT
PART 1 LAYOUT

SECTION 2

GROUND FLOOR



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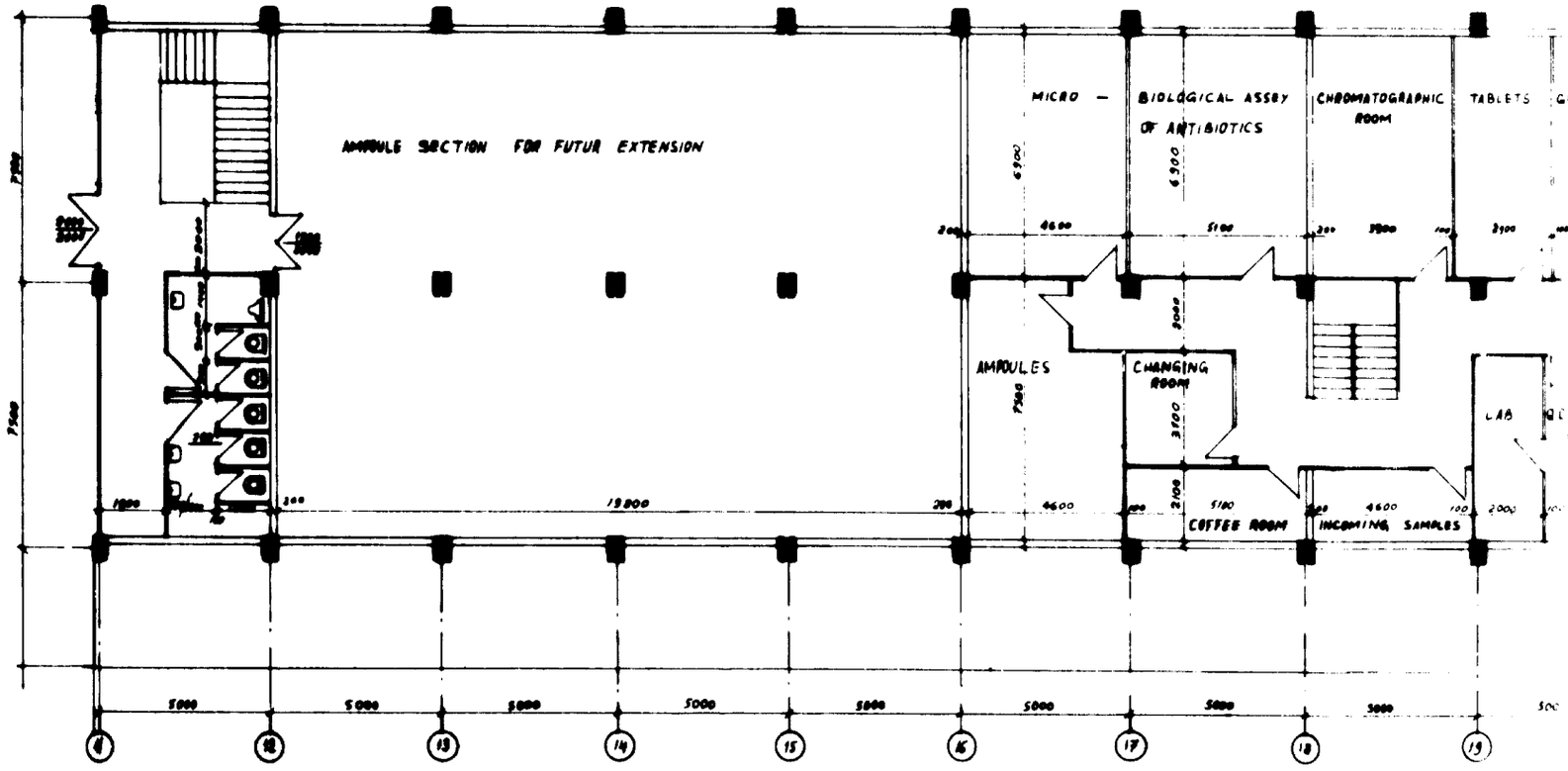

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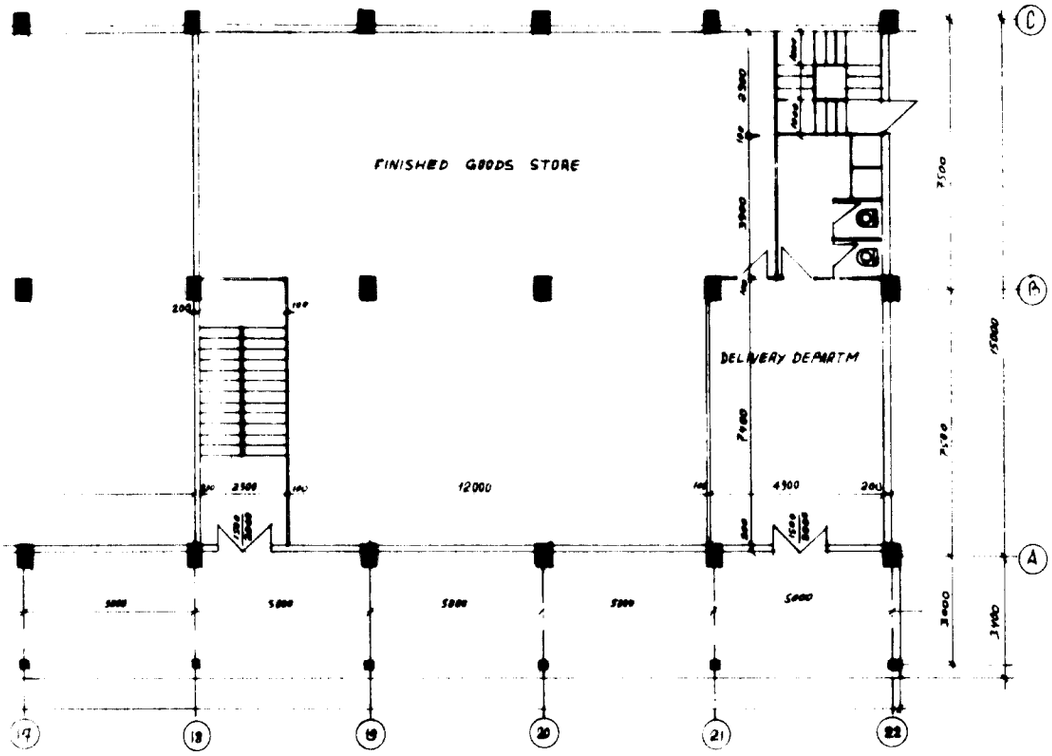
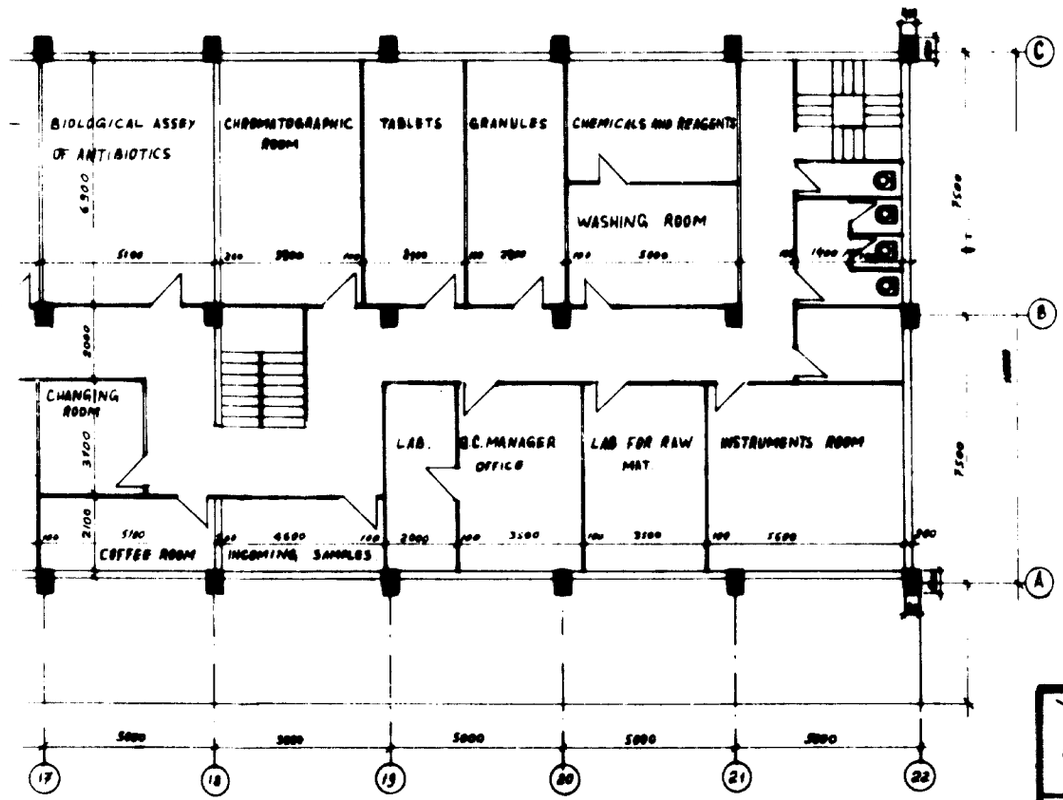
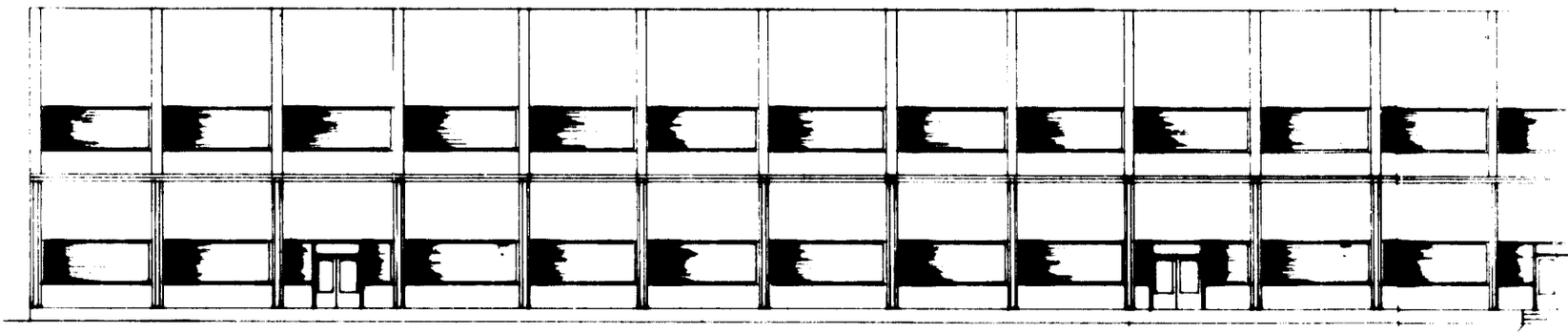
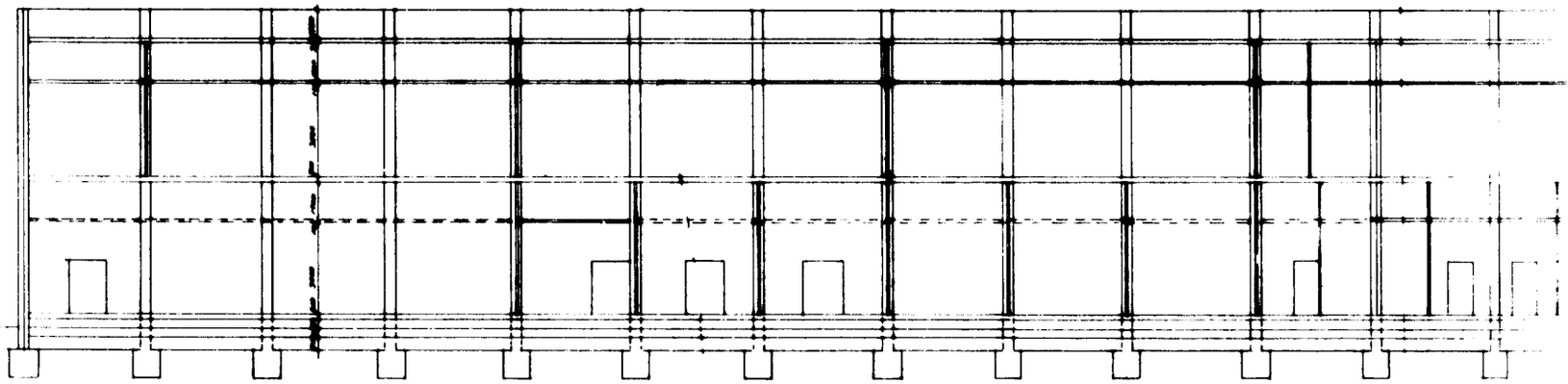




YEMEN ARAB REPUBLIC
MINISTRY OF PUBLIC WORKS
TECHNICAL DEPARTMENT
PHARMACEUTICAL FACTORY
PRODUCTION UNIT
PART 2 LAYOUT

SECTION 2





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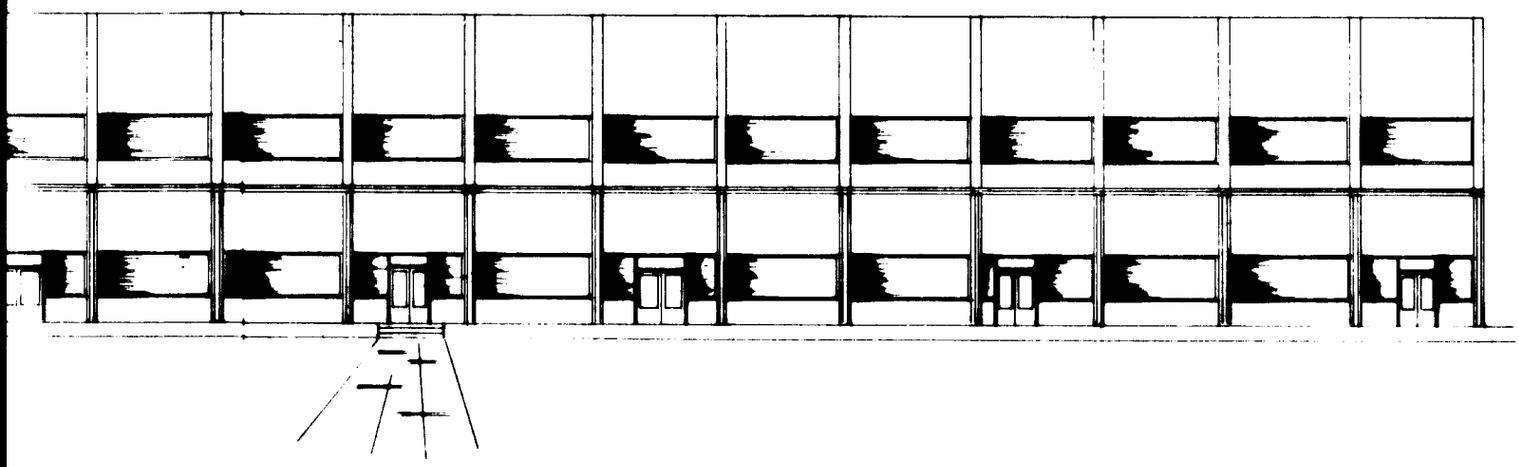
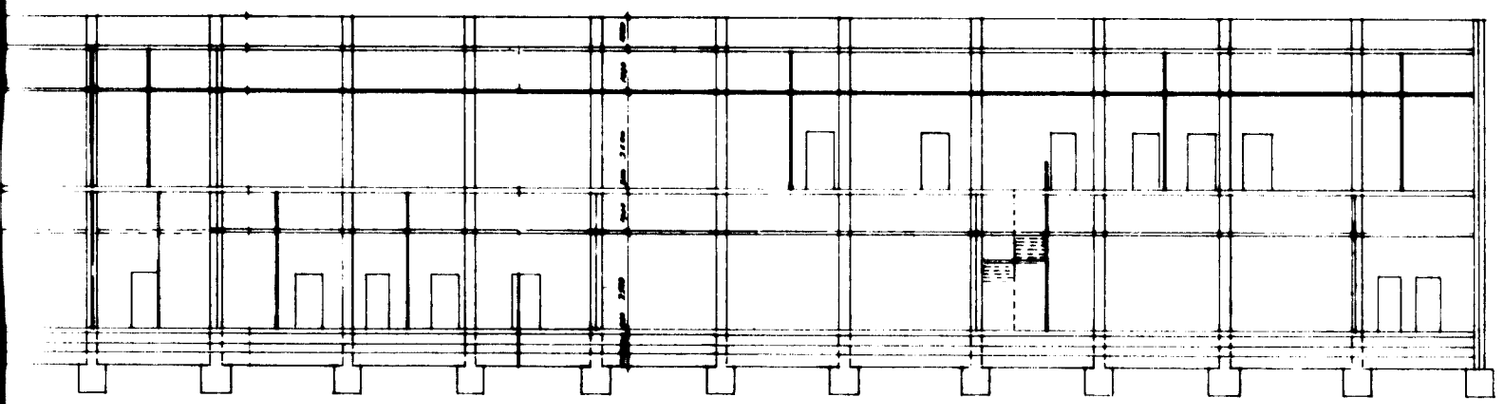




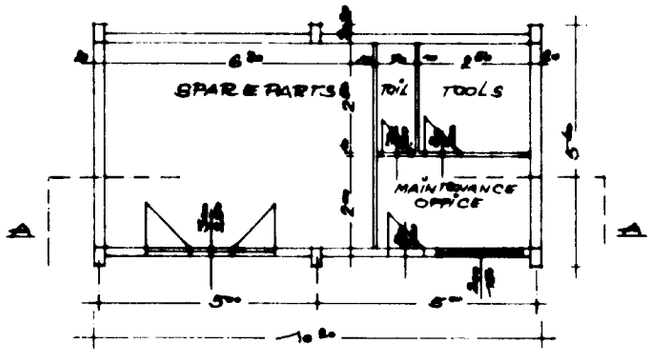
YEMEN ARAB REPUBLIC
MINISTRY OF PUBLIC WORKS
TECHNICAL DEPARTMENT

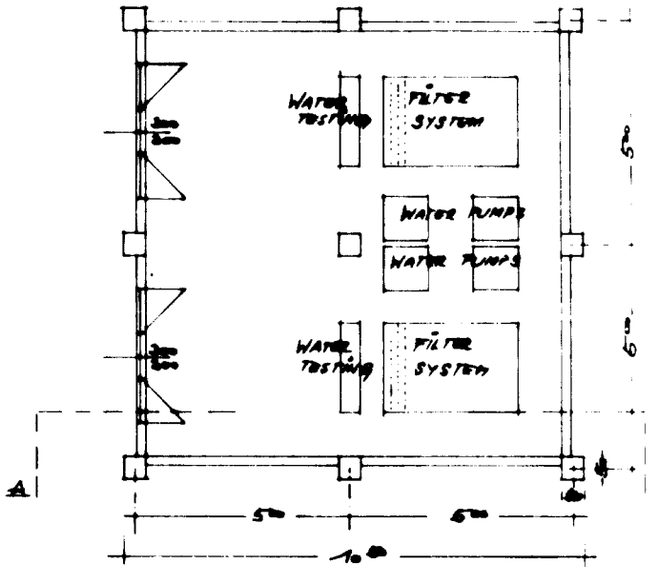
PHARMACEUTICAL FACTORY

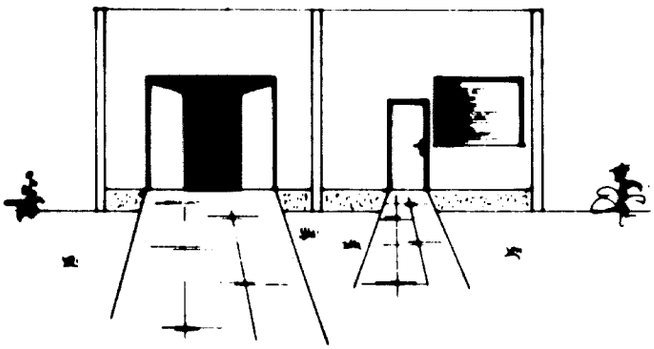
PRODUCTION UNIT

ELEVATION, CUT

SECTION 2







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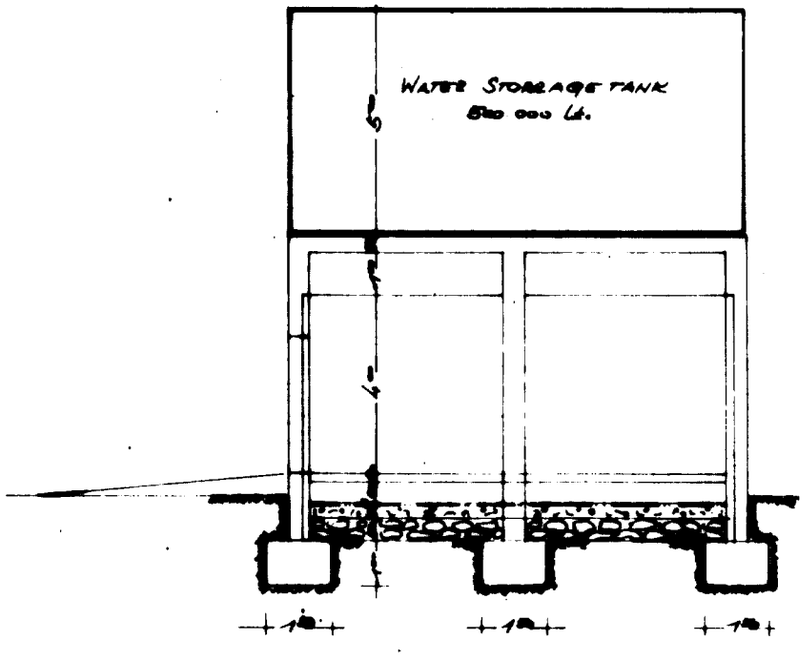

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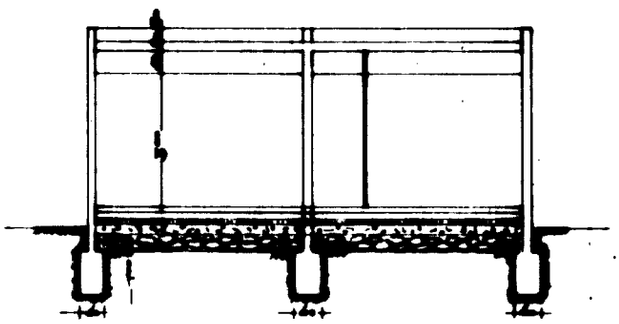

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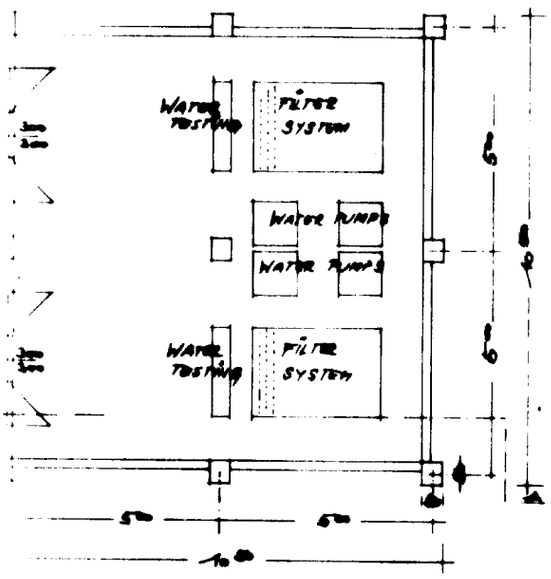
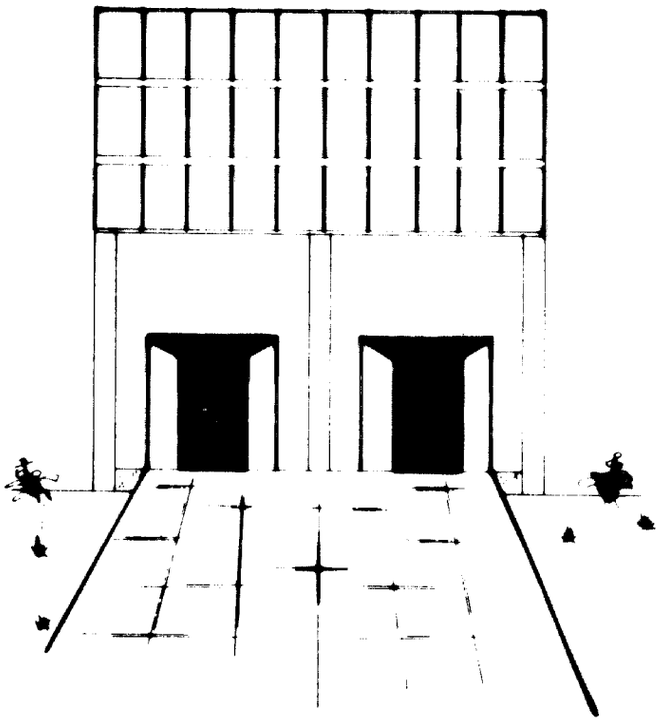
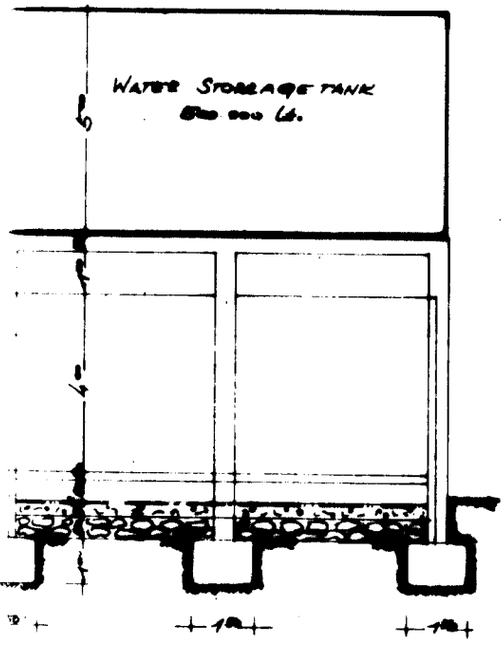




UT A-A



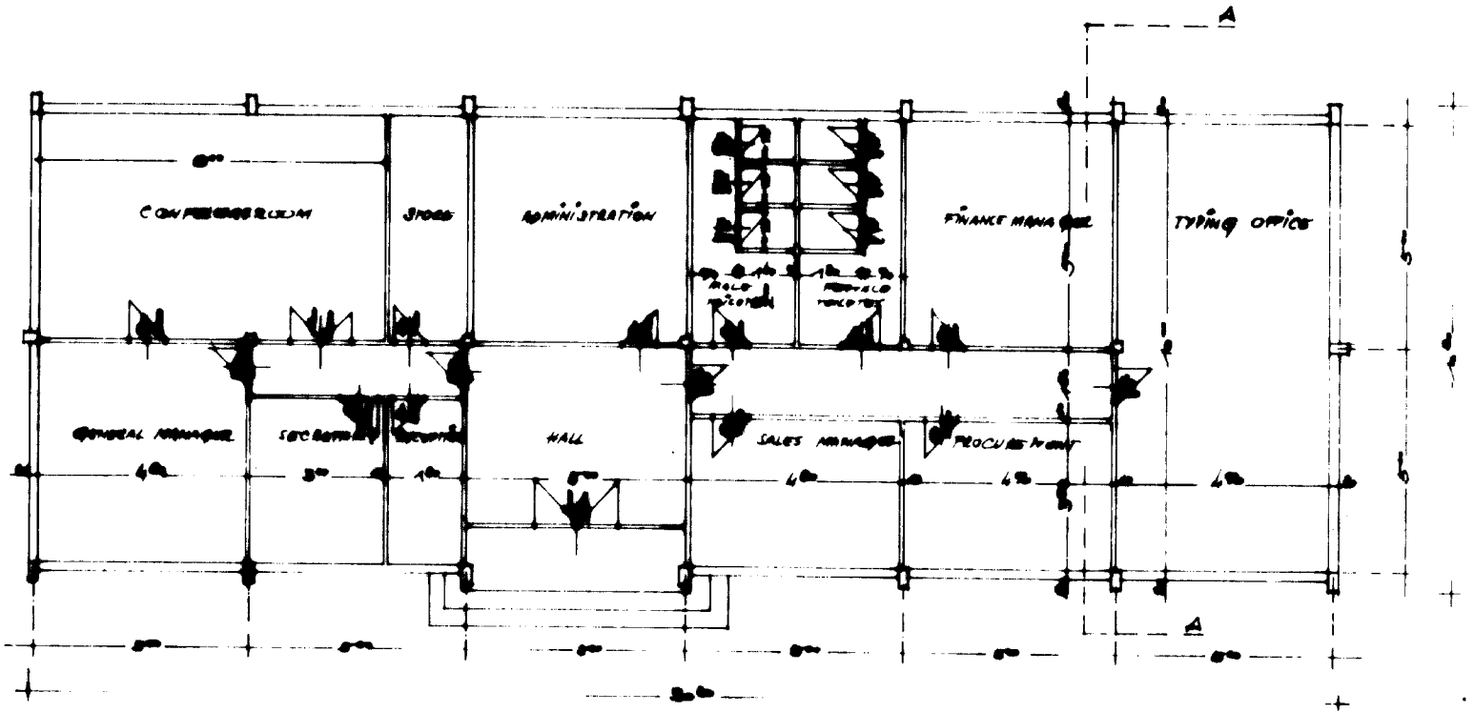
YEMEN ARAB REPUBLIC
MINISTRY OF PUBLIC WORKS
TECHNICAL DEPARTMENT

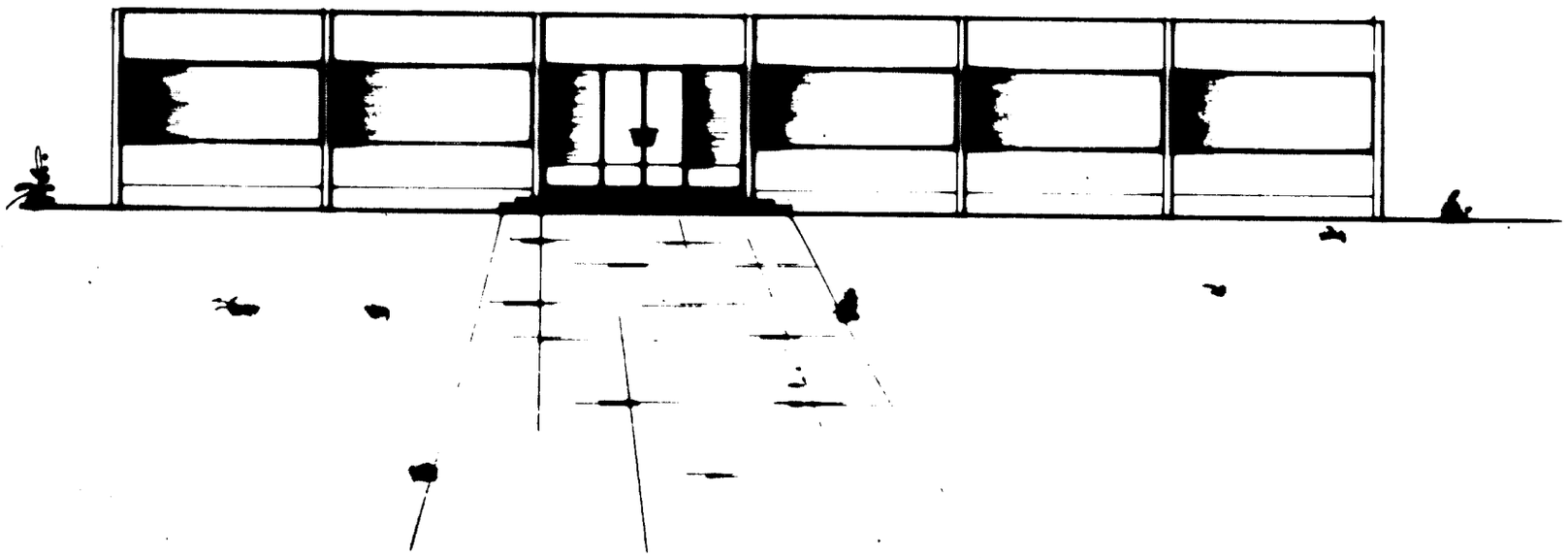
PHARMACEUTICAL FACTORY

MAINTENANCE, WATER H.

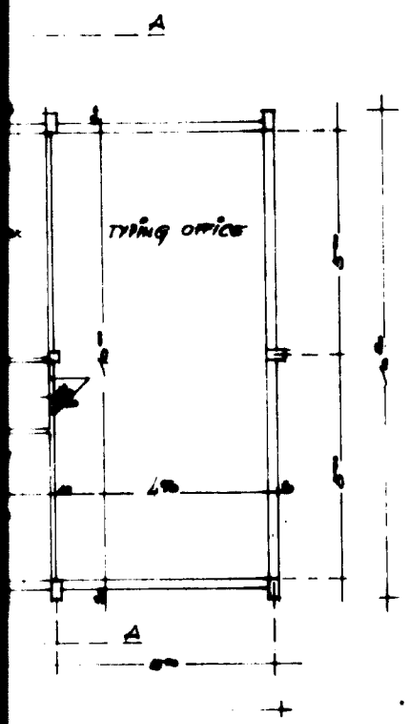
LAYOUT, ELEVATION, CUT

SECTION 2





SECTION 1



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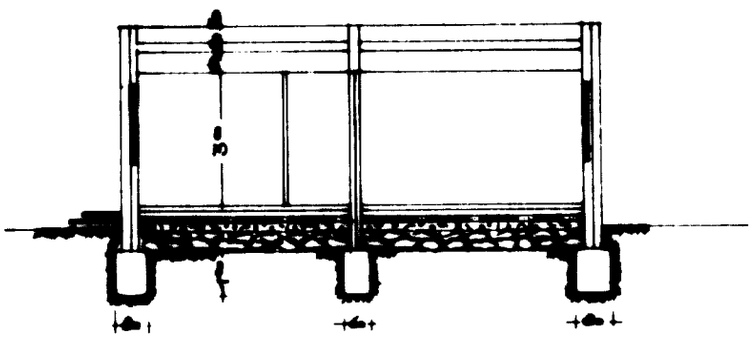
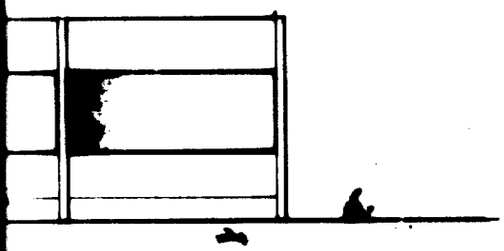
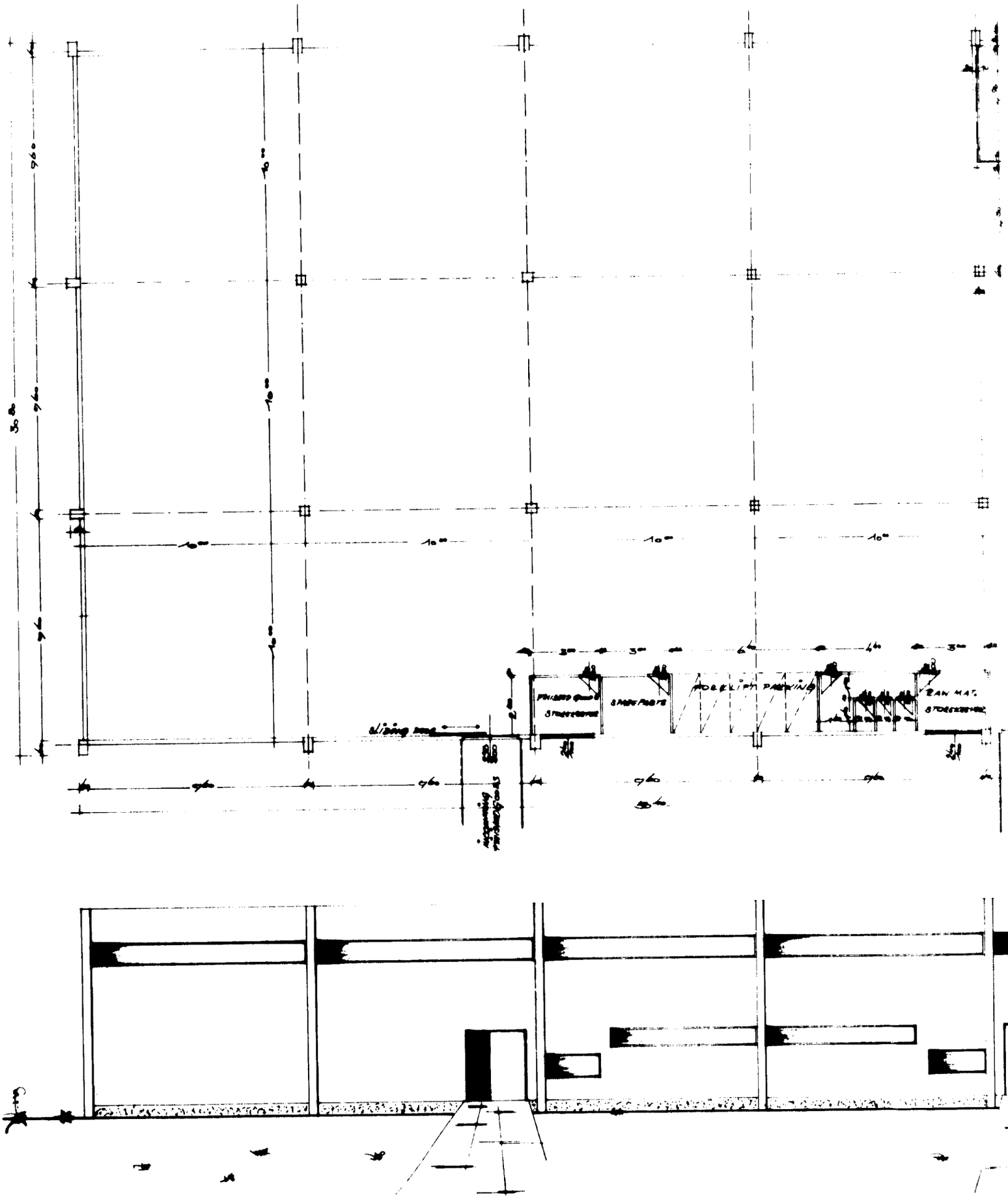


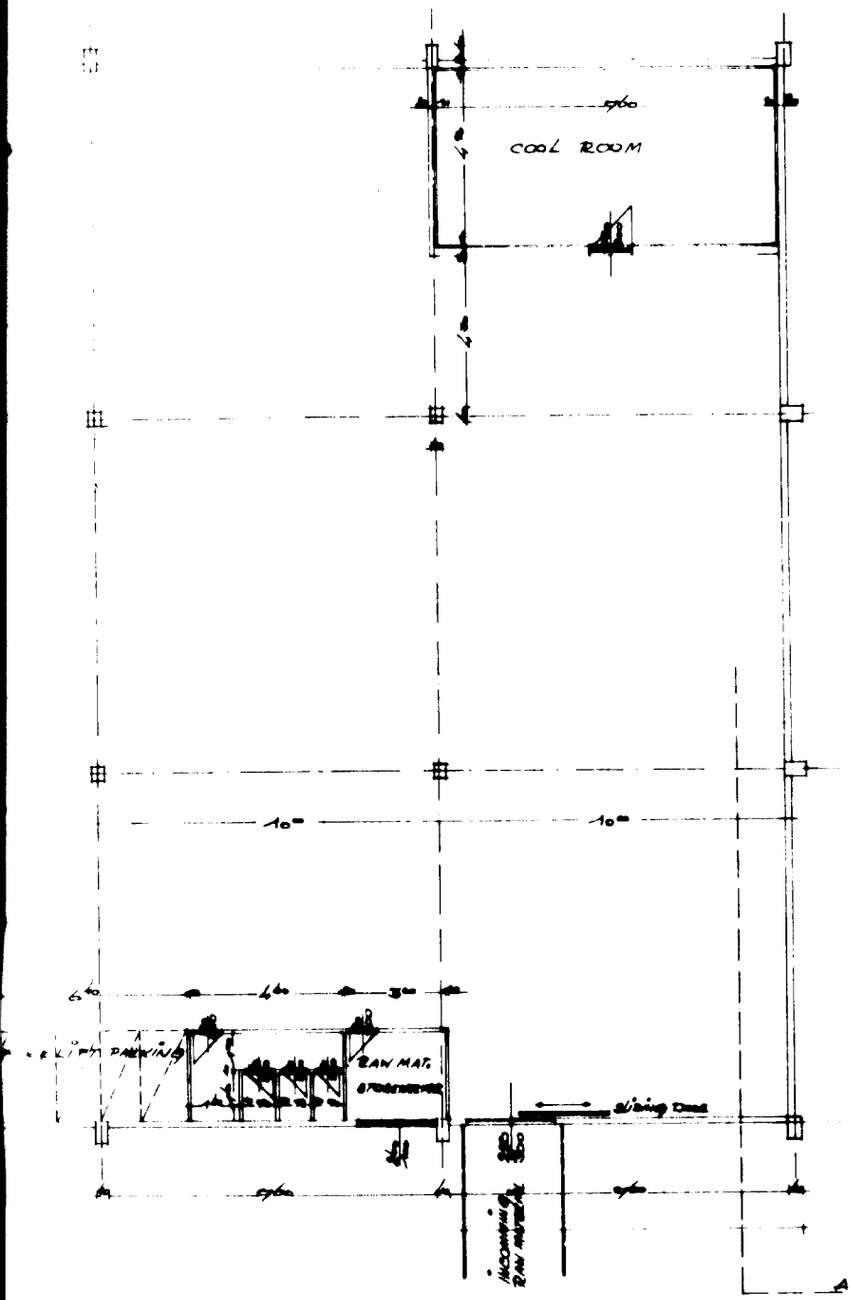


YEMEN ARAB REPUBLIC MINISTRY OF PUBLIC WORKS TECHNICAL DEPARTMENT	
PHARMACEUTICAL FACTORY	
ADMINISTRATION	
LAYOUT, ELEVATION, CUT	

SECTION 2



SECTION 1



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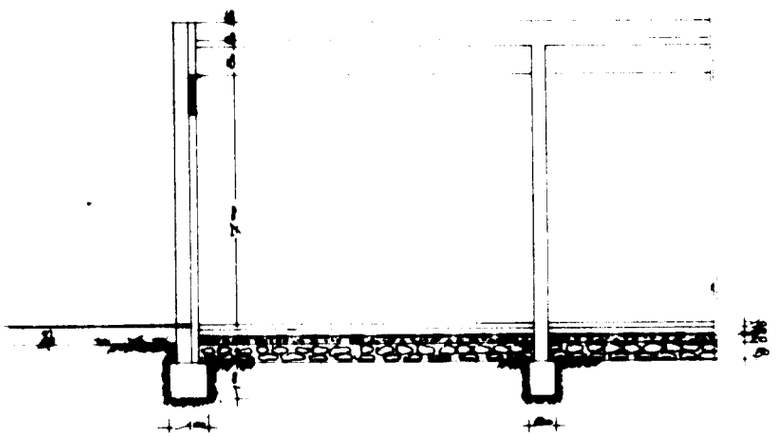
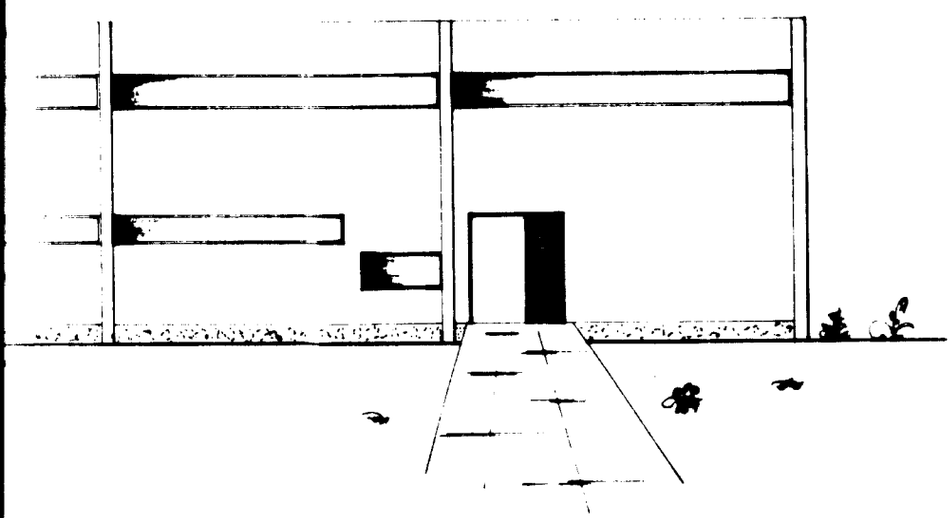
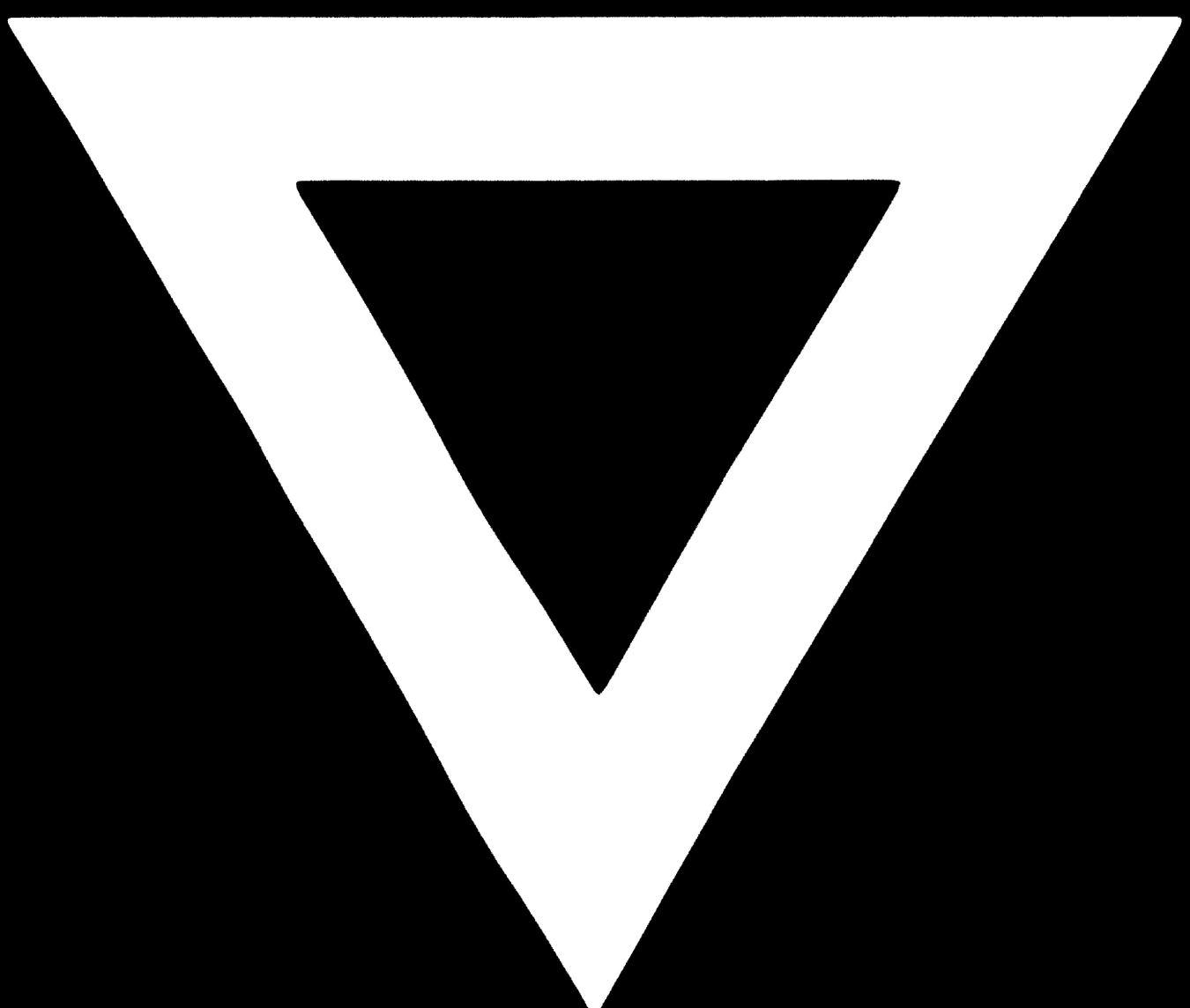




SECTION 2

YEMEN ARAB REPUBLIC
MINISTRY OF PUBLIC WORKS
TECHNICAL DEPARTMENT
PHARMACEUTICAL FACTORY
WAREHOUSE
LAYOUT, ELEVATION, CUT

B-499



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