i) Shop layout

A-Bay: For the prefabrication area for structure, parts and nozzle etc. It is arranged in the area near the outdoor assembly area and material storage yard.

B-Bay: For the preparation of plate works and forming assembly of unit cylinder.

C-Bay: For the machine shop and heat exchanger assembly area.

D-Bay: For the assembly and testing of heavy vessel, structure and heat exchanger.

ii) Storage Area

a) A raw material storage area is arranged in the open side with the prefabrication, blasting and painting areas. For the handling of materials, a gantry crane is arranged as well.

b) The storage of forming dies and jig shall be made in the open.

iii) Layout of equipment

a) The exclusive machines are scattered to each bay so that they can be optimized with respect to the manufacturing process flow of the objective products.

b) General purpose machine tools are concentrated upon C-bay as a machine shop.

c) Forming equipment is concentrated on A and B-bay according to the manufacturing process flow. Heavy duty

head flanging machine is arranged in C-bay because it should be installed in the vicinity of press machine.

d) Material preparation areas are arranged in plate works (B-bay) and structure works (A-bay).

e) Welding equipment is arranged according to the manufacturing process flow.

f) X-ray room for the heavy vessel and furnace for stress relief, blasting and painting areas are arranged in D-bay.

g) Although acid cleaning equipment is required for the processing of stainless steel, this equipment is arranged in a separate building because its installation in the shop is unsuitable due to the waste water disposal problem.

h) Heating furnace and midway X-ray room are arranged in the east side of A and B-bays respectively.

i) Material testing equipment which is indispensable for the plate works is arranged in the east side corner of A-bay.

j) The packings of the heavy and light works are arranged in the assembly yard and storage area respectively.

k) Bay transfer is arranged in the center of the south side of the factory.

2) Construction cost

The details of the investment required for the renovation is shown in Table V-2-3 Summary of investment cost. But the cost does not include the cost to use the existing organization and the labor charge of the workers during the training period.

3) Renovation project promotion system

Once the project promotion is decided, the factory is obliged to assure the smooth realization of the renovation without causing troubles and problems; the factory shall carry out (1) designing of the new factory, selection of the parts to be purchased, (2) control and supervision of the construction schedule such as preparation of the plant site, construction of the building, erection of the facilities and training of the managers, engineers, and workers for smooth start-up operation of the plant.

4) Details of actual work

1 Work items

As shown in Table V-2-2 Construction schedule, the actual work is classified as follows; (1) Land preparation (2) Civil works (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.

i) 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.

ii) The main foreign portion work covers the coordination fo 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 V-2-2)

(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.

6) Renovation promotion schedule table

Refer to Table V-2-2 construction schedule.

(3) 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 has proven that the following countermeasures should be taken.

① The production control system should be established to control products so that they are 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 Attention is drawn to production technology, for change in the product mix causes the use of thick plates. This makes important the technology to select forming, heat-treatment, and welding methods, and welding materials and to prevent cracks during welding.

Enhancement of production control and production technology requires increase and training of staff. The point of the training will be to make them master the specific technology required for the specific product in each section. For attaining this purpose, technical tie-up and assistance contracts made with other countries or parties will be necessary. But the program does not include this cost.

2) **Quality control system**

As mentioned, the quality control manual is available at Surabaya factory. Important is that this manual will be followed by all the workers. For this

purpose, the P.D.C.A. circle should be passed on to all the workers.

As the thick plate is used, the following matters will be required:

i) To correspond to the increased non-destructive examination

ii) To take countermeasures against the weld defects such as weld cracks

Therefore, for i) the plant should have its own qualified inspectors and for ii) it should have the quality control specialists who are knowledgeable on the materials and production technology to maintain the quality of the products.

Also, the data on failures and claims should be collected and kept carefully for improving the quality of the products.

3) Safety control system

① The base for safety control is the arrangement and cleaning of the plant but these are not followed necessarily at present. So it is necessary to make all the members cultivate consciousness of these matters.

② To avoid the accidents such as gas explosion, training and education of the workers who operate crane, slinging workers and other workers will be important.

4) Maintenance

It is necessary to stabilize the following maintenance system based on the maintenance technique of Surabaya factory.

① The maintenance manual is necessary for fulfilling the daily and periodical inspection of each machine, equipment and instrument. In the manual, inspection items, time and date, portion to be inspected should be clarified.

② Also, the workers should inspect and service the apparatus, tools and other equipment to improve the quality of the products and production efficiency.

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 new work.

In the light of production technology, 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

To meet the new production program at Gresik factory, the following could be considered.

① As for the new production technology for heat exchangers and pressure vessels, technical tie-up and assistance contracts with foreign companies will be necessary.

② As for the products that have been produced by the plant, improvement of design and production technology will be necessary.

③ Capability of designing of the good quality products at low cost including the design of production will be required in the future.

④ Cultivation and education of the designers and engineers who can select materials and instruct the dimension required for the products on the drawing.

7) Training

Training of the production management and engineers were mentioned in 1) - 6).

It is urgently required to train the workers to correspond to the increase of the production and new facilities.

8) Organization and personnel

① Gresik factory is not a sub-unit of Surabaya factory judging from its production capacity and personnel scale. But the sales and accounting can be a part of Surabaya factory.

② The organization of Gresik is simplified.

③ The personnel plan is as follows

i) The number of direct workers is calculated and decided in the method shown in (1) 2) ②.

ii) Indirect personnel is decided by our experience. The general management section is decided by estimation.

Table V-2-1 FORECAST OF PRODUCT MIX

P.T. BARATA: GRESIK FACTORY

ANNUAL PRODUCT CONDITION IN 1989 ~ 1993

UNIT: TON/YEAR

TYPE OF PRODUCT		STEEL CONSTRUCTION	PLATE WORK	TOTAL	BASIC LOAD	SUGAR PLANT	CEMENT PLANT
a. STEEL STRUCTURE	a.1 General structures	1,600	80	1,680	1,680		
	a.2 Bridges and similar structures	500	25	525	525		
	a.3 Industrial structures	3,000	0	3,000		1,648	1,347
	a.4 Big water gates and structures for water engineering	400	400	800	800		
	a.5 Conveyors	165	165	330		333	
b. PLATE WORKS	b.1 Cement plant equipment	0	535	535			536
	b.2 Sugar plant equipment	0	3,860	3,860		3,861	
	b.3 Fertilizer and petrochemical industry	300	1,700	2,000	2,000		
	b.4 Water treatment plants	600	300	900	900		
	b.5 Standardized heat-exchangers	100	1,500	1,600	1,090	447	67
	b.6						
	b.7						
SUB TOTAL		6,665	8,565	15,230	6,995	6,289	1,950
c. SITE WORK	c.1 General industries	3,100	0	3,100		1,372	1,725
	c.2 Vessels (pressure and atmospheric, vacuum)	0	310	310		311	
	c.3 Tanks of different design.	0	460	460		419	45
	c.4 Silos, bins, containers hoppers, ducts, chutes, etc.	200	300	500	500		
	c.5 Pipe works	0	940	940		709	231
SUB TOTAL		3,300	2,010	5,310	500	2,811	2,001
T O T A L		9,965	10,575	20,540	7,495	9,100	3,951

Table V-2-2

Construction Schedule

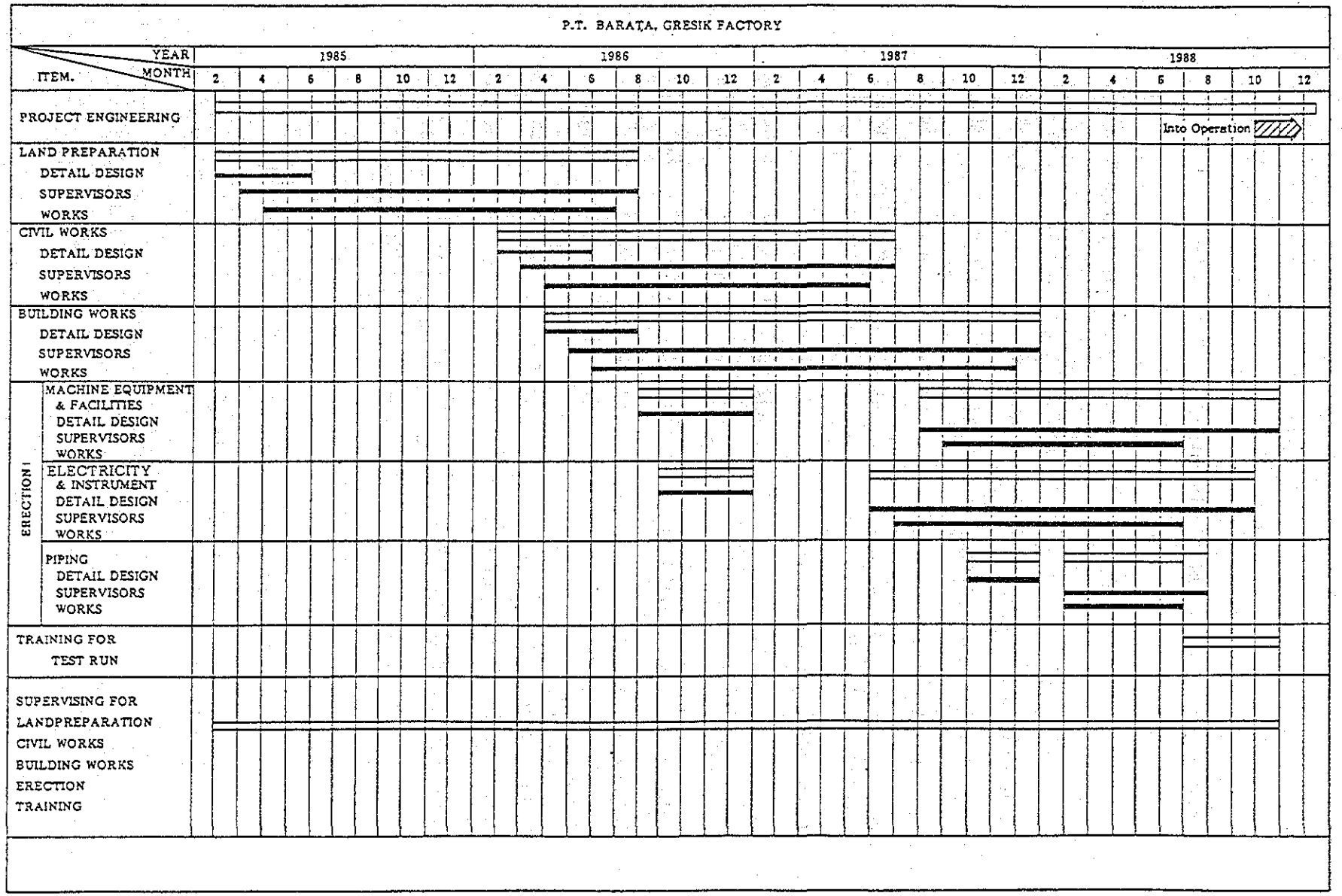


Table V-2-3 Summary of Investment Cost for P.T. Barata Gresik

UNIT: 1,000,000 YEN

	ITEM	FOREIGN	DOMESTIC	TOTAL
1.	MACHINERY & EQUIPMENT	4,630.44		4,630.44
2.	ELECTRICITY & INSTRUMENT	180.97	278.75	459.72
3.	LAND PREPARATION	59.55	450.84	510.39
4.	OCEAN FREIGHT, INSURANCE & LOCAL HANDLING	291.82	69.12	360.94
5	INLAND TRANSPORTATION		65.48	65.48
6.	CIVIL	149.63	1,712.53	1,862.16
7.	ERECTION	15.86	300.52	316.38
8.	BUILDING (PLANT & OTHERS)	238.99	1,654.64	1,893.63
9.	BUILDING (OFFICE)	9.96	68.95	78.91
10.	OTHERS	428.63	7.71	436.34
11.	ENGINEERING FEE	544.08	94.34	638.42
12.	CONSTRUCTION EXPENSES		288.04	288.04
13.	PHYSICAL CONTINGENCIES	196.49	349.36	545.85
	TOTAL	6,746.42	5,340.28	12,086.70

Note:

1. Training fee is not included in this table.
2. The physical continquency of training fee is not included.

(GRESIK FACTORY)

Table V-2-4 SUMMARY OF PRODUCTION FACILITIES

Item	New Facilities	Usable Existing Machine	Total
Machine Tool & Welding Machine	213	73	286
Assembly Equipment & Material Handling	177	0	177
Quality Assurance & Testing Unit	11	0	11
Auxiliary Unit	15	0	15
Total	416	73	489

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

MACHINE NO. AND MACHINE NAME LIST OF FIG. V-2-1 LAYOUT PLAN (GRESIK)

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
1.6	TRAVERSE TYPE RADIAL DRILLING MACHINE
1.7	C.N.C. DRILLING CENTER MACHINE
1.8	PORTABLE UNIVERSAL RADIAL DRILLING MACHINE WITH - SWIVEL AND HEAD
1.9	HORIZONTAL BORING & MILLING MACHINE
1.10	UNIVERSAL MILLING MACHINE
1.11	PLANNING MACHINE
1.12	HEAVY DUTY HUDRAULIC 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 SHARPENING FOR METAL CUTTING CIRCULAR SAW
1.17	PEDESTAL GRINDING MACHINE (DOUBLE GRINDING WHEELS)
1.19	HEAVY DUTY HYDRAULIC PRESS MACHINE
1.20	HYDRAULIC STRAIGHTENING PRESS MACHINE FOR SHAFT
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	MACHANICAL 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

NO.	MACHINE NAME
1.36	UNIVERSAL FILLING AND BAND SAW MACHINE
1.38	PIPE BEVELLING/EDGING MACHINE
1.39	AIR COMPRESSOR
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
2.8	OVERHEAD TRAVELLING CRANE 5 TONS
2.11	OVERHEAD TRAVELLING CRANE 10/3 TONS
2.15	OVERHEAD TRAVELLING CRANE 25/5 TONS
2.18	OVERHEAD TRAVELLING CRANE 50/10 TONS
2.39	PAIR OF DRUM ROTATOR WITH DRIVE MOTOR AND IDLER ROTATOR
2.40	PAIR OF IDLER DRUM ROTATOR WITHOUT DRIVE MOTOR
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
3.6	HIGH PRESSURE WATER PUMP
3.8	UNIVERSAL TESTING MACHINE
4.1	BOGIE HEARTH FURNACE
4.2	SHOT GRIT COMPARTMENT UNIT
4.3	SAND BLASTING MACHINE
4.7	ACID CLEANING EQUIPMENT

200.000

11 x @ 6.000 = 66.000 | 10.000 | 16 x @ 6.000 = 96.000 | 10.000 | 3 x @

RAW MATERIAL STORAGE YARD

25T/5T

4.7

ACID CLEANING EQUIPMENT

STRUCTURE PRE-FAB-COMPLETE WORKS STORAGE YARD

ACORDION HOUSE BLASTING & PAINTING YARD

MARKING & GAS CUTTING AREA

STRUCTURE ASSEMBLY AREA

NOZZLES ASSEMBLY AREA

CYLINDER UNIT ASSEMBLY AREA

MARKING & GAS CUTTING AREA

ASSEMBLY AREA FOR HEAD PLATE

PARTS STORAGE AREA

ASSEMBLY AREA FOR TUBE BUNDLE

ASSEMBLY AREA FOR SHELL

CIRCUM WELDING AREA

CHANNEL WELDING AREA

FINAL ASSEMBLY AREA

ASSEMBLY AREA FOR HEAVY STRUCTURE & WATER GATE ETC.

PRE-ASSEMBLY AREA

BLASTING & PAINTING ROOM

X-RAY ROOM

S/S

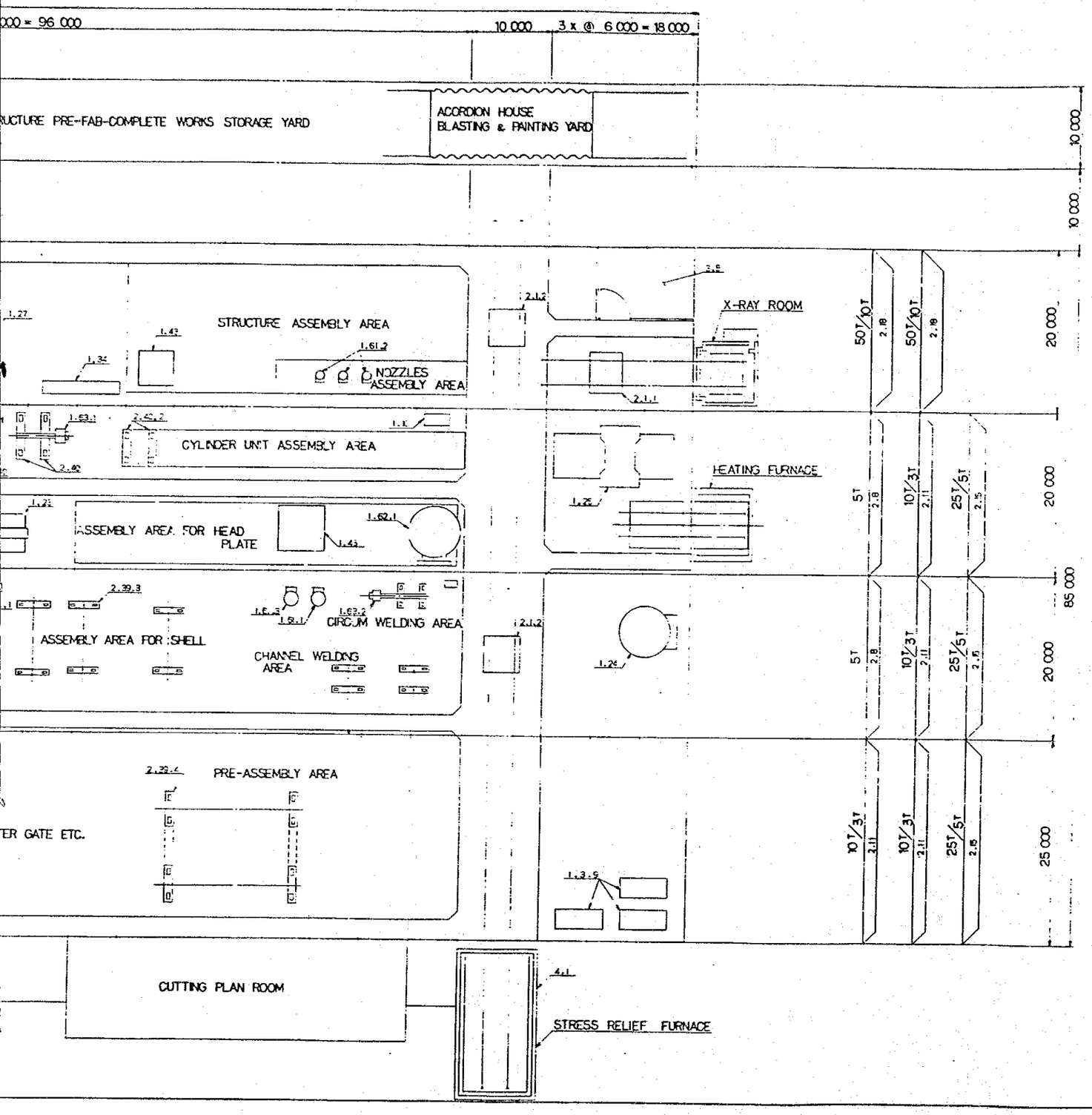
TOOLS STORAGE ROOM

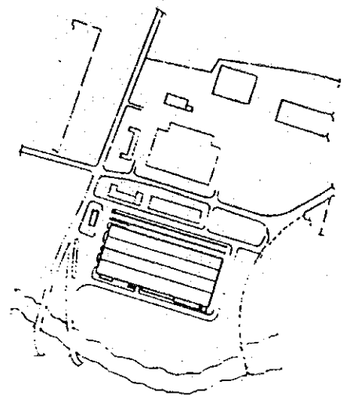
PARTS STORAGE

CUTTING PLAN ROOM

STRESS

J-30-5





KEY PLAN

NO.	MACHINE NAME	NO.	MACHINE NAME
1.1	HEAVY DUTY UNIVERSAL LATHE MACHINE	1.36	UNIVERSAL FILLING AND BAND SAW MACHINE
1.2	HEAVY DUTY FACING LATHE MACHINE	1.38	PIPE BEVELLING/EDGING MACHINE
1.3	VERTICAL BORING & TURNING MILL MACHINE	1.39	AIR COMPRESSOR
1.4	HEAVY DUTY RADIAL DRILLING MACHINE	1.43	SURFACE PLATE FOR MACHINE
1.5	VERTICAL DRILLING MACHINE PILLAR TYPE	1.44	COPIER GAS CUTTING MACHINE
1.6	TRAVERSE TYPE RADIAL DRILLING MACHINE	1.61	WELDING POSITIONER
1.7	C.N.C. DRILLING CENTER MACHINE	1.62	TURNING TABLE FOR GAS CUTTING
1.8	PORTABLE UNIVERSAL RADIAL DRILLING MACHINE WITH - SWIVEL AND HEAD	1.63	BOOM TYPE WELDING MACHINE
1.9	HORIZONTAL BORING & MILLING MACHINE	2.1	BAY TRANSFER CAR
1.10	UNIVERSAL FILLING MACHINE	2.5	30 TONS HYDRAULIC TELESCOPIC TRUCK CRANE
1.11	PLANNING MACHINE	2.8	OVERHEAD TRAVELLING CRANE 5 TONS
1.12	HEAVY DUTY HYDRAULIC HACKSAW MACHINE	2.11	OVERHEAD TRAVELLING CRANE 10/3 TONS
1.13	HEAVY DUTY HYDRAULIC CIRCULAR SAW MACHINE	2.15	OVERHEAD TRAVELLING CRANE 25/5TONS
1.14	UNIVERSAL TOOL & CUTTER GRINDING	2.18	OVERHEAD TRAVELLING CRANE 50/10 TONS
1.15	SEMIAUTOMATIC GRINDER FOR SHARPENING TWIST DRILL & CORE DRILL	2.39	PAIR OF DRUM ROTATOR WITh DRIVE MOTOR AND IDLER ROTATOR
1.16	AUTOMATIC SHARPENING FOR METAL CUTTING CIRCULAR SAWS	2.40	PAIR OF IDLER DRUM ROTATOR WITHOUT DRIVE MOTOR
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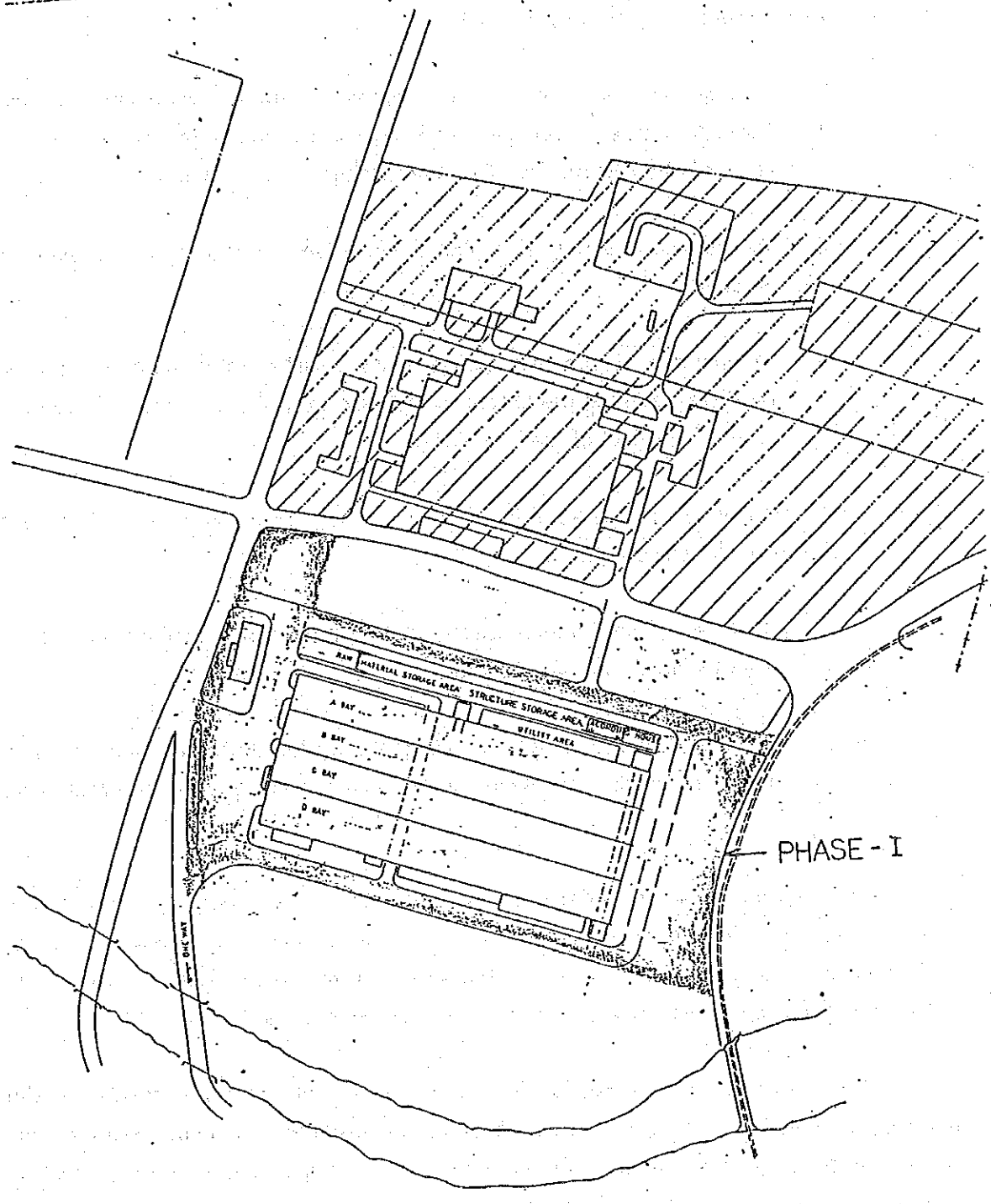
1.20	HYDRAULIC STRAIGHTENING PRESS MACHINE FOR SHAFT	3.4	PORTABLE ULTRASONIC TESTING UNIT
1.21	HYDRAULIC PRESS BRAKE MACHINE	3.5	RADIOGRAPHIC X-RAY TESTING UNIT
1.22	HORIZONTAL PROFILE STRAIGHTENING MACHINE	3.6	HIGH PRESSURE WATER PUMP
1.23	HORIZONTAL CYLINDRICAL SHELL STRAIGHTENING MACHINE	3.8	UNIVERSAL TESTING MACHINE
1.24	HEAVY DUTY HEAD FLANGING MACHINE	4.1	BOGIE HEARTH FURNACE
1.25	HEAVY DUTY HYDRAULIC PRESS MACHINE	4.2	SHOT GRIT COMPARTMENT UNIT
1.26	MECHANICAL PLATE BEND ROLLING MACHINE	4.3	SAND BLASTING MACHINE
1.27	HEAVY DUTY HYDRAULIC PIPE BENDING MACHINE	4.7	ACID CLEANING EQUIPMENT
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		

Fig. V-2-1 LAYOUT PLAN
(GRESIK)

Fig. V-2-2 LAND PREPARATION PLAN
(GRESIK)



V-3 Barata Jakarta

(1) Basic renovation program and its outline

i) Making the new production plan which is suitable for Jakarta factory through market research and shop survey conducted by the study team of the REPELITA-IV of the Indonesian Government.

ii) Making the new facilities plan in accordance with the new production program.

iii) Comparison of capacity between the existing facilities and the new facilities, making the layout of the new factory, and raising problems on the transport of the products.

iv) Checking the cost and process of the factory construction and facilities erection.

v) Checking the organization and production technology after completion of the new factory.

The purpose of the plan is to expand the plate works section of Jakarta plant which is producing steel structure and plate works, and set up the local production section.

Their product mix in the future will consist of facilities and processing, equipment for cement and sugar plants, and other items which have been produced so far as basic load. The production will be increased from about 2,000 tons/year to 10,737 tons/year and this target production will start October, 1988.

On the other hand, Jakarta factory should make such efforts as setting up the training program and improvement of the factory organization and personnel system that is required for training and education of managers, engineers, and skilled workers so as not to cause problems during the new factory construction and after completion of the new factory.

1) **Production program for each factory and product**

① Product mix of Jakarta factory

i) The product mix on which the designing of the factory production facilities are based consists of the following two items: 1) Manufacturing of sugar and cement plant equipment 2) products that have been produced at Jakarta factory under the coordination with the local society and will continuously be produced in the future (hereinafter called as "BASIC LOAD").

ii) It is important that the factory should make efforts to improve quality of products and production by enhancing production technology in relation to the products that are on the same line of products which have long been produced by fabrication section of Jakarta factory. Judging from the products type classification, Jakarta factory should concentrate on the steel structure and plate work from now on.

iii) Therefore, as shown in Table V-3-1, the product mix of Jakarta factory produces consists of 9 items to be produced in the plant and 5 items of the local construction work (here called "Site Work"). This classification of products type was used to decide the kind, the quantity and the location of facilities required.

② Production scale plan for Jakarta factory

i) Category of the products of Jakarta factory

Market research was conducted for cement plant, sugar plant and basic load, and the production scale per year was decided based on the average production forecast during 1989 through 1993. Also, domestic production of the factory facilities in

this country was checked and rate of local production items was obtained.

ii) Then, the rate of the products that can be produced at Jakarta factory was sought among the two kinds of facilities and was divided into steel structure and plate work, and production was decided for each product mix.

iii) The production of basic load in the past also was checked, and the products to be produced in the future was classified into steel structure and plate work, and production was decided for each product mix.

iv) Local production and erection of the factory facilities and basic load were decided to calculate the quantity of the required machine tools and the number of workers.

2) Load plan and required facilities

Production facilities of Jakarta factory were designed to meet 10,737 tons/year based on the production forecast during 1988 - 1993.

The demand forecast is based on the following three items. (1) Ratio of production in Indonesia in cement plant is 60% and share of BA, BI and BO is 60%, (2) rate of production in Indonesia in sugar plant is 95% and share of BA, BI and BO is 100% against the object plant (the object plant is 25% of the total) and (3) ratio of production in Indonesia in basic load is 100%.

As a result, the production forecast during 1988 through 1993 is estimated at 12,570 tons/year that can meet 100% of the production capacity and required facilities are calculated based on the following matters.

(1) Checking if the existing facilities can be used for future production

In accordance with the product mix and production program, the facilities in Jakarta factory were surveyed to check if the existing

facilities can be used for the new program. The criteria for selection of the facilities are as follows.

i) Items surveyed

They are load percentage, tolerance, workability, maintenance and modernization.

ii) Standards for classification are as follows.

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

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

Class III. Cannot produce to the required condition with only rebuild/modification.

iii) The facilities that can be used will be reused for the new production. But the facilities that are not required for the production program will not be used.

② Consideration for the new facilities

While the production capacity was determined by the product mix and production program, the required facilities were decided in accordance with the following criteria.

i) For each product mix, the following were decided.

a) Product model

b) Product time

c) Technical level forecast 5 year later

ii) Criteria for selection of the facilities.

a) The number of the required workers and production time.

b) Required machine models and the number of machines

iii) The number of the existing facilities that can be used is deducted from the number of the required facilities.

iv) Experience was utilized when deciding the above values

3) Program of reconstruction of the existing buildings and construction of the new buildings

It was learned from the survey of Jakarta factory that the factory was too small and lack of facilities for attaining the production program.

As a results of the discussion with Barata main office and Jakarta factory, it was decided to construct a new factory on both sides of Jakarta.

The layout of the factory that will produce mainly plate works and steel structure and the reuse of a part of the facilities will be explained here.

① *The basic plan of the factory layout*

The area of the plant site = 25,000 m^2

The area of the yard for materials = 400 m^2

The area of the building = 6,000 m^2

Layout: See Fig. V-3-1

Annual production = 10,737 tons/year

The facilities and the number of them required for attaining the production program were decided in 2)(2). Then, based on the data the layout was made in accordance with the following procedure.

i) Securing the required work area.

ii) Decision of the appropriate location of the facilities and product flow.

iii) Decision of the shape of the building.

iv) Consideration of the material storage yard and route through which products are passed.

v) Minimization of the material handling.

(2) Production and inspection facilities

i) Production facilities

In the order of preparation, machining, forming, welding and assembly, the following 6 items were checked. Summary of production facilities is shown on Table V-3-4.

a) Preparation facilities and auxiliary facilities

b) Machine tools

c) Forming facilities

d) Welding machines and equipment

e) Assembly tools

f) Overhead travelling crane

Note: a) through e) include the existing facilities of Jakarta factory that can be reused.

ii) Inspection facilities

Inspection plays an important role in quality assurance system. At present, inspection is made by outside inspectors but it is recommendable that it should be done inside the plant by installing the facilities in the future.

The facilities consist of the following items:

a) Non-destructive examination facilities for inspecting mainly the weld.

b) Facilities for testing materials

c) Measuring instruments

③ The basic plan of auxiliary facilities

The auxiliary facilities corresponding to property of the product will be required. The following 4 items were studied at Jakarta factory. The facilities have capability corresponding to the type of the product.

a) Heat treating furnaces

b) Shot blasting

c) Acid cleaning facilities

d) Painting facilities

④ The basic plan of the utility facilities

i) The following electrical facilities will be provided

a) The existing substation transformer will be reused and new survice station will be made.

b) Telephone (60 sets of the telephone set)

c) Paging system

d) Broadcasting equipment

e) Lighting equipment inside and outside of the building.

f) Fire alarm facilities (office only).

g) Emergency generator (emergency lamp only).

h) Air conditioning equipment in the office.

ii) Eight location lines will be provided for the machine tools and auxiliary equipment.

iii) Sewage and wastewater treatment

a) Sanitary sewage treatment includes treatment facilities

b) Acid cleaning include neutralizer

4) Factory construction and erection plan

The factory will be on both sides of the existing Jakarta factory and new facilities will be installed. To minimize the influence the production schedule, the construction will be divided into proper periods.

① Land preparation (refer to the attached drawing Fig. V-3-2)

Whether smooth factory construction and operation can be achieved will depend on this key point.

i) The total site area is 25,000 m^2, and the area to be prepared is 12,100 m^2.

ii) The sand will be piled 1 m high.

② The ground and piles

After preparation of the plant site is completed, hammer PC piles. The shape of piles is ϕ35 cm × 10 or 15 m (L). This is used for the foundation for machines.

③ Building

Steel structure will be adopted mainly. The concrete structure will be used for x-ray room, stress relief furnace, heating furnace and waste treatment facilities. The construction includes the office.

④ Facilities erection plan

i) The erection of the large, midium and small facilities will be constructed separately to shorten construction period. Delivery condition is after completion of test run of the facilities after erection.

ii) The erection of all the facilities will be completed in October, 1988 as shown in Table V-3-2. The preparation of the plant site, civil construction and building construction will be important to attain the target.

⑤ Supervisors to be sent

The supervisors to be sent and supervisors in Indonesia will be considered in relation to be following matters.

i) Civil construction (including preparing the site)

ii) Building construction

iii) Facilities installation

iv) Electrical wiring construction

v) Piping construction in the building

The duty of the supervisors will be finished upon completion of the erection construction. The supervisors of suppliers will be sent for the test run of the important machines but not for the general machines which require only the Operation Manual in English.

(2) Renovation promotion program

1) Outline of the renovation promotion program

In accordance with the basic plan mentioned so far, this chapter describes the details on the hardware of the renovation promotion program.

① Comparison between before and after renovation

To check productivity, the production per unit area and that per direct worker were compared. The results are as follows.

	Before renovation (a)	After renovation (b)	Ratio (b/a)
Production per unit area (ton/year/m^2)	0.38	0.88	2.32
Production per direct worker (ton/year/man)	13.90	32.5	2.34

② Factory layout

In accordance with the calculated plant area, using the exsisting building, one bay on the north side (24 m × 79 m) and two bays (24 m × 79 m × 2 bays) were extended. Existing facilities that can be reused will be reused without changing the location of them.

i) Explanation of each bay

A-Bay: Fining, assembly, testing and painting area for A.F.C.
B-Bay: Header fabrication area for A.F.C.
C-Bay : Pre-fabrication and assembly area for structure
D-Bay
E-Bay: Assembly and testing of heavy vessel and structure
G-Bay: Preparation, forming, assembly of cylinder for plate work.

ii) Storage area

Storage of raw material and completed prefabrication structure and blasting and painting area will be constructed on one line. Gantry crane (25 t/5 t) is planned for handling.

iii) Layout of equipment

a) Special machine is located in each Bay in accordance with the manufacturing process flow of the products.

b) A.F.C. is located in A-Bay and B-Bay in accordance with manufacturing process flow.

c) Machine for machining light structure is located in C-Bay.

d) General purpose machine tools are located in E-Bay that is machine works at present.

e) Heating furnace for Plate works and intermediate X-ray room are located in G-Bay, and X-ray room and stress relief furnace for after-assembly are located outside F-Bay, all according to corresponding manufacturing flow.

f) Material testing equipment required for plate works in the west of D-Bay.

g) Blasting, painting and packing of plate works and water gate will be conducted in F-bay.

h) Acid cleaning equipment required for production flow of A.F.C and stainless steel is located outside of the building considering the waste water treatment.

i) The existing bay transfer will be reused.

2) Construction cost

The details of the investment required for the renovation is shown in Table 4-3 Summary of investment cost. But the cost does not include the cost to use the existing organization and the labor charge of the workers during the training period.

3) Renovation project promotion system

Once the project promotion is decided, the factory is obliged to assure the smooth realization of the renovation without causing troubles and problems; the factory shall carry out (1) designing of the new factory,

selection of the parts to be purchased, (2) control and supervision of the construction schedule such as preparation of the plant site, construction of the building, erection of the facilities and training of the managers, engineers, and workers for smooth start-up and operation of the factory.

4) Details of actual work

① Work items

As shown in Table V-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.

i) 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.

ii) 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 V-3-2)

(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) Boring & milling (3) Planer (4) Press (5) Flanging machine (6) Bending roll and (7) Furnace

6) *Renovation promotion schedule table*

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

(3) Production management and training

The basic items on software required for attaining the development plan mentioned so far is explained here,. The stabilization of the production management system, quality control system and training system will make possible realization of the development plan.

1) Production management system

Judging from the technical diagnoses results the following counter-measures will be required.

① Production management system is required to attain the production as planned. The system should be able to conduct the follow-up of the daily plan and take measures (for example over time work) if the plan is delayed and check the delivery of parts.

② As a means to avoid the delay of delivery, the pile-up plan should be made for grasping the production of the total plan or each kind of job. The plan makes it easy to catch the machine or job that can be bottleneck of the production schedule and take countermeasures.

③ As for the production technique, as the product mix changes, the thick plate is used. So the technique on forming, heat treatment, and selection of welding method and materials, and prevention of the weld cracks will be required.

In order to improve the production management and production technology, training of the staffs will be vitally important. And the point of the training will be to make them master the specific technique required for the specific product in each section. For attaining this purpose, technical tie-up and assistance contracts made with other countries or parties will be necessary. But the program does not include this cost.

2) Quality control system

The quality control manual is available at Jakarta factory. Important is that this manual is followed by all the workers. For this purpose, the P.D.C.A circle should be passed on to all the workers.

As the thick plate is used, the following matters will be required:

i) To correspond to the increased non-destructive examination

ii) To take countermeasures against the weld defects such as weld cracks

Therefore, for (i) the plant should have its own qualified inspectors and for (ii) it should have the quality control specialists who are knowledgable on the materials and production technology to maintain the quality of the products.

Also, the data on failures and claims should be collected and kept carefully for improving the quality of the products.

3) Safety management system

① The base for safety management is arrangement and cleaning of the plant but these are not followed necessarily at present. So it is necessary to make all the members cultivate consciousness of these matters.

② To avoid the accidents such as gas explosion, training and education of the workers who operate crane, slinging workers and other workers will be important.

4) Maintenance

① The maintenance manual is necessary for fulfilling the daily and periodical inspection of each machine, equipment and instrument. In the manual, inspection items, time and date, portion to be inspected should be clarified.

② Also, the workers should inspect and service the apparatus, tools, and other equipment to improve the quality of the products and production efficiency.

5) After sales service

The after sales service is related to the following.

① New order of repair and reconstruction

② New order of extension and new construction

Also, as a result, the following will be made possible and it will help improving engineering, quality control and production technology. Therefore, it will be necessary to have the salesmen who have technical knowledge on the products in the future.

6) Engineering

To meet the new production program at Jakarta factory, the following could be considered.

① As for the new production technology for heat exchangers and pressure vessels, technical tie-up and assistance contracts with foreign companies will be necessary.

② As for the products that have been produced by the plant, improvement of design and production technology will be necessary.

③ Capability of designing of the good quality products at low cost including the design of production will be required in the future.

④ Cultivation and education of the designers and engineers who can select materials and instruct the dimension required for the products on the drawing.

7) Training

Training of the production management and engineers is mentioned in 1) - 6).

It is urgently required to train the workers to correspond to the increase of the production and new facilities.

8) Organization and personnel

① Since Jakarta factory is close to the main office, the general affair section uses the main office organization and its organization is simple.

② The quality control section belongs to the marketing department at present. But since the production of the heat exchangers and pressure vessels is expected to increase, the quality control is important and consequently the section will be independent.

③ The number of direct workers is calculated and decided in the method shown in (1) 2)②.

④ Indirect personnel is decided by our experience. The administrative section is decided by estimation. For the purpose the main office should be used as much as possible and the section should be minimized.

Table V-3-1

FORECAST OF PRODUCT MIX — P.T. BARATA INDONESIA; JAKAKTA FACTORY — ANNUAL PRODUCT CONDITION IN 1989 ~ 1993

UNIT; TON/YEAR

TYPE OF PRODUCT		STEEL CONSTRUCTION	PLATE WORK	TOTAL	BASIC LOAD	SUGAR PLANT
a. STEEL STRUCTURE	a.1 General structures	1,000	50	1,050	1,050	
	a.2 Bridges and similar structures	960	48	1,008	1,008	
	a.3 Industrial structures	355	0	355		355
	a.4 Water gates and structures for water engineering	500	500	1,000	1,000	
	a.5 Conveyors	500	500	1,000	1,000	
b. PLATE WORKS	b.1 Palm oil plant equipment	800	1,000	1,800	1,800	
	b.2 Sugar plant equipment	0	1,400	1,400		1,397
	b.3 Fertilized and petrochemical industry	374	600	974	974	
	b.4 Power plant equipment	50	1,000	1,050	1,050	
	b.5 Air fin cooler	50	1,050	1,100	1,100	
	b.6					
	b.7					
SUB TOTAL		4,589	6,148	10,737	8,982	1,752
c. SITE WORK	c.1 General industries	2,600	0	2,600		2,600
	c.2 Vessels (pressure and atmospheric, vacuum)	0	90	90		91
	c.3 Tanks of different design	0	300	300	180	122
	c.4 Silos, bins, containers hoppers, ducts, chutes etc.	50	450	500	500	
	c.5 Pipe works	0	210	210		207
SUB TOTAL		2,650	1,050	3,700	680	3,020
T O T A L		7,239	7,198	14,437	9,662	4,772

Table V-3-2

Construction Schedule

P.T. BARATA, JAKARTA FACTORY

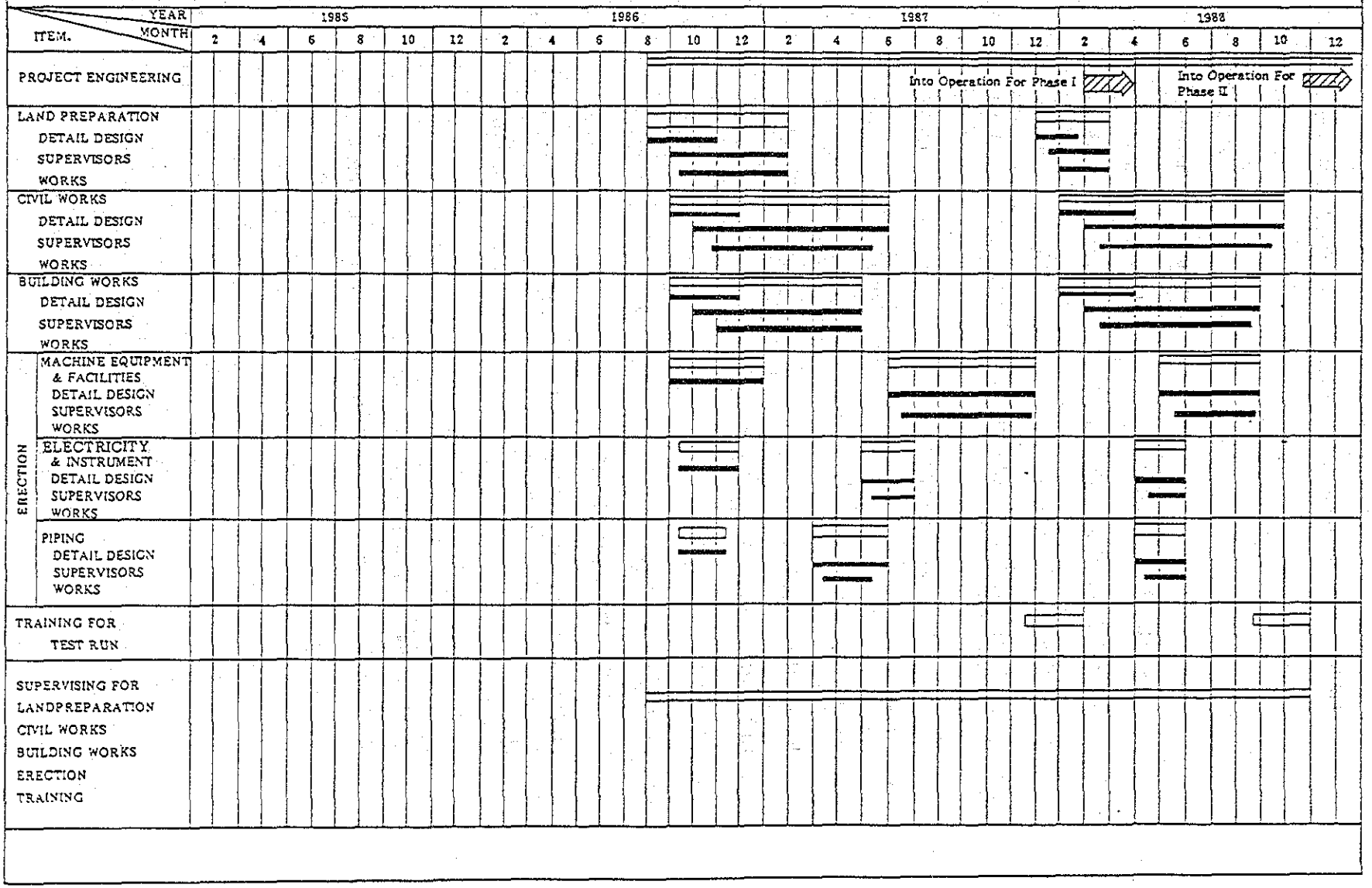


Table V-3-3 Summary of Investment Cost for P.T. Barata Jakarta

UNIT: 1,000,000 YEN

ITEM	FOREIGN	DOMESTIC	TOTAL
1. MACHINERY & EQUIPMENT	3,340.35		3,340.35
2. ELECTRICITY & INSTRUMENT	174.32	321.54	495.86
3. LAND PREPARATION	9.96	95.79	105.75
4. OCEAN FREIGHT, INSURANCE & LOCAL HANDLING	217.75	51.64	269.39
5 INLAND TRANSPORTATION		48.92	48.92
6. CIVIL	66.91	339.33	406.24
7. ERECTION	13.76	261.23	274.99
8. BUILDING (PLANT & OTHERS)	103.19	593.66	696.85
9. BUILDING (OFFICE)	5.43	31.24	36.67
10. OTHERS	305.43	5.38	310.81
11. ENGINEERING FEE	339.18	77.18	416.36
12. CONSTRUCTION EXPENSES		126.09	126.09
13. PHYSICAL CONTINGENCIES	137.29	136.64	273.93
TOTAL	4,713.57	2,088.64	6,802.21

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

(JAKARTA FACTORY)

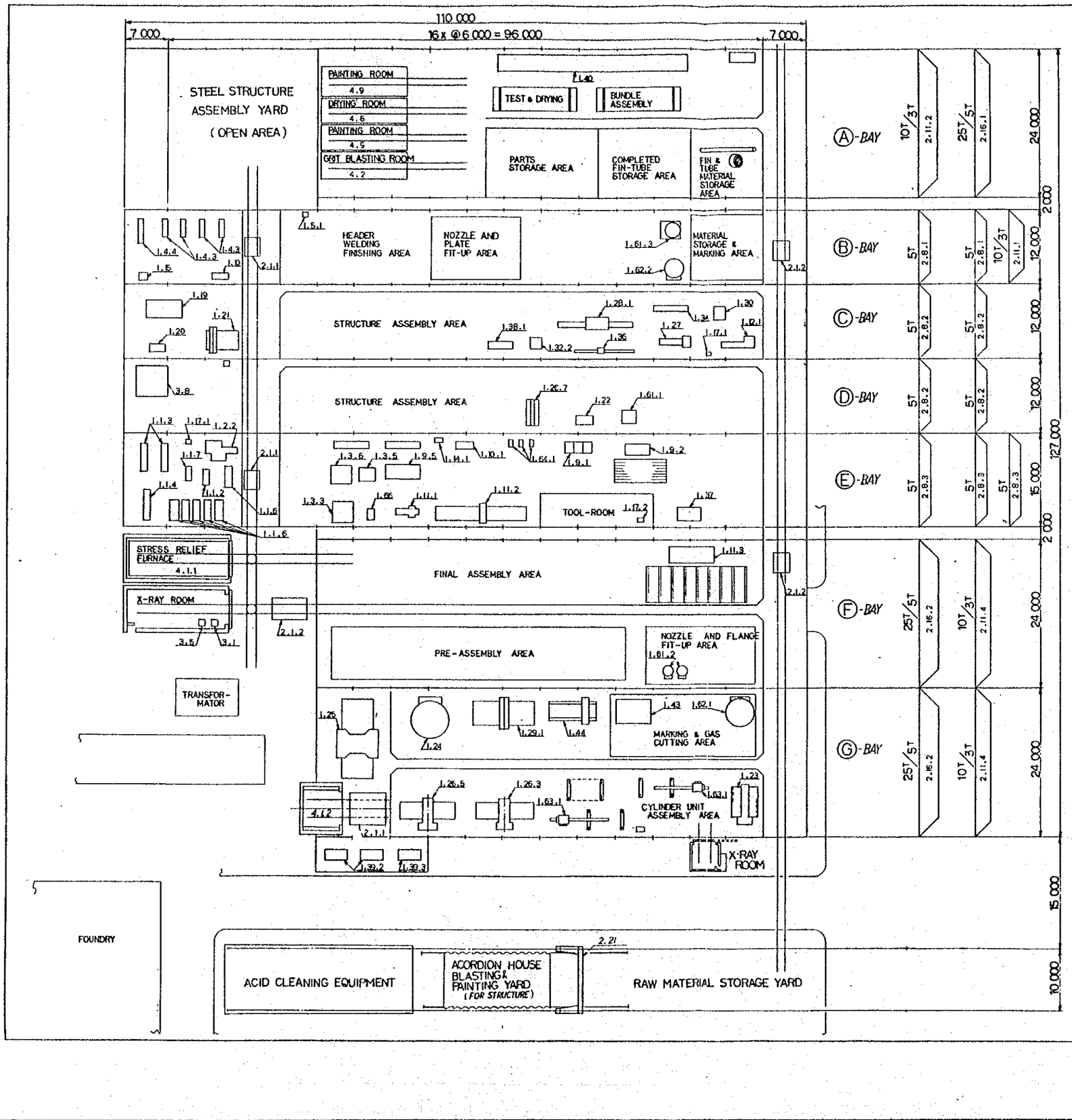
Table V-3-4 SUMMARY OF PRODUCTION FACILITIES

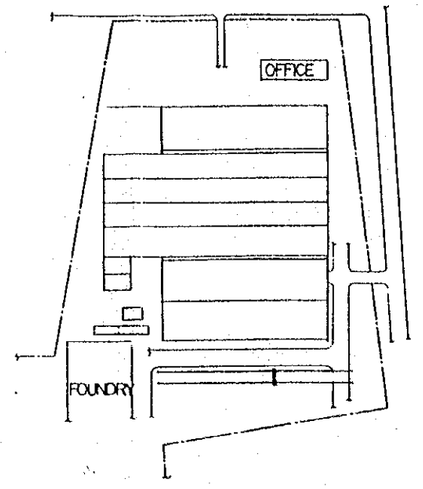
Item	New Facilities	Usable Existing Machine	Total
Machine Tool & Welding Machine	164	66	230
Assembly Equipment & Material Handling	135	0	135
Quality Assurance & Testing Unit	10	0	10
Auxiliary Unit	18	0	18
Total	327	66	393

MACHINE NO. AND MACHINE NAME LIST OF FIG. V-3-1 LAYOUT PLAN (JAKARTA)

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
1.8	PORTABLE UNIVERSAL RADIAL DRILLING MACHINE WITH - SWIVEL RAM AND HEAD
1.9	HORIZONTAL BORING & MILLING MACHINE
1.10	UNIVERSAL MILLING MACHINE
1.12	HEAVY DUTY HYDRAULIC HACKSAW MACHINE
1.14	UNIVERSAL TOOL & CUTTING GRINDING
1.15	SEMIAUTOMATIC GRINDER FOR SHARPENING TWIST DRILL & CORE DRILL
1.17	PEDESTAL GRINDING MACHINE (DOUBLE GRINDING WHEELS)
1.19	HEAVY DUTY HYDRAULIC PRESS MACHINE
1.20	HYDRAULIC STRAIGHTENING PRESS MACHINE FOR SHAFT
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 SEARING 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
1.37	KEY SEATING MACHINE
1.38	PIPE BEVELLING/EDGING MACHINE
1.39	AIR COMPRESSOR
1.40	MECHANICAL TUBE FINNING MACHINE

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
1.64	SHAPING MACHINE
1.66	SLOTTING MACHINE
2.1	BAY TRANSFER CAR
2.5	30 TONS HYDRAULIC TELESCOPIC TRUCK CRANE
2.8	OVERHEAD TRAVELLING CRANE 5 TONS
2.11	OVERHEAD TRAVELLING CRANE 10/3 TONS
2.16	OVERHEAD TRAVELLING CRANE 25/5 TONS
2.21	GANTRY CRANE 25/5 TONS
2.39	PAIR OF DRUM ROTATOR WITH DRIVE MOTOR AND IDLER ROTATOR
2.40	PAIR OF IDLER DRUM ROTATOR WITHOUT DRIVE MOTOR
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
3.6	HIGH PRESSURE WATER PUMP
3.8	UNIVERSAL TESTING MACHINE
4.1	BOGIE HEARTH FURNACE
4.2	SHOT GRIT COMPARTMENT UNIT
4.3	SAND BLASTING MACHINE
4.7	ACID CLEANING EQUIPMENT
4.8	DRYING CHAMBER
4.9	PAINTING CHAMBER

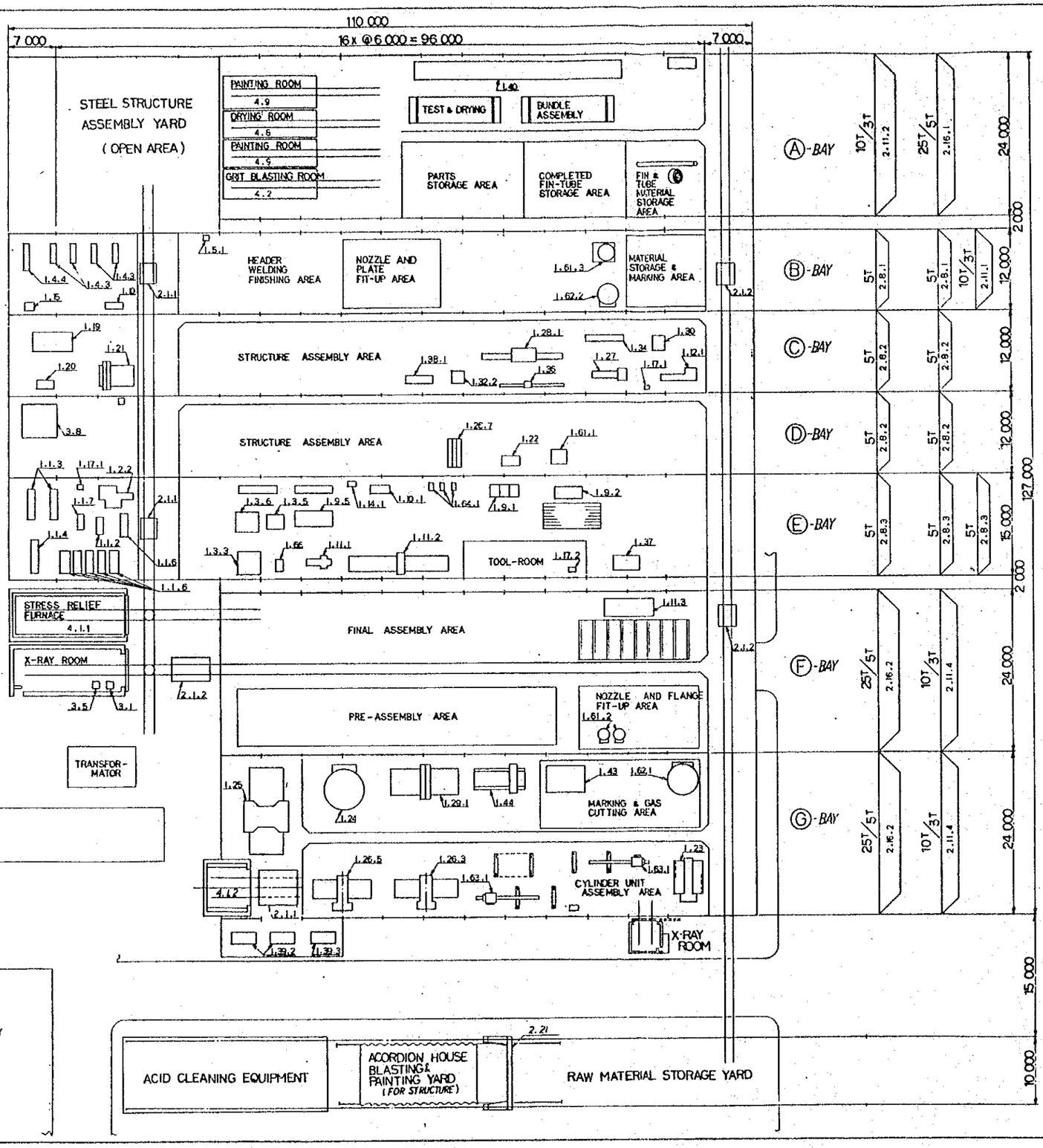


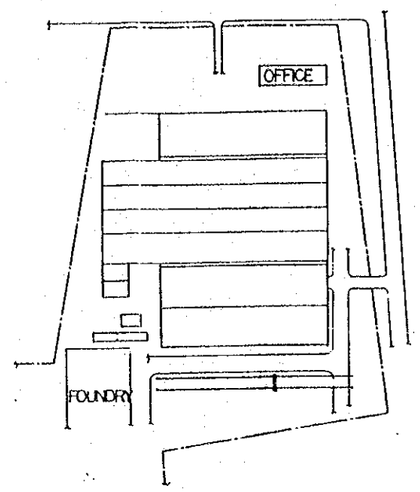


KEY PLAN

NO.	MACHINE NAME	NO.	MACHINE NAME
1.1	HEAVY DUTY UNIVERSAL LATHE MACHINE	1.61	WELDING POSITIONER
1.2	HEAVY DUTY FACING LATHE MACHINE	1.62	TURNING TABLE FOR GAS CUTTING
1.3	VERTICAL BORING & TURNING MILL MACHINE	1.63	BOOM TYPE WELDING MACHINE
1.4	HEAVY DUTY RADIAL DRILLING MACHINE	1.64	SHAPING MACHINE
1.5	VERTICAL DRILLING MACHINE PILLAR TYPE	1.66	SLOTTING MACHINE
1.8	PORTABLE UNIVERSAL RADIAL DRILLING MACHINE WITH SWIVEL RAM AND HEAD	2.1	BAY TRANSFER CAR
		2.5	30 TONS HYDRAULIC TELESCOPIC TRU
1.9	HORIZONTAL BORING & MILLING MACHINE	2.8	OVERHEAD TRAVELLING CRANE 5 TONS
1.10	UNIVERSAL MILLING MACHINE	2.11	OVERHEAD TRAVELLING CRANE 10/3 T
1.12	HEAVY DUTY HYDRAULIC HACKSAW MACHINE	2.16	OVERHEAD TRAVELLING CRANE 25/5 T
1.14	UNIVERSAL TOOL & CUTTING GRINDING	2.21	GANTRY CRANE 25/5 TONS
1.15	SEMIAUTOMATIC GRINDER FOR SHARPENING TWIST DRILL & CORE DRILL	2.39	PAIR OF DRUM ROTATOR WITH DRIVE IDLER ROTATOR
1.17	PEDESTAL GRINDING MACHINE (DOUBLE GRINDING WHEELS)	2.40	PAIR OF IDLER DRUM ROTATOR WITHO DRIVE MOTOR
1.19	HEAVY DUTY HYDRAULIC PRESS MACHINE	3.1	PORTABLE COBALT UNIT AND PORTABL
1.20	HYDRAULIC STRAIGHTENING PRESS MACHINE FOR SHAFT	3.3	COMPLETE SET PORTABLE MAGNETIC P INSPECTION EQUIPMENT
1.21	HYDRAULIC PRESS BRAKE MACHINE	3.4	PORTABLE ULTRASONIC TESTING UNIT
1.22	HORIZONTAL PROFILE STRAIGHTENING MACHINE	3.5	RADIOGRAPHIC X-RAY TESTING UNIT
1.23	HORIZONTAL CYLINDRICAL SHELL STRAIGHTENING MACHINE	3.6	HIGH PRESSURE WATER PUMP
1.24	HEAVY DUTY HEAD FLANGING MACHINE	3.8	UNIVERSAL TESTING MACHINE
1.25	HEAVY DUTY HYDRAULIC PRESS MACHINE	4.1	BOGIE HEARTH FURNACE
1.26	MECHANICAL PLATE BEND ROLLING MACHINE	4.2	SHOPT GRIT COMPARTMENT UNIT
1.27	HEAVY DUTY HYDRAULIC PIPE BENDING MACHINE	4.3	SAND BLASTING MACHINE
1.28	HYDRAULIC BENDING MACHINE	4.7	ACID CLEANING EQUIPMENT
1.29	MECHANICAL PLATE SEARING MACHINE	4.8	DRYING CHAMBER
1.30	MECHANICAL UNIVERSAL STEEL WORKER MACHINE	4.9	PAINTING CHAMBER
1.32	PUNCHING MACHINE		
1.34	MECHANICAL PLATE FORMING MACHINE		
1.36	UNIVERSAL FILLING AND BAND SAW MACHINE		
1.37	KEY SEATING MACHINE		
1.38	PIPE BEVELLING/EDGING MACHINE		
1.39	AIR COMPRESSOR		
1.40	MECHANICAL TUBE FINNING MACHINE		
1.43	SURFACE PLATE FOR MARKING		
1.44	COPIER GAS CUTTING MACHINE		

Fig. V-3-1 LAYOUT PLA
(JAKA



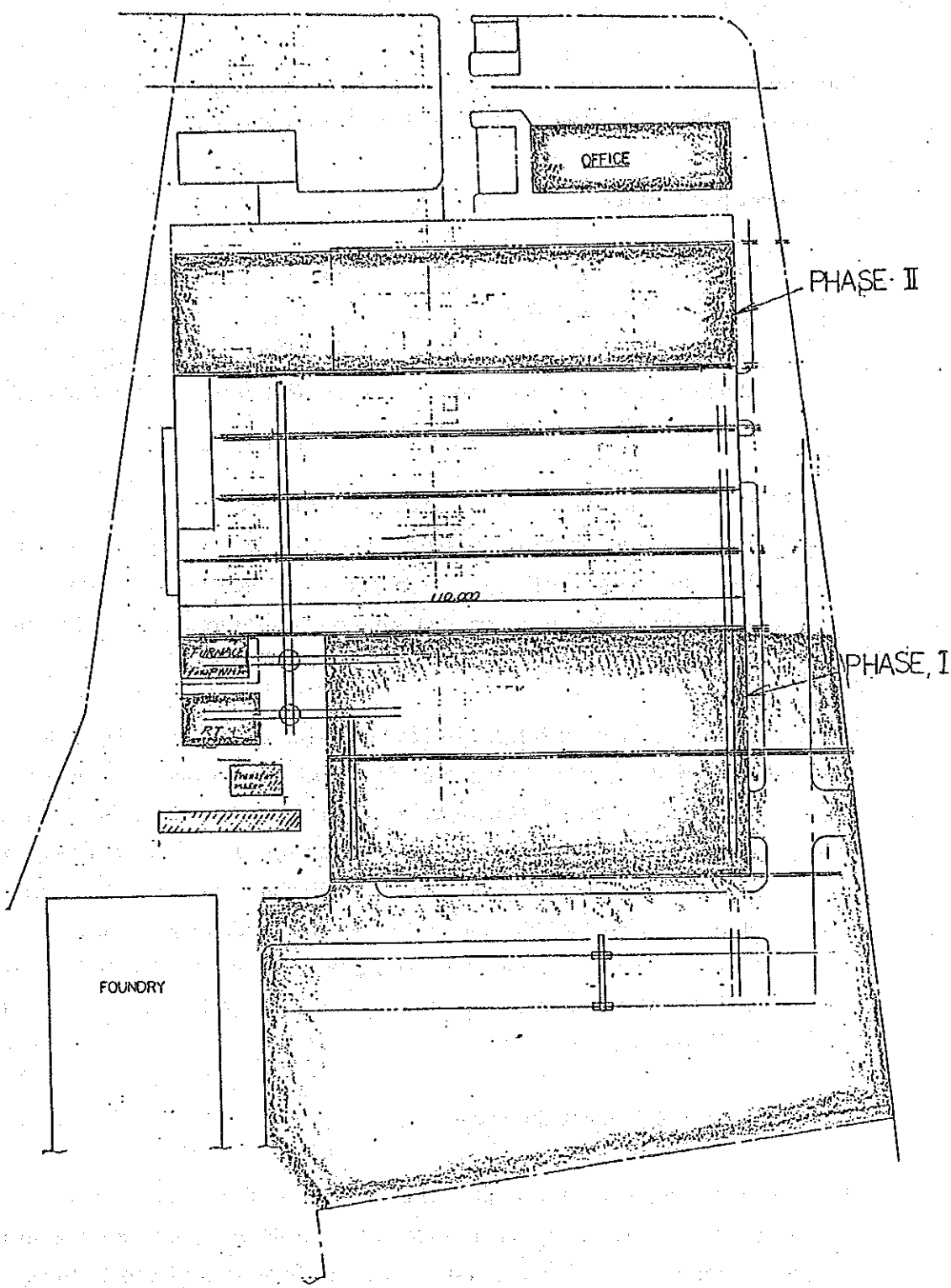


KEY PLAN

NO.	MACHINE NAME	NO.	MACHINE NAME
1.1	HEAVY DUTY UNIVERSAL LATHE MACHINE	1.61	WELDING POSITIONER
1.2	HEAVY DUTY FACING LATHE MACHINE	1.62	TURNING TABLE FOR GAS CUTTING
1.3	VERTICAL BORING & TURNING MILL MACHINE	1.63	BOOM TYPE WELDING MACHINE
1.4	HEAVY DUTY RADIAL DRILLING MACHINE	1.64	SHAPING MACHINE
1.5	VERTICAL DRILLING MACHINE PILLAR TYPE	1.66	SLOTTING MACHINE
1.8	PORTABLE UNIVERSAL RADIAL DRILLING MACHINE WITH SWIVEL RAM AND HEAD	2.1	BAY TRANSFER CAR
1.9	HORIZONTAL BORING & MILLING MACHINE	2.5	30 TONS HYDRAULIC TELESCOPIC TRUCK CRANE
1.10	UNIVERSAL MILLING MACHINE	2.8	OVERHEAD TRAVELLING CRANE 5 TONS
1.12	HEAVY DUTY HYDRAULIC BACKSAW MACHINE	2.11	OVERHEAD TRAVELLING CRANE 10/3 TONS
1.14	UNIVERSAL TOOL & CUTTING GRINDING	2.16	OVERHEAD TRAVELLING CRANE 25/5 TONS
1.15	SEMIAUTOMATIC GRINDER FOR SHARPENING TWIST DRILL & CORE DRILL	2.21	GANTRY CRANE 25/5 TONS
1.17	PEDESTAL GRINDING MACHINE (DOUBLE GRINDING WHEELS)	2.39	PAIR OF DRUM ROTATOR WITH DRIVE MOTOR AND IDLER ROTATOR
1.19	HEAVY DUTY HYDRAULIC PRESS MACHINE	2.40	PAIR OF IDLER DRUM ROTATOR WITHOUT DRIVE MOTOR
1.20	HYDRAULIC STRAIGHTENING PRESS MACHINE FOR SHAFT	3.1	PORTABLE COBALT UNIT AND PORTABLE IDIDUM UNIT
1.21	HYDRAULIC PRESS BRAKE MACHINE	3.3	COMPLETE SET PORTABLE MAGNETIC PARTICLE INSPECTION EQUIPMENT
1.22	HORIZONTAL PROFILE STRAIGHTENING MACHINE	3.4	PORTABLE ULTRASONIC TESTING UNIT
1.23	HORIZONTAL CYLINDRICAL SHELL STRAIGHTENING MACHINE	3.5	RADIOGRAPHIC X-RAY TESTING UNIT
1.24	HEAVY DUTY HEAD FLANGING MACHINE	3.6	HIGH PRESSURE WATER PUMP
1.25	HEAVY DUTY HYDRAULIC PRESS MACHINE	3.8	UNIVERSAL TESTING MACHINE
1.26	MECHANICAL PLATE BEND ROLLING MACHINE	4.1	BOGIE HEARTH FURNACE
1.27	HEAVY DUTY HYDRAULIC PIPE BENDING MACHINE	4.2	SHOPT GRIT COMPARTMENT UNIT
1.28	HYDRAULIC BENDING MACHINE	4.3	SAND BLASTING MACHINE
1.29	MECHANICAL PLATE SEARING MACHINE	4.7	ACID CLEANING EQUIPMENT
1.30	MECHANICAL UNIVERSAL STEEL WORKER MACHINE	4.8	DRYING CHAMBER
1.32	PUNCHING MACHINE	4.9	PAINTING CHAMBER
1.34	MECHANICAL PLATE FORMING MACHINE		
1.36	UNIVERSAL FILLING AND BAND SAW MACHINE		
1.37	KEY SEATING MACHINE		
1.38	PIPE BEVELLING/EDJING MACHINE		
1.39	AIR COMPRESSOR		
1.40	MECHANICAL TUBE FINNING MACHINE		
1.43	SURFACE PLATE FOR MARKING		
1.44	COPIER GAS CUTTING MACHINE		

Fig. V-3-1 LAYOUT PLAN (JAKARTA)

Fig. V-3-2 LAND PREPARATION PLAN
(JAKARTA)



V-4 Barata Tegal Workshop

(1) Investment cost

The investment cost for the renovation of Tegal workshop is as shown in the attached Table V-4-1, refer to the Chapter 4 Para. 4.4.4 for the details.

1) Production facility

① The new installation of the fabrication machineries includes the special machine for the cane mill, the floor type boring machine, the vertical lathe, bevel gear shaper and others. The investment cost including the cost for the foundation and installation cost amounted to 1,202.7 million yen (RP 5,183.6 mil.).

② The new installation of the plate work facility includes the hydraulic press and the bending roller for the plate forming, the flame planer for the plate cutting, the submerge welder, turning roller and manipulator for the automatic welding, and others. The investment cost amounted to 219.2 million yen (RP 944.7 mil.)

③ The improvement/rehabilitation of existing facilities such as the reforming of belt-driving machines, cutting capacity improvement and/or accuracy adjustment of the deteriorated machines is estimated in amount of 154.2 million yen (Parts supply and supervision cost 89.8 million yen., the modification and repair work cost 64.4 million yen), provided that the modification and repair work as well as the final assembly and adjustment is undertaken by P.T. Barata Indonesia with the supplied substitution parts and under the supervision by the facilities supplier.

④ Table V-4-2 shows the above.

2) The reinforcement and modification of the workshop buildings shall be executed in Indonesia in accordance with the drawing and the execution supervision of the D/D consultant. Special illuminations and trolleys for the crane are placed in the foreign portion.

3) The D/D consultant cost is minimized in the investment cost on condition that some of the pre-engineering survey and measurement and the detailed design drawings should be partially undertaken by Indonesian engineering sub-contractors, but under the single responsibility of the D/D consultant.

4) As for the educational training cost, only the cost for the consultant whose training is related to the production techniques and the quality control is appropriated in this subject. The skill training which shall be continuously rendered by the suppliers after the commissioning is appropriated in the facility cost as the erection and commissioning fee.

(2) Principal improvements

The expected effect after the execution of the renovation is to materialize the aim of this renovation plan. The concrete points of the effect, including indirect effects, are presumed as follows.

1) Reinforcement of the production capacity.

① The improved workshop layout and the reinforced transportation facility shall enlarge the effective operation area and increase the production capacity remarkably as accompanied by the extension and modification of the production facility.

② The newly installed plate forming equipment and the floor type boring/milling machine shall enlarge the production range and facilitate the order taking activity.

2) Enhancement of the productivity

① The drastic modification of the layout shall greatly shorten the fabrication flow to a great extent and eliminate the extra handling stages.

② The reinforced transportation facility shall greatly shorten the inter-handling time and reduce the crane-waiting-loss-hours.

③ The introduction of the modernized facility equipments, the modification of the present facility equipments, and the educational training program shall result in shortened fabrication time, and lowered mis-fabrication rate.

3) Improvement of the quality

① The multiplied effect from the completion of the inspection equipments and tools and the reinforcement of the quality control system shall yield high quality products and enhance the credit in the market and expedite order taking activity.

② The advanced inspection shall be thoroughly executed to make the early-stage detection of the defects and prompt delivery possible.

(3) Workshop layout and implementation schedule

1) Workshop layout

Points of improvement in the workshop layout is as stated in the preceding chapter, though the summary of the new layout is shown in the attached Figure V-4-1. Refer to the chapter 4 for the detailed layout of the production facilities.

2) Implementation schedule

The renovation execution process shown in Figure V-4-2 is based on the requirements described in the preceding chapter. According to the process, the renovated facilities actually commence the operation at the beginning of 1988. And the result of the training program shall be evaluated by March 1989.

Table V-4-1 Summary of Investment Cost

BARATA TEGAL GENERAL WORK SHOP

ITEM	FOREIGN PORTION (MIL.YEN)	DOMESTIC PORTION (MIL. YEN)	TOTAL (MIL. YEN)	Remarks*
1. Machine tool	1,108.6	94.1	1,202.7	Table 4-2
2. Steel fabrication equipment	191.5	27.7	219.2	Table 4-2
3. Miscellaneous equipment, tool etc.	112.1	0.5	112.6	Table 4-2
4. Handling equipment	65.5	6.5	72.0	Table 4-2
5. Machinery reforming	89.8	64.4	154.2	Table 4-3
6. Building & miscellaneous facilities	6.2	50.8	57.0	Table 4-4
7. Electrical & utility facilities	40.0	36.6	76.6	Table 4-4
(Subtotal-1)	(1,613.7)	(280.6)	(1,894.3)	
8. Detailed designing	47.6	22.4	70.0	Table 4-5
9. Implementing body	-	22.7	22.7	
10. Training	96.4	37.4	133.8	
(Subtotal-2)	(144.0)	(82.5)	(226.5)	
11. Contract tax	-	245.7	245.7	
12. Contingency				
12-1 Phisical	52.7	25.4	78.1	
12-2 Escalation	109.7	148.2	257.9	
(Subtotal-3)	(162.4)	(419.3)	(581.7)	
TOTAL	1,920.1	782.4	2,702.5	

Remarks* : Details are specified in the Tables under Chapter 4 para. 4.4.4. of the Report.

Table V-4-2 Summary of Production Facilities

(BARATA - TEGAL WORKSHOP)

(UNIT; SETS)

	NEW FACILITIES	RE-USE OF EXISTING FACILITIES		TOTAL
		TO BE IMPROVED	AS IT IS	
1. MACHINING FACILITIES	20	9	31	60
2. TOOL GRINDING MACHINES, ETC.	7	-	-	7
3. PLATE WORK FACILITIES	31	2	14	47
4. HANDLING FACILITIES	12	1	4	17
TOTAL	70	12	49	131

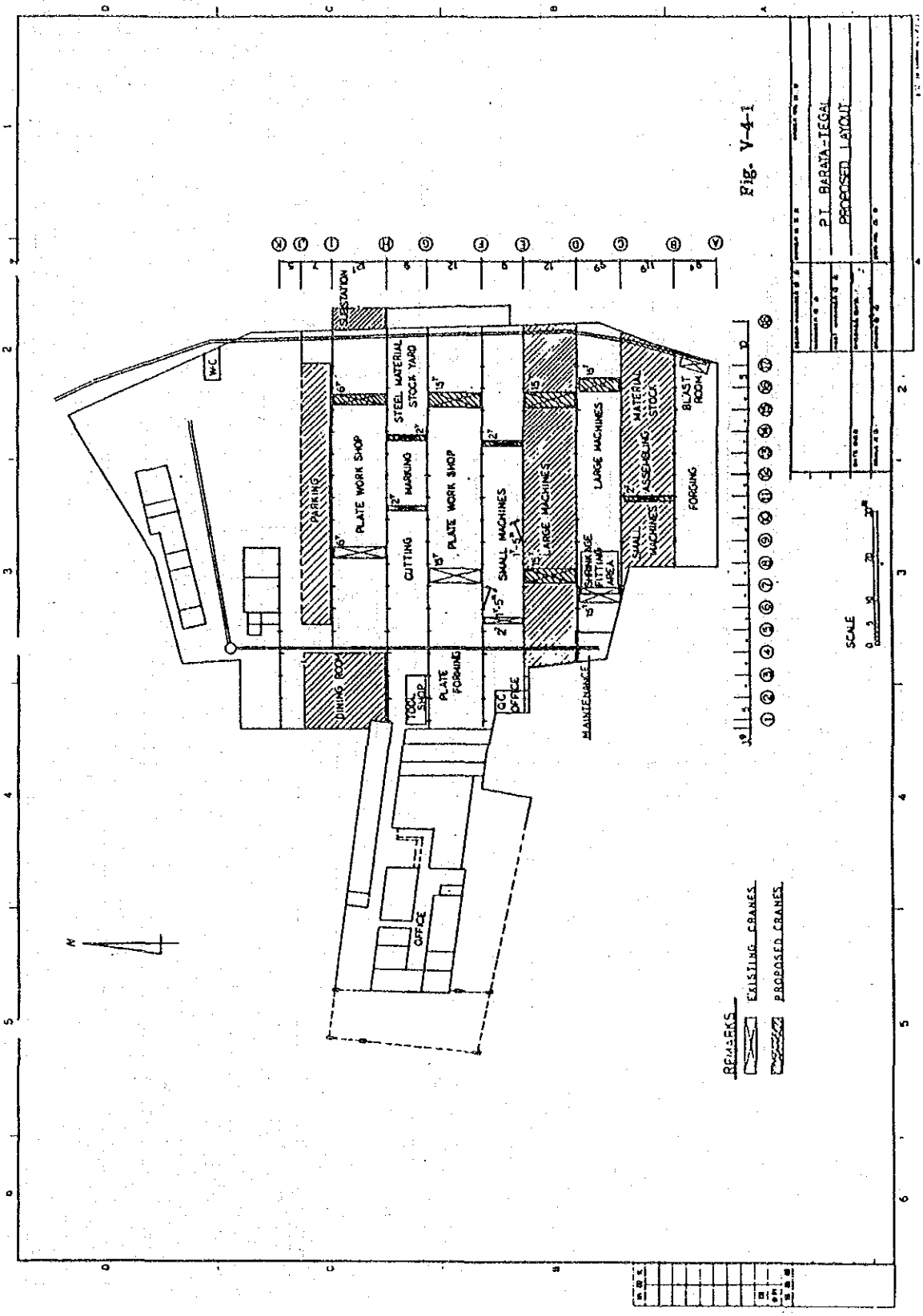
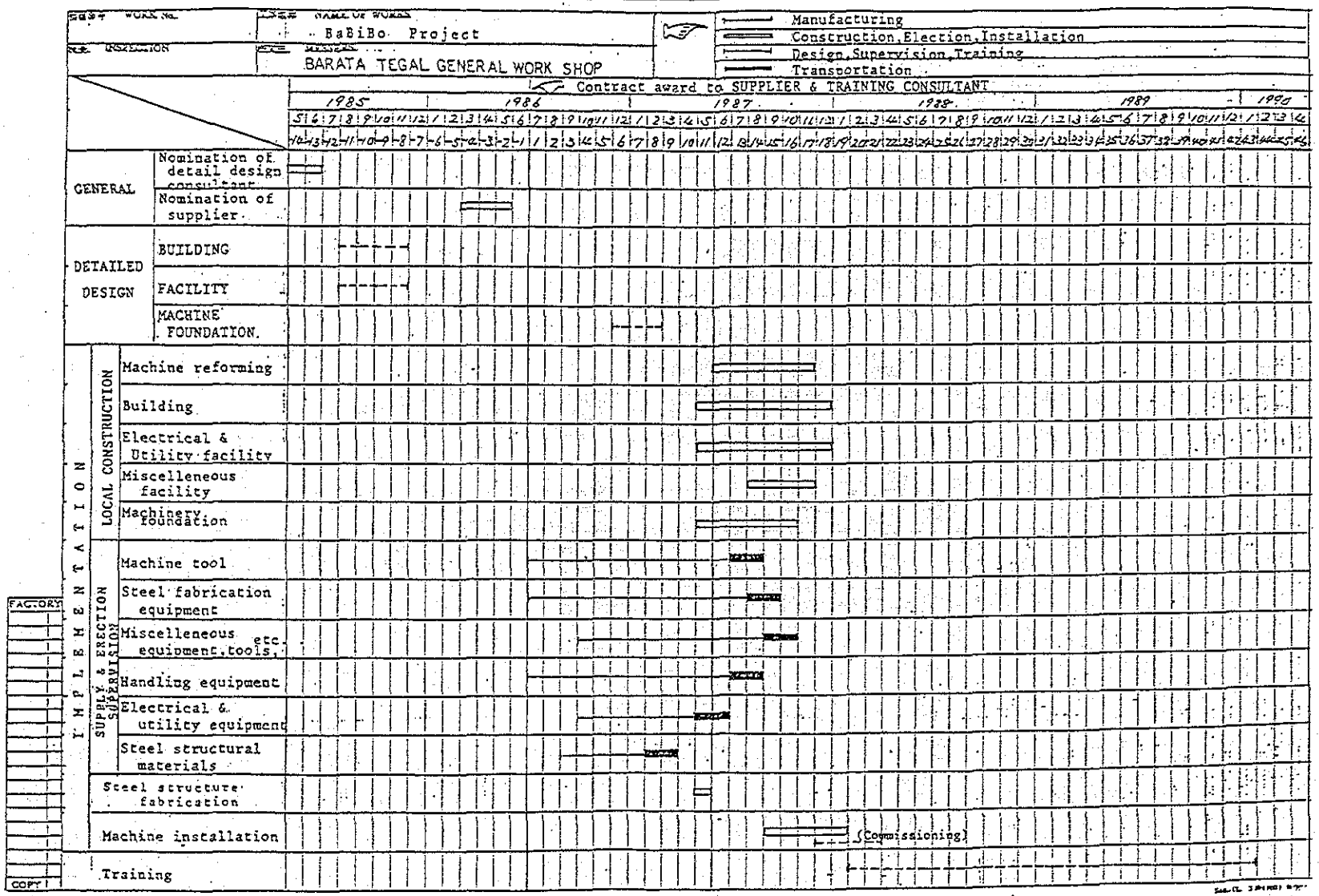


Fig. V-4-1
P.T. BARATA-TEGAL
PROPOSED LAYOUT
SUBSTATION
W.C.
PARKING
PLATE WORK SHOP
STEEL MATERIAL STOCK YARD
MARKING
CUTTING
PLATE WORK SHOP
SMALL MACHINES
LARGE MACHINES
LARGE MACHINES
LARGE MACHINES
MATERIAL ASSEMBLING STOCK
BLAST ROOM
FORGING
DINING ROOM
TOOL SHOP
PLATE FORMING
QC OFFICE
FORGING FITTING AREA
MAINTENANCE
OFFICE
SCALE
REMARKS
EXISTING CRANES
PROPOSED CRANES

Fig. V-4-2 IMPLEMENTATION SCHEDULE



V-5 Boma Bisma Indra, Indra

(1) Basic renovation program and its outline

The basic renovation plan is made according to the following procedure.

i) A new production plan is made to produce the products suitable for Indra Unit in accordance with the REPELITA-IV Plan of Indonesia Government and on the basis of the market research and field survey performed by the study team.

ii) A plan of the capacity of new equipment is made in accordance with the new production plan.

iii) The capacity of new equipment is compared with that of the existing equipment, and factory layout is prepared, and problems in transporting products are reviewed.

iv) Problems relevant to cost and processes such as construction of Indra Unit and installation of machinery are reviewed.

v) Consideration is given to organization, production technology etc. applicable after completion of new Indra Unit.

The basic plan is summarized as follows, Machine/tool Department and Steel Structures Department are enlarged to increase production through newly designed product mix. For the purpose, new equipment is added and the existing equipment is reformed.

The product mix specifies the machinery, process machines and equipment mainly for fertilizer and pulp/paper plants, and the "basic load' which has so far been produced and will be produced in succession.

The capacity of equipment of Indra Unit, that is, hardware of Indra Unit, is so designed as to allow a production of 12,500 T/Y by far exceeding the registered production results, about 5,800 T/Y. The production in Indra is so designed as to start at a target date in October, 1988.

On the other hand, Indra Unit is under obligation to operate the software. The software includes: (1) improvement of process of Indra Unit, (2) preparation of the training program or schedule necessary for upbringing and increase of controllers and engineers and, upbringing, increase, and leveling-up of skilled workers to prevent troubles in operation after start up, (3) improvement of organization system and personnel organization. The software has also been studied and discussed.

1) Production plan classified into products manufactured by factory

① Product mix at Indra Unit

i) The product mix which is the basis of facility capacity design consists of the following two items:

a) Manufacturing of fertilizer and pulp & paper plant equipment

b) Manufacturing of products which have so for been and will be manufactured by Indra Unit in a close relation with the local region (hereinafter called the "BASIC LOAD").

ii) The basic products should be within a reach of production technology of machine/tool Department and Steel Structures Department, that is, the production department of Indra Unit, and should be expected to be improved in quality, increased in production, and leveled up in technology through the introduction of new technology. It is reasonable for Indra Unit to perform work centered on machines, tools, and steel structures, judging from the classification of products by type.

iii) For the purpose of the product mix, the products in Indra Unit are classified into two categories: one consists of five items produced in Indra Unit and the other is field-work-oriented products (hereinafter referred to as site work for convenience), as shown in Table V-5-1.

② Plan of production scale in Indra unit

i) Market research has been made on fertilizer plants and pulp/paper plants relating to Indra Unit, and the research on the basic load. As a result of the market research, the annual production scale for the above is determined on the average demand from 1989 to 1993. The plant machinery is reviewed for local content in Indonesia to find the local content index.

ii) The share of Indra Unit is therefore set for the local content item of machinery for above two designated plants. The products are divided into steel structures and plate works. Production quality is also allotted to each product.

iii) On the other hand, the basic load is reseached for the production results. The products possibly produced in future are classified into steel structures and plate works, and production quantity is allotted to each product, in the same way as in ii).

iv) The quantity of site fabrication and installation for plant machinery and the basic load is set. This leads to the calculation of number of machine tools and workers required.

2) Load plan and necessary equipment

The production capacity of Indra Unit is set to 12,500 T/Y on the basis of the average demand forecast form 1988 to 1993, as stated. The demand forecast is made on the basis of the following factors.

a) Fertilizer plant machinery: local content ratio - average 65%
BABIBO's share - 75%

b) Pulp/paper plant machinery: local content ratio - 42%
BABIBO's share - 75%

c) Basic load: 100%

Calculations show that the forecast demand is 13,070 T/Y on an average from 1988 to 1993. This result will satisfy the load in Indra Unit. However, steel structures must depend on outside manufactures, for 5,400 T/Y, which meets the requirement of Indra Unit.

(1) Review on possibility of diverting of existing equipment

The newly established product mix and production plan are followed by the research of all machinery and equipment in Indra Unit. This survey leads to the determination of machinery and equipment to be diverted. The determination is made according to the following criterion.

i) Survey item

Machinery and equipment are surveyed for five items: loading percentage, tolerance, workability, maintenance, and modernization.

ii) Classification standard

Machinery and equipment are classified by the following classification standard.

Class I - can produce to the required condition without further improvement on exiting condition.

Class II - could possibly produce to the required condition with some rebuild/modernization

Class III - can not produce to the required condition with any other rebuild/modernization.

iii) The equipment judged re-usable is taken into the line as a part of equipment capacity. However, if equipment is deemed unnecessary in capacity and/or in functions, the equipment is not reviewed even if judged reusable.

② Review on new equipment

The design production capacity of Indra Unit is determined by the product mix and production plan, while necessary equipment to be determined according to the following criteria.

i) The following item is set for each product mix.

a) Product model

b) Product time

c) Assumed level of technology after five years.

ii) Criteria

Criteria are determined for the following items.

a) Calculation of number of main workers, and production time.

b) Determination of necessary model and number of necessary units.

iii) Offset against reusable existing equipment.

iv) The above determination is made by introducing our empirical values.

3) Improvement and new installation plan for present unit

Survey on present Indra Unit has proven that the floor space is excessively narrow and equipment is insufficiently provided to accomplish the newly established product mix and production plan.

This survey is followed by discussions with B.B.I. Head Office and Indra Unit. The discussions lead to the following conclusion; a plan is laid out to place an order of the quantity exceeding the capacity of producing steel structures, 5,400 T/Y, with outside manufactures. This item deals with the layout of Indra Unit oriented to the production of machines/tools and steel structures, and partial diversion of the equipment in use.

① Basic plan of layout of Indra Unit

Area of machine/tools shop to be improved:	2,136 m^2
Area of fitting area to be improved:	1,008 m^2
Area of steel structures shop to be improved:	3,600 m^2
Layout: as shown in Fig. V-5-1.	
Design production capacity:	12,500 T/Y

The equipment and number of units necessary for accomplishing the production plan is determined in (1) 2) ②. Based on these data, the layout is determined according to the following procedure.

i) Determination of necessary work area.

ii) Determination of proper machinery layout and product flow.

iii) Determination of building shape.

iv) Consideration for material storage yard and product delivery route.

v) Minimizing material handling.

② Production facilities and inspection equipment

i) Production facilities

a) Summary of production facilities is shown in Table V-5-4.

Machining capacity is difficult to express in weight. The shape of products is diversified as assumed by the basic load, orders from fertilizer and pulp paper plants. Therefore, the average machining time by weight ton and Product Model are determined from our empirical values, and the model of machines and number of units are determined accordingly.

b) Steel structures

The manufacturing process flow of products consists of preparation, machining forming, welding, fitting, and material handling.

ii) Inspection equipment

Inspection plays a main part to fulfil the quality assurance function. The equipment to be delivered to Indra Unit is as shown below.

a) Measuring equipment for machine/tools.

b) Other equipment is made available from the equipment in use.

③ Basic plan of attached equipment

The properties of products require types of equipment. The following equipment is considered necessary for Indra Unit.

i) Sandblast equipment for steel structures.

ii) Painting equipment for steel structures.

④ Basic plan of utility facilities

i) Electric installations are provided with the following equipment.

a) New installation of transformer type substation with increased capacity.

b) Emergency generator only for emergency lamps.

c) Paging equipment.

d) The diesel-engine type generator in use is utilized only in an emergency.

ii) Piping are laid to carry the fluid for machine tools and other attached equipment.

4) Shop construction work and installation plan

New equipment is introduced and machines are relocated inside the present Indra Unit. It is proposed that the progress is divided into three periods to minimize undesired influence on the present process with consideration given to relation to the construction process in Wahana Unit.

① Land reclamation not required

② Soiling and piling not required

③ Building not required

④ Machine installation plan

i) The installation is carried out in three periods to minimize

undesired influence on production quantity, with consideration given to the relation to the construction process in Wahana Unit.

ii) Table V-5-2 shows the overall installation process. The target is to complete the process by October, 1988. One of the terms of delivery is the completion of test-run after installation.

⑤ Supervisor

It is proposed that supervisors be sent by manufacturers and Indonesian supervisers be employed for the following works.

i) Machine Installation Works

ii) Electric Wiring Works

iii) Piping Works

The duty of the supervisor ends with the completion of work for which he is responsible.
It is proposed that the supervisor be sent by the machine supplier to witness the test run of the machines deemed particularly important providing only specifications written in English should be submitted for other common machines.

(2) Renovation promotion plan

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

1) Outline of renovation promotion plan

① Effect of renovation

The production per unit area and production per direct work after renovation are compared with those before renovation to examine the degree of improvement in productivity. The works, the object of comparison, are parts/machinery, piping work, and steel structures. The result of comparison is shown in the following tables.

Effect of Renovation

	Before renovation (a)	After renovation (b)	Ratio (b/a)
Production per unit area (ton/year/m^2)	0.52	0.76	1.5
Production per direct worker (ton/year/man)	18.3	41.9	2.3

② Shop layout

i) Machinery shop

Unnecessary and absolute machines are scrapped down and replaced with new ones to the extent of necessity. This results in reduction in the quantity of machines, with more floor space. As a result, the present complicated layout of machines is put in order and integrated to the new layout in which machines are arranged by kind and by size. This improves productivity, and compensates reduction in machines and increases in production with increased machine operation ratio.

ii) Steel structures shop

In present Plate Shop, one of two bays is reformed to a special-purposed bay for steel structures to meet increase in the production of steel structure to some extent. However, this is insufficient to treat the total production, and products exceeding the capacity depend on outside orders. In addition, sandblast equipment is installed within Steel Structures Shop

to improve productivity since shop diagnosis proves that material handling takes rather much time for sandblasting. The machines and equipment are so arranged to fit the production process and prevent the reverse flow of products on the way of machining, which was found during survey.

iii) Plate shop

Indra Unit requires reorganization in plate works because the major plate works such as large-size and heavy-weight pressure vessels are transferred to Wahama Unit. Indra Unit is allotted to pre-fabrication pipe works, small-size plate works, and plant maintenance machinery. For this purpose, one of two bays is exclusively used. As to production equipment, the existing equipment is diverted with priority, with only necessary equipment supplemented.

2) Construction cost

Investments required for the renovation are detailed in Table V-5-3, Summary of investment cost. The following cost and expenditure are not included in the investment cost. The cost required for utilizing the existing organization during the term of renovation, and the personnel expenditure for trainees during the term of skill training.

3) Renovation promotion system

When the promotion of this project is determined, Indra Unit is under obligation, as a shop, to implement the following items in order not to cause troubles to the promotion and not to cause problems.

① Design of new shops, and determination of parts to be purchased.

② Control and supervision of construction process such as civil engineering work, machine installation work. Smooth startup and operation.

③ Preparation and implementation of increase and training plan for controllers, engineers, and workers.

4) Content of renovation work

① Work item

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

② Content of work

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

i) 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.

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

5) Supervision of work and training plan

① The work items requiring supervisions are as shown below. (Refer to Table V-5-2)

i) Erection of machines and equipment

ii) Erection of electricity and instruments

iii) Piping works

iv) Operation instructions on main machines and equipment

② Training plan

The plan of shop worker training is implemented for the following machines as a minimum requirement. The purpose of the training plan is to familiarize workers with machines of which they are in charge during the term from completion of installation of shop machines and equipment to startup. Voluntary training in shop is recommended during the considerably long time until October in 1988.

i) Boring & turning mill

ii) Boring & milling machine

iii) Planer

iv) Press

v) Bending roller

6) Construction schedule of renovation

The renovation Schedule renovation of this project is shown in Table V-5-2, which includes the content described in 4) and 5).

(3) 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 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 subsystem 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 pile-up plan permits checking in earlier stages a machine or work that may form a bottleneck of the process, thus making it easy to take countermeasure without delay.

2) **Quality control system**

Indra Unit has not yet prepared a quality control manual. Maragets in Indra Unit should take cognizance of the importance of quality control and hasten to prepare a quality control manual at their responsibility.

3) **Safety control system**

① The basis of safety is to put in order and keep clean what is related to production. Unfortunately, the present situation in Wakana Unit is not necessarily satisfactory. 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 educational instruction 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.

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

Table V-S-1 FORECAST OF PRODUCT MIX

P.T. BOMA BISMA INDRA: INDRA UNIT

ANNUAL PRODUCT CONDITION IN 1989 ~ 1993

UNIT: TON/YEAR

TYPE OF PRODUCT		STEEL CONSTRUCTION	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	8,380	70	8,450	8,450							
	a.2 Bridges and similar structures											
	a.3 Industrial structures	1,040	0	1,040		317	124	194	82	91	808	233
	a.4 Water gates and structures for water engineering											
	a.5 Conveyors											
b. PLATE WORKS	b.1 Fertilizer plant equipment											
	b.2 Pulp and paper plant equipment											
	b.3 Pipe works	0	870	870	870							
	b.4 Parts/Machine	0	1,990	1,990	1,931	9	4	34	1	8	56	
	b.5 Others	74	100	174	174							
	b.6											
	b.7											
SUB TOTAL		9,494	3,030	12,524	11,425	326	128	228	83	99	864	233
c. SITE WORK	c.1 General industries	1,770	0	1,770		540	212	330	139	156	1,377	396
	c.2 Vessels (pressure and atmospheric, vacuum)											
	c.3 Tanks of different design											
	c.4 Silos, bins, containers hoppers, ducts, chutes etc											
	c.5 Pipe works											
SUB TOTAL		1,770	0	1,770	0	540	212	330	139	156	1,377	396
T O T A L		11,264	3,030	14,294	11,425	866	340	558	222	255	2,241	629

Table V-5-2 Construction Schedule

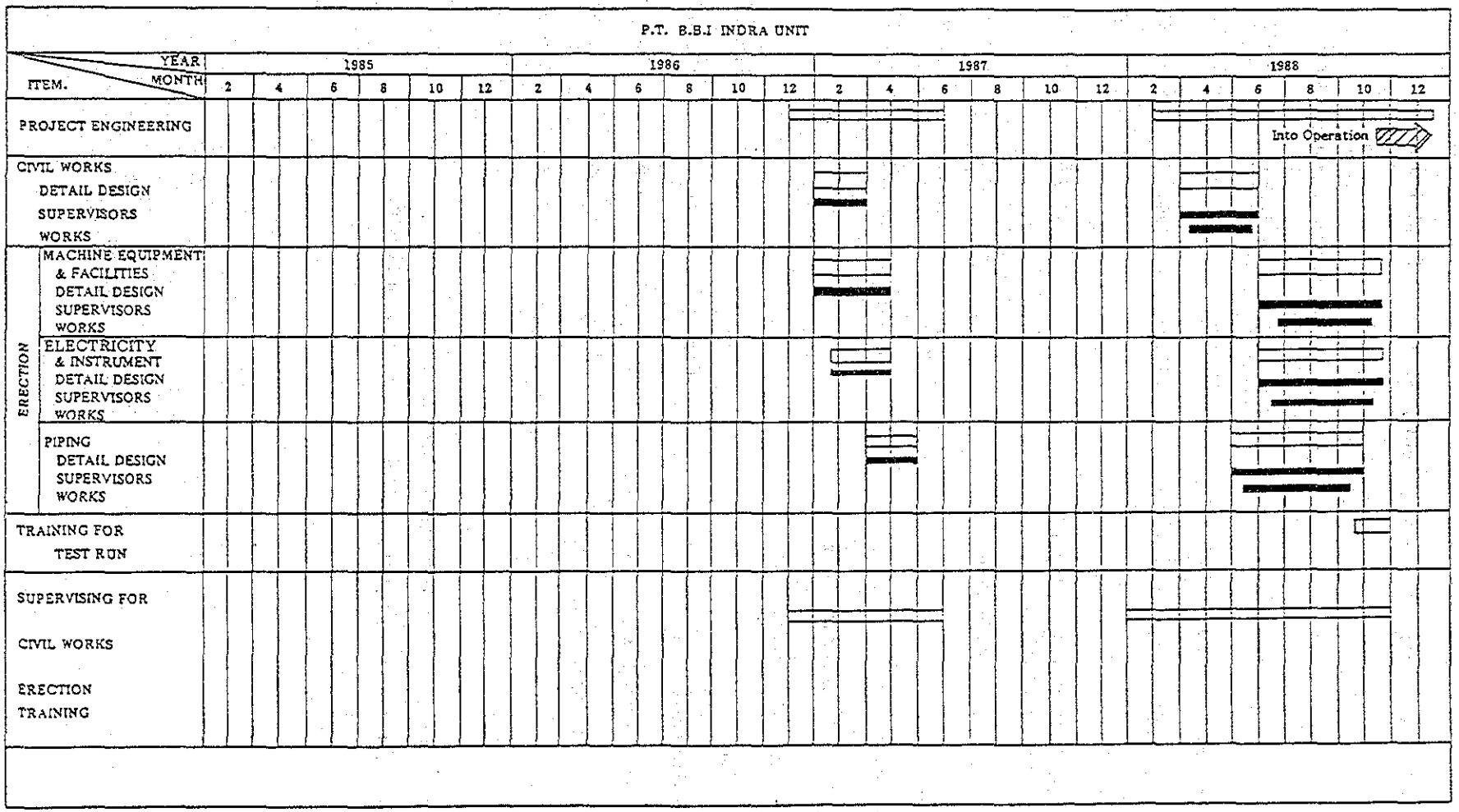


Table V-5-3 Summary of Investment Cost for P.T. B.B.I. Indra Unit

UNIT: 1,000,000 YEN

ITEM	FOREIGN	DOMESTIC	TOTAL
1. MACHINERY & EQUIPMENT	1,287.72		1,287.72
2. ELECTRICITY & INSTRUMENT	141.59	284.50	426.09
3. LAND PREPARATION			0
4. OCEAN FREIGHT, INSURANCE & LOCAL HANDLING	78.25	18.56	96.81
5 INLAND TRANSPORTATION		17.58	17.58
6. CIVIL	6.03	59.84	65.87
7. ERECTION	8.92	169.21	178.13
8. BUILDING (PLANT & OTHERS)			0
9. BUILDING (OFFICE)			0
10. OTHERS	114.63	1.98	116.61
11. ENGINEERING FEE	137.11	41.29	178.40
12. CONSTRUCTION EXPENSES		35.91	35.91
13. PHYSICAL CONTINGENCIES	53.23	44.01	97.24
TOTAL	1,827.48	672.88	2,500.36

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

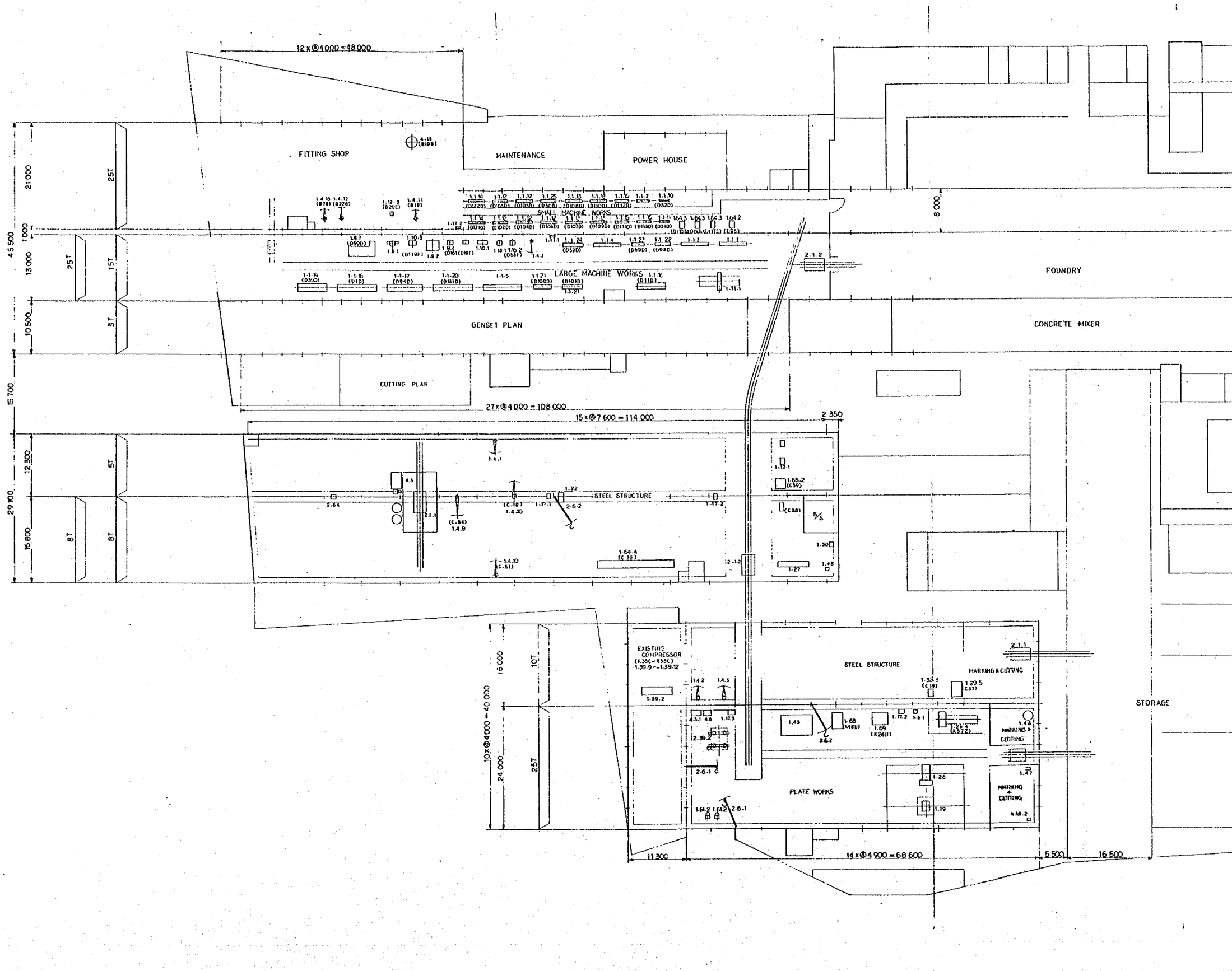
(INDRA UNIT)

Table V-5-4 SUMMARY OF PRODUCTION FACILITIES

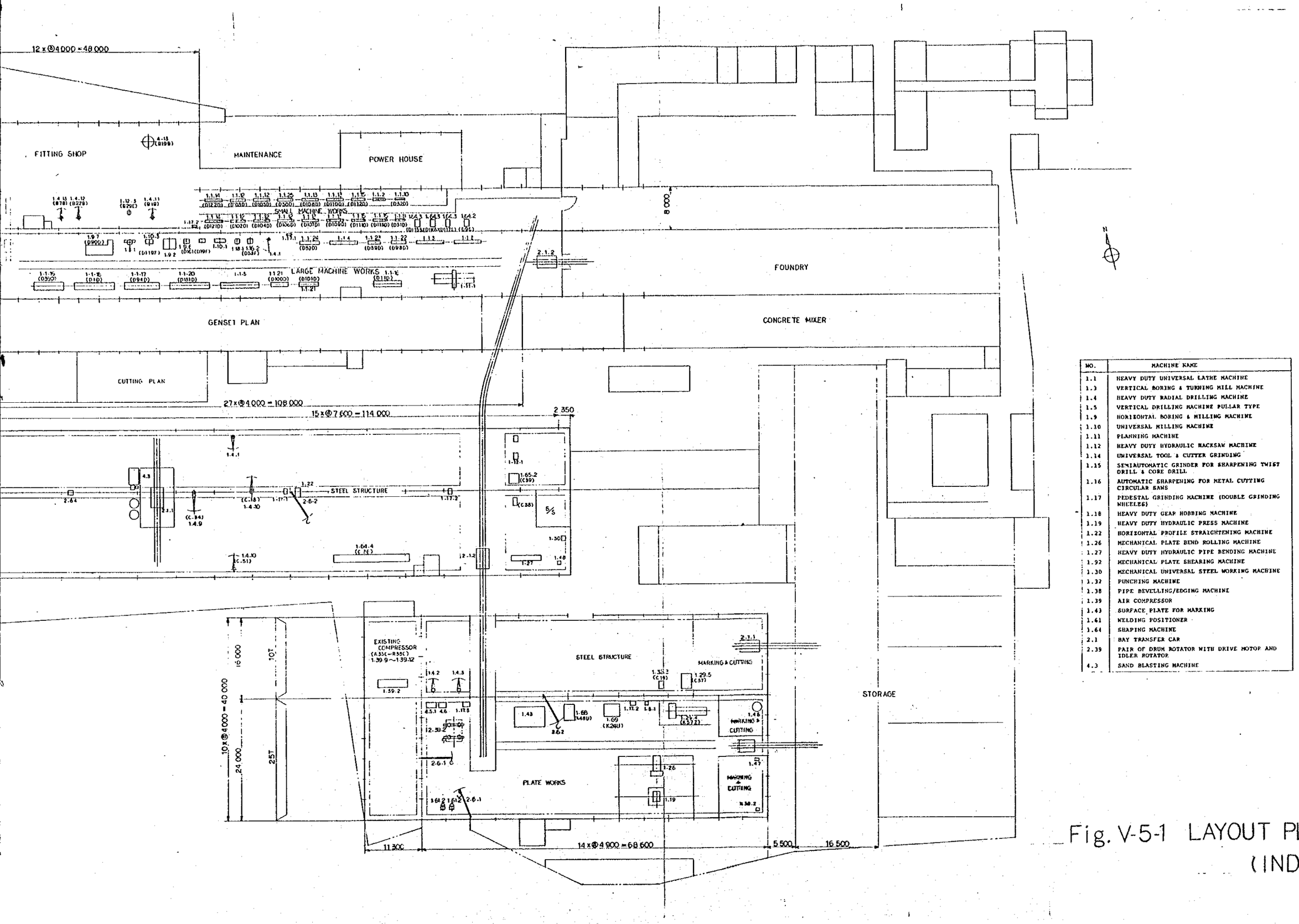
Item	New Facilities	Usable Existing Machine	Total
Machine Tool & Welding Machine	83	109	192
Assembly Equipment & Material Handling	58	0	58
Quality Assurance & Testing Unit	1	0	1
Auxiliary Unit	7	2	9
Total	149	111	260

MACHINE NO. AND MACHINE NAME LIST OF Fig. V-5-1 LAYOUT PLAN (INDRA)

NO.	MACHINE NAME
1.1	HEAVY DUTY UNIVERSAL LATHE MACHINE
1.3	VERTICAL BORING & TURNING MILL MACHINE
1.4	HEAVY DUTY RADIAL DRILLING MACHINE
1.5	VERTICAL DRILLING MACHINE PULLAR TYPE
1.9	HORIZONTAL BORING & MILLING MAHINE
1.10	UNIVERSAL MILLING MACHINE
1.11	PLANNING MACHINE
1.12	HEAVY DUTY HYDRAULIC HACKSAW MACHINE
1.14	UNIVERSAL TOOL & CUTTER GRINDING
1.15	SEMIAUTOMATIC GRINDER FOR SHARPENING TWIST DRILL & CORE DRIL
1.16	AUTOMATIC SHARPENING FOR METAL CUTTING CIRCULAR SAWS
1.17	PEDESTAL GRINDING MACHINE (DOUBLE GRINDING WHEELES)
1.18	HEAVY DUTY GEAR HOBBING MACHINE
1.19	HEAVY DUTY HYDRAULIC PRESS MACHINE
1.22	HORIZONTAL PROFILE STRAIGHTENING MACHINE
1.26	MECHANICAL PLATE BEND ROLLING MACHINE
1.27	HEAVY DUTY HYDRAULIC PIPE BENDING MACHINE
1.92	MECHANICAL PLATE SHEARING MACHINE
1.30	MECHANICAL UNIVERSAL STEEL WORKING MACHINE
1.32	PUNCHING MACHINE
1.38	PIPE BEVELLING/EDGING MACHINE
1.39	AIR COMPRESSOR
1.43	SURFACE PLATE FOR MARKING
1.61	WELDING POSITIONER
1.64	SHAPING MACHINE
2.1	BAY TRANSFER CAR
2.39	PAIR OF DRUM ROTATOR WITH DRIVE MOTOR AND IDLER ROTATOR
4.3	SAND BLASTING MACHINE


12 x @ 4 000 = 48 000
FITTING SHOP
MAINTENANCE
POWER HOUSE
FOUNDRY
SMALL MACHINE WORKS
LARGE MACHINE WORKS
GENSET PLAN
CONCRETE MIXER
CUTTING PLAN
27 x @ 4 000 = 108 000
15 x @ 7 600 = 114 000
2 350
STEEL STRUCTURE
21 000
13 000
10 500
15 700
12 300
16 800
29 100
45 500
1 000
8 000
25T
15T
3T
5T
8T
EXISTING COMPRESSOR
(R 33C – R 33C)
1.39.9 ~ 1.39.12
STEEL STRUCTURE
MARKING & CUTTING
PLATE WORKS
MARKING & CUTTING
STORAGE
16 000
24 000
10 x @ 4 000 = 40 000
10T
25T
11 300
14 x @ 4 900 = 68 600
5 500
16 500

5-70-5



NO.	MACHINE NAME
1.1	HEAVY DUTY UNIVERSAL LATHE MACHINE
1.3	VERTICAL BORING & TURNING MILL MACHINE
1.4	HEAVY DUTY RADIAL DRILLING MACHINE
1.5	VERTICAL DRILLING MACHINE PULLAR TYPE
1.9	HORIZONTAL BORING & MILLING MACHINE
1.10	UNIVERSAL MILLING MACHINE
1.11	PLANNING MACHINE
1.12	HEAVY DUTY HYDRAULIC HACKSAW MACHINE
1.14	UNIVERSAL TOOL & CUTTER GRINDING
1.15	SEMIAUTOMATIC GRINDER FOR SHARPENING TWIST DRILL & CORE DRILL
1.16	AUTOMATIC SHARPENING FOR METAL CUTTING CIRCULAR SAWS
1.17	PEDESTAL GRINDING MACHINE (DOUBLE GRINDING WHEELED)
1.18	HEAVY DUTY GEAR HOBBING MACHINE
1.19	HEAVY DUTY HYDRAULIC PRESS MACHINE
1.22	HORIZONTAL PROFILE STRAIGHTENING MACHINE
1.26	MECHANICAL PLATE BEND ROLLING MACHINE
1.27	HEAVY DUTY HYDRAULIC PIPE BENDING MACHINE
1.92	MECHANICAL PLATE SHEARING MACHINE
1.30	MECHANICAL UNIVERSAL STEEL WORKING MACHINE
1.32	PUNCHING MACHINE
1.38	PIPE BEVELLING/EDGING MACHINE
1.39	AIR COMPRESSOR
1.43	SURFACE PLATE FOR MARKING
1.61	WELDING POSITIONER
1.64	SHAPING MACHINE
2.1	BAY TRANSFER CAR
2.39	PAIR OF DRUM ROTATOR WITH DRIVE MOTOR AND IDLER ROTATOR
4.3	SAND BLASTING MACHINE

Fig. V-5-1 LAYOUT PLAN (INDRA)

V-6 Boma Bisma Indra, Wahana

(1) Basic renovation program and its outline

The basic plan was made in accordance with the following procedure.

i) Making the new production plan which is suitable for Wahana Unit through market research and shop survey conducted by the study team of the REPELITA-IV plan of the Indonesia Government.

ii) Making the new facilities plan in accordance with the new production program.

iii) Comparison of capacity between the existing facilities and the new facilities, making the layout of the new factory, and raising problems on the transport of the products.

iv) Checking the cost and process of the factory construction and facilities erection.

v) Checking the organization and production technology after completion of the new factory.

Wanaha Unit was derived from the plate work shop of Indra Unit, and now main works are production of steel structure and plate work, and local construction. Their product mix in the future will consist of facilities and processing, equipment for fertilizer and pulp/paper plants, and other items which have been produced so far as basic load. The production will be increased from about 4,000 tons/year to 12,500 tons/year and this target production will start in October, 1988.

On the other hand, Wahana Unit should make such efforts as setting up the training program and improvement of the factory organization and personnel system that is required for training and education of managers, engineers, and skilled workers so as not to cause problems during the new factory construction and after completion of the new factory.

1) Production program for product

① Product mix of Wahana Unit

i) The product mix on which the designing of the factory production facilities are based consists of the following two items: 1) manufacturing of fertilizer and pulp & paper plant equipment 2) products that have been produced at P.T.B.B.I Indra unit under the coordination with the local society and will continuously be produced in the future (hereinafter called "BASIC LOAD").

ii) It is important that the factory should make efforts to improve quality of products and production by enhancing production technology in relation to the products that are on the same line of products which have long been produced by fabrication section of Indra Unit. Juding from the products type classification, Wahana Unit should concentrate on the steel structure and plate work from now on.

iii) Therefore, as shown in Table V-6-1, the product mix Wahana Unit produces consists of 8 items to be produced in the plant and 3 items of the local construction work (here called "Site Work"). This classification of products type was used to decide the kind, the quantity and the location of facilities required.

② Production scale plan for Wahana Unit

i) Category of the products of Wahana Unit

Market research was conducted for fertilizer plant, pulp/paper plant and basic load, and the production scale per year was decided based on the average production forecast during 1988 through 1993. Also, local contents of the plant facilities in this country were checked and rate of local contents items was obtained.

ii) Then, the rate of the products that can be produced at Wahana Unit was sought among the two kinds of factory facilities and was divided into steel structure and plate work, and production was decided for each product mix.

iii) The production of basic load in the past also was checked, and the products to be produced in the future was classified into steel structure and plate work, and production was decided for each product mix.

iv) Local production and erection of the factory facilities and basic load were decided to calculate the quantity of the required machine tools and the number of workers.

2) Load plan and required facilities

Production facilities of Wahana Unit was designed to meet 12,500 tons/year based on the production forecast during 1988 - 1993.

The demand forecast is based on the following three items.

(1) Rate of production in Indonesia in fertilizer plant is 65% and rate of BA, BI, BO is 75%, (2) rate of production in Indonesia in pulp/paper plant is 42% and rate of BA, BI, BO is 75% and (3) rate of production in Indonesia in basic load is 100%.

AS a result, the production forecast during 1988 through 1993 is estimated at 10,675 tons/year that can meet 85% of the production capacity, but it is increased to 12,500 tons/year in accordance with the request of the factory.

① Checking if the existing facilities can be used for future production

In accordance with the product mix and production program, the facilities in the fabrication division of Indra Unit were surveyed to check if the existing facilities can be reused for the new program.

The criteria for selection of the facilities are as follows.

i) Items surveyed

They are load percentage, tolerance, workability, maintenance and modernization.

ii) Standards for classification are as follows.

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

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

Class III. Cannot produce to the required condition with only other rebuild/modification.

iii) The facilities that can be used will be reused for the new production. But the facilities that are not required for the production program will not be used.

② Consideration for the new facilities

While the production capacity was determined by the product mix and production program, the required facilities were decided in accordance with the following criteria.

i) For each product mix, the following were decided.

a) Product model

b) Product time

c) Technical level forecast 5 year later

ii) Criteria for selection of the facilities

a) The number of the required workers and production time

b) Required machine models and the number of machines

iii) The number of the existing facilities that can be reused is deducted from the number of the required facilities.

iv) Experience was utilized when deciding the above values.

3) Program of reconstruction of the existing buildings and construction of the new buildings

It was learned from the survey of Indra unit that the factory was too small for attaining the production program.

As a results of the discussion with B.B.I main office and Indra unit, it was decided that a new factory will be built at Wahana sub-unit in Pasuruan.

The layout of the factory that will produce mainly plate works and steel structure and the transfer of a part of the facilities of Indra unit will be explained here.

① The basic plan of the factory layout

The area of the plant site = 72,000 m^2
The area of the yard for material = 1,000 m^2
The area of the building = 23,736 m^2
Layout: See Fig. V-6-1
Annual production = 12,500 tons/year

The facilities and the number of them required for attaining the production program were decided in 2) ②. Then, based on the data the layout was made in accordance with the following procedure.

i) Securing the required work area.

ii) Decision of the appropriate location of the facilities and product flow.

iii) Decision of the shape of the building.

iv) Consideration of the material storage yard and route through which products are passed.

v) Minimization of the material handling.

② Production and inspection facilities

i) Production facilities

In the order of preparation machining, forming, welding and assembly, the following 6 items were checked. Summary of production facilities is shown on Table V-6-4.

a) Preparation facilities and auxiliary facilities

b) Machine tools

c) Forming facilities

d) Welding machines and equipment

e) Assembly tools

f) Overhead travelling crane

Note: a) through e) include the existing facilities of Indra unit that can be reused.

ii) Inspection facilities

Inspection plays an important role in quality assurance system. At present, inspection is made by outside inspectors but it is recommendable that it should be done inside the factory by installing the facilities in the future.

The facilities consist of the following items:

a) Non-destructive examination facilities for inspecting mainly the weld.

b) Facilities for testing materials.

c) Measuring instruments

③ The basic plan of auxiliary facilities

The auxiliary facilities corresponding to property of the product will be required. The following 4 items were studied. The facilities have capability corresponding to the type of the product.

i) Heat treating furnaces

ii) Shot blasting

iii) Acid cleaning facility

iv) Painting facility

④ The basic plan of the utility facilities

i) The following electrical facilities will be provided.

a) The substation transformer will be newly installed.

b) Telephone (60 sets of the telephone set)

c) Paging system

d) Broadcasting equipment

e) Lighting equipment inside and outside of the building.

f) Fire alarm facilities (office only).

g) Emergency generator (emergency lamp only).

h) Air conditioning equipment in the office.

ii) Eight location lines will be provided for the machine tools and auxiliary equipment.

iii) Sewage and wastewater treatment

a) Sanitary sewage treatment includes treatment facilities

b) Acid cleaning include neutralizer

4) Factory construction and erection plan

The factory will be built at Wahana subunit at Pasuruam about 60 km far from Surabaya city. The following matters were checked carefully.

① Preparing the plant site

Whether smooth factory construction and operation can be achieved will depend on this key point.

i) The total site area is 72,000 m^2, and land preparation area is 46,626 m^2.

ii) The surface soil is removed about 30 cm deep and the sand is

put about 30 cm. The sand will be piled about 70 cm.

② The ground and piles

After completion of preparation, PC piles are hammered. The dimension of the pile is ϕ35 cm × 10-15 m (L). This is used for the foundation for the machines.

③ Building

Steel structure will be adopted mainly. The concrete structure will used for x-ray room, stress relief furnace, heating furnace and sewage treatment facilities. The construction includes the office.

④ *Facilities erection plan*

i) The erection of the large, medium and small facilities will be constructed separately to shorten construction period. Delivery conditions is after completion of test run of the facilities after erection.

ii) The erection of all the facilities will be completed in October, 1988 as shown in Table V-6-2. The preparation of the plant site, civil construction and building construction will be important to attain the target.

⑤ Supervisors to be sent

i) The supervisors to be sent and supervisors in Indonesia will be considered in relation to the following matters.

a) Civil construction (including land preparing the site)

b) Building construction

c) Facilities installation

d) Electrical wiring construction

e) Piping construction in the building

The duty of the supervisors will be finished upon completion of the erection construction. The supervisors of suppliers will be sent for the test run of the important machines but not for the general machines which require only the Operation Manual in English.

(2) Renovation promotion program

In accordance with the basic plan mentioned so far, this chapter describes the details on the hardware of the renovation promotion program.

1) Outline of renovation promotion program

① Comparision between before and after renovation

To check productivity, the production per unit area and that per direct worker were compared. The results are as follows.

	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 productivity decreases since high production technology is required for fertilizer plant and pulp & paper plant and the production of facilities for pressure vessels and other facilities made of special materials occupy the big space and make necessary more personnel in the factory.

② Factory layout

The production process is sometimes reversed or similar different production is seen, so the appropriate Bay division should be made, and concentrated production system is adopted.

i) A-Bay

Preparation works after obtaining materials is done only in A-Bay and machined materials will be passed to each bays. Those facilities for marking, gas cutting, shearing, press forming, and flange-machining are installed in this bay.

ii) B-Bay

Only products that require shape steel, flat steel and pipes are manufactured here in this bay. The band saw, angle bender, and pipe bender are installed. Production areas for nozzles, prefabrication piping and steel structure are sit up in the bay.

The nozzles produced here will be sent to each bays.

iii) C-Bay

The general plate works (such as atmospheric vessels, tank and containers) are produced here, and the products that do not require radiographic examination, hydrostatic test and post weld heat treatment are produced here. The plate works produced here are sent to other bays when necessary.

iv) D-Bay

Only unit cylinders for pressure vessels, small and light vessels and heat exchanger are produced here. The areas where radiographic examination for unit cylinder is conducted and those for installing heat exchanger production facilities are

located separately. After radiographic examination, unit cylinders are sent to E-bay for assembly when necessary.

v) E-Bay

Only head block and large and heavy pressure vessels are produced here in this bay.

Large machine tools are installed. When necessary, head blocks are sent to each bay.

vi) Surface treatment yard

Between the new shop and wagon carriage production shop sand blasting, painting and acid cleaning facilities are installed on the same line.

vii) Raw materials storage yard

The raw material storage yard is located in the extreme eastern end of the plant site and its relation to A-bay and future extraction are considered.

2) Construction cost

The details of the investment required for the renovation is shown in Table V-6-3 Summary of investment cost. But the cost does not include the cost to use the existing organization and the labor charge of the workers during the training period.

3) Renovation project promotion system

Once the project promotion is decided, the plant is obliged to assure the smooth realization of the renovation without causing troubles and problems; the factory shall carry out (1) designing of the new factory, selection of the parts to be purchased, (2) control and supervision of the construction schedule such as preparation of the plant site, construction

of the building, erection of the facilities and training of the managers, engineers, and workers for smooth start-up and operation of the factory.

4) Details of actual work

① Work items

As shown in Table V-6-2 Construction schedule, the actual work is classified as follows; (1) Land preparation (2) Civil works (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.

i) 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.

ii) 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.

(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.

6) **Renovation promotion schedule table**

The project promotion schedule table including the items explained in 4) and 5) is shown in Table V-6-2.

(3) Production management and training

The basic items on software required for attaining the development plan mentioned so far is explained here. The stabilization of the production management system, quality control system and training system will make possible realization of the development plan.

1) **Production management system**

① Production management system is required to attain the production as planned. The system should be able to conduct the follow-up of

the daily plan and take measures (for example over time work) if the plan is delayed and check the delivery of parts.

② As a means to avoid the delay of delivery, the pile-up plan should be made for grasping the production of the total plan or each kind of job. The plan makes it easy to catch the machine or job that can be bottleneck of the production schedule and take countermeasures.

③ As for the production technology, as the product mix changes, the thick plate is used. So the technology on forming, heat treatment, and selection of welding method and materials, and prevention of the weld cracks will be required.

In order to improve the production management and production technology, training of the staffs will be vitally important. And the point of the training will be to make them master the specific technology required for the specific product in each section. For attaining this purpose, technical tie-up and assistance contracts made with other countries or parties will be necessary. But the program does not include this cost.

2) Quality control system

The quality control manual is unavailable at Indra Unit. It is recommendable that the management of Wahana unit recognizes importance of quality control and makes the quality control manual.

As the thick plate is used, the following matters will be required:

① To correspond to the increased non-destructive examination

② To take countermeasures against the weld defects such as weld cracks

Therefore, for ① the factory should have its own qualified inspectors and for ② it should have the quality control specialists who are

knowledgable on the materials and production technology to maintain the quality of the products.

Also, the data on failures and claims should be collected and kept carefully for improving the quality of the products.

3) Safety management system

① The safety management is arrangement and cleaning of the shop but these are not followed necessarily at present. So it is necessary to make all the members cultivate consciousness of these matters.

② To avoid the accidents such as gas explosion, training and education of the workers who operate crane, slinging workers and other workers will be important.

4) Maintenance

It is necessary to stabilize the following maintenance system based on the maintenance technique of Indra Unit.

① The maintenance manual is necessary for fulfilling the daily and periodical inspection of each machine, equipment and instrument.

② Also, the workers should inspect and service the apparatus, tools and other equipment to improve the quality of the products and production efficiency.

5) After sales service

The after sales service is related to the following.

① New order of repair and reconstruction

② New order of extension and new construction

Also, as a result, the following will be made possible and it will help improving engineering, quality control and production technology. Therefore, it will be necessary to have the salesmen who have technical knowledge on the products in the future.

6) Engineering

To meet the new production program at Wahana unit, the following could be considered.

① As for the new production technology for heat exchangers and pressure vesseles, technical tie-up and assistance contracts with foreign companies will be necessary.

② As for the products that have been produced by the factory, improvement of design and production technology will be necessary.

③ Capability of designing of the good quality products at low cost including the design of production will be required in the future.

④ Cultivation and education of the designers and engineers who can select materials and instruct the dimension required for the products on the drawing.

7) Training

Training of the production management and engineers were mentioned in 1) - 6).

It is urgently required to train the workers to correspond to the increase of the production and new facilities.

8) Organization and personnel

① Wahana unit should be separated from Indra unit judging from its production and personnel scale. But the administrative and

accounting sections could be a part of Indra unit.

② The organization is simplified

③ The personnel plan is as follows.

i) The number of direct workers are calculated and decided in the method shown in (1) 2)②.

ii) Indirect personnel is decided by our experience. The administrative section is decided by estimation.

Table V-6-1

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 Bridge and Similar structures											
	a.3 Industrial structures											
	a.4 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 plant equipment	0	1,000	1,000								1,002
	b.3 Heat-exchangers	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 V-6-2

Construction Schedule

P.T. B.B.I WAHANA UNIT

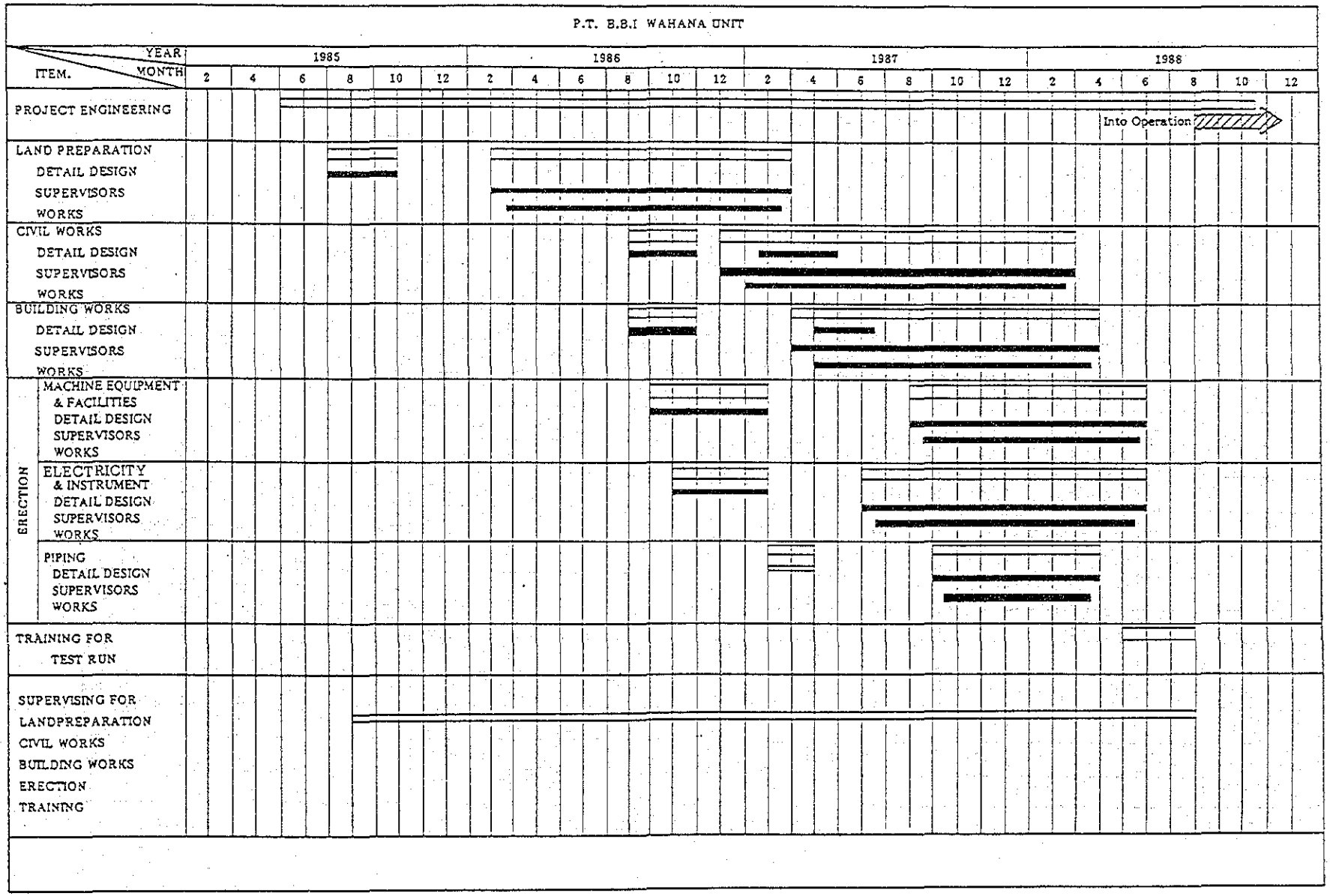


Table V-6-3 Summary of Investment Cost for P.T. B.B.I. Wahana Unit

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.

(WAIHANA UNIT)

Table V-6-4 SUMMARY OF PRODUCTION FACILITIES

Item	New Facilities	Usable Existing Machine	Total
Machine Tool & Welding Machine	229	27	256
Assembly Equipment & Material Handling	187	0	187
Quality Assurance & Testing Unit	11	0	11
Auxiliary Unit	15	0	15
Total	442	27	469

MACHINE NO. AND MACHINE NAME LIST OF FIG. V-6-1 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 SHARPENING 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	MACHANICAL 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

18.000
3.000
6.000
4.000

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

18.000 (B)-BAY — 10T 2.10.1 — 8T 2.9.1 — 8T 2.9.1

24.000 (C)-BAY — 15T 2.12.1 — 10T 2.10.2 — 8T 2.9.2

92.000

20.000 (D)-BAY — 30T/5T 2.17.1 — 20T 2.14 — 15T 2.12.2

30.000 (E)-BAY — 30T/5T 2.17.2 — 30T/5T 2.17.2 — 15T/5T 2.13.1

4.000
6.000
3.000
9.000
18.000

4.1.1

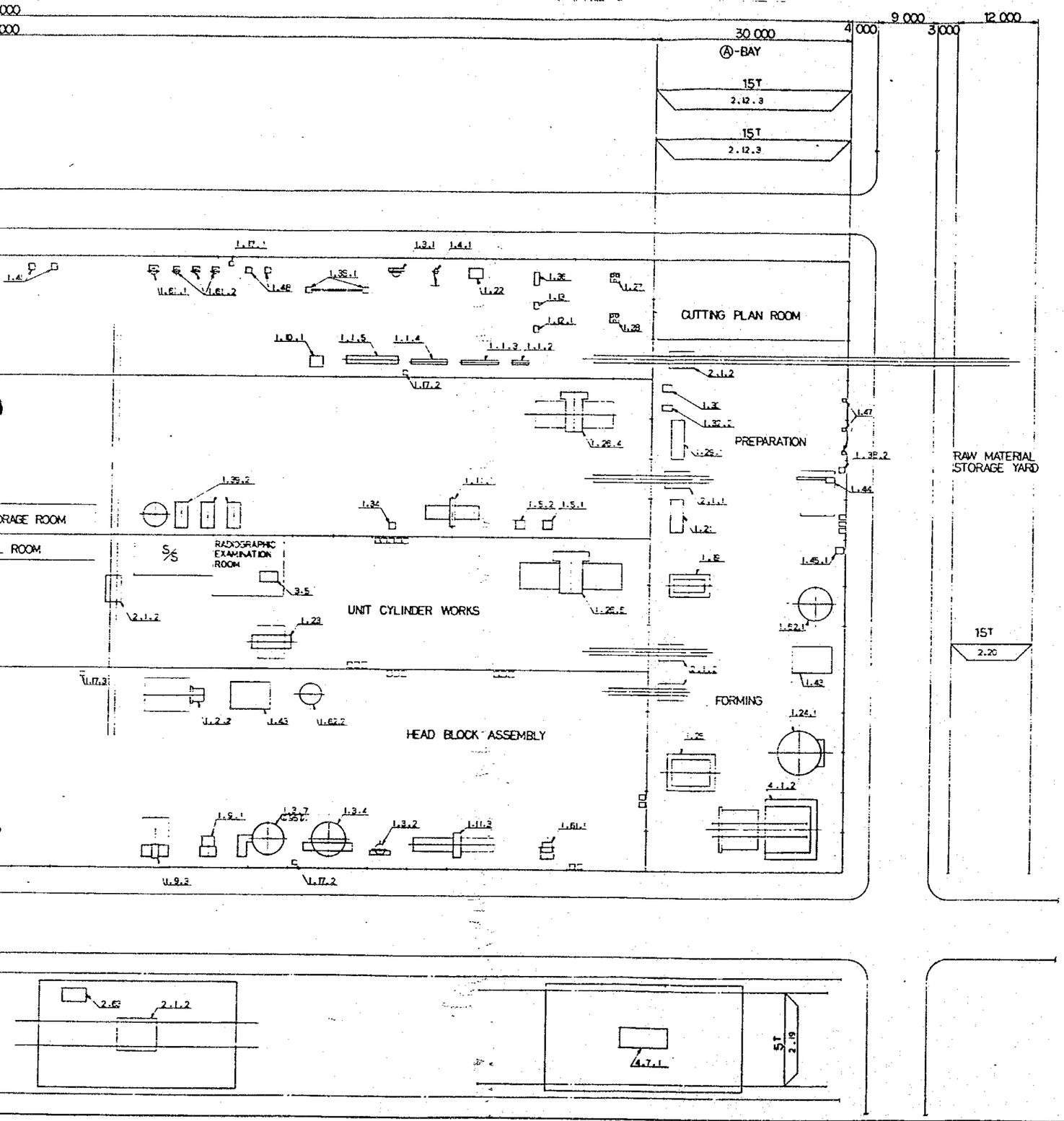
3.5

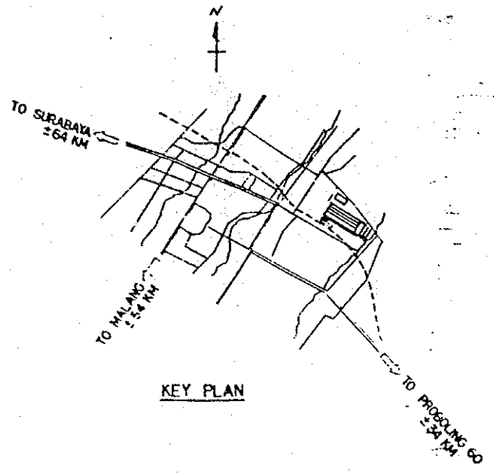
4.2 2.1.2

30T/5T 2.17

2.65 2.1.2

5-88-5





KEY PLAN

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 DRILING 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 GRIDING
1.15	SEMIAUTOMATIC GRINDER FOR SHARPENING TWIST DRILL & CORE DRILL
1.16	AUTOMATIC SHAPEYING FOR METAL CUTTING CIRCULAR SAW
1.17	PEDESTAL GRINDING MACHINE (DOUBLE GRINDING WHEELS)
1.19	HEAVY DUTY HYDRULIC 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	MECANICAL UNIVERSAL STEEL WORKER MACHINE
1.32	FORCING 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
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
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2.12	OVERHEAD TRAVELLING CRANE 15 TONS
2.13	OVERHEAD TRAVELLING CRANE 15/5 TONS
2.14	OVERHEAD TRAVELLING CRANE 20 TONS
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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
6.7	ACID CLEANING EQUIPMENT

Fig. V-6-1 LAYOUT PLAN
(WAHANA)

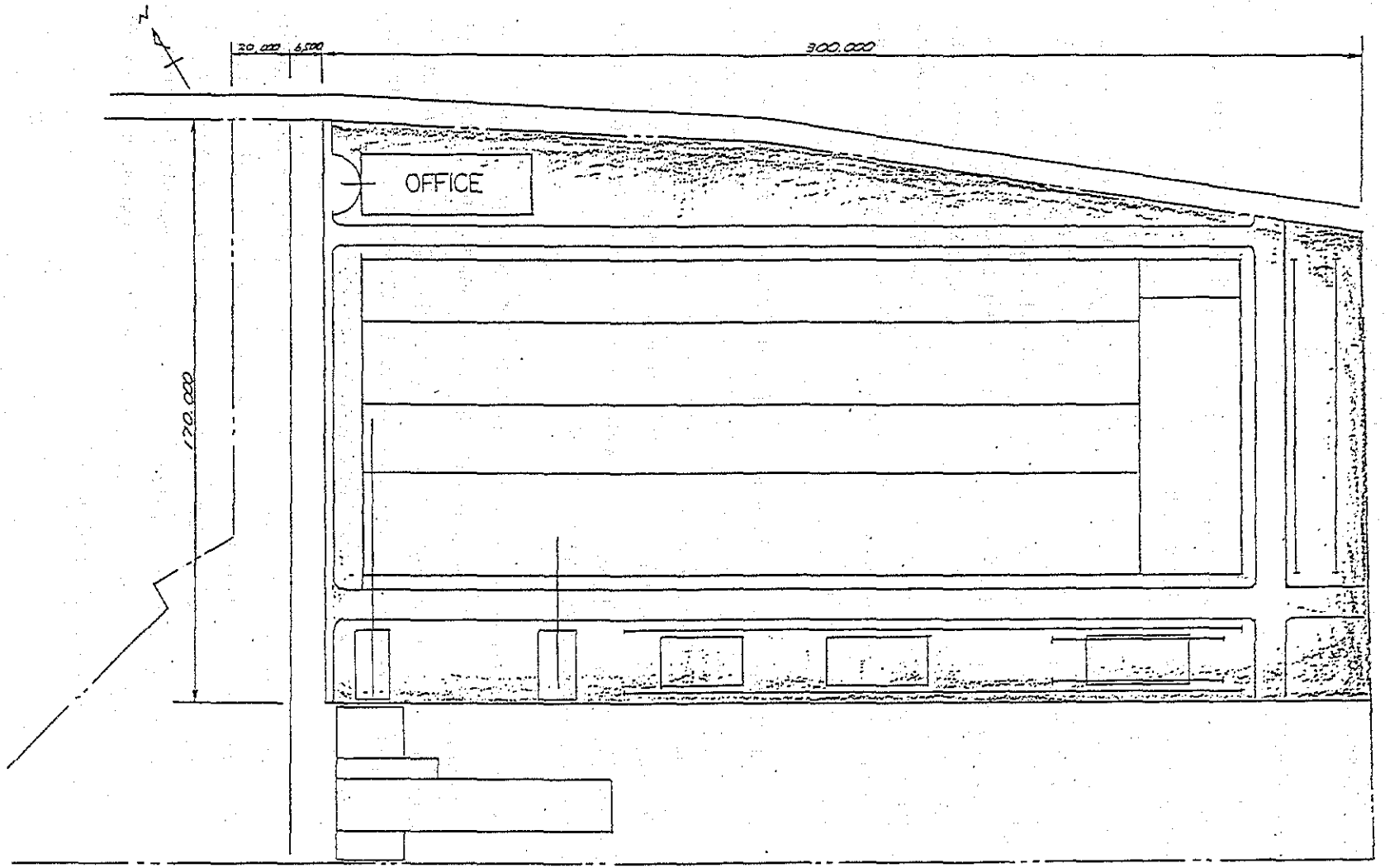

Fig. V-6-2 LAND PREPARATION PLAN
(WAHANA)

V-7 Boma Stork, Pasuruan

(1) Investment cost

The investment cost for this renovation is as shown in Table V-7-1, refer to Chapter 4 Para. 4.7.4. for the details.

1) As for the setting up of the location of the large scale assembly bay and the crane capacity, it was confirmed as a result of various investigations that it is most suitable to extend the existing 12 tons assembling bay by 70 meters to swell its bulk, considering the influence over the other buildings. And in this case, there is only a slight difference in the construction cost between 35 tons and 50 tons as far as the crane capacity is concerned. Accordingly, the building cost and the crane cost are estimated based on the above.

2) The machine fabrication equipments and the steel fabrication equipments are based on the contest stated in the preceding chapter. The cost of the machine reforming is estimated based on that the operation equipments of the old facility shall be partially automated or the processing speed and capacity shall be improved through the power-up of the motor drive system. This is shown in Table V-7-2.

3) As for the D/D (detailed design) consultation, the cost is tried to be minimized on the condition that the pre-engineering measurement and part of the detailed design of the civil engineering and the construction should be partially undertaken by Indonesian engineering subcontractor, but under the single responsibility of D/D consultant.

4) As for the training cost, only the cost for the two instructors dispatched for the period of two years from the training consultant company is appropriated in this cost category. The training fee for the commissioning engineer dispatched by the equipment supplier is treated as the extension of the commissioning, and it is appropriated as the supervision fee in the facility cost.

5) Various expenses for accommodation, meals, transportation, and communication for the D/D consultant and the training consultant during their stay in Indonesia are estimated as the site portion account. The transportation and communication expenses for the supervisor dispatched by the equipment supplier are estimated in the site portion.

(2) Principal improvments

The followings are the principal improvements resulting from this renovation including the indirect effect.

1) Reinforcement of the production capacity

① Reinforcement of the workshop production capacity is limited due to the size of the workshop site and the working floor area. However, the completion of the production equipments and the improvement of the production techniques shall make expansion of the market and order taking for the high value-added products possible.

In another word, general reinforcement for the filling orders including the enhanced capacity for purchasing the finished products such as the fabricated products by the subcontractors, electrical equipments, and reduction gears shall be realized. Against 2,104.5 tons, average production in the past five years, 11,229 tons is expected to be produced in 1994.

② At the same time the extension and the bulk-up of the assembly bay shall make the fabrication of large-scale/heavy-weight products possible. This shall enlarge the order taking range and facilitate the order taking activity.

2) Enhancement of the productivity

① As for the boiler and the pressure vessel in particular, the processing flow shall be shortened and simplified, and the completion of the fabrication equipments shall reduce the handling and processing hours, thus strengthening the sales competitiveness.

② By introducing the automation and NC in the added facilities, morale for the improvement of the production techniques shall be enhanced, thus paving the way for the rationalization of production.

3) Improvement of the quality

① In the plate work, the improvement of the fabrication quality and the stable relilability shall be obtained by the betterment of the cutting, forming and welding, together with the introduction of the nondestructive examination equipments and the installment of the stress relieving furnace. This shall lead to the increased credit of P.T. Boma-Stork in the market.

② In the machine processing, to say nothing of the newly installed equipments, the present equipments also shall bring about the improvement in precision. This shall facilitate the enhancement of consciousness about the quality control.

(3) Workshop layout and implementation schedule

1) Workshop layout

The plan for the modification of the workshop layout is shown in Figure V-7-1. For the plate work, the fabrication flow, including the modified material storage, has become very efficient. As for the assembly and the welding, the total working area has been enlarged by extending or remodeling the large scale assembly bay and by transfering or extending the forming facility. And then, each line has become clear. By the introduction of the crane capacity; the 50 tons bay is for the large size fabrication, the 10 tons bay for the medium size and the 7.5 tons bay for the small size. It has also made the working control easy. By the transfer of the tool shop, the transfer-out route for the products out of machine shop has been secured.

However the storage for the products finish in the workshop should be arranged outside of the workshop site at present and in future as well.

2) Implementation schedule

Based on the condition as stated in the article IV-7, the execution process has been planned as in the attached Figure V-7-2. Even if the two years training has not been completed, the effect of the training (improved skill application) shall be expected by March 1989 to a certain degree.

Table V-7-1 Summary of Investment Cost

BOMA- STORK PASURUAN

ITEM	FOREIGN PORTION (MIL.YEN)	DOMESTIC PORTION (MIL. YEN)	TOTAL (MIL. YEN)	Remarks*
1. Machine tool	839.6	91.0	930.6	Table 4-2
2. Steel fabrication equipment	345.8	30.6	376.4	Table 4-2
3. Miscellaneous equipment, tool etc.	315.7	3.0	318.7	Table 4-2
4. Handling equipment	89.7	5.3	95.0	Table 4-2
5. Machinery reforming	70.5	37.1	107.6	Table 4-3
6. Building & miscellaneous facilities	28.9	179.5	208.4	Table 4-4
7. Electrical & utility facilities	46.9	50.5	97.4	Table 4-4
(Subtotal-1)	(1,737.1)	(397.0)	(2,134.1)	
8. Detailed designing	61.3	28.2	89.5	Table 4-5
9. Implementating body	-	22.7	22.7	
10. Training	96.4	37.4	133.8	
(Subtotal-2)	(157.7)	(88.3)	(246.0)	
11. Contract tax	-	279.5	279.5	
12. Contingency				
12-1 Phisical	56.8	34.0	90.8	
12-2 Escalation	118.7	205.3	324.0	
(Subtotal-3)	(175.5)	(518.8)	(694.3)	
T O T A L	2,070.3	1,004.1	3,074.4	

Remarks* : Details are specified in the Tables under Chapter 4 para. 4.7.4. of the Report.

Table V-7-2 Summary of Production Facilities

(BOMA STORK PASURUAN)

(UNIT; SETS)

	NEW FACILITIES	RE-USE OF EXISTING FACILITIES		TOTAL
		TO BE IMPROVED	AS IT IS	
1. MACHINING FACILITIES	21	19	22	62
2. TOOL GRINDING MACHINES, ETC.	6	-	4	10
3. PLATE WORK FACILITIES	80	13	28	121
4. HANDLING FACILITIES	6	-	25	31
TOTAL	113	32	79	224

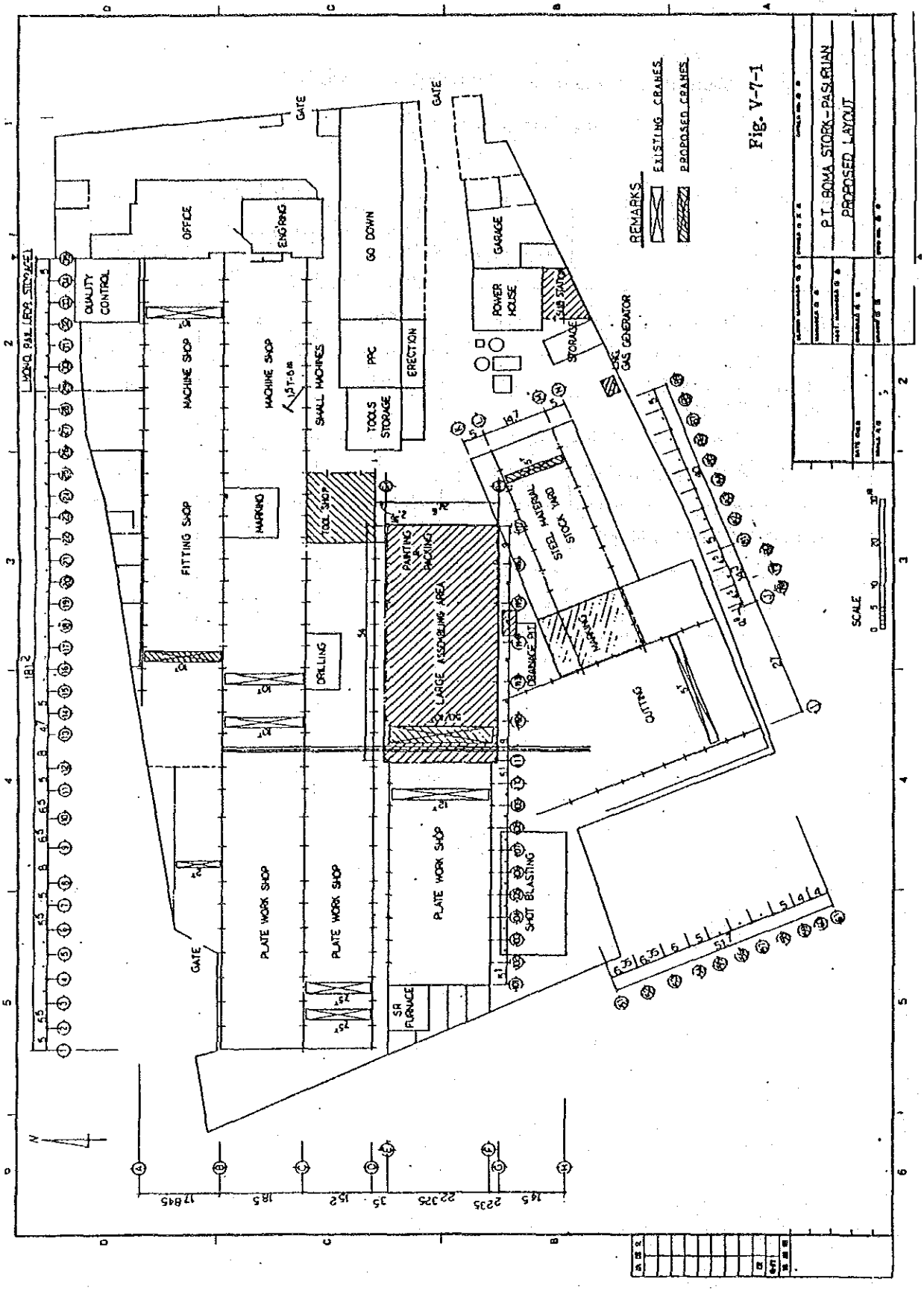
Fig. V-7-1
P.T. BOMA STORK-PASARIAN
PROPOSED LAYOUT
REMARKS
EXISTING CRANES
PROPOSED CRANES
SCALE
OFFICE
ENGRNG
GO DOWN
GATE
QUALITY CONTROL
MACHINE SHOP
MACHINE SHOP
PPC
ERECTION
TOOLS STORAGE
SMALL MACHINES
GARAGE
POWER HOUSE
SUB STATION
STORAGE
DEG. GAS GENERATOR
FITTING SHOP
MARKING
TOOL SHOP
DRILLING
PAINTING & PACKING
LARGE ASSEMBLING AREA
STEEL MATERIAL STOCK YARD
DRAINAGE DIT
CUTTING
PLATE WORK SHOP
PLATE WORK SHOP
PLATE WORK SHOP
SHOT BLASTING
SR FURNACE
GATE
N

Fig. V-7-2 Implementation Schedule