3) Auxiliary facilities such as pickling, stress relieving and painting facilities shall be installed, but not planting facilities. Works for plating shall be commissioned to outside makers.

4) Inspection equipment such as non-destructive examiners shall be installed, and people shall be let known the concept of quality assurance thoroughly.

(3) Transportation limit

1) Transportation of products

① The nearest port from the Unit is Tanjung Perak approximately 60 km away. If the height of the products exceeds 2.4 m, the distance will be 115 km because a bypass must be selected.

② Weight limitation for the road up to the port of Tanjun Perak is regulated as low as 12 tons by Police of Surabaya.

③ Such being the current case, it would be necessary to try to have laws revised and roads and bridges properly maintained so that at least 30 tons of cargo can be carried.

4.6.3 Basic Plan and Overview for Renovation

Based on the results of investigations and diagnosis as described in the preceding chapters, basic plan for renovation was made as follows:

① New production scheme for the products suitable for Wahana Sub-unit was prepared based on the 4th 5-year plan of the Indonesian government, marketing survey made by the study team and the investigations made for the Wahana sub-unit.

② According to the production scheme thus prepared, a scheme for new facilities was prepared.

③ Comparison was made between the current and new facilities, a factory layout was made and problems, if any, with respect to products transportation were reviewed.

④ Costs and processes were reviewed as to the factory construction and machinery installation.

⑤ Reviews were made as to managerial organization and production technology after the new factory will be completed.

Overview of the basic plan: Wahana unit, after separation from the plate work department of Indra unit, will base itself on the businesses of steel structures, plate works and site construction works. The product mix for the new factory shall be equipment mainly for fertilizer and pulp/paper plants, equipment for processing and products that have been familiar with the factory.

Capacity for the newly installed facilities shall be such that shall allow for the production of more than 12,500 tons per year, that is, more than the current figure of 4,140 tons. The target of the start of new facilities shall be in October 1988.

On the other hand, reviews were also made as to training programs and schedules necessary for and in preparation of enlightenment and increase in number of the managerial staffs, technical staffs and skilled workers, and improvements of overall skill. These measures are vitally necessary for avoiding possible obstacles in the course of plant erection and smooth start-up operation of the new factory. Studies were also made as to the administrative organization and personnel line-up of the Unit.

(1) Production schedule by factory and by product

1) Product mix for Wahana unit

① Product mix for the Unit on which the capacity design for the facilities is based shall consist of the following three items:

i) Equipment for fertilizer plants, as agreed in "Scope of work for the feasibility study on the development of plant processing equipment industries" jointly prepared by the Japan International Cooperation Agency and Directorate General of and Basic Metal and Machinery Industries of Ministry of Indonesia dated May 18, 1984.

ii) Equipment for pulp/paper plants as agreed in above-mentioned "Scope of Work"

iii) Products that have been manufactured by Indra Unit of P.T. B.B.I inclose association with other local industries and production for which will be continued in the future (hereinafter to be called "BASIC LOAD").

(2) It is important for the Unit to be able to improve technological level, and hence quality of the products and prepare for increase in production quantity, by adopting not only the techniques currently made use of in the Fabrication Department of Indra unit but also new techniques in the line of the existing ones. Judging from the classification by product, it is properly recommended that Wahana unit should concentrate mainly on steel structures and plate works.

(3) Accordingly Product mix for Wahana unit as shown in Table 3-1 shall be classified into 8 items for in-house production and 3 items for erection site construction (hereinafter to be called "site work(s)" for the sake of convenience). Classification by product thus made, type, the number and the location of the equipment required were decided upon.

2) Plan for the production scale of Wahana unit

(1) Market research was made as to the products of Wahana unit, that is, equipment for fertilizer plants and pulp/paper plants and basic load. Based on this research, production scale per years 1989 to 1993. Then, reviews were made as to what portion of

the equipment thus required can be supplied from domestic sources in Indonesia.

② Then, for the equipment to be supplied from domestic sources for the two fields mentioned, a figure of percentage was set as which Wahana unit would be able to supply. The obtained figures were broken down into and allocated to steel structures and plate works.

③ Another investigation into the records of past factory production was made as to the category of the basic load, and as described in the preceding clause ②, breakdown and allocation was made to each of he product mix, that is, steel structures and plate works for the products possible manufactured by the Unit in the future.

④ Amount of erection site processing and installation for the plant equipment and basic load were set up, and based on this scheme, the number of the machine tools and the size of the working force was estimated.

⑤ The results obtained for the clauses ② through ④ were classified and allocated to each of the three categories, that is, steel structures, plate works and site works. The resultant summation is shown in Table 3-1. With reference to these figures thus obtained, design capacity for the factory is set at 12,500 T/Y.

(2) Scheme for workload and facilities required

As described in the preceding clauses (1) - ⑤, production capacity for Wahana unit was set at 12,500 T/Y based on the demand forecast for the years 1988 to 1993. Demand forecast was made with the following assumptions:

1) Domestic production rate in Indonesia for equipment for fertilizer plants is 65%. Share of BA-BI-BO among this is 75%.

2) Domestic production rate in Indonesia for equipment for pulp/paper plants is 42%. Share of BA-BI-BO among this is 75%.

3) Share of BA-BI-BO for the basic load is 100%.

The results thus obtained for the Unit from the demand forecast led to the figure of 10,675 T/Y, which accounted for 85% of the design capacity for the new factory. Because of the strong request from the Unit, design capacity of 12,500 T/Y was decided upon.

1) *Reviews on the availability of existing facilities*

Based on the afore-mentioned product mix and the production schedule, machinery and equipment presently under the control of Indra unit were checked if any of these can be available. Selection criteria for availability was as follows:

(1) Items checked

Loading %, tolerance, workability, maintenance and modernization.

(2) Classification was made according to the following classification standard:

Class I : Can produce to the required condition without further improvement to the existing condition.

Class II : Could possibly produce to the required condition with some rebuild/modernization.

Class III : Cannot produce to the required condition with any other rebuild/modernization.

(3) Those machinery and equipment that were found available are used as a part of the capacity. However, those machinery and

equipment that were considered not necessary in terms of capacity and/or function are not included, though found to be available.

2) Reviews on new facilities

The dominant factors for the design capacity of factory production were product mix and its production schedule. On the other hand, facilities required were selected according to the following criteria:

(1) Items given below were set up for each of the product mix:

i) Standard type, weight, material and details of working (determination of the product model),

ii) Standard operation, processes and operation time (establishment of time required for product), and

iii) Estimated level of technology 5 years ahead.

(2) Standards were established for the following items:

i) Number of personnels required for main works and number of production hours required for them.

ii) Type and number of equipment required.

(3) Availability of the old facilities.

(4) For the determination of the above, our past experiences were made use of.

(3) Improvements and new additions to the present unit

It was found upon investigation that INDRA Unit is considerably small-sized and in short of required facilities to materialize the newly established product mix

and achieve the production schedule. Accordingly, it has been determined, upon consultations with the B.B.I Headquarter and INDRA Unit, that new plant should be set up in Wahana Sub Unit.

This clause describes the plant layout mainly for the production of plate works and steel structures. It also describes equipment to be moved from INDRA Unit.

1) Basic plan for factory layout

Plant premises: 72,000 m^2
Size of materials yard: 1,000 m^2
Size of buildings: 23,736 m^2
Layout: Refer to the attached figure 3-1
Production per year: 12,500 T/Y

Facilities and the number of equipment required to achieve the production target was determined in the clause 4-6-3-(2)-2). Based on the data, layout of the factory was made according to the following procedures:

(1) Securement of area required for the works.

(2) Determination of adequate location for the equipment and the product flow.

(3) Determination of the types of buildings.

(4) Allowances for the materials yard and passages for delivery.

(5) Minimization of material handlings.

2) Facilities for production and inspection

① Facilities for production

Reviews were made for the following 6 items for the procedures

of preparation machining, forming, welding and assembly which will be the main processes of the factory operations. In this, specifications for the equipment were made according to the types and number of the equipment as determined in the clause 4.6.3 (2) 2) and products flow as determined n the clause 4.6.3 (3)-1)-2.

i) Facilities and auxiliary equipment for preparation machining

ii) Facilities for machining

iii) Facilities for forming

iv) Facilities for welding

v) Tools for assembling

vi) Overhead traveling cranes

Note: Existing facilities presently under the control of INDRA Unit, if available, are included in the items i) through v).

② Facilities for inspection

Inspections have vital role in the functions of quality assurance. It is recommended that the facilities for inspection be installed for the items currently commissioned to the outside institutions.

The facilities shall consist of the following:

i) Equipment for non-destructive inspections for welded parts.
ii) Equipment for the tests of materials.
iii) Equipment for measurement.

3) Basic plan for auxiliary facilities

Several kinds of auxiliary facilities are needed according to the characteristics of the products. Reviews were made as to Wahana unit for the following four items. These facilities were designed to the capacity according to each product they are to be involved with.

①	Facilities for heat treatment	Plate Works
②	Facilities for shot blast	Plate works, steel structures
③	Facilities for pickling	Plate works
④	Facilities for painting	Plate works and steel structures

4) Basic plan for utilities

① Following facilities shall be installed in connection with electricity:

i) Transformers for power supply shall be newly installed.
ii) Telephone facilities (60 telephone sets)
iii) Paging facility
iv) Broadcast facilities
v) Inside and outside lighting
vi) Fire alarms (only in the office)
vii) Generator for emergency use (for emergency lighting only)
viii) Air-conditioning facilities for the office

② Following pipelines shall be installed for the machining and auxiliry facilities:

i) Propane gas
ii) Oxygen
iii) Acetylene
iv) Argon
v) CO_2
vi) Air
vii) Industrial water

viii) Drinking water (city water). No facilities for drinking water producing shall be installed.

③ Sewage and waste water treatment.

i) Facilities for sewage treatment are included.
ii) Neutralizing facilities for pickling are included.

(4) Plan for plant erection and installation

The plant shall be set up is Wahana Sub Unit located in Pasuruan about 60 km apart from the city of Surabaya. Reviews were made for the following items:

1) Land preparation

Ground preparation is the key factor for a smooth progress of the plant erection and subsequent operation according to the prescribed schedule.

① Of the plant premises of 72,000 m^2, area of 46,626 m^2 shall be subjected to ground preparation works.

② Surface soil shall be removed by the depth of 30 cm and sands shall be put there by the same depth, over which earth shall be laid by the depth of 70 cm.

2) Foundation and piling

After the ground preparation is finished, PC piles shall be driven by a driving method. Shape of the piles shall be 35 cm in diameter and 10 to 15 m in length. These shall be used for the pillars and foundation for machinery.

3) Buildings

The main building shall be of the steel structure. X-ray room, stress

relief furnace, heating furnace and sewage treatment facilities shall be of concrete structure.

4) Plan for installation of equipment

① First, construction works for laying cables for electrical wirings shall be performed according to the erection schedule of the buildings. Next, overhead traveling cranes shall be installed and connected to power supply according to the roof construction schedule.

② Installation of equipment shall be effected with minimum processes by classifying the equipment into large-sized, medium-sized and small-sized categories. Terms for acceptance shall be at the point where a test run is successfully done after the installation.

③ As shown in the attached Table 3-2, installation for all equipment shall be finished by October in 1988. This target would be greatly affected by the progress in land preparation, civil constructions and building construction works.

5) Dispatch of supervisors

① Dispatch of supervisors or employment of supervisors in Indonesia shall be considered for the following items:

i) Civil constructions including land preparation
ii) Building constructions
iii) Installations of equipment
iv) Electrical wirings
v) Piping works inside the buildings

Duties of the supervisors shall come to an end when the construction works are finished. It is a normal practice for the suppliers of critical equipment to send their own supervisors at

the occasion of the test run. For the equipment of lesser importance, however, the suppliers are usually requested only to submit instruction manuals in English.

4.6.4 Renovation Promotion Plan

This chapter describes the hardware section of the renovation program, that is, comparatively detailed data of the promotion plan, in accordance with the basic program dealt with in the foregoing chapters.

(1) Outline and design conditions of renovation

1) Outline of renovation at Wahana unit

The renovation at Wahana unit is so designed as to allow as annual production of 12,500 tons, which is centered to plate work and steel structures as shown in attached Table 3-1, Forecast of Product mix.

The Shop is removed from the present location of Indra Unit to Wahana.

Product quality is so reviewed to be improved in excess of the present quality and to allow manufacturing products with higher quality than the present quality of the products.

2) Factory design conditions

The design conditions are decided on the basis of the product mix, considering the weights, sizes, quantities and production processes of the products and reflecting the shop areas, the heights and widths of the buildings and the lifting capacities and quantities of the overhead traveling cranes to be provided in the shops.

(1) Setting of product model

The product model (Refer to Table 4-1.)has been derived from the product mix to determine the specifications of the production facilities.

② Setting of the lifting capacities of overhead traveling cranes

The lifting capacities of the overhead traveling cranes are set on the basis of the product model. (Refer to Fig. 3-1.)

③ Setting of the heights of overhead traveling cranes

The overhead traveling crane rail heights are set on the basis of the product model, considering the effective lifting heights of the overhead traveling cranes.

④ Setting of the specifications of major production facilities

The specifications of major production facilities are set on the basis of the product model. (Refer to List 4-1.)

⑤ Calculation of production time

The production time per operation unit is calculated, extracting the typical products of each plant from the product mix.

⑥ Calculation of the required numbers of production facilities

Based on the production time required for each operation unit, the necessary man-power and the necessary numbers of production facilities are calculated. (Refer to Table 4-7 and List 4-1.)

⑦ Calculation of factory area

i) Work floor area of fixed facilities

The floor area of fixed facilities after taking the scope of work into consideration was integrated by the number of facilities computed in the preceding ⑥.

ii) Required size of assembly area

The required size of assembly area was computed based on the production time computed in previous (5) by adding the manufacturing process flow and original unit which we know through our experience. The results are shown in Table 4-2 "Necessary area of each shop".

(8) Endurance of the floor

For large-sized product - The endurance of the bay shall be 10 t/m^2. The endurance of other sizes of the bays shall be 5 t/m^2.

3) Effect of renovation

comparison has been made on the production per unit area and the production per direct worker between those before and after renovation in order to review the degree of improvement in productivity.

The results of the comparison are shown in following table.

	Before renovation (a)	After renovation (b)	Ratio (b/a)
Production per unit area (ton/year/m^2)	1.34	0.49	0.4
Production per direct worker (ton/year/man)	56.2	33.7	0.6

The table above indicates reduction in production. This is because the fabrication equipment for fertilizer plants, and pulp and paper plants includes pressure vessels and equipment made of special material that require considerably higher fabrication

techniques and wider work floor area and more direct worker to product weight.

4) Shop layout

In planning the shop layout, Bays are classified according to the kind of products in order to minimize the reverse flow and off-and-on Bays phenomenon on the way of fabricating products.

In addition, a centralized production system is applied to parts production. (As for detail, refer to Fig. 3-1.)

(1) Bay A

A new distribution system starts with Bay A. After materials are delivered in, all preparation works are concentrated to Bay A, which in turn distributes members to each Bay for further machining and fabrication.

For this reason, Bay A is equipped with machines and devices for marking, gas cutting, shearing, press forming, flanging, etc.

(2) Bay B

Bay B serves as a special-purpose bay to manufacture the products that require materials such as shape steel, steel plates, pipes, etc. Therefore, Bay B is equipped with band saws, angle benders, pipe benders, and machine tools. bay B is provided with the nozzle manufacture area, pre-fabrication piping area, steel structure fabrication area. Nozzles and steel structures manufactured in Bay B are distributed to each Bay as required.

(3) Bay C

Bay C mainly manufactures general plate works (such as atmospheric vessels, tanks, and containers) that do not require radiographic examination, hydrostatic test and post weld heat

treatment. The plate works manufactured in Bay C are supplied to other Bays as required.

④ Bay D

Bay D is a special-purpose bay that mainly manufactures the unit cylinders for pressure vessels, small-size and light-weight pressure vessels, and heat exchangers. For this purpose, Bay D is specifically provided with an area for radiographic examination and heat exchanger fabricating equipment. The unit cylinders manufactured in Bay D are subjected to radiographic examination, and then supplied to Bay E for further assembling if so scheduled.

⑤ Bay E

Bay E is a special-purpose bay to manufacture head blocks and large-size, heavy pressure vessels. Therefore, Bay E is equipped with large-size machine tools. The head blocks manufactured in Bay E are supplied to other Bays as required.

⑥ Surface treatments yard

Sandblasting, painting, and acid cleaning equipment are located on the same line between the new shop buildings and the existing wagon manufacture shop. The painting equipment is located at the center of the line so as to minimize a distance of removal between the processes, that is, sandblasting to painting and acid cleaning to painting. The surface treatment yard is located at the above location because this yard will function best when located almost at the center considering the surface treatment of wagon and the expansion project in the future.

⑦ Raw material storage yard

The raw material storage yard is located at the farthest east end

of the Shop premises considering the vicinity of Bay A and the expected expansion of the premises.

5) **Machine/tool list and product flow**

① Machine/tool list

List 4-1, New and usable existing machine tool list covers the description of machines and tools including those diverted for re-use.

② Product flow

Fig. 4-1 shows the product flow of typical equipment among those for fertilizer plants and, pulp and paper plants.

(2) Construction cost

Attached Table 4-3, Summary of investment cost shows the detailed investments necessary for this renovation. Description of detailed design, supervising and training fee is shown in Table 4-6. However, the following cost or expenditure are not included in the investments; 1) the cost to use the existing organization during the term of renovation and, 2) personal expenditure for trainees during the term of skill training.

(3) Implementation project system to promote renovation program

Where the promotion of this project is determined, the Shop is under obligation to perform the following items so as not to cause trouble in the course of the promotion and to prevent problems.

1) Design of new Shop and determination of parts to purchase.

2) Control, supervision of construction process such as land preparation, civil engineering work, building construction, machine installation, etc.

3) Preparation and implementation of personnel training program for managers, engineers, and operators to ensure smooth startup and operation.

Attached Table 4-4 details the Implementation project system to promote renovation program.

(4) Details of actual work

1) Work items

As shown in Table 3-2 Construction schedule, the actual work is classified as follows; (1) Land preparation (2) Civil work (3) Building construction (4) Purchase and erection of machine & equipment, electricity and instrument and piping works (5) Arrangement of the total project and detailed design (6) Supervision of the all works mentioned and (7) Training on the special equipment.

2) Description of work

The items stated in 1) above may be otherwise subdivided into domestic portion work and foreign portion work.

(1) Domestic portion work covers the following main items.

Labor service, materials available in Indonesia, inland transportation, import duty, a part of supervision, lease for construction equipment, etc.

(2) The main foreign portion work covers the coordination of the whole project, Details Design and supervision of each item as well as purchase of machines and equipment, and ocean freight and insurance premium.

(5) Supervision of the work and training plan

1) The supervisors will be sent for the following purposes. (See Table 3-2 and Table 4-6).

(1) Land preparation (2) Civil works (3) Building works (4) Erection of machine & equipment (5) Erection of electricity & instrument (6) Piping works and (7) Guidance on operation of the major equipment.

2) Training plan

The training will be conducted in relation to the following equipment as the minimum equipment. The purpose of the training is that the workers can master the operation of the equipment between the erection of the equipment and start-up. But it is recommendable that the training should be conducted flexibly because there is a plenty of time until October, 1988. (1) Boring & turning mill, (2) CNC drilling (3) Boring & milling (4) Planer (5) Press (6) Flanging machine (7) Bending roll and (8) Furnace.
Training fee is shown in Table 4-6.

(6) Renovation promotion schedule table

The project promotion schedule table including the items explained in (4) and (5) is shown in Table 3-2.

4.6.5 Production Control and Training

This chapter describes the basic items on software section necessary for accomplishing the promotion plan stated in the foregoing chapters.

The production control system, quality control system, training shown below are the basic conditions to be satisfied in order to accomplish the purpose of the promotion plan.

(1) Production control system

The technical diagnosis shown in 4.6.1 (4), 2) has proven that the following countermeasures should be taken.

1) The production control system should be established to control products so that they may be manufactured as planned. This system should include checks for the progress schedule at each production step and for the delivery date of parts to be purchased.

   This system should also include such a sub-system that, if any delay occurs in the progress schedule, a countermeasure (such as overtime service) is taken in time.

2) A loading plan is a measure to prevent delay in the time of delivery; the plan should be laid out to grasp work quantity for the Shop in total or for each job. This loading plan permits checking in earlier stages a machine or work that may form a bottleneck of the process, thus making it easy to take countermeasures without delay.

3) Fig. 5-1 shows the PDCA managirial circle. Particular care should be taken in emphasizing item C, Check or Follow-up, and item A, Action, both of which may be neglected in the course of production control.

   In the second, attention is drawn to production techniques. Change in the product mix causes the use of thick gauge plates. This makes important the techniques for forming, heat-treatment, and to select welding methods, and welding materials and to prevent cracks during welding.

   Enhancement of production control and production techniques require increase and training of staff. The training and instructions should be given by supervisors sent by overseas manufacturers. Expenses for the supervisor are stated in (9).

(2) Quality control system

As stated in 4.6.1 (4), 3) Indra Unit has not yet prepared a quality control manual. Managers in Wahana Unit should take cognizance of the importance of quality control and hasten to prepare a quality control manual at their responsibility.

In the second, technical review proves that use of thick gauge plates involves the following important countermeasures.

1) Countermeasures for increased non-destructive examination.
2) Countermeasures for preventing weld defects such as weld cracks.

For increased non-destructive examination, inspection service should be performed in the shop in lieu of the present outside order, that is, qualified inspectors should be increased and trained.

For prevention of weld defects, quality controllers are requied who must be aquainted with materials and fabrication to assure the quality of products before shipment.

In addition, data on defective products and claims filed by customers are very important information and should therefore be collected and assorted with particular care for the purpose of quality assurance.

Instructions for quality assurance engineers and necessary cost are as stated in (9).

(3) Safety control system

The capacity of the overhead traveling crane in Wahana Unit is increased to 30 tons in excess of 25 tons in Indra Unit. The special piping in Shop is required owing to the increase in flammable gas consumption, thereby requiring safety control with more importance. Therefore, the safety control system must place emphasis on the following points.

1) The basis of safety is to put in order and keep clean what is related to production.

First of all, all persons including workers should realize the importance of putting their work conditions in order.

2) Prevention of accidental injury or death requires training for crane operators and slinging workers, and training instructions for prevention of gas explosion.

(4) Maintenance

The maintenance system shown below should be established on the basis of maintenance techniques in Indra Unit and be exercised.

1) A maintenance system should be prepared to ensure that machines, equipment, and instruments are subject to routine checks and periodical inspections by type.
it is important for the maintenance manual to identify check items and the period of checks and to specify a system including repair of failure.

2) Servicing and checking devices, tools, and jigs results in improved product quality and enhanced efficiency. Workers should therefore be trained and instructed to perform routine checks with care.

(5) After-sales service

In the light of sales business, after-sales service results in:

1) Order of repair and reform work.
2) Order of additional and new work.

In the light of production techniques, after-sales service results in.

1) Feedback to design and engineering departments.
2) Feedback to quality control and fabrication departments.

The above feedbacks lead to improvement in technical capacity through grasping problems in quality control and fabrication as well as to improvement in engineering capacity. The business department should train sales engineers who have product knowledge enough to be engaged in sales business including after-sales business.

(6) Engineering

Engineering is shifted from Indra Unit to Wahana Unit provided with new equipment. At this point, the following items are proposed to smoothly expand production items.

1) New techniques such as those for heat exchangers and pressure vessels should be strengthened through the technical assistance agreement with overseas enterprises having wide experience in this field.

2) New techniques, including production techniques, should be introduced even for the products produced at present in order to strengthen technical capacity.

3) Design capacity including production design should be enhanced to develop less expensive and facilitated production methods.

4) Design engineers should be trained and given instructions to the extent that they can decide proper product quality and specify in drawings the dimensional accuracy required for products.

The cost relevant to the above is stated in (9).

(7) Training

Capacity improvements for controllers and engineers are stated in (1) through (6).

The training plan shown in Table 4-5 and Table 5-1 is recommended for workers. It is urgently required to level up worker's skill in order to meet increase in production and to have a perfect command of new equipment.

(8) Organization and personnel

Table 5-2 shows the organization and personnel plan in Wahana Unit.

1) Organization

The organization is based on 4.6.1. (4), Technical diagnosis (for the organization and personnel in Indra Unit) with the following point emphasized.

① Wahana Unit should enjoy independence of Indra Unit in terms of the scale of production and personnel. It should be established as Wahana Unit, not as a sub-unit of Indra Unit. However, Wahana Unit may act as a branch of Indra Unit for business and accounting.

② The organization in Wahana Unit is simplified to a maximum, considering too many departments and sections in Indra Unit.

2) Personnel

The personnel plan is laid out as shown below.

① The number of direct workers is determined as shown in 4.6.3. (2)2)②.

② The number of indirect workers is determined from our experience.

The number of persons in the general affair department is based on assumption.

(9) Training cost

Fig. 5-2 shows the training cost and period of the production control and technique in item (1), (2) and (6), and of the machine works in 4.6.4 (5) 2). Training should be tackled with complete preparation because they have great influence on the operation of new Wahana Unit.

TABLE 3-1 FORECAST OF PRODUCT MIX — P.T. BOMA BISMA INDRA: WAHANA UNIT — ANNUAL PRODUCT CONDITION IN 1989 ~ 1993

UNIT: TON/YEAR

TYPE OF PRODUCT		STEEL CON-STRUCTION	PLATE WORK	TOTAL	BASIC LOAD	FERTILIZER PLANT						PULP AND PAPER PLANT
						AMMONIA	UREA	TSP	P_2O_5	ZA	SUB TOTAL	
a. STEEL STRUCTURE	a.1 General structures											
	a.2 Bridges and similar structures											
	a.3 Industrial structures											
	a.4 Big water gates and structures for water engineering											
	a.5 Conveyors	50	50	100			3	32		5	40	57
b. PLATE WORKS	b.1 Fertilizer plant equipment	0	2,150	2,150		1,199	353	245	93	263	2,153	
	b.2 Pulp and paper	0	1,000	1,000								1,002
	b.3 Heat-exchanger	0	550	550		303	146	14	4	64	531	17
	b.4 Vessels	0	116	116	116							
	b.5 Tanks	0	1,160	1,160	1,160							
	b.6 Plate works	0	1,160	1,160	1,160							
	b.7 Others	1,800	2,690	4,490	4,140	96	60	24	10	44	234	120
SUB TOTAL		1,850	8,876	10,726	6,576	1,598	562	315	107	376	2,958	1,196
c. SITE WORK	c.1 General industries											
	c.2 Vessels (pressure and atmospheric, vacuum)	0	120	120		41	32	10	2	1	86	33
	c.3 Tanks of different design.	0	220	220		32	7	15	16	32	102	118
	c.4 Silos, bins, containers hoppers, ducts, chutes, etc.											
	c.5 Pipe works	0	1,610	1,610		700	294	136	24	57	1,211	401
SUB TOTAL		0	1,950	1,950	0	773	333	161	42	90	1,399	552
T O T A L		1,850	10,826	12,676	6,576	2,371	895	476	149	466	4,357	1,748

Table 3-2

Construction Schedule

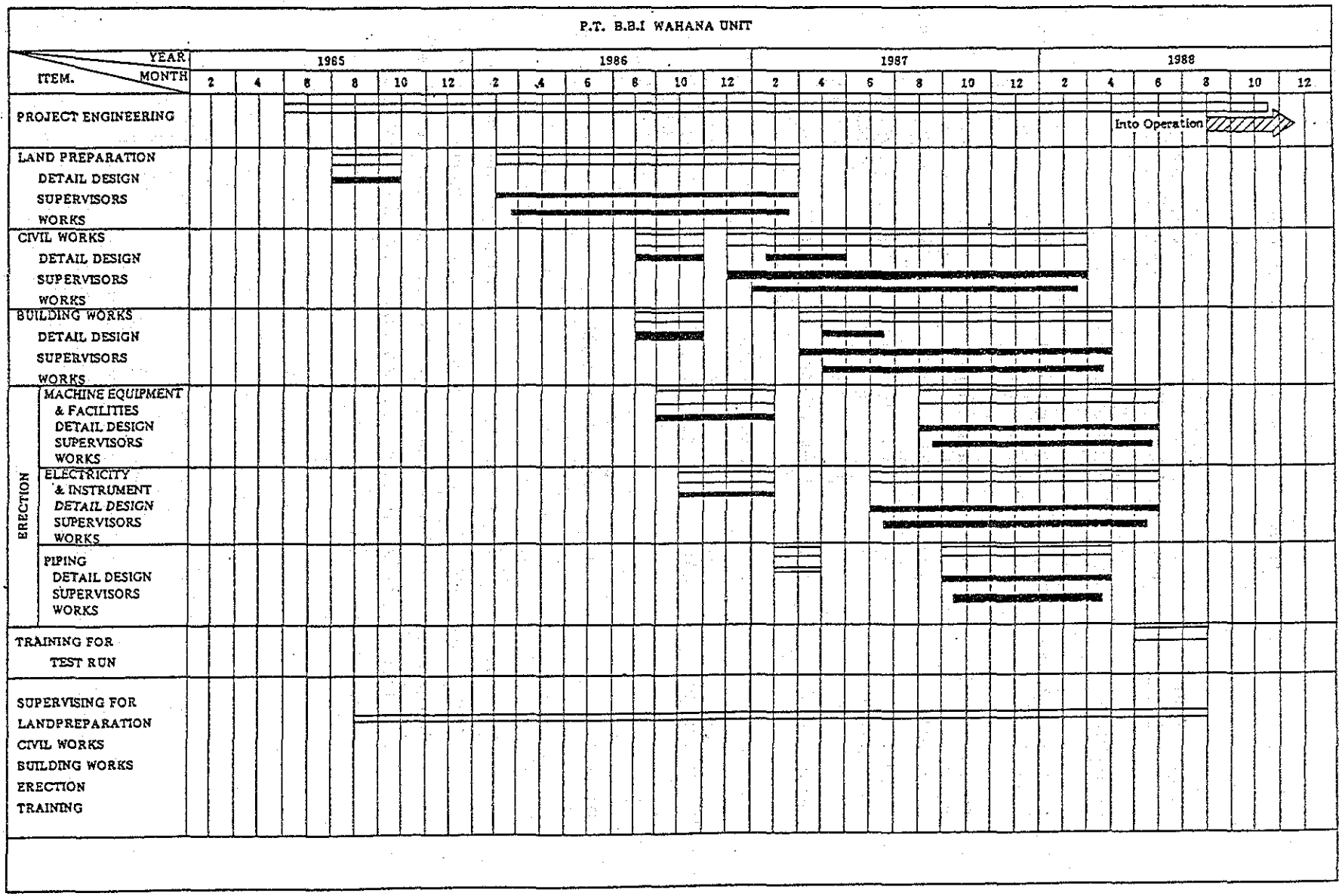


Table 4-1 Product Model for P.T. B.B.I. Wahana Unit

	TYPE OF PRODUCT	THICK-NESS (mm)	PRODUCT SIZE (ID x LENGTH WIDTH x LENGTH) (mm)	DESIGN PRESSURE (kg/cm^2)	MATERIAL	WEIGHT (Ton)
		mm	W H L			
1	CONVEYORS	6-12	2,000 x 1,500 x 10,000	-	C.S	10
2	FERTILIZER PLANT EQUIPMENT	25-50	4,000 ϕ x 30,000L	300	C.S SUS SUS CLAD	60
3	PULP & PAPER PLANT EQUIPMENT	6-16	3,000ϕ x 5,000L	0-20	C.S	6
		30-50	5,000ϕ x 15,000L	50	C.S	60
4	HEAT EXCHANGERS	6-50	2,500ϕ x 12,000 L	100	C.S SUS SUS CLAD	40
5	VESSELS	25-50	5,000ϕ x 30,000L	100	-	60
6	TANKS	6-9	3,500ϕ x 5,000H	-	-	-
7	PLATE WORKS	6-50	5,000ϕ x 5,000L	-	C.S SUS SUS CLAD	-
			W H L			
8	OTHERS	6-50	500 x 2,000 x 10,000	-	C.S	30

Note: The above table shows the major specifications of the products selected per type of plant equipment from the product mix to determine the specifications of the production facilities. Therefore, this table provides an effective guideline for the approximate production capacities of the shops.

Table 4-2 Necessary Area of Each Shop for P.T. B.B.I. Wahana Unit

UNIT: m^2

NO	SHOP NAME	AREA
1	CUTTING PLAN ROOM	360
2	PREPARATION AREA	1,220
3	FORMING AREA	1,647
4	MACHINING AREA	1,788
5	ASSEMBLY AREA (INCLUDED WELDING)	14,169
6	RADIO GRAPHIC EXAMINATION ROOM	288
7	SAND BLASTING PAINTING AND ACID CLEANING ROOM	1,008
8	RAW MATERIAL STORAGE AREA	1,000
9	TOOL ROOM	108
10	PARTS STORAGE AREA	360
11	MAIN PASSAGE AND OTHERS	3,976
	Total	25,924

Table 4-3 Summary of Investment Cost for P.T. B.B.I. Wahana Unit

UNIT: 1,000,000 YEN

ITEM	FOREIGN	DOMESTIC	TOTAL
1. MACHINERY & EQUIPMENT	4,216.92		4,216.92
2. ELECTRICITY & INSTRUMENT	177.65	321.54	499.19
3. LAND PREPARATION	43.12	136.54	179.66
4. OCEAN FREIGHT, INSURANCE & LOCAL HANDLING	361.13	85.64	446.77
5 INLAND TRANSPORTATION		81.12	81.12
6. CIVIL	213.08	1,181.85	1,394.93
7. ERECTION	15.83	300.05	315.88
8. BUILDING (PLANT & OTHERS)	348.06	1,877.68	2,225.74
9. BUILDING (OFFICE)	18.32	98.82	117.14
10. OTHERS	396.43	7.39	403.82
11. ENGINEERING FEE	460.39	88.03	548.42
12. CONSTRUCTION EXPENSES		261.48	261.48
13. PHYSICAL CONTINGENCIES	187.53	310.81	498.34
TOTAL	6,438.46	4,750.95	11,189.41

Note:
1. Training fee is not included in this table.
2. The physical contingency of training fee is not included.

Table 4-4 Implementation Project System for P.T. B.B.I. Wahana Unit

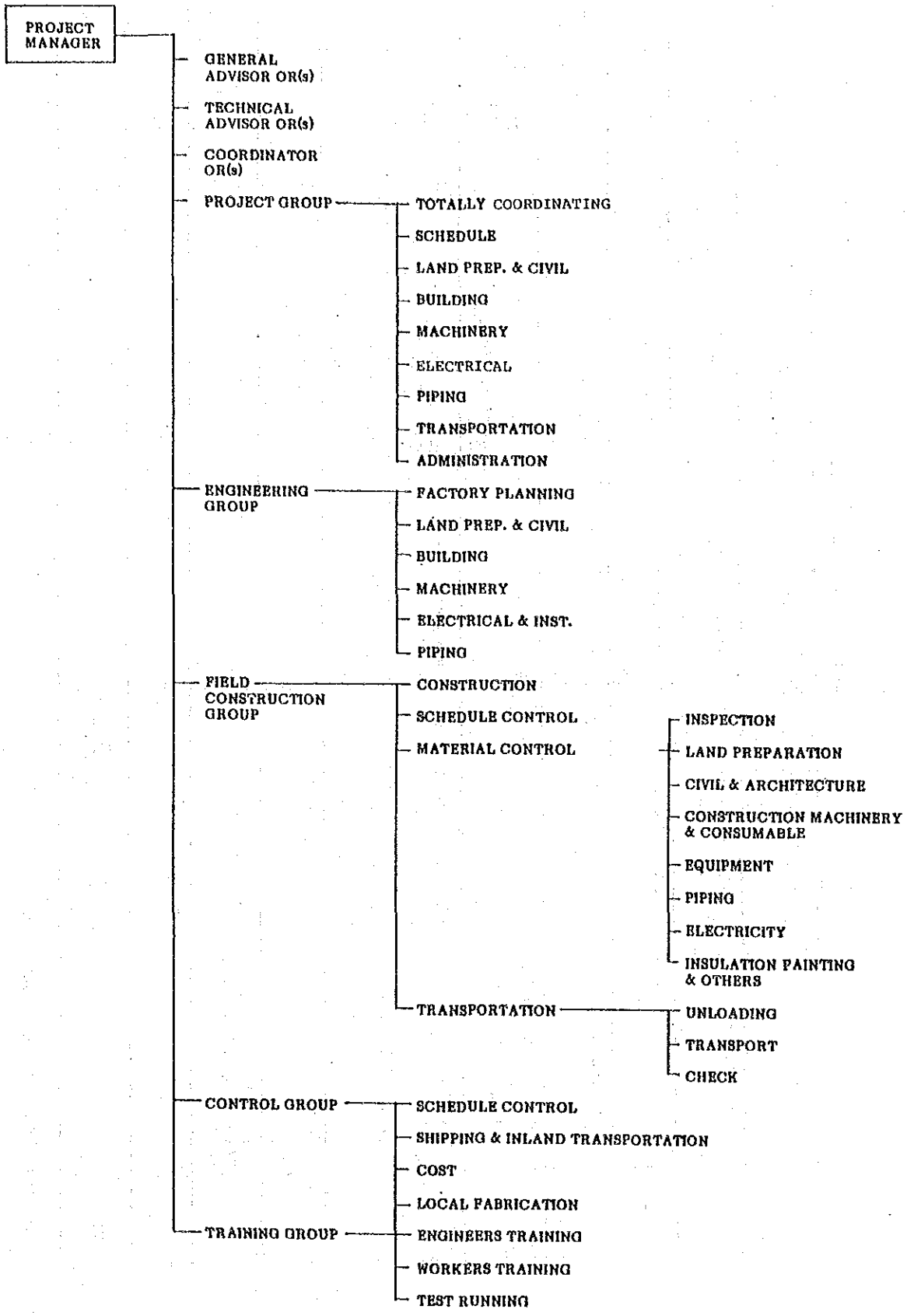


Table 4-5 Training Plan of Worker

STEP	LATHE MACHINE	MILLING MACHINE	GAS CUTTING	SHIELDED METAL ARC WELDING	GAS-SHIELDED TUNGSTEN ARC WELDING
1	INTRODUCTION *	INTRODUCTION *	INTRODUCTION *	INTRODUCTION *	INTRODUCTION *
2	CYLINDRICAL MACHINING *	PLANE MILLING *	MANUAL CUTTING *	BEADS ON PLATE *	BEADS ON PLATE *
3	MACHINING OF SHOULDER SHAFT *	MILLING TO HEXAGONAL PIECES *	STRAIGHT LINE CUTTING *	FILLET WELDING *	SINGLE VEE-GROOVE BUTT WELDING *
4	MACHINING OF CURVED SURFACE	MARKING *	BEVELLING	SINGLE VEE-GROOVE BUTT WELDING (9 mm) *	BUTT WELDING OF PIPE
5	BORING *	SIDE AND END MILLING *	CIRCLE CUTTING	SINGLE VEE-GROOVE BUTT WELDING (25 mm) *	TEST
6	MACHINING OF TAPER *	SLOT MILLING *	GAS CUTTING TEST *	APPLICATION (MIXED TRAINING OF FILLET AND BUTT WELDING)	
7	THREADING *	CIRCULAR MILLING *		BUTT WELDING OF PIPE	
8	FABRICATING COMPULSORY PARTS IN QUALIFICATION TEST	DOVETAIL MILLING		TEST *	
9		DIVIDING			
10		FABRICATION COMPULSORY PARTS IN QUALIFICATION TEST.			

*: INCLUDED LECTURE (BASIC THEORY)

TABLE 4-6 Description of Investment Cost for Detail Design, Supervising and Training fee for B.B.I WAHANA Unit: 1,000,000 YEN

Description of Detail Design, Supervising & Training fee		Cost Estimation of Detail Design	Cost Estimation of Supervision and Training fee	Estimated Interval
Project Engineering	Review of F/S, preparation of implementation program, supervision of construction schedule and general consultation to the implementation of the project.	F=141.82 D= 7.39 Item 10 of Table 4-3		Refer to Table 3-2 of Construction schedule
Land preparation	Lay-out planning and designing, preparation of specification both for working and supervision.	F= 1.09 D= 0.12 Item 3 of Table 4-3	F= 69.13 D= -	
Civil works	Designing, Preparation of specification for foundation plan of building, machinery, facilities and supervision	F= 16.95 D= 1.88 Item 6 of Table 4-3	Item 11 of Table 4-3	
Building works	Designing, Preparation of specification for procurement of building materials, site fabrication and supervision.	F= 52.19 D= 5.80 Item8,9 of Table 4-3	F=133.45 D= - Item 11 of Table 4-3	
Machinery equipment and facilities	Lay-out planning and designing of above mentioned equipment, preparation of specification both for procurement of machinery, equipment, parts and tools, facilities and supervision.	F=248.00 D= - Item 10 of Table 4-3	F= 98.73 D= 46.98 Item 11 of Table 4-3	
Electricities	Lay-out planning and designing of above mentioned equipment, preparation of specification both for procurement of electricities and supervision.	F= 26.88 D= - Item 2 of Table 4-3	F=128.81 D= 41.05 Item 11 of Table 4-3	
Piping works	Designing, Preparation of specification for procurement and supervision.	F= 1.22 D= - Item 10 of Table 4-3	F= 7.72 D= - Item 11 of Table 4-3	
Training for testrun	Supervision for machine operators at machinery erecting intervals type of machinery for supervision listed in item.		F= 22.55 D= - Item 11 of Table 4-3	

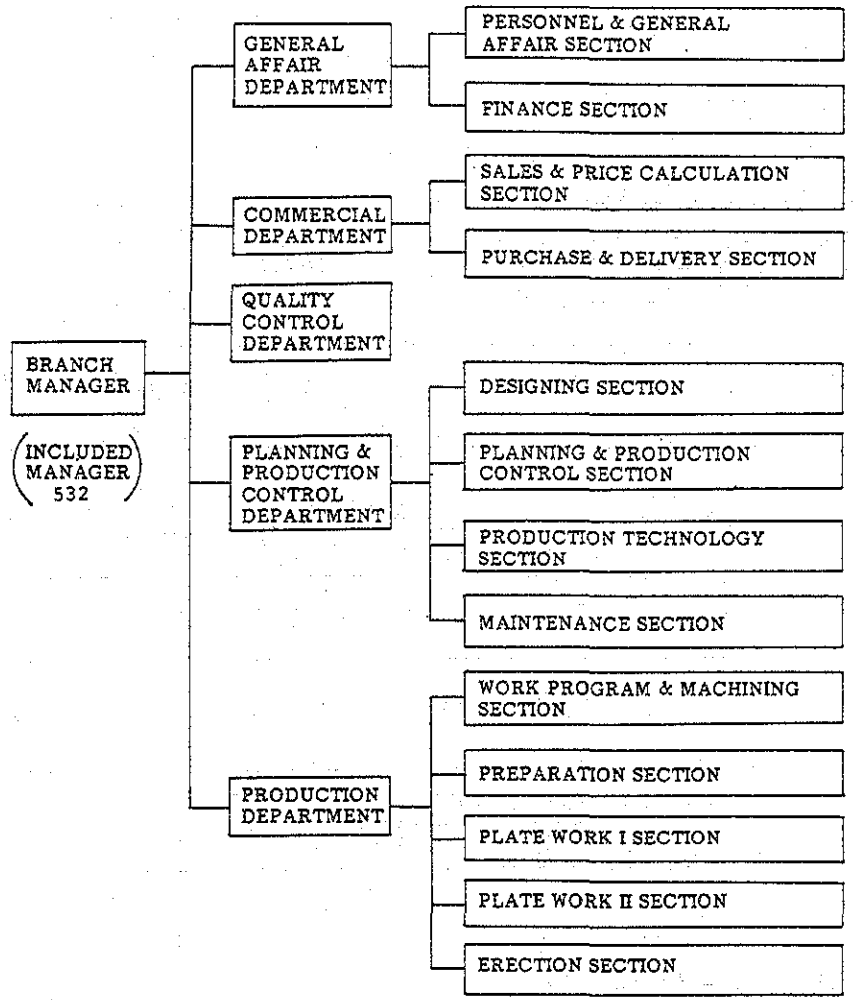
Table 4-7 Equipment Planning Bases (WAHANA)

NO.	MACHINE NAME	SELECTION BASE	PRODUCT	LOADING FACTOR (%)
1.1	HEAVY DUTY UNIVERSAL LATHE MACHINE	TO MACHINE SMALL PARTS, NOZZLES AND FLANGES	FERTILIZER & PETROCHEMICAL PLANT	90
1.2	HEAVY DUTY FACING LATHE MACHINE	TO FACE LARGE CYLINDRICAL SHELLS	DITTO	73
1.3	VERTICAL BORING & TURNING MILL MACHINE	TO MACHINE NOZZLES, FLANGES AND END PLATES OF MEDIUM AND LARGE PRODUCTS	HEAT EXCHANGER, FERTILIZER & PETRO-CHEMICAL PLANT	80
1.4	HEAVY DUTY RADIAL DRILLING MACHINE	TO DRILL TUBE SHEETS, ETC.	DITTO	93
1.7	C.N.C. DRILLING CENTER MACHINE	TO SECURE DIMENSIONAL ACCURACIES OF PRODUCTS	HEAT EXCHANGER	91
1.9	HORIZONTAL BORING & MILLING MACHINE	TO BORE VARIOUS PARTS	HEAT EXCHANGER, FERTILIZER & PETRO-CHEMICAL PLANT	86
1.10	UNIVERSAL MILLING MACHINE	TO MILL VARIOUS PARTS	DITTO	67
1.11	PLANING MACHINE	TO PLANE VARIOUS PARTS	DITTO	89
1.23	HORIZONTAL CYLINDRICAL SHELL STRAIGHTENING MACHINE	TO STRAIGHTEN CYLINDRICAL SHELLS AFTER LONGITUDINAL WELDING	DITTO & ALSO PULP & PAPER PLANT	82
1.24	HEAVY DUTY HEAD FLANGING MACHINE	TO FORM HEADS	DITTO	90
1.25	HEAVY DUTY HYDRAULIC PRESS MACHINE	TO DISH HEADS AND TO FORM THICK PLATES	DITTO	88
1.26	MECHANICAL PLATE BEND ROLLING MACHINE	TO FORM SHELL PLATES	DITTO	84
1.44	COPIER GAS CUTTING MACHINE	TO PRODUCE LARGE QUANTITIES OF SMALL PARTS	DITTO	72
3.1	PORTABLE COBALT UNIT AND PORTABLE IRIDIUM UNIT	TO DETECT INTERNAL DEFECTS IN THICK-WALL WELDS	FERTILIZER & PETROCHEMICAL PLANT	-
3.3	COMPLETE SET PORTABLE MAGNETIC PARTICLE INSPECTION EQUIPMENT	TO DETECT SURFACE DEFECTS IN RAW MATERIALS AND WELDS	HEAT EXCHANGER, FERTILIZER & PETRO-CHEMICAL PLANT	-
3.4	PORTABLE ULTRASONIC TESTING UNIT	TO DETECT INTERNAL DEFECTS IN RAW MATERIALS AND WELDS	FERTILIZER & PETROCHEMICAL PLANT	-
3.5	RADIOGRAPHIC X-RAY TESTING UNIT	TO DETECT DEFECTS IN WELDS	HEAT EXCHANGER, FERTILIZER & PETRO-CHEMICAL PLANT	-
3.6	HIGH PRESSURE WATER PUMP	TO MAKE HYDROSTATIC TEST OF PRESSURE VESSELS	DITTO	-
3.8	UNIVERSAL TESTING MACHINE	TO CONDUCT MECHANICAL TEST FOR GUARANTEE OF PRODUCTS	DITTO	-
4.1	BOGIE HEARTH FURNACE	FOR HOT FORMING OR POSTWELD HEAT TREAT-MENT	DITTO	-
4.2	SHOT GRIT COMPARTMENT UNIT	FOR SURFACE TREATMENT OF PRODUCTS	DITTO & ALSO PULP & PAPER UNIT	-
4.7	ACID CLEANING EQUIPMENT	TO CLEAN RAW MATERIALS, PARTS AND COMPLETED PRODUCTS	DITTO	-

Table 5-1 Training Plan

Purpose	(1) Level up of Quality Assurance (2) Level up of working skill and skill transfer				
Training System	On the Job Training		Off the Job Training		
Trainer	SUPERVISOR	FOREMAN	SUPERVISOR	FOREMAN	INSTRUCTOR
Supplier	(1) Machine Supplier (2) Technical Licensor	Company's Own System	(1) Machine Supplier (2) Technical Licensor	Company's Own System	Consulting Company
Training Material	Supplied Equipment	Working Equipment	Paper	Paper	Paper
Manuals	Operation Manual Instruction Manual Their Own Skill	Their Own Skill Production drawing Operation Specification	Operation Manual Instruction Manual Production drawing	Their Own Skill QC Manual	——
Training Schedule	Day by Day		2 - 3 weeks/year & step by step		
Worker	Inspector, Machinist, Fabricator, welder Assembler, Electrician, Maintenance worker, and so on				
Results	Production: up Quality: up Moral: up				

Table 5-2 New Organization and Personnel for P.T. B.B.I Wahana Unit



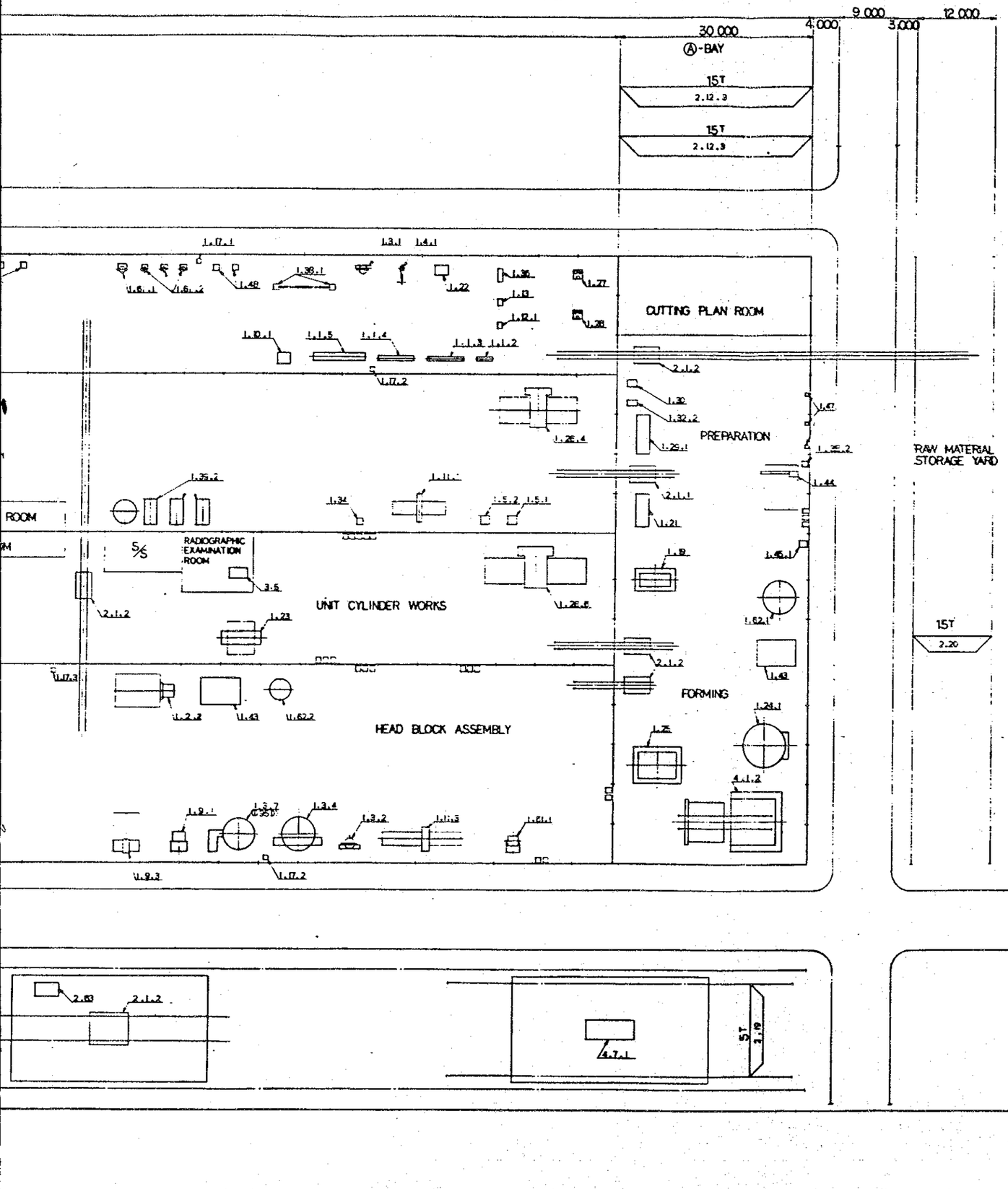
ORGANIZATION	TOTAL PERSONNEL	SECTION MANAGER	ENGINEER S/V & OFFICER	DIRECT WORKER	INDIRECT WORKER
GENERAL AFFAIR DEPARTMENT	43	2	26		15
PERSONNEL & GENERAL AFFAIR SECTION					
FINANCE SECTION					
COMMERCIAL DEPARTMENT	27	2	22		3
SALES & PRICE CALCULATION SECTION					
PURCHASE & DELIVERY SECTION					
QUALITY CONTROL DEPARTMENT	16		4	12	
PLANNING & PRODUCTION CONTROL DEPARTMENT	68				
DESIGNING SECTION		1	12		
PLANNING & PRODUCTION CONTROL SECTION		1	22		
PRODUCTION TECHNOLOGY SECTION		1	8		
MAINTENANCE SECTION		1	2		20
PRODUCTION DEPARTMENT	372				
WORK PROGRAM & MACHINING SECTION		1	7	26	25
PREPARATION SECTION		1	3	57	
PLATE WORK I SECTION		1	3	119	
PLATE WORK II SECTION		1	3	118	
ERECTION SECTION		1	6		
TOTAL	526	13	118	332	63

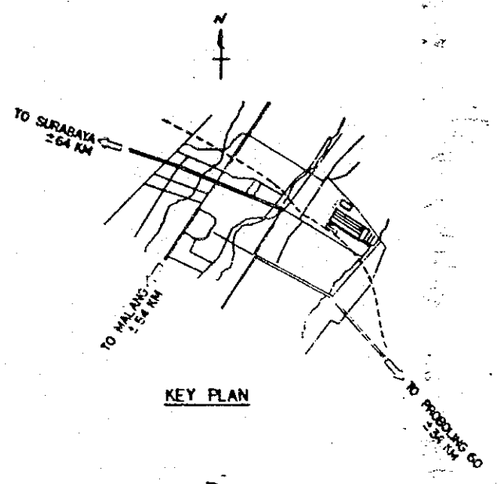
MACHINE NO. AND MACHINE NAME LIST OF Fig. 3-1 LAYOUT PLAN (WAHANA)

NO.	MACHINE NAME
1.1	HEAVY DUTY UNIVERSAL LATHE MACHINE
1.2	HEAVY DUTY FACING LATHE MACHINE
1.3	VERTICAL BORING & TURNING MILL MACHINE
1.4	HEAVY DUTY RADIAL DRILLING MACHINE
1.5	VERTICAL DRILLING MACHINE PILLAR TYPE
1.7	C.N.C. DRILLING CENTER MACHINE
1.8	PORTABLE UNIVERSAL RADIAL DRILLING MACHINE WITH SWIVEL RAM AND HEAD
1.9	HORIZONTAL BORING & MILLING MACHINE
1.10	UNIVERSAL MILLING MACHINE
1.11	PLANNING MACHINE
1.12	HEAVY DUTY HYDRAULIC HACKSAW MACHINE
1.13	HEAVY DUTY HYDRAULIC CIRCULAR SAW MACHINE
1.14	UNIVERSAL TOOL & CUTTER GRINDING
1.15	SEMIAUTOMATIC GRINDER FOR SHARPENING TWIST DRILL & CORE DRILL
1.16	AUTOMATIC SHAPENING FOR METAL CUTTING CIRCULAR SAW
1.17	PEDESTAL GRINDING MACHINE (DOUBLE GRINDING WHEELS)
1.19	HEAVY DUTY HYDRAULIC PRESS MACHINE
1.21	HYDRAULIC PRESS BRAKE MACHINE
1.22	HORIZONTAL PROFILE STRAIGHTENING MACHINE
1.23	HORIZONTAL CYLINDRICAL SHELL STRAIGHTENING MACHINE
1.24	HEAVY DUTY HEAD FLANGING MACHINE
1.25	HEAVY DUTY HYDRAULIC PRESS MACHINE
1.26	MECHANICAL PLATE BEND ROLLING MACHINE
1.27	HEAVY DUTY HYDRAULIC PIPE BENDING MACHINE
1.28	HYDRAULIC BENDING MACHINE
1.29	MECHANICAL PLATE SHEARING MACHINE
1.30	MECHANICAL UNIVERSAL STEEL WORKER MACHINE
1.32	PUNCHING MACHINE
1.34	MECHANICAL PLATE FORMING MACHINE
1.36	UNIVERSAL FILLING AND BAND SAW MACHINE
1.38	PIPE BEVELLING/EDGING MACHINE
1.39	AIR COMPRESSOR

NO.	MACHINE NAME
1.43	SURFACE PLATE FOR MARKING
1.44	COPIER GAS CUTTING MACHINE
1.61	WELDING POSITIONER
1.62	TURNING TABLE FOR GAS CUTTING
1.63	BOOM TYPE WELDING MACHINE
2.1	BAY TRANSFER CAR
2.5	30 TONS HYDRAULIC TELESCOPIC TRUCK CRANE
2.9	OVERHEAD TRAVELLING CRANE 8 TONS
2.10	OVERHEAD TRAVELLING CRANE 10 TONS
2.12	OVERHEAD TRAVELLING CRANE 15 TONS
2.13	OVERHEAD TRAVELLING CRANE 15/5 TONS
2.14	OVERHEAD TRAVELLING CRANE 20 TONS
2.17	OVERHEAD TRAVELLING CRANE 30/5 TONS
2.19	GANTRY CRANE 5 TONS
2.20	GANTRY CRANE 15 TONS
2.22	GANTRY CRANE 30/5 TONS
2.39	PAIR OF DRUM ROTATOR WITH DRIVE MOTOR AND IDLER ROTATOR
2.40	PAIR OF IDLER DRUM ROTATOR WITHOUT DRIVE MOTOR
2.41	YOKE OR CHAIN PIPE VISE WITH TRIPOD STAND
3.1	PORTABLE COBALT UNIT AND PORTABLE IRIDIUM UNIT
3.3	COMPLETE SET PORTABLE MAGNETIC PARTICLE INSPECTION EQUIPMENT
3.4	PORTABLE ULTRASONIC TESTING UNIT
3.5	RADIOGRAPHIC X-RAY TESTING UNIT
3.8	UNIVERSAL TESTING MACHINE
4.1	BOGIE HEARTH FURNACE
4.3	SAND BLASTING MACHINE
4.7	ACID CLEANING EQUIPMENT

17.000 12.000 8.500 258.000
38 x @ 6.000 = 228.000
OFFICE
50.000
STEEL STRUCTURE ASSEMBLY
PRE-FABRICATION PIPING WORKS
GENERAL PLATE WORKS ASSEMBLY
PARTS STORAGE ROOM
TOOL ROOM
RADIOGRAPHIC EXAMINATION ROOM
HEAT EXCHANGER ASSEMBLY
HEAVY PLATE WORKS ASSEMBLY
Ⓑ-BAY
Ⓒ-BAY
Ⓓ-BAY
Ⓔ-BAY





KEY PLAN

NO.	MACHINE NAME	NO.	MACHINE NAME
1.1	HEAVY DUTY UNIVERSAL LATHE MACHINE	1.43	SURFACE PLATE FOR MARKING
1.2	HEAVY DUTY FACING LATHE MACHINE	1.44	COPIER GAS CUTTING MACHINE
1.3	VERTICAL BORING & TURNING MILL MACHINE	1.61	WELDING POSITIONER
1.4	HEAVY DUTY RADIAL DRILLING MACHINE	1.62	TURNING TABLE FOR GAS CUTTING
1.5	VERTICAL DRILLING MACHINE PILLAR TYPE	1.63	BOOM TYPE WELDING MACHINE
1.7	C.N.C. DRILLING CENTER MACHINE	2.1	BAY TRANSFER CAR
1.8	PORTABLE UNIVERSAL RADIAL DRILLING MACHINE WITH SWIVEL RAM AND HEAD	2.5	30 TONS HYDRAULIC TELESCOPIC TRUCK CRANE
1.9	HORIZONTAL BORING & MILLING MACHINE	2.9	OVERHEAD TRAVELLING CRANE 8 TONS
1.10	UNIVERSAL MILLING MACHINE	2.10	OVERHEAD TRAVELLING CRANE 10 TONS
1.11	PLANNING MACHINE	2.12	OVERHEAD TRAVELLING CRANE 15 TONS
1.12	HEAVY DUTY HYDRAULIC HACKSAW MACHINE	2.13	OVERHEAD TRAVELLING CRANE 15/5 TONS
1.13	HEAVY DUTY HYDRAULIC CIRCULAR SAW MACHINE	2.14	OVERHEAD TRAVELLING CRANE 20 TONS
1.14	UNIVERSAL TOOL & CUTTER GRINDING	2.17	OVERHEAD TRAVELLING CRANE 30/5 TONS
1.15	SEMIAUTOMATIC GRINDER FOR SHARPENING TWIST DRILL & CORE DRILL	2.19	GANTRY CRANE 5 TONS
1.16	AUTOMATIC SHAPENING FOR METAL CUTTING CIRCULAR SAW	2.20	GANTRY CRANE 15 TONS
1.17	PEDESTAL GRINDING MACHINE (DOUBLE GRINDING WHEELS)	2.22	GANTRY CRANE 30/5 TONS
1.19	HEAVY DUTY HYDRAULIC PRESS MACHINE	2.39	PAIR OF DRUM ROTATOR WITH DRIVE MOTOR AND IDLER ROTATOR
1.21	HYDRAULIC PRESS BRAKE MACHINE	2.40	PAIR OF IDLER DRUM ROTATOR WITHOUT DRIVE MOTOR
1.22	HORIZONTAL PROFILE STRAIGHTENING MACHINE	2.41	YOKE OR CHAIN PIPE WISE WITH TRIPOD STAND
1.23	HORIZONTAL CYLINDRICAL SHELL STRAIGHTENING MACHINE	3.1	PORTABLE COBALT UNIT AND PORTABLE IRIDUM UNIT
1.24	HEAVY DUTY HEAD FLANGING MACHINE	3.3	COMPLETE SET PORTABLE MAGNETIC PARTICLE INSPECTION EQUIPMENT
1.25	HEAVY DUTY HYDRAULIC PRESS MACHINE	3.4	PORTABLE ULTRASONIC TESTING UNIT
1.26	MECHANICAL PLATE EDGE MILLING MACHINE	3.5	RADIOGRAPHIC X-RAY TESTING UNIT
1.27	HEAVY DUTY HYDRAULIC PIPE BENDING MACHINE	3.8	UNIVERSAL TESTING MACHINE
1.28	HYDRAULIC BENDING MACHINE	4.1	BOGIE HEARTH FURNACE
1.29	MECHANICAL PLATE SHEARING MACHINE	4.3	SAND BLASTING MACHINE
1.30	MECHANICAL UNIVERSAL STEEL WORKER MACHINE	4.7	ACID CLEANING EQUIPMENT
1.32	PUNCHING MACHINE		
1.34	MECHANICAL PLATE FORMING MACHINE		
1.36	UNIVERSAL FILLING AND BAND SAW MACHINE		
1.38	PIPE BEVELLING/EDGING MACHINE		
1.39	AIR COMPRESSOR		

Fig. 3-1 LAYOUT PLAN
(WAHANA)

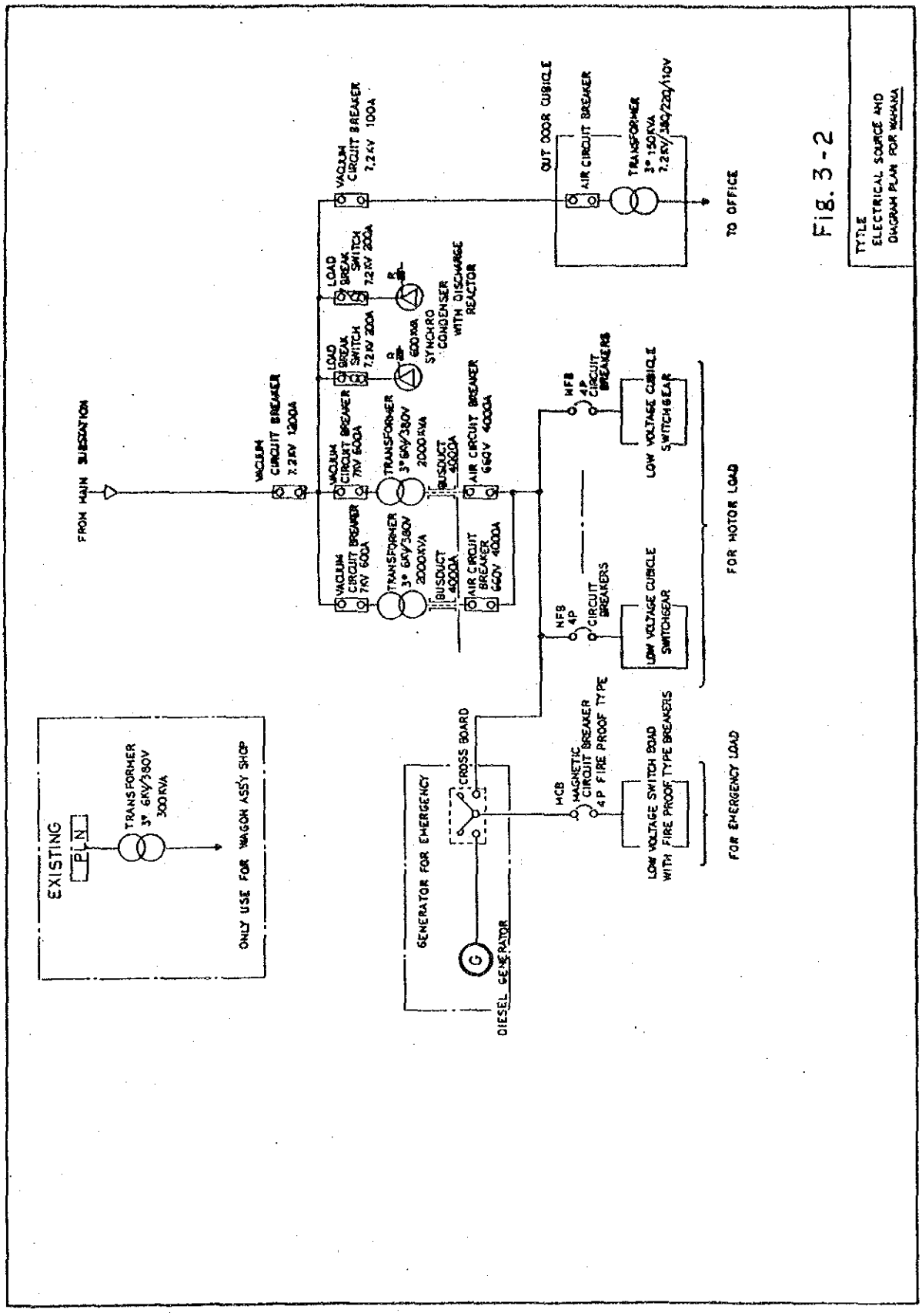
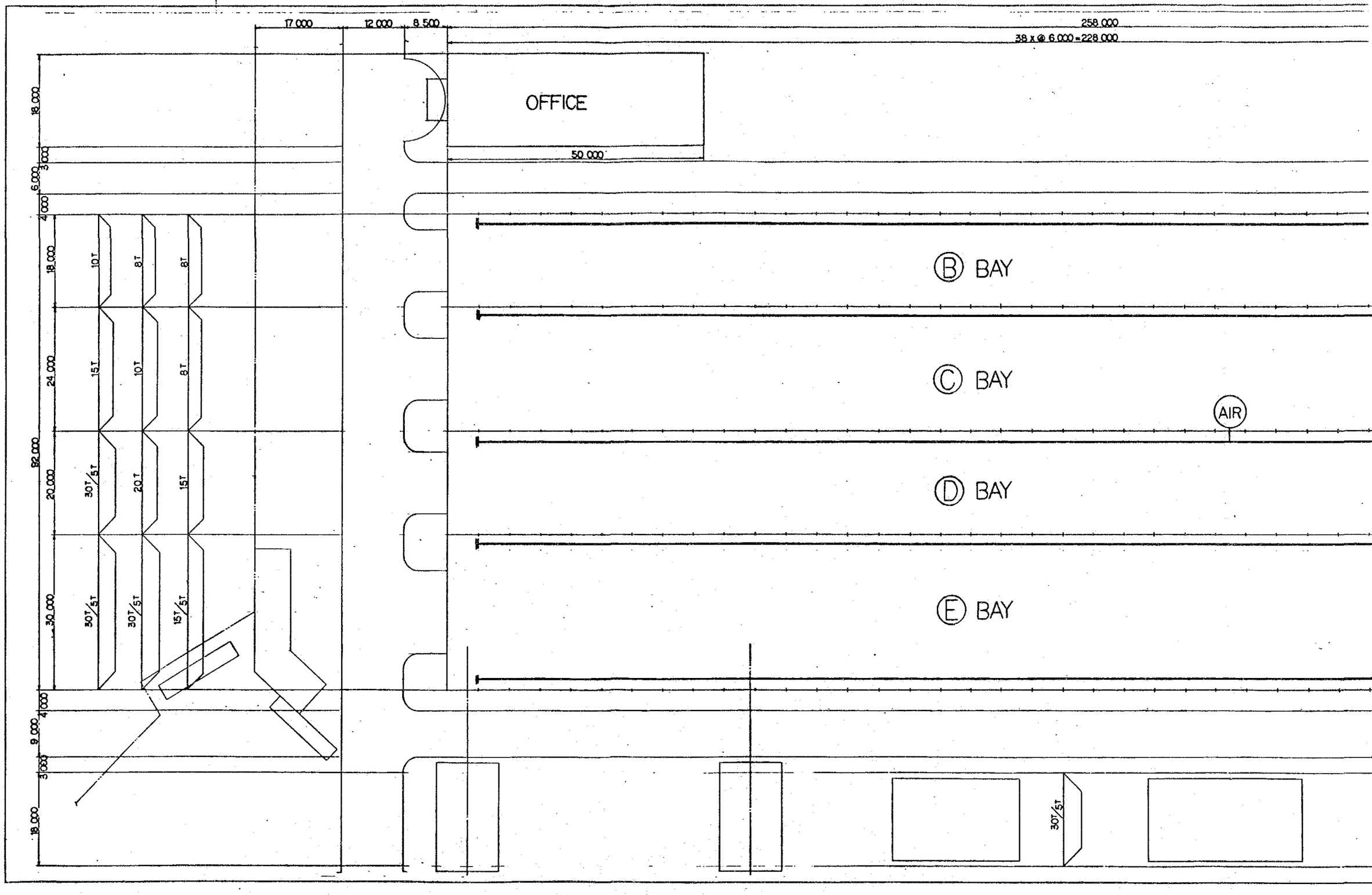
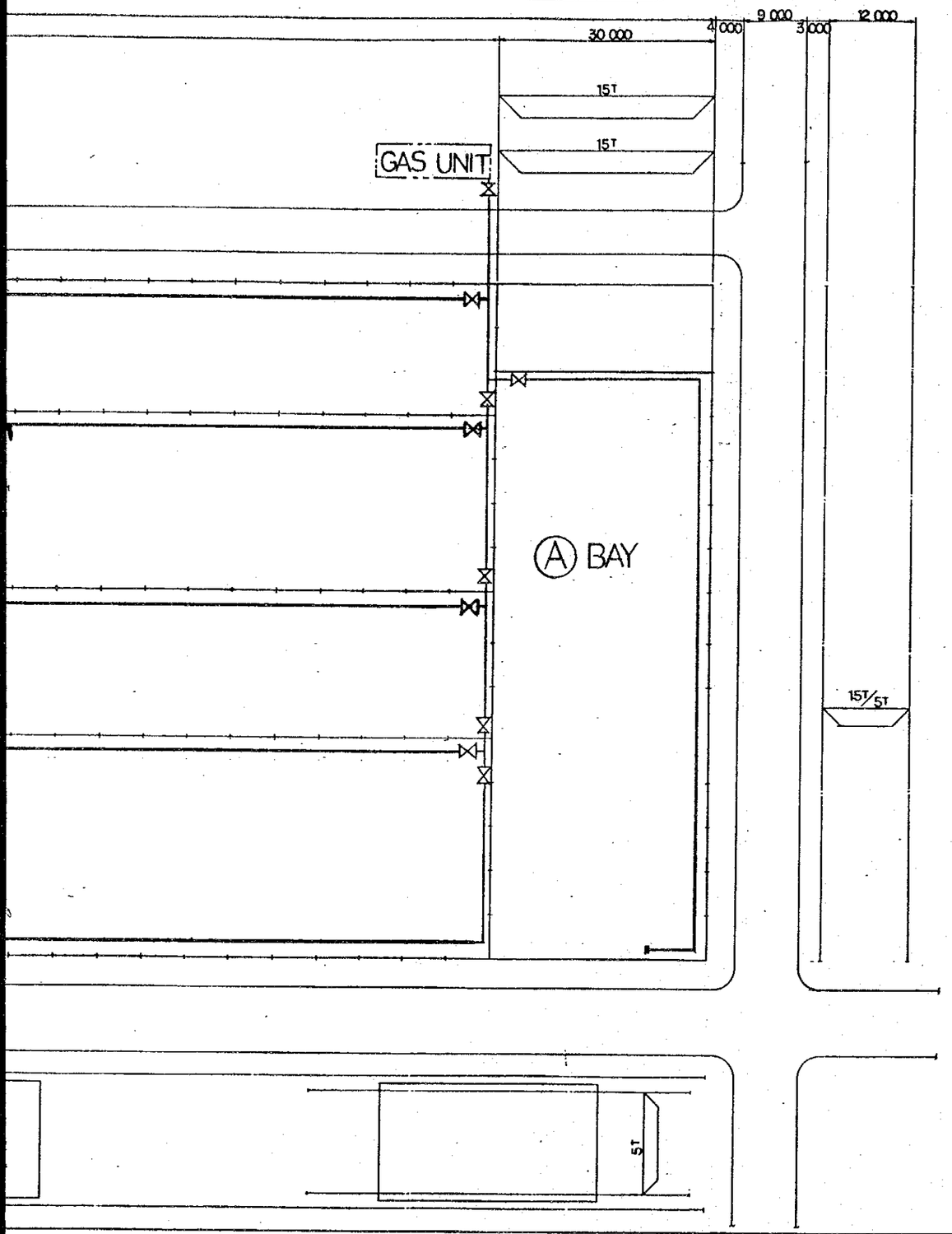
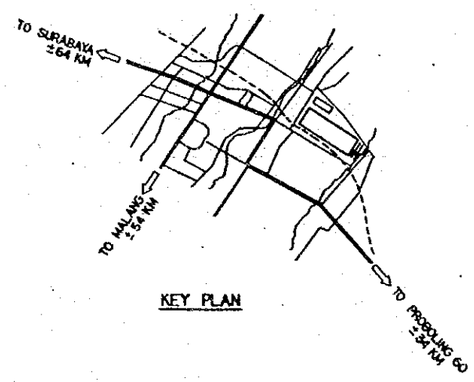

FROM MAIN SUBSTATION
VACUUM CIRCUIT BREAKER 7.2 KV 1200A
VACUUM CIRCUIT BREAKER 7KV 600A
TRANSFORMER 3Φ 6KV/380V 2000KVA
BUSDUCT 4000A
AIR CIRCUIT BREAKER 660V 4000A
LOAD BREAK SWITCH 7.2KV 200A
600KVA SYNCHRO CONDENSER WITH DISCHARGE REACTOR
VACUUM CIRCUIT BREAKER 7.2 KV 100A
OUT DOOR CUBICLE
AIR CIRCUIT BREAKER
TRANSFORMER 3Φ 150KVA 7.2KV/380/220/110V
TO OFFICE
NFB 4P CIRCUIT BREAKERS
LOW VOLTAGE CUBICLE SWITCHGEAR
FOR MOTOR LOAD
EXISTING
PLN
TRANSFORMER 3Φ 6KV/380V 300KVA
ONLY USE FOR WAGON ASSY SHOP
GENERATOR FOR EMERGENCY
CROSS BOARD
DIESEL GENERATOR
MCB MAGNETIC CIRCUIT BREAKER 4P FIRE PROOF TYPE
LOW VOLTAGE SWITCH BOAD WITH FIRE PROOF TYPE BREAKERS
FOR EMERGENCY LOAD
TITLE
ELECTRICAL SOURCE AND DIAGRAM PLAN FOR WAHANA

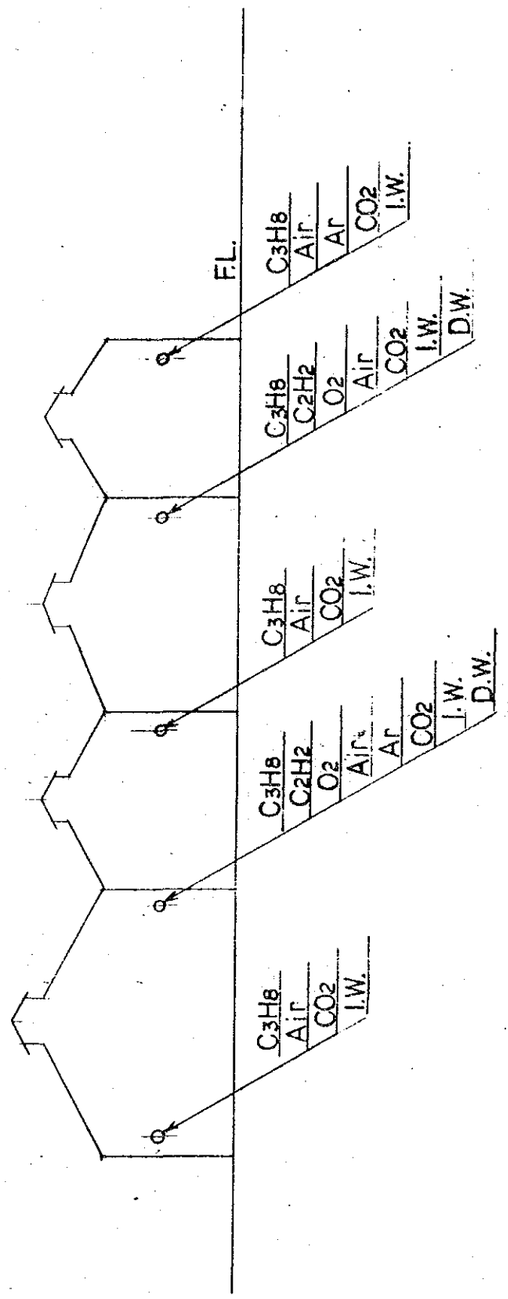
Fig. 3-2


17.000
12.000
8.500
258.000
38 x @ 6.000 = 228.000
OFFICE
50.000
18.000
3.000
6.000
4.000
18.000
24.000
82.000
20.000
30.000
4.000
9.000
3.000
18.000
10T
8T
8T
15T
10T
8T
30T/5T
20T
15T
30T/5T
30T/5T
15T/5T
Ⓑ BAY
Ⓒ BAY
AIR
Ⓓ BAY
Ⓔ BAY
30T/5T





KEY PLAN



I.W. : Industrial Water
D.W. : Drinking Water

Fig. 3-4 UTILITY PIPING PLAN
(WAHANA)

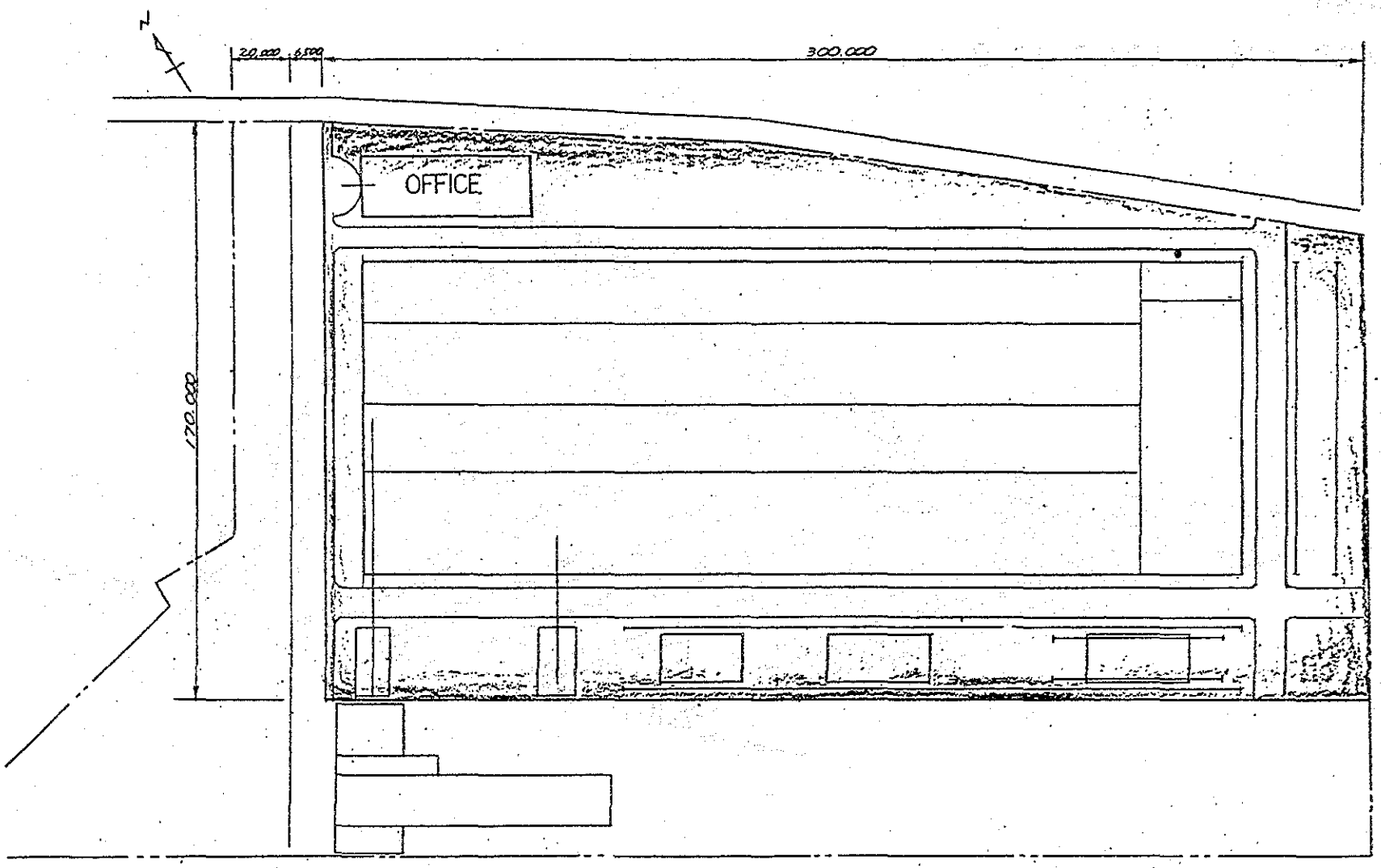


Fig.3-5 LAND PREPARATION PLAN
(WAHANA)

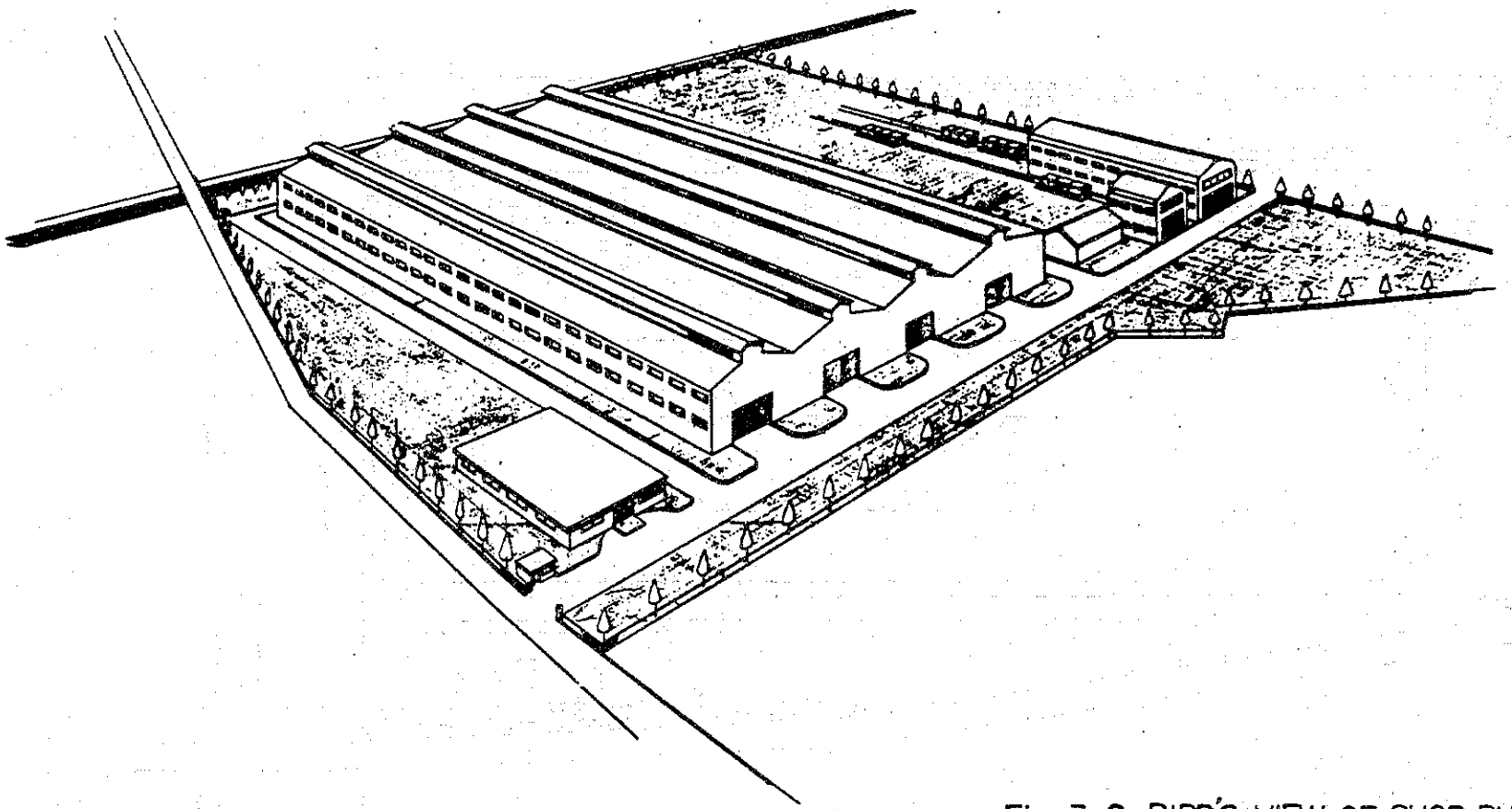


Fig. 3-6 BIRD'S VIEW OF SHOP BUILDING
(WAHANA)

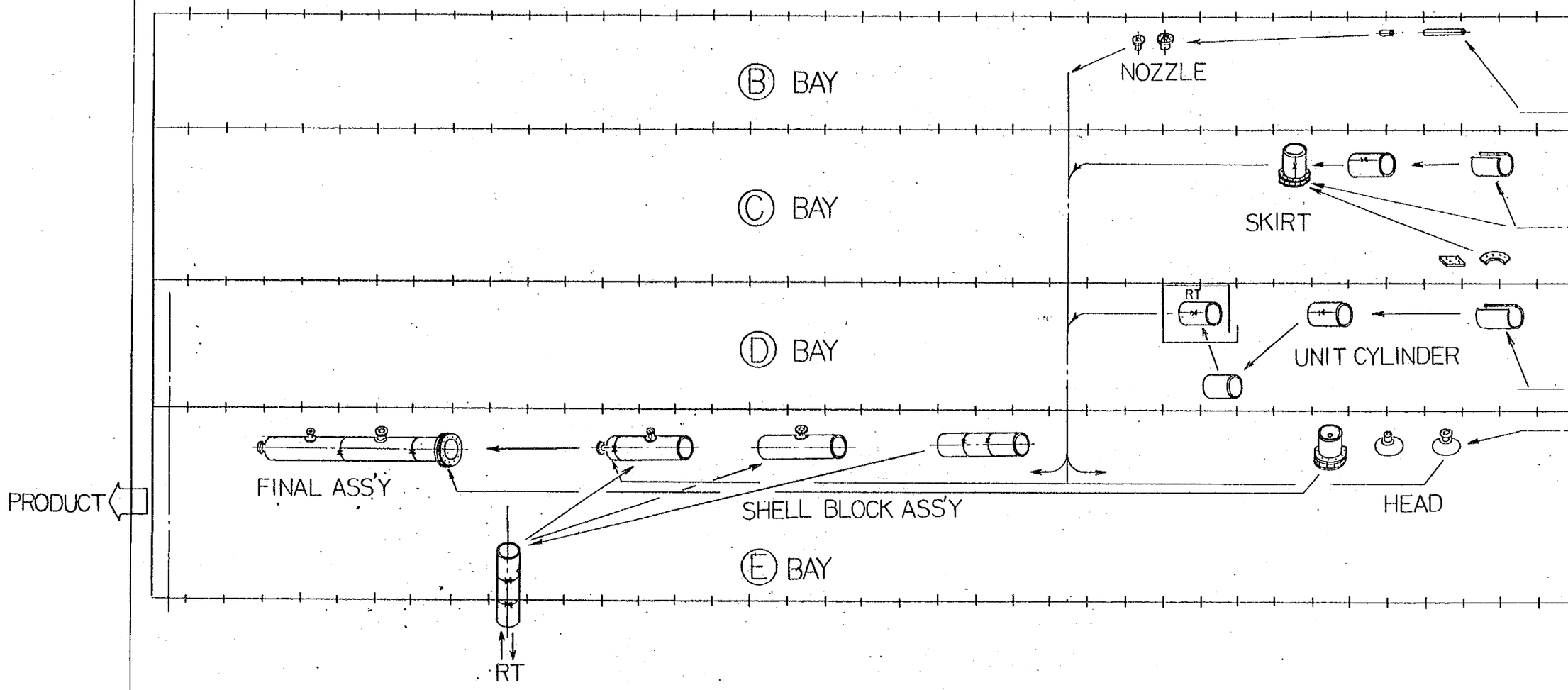

Ⓑ BAY
Ⓒ BAY
Ⓓ BAY
Ⓔ BAY
NOZZLE
SKIRT
RT
UNIT CYLINDER
FINAL ASS'Y
SHELL BLOCK ASS'Y
HEAD
PRODUCT
RT

Fig.4-1

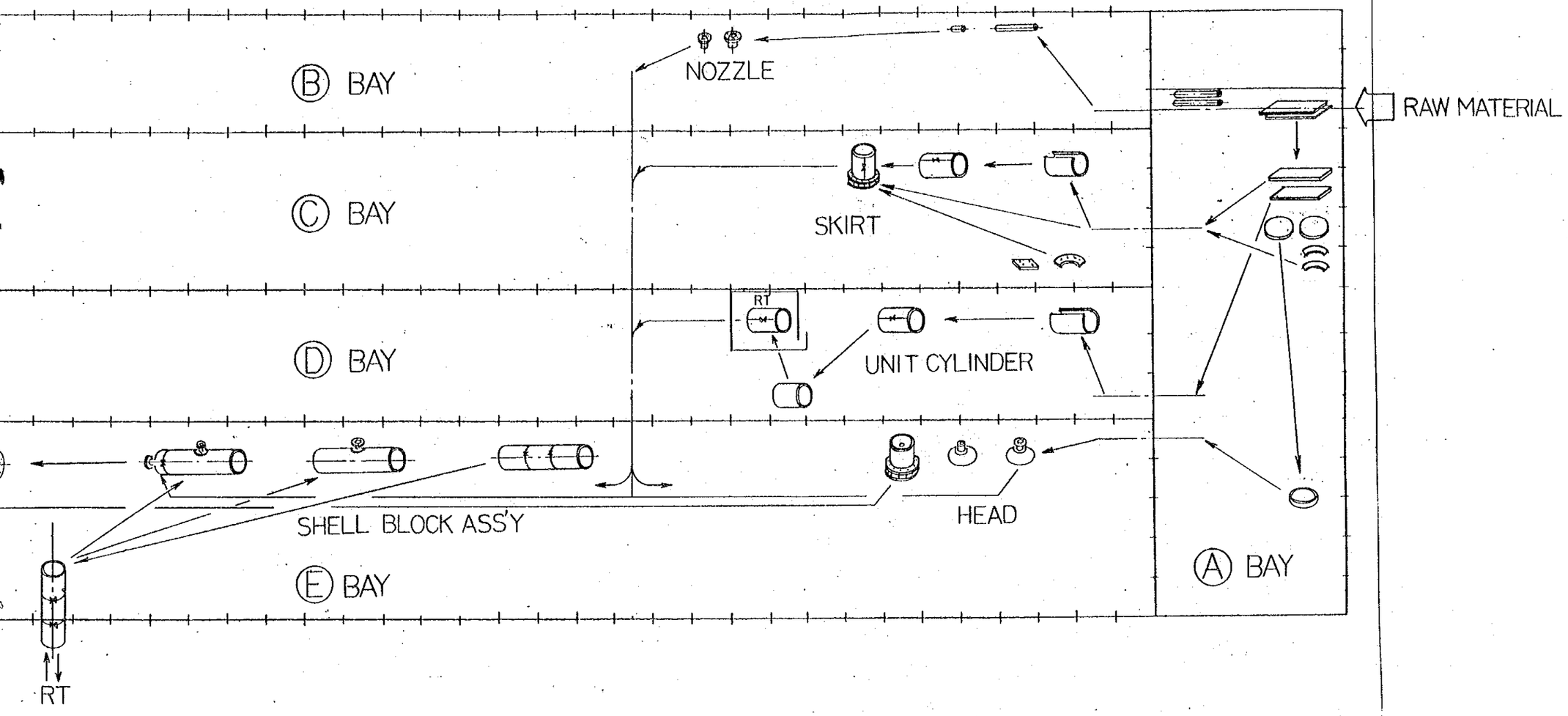
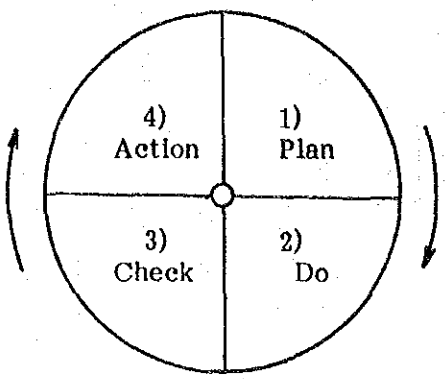


Fig.4-1 MANUFACTURING PROCESS FLOW (TOWER)

(WAHANA)



(1) Plan a job. (Plan)

(2) Do the job as planned. (Do)

(3) Check the job for result done. (Check)

(4) Based on the result, correct the plan. (Action)

Fig. 5-1 P.D.C.A Managerial Circle.

Fig. 5-2 TRAINING COST FOR P.T. B.B.I WAHANA UNIT

UNIT: 1,000,000 YEN

TRAINING ITEM \ YEAR		1985	1986	1987	1988	1989	1990
FOR ENGINEER 1. PRODUCTION CONTROL 2. PRODUCTION TECHNIQUE 3. QUALITY CONTROL						⇒ INTO OPERATION SUPERVISOR BY TECHNICAL LICENSE 2 YEARS	
					F: 9.48 D: 7.19	F: 56.85 D: 43.15	F: 47.38 D: 35.95
FOR WORKER 1. MACHINE WORKER 2. WELDING 3. FORMING 4. INSPECTION, ETC			BY COMPANY'S OWN SYSTEM		SUPERVISOR BY MACHINE SUPPLIER F: 22.55 D: —		
TRAINING COST	FOREIGN				32.03	56.85	47.38
	DOMESTIC				7.19	43.15	35.95

P.T. BOMA BISMA INDRA: WAHANA UNIT

LIST 4-1 NEW AND USABLE EXISTING MACHINE/TOOL LIST

		PAGE
1.	MACHINE TOOLS & WELDING MACHINES	2 - 12
2.	ASSEMBLY EQUIPMENT & MATERIAL HANDLING	13 - 21
3.	QUALITY ASSURANCE & TESTING UNIT	22 - 23
4.	AUXILIARY UNIT	24 - 25

( ); shown usable existing machine Code No.

1. MACHINE TOOLS & WELDING MACHINES

NO.	TYPE OF MACHINE		QUANTITY
1.1	HEAVY DUTY UNIVERSAL LATHE MACHINE		
1.1.1	Max. turning diameter Distance between center	290 mm 1000 mm	1 For site
1.1.2	Max. turning diameter Distance between center	350 mm 1500 mm	1
1.1.3	Max. turning diameter Distance between center	450 mm 4000 mm	1
1.1.4	Max. turning diameter Distance between center	550 mm 4000 mm	1
1.1.5	Max. turning diameter Distance between center	1100 mm 6000 mm	1
1.2	HEAVY DUTY FACING LATHE MACHINE		
1.2.2	Max. turning diameter Max. work size	5000 mm 5,000 mmø x 10,000 mmL	1
1.3	VERTICAL BORING & TURNING MILL MACHINE		
1.3.1	Max. turning diameter Max. turning height	1000 mm 1000 mm	1
1.3.2	Max. turning diameter Max. turning height	1600 mm 1500 mm	1
1.3.3	Max. turning diameter Max. turning height	2350 mm 2550 mm	1
1.3.4	Max. turning diameter Max. turning height	5000 mm 2000 mm	1

NO.	TYPE OF MACHINE		QUANTITY
1.3.7 (D95D)	Table size Length of arm Range of table speed	4500 mm 3000 mm 0.34 - 8.4 rpm	1
1.4	HEAVY DUTY RADIAL DRILLING MACHINE		
1.4.1	Max. drilling capacity	35 mmø	4 2; For site
1.4.2	Max. drilling capacity	50 mmø	3
1.4.3	Max. drilling capacity	65 mmø	2
1.4.4	Max. drilling capacity	80 mmø	2
1.5	VERTICAL DRILLING MACHINE PILLAR TYPE		
1.5.1	Max. capacity	35 mmø	1
1.5.2	Max. capacity	45 mmø	1
1.7	C.N.C. DRILLING CENTER MACHINE		
	Max. drilling capacity Max. column travel Spindle head travel Arm vertical travel	65 mmø 6000 mm 3100 mm 1000 mm	1
1.8	PORTABLE UNIVERSAL RADIAL DRILLING MACHINE WITH SWIVEL RAM AND HEAD		
	Max., drilling capacity	45 mmø	1
1.9	HORIZONTAL BORING & MILLING MACHINE		
1.9.1	Heavy duty horizontal boring & milling machine - (Table type)		
	Spindle diameter Table size	130 mm 1520 x 1700 mm	1

NO.	TYPE OF MACHINE		QUANTITY
1.9.3	Heavy duty horizontal boring & milling machine- (Floor type)		
	Spindle diameter	130 mm	1
	Floor size	4000 x 4000 mm	
1.10	UNIVERSAL MILLING MACHINE		
	Table size	1800 x 560 mm	1
1.11	PLANING MACHINE		
1.11.1	Heavy duty double column planing machine		
	Table size	4000 x 2000 mm	1
1.11.3	Heavy duty open side planing machine		
	Table size	6000 x 2000 mm	1
1.12	HEAVY DUTY HYDRAULIC HACKSAW MACHINE		
1.12.1	Max. cutting	280 mmϕ	1
1.13	HEAVY DUTY HYDRAULIC CIRCULAR SAW MACHINE		
	Max. cutting	350 mmϕ	1
1.14	UNIVERSAL TOOL & CUTTER GRINDING		
1.14.1	Swing	265 mm	1
	Distance between workhead and tailstock	910 mm	
	Table size	180 x 1320 mm	
1.15	SEMIAUTOMATIC GRINDER FOR SHARPENING TWIST DRILL & CORE DRILL		

NO.	TYPE OF MACHINE		QUANTITY
1.15.1	Range drills diameter Point angle	10 - 100 mm 80 1/4 - 170 1/4	1
1.16	AUTOMATIC SHARPENING FOR METAL CUTTING CIRCULAR SAW		
1.16.1	Max. outside diameter	1600/2000 mm	1
1.17	PEDESTAL GRINDING MACHINE (DOUBLE GRINDING WHEELS)		
1.17.1	Pedestal grinding machine Wheel size	150 x 25 x 51mm	2
1.17.2	Pedestal grinding machine Wheel size	300 x 40 x 76mm	6
1.17.3	Pedestal grinding machine Wheel size	500 x 60 x 127mm	1
1.19	HEAVY DUTY HYDRAULIC PRESS MACHINE		
1.19.1	Power Table area Stroke Daylight Example of cold forming capacity 1. 1,000 mmR x 3,000 mmL at plate thickness 2. 1,000 mmR x 4,500 mmL at plate thickness	900 Tons 4800 x 2000 mm 600 mm 1,500 mm 35 mm 25 mm	1
1.21	HYDRAULIC PRESS BRAKE MACHINE		
	Power press Max. plate width Throat depth Daylight Stroke	750 Tons 4000 mm 400 mm 650 mm 350 mm	1
1.22	HORIZONTAL PROFILE STRAIGHTENING MACHINE		
	Force Throat depth Stroke Daylight Table block size	200 Tons 235 mm 750 mm 600 mm 450 x 1,700 mm	1
1.23	HORIZONTAL CYLINDRICAL SHELL STRAIGHTENING MACHINE		1
	Force Daylight Stroke Max. plate width	800 Tons 650 mm 200 mm 4,000 mm	

1.24	HEAVY DUTY HEAD FLANGING MACHINE		
1.24.1	Max. head diameter (Range of plate thickness : 9 - 30 mm) Min. head diameter (Range of plate thickness : 4.5 - 12 mm)	5,000 mm 800 mm	1
1.25	HEAVY DUTY HYDRAULIC PRESS MACHINE		
1.25.1	Force Table area Stroke Daylight (Example of cold forming capacity 1. 1,500 mmR x 3,000 mmL at plate thickness 2. 1,500 mmR x 6,000 mmL at plate thickness)	2000 Tons 6000 x 4000 mm 1000 mm 2000 mm 90 mm 50 mm	1
1.26	MECHANICAL PLATE BEND ROLLING MACHINE		
1.26.1	Max. plate thickness bending capacity Max. plate width Min. bending diameter	12 mm 2000 mm 450 mm	2. For site
1.26.4	Max. plate thickness bending capacity Max. plate width Min. bending diameter	25 mm 4000 mm 700 mm	1
1.26.6	Max. plate thickness bending capacity Max. plate width Min. bending diameter	60 mm 4000 mm 1,000 mm	1
1.27	HEAVY DUTY HYDRAULIC PIPE BENDING MACHINE		
	Max. bending capacity of pipe	4 inch ϕ	1
1.28	HYDRAULIC BENDING MACHINE		
	Max. bending for: Pipe ST.37 (diameter x thickness) Square solid bar Round bar	 216 x 5.8 mm 110 mm 120 mm	1
1.29	MECHANICAL PLATE SHEARING MACHINE		
1.29.1	Max. plate thickness Plate width	16 mm 4000 mm	1

NO.	TYPE OF MACHINE		QUANTITY
1.30	MECHANICAL UNIVERSAL STEEL WORKER MACHINE		
	Flat shear max.	250 x 22 mm	1
	Bar stock shear	65 mmø	
	Square stock shear	55 mmø	
	Punch max. ø38 in thickness	27 mm	
	Notching	16 mmø	
1.31	HAND NIBBLING MACHINE		
	Max. nibbling capacity	8 mm	1
	Smallest radius	300 mm	
1.32	PUNCHING MACHINE		
1.32.1	Handy portable hydraulic heavy duty punching machine		
	Max. punching capacity hole	30 mmø in 16 mm	1
	Depth throat	100 mm	
1.32.2	Mechanical heavy duty punching machine		
	Max. punching capacity	30 mmø	1
	Thickness	25 mm	
1.33	HANDY HEAVY PNEUMATIC RIVETING HAMMER		
	Max. river diameter:		
	Steel construction up to	37 mm	2
	Boiler construction up to	33 mm	
1.34	MECHANICAL PLATE FORMING MACHINE		
	Max. plate thickness	8 mm (light metal St. 37)	1
	Depth of gap horizontal	675 mm	
1.35	TUBE EXPANDER		
	Max. pipe diameter	10 - 45 mm	2

NO.	TYPE OF MACHINE		QUANTITY
1.36	UNIVERSAL FILING AND BAND SAW MACHINE		
	Strokeof blade of file	0 - 120 mm	1
	Table	400 x 400 mm	
1.38	PIPE BEVELLING/EDGING MACHINE		
1.38.1	Edge cutting machine		1
	Cutting length	8000 mm	
1.38.2	Portable handy electric bevelling machine		
	Max. material thickness	32 mm	1
1.39	AIR COMPRESSOR		
1.39.1	Mobile air compressor with diesel power		
	Max. pressure	10 bar	1
	Capacity	20 m^3/min	
1.39.2	Static air compressor		
	Max. pressure	8.8 bar	3
	Capacity	15 m^3/min.	
1.39.3	High pressure air compressor		
	Max. pressure	300 atm	1
	Capacity	22 m^3/hr	
	Motor	11 kW	
1.41	INDUCTION HEATING EQUIPMENT		
	Welding current	600 Amp	2
	Duty cycle	100% at 600 Amp	
	Output voltage	60 - 80 volts	
1.42	CUTTING TOOLS		1
1.43	SURFACE PLATE FOR MARKING		
	Dimension	4000 x 6000 x 4000 mm	2
	Max. load	10 Tons	

NO.	TYPE OF MACHINE		QUANTITY
1.44	COPIER GAS CUTTING MACHINE		
	4 cutting torches		1
	Max. plate thickness	150 mm	
	Effective cutting	6000 x 3000 mm	
1.45	PLASMA CUTTING MACHINE		
1.45.1	Max. cutting thickness alloy steel	70 mm	1
1.45.2 (-)	-		1
1.46	AUTOMATIC GAS CUTTING MACHINE (CIRCULAR)		
	Max. cutting thickness	150 mm	1
	Circle cutting range diameter	60 - 2000 mm	
	Cutting speed range	80 - 1000 mm/min	
1.47	PORTABLE FLAME CUTTING MACHINE		
	Cutting capacity	150 mm	3
1.48	PIPEEND BEVELLING FLAME CUTTING MACHINE		
	Effective pipe diameter	150 - 1000	2
	Pipe thickness	5 - 50 mm	
1.49	MANUAL FLAME CUTTING		
	Max. cuttint thickness	150 mm	15 5 For site
1.50	SEMIAUTOMATIC GAS METAL ARC WELDING MACHINE		
1.50.1	Max. welding current	600 Amp	10
	Max. wire diameter	1.6 mm	

NO.	TYPE OF MACHINE		QUANTITY
1.51	SUBMERGED ARC AUTOMATIC TANK WELDING MACHINE		
	1400 Amp. Max. wire diameter	6 mm	3
	Max. vertical height	4200 mm	
1.52	AUTOMATIC SUBMERGED ARC WELDING MACHINE		
1.52.1	1500 Amp. Max. wire diameter	6 mm	13 3 For site
1.53	AC ARC WELDING MACHINE		
1.53.1	Max. welding current	500 Amp	40
	Duty cycle	60% at 500 Amp. AC	
1.53.2 (-)	Max. welding current	300 - 500 Amp.	10
1.54	DC ARC WELDING MACHINE		
1.54.1	Max. welding current	500 Amp.	20
	Duty cycle	60% at 450 Amp. DC	
1.54.2 (-)	Max. welding current	300 - 500 Amp.	15
1.55	DC MOTOR GENERATOR WELDING MACHINE		
	Max. welding current	600 Amp.	10
	Duty cycle	60% at 600 Amp.	
1.56	DC DIESEL GENERATOR WELDING MACHINE		
1.56.1	Max. welding current	600 Amp.	6
	Duty cycle	60% at 600 Amp.	For site

NO.	TYPE OF MACHINE		QUANTITY
1.57	T.I.G. WELDING MACHINE		
1.57.1	Out put current Duty cycle	DC Max. 500 Amp. 60% at 500 Amp.	6
1.58	AUTOMATIC SEAL WELDING MACHINE FOR TUBE END WELDING		
	Tube diameter range Steel tube boiler material and exchanger	20 - 100 mm	2
1.59	DIESEL GENERATOR		
	Continuous output 3 phase alternating current (AC)	250 kVA 380/220 Volt, 50 Hz	2
1.60	CARBON ARC AIR GOUGING MACHINE		
	Rated current Duty cycle Usable carbon diameter	DC 600 Amp. 100% 5 - 11 mm	5
1.61	WELDING POSITIONER		
1.61.1	Rotated and tilting table Table size Max. load on table in horizontal position	 1500 x 1500 mm 4 Tons	1
1.61.2	Rated and tilting table Table size diameter Max. load on table in horizontal position	 500 mm 500 kg	3
1.61.3	Welding positioner Rotated and tilting table Table size diameter Max. load on table in horizontal position	 1000 mm 1000 kg	1

NO.	TYPE OF MACHINE		QUANTITY
1.62	TURNING TABLE FOR GAS CUTTING		
1.62.1	Turning table for gas cutting Effective cutting diameter Max. load	 5000 mm 15 Tons	1
1.62.2	Turning table for gas cutting Effective cutting diameter Max. load	 4000 mm 10 Tons	1
1.63	BOOM TYPE WELDING MACHINE		
1.63.1	Boom type automatic submerged arc welding machine Automatic welding carrier Vertical Horizontal Submerged arc welding machine	 4000 mm 5000 mm 1200 Amp. 4.8mm	2
1.63.2	Boom type automatic gas metal arc welding machine Automatic welding carrier Vertical Horizontal Gas metal arc welding machine	 1000 mm 5000 mm 500 Amp. 1.6mm	1

2. ASSEMBLY EQUIPMENTS & MATERIAL HANDLING

NO.	TYPE OF MACHINE		QUANTITY
2.1	BAY TRANSFER CAR		
2.1.1	Capacity	10 Tons	1
2.1.2	Capacity	20 Tons	7
2.2	FORKLIFT TRUCK	3 Tons	1
2.3	FORKLIFT TRUCK	5 Tons	1
2.4	FORKLIFT TRUCK	10 Tons	1
2.5	30 TONS HYDRAULIC TELESCOPIC TRUCK CRANE		1
2.6	HOIST		
2.6.1	Hoist	1 Ton x 6M	10
2.6.2	Hoist	2 Ton x 6M	10
2.7	JIB CRANE 1 TON		
	Lifting height 5 meters		3
2.9	OVERHEAD TRAVELLING CRANE 8 TONS		
2.9.1	Lifting height Rail span	11 meters 18 meters	2
2.9.2	Lifting height Rail span	11 meters 24 meters	1

2.10	OVERHEAD TRAVELLING CRANE 10 TONS		
2.10.1	Lifting height Rail span	11 meters 18 meters	1
2.10.2	Lifting height Rail span	11 meters 24 meters	1
2.12	OVERHEAD TRAVELLING CRANE 15 TONS		
2.12.1	Lifting height Rail span	11 meters 24 meters	1
2.12.2	Lifting height Rail Span	12 meters 20 meters	1
2.12.3	Lifting height Rail span	12 meters 30 meters	2
2.13	OVERHEAD TRAVELLING CRANE 15/5 TONS		
2.13.1	Lifting height Rail span	14 meters 30 meters	1
2.14	OVERHEAD TRAVELLING CRANE 20 TONS		
	Lifting height Rail span	12 meters 20 meters	1
2.17	OVERHEAD TRAVELLING CRANE 30/5 TONS		
2.17.1	Lifting height Rail span	12 meters 20 meters	1
2.17.2	Lifting height Rail span	14 meters 30 meters	2

NO.	TYPE OF MACHINE		QUANTITY
2.19	GANTRY CRANE 5 TONS		
	Lifting height	8 meters	1
	Rail span	12 meters	
2.20	GANTRY CRANE 15 TONS		
	Lifting height	10 meters	1
	Rail span	12 meters	
2.22	GANTRY CRANE 30/5 TONS		
	Lifting height	12 meters	1
	Rail span	18 meters	
2.23	PULLERS WITH LOAD LIMITER		
	Pulling capacity	Approx. 3000kgs	1
	Cable diameter	5/8"	
2.24	UNIVERSAL THEODOLITE COMPLETE SET		1
2.25	MANUAL SCREW JACK		
	Liftint capacity	10 Tons	3
	Stroke	150 mm	
	Collapsed height	280 mm	
2.26	HAND PUMP HYDRAULIC JACK 10 TONS		
	Stroke	150 mm	3
	Closed height	330 mm	
2.27	HAND PUMP HYDRAULIC JACK 35 TONS		
	Stroke	300 mm	3
	Closed height	545 mm	

NO.	TYPE OF MACHINE		QUANTITY
2.28	HAND PUMP HYDRAULIC JACK 100 TONS		
	Stroke	300 mm	3
	Closed height	598 mm	
2.29	HAND PUMP HYDRAULIC JACK COMPLETE SET 200 TONS		
	Stroke	150 mm	1
	Closed height	473 mm	
2.30	HAND PUMP HYDRAULIC SPREAD CYLINDER SPRING RETURN		
	Lifting capacity	1 Ton	3
	Max. stroke	±150 mm	
2.31	HAND PUMP HYDRAULIC SPREAD CYLINDER SPRING RETURN		
	Lifting capacity	3 Tons	3
	Max. stroke	±250 mm	
2.32	HAND PUMP HYDRAULIC PIPE BENDER COMPLETE SET		
	Max. pipe to be bend	ϕ1/2" up to ϕ4"	2
2.33	ELECTRIC WINCH COMPLETE WITH PANEL CONTROL		
	Max. lifting capacity	15 Tons	2
2.34	ELECTRIC WINCH COMPLETE WITH PANEL CONTROL		
	Max. lifting capacity	25 Tons	1

NO.	TYPE OF MACHINE		QUANTITY
2.35	ROPE PULLEY		
	Max. 250 kg		6
2.36	CHAIN BLOCK PULLEY		
	Max. load and lifting capacity	5 tons & 3000 mm	3
2.37	CHAIN BLOCK PULLEY		
	Max. load and lifting capacity	10 tons & 3400 mm	3
2.38	CHAIN BLOCK PULLEY		
	Max. load and lifting capacity	25 tons & 3500 mm	3
2.39	PAIR OF DRUM ROTATOR WITH DRIVE MOTOR AND IDLER ROTATOR		
	Adjustable rotating speed Drum diameter	1000 - 5000 mm	
2.39.1	5 Tons		3
2.39.2	10 Tons		5
2.39.3	20 Tons		5
2.39.4	50 Tons		2
2.40	PAIR OF IDLER DRUM ROTATOR WITHOUT DRIVE MOTOR		
	Max. load Drum diameter	5 Tons 1000 - 3000 mm	3

NO.	TYPE OF MACHINE		QUANTITY
2.41	YOKE OR CHAIN PIPE VISE WITH TRIPOD STAND		
	Max. pipe diameter	100 mm	3
2.42	HEAVY DUTY PORTABLE ANGLE GRINDER		
	Wheel diameter Drive motor	175 mm Approx. 1.5 kW	15
2.43	HEAVY DUTY VERTICAL SANDER		
	Wheel sander Drive motor	175 mmϕ 1.5 kW	3
2.44	POWER CABLE PULLERS		
	Max. pulling power with drive motor	2 Tons	3
2.45	HAND WINCH (TOTALLY ENCLOSED TYPE)		
	Capacity Length	1000 kg 50 m	3
2.46	CABLE FISH- TAPE BLOWER VACUUM		
	Tube in diameter to be vacuum	19 - 31 mm	3
2.47	CABLE SHEAVE & ROLLER SEVERAL TYPE		
	Max. power of pulley Range diameter of cable to be pulled	1 Ton 2 - 15 m	3

NO.	TYPE OF MACHINE		QUANTITY
2.48	COMPLETE SET CABLE GRIPS (WIRE & CABLE CRIMPING TOOL)		
	Max. safety load Range of strip copper wire cable	1000 kg 5 - 150 mm	3
2.49	COMPACT HYDRAULIC CABLE BENDER		
	Bend capacity	250 up to 1000 MCM	3
2.50	MANUAL TACHET CABLE BENDER		
	Universal bending shoe fits all cable size	500 MCM	3
2.51	MANUAL HYDRAULIC CABLE CUTTER		
	Max. cable diameter to be cut	2"	3
2.52	CABLE STRIPPER		
	Range capacity of cable stripper	6 up to 20 AWG	3
2.53	CABLE STRIPPER		
	Range capacity of cable stripper	4 AWG up to 1000 MCM	4
2.54	PORTABLE HYDRAULIC CABLE CUTTER		
	Max. cable diameter to be cut	100 mm	3

NO.	TYPE OF MACHINE		QUANTITY
2.55	CABLE LUG PRESSURE (CRIMPER MANUAL)		
	Range capacity	1.25 - 8 mm	3
2.56	CABLE LUG PRESSURE (CRIMPER MANUAL)		
	Range capacity	5.5 - 14 mm	3
2.57	CABLE LUG PRESSURE (CRIMPER HYDRAULIC)		
	Range capacity Power	14 - 150 mm 10 Tons	3
2.58	PRECISION CURRENT TRANSFORMER		
	Primary rating	10/15/30/50/100 250/300/500/750 1000A	2
2.59	PRECISION AMPERE METER (AMMETER)		
	Range	100/200/500/ 1000 MA	2
2.60	PRECISION AMMETER (LINE CURRENT TESTER)		
	Full scale valve	15/30/75/150/ 300 A	2
2.61	PRECISION VOLT METER		
	Range	30.75/150/300 V	2
2.62	INSULATION TESTER		2

NO.	TYPE OF MACHINE	QUANTITY
2.63	AIRLESS PAINTING SPRAYING UNIT COMPLETE MOBILE TYPE Suitable for high pressure design for heavy viscosity of paint.	2

3. QUALITY ASSURANCE & TESTING UNIT

NO.	TYPE OF MACHINE	QUANTITY
3.1	PORTABLE COBALT UNIT AND PORTABLE IRIDIUM UNIT	1
3.2	AUTOMATIC FILM PROCESSING UNIT	1
3.3	COMPLETE SET PORTABLE MAGNETIC PARTICLE INSPECTION EQUIPMENT	2
3.4	PORTABLE ULTRASONIC TESTING UNIT Suitable for weld inspection, corrosion and also crack detection. Complete set with standard accessories.	1
3.5	RADIOGRAPHIC X-RAY TESTING UNIT Complete set with standard accessories.	2
3.6	HIGH PRESSURE WATER PUMP	
3.6.1	With electric motor. For testing the leakage of the pipe or pressure vessel after welding. Max. pressure 40 Atm.	1
3.6.2	With electric motor. For testing the leakage of the pipe or pressure vessel after welding. Max. pressure 400 Atm.	1
3.7	ELECTRO MAGNETIC PAINT THICKNESS TESTER Complete with recommended standard accessories.	1

NO.	TYPE OF MACHINE	QUANTITY
3.8	UNIVERSAL TESTING MACHINE For tensile test, compression test, transverse test and bending test.	1

4. AUXILIARY UNIT

NO.	TYPE OF MACHINE		QUANTITY
4.1	BOGIE HEARTH FURNACE		
4.1.1	Effective chamber	6000 x 6000 x 18000 mm	1
	Working temperature	Max. 750°C	
4.1.2	Max. charge weight Working temperature Effective chamber	25 Tons Max. 950°C 6000 x 6000 x 3000 mm	1
4.2	SHOT GRIT COMPARTMENT UNIT		1
	Size	6000 x 4500 x 1500 mm	
	Complete with dust collector		
4.3	SAND BLASTING MACHINE		
	Movable type Tank content Working pressure	 140 liters 8 bar	1
4.5	WELDING ELECTRODE OVEN		
4.5.1	Dimension	2000 x 2000 x 1000 mm	2
	Adjustable temperature range	Max. 100°C	
4.5.2	Capacity	100 kg	2 For site
4.6	SUBMERGED-ARC FLUX DRYING OVEN		4 2 For site

NO.	TYPE OF MACHINE	QUANTITY
4.7	ACID CLEANING EQUIPMENT	
4.7.1	Acid cleaning equipment	1
4.10	SPECIAL EQUIPMENT/JIGS & FIXTURES	1
4.11	MEASURING DEVICES	1

4.7 P.T. Boma Stork, Pasuruan Factory

4.7.1 Technical Analysis of the Plant

(1) History of the plant and production status

The Pasuruan plant of P.T. Boma Stork started its production as De Bromo in 1865. In May, 1974, P.T. Boma Stork was reorganized as a new joint venture and then all the facilities were rehabilitated and new facilities were added to them. As a result, the production capacity of the plant has increased as follows:

Steel structure	1,500 tons/year
Plate work	2,500 tons/year
Machinery	500 tons/year
Total	4,500 tons/year

Since 1974, P.T. Boma Stork has expanded the range of its products and improved production technique owing to the production technique at the sugar plant given by Stork Werkspoor Sugar, and other technical tie-up and collaboration with other foreign companies as well as its own technical development.

However, since then the company has not increased the facilities and depended on the old facilities and production processes. Consequently it could not meet requirements of the market, and the orders from clients has not increased satisfactorily.

P.T. Boma Stork was originally established as a maintenance shop of sugar plant in the era of sugar plantation by the Netherlands. But today it produces and sells various boilers not only for sugar plants and palm oil plant but also for other fields such as petrochemical industry and so on. For instance, it has ASME and ABI certificates on the production of the pressure vessel. Further, it has experience in production of marine engines.

(2) Present production capacity and technique

Table 1-1 Production Record shows the production record of P.T. Boma Stork in the past five years (including the production in 1984 that was expected). Since the present market requires high technology and completely assembled products, P.T. Boma Stork, who has old production facilities and technique, is unable to meet requirement of the present market. This also applies to the both sugar and palm oil plants, where the Indonesian Government expects the P.T. Boma Stork to expand the business of its main products. Thus, Table 1-2 Production Analysis shows the problems the company has in relation to its equipment and technique at present.

The production in the past five years has not reached even half of 4,500 tons that was the target of the program set up in 1974. The reason for this is, as shown in Table 1-2 Production Analysis, that the plant has the very old facilities and production system causing inefficiency in production.

(3) Managerial organization and personnel structure

P.T. Boma Stork has the following three functional groups under the managing director.

1) Marketing and sales group

The function of this group is to conduct market survey, sales in the agricaltural field, sales in the other field except for the agricaltural field, estimation, making contract on the site work. The group consists of 18 members. The estimation includes making specifications and review of conditions of contracts.

2) Financial group

The function of this group is financing, accounting, procurement of the materials, and personnel. The group consists of 36 members.

3) Production group

As shown in Figure 1-1 Organization Chart, the group has various functions under the control of the general manager. The group consists of 569 members.

(4) Production management system

The key function and system of the production group mentioned above are as follows.

1) Production planning and control

Production planning and control system is as shown in Fig. 1-2 Production Order Flow.

2) Quality control

The quality control section consists of 6 inspectors and 1 typist under the direct control of the general manager. The quality control has the following three patterns.

① Materials and outside product

This procurement inspection and review team consists of the members selected from production control, financing, marketing, purchasing and quality control sections so that they can review and evaluate purchasing conditions, specifications, delivery and quality from ordering to acceptance.

When purchasing steel materials this quality control section files the mill certificate after identification of the materials.

② Welded items

The quality control of the welded items such as boilers, pressure vessels and so on is carried out in accordance with the following procedures.

i) The drawing and inspection procedures are reviewed and approved by the client or the governmental inspection authority.

ii) The engineer of the welding section checks the quality and dryness of the welding rod and the welding flux before welding.

iii) The non-destructive inspection of the weld is conducted in the presence of the governmental inspection authority. Since P.T. Boma Stork does not provide the facilities for non-destructive inspection, the inspection is conducted by the outside inspector.

③ Other items

The quality control of the products is usually conducted by the engineer of the respective section. But the important parts and/or production processes are conducted by the quality engineer who is in charge of the product.

3) Production

The production department consists of the following 5 working sections.

① Preparation sections

The section consists of an engineer and 62 workers and conducts marking, cutting, bevelling and forming in plate work.

② Machining section

The section consists of an engineer and 77 workers and conducts machining including marking.

③ Assembling section

The section consists of an engineer and 70 workers and conducts fitting and assembling in plate work.

④ Welding section

The section consists of an engineer and 25 qualified welders and 37 unqualified welders and conducts welding in plate work and piping work.

⑤ Fitting section

The section consists of an engineer and 63 workers and conducts shrinkage fitting and assembling.

The above members of each section of the production department includes 60 workers who are in charge of material handling. As for quality control, as shown in Figure 1-2 Production Order Flow, the quality engineer who work directly for each section pay important role in the quality control.

(5) Layout, handling equipment, building and auxiliary facilities

1) Layout

An outline of the present layout is shown in Fig. 1-3 Existing Layout. The features and survey results of the layout are as follows.

① The area of the plant site including the employee houses is about 25,600 m^2 and is surrounded by the highway and a canal.

② Most of the site is occupied by the factory building and auxiliary facilities and there is no extra space for extension of the building. In fact, there is no space to keep finished products, so P.T. Boma Stork obtained permission to use a part of the highway as the space for products storage and has been paying a ground rent.

③ It is impossible to connect the materials storage area and cutting and marking areas by overhead travelling crane. So the work is very inefficient.

④ The floor of the boiler assembly plant is lower than the level of the highway surrounding the plant. The lift of the overhead travelling crane is enough only to assemble boilers.

2) Handling equipment

An outline of the present handling facilities is shown in Fig. 1-3 Existing Layout. One transfer carriage and another small truck are available at the plant.

3) Buildings and auxiliary facilities

The features of the building and facilities is as follows.

① The building was completed about 40 years ago and since then it has been extended in order. Since the roof has recently been repaired, the building can be used for work.

② The southern part of the factory site, which is 1/3 of the total site area, is frequently flooded in the rainy season.

(6) Infrastructure and electrical and utility facilities

The layout, specification and the status of the infrastructure and electrical and utility facilities along with the additional explanation on the survey results are shown in Table 1-3 Infrastructure and Table 1-4 Electrical and Utility Facilities.

Table 1-1 Production Record

	1980		1981		1982		1983		1984		AVERAGE	
	Qty	Ton	Qty	Ton	Qty	Ton	Qty	Ton	Qty	Ton	Qty	Ton
Combi - boiler	3	180	6	360	12	720	15	900	20	1,200	11.2	672
Fire - boiler	6	90	9	135	15	225	20	300	30	450	16	240
Package boiler	3	22.5	5	37.5	8	60	16	120	100	750	26.4	198
Pressure vessels	3	36	6	72	6	72	12	144	50	600	15.4	184.8
Evaporator vacuum pan	5	50	7	70	13	130	19	190	40	400	16.8	168
Juice heater, crysterlizer centrifugal	11	88	18	144	27	216	28	224	30	240	22.8	182.4
Binner trommel	9	9	12	5	17	7	19	7.5	25	10	16.4	7.7
Roller for mill	6	48	9	63	14	112	18	145	24	190	14.2	111.6
Valve, damper	7	7	9	9	13	13	17	17	30	30	15.2	15.2
SO_2 oven	5	6	7	8.5	11	13.5	17	21	25	30	15	15.8
Others	-	175	-	240	-	290	-	340	-	500	-	309
TOTAL	-	706.5	-	1,144	-	1,858.5	-	2,408.5	-	4,400	-	2,104.5

Table 1-2
Production Analysis

Name of Factory: P.T. Boma Stork

Category of Plant	Name and Specification of Typical Component	Average Production per annum (pcs)	Drawings Source			Bottleneck Facility	Critical Path in Procedure	Bottleneck Technique	Remarks
			Own Design	Sub-contract	Under License				
Sugar	Boiler				o	Drill (tube sheet) X-ray (welding) Crane (capacity) Tube expander	material (3 mon.) Bending (capacity)	Auto. welding	
	Shredder		o				Hardening		Cutter Surface by welding (welding rod imported)
Others	Boiler/Vessel		o	o	o	Crane (capacity)			

Table 1-3 Infra-Structure

ITEM	SURVEY RESULT	REMARKS
1.3.1 *Transportation*		
(1) Name and location of port	Tanjung Perak	
(2) Capacity of pier	35,000 Ton	
(3) Capacity of loading/unloading equipment	300 Ton (floating crane)	
(4) Distance to loading/unloading port	60 Km but for cargo is higher than 3m, 115 km	
(5) Minimim width of road	-	
(6) Hight clearance of overbridge structure	3.5 m	
(7) Limitation of cargo size	2.5 mW x 12 mL	
(8) Limitation of load over access road	12 T	
1.3.2 Electrical/Communication system		
(1) Availability of power supply system	P.L.N.	
(2) Availability of public telehone system	*TELCOM* (2 lines)	
(3) Availability of public telex system	TELCOM (1 set)	
1.3.3 Utility		
(1) Availability of public water supply system	P.D.A.M. and Well	
(2) Junction of site drainage with public waterway	Public Canal	

Table 1-4 Electrical and Utility Facilities (1/3)

ITEM	SURVEY RESULT	REMARKS
1.4.1 Power supply system		
(1) Power source	P.L.N. (contract: 480 KVA)	
(2) Capacity of power source		
1) Capacity of main transformer (KVA)	480 KVA (160 KVA x 3 sets)	
(3) Voltage		
1) Receiving voltage (HV/UHV)	6 KV, 3 Phase 50 Hz	
2) Service voltage (LV)	380 V, 3 Phase for Motor 220 V, 1 Phase for LTG & Outlet 110 V. 1 Phase for LTG & Outlet	
(4) Operating conditions		
1) Demand	Approx. 400 KW	
2) Power factor	- %	
3) Consumption	60,000 KWH/Mo	
4) Demand factor	- %	
(5) Emergency generator	Type: Diesel Gene. — Quantity: 3 sets Rating: Output voltage : 380 V Output capacity : 200, 147, 147 KVA No. of phase : 3 Power factor : 80%	

Table 1-4 Electrical and Utility Facilities (2/3)

ITEM	SURVEY RESULT	REMARKS
1.4.2 Lighting system (Illumination level)		
Location	Illumination Level — Kind of lamp	
(1) Work Shop	100 Lux — Mercury vapor lamp	
(2) Office	300 - 500 Lux — Fluorescent lamp	
1.4.3 Communication system		
(1) Inter phone system	15 sets of local lines	
1.4.4 Air conditioning/ventilation system		
(1) Office building	1 central type Unit type (others)	
(2) Work Shop	Natural ventilation	
1.4.5 Fire fighting		
(1) Lightning protection	Highest building only	
(2) Fire Extinguisher	40 sets of A.B.C. type	
1.4.6 Compressed-air supply system		
Compressor		
Type :	Oil lubricated	
Quantity :	4 sets	
Capacity :	400 CFM each	
Pressure :	6 kg/cm^2	
Quality : Dehydrator (Yes, No)	No	
	by piping service to facilities	

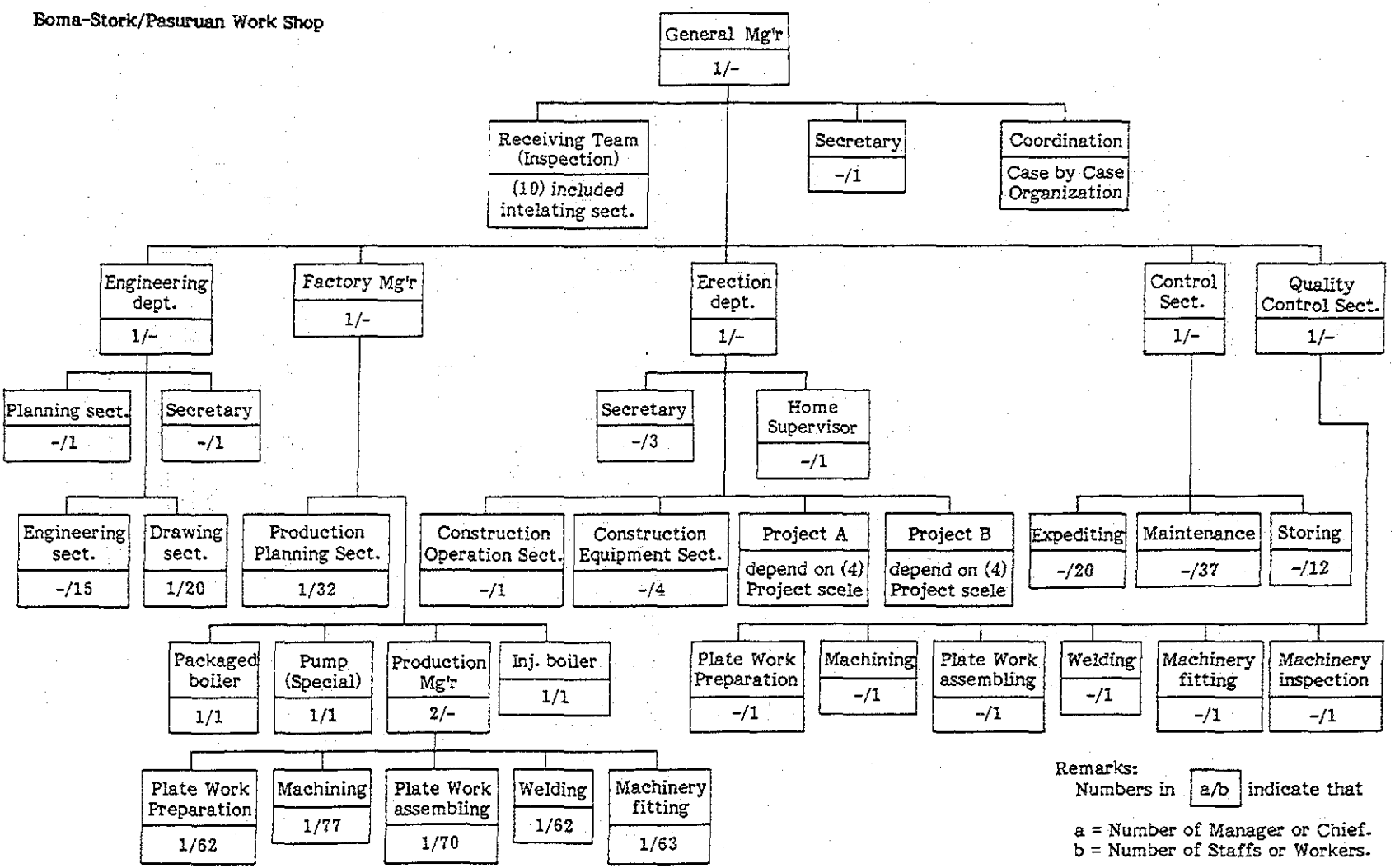
Table 1-4 Electrical and Utility Facilities (3/3)

ITEM	SURVEY RESULT		REMARKS
1.4.7 Water Supply System			
(1) Water source	P.D.A.M.	WELL (Deep: 15 M)	During dry season, capacity of well is insufficient, therefore purchasing from PDAM by tank approx. 5 m^3/day
(2) Capacity of water source			
1) Supply pump capacity	200 L/Min	5 HP x 2 set	
2) Storage tank capacity	———	5 Ton	
(3) Consumption of water	250 Ton/Mo	———	
(4) Service pressure	4 Kg/Cm^2	2 Kg/Cm^2	
(5) Water treatment for special purpose	Boiling		
	For Office use	For Industrial use	
1.4.8 Drainage			
(1) Rain Water	Pumping up system		Gravity system
1) Covering area	Southern part (approx. 2/3)		Northern part (approx. 1/3)
2) Discharge pipe	8" steel pipe		ϕ400 underground concrete pipe
3) Discharge pump	18.5 KW, 5.5 KW and 3 KW Total: 3 sets		
4) Pump pit	Approx. 50 m^3		
	Capacity of both discharge pump and guide pipe to pump pit is insufficient.		

Fig. 1-1

Organization Chart

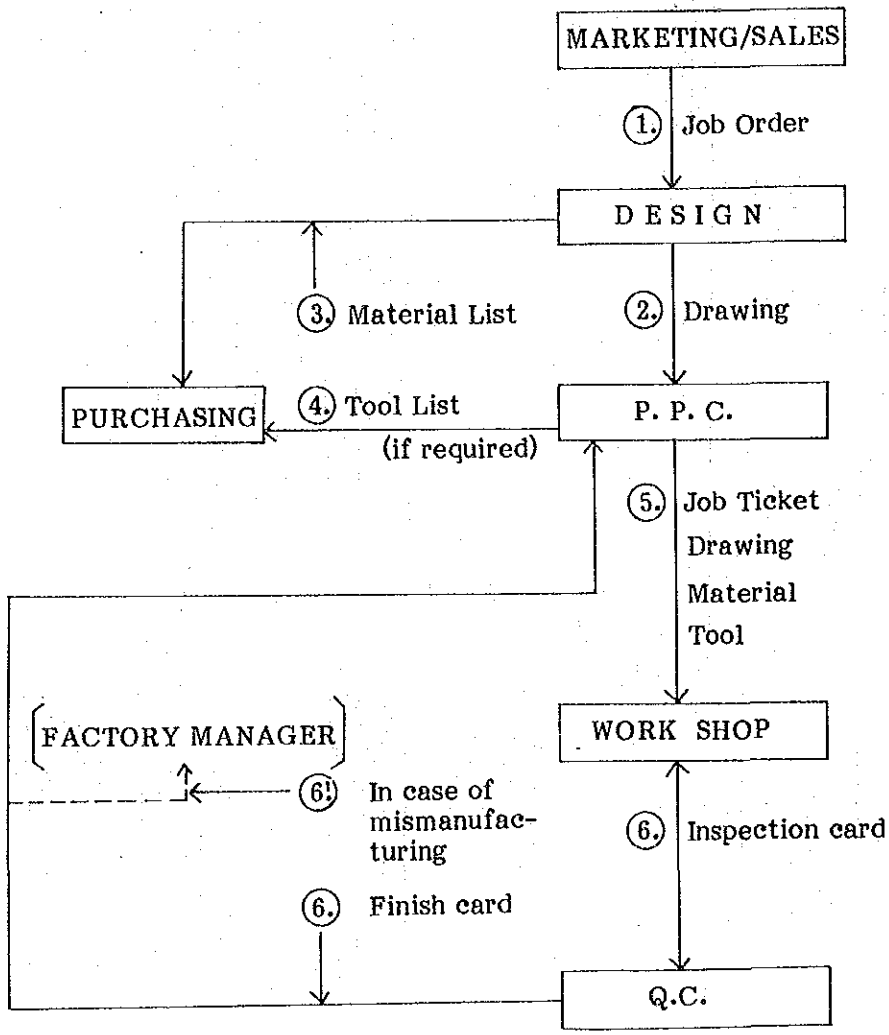
Boma-Stork/Pasuruan Work Shop



Remarks:
Numbers in [a/b] indicate that

a = Number of Manager or Chief.
b = Number of Staffs or Workers.

Fig. 1-2 Production Order Flow



R E M A R K S :

(i) Drawing in flow (2) includes some documents such as W.P.S. etc. if required.

(ii) Key function of the P.P.C. is as follows.
* Planing of work load & time schedule
* Manufacturing engineering.

(iii) Manufacturing procedures of main components have been standarized by P.P.C.

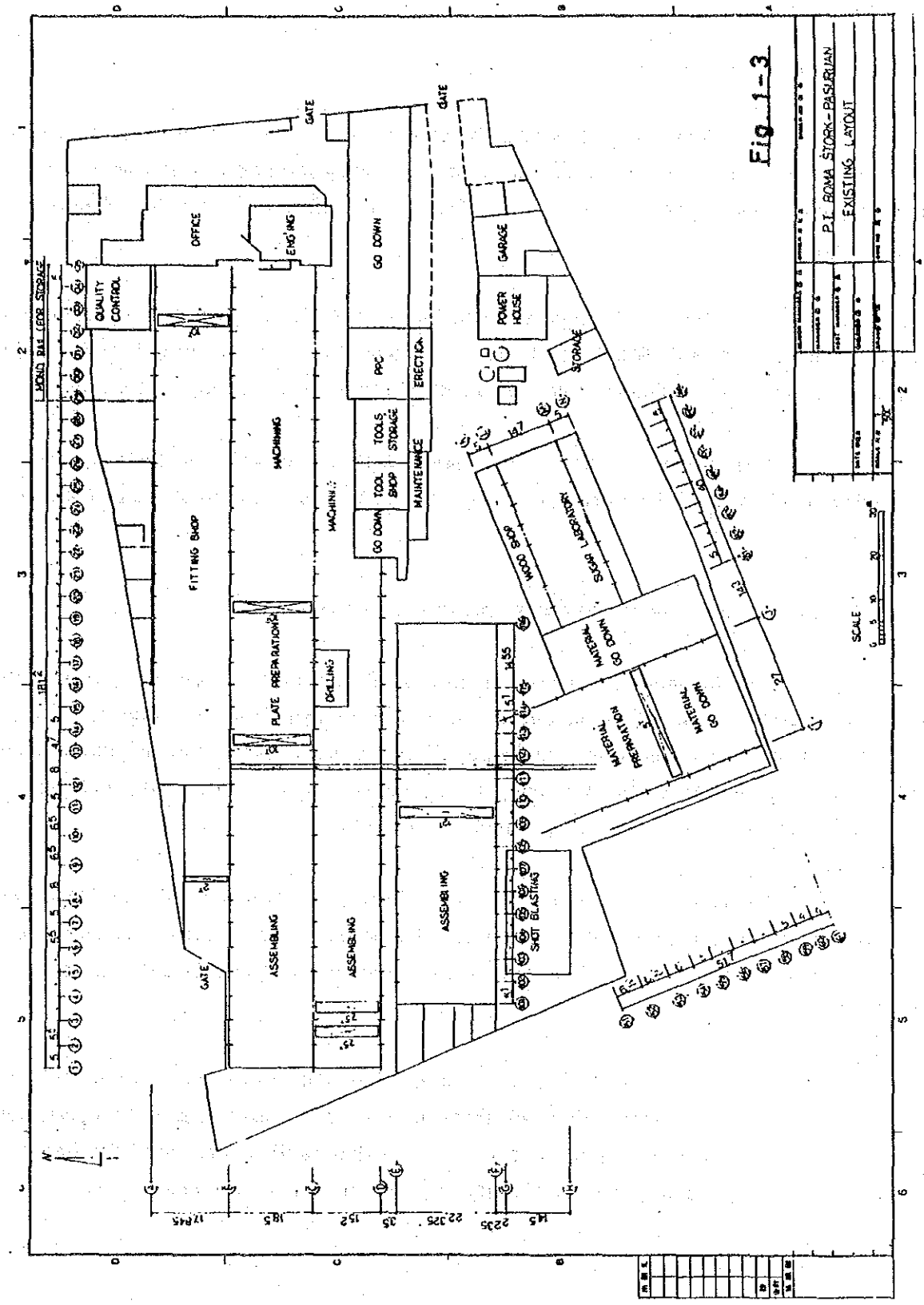


Fig 1-3
P.T. BOMA BISTOK - PASURUAN
EXISTING LAYOUT
SCALE
OFFICE
ENGING
GO DOWN
GARAGE
POWER HOUSE
STORAGE
QUALITY CONTROL
FITTING SHOP
MACHINING
PPC
ERECTION
TOOLS STORAGE
TOOL SHOP
MAINTENANCE
WOOD SHOP
STEEL LABORATORY
MATERIAL GO DOWN
MATERIAL PREPARATION
PLATE PREPARATION
DRILLING
ASSEMBLING
SHOT BLASTING
GATE
N

4.7.2 Technical Prerequisites

(1) Plant location

P.T. Boma Stork Pasuruan Work Shop is located at Pasuruan, about 60 km away from Surabaya City. The plant site is surrounded by the highway and private houses and occupied by the factory building. And there is no extra space inside and outside of the plant site.

Therefore, it is impossible to increase facilities and extend the building without removing a part of the building. It is necessary to check carefully if it is possible to remove a part of the building from view point of the existing layout and function.

The factory floor is on a level with or lower than the highway and frequently flooded. So it is necessary to take measures to prevent the factory from being flooded.

(2) Criteria for selection of production equipment

The Indonesian Government has given P.T. Boma Stork the guidance that sugar plant and palm oil plant should be made the company's main products. But the factory has been producing boilers including those for sugar plant and the down stream equipment for sugar plant. So it is not wise to change products drastically judging from the building structure and techniques owned by the factory.

Therefore, the plant should follow the guidance of the Indonesian Government in relation to the production scheduling taking the status mentioned above into consideration and should set up the facility planning in the line with the policy as explained below.

1) The production line of boilers including those for sugar plant should be double checked from materials through assembly particularly important points on the line so that facilities required for improving productivity and quality of products can be provided.

2) The down stream equipment for the sugar plant and equipment for the palm oil plant should be examined up to machining and assembly, and particularly equipment for improving efficiency of machining of medium and small parts should be considered.

3) The specification and capacity of the distribution facilities and utility facilities will be checked based on the power substation planning. Since it is clear that the existing power substation are not appropriate in both specifications and capacity, they should definitely be replaced with new ones.

(3) Transportation limitation

Surabaya Perak port, about 60 km away form the plant, is the only port to be used for shipment of the products. But when the height of the products loaded on the truck is over 3 m, the truck has to avoid passing under girder bridge of a railroad. In this case, it is 115 km from the plant to Surabaya Perak port. The permitted maximum dimension of the cargo on the truck is 3.5 m (H) $\times$ 2.5 m (W) $\times$ 12 m (L) and the maximum weight is 12 tons or less.

4.7.3 Basic Renovation Program

(1) Production program

Although the Indonesian Government expects P.T. Boma Stork to produce equipments for sugar plant and palm oil plant, the factory is producing boilers and related products basically because of the existing production facilities and techniques.

On the other hand, it is true that the sugar and palm oil industry is still attractive market, so it is necessary for the company to maintain and develop the market share in these fields.

Therefore, when setting up the production schedule for the future, P.T. Boma Stork should consider the following two categories as base products.

1) Equipment for the sugar plant and palm oil plant.

2) Boiler (including for sugar and palm oil plants) and related products.

P.T. Boma Stork is planning to raise the production capacity to 10,000 tons yearly but it seems impossible to attain the target because of the existing plant site, building layout and so on. But the purpose of the renovation is to make production close to the target by considering the products mix, improvement of efficiency of facilities and layout improvement on flow of products.

The production program has been set up based on the demand through market research and localization as shown in Table 3-1 Production Program.

(1) With reference to the sugar plant, considering the market requirements for large equipment, the present layout of the plant, purchase and handling, it is wise to avoid the production and machining of large mill cheek and cane roll and put emphasis on the production of the down stream equipment and mini plant.

② Since the palm oil plant is small fundamentally, efforts should be made to expand and improve technique for completing the total plant.

③ The market share on boilers and pressure vessels should be expanded by modernizing the facilities drastically for improvement of productivity and prices.

④ Products that do not require machining equipment but big space, such as steel structure and water treatment equipment should be produced by site fabrication or purchased outside.

The local contents in the production program depend on various conditions inside and outside of the factory such as working drawing and quality and prices of materials as well as facilities and machining technique. But the local contents in Table 3-1 Production Program are based on localization by market research.

(2) Load plan and required facilities

1) Load program

Production program mentioned in the previous section is divided into each process load by man/machine hour in Table 3-2 Production Load Plan.

In the table, plate work is shown by man-hour and machining is shown by machine hour. Difference of facilities efficiency between after and before renovation, and improvement of productivity by mastering work are included in the table.

2) Criteria for selection of the new facilities

Criteria for selection of the new facilities are as follows.

① The principle is to limit the new facilities to the important main products at the plant.

② The modern new facilities should be selected considering product structure and productivity.

For instance, the new medium size floor type boring/milling machine will provide NC equipment and the submerged arc automatic welding machine will be provided to correspond to the trend of automation of welding.

③ The equipment required for production process of the items that are to be newly localized will be installed.

For instance, γ-ray equipment for non-destructive inspection of the weld of the boiler, boiler drum and the annealing furnace that is required for the production process of the pressure vessels will be installed.

Further, the flanging machine or forming process plus metal die is required for production of the end plate that is one of the components of boiler drum and pressure vessel. But these will not be provided because of the following reasons this time.

i) Full operation of the equipment can not be expected and there are many sizes of end plate. So installation of the equipment does not pay.

ii) The steel materials for the end plates have been imported and it is recommendable that good quality finished products should be purchased for the time being.

④ The existing facilities that can be used for different purposes will be reused considering measures for rough machining and load peak time.

⑤ The use of a part of the existing facilities mentioned above is based on condition that these facilities will not be operated constantly and will be operated by workers who are in charge of other section when necessary because of the low load factor.

(3) The renovation program of the existing plant

The renovation program of the existing plant that is required for providing the equipment to correspond to (1) the production program and (2) load plan is explained below.

1) Production and inspection facilities

① As a result of the survey of the plant, the existing machines are divided into three groups; machines that can be used, those that can be used after repair, and those that can not be used because of the new program. They are shown in Table 3-3 Summary of the Existing Facilities.

② As for the machines that can be used after repairing, the description of the modification and repair is shown in Table 3-4 Facility Plan (machine rehabilitation and relocation).

Modification and repair of the machines will be carried out by the respective supplier as follows.

i) The supervisor sent by the supplier checks the machines and gives the points on the modification and repair of the machines.

ii) Based on the points above, the supplier fabricates and supplies the required parts.

iii) Modification and repair will be carried out by the maintenance members of P.T. Boma Stork under the supervision of the supervisor of the supplier.

③ Table 3-5 Facility Plan (new machine tools) shows the outline of specifications of the equipment to be obtained newly to meet the quantity and kind of equipment determined by the load plan.

2) Handling equipment

① From the viewpoint of flow and handling weight of products based on the survey of the existing facilities and production program, the cranes shown in the layout will be required. The following items will be newly obtained.

Overhead travelling crane	50/10 tons	1
Overhead travelling crane	10 tons	1
Overhead travelling crane	5 tons	1
Pole type jib hoist	2 tons	1

② The following vehicles also will be required for handling the products in and between buildings.

Forklift	2 tons	1
Transfer carriage	2 tons	1

③ The outline of the equipment such as crane to be purchased is shown in Table 3-6 Facility Plan (handling facilities).

3) Building and auxiliary facilities

For accommodating the production, inspection and handling facilities, the following reconstruction will be required.

The outline of reconstruction is shown in Table 3-7 Facility Plan (building and auxiliary facilities).

① Reconstruction of bay E-F

For assembly of large type of products, the building will be

removed and the new building that can accommodate 50 ton crane will be constructed.

② Reconstruction of bay L-M

A part of bay L-M will be removed and the building will be extended up to J street. The 5 tons crane will be provided in the building.

③ Construction of substation building

④ Reconstruction of partition for tool room

⑤ Reinforcement of the column for the pole type jib crane

4) Electrical and utility facilities

The following reconstruction or renewal construction will be required as measures to improve efficiency of the existing facilities and those for the obsolescence of equipment and realize the production program. The outline of the renovation is shown in Table 3-8 Facility Plan (infrastructure/electrical/utility facilities).

① Imposition to Electric Power Corporation (PLN) for increasing of power consumption

This is the expense for increasing power to 1,000 kVA. Voltage also will be increased to 22 kV from 6 kV.

② Substation system

The entire substation system will be renewed to increase power and renew the obsolete facilities. The existing emergency generator sets will be reused.

③ The L.V. power supply system

The reconstruction of the L.V. power supply system will be conducted to install the new machine tools and equipment and relocate or remove the existing facilities. But the existing underground conduit will be reused as much as possible.

④ Lighting system

Extension of lighting system will be conducted for improving productivity and safety. The area to be extended and new intensity of illumination are as follows.

1) Marking area	200 Lux
2) Main passes in the plant	50 Lux

⑤ LNG gas generator

The LNG gas generator and supply pipings will be newly installed for the SR (Stress Relief) furnace.

⑥ Drainage system

Drainage ditch and pump pit will be constructed and a pump will be installed.

It is recommended that a well will be constructed for the dry season and to save expense.

(4) Factory construction and installation plan

In order to conduct the renovation of the plan, based on the basic program shown in the feasibility study, the detailed specifications of the equipment and that for extension and reconstruction of infrastructure, handling facilities, buildings, electrical and utility facilities should be determined. Then the company must entrust procurement of facilities and construction to the outside group.

It is desirable to use a consultant who has much experience in the project similar to the renovation and capable of total engineering since the contents of the D/D will affect the total investment and process.

Further, in the renovation many designs such as that for equipment foundation and reconstruction of buildings will be required in respect of process and adjustment of the status. Also, in some cases the designer will be required to supervise a part of the construction. So the designer who has such an experience in this field in Indonesia should be used under the responsibility of the D/D consultant.

The description of the D/D consultant needed to conduct are as follows.

1) Detailed survey of the existing facilities.

2) Understanding of the feasibility study and correction when required.

3) Making specifications for purchase and installation of the new facilities and tools.

4) Making specifications for the existing facilities and tools.

5) Making specifications for purchase and installation of handling facilities.

6) Design and making order specifications on the building to be reconstructed.

7) Design and making order specifications of electrical and utility facilities to be reconstructed.

8) Making the renovation implementation program.

9) Consulting on procurement, contract of construction work and contract procedure.

10) Approval of the drawing and specifications of the facilities to be purchased.

11) Design and making order specifications of the foundation for facilities.

12) Inspection of the main facilities and supervision of the main constructions.

But note the supervision for installation and test operation of the main equipment and facilities is included in the job of the supplier of equipment and facilities and not that of the D/D consultant.

BOMA-STORK PASURUAN WORK SHOP **TABLE 3-1 Production Program**

REMARKS
M : MACHINERY & MACHINING ITEMS
P : PLATE WORK
S : STEEL STRUCTURE

UNIT: Ton

PRODUCTS	1985					1989					1994					1999				
	Q'TY	M	P	S	TOTAL	Q'TY	M	P	S	TOTAL	Q'TY	M	P	S	TOTAL	Q'TY	M	P	S	TOTAL
SUGAR 4000T/D PLANT	1	171	3,260	1,400	4,831	1	171	3,260	2,400	5,831	1	171	3,260	2,400	5,831	1	171	3,260	2,400	5,831
DOWN SREAM EQUIPMENT	50		100		100	90		180		180	100		200		200	100		200		200
SPARE PARTS		5			5		10			10		15			15		20			20
PLANT REHABILITATION	1	100	500	500	1,100	1	100	500	500	1,100	1	100	500	500	1,100	1	100	500	500	1,100
PALM OIL 30T/D FFB PLANT	2	122	213	160	495	3	183	320	240	743	3	183	320	240	743	3	183	320	240	743
SPARE PARTS		10			10		20			20		40			40		50			50
BOILER FIRE TUBE BOILER	15		225		225	20		300		300	30		450		450	30		450		450
COMBI-BOILER	10		600		600	15		900		900	20		1,200		1,200	20		1,200		1,200
PACKAGE BOILER	25		190		190	50		375		375	100		700		700	100		700		700
OTHERS VESSELS	15		75		75	30		150		150	50		250		250	50		250		250
WATER TREATM'T	1		200		200	1		200		200	1		500		500	1		500		500
OTHERS		200			200		200			200		200			200		200			200
TOTAL		608	5,363	2,060	8,031		684	6,185	3,140	10,009		709	7,380	3,140	11,229		724	7,380	3,140	11,244

BOMA-STORK PASURUAN WORK SHOP

Table 3-2 Production Load Plan (1/2)

YEAR	CATEGORY of PRODUCTS	TOTAL PRODUCTION			BREAKDOWN of MAN/MACHINE HOURS within OWN WORKSHOP									
					PLATE WORK					MACHINING				
		in WEIGHT TON	in M/M HOURS within own shop	in M/M HOURS by sub-con. & site fabri.	MARK'G CUTTING VEBEL'G	BENDING FORMING	FITTING WELDING	OTHERS	TOTAL	LATHE group	BORING FACING group	DRILL	OTHERS	TOTAL
	SUGAR PLANT COMPONENTS	6,036	160,330	381,960	24,620	11,020	117,340		152,980	1,100	540	2,040	3,670	7,350
1985	BOILERS for SUGAR & OTHERS	1,015	170,000	42,570	29,080	17,120	123,800		170,000					
	PALMOIL PLANT COMPONENTS	505	20,160	26,960	3,060	2,370	11,430		16,860	990	550	990	770	3,300
	OTHERS	475	30,720	11,800	2,870	2,710	11,140		16,720	2,100	1,020	3,870	7,010	14,000
	TOTAL	8,031	381,210	463,290	59,630	33,220	263,710		356,560	4,190	2,110	6,900	11,450	24,650
	SUGAR PLANT COMPONENTS	7,121	171,850	409,400	22,900	12,970	129,300		165,170	1,000	490	1,850	3,340	6,680
1989	BOILERS for SUGAR & OTHERS	1,575	220,410	55,190	32,370	19,160	168,880		220,410					
	PALMOIL PLANT COMPONENTS	763	27,760	37,120	3,620	2,830	16,690		23,140	1,380	770	1,380	1,090	4,620
	OTHERS	550	30,460	11,700	2,610	1,400	13,720		17,730	1,910	930	3,520	6,370	12,730
	TOTAL	10,009	450,480	513,410	61,500	36,360	328,590		426,450	4,290	2,190	6,750	10,800	24,030
	SUGAR PLANT COMPONENTS	7,146	138,980	331,100	18,320	10,450	103,830		132,600	950	470	1,770	3,190	6,380
1994	BOILERS for SUGAR & OTHERS	2,350	240,800	60,300	35,340	21,080	184,380		240,800					
	PALMOIL PLANT COMPONENTS	783	23,630	31,600	2,950	2,330	13,720		19,000	1,380	770	1,390	1,090	4,630
	OTHERS	950	43,480	16,700	4,470	2,400	23,530		30,400	1,960	960	3,620	6,540	13,080
	TOTAL	11,229	446,890	439,700	61,080	36,260	325,460		422,800	4,290	2,200	6,780	10,820	24,090

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Table 3-2 Production Load Plan (2/2)

YEAR	CATEGORY of PRODUCTS	TOTAL PRODUCTION			BREAKDOWN of MAN/MACHINE HOURS within OWN WORKSHOP									
					PLATE WORK					MACHINING				
		in WEIGHT TON	in M/M HOURS within own shop	in M/M HOURS by sub-con. & site fabri.	MARK'G CUTTING VEBEL'G	BENDING FORMING	FITTING WELDING	OTHERS	TOTAL	LATHE group	BORING FACING group	DRILL	OTHERS	TOTAL
1999	SUGAR PLANT COMPONENTS	7,151	130,830	311,680	17,140	9,810	97,360		124,310	970	480	1,810	3,260	6,520
	BOILERS for SUGAR & OTHERS	2,350	225,750	56,530	33,070	19,790	172,890		225,750					
	PALMOIL PLANT COMPONENTS	793	22,480	30,060	2,760	2,180	12,870		17,810	1,390	780	1,400	1,100	4,670
	OTHERS	950	41,390	15,900	4,140	2,230	21,940		28,310	1,960	960	3,620	6,540	13,080
	TOTAL	11,244	420,450	414,170	57,110	34,010	305,060		396,180	4,320	2,220	6,830	10,900	24,270

TABLE 3-3 Summary of Existing Facilities (1/4)

COMPANY WORKS: BOMA-STORK/PASURUAN WORKS

MACHINE NAME	MAX	CAPACITY/ SIZE	YEAR A.D. When machine was manufactured	Q'TY	RESULT OF SURVEY: TO BE SCRAPPED	TO BE MODERNIZED	WORKABLE	REMARKS
LATHE MACHINE	SWING OVER CARRIAGE	:ø1,100 mm	1970 -	1	-	-	1	
	CENTER DISTANCE	: 6,000 mm	1950 - 1969	13	3	4	6	
			1930 - 1949	8	4	2	2	
			- 1929	1	1	-	-	
BORING MACHINE	SPINDLE DIA.	:ø 125 mm	1970 -	-	-	-	-	
	VERTICAL HEAD TRAVEL	: 3,000 mm	1950 - 1969	3	-	1	2	
	SPINDLE TRAVEL	: 4,000 mm	1930 - 1949	1	-	-	1	
			- 1929	1	-	1	-	
TURNING MACHINE	TURNING DIA.	: 1,600 mm	1970 -	-	-	-	-	
	TABLE DIA.	: 1,500 mm	1950 - 1969	1	-	-	1	
	TURNING HEIGHT	: 900 mm	1930 - 1949	2	1	1	-	
			- 1929	-	-	-	-	
DRILLING MACHINE	RADIAS	: 1,000 mm	1970 -	1	-	-	1	
	BORE	:ø 60 mm	1950 - 1969	7	-	5	2	
			1930 - 1949	1	-	1	-	
			- 1929	-	-	-	-	

TABLE 3-3 Summary of Existing Facilities (2/4)

COMPANY WORKS: BOMA-STORK/PASURUAN WORKS

MACHINE NAME	MAX	CAPACITY/ SIZE	YEAR A.D. When machine was manufactured	Q'TY	RESULT OF SURVEY TO BE SCRAPPED	TO BE MODERNIZED	WORKABLE	REMARKS
PLANOMILLER & PLANER	TABLE LENGTH	: 5,500 mm	1970 -	-	-	-	-	
	TABLE WIDTH	: 1,000 mm	1950 - 1969	1	-	-	1	
	STROKE	: 5,100 mm	1930 - 1949	1	-	1	-	
			- 1929	-	-	-	-	
SHAPER	STROKE	: 600 mm	1970 -	-	-	-	-	
	TABLE LENGTH	: 690 mm	1950 - 1969	3	-	-	3	
	TABLE WIDTH	: 400 mm	1930 - 1949	2	-	-	2	
			- 1929	-	-	-	-	
SLOTTER	STROKE	: 600 mm	1970 -	-	-	-	-	
	TABLE SIZE	:ϕ1,350 mm	1950 - 1969	-	-	-	-	
			1930 - 1949	2	1	1	-	
			- 1929	-	-	-	-	
OTHER MACHINERY			1970 -	-	-	-	-	GEAR HOBBING MACHINE GRINDING MACHINE
			1950 - 1969	4	1	2	1	
			1930 - 1949	1	1	-	-	
			- 1929	-	-	-	-	

TABLE 3-3 Summary of Existing Facilities (3/4)

COMPANY WORKS: BOMA-STORK/PASURUAN WORKS

MACHINE NAME	MAX	CAPACITY/ SIZE	YEAR A.D. When machine was manufactured	Q'TY	RESULT OF SURVEY TO BE SCRAPPED	TO BE MODERNIZED	WORKABLE	REMARKS
TESTING & EXAMINATION EQUIPMENT			1970 -	3	-	-	3	
			1950 - 1969	-	-	-	-	
			1930 - 1949	-	-	-	-	
			- 1929	-	-	-	-	
CUTTING EQUIPMENT	CAPACITY	: 50 kg/cm^2	1970 -	-	-	-	-	
	MAX.	: 3,150x10 mm	1950 - 1969	7	1	3	3	
			1930 - 1949	5	-	-	5	
			- 1929	-	-	-	-	
FORMING MACHINE			1970 -	-	-	-	-	
			1950 - 1969	6	2	2	2	
			1930 - 1949	5	1	4	-	
			- 1929	-	-	-	-	
WELDING EQUIPMENT	DIESEL	: 4KVA/240V/ AC	1970 -	9	-	-	9	
			1950 - 1969	2	-	2	-	
			1930 - 1949	-	-	-	-	
			- 1929	1	1	-	-	

TABLE 3-3 Summary of Existing Facilities (4/4)

COMPANY WORKS: BOMA-STORK/PASURUAN WORKS

MACHINE NAME	MAX CAPACITY/ SIZE	YEAR A.D. When machine was manufactured	Q'TY	RESULT OF SURVEY TO BE SCRAPPED	TO BE MODERNIZED	WORKABLE	REMARKS
OTHER FACILITY & EQUIPMENT		1970 -	6	-	-	6	
		1950 - 1969	2	-	-	2	
		1930 - 1949	1	-	-	1	
		- 1929	-	-	-	-	
OVERHEAD CRANE	CAPACITY : 12 ton	1970 -	2	-	-	2	
		1950 - 1969	5	-	-	5	
		1930 - 1949	-	-	-	-	
		- 1929	-	-	-	-	

Table 3-4 Facility Plan (Machine Rehabilitation & Relocation) (1/6)

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
	D8 (1 set)	Lathe Machine (Overhaul specifications) 1. Disassembly and inspection of all machines. Replacement and adjustment of all bearing metals and bearings 2. Balancing and accuracy adjustment of worn contact faces and connecting portion, and replacement and adjustment of the worn parts 3. Inspection of electrical, hydraulic, air and lubricating systems, and repair and adjustment of deteriorated function and unusable parts (including cutting oil pumping equipment) 4. Replacement of adjustment of guide screws and female screws 5. Assembly, test operation and machining test of the machines 6. Repair, adjustment and painting of outer components	This machine is extremely damaged its accuracy and operation efficiency due to deterioration, so required to be overhauled and remedied to cover the peak load.	
	D9 (1 set)	Lathe Machine (Overhaul specifications) 1. Disassembly and inspection of all machines. Replacement and adjustment of all bearing metals and bearings 2. Balancing and accuracy adjustment of worn contact faces and connnecting portion, and replacement and adjustment of the worn parts 3. Inspection of electrical, hydraulic, air and lubricating systems, and repair and adjustment of deteriorated function and unusable parts (including cutting oil pumping equipment) 4. Replacement of adjustment of guide screws and female screws 5. Assembly, test operation and machining test of the machines 6. Repair, adjustment and painting of outer components	This machine is extremely damaged its accuracy and operation efficiency due to deterioration, so required to be overhauled and remedied to cover the peak load.	

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Table 3-4 Facility Plan (Machine Rehabilitation & Relocation) (2/6)

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
	D18 (1 set)	Lathe Machine (Overhaul specifications) 1. Disassembly and inspection of all machines. Replacement and adjustment of all bearing metals and bearings 2. Balancing and accuracy adjustment of worn contact faces and connecting portion, and replacement and adjustment of the worn parts 3. Inspection of electrical, hydraulic, air and lubricating systems, and repair and adjustment of deteriorated function and unusable parts (including cutting oil pumping equipment) 4. Replacement of adjustment of guide screws and female screws 5. Assembly, test operation and machining test of the machines 6. Repair, adjustment and painting of outer components	This machine is extremely damaged its accuracy and operation efficiency due to deterioration, so required to be overhauled and remedied to cover the peak load.	
	ST1 (1 set)	Slotting Machine (Overhaul specifications) 1. Disassembly and inspection of all machines. Replacement and adjustment of all bearing metals and bearings 2. Balancing and accuracy adjustment of worn contact faces and connnecting portion, and replacement and adjustment of the worn parts 3. Inspection of electrical, hydraulic, air and lubricating systems, and repair and adjustment of deteriorated function and unusable parts (including cutting oil pumping equipment) 4. Replacement of adjustment of guide screws and female screws 5. Assembly, test operation and machining test of the machines 6. Repair, adjustment and painting of outer components	This machine is extremely damaged its accuracy and operation efficiency due to deterioration, so required to be overhauled and remedied to cover the peak load.	

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
	F6 (1 set)	Universal Milling Machine (Overhaul specifications) 1. Disassembly and inspection of all machines. Replacement and adjustment of all bearing metals and bearings 2. Balancing and accuracy adjustment of worn contact faces and connecting portion, and replacement and adjustment of the worn parts 3. Inspection of electrical, hydraulic, air and lubricating systems, and repair and adjustment of deteriorated function and unusable parts (including cutting oil pumping equipment) 4. Replacement of adjustment of guide screws and female screws 5. Assembly, test operation and machining test of the machines 6. Repair, adjustment and painting of outer components	This machine is extremely damaged its accuracy and operation efficiency due to deterioration, so required to be overhauled and remedied to cover the peak load.	
	F5 (1 set)	Gear Hobbing Machine (Overhaul specifications) 1. Disassembly and inspection of all machines. Replacement and adjustment of all bearing metals and bearings. 2. Balancing and accuracy adjustment of worn contact faces and connecting portion, and replacement and adjustment of the worn parts 3. Inspection of electrical, hydraulic, air and lubricating systems, and repair and adjustment of the deteriorated function and unusable parts 4. Replacement of adjustment of guide screws and female screws 5. Assembly, test operation and machining test of all the machines	This machine is extremely damaged its accuracy and operation efficiency due to deterioration, so required to be overhauled and remedied to cover the peak load.	

BOMA-STORK PASURUAN WORK SHOP

Table 3-4 Facility Plan (Machine Rehabilitation & Relocation) (4/6)

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
	F5 (1 set)	Gear Hobbing Machine (Overhaul specifications) (cont'd) 6. Repair, adjustment and painting of outer components 7. Inspection and repair of the master index gear (If it cannot be operated for rough cutting, replacement by a new machine is necessary.) 8. Inspection and addition of the replacement gear		
	C4 (1 set)	Vertical Lathe Machine (Overhaul specifications) 1. Disassembly and inspection of all machines. Replacement and adjustment of all bearing metals and bearings 2. Balancing and accuracy adjustment of worn contact faces and connecting portion, and replacement and adjustment of the worn parts 3. Inspection of electrical, hydraulic, air and lubricating systems, and repair and adjustment of deteriorated function and unusable parts (including cutting oil pumping equipment) 4. Replacement of adjustment of guide screws and female screws 5. Assembly, test operation and machining test of the machines 6. Repair, adjustment and painting of outer components	This machine is extremely damaged its accuracy and operation efficiency due to deterioration, so required to be over-hauled and remedied to cover the peak load.	
	S7 (1 set)	Planer Machine (Overhaul specifications) 1. Disasssembly and inspection of all machines. Replacement and adjustment of all bearing metals and bearings 2. Balancing and accuracy adjustment of worn contact faces and connecting portion, and replacement and adjustment of the worn parts	This machine is extremely damaged its accuracy and operation efficiency due to deterioration, so required to be over-hauled and remedied to cover the peak load.	

Table 3-4 Facility Plan (Machine Rehabilitation & Relocation) (5/6)

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
	S7 (1 set)	Planer Machine (Overhaul specifications) (cont'd) 3. Inspection of electrical, hydraulic, air and lubricating systems, and repair and adjustment of deteriorated function and unusable parts (including cutting oil pumping equipment) 4. Replacement of adjustment of guide screws and female screws 5. Assembly, test operation and machining test of the machines 6. Repair, adjustment and painting of outer components		
	W6 (1 set)	Rolling Machine (Overhaul specifications) 1. Disassembly and inspection of all machines. Replacement and adjustment of all bearing metals and bearings 2. Balancing and accuracy adjustment of worn contact faces and connecting portion, and replacement and adjustment of the worn parts 3. Inspection of electrical, hydraulic, air and lubricating systems, and repair and adjustment of deteriorated function and unusable parts (including cutting oil pumping equipment) 4. Replacement of adjustment of guide screws and female screws 5. Assembly, test operation and machining test of the machines 6. Repair, adjustment and painting of outer components	This machine is extremely damaged its accuracy and operation efficiency due to deterioration, so required to be overhauled and remedied to cover the peak load.	

Table 3-4 Facility Plan (Machine Rehabilitation & Relocation) (6/6)

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
	B16 (1 set)	Drilling Machine (Overhaul specifications) 1. Disassembly and inspection of all machines. Replacement and adjustment of all bearing metals and bearings 2. Balancing and accuracy adjustment of worn contact faces and connecting portion, and replacement and adjustment of the worn parts 3. Inspection of electrical, hydraulic, air and lubricating systems, and repair and adjustment of deteriorated function and unusable parts (including cutting oil pumping equipment) 4. Replacement of adjustment of guide screws and female screws 5. Assembly, test operation and machining test of the machines 6. Repair, adjustment and painting of outer components	This machine is extremely damaged its accuracy and operation efficiency due to deterioration, so required to be over-hauled and remedied to cover the peak load.	
	K2 (1 set)	Boring & Milling Machine	This machine is required to relocate for the layout improvement due to the installation of new machines in the same area.	Transfer to B-C building
	Others	Machine tools & plate work equipment (Overhaul and repair of parts) When designing the details, recheck the details and modify the specifications including necessary repair.		

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Table 3-5 Facility Plan (New Machine Tool) (1/43)

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
L-1	L (1 set)	Heavy Duty High Speed Lathe	Replace because of obsolescence of the facilities	

1. Specifications

(1)	Swing over bed	mm (in)	630	(24 3/4)
(2)	Swing over carriage	mm (in)	400	(15 3/4)
(3)	Swing in gap	mm (in)	900	(35 1/2)
(4)	Distance between centers	mm (in)	1,500	(59)

(5) Main drive motor: 4P 7.5 or 11 kW (10 or 15 HP)
(6) Headstock lubrication pump motor: 4P 0.2 kW (0.3 HP)
(7) Rapid feed motor: (Special) 4P 0.4 kW (0.6 HP)
(8) Coolant pump motor: (Special) 2P 0.18 kW (0.24 HP)

2. Standard accessories 1 set

3 Special accessories 1 set

(1)	3-jaw self centering chuck 300 mm (12") dia.	(1 set)
(2)	Face plate 630 mm (24") dia	(1 set)
(3)	Steady rest 20 - 200 mm	(1 set)
(4)	Follow rest 20 - 200 mm	(1 set)
(5)	Coolant system	(1 set)
(6)	Work light	(1 set)

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Table 3-5 Facility Plan (New Machine Tool) (2/43)

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
L-2	L (2 sets)	Heavy Duty High Speed Lathe	Replace because of deterioration of existing facilities.	

1. Specifications

(1)	Swing over bed	mm (in)	630	(24 3/4)
(2)	Swing over carriage	mm (in)	400	(15 3/4)
(3)	Swing in gap	mm (in)	900	(35 1/2)
(4)	Distance between centers	mm (in)	4,000	(157 1/2)

(5) Main drive motor: 4P 7.5 or 11 kW (10 or 15 HP)

(6) Headstock lubrication pump motor: 4P 0.2 kW (0.3 HP)

(7) Rapid feed motor: (Special) 4P 0.4 kW (0.6 HP)

(8) Coolant pump motor: (Special) 2P 0.18 kW (0.24 HP)

2. Standard accessories — 1 set

3 Special accessories — 1 set

(1)	3-jaw self centering chuck 300 mm (12") dia.	(1 set)
(2)	Face plate 630 mm (24") dia	(1 set)
(3)	Steady rest 20 - 200 mm	(1 set)
(4)	Follow rest 20 - 200 mm	(1 set)
(5)	Coolant system	(1 set)
(6)	Work light	(1 set)

Table 3-5 Facility Plan (New Machine Tool) (3/43)

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
L-3	L (1 set)	Heavy Duty Productive Lathe	Replace	

1. Specifications

(1)	Center height	mm (in)	375	(14 3/4)
(2)	Swing over bed	mm (in)	750	(29 1/2)
(3)	Swing over carriage	mm (in)	530	(20 7/8)
(4)	Swing over gap	mm (in)	1,000	(39 3/8)
(5)	Distance between centers	mm (in)	6,000	(236 1/4)

(6) Motors

- Main motor : AC 3ph 4P 11 kW (15 HP)
- Rapid feed motor : AC 3ph 4P 0.4 kW (0.5 HP)
- Lubricant pump motor : AC 3ph 4P 0.2 kW (0.3 HP)
- Pole change motor : 4/8P 11/5.5 kW or 4/8P 7.5/3.7 kW
- Coolant pump : 2P 0.15 kW

2. Standard accessories 1 set

3. Special accessories 1 set

(1) Steady rest : 30 - 225 mm (1 set)
(2) 3-jaw chuck : 350 mm (1 set)
(3) Follow rest : 30 - 200 mm (1 set)
(4) Coolant system (1 set)
(5) Work light (1 set)

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Table 3-5 Facility Plan (New Machine Tool) (4/43)

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
L-5	L (1 set)	Heavy Duty Gap Lathe			Improve performance	
		1. Specifications				
		(1) Swing over bed	mm	1,400		
		(2) Swing over carriage	mm	1,200		
		(3) Swing in gap	mm	3,000		
		(4) Distance between centers	mm	6,000		
		(5) Main drive motor	kW	37		
		(6) Headstock lubrication pump motor		-		
		(7) Rapid feed motor		-		
		(8) Coolant pump motor		-		
		(9) Width of gap in front of face plate	mm	1,000		
		2. Standard accessories		1 set		
		3. Special accessories		1 set		
		(1) 4-jaw self centering chuck 1,000 mm (40") dia		(1 set)		
		(2) Face plate 2,500 mm (100") dia		(1 set)		
		(3) Coolant system		(1 set)		

BOMA-STORK PASURUAN WORK SHOP

Table 3-5 Facility Plan (New Machine Tool) (5/43)

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
L-6	L (1 set)	Heavy Duty Lathe	Substitution of existing deteriorated machines	

1. Specifications

(1)	Swing over bed	mm (in)	1,400	(55 1/8)
(2)	Swing over carriage	mm (in)	1,000	(40)
(3)	Distance between centers	mm (in)	4,000	(157 1/2)
(4)	Motors			
	. Main drive	: AC 4P 45 kW		(60 HP)
	. Carriage rapid feed	: AC 4P 2.2 kW		(3 HP)
	. Tailstock rapid feed	: AC 4P 2.2 kW		(3 HP)
	. Tailstock spindle rapid feed	: AC 4P 1.5 kW		(2 HP)
	. Lubricant pump	: AC 4P 0.2 kW		(0.3 HP)

2. Standard accessories 1 set

3. Special accessories 1 set

(1)	Steady rest 200 - 480 mm	(1 set)
(2)	Standard tooling	(1 set)
(3)	Coolant pump	(1 set)
(4)	Work light	(1 set)

Table 3-5 Facility Plan (New Machine Tool) (6/43)

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
L-18	LV (1 set)	Vertical Boring & Turning Mill	Replace due to deterioration of existing machine	

1. Specifications

(1)	Table diameter	mm (in)	3,000	(118)
(2)	Max. swing	mm (in)	5,500	(216.5)
(3)	Max. work height	mm (in)	2,600	(102)
(4)	Vertical travel of rail head	mm (in)	1,000	(39.4)
(5)	Horizontal travel of side head ram	mm (in)	500	(19.6)
(6)	Swivel angle of rail head (both in and out)		30°	
(7)	Vertical travel of cross rail	mm (in)	2,000	(79)
(8)	Max. table load	kgf (lbs)	16,000	(35,300)
(9)	Main motor	AC 4P 37 kW	(50 HP)	
(10)	Motor for rail head feed	AC 4P 2.2 kW	(3 HP)	

2. Standard accessories — 1 set

3. Special accessories — 1 set

(1) Digital read-out system (axis X,Y) — (1 set)

(2) Work light — (1 set)

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Table 3-5 Facility Plan (New Machine Tool) (7/43)

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
B-1	BF (1 set)	Floor-type Horizontal Milling & Boring Machine	Replace because of obsolescence	
		1. Machine specifications	Improve accuracy and efficiency by installing the NC machine	
		(1) Spindle diameter — mm (in) 130 (5.12)		
		(2) Sliding sleeve diameter — mm (in) 340 (13.4)		
		(3) Milling spindle nose diameter — mm (in) 225 (8.86)		
		(4) Spindle taper — ISO 7/24 taper No. 50		
		(5) Sliding sleeve travel — mm (in) 450 (17.7)		
		(6) Spindle travel — mm (in) 1,000 (39.4)		
		(7) Total travel of sliding sleeve and spindle — mm (in) 1,000 (39.4)		
		2. Electrical equipment		
		(1) Power supply — AC 230 V/460 V, 50 Hz		
		(2) Allowable voltage fluctuation — ±10%		
		(3) Control voltage (transformer incorporated) — AC 110 V, 50 Hz		
		(4) Spindle drive motor — DC 18.5/25 kW (25/33HP) cont. 30 min rating		
		(5) Motor for spindle head lubricating pump — AC 4P 0.4 kW (0.5HP)		
		(6) Motor for column base gear box lubricating oil pump — AC 4P 0.1 kW (0.15HP)		
		(7) Oil pump motor — AC 4P 0.75 kW (1HP) AC 2P 0.25 kW (0.3HP)		

Table 3-5 Facility Plan (New Machine Tool) (8/43)

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
B-1	BF	Floor-type Horizontal Milling & Boring Machine (cont'd)				
		(8) Axis drive DC servo motor		2.8 kw (4P)		
		3. Machine dimensions in relation to column horizontal travel and spindle head vertical travel				
		(1) Column horizontal travel	mm (in)	4,500 (177)		
		(2) Spindle head vertical travel	mm (in)	3,500 (138)		
		4. Standard accessories		1 set		
		5. Optional accessories		1 set		
		(1) Electric jib crane		(1 set)		
		Lifting capacity	300 kgf	(660 lbs)		
		Crane travel	1,000 mm	(39.4")		
		(2) Working light		(1 set)		
		(3) Angle head		(1 set)		
		(4) Universal head		(1 set)		
		(5) Facing head C (with automatic feed based on spindle feed)		(1 set)		
		(6) Rotary table (various type)		(1 set)		
		(7) Floor plate and juck screws for level adjustment 1,600 x 2,400 x 300 mm (63 x 84 x 39.5")		(4 sets)		

Table 3-5 **Facility Plan (New Machine Tool)** (9/43)

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
B-1	BF	Floor-type Horizontal Milling & Boring Machine (cont'd)		
		(8) Angle plate 1,500 x 2,500 x 4,000 mm (59 x 98.4 x 157.5") (2 pcs/set)		
		(9) Outer support (1 set)		
		(10) Boring bar 130 mm dia x 3,500 mm Length (1 set)		
		(11) MDI-system (1 set)		
B-5	BT (1 set)	Table-Type Horizontal Boring & Milling Machine		
		1. Machine Specifications		
		(1) Spindle diameter mm (in) 110 (4.3)	This machine substitutes for the existing deteriorated machie.	
		(2) Spindle taper ISO 7/24 taper No. 50		
		(3) Milling spindle diameter mm (in) 225 (8.86)		
		(4) Main motor output kw (HP) DC15 (20)		
		(5) Spindle head vertical travel mm (in) 1,500 (59)		
		(6) Table cross travel mm (in) 1,800 (70.9)		
		(7) Table longitudinal Travel mm (in) 1,450 (57)		
		(8) Table working area mm (in) 1,400 x 1,600 (55.1 x 63)		
		(9) Max. load on table kgf (lbs) 6,300 (13,860)		
		2. Standard Accessories 1 set		
		3. Optional Accessories 1 set		
		(1) Angle head (ISO No. 50) (1 set)		

Table 3-5 Facility Plan (New Machine Tool) (10/43)

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
P-1	PL/PM (1 set)	Heavy Duty Double Housing Planer				
		1. Main specifications				
		(1) Capacity				
		. Working area of table	mm	1,000 x 3,000		
		. Planing height	mm	1,000		
		. Planing width	mm	1,300		
		. Max. stroke	mm	3,200		
		(2) Motors				
		. Table drive motor	kW	DC11 or 22		
		. Crossrail elevation motor	kW	2.2		
		. Tool-heads feed motor, etc.	kW	1.975		
		2. Specification of combined milling machine				
		(1) Capacity				
		. Planing height	mm	740 - 940		
		. Planing width	mm	1,300		
		(2) Motors				
		. Table drive motor (milling feed)	kW	0.75 or DC2.2		
		. Table drive motor (milling rapid feed)	kW	1.5 or 2.2		
		3. Accessories				
		(1) Standard accessories		1 set		
		(2) Optinal accessories		1 set		
		. Milling unit		(1 set)		
		. Cutter relief & automatic cutter clamp		(1 set)		

Table 3-5 Facility Plan (New Machine Tool) (11/43)

NO.	FACILITY	DESCRIPTION		BASIS OF PLAN	REMARKS
P-1	PL/PM	Heavy Duty Double Housing Planer (cont'd)			
		. Cutting unit	(1 set)		
		. Milling or cutting unit & table feeding device	(1 set)		
		. Cross feeding device for milling	(1 set)		
		. Tool head for combined milling	(1 set)		
		. Dust-proof bellows for table	(1 set)		
		. Automatic adjuster for table stroke	(1 set)		
M-1	HM (2 sets)	Horizontal Milling Machine		Substitution of existing deteriorated machines	
		1. Specifications			
		(1) Table	mm		
		. Max. travel (longi., cross, vert.)	560 x 200 x 400		
		. Working surface	1,100 x 260		
		(2) Motors			
		. Spindle drive motor	2.2 kW		
		. Feed motor	0.4 kW		
		. Coolant pump drive motor	60 W		
		2. Special accessories	1 set		
		3. Optional accessories	1 set		
		(1) Vertical attachment (7V-1)	(1 set)		
		(2) Machine vice 125 (125-VGVS)	(1 set)		
		(3) Round table (300-CTK)	(1 set)		
		(4) Universal dividing head (200-H)	(1 set)		
		(5) Work light	(1 set)		

Table 3-5 Facility Plan (New Machine Tool) (12/43)

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
D-2	DR (2 sets)	Radial Drills			Increase the drilling capacity for boiler tube sheet.	
		1. Specifications				
		(1) Machining capacity				
		. Drilling solid steel	mm (in)	75 (3)		
		. Drilling cast iron	mm (in)	90 (3-5/8)		
		. Boring in steel	mm (in)	200 (7-7/8)		
		. Boring cast iron	mm (in)	280 (11)		
		(2) Spindle				
		. Dia. of spindle and quil	mm (in)	75/95 (3 / 3-3/4)		
		. Vertical travel	mm (in)	400 (15-3/4)		
		(3) Dimensions				
		. Column diameter	mm (in)	500 (19-11/16)		
		. Max. distance, column surface to spindle center	mm (in)	2,020 (79-1/2)		
		. Min. distance, column surface to spindle center	mm (in)	410 (16-1/8)		
		(4) Motors				
		. Spindle drive	kW (HP)	7.5 (10)		
		. Arm elevation	kW (HP)	3.7 (5)		
		. Clamping	kW (HP)	1.5 (2)		
		. Coolant pump	W	40		
		2. Standard accessories		1 set		

Table 3-5 Facility Plan (New Machine Tool) (13/43)

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
D-2	DR	Radial Drills (cont'd)				
		3. Special accessories		1 set		
		(1) Leveling block		(4 pcs)		
		(2) Tilting table		(1 set)		
		(3) Quick chuck		(1 set)		
		(4) Sockets MT 5x5 - 5x2		(1 set)		
		(5) Drill sleeves MT 5x5 - 5x2		(1 set)		
		(6) Drill tapper		(1 set)		
		(7) Boring tools & arbors		(1 set)		
		(8) Long size tape holder (- 35 mm)		(1 set)		
DP-1	DP (1 set)	Universal Portable Radial Drilling Machine			Considering the sized-up of boiler, portable type is useful for the drilling at the stage of assembling.	
		1. Specifications				
		(1) Drilling capacity	mm	50		
		(2) Tapping capacity	mm	M48		
		(3) Max/Min. distance column sleeve to spindle	mm	2,070/1,170		
		(4) Diameter of column sleeve	mm	400		
		(5) Diameter of spindle nose	mm	75		
		(6) Spindle stroke	mm	350		
		(7) Drilling motor (power/speed)	kW/rpm	4/1,425		
		(8) Total input of machine	KVA	13		
		2. Standard accessories		1 set		
		3. Optional accessories		1 set		
		(1) Coolant pump		(1 set)		

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Table 3-5 Facility Plan (New Machine Tool) (14/43)

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
Z-1	HOB (1 set)	Gear Hobbing Machine			Reinforce facilities to correspond to increase of roll pinion for cane mill.	
		1. Specifications				
		(1) Max. diameter of gear to be hobbed	mm	2,500		
		(2) Max. diameter of gear to be cut with milling cutter	mm	4,300		
		(3) Max. module of gear to be hobbed	mm	25		
		(4) Max. module of gear to be cut with milling cutter	mm	35		
		(5) Min. number of teeth in gear to be cut		10		
		(6) Center distance between hob and work arbor				
		Min. distance	mm	230		
		Max. distance	mm	2,310		
		(7) Max. hob dimensions				
		Diameter	mm	380		
		Length	mm	510		
		(8) Max. weight of work piece	kg	10,000		
		(9) Main motor (DC motor)	kW	18.5		
		(10) Rapid traverse motor (3 phase induction motor)				
		for hob saddle	kW	5.5		
		for work table	kW	5.5		
		(11) Fine feed motor for work table	kW	DC0.5		
		(12) Coolant pump motor (3 phase induction motor)	kW	0.75 x 2		

Table 3-5 Facility Plan (New Machine Tool) (15/43)

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
Z-1	HOB	Gear Hobbing Machine (cont'd) (13) Lubricating pump motor (3 phase induction motor) kW 0.2, 0.03 x 2, 0.075 (14) Hydraulic oil pump motor (3 phase induction motor) kW 0.75 (15) Hob head swiveling motor (3 phase induction motor) kW 1.5 2. Standard accessories 1 set 3. Optional accessories 1 set (1) Crowning device (1 set) (2) Automatic single-indexing device (1 set) (3) Outer support (1 set)		
Z-2	BGS (1 set)	Bevel Gear Shaper 1. Capacity (1) Max. pitch diameter of work piece to be cut Ratio 2:1 to 8:1 mm 610 Ratio 1:1 mm 610 (2) Max. cone distance of bevel gear mm 525 (3) Max. width of tooth mm 160 (4) Max. module mm 20 (5) Min. number of teeth Ratio 8:1 10 Ratio 1:1 14	Replace the existing facilities with new one to improve performance	

Table 3-5 Facility Plan (New Machine Tool) (16/43)

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
Z-2	BGS	Bevel Gear Shaper (cont'd)				
		(6) Pitch cone angle of bevel gear				
		Max.		83°		
		Min.		7°		
		(7) Max. ratio of gear		8:1		
		2. Dimensions				
		(1) Distance from face plate to apex				
		Max.	mm	521		
		Min.	mm	51		
		(2) Diameter of face plate	mm	480		
		(3) Center height of workhead	mm	343		
		3. Motors				
		(1) Main motor	kW	5.5		
		(2) Rapid return motor	kW	1.5		
		(3) Indexing motor	kW	0.4		
		(4) Lubricating pump motor	kW	0.075		
		(5) Coolant pump motor	kW	0.25		
		4. Standard accessories		1 set		
		5. Optional accessories		1 set		
		(1) Templates (P.A 14-1/2)	(35 pcs)	(1 set)		

Table 3-5 Facility Plan (New Machine Tool) (17/43)

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
G-1	U.T.G (1 set)	Universal Cutter & Tool Grinder				
		1. General specifications				
		(1) Capacity				
		. Swing over table	mm (in)	250 (10)		
		. Distance between centers	mm (in)	700 (27-1/2)		
		. Distance between Tailstocks & workhead	mm (in)	580 (22-3/4)		
		. Taper hole in workhead spindle				
		One end	ASA No.50			
		Others end	B & S No.12			
		or (Specify by order)	MT No.5			
		(2) Table				
		. T-slot (number & size)	mm (in)	14.3 +0.05(0.565) -0 (0.536)		
		. Working surface	mm (in)	135x940 (5-5/6x37)		
		(3) Motors				
		Grinding wheel spindle motor	kW (HP)	0.75 (1)		
			(option)	kW (HP) 1.5 (2)		
		2. Standard equipment & tool cabinet		1 set		
		(1) Standard accessories		(1 set)		
		3. Optional accessories		1 set		
		(1) Cylindrical grinding attachment		(1 set)		
		(2) Formed cutter grinding attachment		(1 set)		
		(3) Surface grinding attachment		(1 set)		

Table 3-5 Facility Plan (New Machine Tool) (18/43)

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
G-1	U.T.G	Universal Cutter & Tool Grinder (cont'd)		
		(4) Internal grinding attachment (20,000 R.P.M) (1 set)		
		(5) Internal grinding attachment (50,000 R.P.M) (1 set)		
		(6) Spring collect chuck (1 set)		
G-2	DHG (2 sets)	High Speed Double Head Grinding Machine		
		1. Specifications		
		(1) Wheel size (O.D x W x I.D) mm ø355 x 50 x ø31.75		
		(2) Motor for wheel head kW 2.2/0.75		
		(3) Peripheral velocity 50 HZ/60 HZ m/min 1,617/1,951		
		(4) Spindle speed 50 HZ/60 HZ r.p.m 1,500/1,800		
		2. Standard accessories 1 set		
		(1) Wheel cover (1 set)		
		(2) Tool rest (1 set)		
		(3) Eye shield (1 set)		
		(4) Grinding wheel (1 set)		
		3. Optional accessories 1 set		
		(1) Grinding wheel (1 set)		

Table 3-5 Facility Plan (New Machine Tool) (19/43)

NO.	FACILITY	DESCRIPTION		BASIS OF PLAN	REMARKS
BA-2	BAM (1 set)	Electro-Dynamic Balancing Machine		For balancing test of rotating machinery for sugar plant and other field.	
		1. Specifications			
		Capacity			
		(1) Rotor weight, normal	40~7,000 kg		
		(2) Occasional overload permitted upto	9,000 kg		
		(3) Rotor diameter	max. 2,100 mm		
		(4) Distance between bearings	min. 200 mm		
		(5) Distance from coupling flange of drive shaft to center of remote bearing	max. 3,145 mm		
		(6) Journal diameters normal	40 - 180 mm		
		2. Accessories	1 set		
		(1) Printers	(1 set)		
		(2) Roller bearings (180 - 320 mm)	(1 set)		
		(3) Center roller bearings (2 pcs.)	(1 set)		
		(4) Test loader (500 kg) and test weights	(1 set)		
CP-1	Compressor (1 set)	Screw Compressor		Install for air tools and for gouging	
		1. Specifications			
		(1) Discharge	12 m^3/min		
		(2) Suction pressure	atmospheric pressure		
		(3) Suction temperature	30°C		
		(4) Delivery pressure	7 kgf/cm^2G		
		(5) Delivery temperature	40°C		

Table 3-5 Facility Plan (New Machine Tool) (20/43)

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
CP-1	Compressor	Screw Compressor (cont'd)				
		(6) Cooling water	6.5 ton/Hr			
		(7) Cooling water temperature	30°C			
		(8) Motor power	400/440 75 kW 50 Hz/60 Hz			
		2. Accessories	1 set			
WZ-5	Portable flame cutting machine (7 sets)	Semi automatically cuts straight lines and bevels			For improving efficiency of cutting and accuracy of welding bevel	
		1. Specifications				
		(1) Overall dimensions (L x W x H)	mm (in)	440 x 205 x 215 (17 x 8 x 8-1/2)		
		(2) Motor-Condenser induction				
			Motor	9 W/10 W A.C. 100 V or 200 V		
		Revolution (unload)	r.p.m.	1,500		
			(240 V is available)			
			(load) r.p.m.	1,350		
		(3) Reduction gear	Double cone system			
		(4) Cutting speed range	Standard 50 cycle/60 cycle			
			mm/min	80-800 100-1,000		
			(in/min)	(3-31) (4-39)		
			Special			
			L	Same as standard		
				240-2400 300-3000		
			H	(9-1/2 - 94-1/2) (12-118)		
		(5) Cutting capacity (thickness)	mm (in)	5 - 100 (1/2 - 4)		
		(6) Weight		kg (lbs) 11.5 (25)		

Table 3-5 Facility Plan (New Machine Tool) (21/43)

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
WZ-5	Portable *flame cutting* machine	Semi automatically cuts straight lines and bevels (cont'd)				
		2. Standard accessories		1 set		
		3. Options		1 set		
		(1) Extension plate track	1,800 mm	1 pc.		
		(2) Cutting tips		1 set		
WZ-6	Portable frame cutting maciline (7 sets)	Semi automatically cuts straight lines, circles, and bevels			For improving efficiency of cutting and accuracy of welding bevel	
		1. Specifications				
		(1) Overall dimensions (L x W x H)	mm (in)	460 x 120 x 240 (18 x 43/4 x 9-1/2)		
		(2) Motor (Universal motor A.C. D.C)	V	100 or 200		
		(3) Cutting speed range	mm/min (in/min)	150 - 1,000 (6 - 40)		
		(4) Speed change		Variable register		
		(5) Cutting capacity (thickness)	mm (in)	5 - 100 (1/5 - 4)		
		(6) Circle cutting range (diameter)	mm (in)	60 - 1,200 (2 - 47)		
		(7) Weight	kg (lbs)	9.8 (21.6)		
		2. Construction & accessories		1 set		
		(1) Body		(1 set)		
		(2) Power cable 3 m (118")		(1 set)		
		(3) Medium pressure torch		(1 set)		
		(4) Torch holder		(1 set)		
		(5) Radius rod and pivot pin		(1 set)		
		(6) Hose 400 mm (15") each		(3 pcs)		
		(7) Plate track 1.8 m (70")		(1 set)		

Table 3-5 Facility Plan (New Machine Tool) (22/43)

NO.	FACILITY	DESCRIPTION		BASIS OF PLAN	REMARKS
WZ-6	Portable frame cutting machine	Semi automatically cuts straight lines, circles and bevels (cont'd)			
		2. Construction & accessories			
		(8) Torch holding bar	(1 set)		
		(9) Counter weight	(1 set)		
		(10) Standard tool box	(1 set)		
		(11) Spanner	(1 set)		
		(12) Screw driver	(1 set)		
		(13) Tips	(3 set)		
		(14) Spare carbon	(1 set)		
		(15) Radius rod fitter	(1 set)		
		(16) Screw for the above	(1 set)		
		(17) Tip cleaner	(1 set)		
SM-1	Shearing machine (1 set)	New Gapless Shears			
		1. Specifications			
		(1) Cutting capacity	10 mm x 2,500 mm		
		(2) Shear angle	2°30'		
		(3) Motor powers	11 kW (15 HP)		
		2. Accessories	1 set		

Table 3-5 Facility Plan (New Machine Tool) (23/43)

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
BR-1	Bending roller (1 set)	Pinch Pyramid Type Plate Bending Rolls 1. Specifications (1) Bending capacity . Materials of steel plates to be bent . Material JIS SS41, eqv. steel plate . Tensile strength not more than 45 kg/mm^2 . Yield strength not more than 28 kg/mm^2 . Max. pre-bending capacity . Width 2,000 mm . Thickness 6 mm . Inside diameter 300 mm Edge flat for the plate thickness 2.5 x plate thickness . Max. rolling capacity . Width 2,000 mm . Thickness 10 mm . Inside diameter 350 mm . Min. bending capacity . Width 2,000 mm . Thickness 10 mm . Inside diameter 500 mm (2) Motors . Main drive motor 7.5 kW, 6P, wound motor type with brake 1 set . Bottom roll adjusting motor 3.7 kW, 6P, Squirrel cage type 2 sets 2. Accessories & spare parts 1 set	Replace because of obsolescence of the existing facilities	

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Table 3-5 Facility Plan (New Machine Tool) (24/43)

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
BR-3	Bending roller (1 set)	Pyramid Type Plate Bending Rolls 1. Specifications (1) Bending capacity . Materials of steel plate to be bent . Material: Steel plate . Tensile strength: 45 kg/mm^2 . Yield strength: 28 kg/mm^2 . Max. bending capacity . Width: 3,500 mm . Thickness: 40 mm . Inside diameter: 900 mm . Min. bending capacity . Width: 3,500 mm . Thickness: 9 mm (2) Motors . Main drive motor: 75 kW 6P: 1 set . Top roll adjusting motor: 55 kW 6P: 1 set . Top roll countrebalance motor: 5.5 kW 6P: 1 set . Bearing swing down motor: 3.7 kW 6P: 1 set 2. Accessories & spare parts: 1 set	For the improvement of efficiency and capacity for the boiler drum-forming.	

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Table 3-5 *Facility Plan (New Machine Tool)* (25/43)

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
HP-1	Hydraulic Press (1 set)	800 Ton Ram Head Type Hydraulic Press. 1. Mechanical specifications (1) Max. pressing capacity — 800 ton (2) Lifting capacity (Net) — 30 ton (3) Stroke — 1,000 mm (4) Daylight — 1,500 mm (5) Die space — 500 mm (6) Main ram diameter — 700 mm (7) Effective working area of bed — 4,000 x 1,300 mm (8) Effective working area of ram head — 1,600 x 1,000 mm (9) Approaching speed — 10,000 - 4,000 mm/min (10) Pressing speed — 50 - 200 mm/min (11) Lifting speed — 1,000 - 4,000 mm/min (12) Hydraulic pump — 1 set Normal operating pressure — 210 kg/cm^2 Delivery — 82 l/min (13) Operating type Push-button system with main operation panel and portable operation box 2. Accessories — 1 set 3. Special spare parts — 1 set Note: The following spare parts will only be supplied in case the press is exported overseas. (1) Coil of solenoid valves — 50% (2) Pressure (with ton scale reading) — (1 pc) (3) Magnetic relays — (1 pc each) (4) Timers — (1 pc each)	For the edge pre-bending of boiler drum plate corresponding to BR-3.	

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Table 3-5 Facility Plan (New Machine Tool) (26/43)

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
PB-1	Pipe bender (1 set)	Pipe Bender			Substitution of the existing deteriorated equipment.	
		1. Specifications				
		(1) Bending dimensions (max.)	165ϕ mm			
		(2) Bending angle	90°			
		2. Accessories	1 set			
W-1	Welding machine (3 sets)	Submerged Arc Welder			Automate the welding process of boiler drum external circumference	
		1. Specifications				
		(1) Max. welding current	A	1,500		
		(2) Welding wire diameter	mm	3.2 - 6.4		
		(3) Control system ... Solid state variable speed control				
		(4) Travel speed	cm/min	10 - 100		
		(5) Wire reel	Magazine type			
		(6) Capacity of flux hopper	ℓ	6		
		(7) Adjustable range of nozzle	mm	Vertical 50		
			mm	Horizontal 50		
		2. Accessories	1 set			

Table 3-5 Facility Plan (New Machine Tool) (27/43)

NO.	FACILITY	DESCRIPTION				BASIS OF PLAN	REMARKS
W-2 W-3	Welding machine (6 sets)	A-C Arc Welders					
		1. Specifications		W-2	W-3		
		(1) Secondary support	A	500	300		
		(2) Primary input	kVA-kW	43-23	24-13		
		(3) Secondary current range	A	80-500	50-300		
		(4) Max. secondary no-load voltage	V	85	80		
		(5) Duty cycle	%	60	40		
		(6) Electrode size	mm	3.2-8	2.0-6		
		2. Accessories		1 set			
W-4	Welding machine (MRA-600) (3 sets)	Thyristor Controlled DC Power Supplies, For Arc Air Gouging & Blasting					
		1. Specifications					
		(1) Rated output current	A	600			
		(2) Current range (single range)	A	100-600			
		(3) Arc voltage	V	46			
		(4) Duty cycle	%	60			
		(5) Open circuit voltage	V	15			
		(6) Input voltage/phase	V	380-3			
		(7) Frequency	Hz	50/60			
		(8) Input at rated load	kVA-kW	42-33.5			

Table 3-5 Facility Plan (New Machine Tool) (28/43)

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
W-5	Diesel welder (2 sets)	Engine Welder				
		1. Specifications				
		(1) Welding motor generator				
		. Nominal rating	kW	6.82		
		. Rated output current	A	220		
		. Rated voltage	V	31		
		. Current range	A	50 - 240		
		. Duty cycle	%	50		
		. Rotation frequency	rpm	3,000		
		. Electrode size	mm	2.6 - 4.0		
		(2) Alternating current generator				
		. Nominal rating (3 phase)	kVA	5		
		. Rated voltage	V	200		
		. Power factor		1.0		
		. Frequency	Hz	50		
		. Rating		Continuous		
		(3) Engine				
		. Nominal rating	PS/rpm	16/3,000		
		. Displacement	c.c	751		
		. Fuel		Gas oil (JIS No.2)		
		. Fuel tank capacity	l	19		
		. Starting system		Cell motor		
		. Battery		12V.NS-60		
		. Dimensions (L x W x H)	mm	1,340 x 675 x 890		
		. Weight	kg	375		

Table 3-5 Facility Plan (New Machine Tool) (29/43)

NO.	FACILITY	DESCRIPTION		BASIS OF PLAN	REMARKS
MP-1	Manipulators (3 sets)	Center Boom Manipulators		Automate the welding process of boiler drum external circumference	
		1. Specifications			
		(1) Horizontal boom travel distance	3,000 mm	Related to automating of the welding	
		(2) Horizontal boom travel speed	150 - 1,500 mm/min		
		(3) Vertical boom travel distance	3,000 mm		
		(4) Vertical boom travel speed	800 mm/min		
		(5) Max. load capacity at boom's end	100 kg		
		2. Accessories (Standard)	1 set		
TR-1	Turning rolls (4 sets)	Low Shaft Type Turning Rolls		Automate the welding process of boiler drum external circumference	
		1. Specifications			
		(1) Loading weight	20,000 kg	For medium and small type boiler drum	
		(2) Work piece dia.	400 - 3,500 mm		
		(3) Roll peripheral speed 50 Hz/60 Hz	83-830/100-1,000 mm/min		
		(4) Roll outer dia. & width	ø315 x 170		
		(5) Drive	Double wheels		
		(6) Motor	3ø 200 V - 1.5 kW		
		2. Accessories (Standard)	4 sets		

Table 3-5 Facility Plan (New Machine Tool) (30/43)

NO.	FACILITY	DESCRIPTION		BASIS OF PLAN	REMARKS
TR-2	Turning rolls (4 sets)	Low Shaft Type Turning Rolls		Facilities required for automating the welding of the large boiler drum	
		1. Specifications			
		(1) Loading weight	60,000 kg		
		(2) Work piece dia.	600 - 7,000 mm		
		(3) Roll peripheral speed	50 Hz/60 Hz 83-830 rpm/100-1,000 rpm		
		(4) Roll outer dia. x width	ϕ400 x 260 mm		
		(5) Drive	Double wheels		
		(6) Motor	3ϕ 200 V - 3.7 kW		
		2. Accessories (Standard)	4 sets		
SR-1	Steel rolls (12 sets)	Steel Rolls			
		1. Specifications			
		(1) Loading weight	20,000 kg		
		(2) Work piece dia.	600 - 7,000 mm		
		(3) Roll outer dia. x width	ϕ315 x 170 mm		
		(4) Drive	Nothing		
		2. Accessories (Standard)	1 set		

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Table 3-5 Facility Plan (New Machine Tool) (31/43)

NO.	FACILITY	DESCRIPTION		BASIS OF PLAN	REMARKS
WD-1	Welding rod dryer (1 set)	Drying Oven for Electrodes		Improvement of welding quality	
		1. Specifications			
		(1) Total welding rod weight treatable	200 kg		
		(2) Max. operating temperature	400°C		
		(3) Number of shelves	5 tiers, 2 rows		
		(4) Max. power consumption	6.0 kW		
		(5) Power supply	3 phase, 200 V		
		(6) Temperature regulator	electronically controlled		
		(7) Max. welding rod length treatable	550 mm		
		(8) Agitating fan	x		
		(9) Thermometer	o		
		(10) Wheeled or not	Not wheeled		
		(11) Overall dimension (H x W x D)	975 x 750 x 680 mm		
		(12) Capacity (H x W x D)	450 x 650 x 570 mm		
		(13) Weight	200 kg		
WD-2	Welding flux dryer (2 sets)	Drying Oven for Electrodes Flux		Required facilities relating to W-1	
		1. Specifications			
		(1) Weight of flux-cored wire treatable	50 kg		
		(2) Max. operating temperature	300°C		
		(3) Number of chambers	1		
		(4) Max. power consumption	6 kW		

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Table 3-5 Facility Plan (New Machine Tool) (32/43)

NO.	FACILITY	DESCRIPTION		BASIS OF PLAN	REMARKS
WD-2	Welding flux dryer	Drying Oven for Electrodes Flux (cont'd)			
		1. Specifications			
		(5) Power supply	200 V, 3 phase		
		(6) Temperature regulator	Electronically controlled		
		(7) Mode of drying	Rotary drum		
		(8) Thermometer	Provided		
		(9) Overall dimension (H x W x D)	1,200 x 1,550 x 950 mm		
		(10) Weight			
WD-3	Welding rod oven (2 sets)	Welding Rod Oven		Improvement of welding quality	
		1. Specifications			
		(1) Total welding rod weight treatable	200 kg		
		(2) Max. operating temperature	120°C		
		(3) Number of chambers	5 tiers, 2 rows		
		(4) Max. power consumption	3.6 kW		
		(5) Power supply	220 V		
		(6) Temperature regulator	Electronically controlled		
		(7) Max. welding rod length treatable	550 mm		
		(8) Wheeled or not	Not wheeled		
		(9) Overall dimension (H x W x D)	1,255 x 650 x 800 mm		
		(10) Weight	200 kg		

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Table 3-5 Facility Plan (New Machine Tool) (33/43)

NO.	FACILITY	DESCRIPTION		BASIS OF PLAN	REMARKS
BM-1	Tools-Brazing Machine (1 set)	Electric Brazing Machine			
		1. Specifications			
		(1) Power supply	2.0 kVA - 20 A, 100 V		
		(2) Capacity	25 x 30 mm		
		2. Accessories			
		(1) Work tools	1 set		
WZ-1	Bader machine (4 sets)	Bader Machine		Raise finishing efficiency of the welding bead	
		1. Specifications			
		(1) Belt size (width & length)	75 x 3,357 mm		
		(2) Belt speed	2,000 m/min		
		(3) Motor	200/220 V 2P 5 HP		
		2. Accessories (Standard)	1 set		
WZ-2	Tube expander (2 sets)	Total Tube Expanding Control		Reinforce facilities	
		1. Specifications			
		(1) Tube expanding digital controllers	1 set		
		(2) Automatic voltage regulators (O.D 10 - 63 mm)	1 set		
		(3) Tube rollers (O.D 10 - 63 mm)	1 set		
		(4) Tube expanders	1 set		

BOMA-STORK PASURUAN WORK SHOP

Table 3-5 Facility Plan (New Machine Tool) (34/43)

NO.	FACILITY	DESCRIPTION		BASIS OF PLAN	REMARKS
WZ-2	Tube expander	Total Tube Expanding Control (cont'd)			
		1. Specifications			
		(5) Mandrel couplings	1 set		
		(6) Spring balancers	1 set		
		2. Attachments	1 set		
WZ-4	High speed Cutting machine (4 sets)	High Speed Cutting Machine (Cutting Grinder)		Improve cutting efficiency of tubes and shape steel	
		1. Specifications			
		(1) Wheel dimensions	510ø x 4 x 30ø mm		
		(2) Vice O.D	250 mm		
		(3) Cutting capacity (Max.)	125ø mm		
		(4) Motor power	5.5 kW		
		2. Accessories (standard)	1 set		
WP-2	Welding positioners (1 set)	Positioners		Provide newly for improving efficiency in fitting and welding of attachments such as nozzles and flanges for boilers and pressure vessels, and the welding quality	
		1. Specifications			
		(1) Loading capacity	kg 12,000		
		(2) R.P.M of table 50 Hz	rpm 0.0125 - 0.25		
		(3) Table tilting angle	0 - 135°		
		(4) Table dimension	mm 2,000 x 2,000		
		(5) Motor for table turning	kW 5.5		
		(6) Motor for table tilting	kW 7.5		
		(7) Input voltage	V AC 3ø 200		
		(8) Height x width x depth	mm 1,970 x 2,000 x 3,020		
		(9) Weight	kg 8000		

BOMA-STORK PASURUAN WORK SHOP

Table 3-5 Facility Plan (New Machine Tool) (35/43)

NO.	FACILITY	DESCRIPTION		BASIS OF PLAN	REMARKS
WP-2	Welding positioners	Positioners (cont'd)			
		2. Standard accessories			
		(1) Tool kits	1 set		
SR-1	Stress relief furnace (1 set)	200 Ton/CH Stress Relief Furnace		Required indispensably for production of boilers and pressure vessels	
		1. Specifications			
		(1) Furnace volume dimensions	8,000 x 8,000 x 10,000 mm		
		(2) Temperature	625°C ± 25°C		
		(3) Capacity/charge	200 Tons		
		2. Accessories			
		(1) Work piece carrier	1 set		
QF-1	Tools quenching furnace (1 set)	Box-Type Electric Furnace			
		1. Specifications			
		(1) Capacity weights	300 kg/batch		
		(2) Capacity dimensions	600ø x 100 - 150H mm		
			400W x 600L x 100 - 150H mm		
		(3) Temperature (1,030 - 1,050°C)	Max. 1,100°C		
		(4) Temperature rise time	1+1.100°C/15 Hr		
		(5) Temperature difference	±5°C		
		(6) Heat source (metal heater)	3ø 220 V 50 Hz		
		(7) Power supply	45 kW		
		(8) Temperature controll thermostat x 2 - PID control			
		(9) Furnace effective dimensions	600W x 800L x 250H mm		

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Table 3-5 Facility Plan (New Machine Tool) (36/43)

NO.	FACILITY	DESCRIPTION		BASIS OF PLAN	REMARKS
ND-1	γ-Ray	γ-Ray Equipment		Required indispensably for non-destructive inspection of boilers and pressure vessels	
		1. Specifications & Accessories			
		(1) Capacity	Co 60 7 ci or Ir 192, 20 ci		
		(2) Automatic development device	1 set		
		(3) Leak detector	1 set		
		(4) Electric type controller	1 set		
		(5) Circuit cable etc.	1 set		
		(6) Haulage box	1 set		
IE-1	Inspection equipment & measuring tools (1 set)	1. Measuring tools		Reinforced facilities for general inspection	
		(1) Block gauge sets class A, (103 pcs)	1 set		
		(2) Accessories for blockgauge (standard)	1 set		
		(3) Angle blockgauge sets (standard)	1 set		
		(4) Wedge blockgauge sets (standard)	1 set		
		(5) Height master	1 set		
		(6) Dial gauge (2 types x 10 pcs.)	1 set		
		(7) Lever type dial test indication (2 type x 10 pcs)	1 set		
		(8) Magnet base (lever type)	10 sets		
		(9) Cylinder gauge sets (6ø - 600ø)	1 set		
		(10) Surface measuring instrument	1 set		
		(11) Surface roughness scale sets (4 type x 1 pc)	1 set		
		(12) Hardnester (standard Hs, HRc 8 type x 1 pc)	1 set		
		(13) External micrometers (0 - 25 mm - 475 - 500 mm 20 size)	20 pcs		
		(14) Micrometer with interchangeable anvil (0 - 100 mm - 900 - 1,000 mm 11 size)	11 pcs		
		(15) Point micrometer (0 - 25 mm - 75 - 100 mm 4 size)	4 pcs		

Table 3-5 Facility Plan (New Machine Tool) (37/43)

NO.	FACILITY	DESCRIPTION		BASIS OF PLAN	REMARKS
IE-1	Inspection equipment & measuring tools	1. Measuring tools (cont'd)			
		(16) Vernier caliper (150 mm - 5/100, 200 mm - 5/100 300 mm - 5/100, 600 mm 5/100 1,000 mm - 5/100 5 size)	43 pcs		
		(17) Steel rule (150 mm, 300, 600, 1,000, 1,500, 2,000, 6 size)	110 pcs		
		(18) Universal bevel protractor (150 mm, 300 mm 2 size)	6 pcs		
		(19) Square(150 mm x 100, 300 x 200, 600 x 350, 1,000 x 550 4 size)	14 pcs		
		(20) Cylindrical square(ø150 x 400L x ±4 μ)	1 pc		
		(21) Precision square level (JIS 1 class, 200 mm x 200)	1 pc		
		(22) Cast iron surface plate (JIS 1 class, 1,200 x 2,400 x 320)	1 pc		
		(23) Steel V block (25 - 100 mm 5 size)	10 sets		
		(24) Box block with V groove (A class 250 mm)	1 set		
		(25) Steel tape measuring (30 m)	1 pc		
		(26) Convex rule (5 m)	10 pcs		
		(27) Y level (x30 - 40 mm x 30 sec)	1 set		
		(28) Plumb bob (Brass made)	3 pcs		
		(29) Weld-thickness gauge sets	5 sets		
		(30) Jointed inside micrometer (2 m - 5 m)	1 set		
		(31) Tubular type inside micrometer (50 - 75 mm - 475 - 500 mm)	18 sets		
		(32) Precision straight edge (A class 1,000 x 60 x 12) (A class 3,000 x 100 x 24)	1 pc		

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Table 3-5 Facility Plan (New Machine Tool) (38/43)

NO.	FACILITY	DESCRIPTION		BASIS OF PLAN	REMARKS
IE-1	Inspection equipment & measuring tools	1. Measuring tools (cont'd)			
		(33) Dial caliper gauge (10 type)	1 set		
		(34) Depth micrometer (0 - 50 - 75 - 100 11 size)	1 set		
		(35) Depth gauge (A type 150 - 1,000 7 size)	1 set		
		(36) Gear tooth vernier (M1.5 - 12, 2.5 - 25 2 size)	1 set		
		(37) Thickness & taper gauge (No. 65M, No. 150 MZ, No. 245 M) 3 type	1 set		
		(38) Calipers (3 type 100 mm - 1,000 mm) total	300 pcs		
		(39) Screw thread limit gauge	1 set		
		(40) Hardness tester (Shore type, Brinnel type)	1 set		
		(41) Thermometer (0 - 200°C -30 - 100°C mercury stick type)	10 pcs		
		(42) Digital thermometer (-50 - 1,200°C)	2 sets		
		(43) Noise indicators	1 set		
		(44) Vibration meters	1 set		
		(45) Tester	1 set		
		(46) Thickness meter	1 set		
		(47) Photoelectric counter	1 set		
		(48) Handy digital tachometer	1 set		
		(49) Stop watch	1 pc		
		(50) Precision spring testing machine	1 set		
		(51) Transit	1 set		
		2. Nondestructive testing machine & tools			
		(1) Magnetic particle meter	1 set		
		(2) Ultrasonic detector	1 set		

Table 3-5 Facility Plan (New Machine Tool) (39/43)

NO.	FACILITY	DESCRIPTION		BASIS OF PLAN	REMARKS
MT-1	Machining tools (1 set)	1. Machining tools		Required for the *continuous operation* of machines and the improvement of *cutting efficiency*.	
		(1) For B-1 machining tools	1 set		
		. Milling cutter & tips (6" - 10" - 2 pcs)	(1 set)		
		. Taper drills (10ϕ - 80ϕ - 111 pcs)	(1 set)		
		. Super drills, center drill & blades (80ϕ - 120ϕ)	(20 sets)		
		. Chucking reamers (10ϕ - 80ϕ - 111 pcs)	(1 set)		
		. Endmills (10ϕ - 50ϕ - 158 pcs)	(1 set)		
		. Taps (M10 - M80 x 30 sets & 15 pcs)	(1 set)		
		. Cutter arbors, Drill sleeve & sockets	(1 set)		
		. Tappers	(1 set)		
		(2) For L-1, L-2 machining tools	2 sets		
		. Standard brazed tools (4 size x 16 pcs)	(1 set)		
		(3) For L-3, L-5, L-6 machining tools	3 sets		
		. Standard brazed tools (4 size x 16 pcs)	(1 set)		
		(4) For L-18 machining tools	1 set		
		. Milling cutter & tips (6" - 12" - 2 pcs)	(8 sets)		
		. Taper drills (10ϕ - 80ϕ - 111 pcs)	(1 set)		
		. Super drills, center drill & blades (80ϕ-120ϕ)	(40 sets)		
		. Chucking reamers (10ϕ - 80ϕ- 111 pcs)	(1 set)		
		. Taps (M10 - M80 x 20 sets & 15 pcs)	(1 set)		
		. Cutter arbors, Drill sleeve & Sockets	(1 set)		
		. Tappers	(1 set)		
		(5) For M-1 Machining tools	x 2 sets		
		. Milling cutter & tips (3", 4"-2 size x 2)	(1 set)		
		. End mills (1 ϕ - 20ϕ - 94 pcs)	(1 set)		
		(6) For Z-1 Machining tools	1 set		
		. Gear hobs (M5 - M25 - 16 pcs)	(1 set)		
		(7) For Z-1 Machining tools	1 set		
		. Straight bevel gear generating cutters (M2 - M25 - 19 size)	(1 set)		

BOMA-STORK PASURUAN WORK SHOP

Table 3-5 Facility Plan (New Machine Tool) (40/43)

NO.	FACILITY	DESCRIPTION		BASIS OF PLAN	REMARKS
MT-1	Machining tools	1. Machining tools (cont'd)			
		(8) For P-1 Machining tools	1 set		
		. Milling cutter & tips (6" - 10" - 6 pcs)	(1 set)		
		(9) For S-1 Machining tools	1 set		
		. Standard brazed tools (4 size x 11 pcs)	(1 set)		
		(10) For SL-1 Machining tools	1 set		
		. Standard brazed tools (10 pcs)	(1 set)		
		(11) For D-2 Machining tools	x 2 sets		
		. Taper drills (10ø - 75ø - 116 pcs)	(1 set)		
		. Reamers (10ø - 75ø - 116 pcs)	(1 set)		
		. Taps (M10 - M70 18 set/15 pcs)	(1 set)		
		. Boring tool bits (50 pcs)	(1 set)		
FA-1	Fitting & assembly tools (1 set)	Fitting and Assembly Tools		Required for the efficiency improvement in assembling and finishing work.	
		(1) Working table	5 sets		
		. Dimensions (1,500 mmW x 2,500 mmL x 800 mmH)			
		(2) Parallel vice	1 set		
		. Calibar (110 mm)	(5 pcs)		
		(135 mm)	(5 pcs)		
		(160 mm)	(5 pcs)		
		(3) Hand tools	1 set		
		. Gear puller (dia. 75,100,150,200,250,300,375, 450 mm)	(8 sets)		
		. Bearing puller set (10 - 13ø - 55 - 60ø)	(2 sets)		
		. Socket wrench set	(5 sets)		
		. 45° double offset wrench	(5 sets)		
		. Torque wrench (0 - 230 - 0 - 10,000 cm-kg)	(1 set)		
		. Adjustable angle wrench (150, 200, 250, 300, 375 mm)	(10 sets)		