Table 3-5 Facility Plan (New Machine Tool) (27/36)

NO.	FACILITY	DESCRIPTION		BASIS OF PLAN	REMARKS
BM-1	Tools-Brazing Machine (1 set)	Electric Brazing Machine			
		1. Specifications			
		(1) Power supply	2.0 kVA - 20 A 100 V		
		(2) Capacity	25 x 30 mm		
		2. Accessories			
		(1) Work tools	1 set		

Table 3-5 Facility Plan (New Machine Tool) (28/36)

NO.	FACILITY	DESCRIPTION		BASIS OF PLAN	REMARKS
IE-1	Inspection Equipment & Measuring Tools	1. Measuring tools		Augmented equipment for the purpose of general inspection.	
		(1) Block gauge sets Class A (103 pcs)	1 set		
		(2) Accessories for block gauge (standard)	1 set		
		(3) Angle block gauge sets (standard)	1 set		
		(4) Wedge block gauge sets (standard)	1 set		
		(5) Height master	1 set		
		(6) Dial gauge (2 types x 10 pcs)	1 set		
		(7) Lever type dial test indication (2 types x 10 pcs)	1 set		
		(8) Magnet base (lever type)	10 sets		
		(9) Cylinder gauge sets (6^{ϕ} - 600^{ϕ})	1 set		
		(10) Surface measuring instrument	1 set		
		(11) Surface roughness scale sets (4 types x 1 pc)	1 set		
		(12) Hardnester (standard Hs, Hrc 8 type x 1 pc)	1 set		
		(13) External micrometer (0-15mm - 475-500mm 20 size)	20 pcs		
		(14) Micrometer with interchageable anvil (0-100mm - 900-1,000mm 11 size)	11 pcs		
		(15) Point micrometer (0-25mm - 75-100mm 4 size)	4 pcs		
		(16) Vernier caliper (150mm-5/100, 200mm-5/100, 300mm-5/100, 600mm-5/100,1,000mm-5/100 4 size)	43 pcs		
		(17) Steel rule (150mm, 300, 600, 1,000, 1,500, 2,000 6 size)	110 pcs		
		(18) Universal bevel protractor (150mm, 300mm 2 size)	6 pcs		
		(19) Square(150mm x 100, 300 x 200, 600 x 350, 1,000 x 550 4 size)	14 pcs		
		(20) Cylindrical square($^{\phi}150 \times 400^{L}$ x $\pm 4\ \mu$)	1 pcs		

Table 3-5 Facility Plan (New Machine Tool) (29/36)

NO.	FACILITY	DESCRIPTION		BASIS OF PLAN	REMARKS
		(21)	Precision square level (JIS 1 class 200mm x 200)	1 pc	
		(22)	Cast iron surface plate (JIS 1 class 1,200 x 2,400 x 320)	1 pc	
		(23)	Steel V block (25 - 100 mm 5 size)	10 sets	
		(24)	Box block with V groove (A class 250 mm)	1 set	
		(25)	Steel tape measuring (30 m)	1 pc	
		(26)	Convex rule (5 m)	10 pcs	
		(27)	Y level (X30 - 40 mm x 30 sec)	1 set	
		(28)	Plumb bob (brass made)	3 pcs	
		(29)	Weld-thickness gauge sets	5 sets	
		(30)	Jointed inside micrometer (2m x 5 m)	1 set	
		(31)	Tubular type inside micrometer (50-75mm - 475-500mm)	18 sets	
		(32)	Precision straight edge (A class 1,000 x 60 x 12) (A class 3,000 x 120 x 22)	1 pc 1 pc	
		(33)	Dial caliper gauge (I0 type)	1 set	
		(34)	Depth micrometer (0-50 - 75-100 11 size)	1 set	
		(35)	Depth gauge (A type 150 - 1,000 7 size)	1 set	
		(36)	Gear tooth vernier (M1.5-12, 2.5-25 2 size)	1 set	
		(37)	Thickness & taper gauge (No. 65M, No.150MZ No. 245M 3 type)	1 set	
		(38)	Calipers (3 type 100mm - 1,000mm) total	300 pcs	
		(39)	Screw thread limit gauge	1 set	
		(40)	Hardness tester (shore type, brinnel type)	1 set	
		(41)	Thermo meter (0-200°C - 30 - 100°C mercury stick type)	10 pcs	
		(42)	Digital thermo meter (-50 - 1,200°C)	2 sets	
		(43)	Noise indicators	1 set	
		(44)	Vibration meters	1 set	
		(45)	Tester	1 set	

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Table 3-5 Facility Plan (New Machine Tool) (30/36)

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
		(46) Thickness meter	1 set	
		(47) Photoelectric counter	1 set	
		(48) Handy digital tachometer	1 set	
		(49) Stop watch	1 pc	
		(50) Precision spring testing machine	1 set	
		(51) Transit	1 set	
		2. Nondestructive testing machine & tools		
		(1) Magnetic particle meter	1 set	
		(2) Ultrasonic detector	1 set	

Table 3-5 Facility Plan (New Machine Tool) (31/36)

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
MT-1	Machining tools	1. Machining tools (1) For B-1 machining tools — 1 set · Milling cutter & tips (6" - 12" 2 pcs x 4 size) (1 set) · Taper drills (10ϕ - 80ϕ - 111 pcs) (1 set) · Super drills, center drills & blades (80ϕ - 120ϕ) (40 sets) · Chucking reamers (10ϕ - 80ϕ - 111 pcs) (1 set) · End mills (10ϕ - 50ϕ - 158 pcs) (1 set) · Taps (M10 - M56 x 20 sets & 15 pcs) (1 set) · Cutter arbors, Drill sleeve & sockets (1 set) · Tappers (1 set) (2) For L-7 machining tools — 3 sets · Standard brazed tools (5 size x 16 pcs) (1 set) (3) For L-8 machining tools — 1 set · Standard brazed tools (4 size x 16 pcs) (1 set) (4) For L-9 machining tools — 1 set · Milling cutter & tips (6" - 12" 2 pcs x 4 size) (1 set) · Taper drills (10ϕ - 80ϕ - 111 pcs) (1 set) · Super drills, Center drills & blades (80ϕ - 120ϕ) (40 sets) · Chucking reamers (10ϕ - 80ϕ - 158 pcs) (1 set) · End mills (10ϕ - 50ϕ - 158 pcs) (1 set) · Taps (M10 - M56 x 20 sets & 15 pcs) (1 set) · Cutter arbors, Drill sleeve & sockets (1 set) · Tappers (1 set) (5) For L-10 machining tools — 3 sets · Standard brazed tools (4 size x 16 pcs) (1 set) (6) For L-11 machining tools — 1 set · Standard brazed tools (4 size x 16 pcs) (1 set)	These machining tools are required to develop the capacity (performance and efficiency) of the newly installed machines to a maximum.	

Table 3-5 Facility Plan (New Machine Tool) (32/36)

NO.	FACILITY	DESCRIPTION		BASIS OF PLAN	REMARKS
		(7) For L-17 machining tools	1 set		
		· Standard brazed tools (4 size x 16 pcs)	(1 set)		
		(8) For Z-2 machining tools	1 set		
		· Straight bevel gear generating cutters (M2 - M25 - 19 size)	(1 set)		
		(9) For S-1 machining tools	1 set		
		· Standard brazed tools (4 size x 11 pcs)	(1 set)		
		(10) For SL-1 machining tools	1 set		
		· Standard brazed tools (1 size x 10 pcs)	(1 set)		
		(11) For D-1 & D-2 machining tools	4 sets		
		· Taper drills (10ϕ - 85ϕ - 232 pcs)	(1 set)		
		· Reamers (10ϕ - 85ϕ - 232 pcs)	(1 set)		
		· Taps (10ϕ - 70ϕ - 32 sets/30 pcs)	(1 set)		
		· Boring tool bits (100 pcs)	(1 set)		

Table 3-5 Facility Plan (New Machine Tool) (33/36)

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
FA-1	Fitting & Assembly tools (1 set)	Fitting and Assembly Tools			These tools are required for accomplishing augmentation of the assembling equipment & tools, and improvement in work efficiency.	
		(1) Working table		5 sets		
		· Dimensions (1500 mmW x 2500 mmL x 800 mmH)				
		(2) Parallel vise		1 set		
		· Caliber	(110 mm)	(5 pcs)		
			(135 mm)	(5 pcs)		
			(160 mm)	(5 pcs)		
		(3) Hand tools		1 set		
		· Gear puller (dia 75, 100, 150, 200, 250, 300 375, 450 mm)		(8 sets)		
		· Bearing puller set (10 - 13ø - 55 - 50ø)		(2 sets)		
		· Socket wrench set		(5 sets)		
		· 45° double offset wrench		(5 sets)		
		· Torque wrench (0-230 - 0-10,000 cm-kg)		(1 set)		
		· Adjustable angle wrench (150, 200, 250, 300, 375 mm)		(10 sets)		
		· Open ended spanners with double end type (5.5 x 7 - 55 x 60 mm)		(10 sets)		
		· Open ended spanners with single end type (5.5 - 38 mm)		(10 sets)		
		· 6 set wrench (5.5 x 7 - 22 x 24 mm)		(10 sets)		
		(4) Electrical and pneumatic tools		1 set		
		· Portable electric drill (5 - 32 mmø)		(2 sets)		
		· Disc grinder (100 - 205 mmø)		(2 sets)		
		· Portable electric grinder (100 mmø, 125 mmø)		(2 sets)		
		· Grinding wheels		(40 pcs)		

Table 3-5 Facility Plan (New Machine Tool) (34/36)

NO.	FACILITY	DESCRIPTION		BASIS OF PLAN	REMARKS
		(5) Hydraulic tools	1 set		
		· Hydraulic jack with detached pump (20 tons, 30 tons, 50 tons)	(4x3 sets)		
		· Hydraulic oil jack (2, 5, 7, 10, 12, 20, 50 tons)	(4x7 sets)		
		(6) Other tools	1 set		
		· Spur geared chain hoist (1/2, 1, 1 1/2, 2, 3, 5, 10 tons)	(7x2 sets)		
		· Ratchet lever hoist (3/4, 1 1/2, 3, 6 tons)	(4x2 sets)		
AC-1	Air Compressor (2 sets)	Unloader Type Oil Free Baby Compressor		This compressor is used for various types of air tools.	
		1. Specifications			
		(1) Power	3.7 kW		
		(2) Pressure	7 kg/cm^2		
		(3) Discharge	500 lit/min		
		(4) Tank capacity	160 lit		
		2. Accessories (standard)	1 set		

Table 3-5 Facility Plan (New Machine Tool) (35/36)

NO.	FACILITY	DESCRIPTION		BASIS OF PLAN	REMARKS
PT-1	Plate working tools (1 set)	Plate working tools		Tools to augment the capacity of steel structure work and welding work.	
		(1) Gas cutting & welding tools	1 set		
		· Cutting trestle (2,500 mmW x 5,000 mmL x 300 mmH)	(3 sets)		
		· Gas welder	(20 sets)		
		· Gas & oxygen hose	(15 sets)		
		· Gas regulater	(30 sets)		
		(2) Crane & Handling tools	1 set		
		· Shackles (1 - 15 tons)	(1 set)		
		· Steel wire rope (10ø x 3 m - 18ø x 8 m)	(1 set)		
		· Hang clamp (0-35 mm - 3 tons, 0-50 mm - 5 tons)	(1 set)		
		· Spur geared chain hoist (1/2, 1, 1 1/2, 2, 2 1/2, 5 tons)	(1 set)		
		(3) Electric welding tools	1 set		
		· Portable type electric dryer (10 kg - 50 - 300°C)	(6 sets)		
		· Holder (300A, 500A)	(20 sets)		
		· Gouging torch (600A)	(3 sets)		
		· Air tools (Pneumatic multiple jet chisel etc.)	(2x1 set)		
		(4) Fitting tools	1 set		
		· Disc sander (Air type)	(15 sets)		
		· Ratchet lever hoist (1.5, 3, 6 tons)	(2 sets)		
		· Air hose (3/4" x 50M)	(1 set)		
		· Impact wrench	(1 set)		
		· Hydraulic jack (15, 25, 50, 100 tons)	(1 set)		
		· Magnetic drill press (25ø, 32ø)	(1 set)		
		· Spare parts etc.	(1 set)		

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

NO.	FACILITY	DESCRIPTION		BASIS OF PLAN	REMARKS
		(5) Measuring tools (for plate works)	1 set		
		· Automatic level (x28 - 40ϕ)	(1 set)		
		· Transit (x30 - 40ϕ)	(1 set)		
		· Precision square level (300 mm x B class)	(1 set)		
		· Vernier caliper (300 mm x 10 pcs)	(1 set)		
		· Tempered steel rule (150 mm, 1 m, 2 m) etc.	(1 set)		
		(6) Maintenance tools	1 set		
		· Insulation resistance tester	(1 set)		
		· Tester	(1 set)		
		· Simple thermometer	(1 set)		
		· Tachometer	(1 set)		
		· Spanners	(1 set)		
		· Bench grinder (150ϕ)	(1 set)		
		· Bearing puller set	(1 set)		
		· Tool cabinet (590W x 600H x 540D x 5 stage)	(27 sets)		
		· Tool cabinet (750W x 1100H x 700D x 9 stage)	(9 sets)		
		· Tool rack (1200W x 1800H x 450D, 875W x 1900H x 450D)	(18 sets)		

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Table 3-6 Facility Plan (Handling Equipment) (1/2)

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
H-01	15T O.H.C (2 Sets)	Major specifications 1) Lifting capacity ; 15 TON 2) Lifting height ; 10 M 3) Crane span ; 11 M 4) Operation method ; By directly	Scaling-up of parts and components to be fabricated.	Location; Bay D-E
H-02	15T O.H.C. (1 Set)	Major specifications 1) Lifting capacity ; 15 TON 2) Lifting height ; 10 M 3) Crane span ; 11 M 4) Operation method ; By radio	Enhancement of assembling work efficiency.	Location; Bay F-G
H-03	15T O.H.C. (1 Set)	Major specifications 1) Lifting capacity ; 15 TON 2) Lifting height ; 6 M 3) Crane span ; 9 M 4) Operation method ; By directly	Scaling-up of parts and components to be fabricated.	Location; Bay C-D
H-04	6T O.H.C. (1 Set)	Major specifications 1) Lifting capacity ; 6 TON 2) Lifting height ; 6 M 3 Crane span ; 11 M 4) Operation method ; By radio	Enhancement of assembling work	Location; Bay H-I
H-05	2T O.H.C. (1 Set)	Major specifications 1) Lifting capacity ; 2 TON 2) Lifting height ; 6.5 M 3) Crane span ; 10 M 4) Operation method ; By pendant switch	Enhancement of assembling work	Location; Bay B-C

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Table 3-6 Facility Plan (Handling Equipment) (2/2)

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
H-06	2T O.H.C. (1 Set)	Major specifications 1) Lifting capacity ; 2 TON 2) Lifting height ; 6.5 M 3) Crane span ; 8 M 4) Operation method ; By radio	Enhancement of transport efficiency	Location; Bay G-H
H-07	1T Jib hoist (2 Sets)	Major specifications 1) Lifting capacity ; 1 TON 2) Lifting height ; 7 M 3) Arm length ; 5 M 4) Operation method ; By pendant switch	Enhancement of assembling work	Location; E-9 F-6
H-08	2T Forklift (1 Set)	Major specifications 1) Type ; Front lifting type 2) Rated capacity ; 2 Ton 3) Engine ; Diesel engine	Enhancement of transport efficiency	
H-09	15T Transfer Carriage (1 Set)	Major specifications 1) Type ; Low-bed type 2) Rated capacity ; 15 TON 3) Engine ; Diesel engine	Enhancement of transport efficiency	
H-10	2T Transfer Carriage (1 Set)	Major specifications 1) Type ; Low-bed type 2) Rated capacity ; 2 TON 3) Engine ; Gasoline engine	Enhancement of transport efficiency	

Table 3-7 Facility Plan (Building & Auxiliary Facilities) (1/2)

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
BW-01	Reinforcement of Bay D-E	Major specifications 1) Dimension Width ; 12 M Length ; 75 M 2) Outline of works a. Reinforcement of existing columns b. Reinforcement of existing foundation c. Renewal of crane girder and rail for 15T O.H.C	Reinforcement work due to the leveled-up crane	Details are shown on Fig. 3-1
BW-02	Reinforcement of Bay B-C	Major specifictions 1) Dimension Width ; 11.9 M Length ; 45 M 2) Outline of works Installation of new crane girder and rail for 2T O.H.C	Reform work due to the newly installed crane.	Details are shown on Fig. 3-1
BW-03	Substation building	Major specifications 1) Dimension (Total 54 M^2) Width ; 4.5 M Length ; 12 M Height ; 4 M 2) Structure ; Reinforced concrete		

BARATA TEGAL GENERAL WORK SHOP

Table 3-7 Facility Plan (Building & Auxiliary Facilities) (2/2)

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
BW-04	Partition work for Dining room	Major specifications 1) Dimension (Total 285 M^2) Width ; 19 M Length ; 15 M Height ; 4 M 2) Structure Wall ; C.G.I.S. Ceiling ; board		Location; Bay; H-I Column; I-4
BW-05	Partition work for Parking area	Major specifications 1) Dimension (Total 413 M^2) Width ; 7 M Length ; 59 M 2) Outline works a. New partition work along bay I b. Removal of existing wall along bay J		Location; Bay; I-J Column; 5-17
BW-06	Reinforcement of columns for Jib hoist (2 places)	Major specifications Capacity of Jib hoist ; 1 TON - 5 M		Location; E-9, F-6

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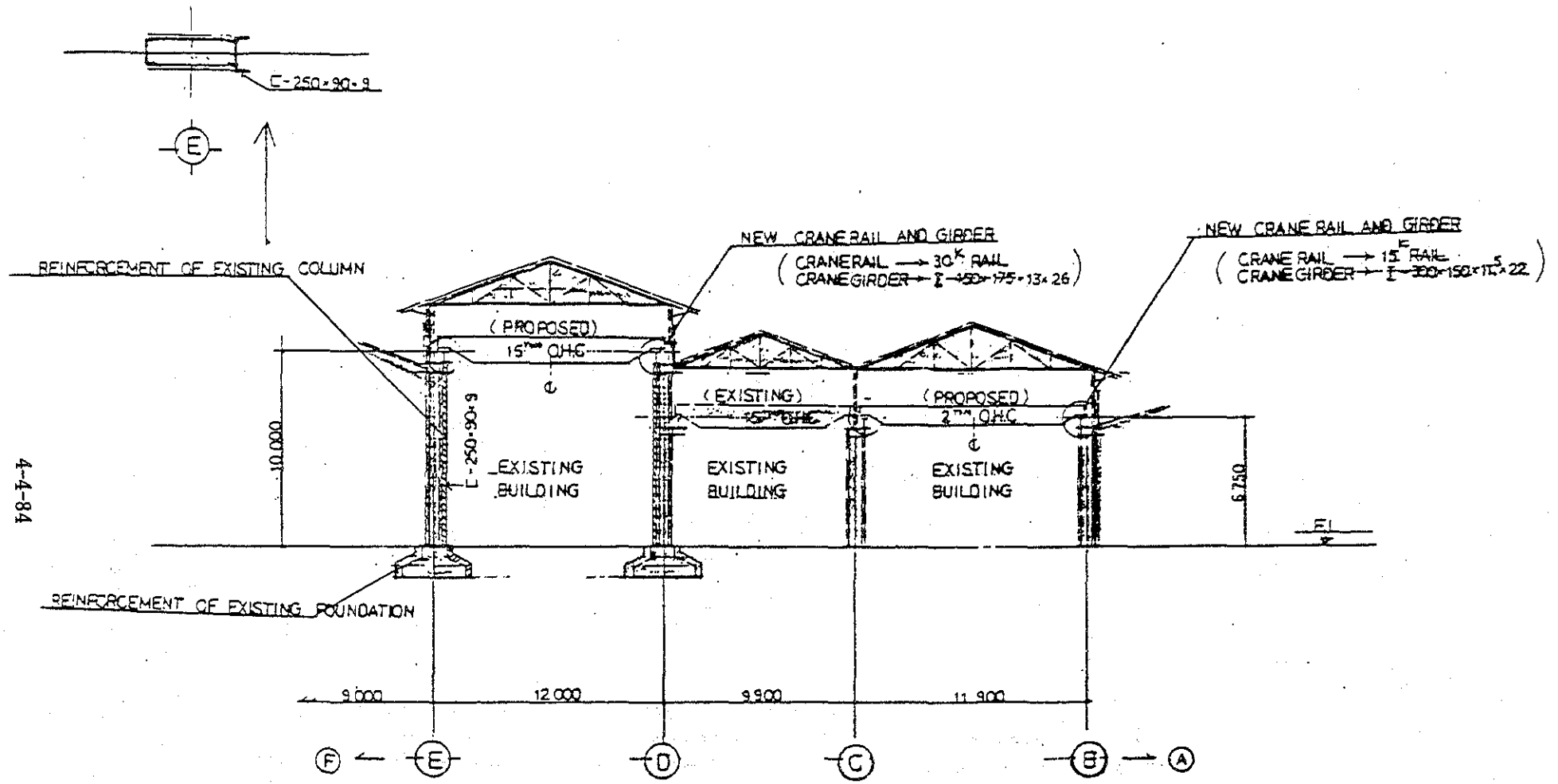
Table 3-8 Facility Plan (Infra-Structure/Electrical/Utility Facilities) (1/2)

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
UW-01	Connection fee to P.L.N	Payment to P.L.N. for proposed 22 KV transmission line		
UW-02	Substation system	Major specifications 1) Type ; Indoor, load-center type a. Switchgear ; Metal enclosed, self standing b. Transformer ; Oil-immersed, self cooled type 2) Voltage a. Primary ; 22 KV, 3 Phase, 50 Hz b. Secondary ; 380V, 3 Phase, 4 wires 3) Capacity ; 750 KVA 4) Aux. equipment/materials/works a. Power capacitors for power factor improvement b. Spare parts and maintenance tools c. Foundation work for substation equipment d. Installation work including testing	The purpose of this system is to level up capacity involved by the installation of new equipment.	Details are shown on Fig. 3-2
UW-03	L.V. Power supply system	Major specifications 1) Scope ; Wiring work from substation to electrical equipment/facilities 2) Wiring method ; Overhead conduit system 3) Materials a. Power cable ; 600V PVC Insulated b. Panel boards ; Metal enclosed, wall hanging type	as above	Details are shown on Fig. 3-3

BARATA TEGAL GENERAL WORK SHOP

Table 3-8 Facility Plan (Infra-Structure/Electrical/Utility Facilities) (2/2)

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
UW-04	Lighting system	Major specifications	Illumination level	
		1) Lighting fixtures ; Mercury vapor lamp	Marking area 200 Lux	
		2) Wiring method ; Overhead conduit system	Main walk way 50 Lux	
		3) Panelboards ; Metal enclosed, wall hanging type		



SECTION (B)~(E) S=1/200

Fig. 3-1

BARATA -TEGAL

REINFORCEMENT OF BAY B-C & D-E

4-4-84

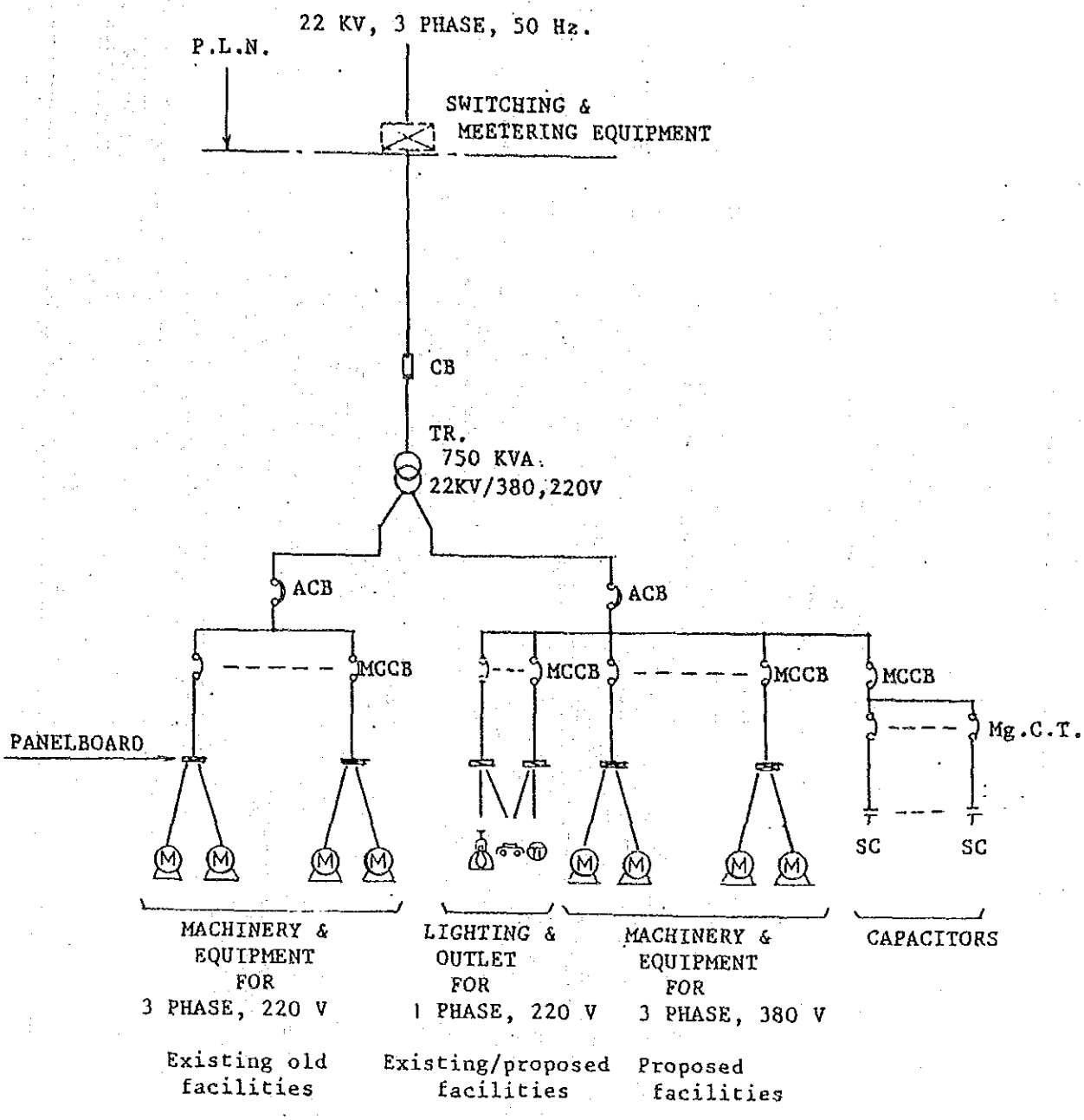


Fig. 3 - 2

BARATA TEGAL GENERAL WORK SHOP

PROPOSED SUBSTATION SYSTEM

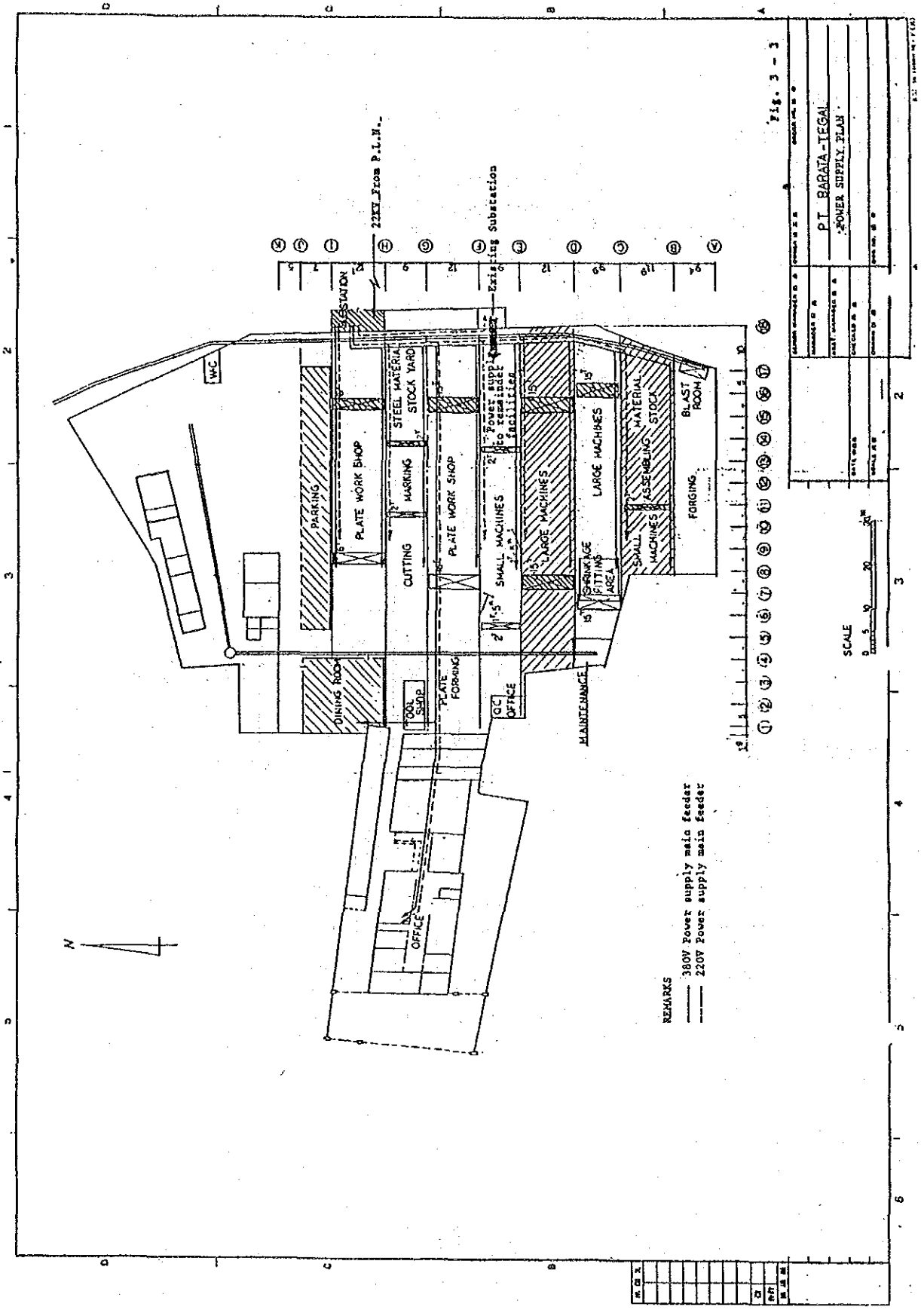


Fig. 3 - 3
P.T. BARATA-TEGAL
POWER SUPPLY PLAN
22KV from P.L.N.
Existing Substation
Power supply to remainder facilities
SUBSTATION
WHC
PARKING
PLATE WORK SHOP
STEEL MATERIAL STOCK YARD
CUTTING
MARKING
PLATE WORK SHOP
SMALL MACHINES
LARGE MACHINES
SHRINKAGE FITTING AREA
LARGE MACHINES
SMALL MACHINES
ASSEMBLING MATERIAL STOCK
BLAST ROOM
FORGING
DINING ROOM
TOOL SHOP
PLATE FORMING
QC OFFICE
MAINTENANCE
OFFICE
SCALE
REMARKS
380V Power supply main feeder
220V Power supply main feeder

4.4.4 Renovation Plan

(1) Overview and layout of renovation

1) Basic plan for layout

Based on the results of the diagnosis for the current conditions and on the considerations for the products line-ups and their quantities, the focal points of the new layout plan for the shop shall be as follows:

① Improvements for flow of products and materials

Layout plans shall be made for each building with emphasis laid on reduction and simplification of work process flows.

② Installation of yards for materials

The yards shall be defined as the start point for manufacturing. This could lead to the decrease of half-made products through the timely supply of materials.

③ Improvements on transportation facilities

More efficient and flexible system shall be established for inter-bays and intra-bays transportation of materials not only through the use of overhead travelling cranes and rail carriages but also through utilization of forklifts and railless carriages.

2) Details of layout for buildings and machinery

Layout for the buildings based on the afore-mentioned basic plan, including utility and auxiliary facilities, is shown in Fig. 4-1 "Proposed Layout". Details of layout for machinery in each bay is shown in Fig. 4-2 "Detailed Layout". Main points for the layout are as follows:

① The present functions in all bays shall be re-organized so that the plate work facilities are gathered in the northern part of the shop and machine shop facilities are located in the southern part.

② Improvements shall be made to the D-E bay so that two 15 tons overhead travelling cranes are installed. A 15 tons overhead travelling crane shall also be newly installed to the C-D bay. By means of these improvements, pre-processing to shrinkage fitting, processing for shrinkage fitting and roll finish processing after shrinkage fitting are all done within the C-D bay. Along with the merit as described above, large-sized machinery for non-roll machining purpose can also be installed in the C-D bay. This would make the shop layout quite simple.

③ Improvements shall be made to the B-C bay so that a 2 tons overhead travelling cranes are newly installed. This shall be the stock yard for the small-sized machinery and materials.

④ Existing I-J bay shall be utilized as a parking area. For this purpose the following remodelling works shall be required:

i) Move the forging facilities to the A-B bay,

ii) Remove the wall on the J row and install a wall on the I row, and

iii) Move the dining room and remove some part of the parts warehouse in order to secure passage for vehicles.

⑤ Improvements, shall be made to the F-G bay so that a 15 tons overhead travelling crane is added to utilize the building more efficiently as the plate work shop. Hydraulic presses and bending rollers shall be installed in the building for the manufacturing of medium gauge plates.

⑥ Improvements shall be made to the G-H bay so that a 2 tons overhead travelling crane is newly added and areas for steel materials, marking and cutting are defined. Also a tool shop shall be newly installed to the west of the G-H bay.

⑦ Improvements shall be made to the H-I bay so that a 6 tons overhead travelling crane is newly added to make this bay the plate work shop for light-weight small-size products such as gates for irrigation facilities.

⑧ Improvements shall be made to the E-F bay so that a 2 tons overhead travelling crane is newly added to utilize this building as previously, as the small-size machinery area. Also two 1 ton jib-cranes shall be installed here for handling small size parts.

⑨ Renewal and Relocation of substation

The substation for power supply shall be renewed and relocated to the place shown in Fig. 4-1 to replace deteriorated facilities and to meet with increase in production capacities.

⑩ Increase in other handling facilities

Apart from the improvements of crane facilities in each bay as described above, fork lifts and railless carriages shall be newly installed as inter-bays transportation means in addition to the existing rail carriages. Particularly, a 15 tons railless carriage shall be provided as transportation means between C-D and D-E bays for sugar plant rolls.

In comparison with the rail carriages, the railless carriages are more advantageous because they can cover more areas and make the work areas of the shop to be more efficiently utilized.

3) Comparison between before and after improvements

Work-flow for the Tegal General Work Shop's main product, roll for sugar plant, before improvements is shown in Fig. 4-3 "Existing

Production Flow" and that after improvements in Fig. 4-4 "Proposed Production Flow". After improvements are made, following points can be highlighted as compared to the existing conditions:

(1) Shorter and simpler production flow
Before improvements, paths for materials handling were long and complicated since the bay F-G for roll lathes and the bay C-D for shrinkage fitting was separated by 2 bays in-between. After improvements, production flow will become extremely simple and short-distanced since both the pre-shrinkage fitting working and shrinkage fitting are performed in the C-D bay and all workings after the shrinkage fitting are done in the D-E bay.

(2) By new installation of a yard for materials more efficient utilization of work spaces and solution of handling problems can be expected. Before improvements, materials are stocked arbitrarily around each machine since no stock yards for materials are designated. This results in complicated paths for transportation and loss in handling.

(3) By new installation of a marking table, improved efficiency and accuracy of marking works can be expected. Before improvements, marking works are done on the shop floor, which degrades workability and causes inconveniences of looking for appropriate places and loss in handling.

(4) By replacements and relocations of deteriorated machines, improved efficiency of work processes can be expected.

Through the exclusive use of working facilities for processes such as boring of shell's inside diameter, outside finishing after shrinkage fitting, and working on circumferential grooves and on chevron grooves, improvement in efficiency can be expected.

The number of machines for each process as described above shall be determined on the basis of machine-hours required for

each process, with considerations taken for balance between lines.

⑤ In the figures for "Production Flow" as stated above, flow of materials for plate work is included along with work flow for rolls for sugar plant. It is noted in these figures that flow of materials is also shortened and simplified by bringing together of plate work shop.

(2) Costs for renovation

Table 4-1 "Summary of Investment Cost" shows details of investment required for this renovation. However, costs for utilizing the existing organization of the shop during the renovation period and for training the trainees during the technological training period are not included in the table.

(3) Promotion of the renovation project

1) Actual organizations to perform the project are as follows:

① Renovation project team

② D/D (detailed design) consultants

③ Suppliers of facilities

Suppliers of machine tools, plate work equipment, tools, cranes, structural steel, electric equipment and machines, parts for remodelling machines, and others.

④ Contractors for site works

Contractors for foundation, structural steel building, electrical and utility installation and crane/machinery installation.

⑤ Instructors for training

2) Renovation project team

In order to promote the renovation project effectively, a body of renovation project team representing Barata that functions properly must exist before consultants who perform D/D (Detailed Design) tasks are selected. The team must preferably consists of at least two full-time personnels. These personnels must be suitable for promoting the following tasks to:

① Select D/D consultants,
② Instruct and cooperate with D/D consultants,
③ Approve renovation implementation plans,
④ Select suppliers for equipment and facilities,
⑤ Select contractors for site works,
⑥ Supervise the suppliers and contractors (excluding technical supervision)
⑦ Adjust among suppliers and contractors,
⑧ Select instructors for job training,
⑨ Instruct and cooperate with the instructors for job training.

It goes without saying that the renovation project team cannot do everything. For ordering, contracting, paying and accepting purchased commodities, day-to-day cooperation by the existing organization of the shop is definitely required.

(4) Management of renovation works

As a rule, the renovation project team backed by Barata shall supervise suppliers and contractors during the course of the renovation, with cooperation from the existing organizations as described in the clause (3). However, following tasks can preferably be commissioned to the D/D consultants;

1) For suppliers of equipment and machinery;

i) Plant inspection of main machinery.
ii) Approval of maker's specifications and drawings for main machinery.

2) For contractors;

i) Management on construction schedule,
ii) Quality check of main construction works.

(5) *Implementation schedule for renovation*

Fig. 4-5 "Implementation Schedule" shows individual schedules of the renovation project of this feasibility study. It is considered that the D/D consultants will be selected early May in 1985 and contracts with suppliers of equipment will come into effect at the end of June, 1986.

Table 4-1 Summary of Investment Cost

Barata Tegal General Work Shop

ITEM	FOREIGN PORTION (MIL.YEN)	DOMESTIC PORTION (MIL. YEN)	TOTAL (MIL. YEN)	Details are Specified in
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 Physical	52.7	25.4	78.1	
12-2 Escalation	109.7	148.2	257.9	
(Subtotal-3)	(162.4)	(419.3)	(581.7)	
T O T A L	1,920.1	782.4	2,702.5	

BARATA TEGAL GENERAL WORK SHOP

Table 4-2 Investment Cost Estimation (New Machine & Handling Equipment)

	FACILITY	Q'TY	FOREIGN PORTION (MIL. YEN) FOB	OCEAN FREIGHT	INSURANCE	SUPERVISION	SUB TOTAL	DOMESTIC PORTION (MIL. YEN) CUSTOM TRANSPORTS	FOUNDATION	INSTALLATION	LOCAL EXPENSE	SUB TOTAL	TOTAL (MIL. YEN)
Machine tool	Lathe	7	709.1	11.7	2.4	11.2	734.4	6.2	30.8	16.7	0.6	54.3	788.7
	Vartical lathe	2	81.8	1.3	0.3	2.8	86.2	0.7	12.1	6.2	0.1	19.1	105.3
	Boring machine	1	134.4	1.0	0.5	1.4	137.3	0.5	6.3	2.7	0.1	9.6	146.9
	Planer/planomiller												
	Drilling machine	4	36.4	0.9	0.1	2.8	40.2	0.5	1.9	1.3	0.1	3.8	44.0
	Gear cutting machine	1	35.2	0.1	0.1	1.4	36.8	0.1	2.3	0.9	0.1	3.4	40.2
	Others	5	72.1	0.2	-	1.4	73.7	0.1	1.4	2.3	0.1	3.9	77.6
	(Subtotal)	(20)	(1,069.0)	(15.2)	(3.4)	(21.0)	(1,108.6)	(8.1)	(54.8)	(30.1)	(1.1)	(94.1)	(1,202.7)
Steel fabrication equipment	Cutting equipment	7	9.7	1.2	-	0.7	11.6	0.6	1.2	1.2	-	3.0	14.6
	Bending equipment	3	108.0	3.7	0.3	14.7	126.7	1.9	16.5	5.1	0.7	24.2	150.9
	Welding equipment	18	25.1	0.5	-	-	25.6	0.2	-	-	-	0.2	25.8
	Others	3	27.0	0.5	0.1	-	27.6	0.3	-	-	-	0.3	27.9
	(Subtotal)	(31)	(169.8)	(5.9)	(0.4)	(15.4)	(191.5)	(3.0)	(17.7)	(6.3)	(0.7)	(27.7)	(219.2)
Miscelleneous equipment, tools	Heat treatment facility												
	Marking/inspection plate Inspection equipment/tools	7	110.7	1.0	0.4	-	112.1	0.5	-	-	-	0.5	112.6
	Tools												
	(Subtotal)	(7)	(110.7)	(1.0)	(0.4)	(-)	(112.1)	(0.5)	(-)	(-)	(-)	(0.5)	(112.6)
Handling equipment	Overhead traveling crane	7	45.1	4.8	0.2	-	50.1	2.4	-	3.3	-	5.7	55.8
	Wall crane												
	Jib hoist	2	2.1	0.1	-	-	2.2	0.1	-	0.2	2.2	0.3	2.5
	Forklift/transfer carriage	3	12.1	1.1	-	-	13.2	0.5	-	-	-	0.5	13.7
	(Subtotal)	(12)	(59.3)	(6.0)	(0.2)	(-)	(65.5)	(3.0)	(-)	(3.5)	(-)	(6.5)	(72.0)
	TOTAL	70	1,408.8	28.1	4.4	36.4	1,477.7	14.6	72.5	39.9	1.8	128.8	1,606.5

BARATA TEGAL GENERAL WORK SHOP

Table 4-3 Investment Cost Estimation (Machinery Reforming)

REHABILITATION & RELOCATION		Q'TY	FOREIGN PORTION (MIL. YEN) FOB	OCEAN FREIGHT	INSURANCE	SUPERVISION	SUB TOTAL	DOMESTIC PORTION (MIL. YEN) CUSTOM TRANSPORTS	HANDLING	IMPROVEMENT	FOUNDATION	ERECTION	LOCAL EXPENSE	SUB TOTAL	TOTAL (MIL. YEN)
MACHINE TOOL	IMPROVEMENT OVERHAUL	9	77.3	0.7	0.1	6.5	84.6	0.7		30.5			0.3	31.5	116.1
"	REMOVAL	13							11.7					11.7	11.7
"	RELOCATION	21	3.2	0.1		0.8	4.1	0.1		5.8	2.4	6.7	0.1	15.1	19.2
STEEL FABRICATION EQUIPMENT	REMOVAL	5							2.4					2.4	2.4
"	RELOCATION	14	0.8			0.3	1.1			1.4	0.6	1.7		3.7	4.8
	TOTAL	62	81.3	0.8	0.1	7.6	89.8	0.8	14.1	37.7	3.0	8.4	0.4	64.4	154.2

BARATA TEGAL GENERAL WORK SHOP

Table 4-4 Investment Cost Estimation (Building/Electrical/Utility Facilities)

CONSTRUCTION WORK		Q'TY	FOREIGN PORTION (MIL. YEN) FOB	OCEAN FREIGHT	INSUR-ANCE	SUPER-VISION	SUB TOTAL	DOMESTIC PORTION (MIL. YEN) CUSTOM TRANS-PORTS	FABRI-CATION	FOUN-DATION	EREC-TION	LOCAL EXPENSE	SUB TOTAL	TOTAL (MIL. YEN)
Building & mis-celleneous facilities	Reinforcement of columns Bay D-E for O.H.C		4.4	0.5			4.9	0.6	3.8	6.6	16.0		27.0	31.9
	Improvement of Bay B-C For O.H.C.		1.2	0.1			1.3	0.1	1.0		2.9		4.0	5.3
	Substation building						-			0.6	3.4		4.0	4.0
	Partition work for dining room						-				8.0		8.0	8.0
	Partition work for parking area						-				6.0		6.0	6.0
	Reinforcement of columns for Jib hoist						-			0.4	1.4		1.8	1.8
	(Subtotal)		(5.6)	(0.6)	(-)	(-)	(6.2)	(0.7)	(4.8)	(7.6)	(37.7)	(-)	(50.8)	(57.0)
Electrical & utility facilities	Connection fee to P.L.N.						-					9.5	9.5	9.5
	Substation system		24.9	1.5	0.1	2.0	28.5	0.8			6.0	0.1	6.9	35.4
	L.V Power supply system		7.3	0.7			8.0	0.4			15.4		15.8	23.8
	Lighting system		2.8	0.7			3.5	0.6			3.8		4.4	7.9
	(Subtotal)		(35.0)	(2.9)	(0.1)	(2.0)	(40.0)	(1.8)	(-)	(-)	(25.2)	(9.6)	(36.6)	(76.6)
	TOTAL		40.6	3.5	0.1	2.0	46.2	2.5	4.8	7.6	62.9	9.6	87.4	133.6

BARATA TEGAL GENERAL WORK SHOP

Table 4-5 Investment Cost Estimation (Detailed Design Work)

A —— ENGINEERING WORK & SUPERVISION IN INDONESIA
B ═══ ENGINEERING & DESIGN IN CONSULTANT'S HOME WORK
C ------ LOCAL EXPENSES

DESCRIPTION		COST ESTIMATION (MIL. YEN)				SCHEDULE					
		A	B	C	TOTAL	1985	1986	1987	1988	1989	1990
Expansion/reconstruction of buildings	Investigation of existing situations, designing, preparation of specifications both for construction works and procurement of steel materials, and supervision of construction works.	5.2		1.8	7.0	1 2					
			1.8		1.8	300 H					
				2.9	2.9	200 H	16 M				
Electrical and utility facilities	Investigation of existing situations, planning of infra-structure, designing, preparation of specifications both for construction works and procurement of materials and equipment, and supervision.	7.1		2.4	9.5	1	2	1			
			2.4		2.4	400 H					
				0.3	0.3		100 H				
Machinery equipment	Investigation of existing situations, preparation of specification both for procurement of machinery, equipment, parts and tools, and machinery reforming work and supervision.	1.9		0.6	2.5	1					
			6.0		6.0	1000 H					
Machinery foundation	Designing, preparation of specification for foundation work, and supervision.	4.7		1.8	6.5		3				
				1.8	1.8		700 H				
Handling facilities	Preparation of specification for procurement.		1.2		1.2	200 H					
Site fabrication	Preparation of specification and supervision for site fabrication of steel materials for buildings.		0.4		0.4	60 H					
General	Review of F/S, preparation of implementation program, supervision of implementation time schedule and general consultation to the implementation of the project.	16.9		6.6	23.5	1	6		4		
				4.2	4.2			31 M			
TOTAL		35.8	11.8	22.4	70.0						

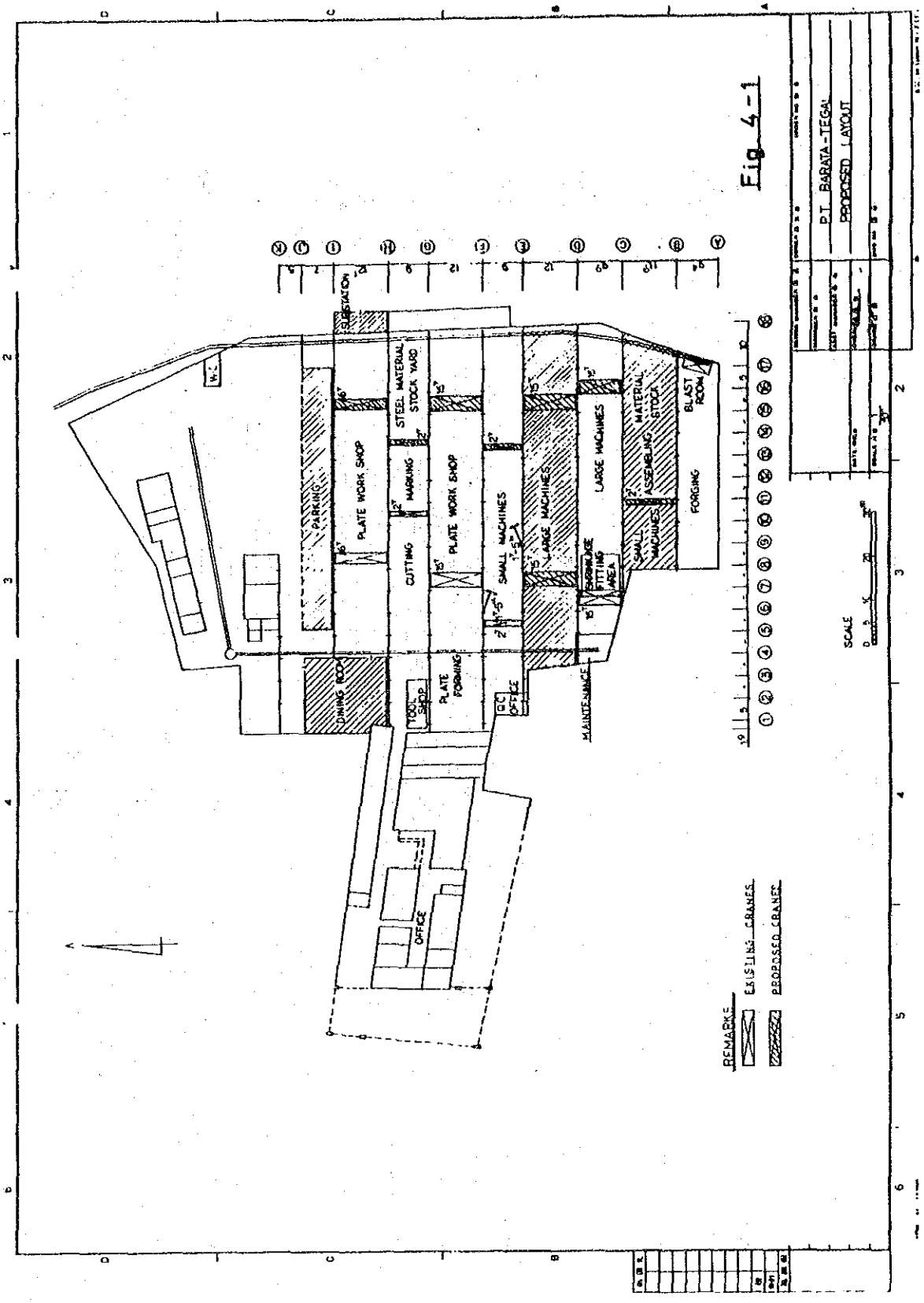
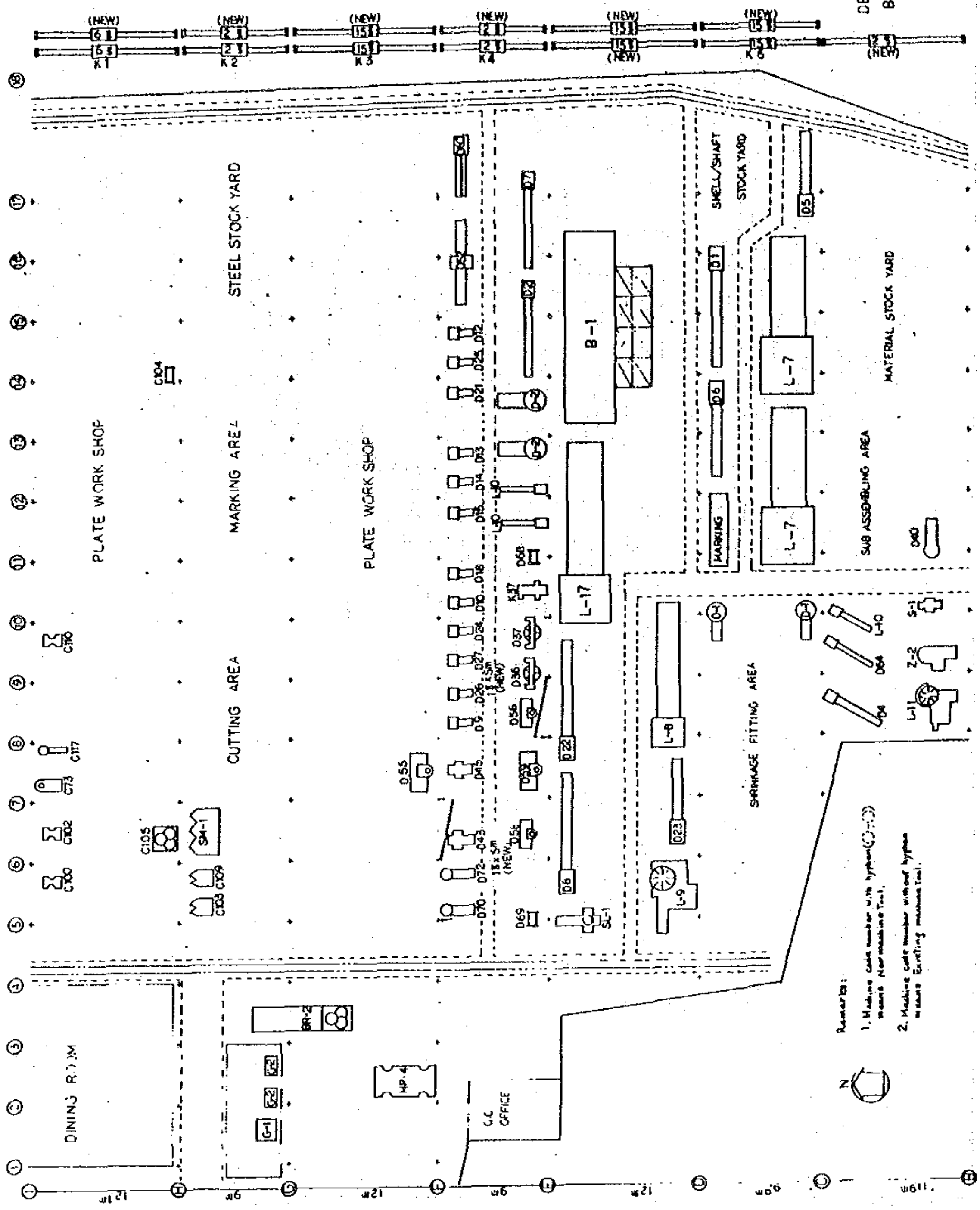


Fig 4-1
P.T. BARATA - TEGAL
PROPOSED LAYOUT
SUBSTATION
PARKING
PLATE WORK SHOP
STEEL MATERIAL STOCK YARD
MARKING
CUTTING
PLATE WORK SHOP
SMALL MACHINES
LARGE MACHINES
LARGE MACHINES
MATERIAL STOCK
SMALL MACHINES
BLAST ROOM
FORGING
WAREHOUSE FITTING AREA
MAINTENANCE
TOOL SHOP
PLATE FORMING
QC OFFICE
TOOL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

Fig. 4-2
DETAILED LAYOUT
BARATA-TEGAL



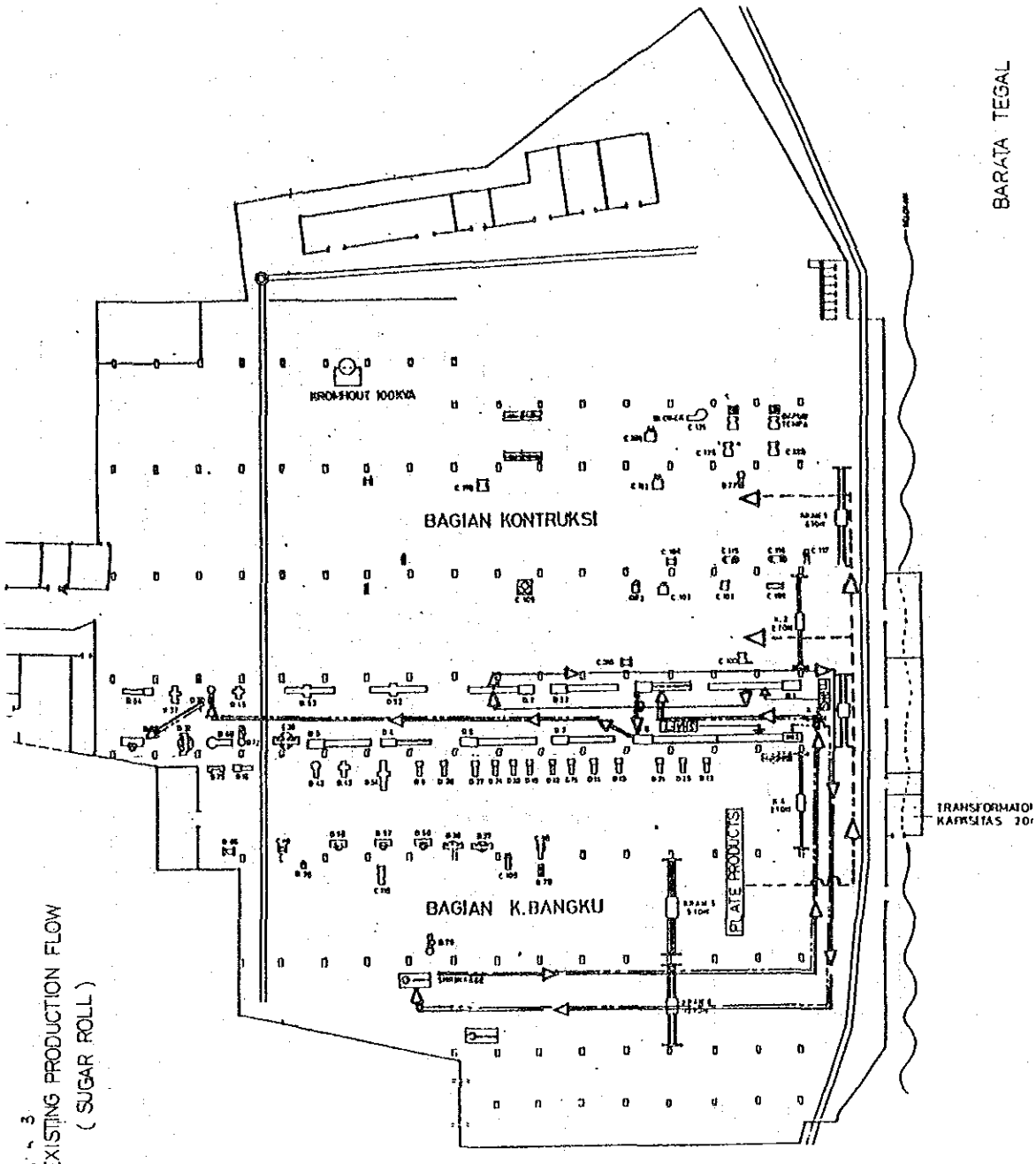


Fig. - 3
EXISTING PRODUCTION FLOW
(SUGAR ROLL)

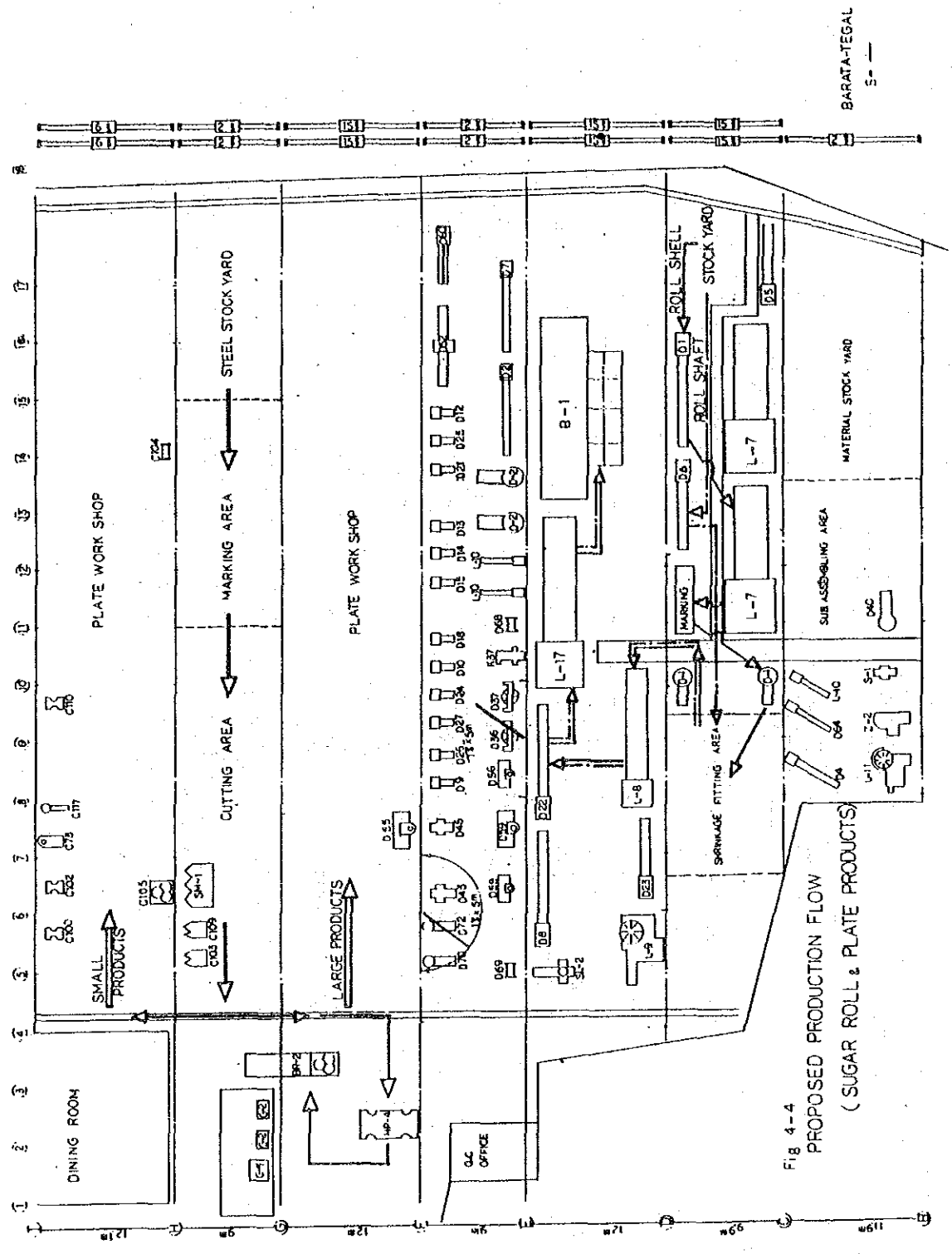
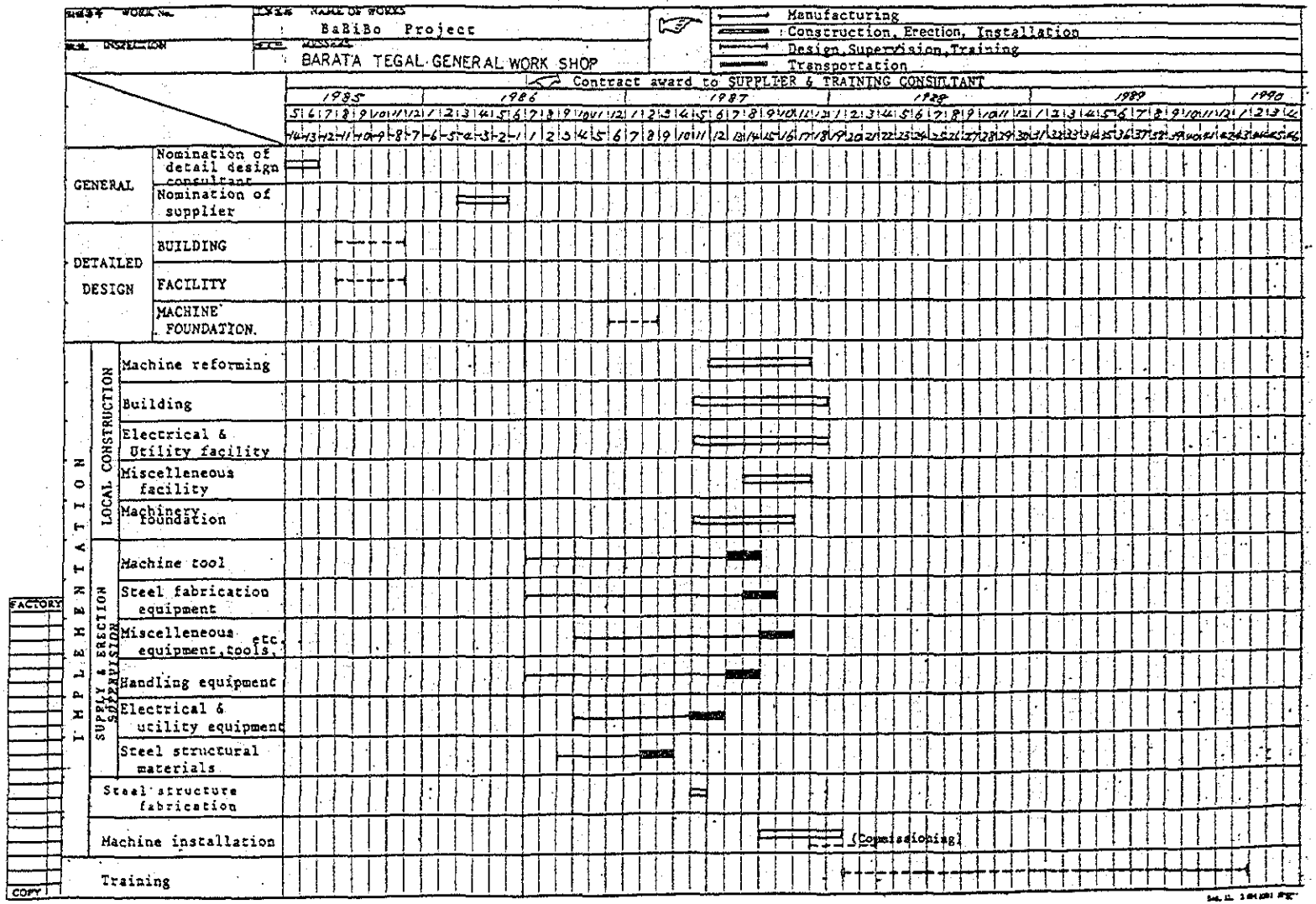


Fig 4-4
PROPOSED PRODUCTION FLOW
(SUGAR ROLL & PLATE PRODUCTS)

Fig. 4-5 IMPLEMENTATION SCHEDULE



4.4.5 Production Management and Job Training

(1) Managerial organization

As is described in the clause 1-3, current organization of Tegal Work Shop is based on the production system with emphasis on maintenance works for sugar cane mills. If this production system will not change basically, there will be no need for changing drastically the existing organization and managerial system.

Accordingly, only those points that need improvements in both managerial and organizational system are given below.

1) Quality control

Improvements are needed in the areas of acceptance inspections of materials, in-process inspections in the course of manufacturing procedures and final inspections after the working processes are finished. For these purposes, calibration of the newly introduced non-destructive inspection equipment must be recognized as a new responsibility.

2) Preventive maintenance

Taking the opportunity of repairs and remodelling of the equipment and new addition of facilities, it is strongly requested that preventive maintenance works be further improved and that jigs and tools be repaired and replenished satisfactorily.

3) Handling control

Since the overhead travelling cranes will be added and handling vehicles for interbays and between the warehouse will be installed, maintenance and control of the handling facilities should be done to the utmost efficiency.

4) Marketing

As described earlier in the clause 3-1, in order for Tegal Work Shop to double market share of cane mill rolls for sugar plants it would be imperative to reinforce marketing personnels and conduct effective sales promotion. Along with build-up of the marketing forces for not only cane mill rolls but also for more sales of plate work products for irrigation and spare equipment for cement plants, it is strongly recommended to have new functions for cooperation with other business and project groups in connection with construction works for cement and sugar plants, and for coordination with both foundries in connection with the machine works for shafts of carriages and pump casings.

(2) Plan for organization and personnels

As is discussed earlier in the above (1), no change in the organization of Tegal Work Shop will be necessary since the production and managerial systems for the shop will not change drastically and no problems are found in the existing system of management.

Reinforcements in facilities and resultant increase in production will naturally necessitate increase in personnels in each work classification. In addition to this, managerial improvements as discussed in the above (1) also makes it indispensable to increase the number of personnels responsible for the field. Personnel program based on an analysis of the current situations is shown in Table 5-1 "Personnel Program". Actual program for personnels should be made with considerations taken to secure personnels of right qualifications. Since personnel problems for marketing and administrative departments are to be considered in the light of the whole organization of P.T. Barata Indonesia, no plan concerning the number of personnels can be discussed here.

(3) Training plan

Table 5-2 shows present situation of education and training in P.T. Barata Indonesia. Education and training are indispensable at Tegal Work Shop for the following areas:

1) **Production technique**

It may be said that because of relative inadequacy of the facilities sufficient development and improvements of production technique could not be made until now. However, with new facilities installed, it will be definitely necessary to make improvements in the areas of production routing and jigs/tools, to endeavour to reduce man/machine hours and to improve productivity by making best use of these facilities.

2) **Quality control**

First of all, it will be necessary to establish how must be the quality control system for Tegal Work Shop. This must be done by engineers and foremen of Tegal Work Shop themselves with the aid of overseas specialists despatched for training programs. They should face with this problem themselves. In the course of the reviews they must get their own expertise in each field and create quality control manuals as fruitful outputs of their own study. At the same time, it is recommended that they receive guidance as to how to use the newly introduced inspection equipment including that for supersonic examinator and how to determine the inspection results.

3) **Operator's skill**

As described earlier in the present feasibility study, skill level of Tegal Work Shop workers is relatively high in general.

It is recommended that they receive advice from the specialists sent from overseas enterprises on how to use to the maximum efficiency the newly installed facilities such as forming presses and bending rollers and also the application uses of these facilities. It is also requested that they receive training on how to use submerged welder with manipulator and numerically controlled floor type boring and milling machine.

Table 5-3 shows the training plan with the factors mentioned above. In order to make this training program a success, it is imperative for the management of Tegal Work Shop to participate in the program themselves and act as leaders of the plan.

Barata Tegal work shop

Table 5-1 Personnel Program

ORGANIZATION	MAIN FUNCTION	PERSONNEL PLAN							
		1984		1989		1994		1999	
		MANAGER ENGINEER & STAFF	WORKER	MANAGER ENGINEER & STAFF	WORKER	MANAGER ENGINEER & STAFF	WORKER	MANAGER ENGINEER & STAFF	WORKER
Branch manager		1		1		1		1	
Quality control	1) material inspection 2) work & product inspection 3) calibration of inspection tool	3		3	7	5	8	5	10
Factory manager		1		1		1		1	
Production preparation	1) preparation of material/subcontract 2) preparation of work instruction 3) production scheduling	9		4	6	5	7	6	9
Production handling	1) time keeping 2) expedition and follow up 3) material handling 4) despatching and delivery	6		7	17	10	17	10	19
Machinery	1) technique for machining 2) preparation of jig & tool 3) machining & assembling	49		6	52	6	62	6	67
Construction	1) technique for plate work 2) plate work 3) site fabrication & erection	55		10	70	10	69	10	74
Maintenance	1) preventive maintenance 2) repair & store of tool 3) maintenance of facilities	8		2	13	2	15	2	15
TOTAL				34	165	40	178	41	194
		132		199		218		235	

NOTE: Commercial Dep't, Finance & General affair Dep't are excluded from above figures.

Table 5-2 Present Situation of Education and Training in P.T. Barata Indonesia

Category	Contents	Present situation of education in P.T. Barata Indonesia
(A) Management training	1) Technique for economic analysis and market forecasts 2) Technique for management control 3) Organizational and personnel control	1) Participation in the seminars sponsored or arranged by the Indonesian government 2) In-service training of P.T. Barata Indonesia with instructors invited from outside. 3) Participation in the seminars both in Indonesia and overseas 4) Education and guidance by the management staffs of P.T. Barata Indonesia.
(B) Design Engineering	1) Design and fabrication of plant equipment 2) Design and drawing of equipment and structures 3) Technique of technological control including computer aided system	1) Education and training by overseas licensers according to the license agreement with the licensers 2) Dispatch of personnels to technical schools and training centers in Indonesia 3) Participation in overseas seminars or dispatch of personnels to the overseas training programs.
(C) Production Engineering	1) Technique for production management 2) Technique for quality control 3) Production technique including remodelling of work facilities	1) Dispatch of personnels to or participation in the overseas seminars and/or training programs 2) Study through overseas magazines and/or documents of overseas makers 3) Advice and/or guidance by consultants 4) Guidance and/or introduction of new techniques by the supervisors of the facilities purchased
(D) Skill	1) Training of workers for higher skill	1) Training within P.T. Barata Indonesia 2) Dispatch of personnels to the training centers in Indonesia 3) Guidance by the installation supervisors of the facilities purchased.

Table 5-3 Training Plan

Barata Tegal Work Shop

Category	Contents and Methods of Training	Trainees	Training Schedule 1988 1989 1990	Costs
Production Engineering	Training with emphasis of Quality Control shall be conducted by instructors from overseas enterprises. A working group shall be set up from among the engineers and foremen of Tegal Work Shop to create quality control manuals with advice from the instructors. During the course, lectures and demonstrative guidances shall be conducted by the instructors as necessary.	Engineers and foremen both from the administrative and operation sides who are involved in quality control.	⟵——⟶	Instructors: 1 x Engineer 1 x Specialist Training cost - 133.8 million yens (including local costs)
Skill training	1) Comprehensive on-the-job-training including production and measurement techniques shall be conducted by the instructors from overseas enterprises.	Workers of higher level who belong to the Machinery, Construction and Quality Control Sections, particularly those responsible for the following facilities: (1) Submerged welder with manipulator (2) Supersonic Examiner		
	2) On-the-job-training including operation and maintenance works for the newly installed facilities, skill training for application use of them and technical guidance shall be conducted by the installation and commissioning supervisors from the facility suppliers.	Operators and maintenance foremen responsible for the following facilities: (1) Numerically controlled BF-130 (2) Hydraulic forming press (3) Pinch pyramid bending roller (4) Bevel gear shaper	⟵——⟶ ⟵—⟶ ⟵—⟶ ⟵⟶	Included in the cost of facilities supplied

4.5 Boma Bisma Indra, Indra Unit

4.5.1 Technical Diagnosis for Indra unit

Technical diagnosis was made for P.T.B.B.I., Indra unit and Wahana sub-unit from July to August in 1984. This chapter describes technical diagnosis results and recommended countermeasures on technical items.

(1) Outline and history of Unit

1) P.T. Boma Bisma Indra was established by the amalgamation of three companies: De Bromo N.V. established in 1965, De Industrie N.V. established in 1978, and De Vulkaan C.V established in 1918. P.T.B.B.I. has supplied local sugar plants with spare parts. In addition, B.B.I. has added diesel engines and small agricultural tools to its line under the license agreements with KHD Inc., S.H.W. Inc., etc.

2) At present the line of Indra unit covers construction equipment such as crane girders, tower cranes, plate works such as tanks, vessels, penstocks, and water gates, mechanical products such as various pumps and reduction gears. All these products are supplied to cement plants, fertilizer plants, sugar plants, etc.

(2) Present production

1) The annual output of Indra unit is as shown below.

Steel structures	2,700T/Y
Steel plate works	2,300T/Y
Machine/Parts	800T/Y
Total	5,800T/Y

2) **Products percentage in sales amount**

Vessels	2%
Tanks	20%
Piping	15%
Steel structures	25%
Plate works	20%
Parts machining	15%
Others	3%

3) Local survey has proven that Indra unit has not necessarily the close relations with designated plants (cement, sugar, fertilizer, pulp and paper, and palm oil) and that Indra Unit seldom manufactures such a heavy discrete product as exceeding 5 tons in weight.
The diagnosis is followed by the preparation of the products mix of Indra Unit, which is prepared through review on productions and relationship with plants for machines, tools, and steel structures included in the products of Intra Unit.

(3) Production equipment and production technology

1) **Present production equipment**

① Present machinery and equipment are detailed in List 1.1., which includes: Cutting equipment, welding equipment, machinery, testing and examination equipment, and surface preparation utilities.

② Buildings for steel structures and plate works have a floor space of 6,129 m^2, consisting of four bays whose working area is approximately 4,000 m^2 by assumption.

③ Machine/tool and fitting area occupy approximately 4,240 m^2

2) **Production technology**

① Experienced codes and standards
JIS, ASME, API, and Indonesian Standard.

② Experienced materials
Carbon steel, C-Mo steel, austenitic stainless steel, and others (nonferrous materials).

③ Normally required production period after order placement on ex-work base was investigated, but detailed information was not avaibable.

④ At present, Indra Unit sums up production cost, prepares a work pile-up list for major work, and carries out work by operation cards.

3) **Recommendation according to the results of factory survey**

① The production equipment must be reformed, building layout changed, and floor repaired. The area of the present buildings is sufficient to meet the requirements when production is increased and the types of production machines are changed.

② Manufacture of products with higher quality requires the leveling-up of present production technology.

(4) Control system and personnel organization

Indra Unit has a plan to transfer plate works to Wahana Unit for the purpose of expanding production centered to machine/tools and steel structures. The control system and personnel organization have been studied in consideration of increase both in production items and in production, with the present situation made reference to.

1) Management system and personnel organization

Table 1-1 and 1-2 show the present management system and personnel organization.

① *Recommendation to the management system*

The function of the present system is not necessarily identified because departments are mixed with sections, although the present system is functionally organized on the face of the block diagram. It is recommended that the business function be differentiated from the managerial function at the opportunity of constructing a new factory.

② *Personnel*

The most important and urgent problem is for workers to maintain and improve their own skill to keep up with enhancement of quality and increase in production. For this purpose, workers should be leveled up through training, with intention to inhibit possible increase in number of persons.

2) *Production control system*

① The basic function of production control is to establish a system to ensure improvement in quality, enhancement of technology, and reduction in cost. The purpose of production control is to manage each step in production process to ensure that products are finished as planned and as scheduled.

② *The results of the survey show that the production control function of* Production Control and Planning Section is not closely related to the function of technological section.

③ Further consideration should be taken in preventing delay of delivery.

④ Designing

The result of the survey suggests that capacity of designing and drawing be developed for the discrete equipment manufactured in unit.

This is because the basis of quality control, production control, and improvement in production capacity is to prepare good drawings and to produce products as drawings indicates. Further improvement will be assured by good communication and quick response between designing section and production section.

3) Quality control system and inspection

① Quality control manual and non-destructive examination equipment etc. are the basis of quality control in this Unit. Unfortunately, they are not yet available in Indra Unit.

② A control system should be established in such a way as to prepare a quality control manual, familiarize employees with the importance of quality control and thoroughly check products. The first step is to perform, within shop and by its ownhand, inspection, examination, and test that have so far been dependent on subcontractors, that is, non-destructive examination for welds and the material test of major material.

③ In addition, data on defective products and claims filed by customers should carefully be collected to prevent recurrence of these failures. Countermeasures taken for these failures will be a decisive factor in the course of improving quality and increasing production.

4) Maintenance system

Indra Unit has Maintenance Section. The Section should identify the control points such as collection of data because new machines are installed in the course of renovation.

5) **Layout, building structure, and handling equipment**

① The buildings are so structured as to endure further use.

② Overhead traveling cranes are serviceable subject to adequate maintenance and service, although they are of old type, their drive system in particular.

③ Machining Department shares a building with Foundry Shop. Working environment must be improved by means of dust-proofing, etc.

6) **Utilities**

① Power supply equipment uses a diesel engine type generator because of insufficient capacity. The efficiency must be greatly improved.

② No other problems are not found.

4.5.2 Technical Conditions

This chapter describes technical conditions to accomplish the purpose of the renovation plan.

(1) Factory Location

1) The purpose of the renovation plan laid out by P.T.B.B.I., Indra Unit is accomplished in the following way. The Plate Work Department is transferred to Wahana Sub Unit. The space occupied by Plate Work Department is effectively utilized to increase production through newly designed product mix.

2) The renovation plan is not required on land preparation, and new or additional buildings. There, the renovation plan will not have major problems except the transport limitation.

(2) Criterion of selecting production equipment

The major items to be produced at the Indra Unit are process equipment for fertilizer plant and pulp/paper plant, as well as the kinds of equipment which have been produced. Therefore, the production facilities are selected according to the criteria and guidelines stated below.

1) The facilities are at such technical level which can be handled by the factory's current employees at their improved technical skills and provide adequate machining accuracy and capabilities. The facitities are planned with JIS.

2) Since repeated and/or mass produced products are not covered in this renovation plan, manufacturing facilities do not have higher numerically controlled systems such as CAD/CAM machines.

(3) Transport limitation

(1) The port nearest to Indra Unit is in Tanjung Perak (Surabaya District) about 15 km away from Indra Unit.

(2) The weight limitation on the road to the Tanjung Perak Port is set to as light as 12 tons by the requirements of Police of Surabaya. The product transport limit is regulated to an extremely lower level.

(3) It is expected that road regulations are modified and traffic conditions such as roads and bridges are satisfactorily reformed to an extent that a load weighing 30 tons at least may be transported on the road.

4.5.3 Basic Renovation Plan

The renovation plan is based on the status investigations and diagnosis stated in 4.5.2. The basic renovation plan is made according to the following procedure.

(1) A new production plan is made to produce the products suitable for Indra Unit in accordance with the REPELITA-IV of Indonesia Government and

on the basis of the market research and field survey performed by the study team.

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

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

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

(5) 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 this 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/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, and 5,800 T/Y. The production in Indra Unit is so designed as to start at a target data in October, 1988.

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

(1) Production plan classified into products manufactured by factory.

1) Product mix at Indra Unit

① The product mix which is the basis of facility capacity design consists of the following two items:

i) Production of fertilizer plant and pulp & paper plant pursuant to the *"Scope of work for the feasibility study on the development of plant processing equipment industries"* agreed upon by and between the Japan International Cooperation Agency and Directorate General of Basic Metal and Machinery Industries of Ministry of Industry.

ii) Manufacturing of products which have so far been and will be manufactured by Indra Unit in close relations to the local region (hereinafter called the *"Basic Load"*).

② 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.

③ 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 3-1. This classification of products by type has led to the determination of kinds, number of units, and layout of necessary machinery and equipment.

2) **Plan of production scale in Indra Unit**

① Market research has been made on fertilizer plants and pulp/paper plants relating to Indra Unit, and the market of 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.

② The share of Indra Unit is then set for the local content item of machinery for the above two designated plants. The products are divided into machine/tools and steel structures. Production quantity is also allotted to each product.

③ On the other hand, the basic load is researched 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 ②.

④ The quantity of site fabrication and installation for plant machinery and the basic load are set. This leads to the calculation of number of machine tools and workers required.

⑤ The results in ② through ④ are classified into three types of products; steel structures, plate works, and site work. This classification is summed up and listed in Table 3-1 as stated above. Design production capacity of Indra Unit is set to 12,500 T/Y, with the values in Table 3-1 made reference to.

(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 from 1988 to 1993, as stated in 2)-⑤.

The demand forecast is made on the basis of the following three factors.

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

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

iii) 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 sub-contructors for 5,400 T/Y, which meets the requirement of Indra Unit.

1) Review on possibility of usable 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.

(1) Survey item

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

(2) Classification standard

Machinery and equipment are classified by the following classification standard.

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

③ 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 reused 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 is determined according to the following criteria.

① The following item is set for each product.

i) Standard type, weight, material, and allotted work (for the determination of Product Model)

ii) Standard operation, process, and work time (for setting of Product Time)

iii) Assumed level technology after five years.

② Criteria

Criteria are determined for the following items.

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

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

③ Offset against reusable existing equipment.

④ 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 product 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, from sub-contractors.

This item deals with the layout of Indra Unit oriented to the production of machine/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 to be improved:	1,008 m^2
Area of steel structures shop to be improved:	3,600 m^2
Layout: as shown in Fig. 3.1.	
Design production capacity:	12,500 T/Y

The equipment and number of units necessary for accomplishing the production plan are determined in 4.5.3-(2)-2). Based on these data, the layout is determined according to the following procedure.

(1) Determination of necessary work area.

(2) Determination of proper machinery layout and product flow.

(3) Determination of building shape.

(4) Consideration for material storage yard and product delivery route.

⑤ Minimizing material handling

2) Production equipment and inspection equipment

① Production equipment

i) Machine/tools

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.

ii) Steel structures

The specifications of equipment is prepared according to the model and number of machines determined in 4.5.3-(2)-2) and the manufacturing process flow of products in the previous 1)-2. The manufacturing process flow of products consists of preparation, machining, forming, welding, fitting, and material handling.

② 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.

i) Measuring equipment for machine/tools.

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

3) **Basic plan of attached equipment**

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

① Sandblast equipment for steel structures.

② Painting equipment for steel structures.

4) **Basic plan of utility facilities**

① Electric installations are provided with the following equipment.

i) New installation of transformer type sub-station with increased capacity.

ii) Emergency generator only for emergency lamps.

iii) Paging equipment.

iv) Existing diesel-engine type generator is utilized only in an emergency.

② Pipings are laid to carry the next fluid for machine tools and other attached equipment.

i) Propane gas ii) oxygen iii) acetylene iv) argon
v) CO_2 vi) air vii) industrial water
viii) drinking water (city water)

Potable water treatment equipment is not provided.

(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

① 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.

② Table 3.2 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 manufactures and Indonesian supervisors be employed for the following works.

① Machine installation works

② Electric wiring works

③ 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.

4.5.4 Renovation Promotion

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 and Design Conditions of Renovation

1) Outline of Indra Unit

As shown in Table 3.1, the renovation plan is so devised as to permit an annual production of 12,500 tons; this production mainly depends on machine/tools and steel structures.

This plan requires the relocation and new installation of machines in each shop but does not involve the reform of buildings.

Consideration is given in improving the quality of products from the present level and in allowing the approach to more sophisticated products.

2) Design shop conditions

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

(1) Setting of product model

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

(2) Setting of the lifting capacities of overhead traveling cranes

The lifting capacities of the overhead traveling cranes are set on

the basis of the product model. (Refer to Fig. 3-1.)

③ Setting of the heights of overhead traveling cranes

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

④ Setting of the specifications of major production facilities

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

⑤ Calculation of production time

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

⑥ Calculation of the required numbers of production facilities

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

⑦ Review on shop area

i) Work floor area of fixed equipment

The work floor area is calculated as follows. A work scope is added to the floor area of fixed equipment; the sum is multipled by the number of machines calculated in ⑥ above.

ii) Necessary area of assembly area, etc.

The necessary area is calculated on the basis of the production time calculated in ⑤ above, which is weighed

by the production flow and the material unit consumption value empirically obtained. The result is shown in Table 4.2, necessary area of each shop.

⑧ Bearing strength of floors

The bearing strength of the floor is set to 10 ton/m^2 for the heavy-duty bay, and 5 ton/m^2 for the other bays.

3) Effect of renovation

The production per unit area and production per direct worker 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 works, and steel structures.

The result of comparison is shown in the following table.

	Before renovation (a)	After renovation (b)	Ratio (b/a)
Production 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

4) Shop layout

① Machinery shop

Unnecessary and obsoleted 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.

(2) Steel structures shop

In present Plate Shop, one of two bays is reformed to a special-purpose 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 as to fit the production process and prevent the reverse flow of products on the way of machining, which was found during survey.

(3) 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 Wahana Unit. Indra Unit is allotted 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 in priority, with only necessary equipment supplemented.

5) Machine/tool, list and production flow of products

(1) Machine/tool list

The machine/tool is detailed in List No.4-1, new and usable existing machine/tool list. This list includes the machine/tools diverted from the existing machine/tools.

(2) Production flow of products.

The description for Indra Unit is omitted.

(2) Construction cost

Investments required for the renovation are detailed in Table 4-3, Summary of investment cost. Description of detailed design, supervising and training fee is shown in Table 4-6. 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 trouble 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 land reclamation, civil engineering work, building work, machine installation work. Smooth startup and operation.

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

The above system is detailed in Table 4-4.

(4) Content of work

1) Work item

As shown in Table 3-2 Construction schedule, the actural work is classified as follows; (1) Civil works (2) Purchase and erection of machine & equipement, 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.

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

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

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

(5) Supervision of work and training plan

1) **The work items requiring supervisors are as shown below. (Refer to Table 3-2 and Table 4-6.)**

(1) Erection of machines and equipment

(2) Erection of electricity and instruments

(3) Piping works

(4) 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. The training fee is shown in Table 4-6.

① Boring & turning mill

② Boring & milling machine

③ Planer

④ Press

⑤ Bending roller

(6) Construction schedule of renovation

The renovation schedule of this project is shown in Table 3-2, which includes the content described in 4.4 and 4.5.

4.5.5 Production Control and Training

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

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

(1) Production control system

The technical diagnosis shown in 4.5.1 (4) 2) has proven that the following countermeasures should be taken.

1) The production control system should be established to control products so that they are manufactured as planned. This system should include checks for the progress schedule in 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 means to prevent delay in the time of delivery; the plan should be laid out to grasp work quantity for the shop in total or for each job. This loading plan permits checking in earlier stages a machine or work that may form a bottleneck of the process, thus making it easy to take countermeasures without delay.

3) Fig. 5-1 shows the PDCA managerial circle. Particular care should be taken in emphasizing item C, Check or Follow-up, and item A, Action, both of which may be neglected in the course of production control. Enhancement of production control and production techniques require increase and training of staff. The training and instructions should be given by supervisors sent by oversea's manufacturers. Expenses for the supervisor are stated in (9).

(2) Quality control system

As stated in 4.5.1 (4) 3), Indra Unit has not yet prepared a quality control manual. Managers in Indra Unit should take cognizance of the importance of quality control and hasten to prepare a quality control manual at their responsibility.

In the second, it is proposed that inspection be performed in shop and by its own hand, which now depends on sub-contractors, in order to level up inspection techniques. This involves increase and capacity improvement of qualified inspectors.

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

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

(3) Safety control system

Indra Unit is planing to lay pipings to carry flammable gas and other fluid; this increases the importance of the safety control system. The safety control system must be established with the following points emphasized.

1) The basis of safety is to keep working environment in order and clean. Unfortunately, the present situation is not necessarily satisfactory. First of all, all persons including workers should recognize the importance to keep in order and clean what they handle.

2) Crane operators and slinging workers should be trained to prevent accidental injury or death including electric shocks. Training and instructions are also required to prevent gas explosion.

(4) Maintenance

A maintenance system should be established and implemented to increase the operation ratio of new or usable existing equipment.

1) The maintenance manual should be prepared and implemented to ensure that machines, equipment, and instruments are subjected to the routine and periodical checks.

   The maintenance manual should specify a system to identify check items, and countermeasures to be taken including repair of defective part.

2) Servicing and checking devices, tools, and jigs result in improvement in product quality and efficiency. Workers should therefore be trained and instructed to strictly perform the routine check.

(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 or 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.

These feedbacks lead to improvement in engineering capacity as well as improvement in technical capacity as a result of solving problems in quality control, and fabrication. Therefore, Sales Department should bring up sales engineers having knowledge on the products.

(6) Engineering

Indra Unit is reorganized to a steel structure-oriented shop. The following is proposed as a means to smoothly increase its own production capacity and expand production items.

1) Indra Unit should improve production techniques to cut cost and strengthen technical capacity by entering into technical assistance agreements with foreign manufacturers having wide experience in this field.

2) Techniques including production techniques should positively be introduced to extend design and engineering capacities.

3) Design capacity, including production design capacity to devise a production method to produce less expensive products with ease, should be enhanced.

4) Design engineers should be trained and brought up who are capable of selecting materials for specified products and specifying dimensional accuracy necessary for products on drawings.

The cost required in this item is shown in (9).

(7) Training

Improvement of controller's capacity and engineer's capacity is as stated in (1) through (6).

The recommended training plan for workers is shown in Table 4-5 and Table 5-1. It is urgently required that worker's skill be leveled up to keep up with increase in production and to master new equipment.

(8) Organization and personnel

1) Organization

Table 5-2 shows the organization and personnel plan in Indra Unit.
The organization chart is prepared on the basis of 4.5.1 (4), Technical diagnosis and Table 1.1, organization personnel in Indra Unit, with special attention paid to the following main points.

① Vicinity to Head Office enables Indra Unit to depend on Head Office for the organization of the general affair department, which is extremely simplified.

② The production and production control departments are simplified in sections.

2) Personnel

The personnel plan is laid out as shown below.

① The number of direct workers is decided according to the calculations in 4.5.3 (2) 2).

② The number of indirect workers is determined from our experience. The number should be limited to a minimum by depending on assistance given by Head Office as is the case with the general affair department, whose indirect workers are decided by assumption.

(9) Training Cost

Fig 5-2 shows the training cost and period on the production control and technique in item (1), (2) and (6), and on the machine works in 4.5.4 (5) 2). Training has great influence on the operation of Indra Unit and should therefore be approached with an established system.

Table 1-1 Existing Organization Chart of P.T. B.B.I - Indra Unit

AUG. 1984

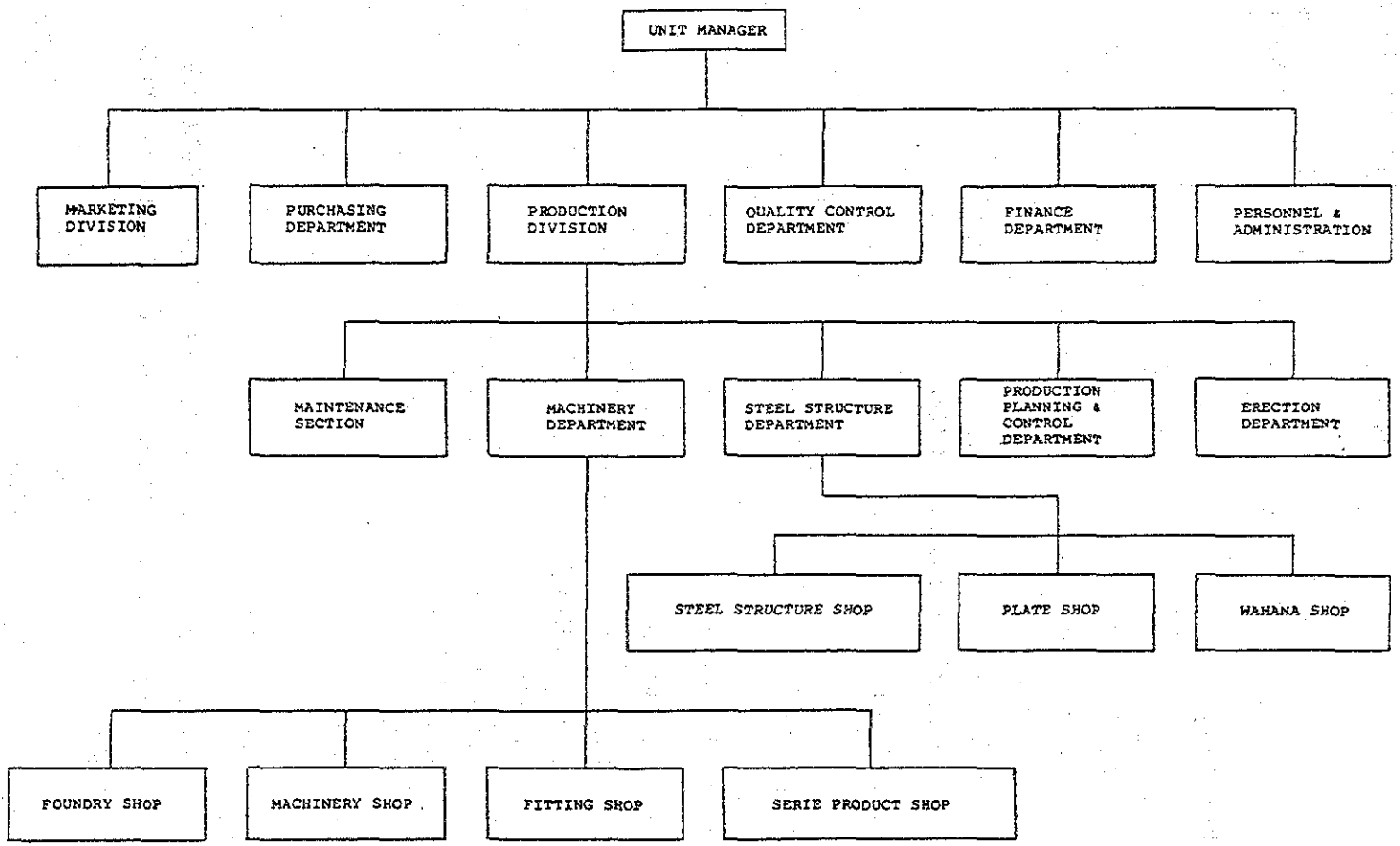


Table 1-2 Existing Number of Employees for P.T. B.B.I. Indra Unit

Aug. 1984 (EXCEPT FOUNDRY)

		NO. OF PERSONNEL
1.	ENGINEERS	
	DESIGN	-
	MECHANICAL	4
	METALLURGICAL	-
	WELDING	1
	OTHERS (SCHEDULE CONT., QC, ETC.)	8
	SUB-TOTAL	13
2.	DRAFTMAN	-
3.	DIRECT WORKERS	
	WELDERS	40
	(QUALIFIED)	(-)
	IRON WORKERS	37
	FITTERS	71
	MECHANICIANS	94
	INSPECTORS	2
	OTHERS	80
	SUB-TOTAL	324
4.	INDIRECT WORKERS	112
	SUCH AS CRANE OPERATORS WAREHOUSE KEEPERS, MECHANICIANS FOR SHOP FACILITIES MAINTENANCE, ETC.	
5.	OTHER STAFFS AND CLERKS	102
	TOTAL EMPLOYEES	551

TABLE 3-1 FORECAST OF PRODUCT MIX

P.T. BOMA BISMA INDRA: INDRA UNIT

ANNUAL PRODUCT CONDITION IN 1989 ~ 1993

UNIT: TON/YEAR

TYPE OF PRODUCT		STEEL 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	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 Big water gates and structures water engineering											
	a.5 Conveyors											
b. PLATE WORKS	b.1 Fertilizer plant equipment											
	b.2 Pulpand 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 3-2

Construction Schedule

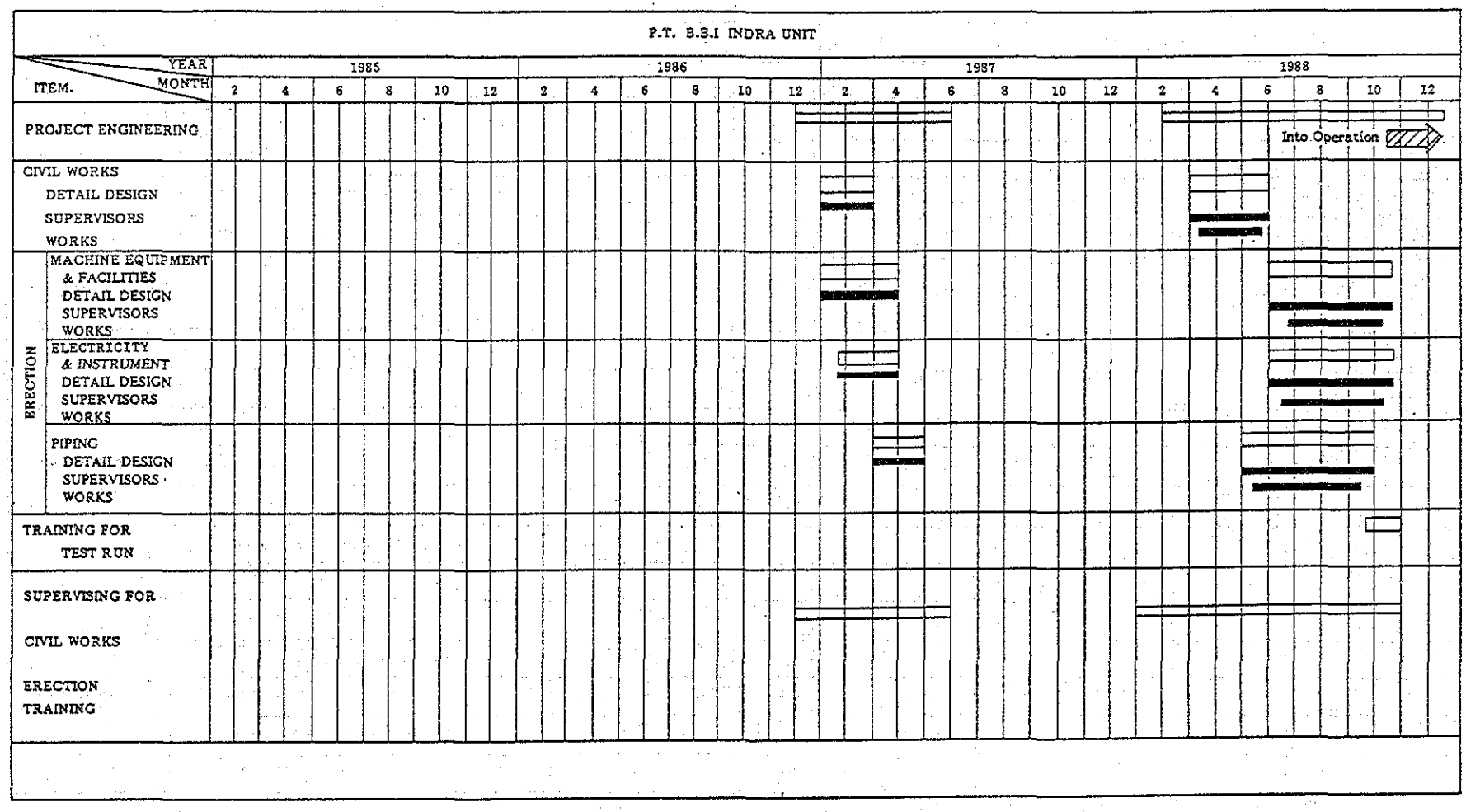


Table 4-1 Product Model for P.T. B.B.I. Indra Unit

	TYPE OF PRODUCT	THICK-NESS (mm)	PRODUCT SIZE (ID x LENGTH WIDTH x LENGTH) (mm)	DESIGN PRESSURE (kg/cm^2)	MATERIAL	WEIGHT (Ton)
		mm	W H L			
1	GENERAL STRUCTURE	6-25	500 x 2,000 x 10,000	-	C.S.	15
			W H L			
2	INDUSTRIAL STRUCTURE	6-25	500 x 2,000 x 10,000	-	C.S.	15
3	PIPE WORKS	-	15A - 1,000 A	-	SUS SUS CLAD SGP.STPG	25
4	OTHERS	-	-	-	-	25
5	PARTS/MACHINE	-	600ø x 6,000L	-	-	25

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

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

UNIT: m^2

NO	SHOP NAME	AREA
1	FITTING SHOP	1,008
2	SMALL MACHINE WORKS SHOP	576
3	LARGE MACHINE WORKS SHOP	1,560
4	STEEL STRUCTURE SHOP	4,483
4.1	PREPARATION AREA	(400)
4.2	FORMING AREA	(233)
4.3	MACHINING AREA	(439)
4.4	ASSEMBLY AREA (INCLUDED WELDING)	(1,542)
4.5	SAND BLASTING ROOM	(72)
4.6	PAINTING AREA	(743)
4.7	MAIN PASSAGE AND OTHERS	(1,054)
5	PLATE WORK SHOP	1,646
5.1	PREPARATION AREA	(470)
5.2	FORMING AREA	(254)
5.3	ASSEMBLY AREA (INCLUDED WELDING)	(706)
5.4	MAIN PASSAGE AND OTHERS	(216)
	Total	9,273

Table 4-3 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.

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

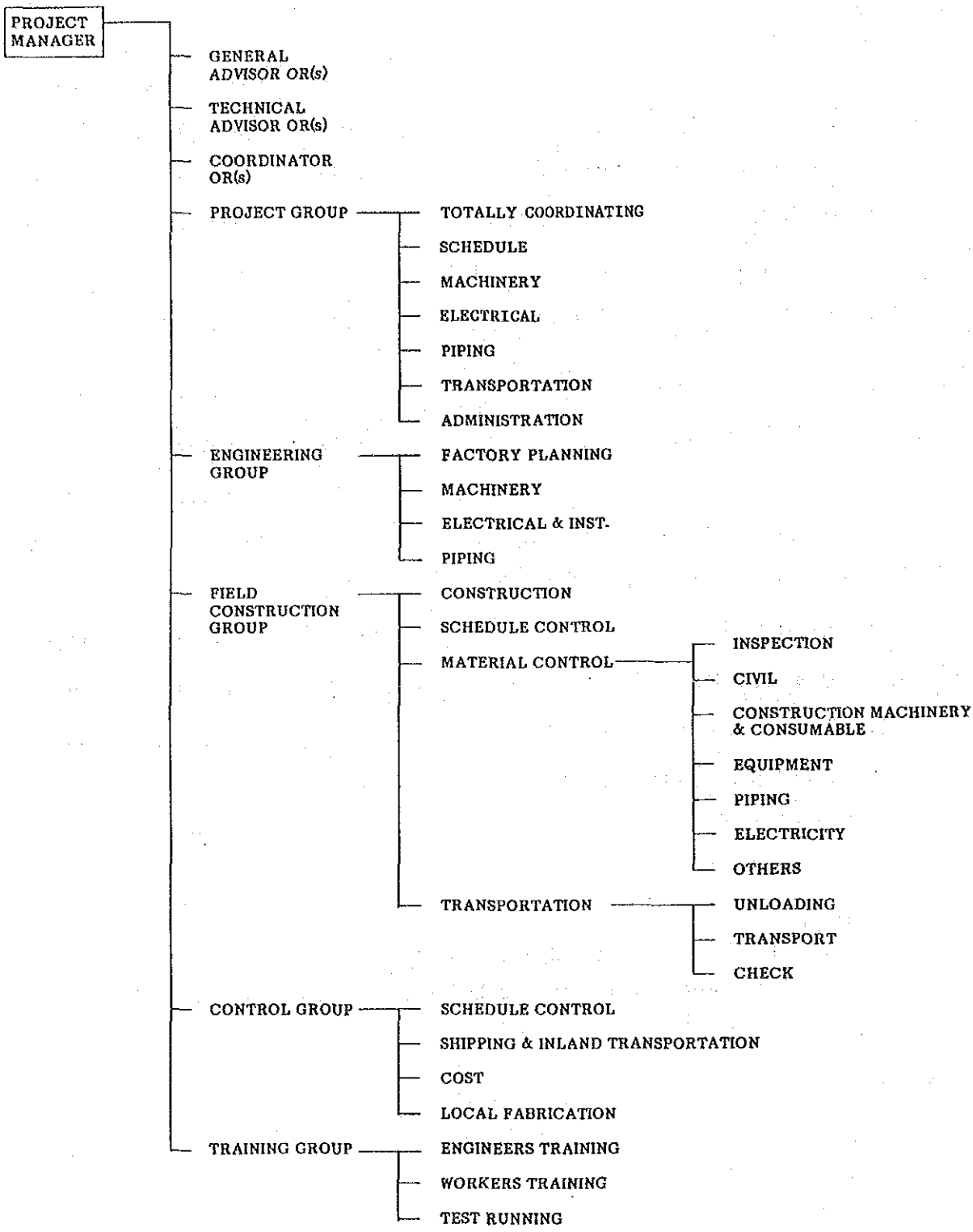


Table 4-5 Training Plan of Worker

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

*: INCLUDED LECTURE (BASIC THEORY)

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

Description of Detail Design, Supervising & Training fee		Cost Estimation of Detail Design	Cost Estimation of Supervision and Training fee	Estimated Interval
Project Engineering	Review of F/S, preparation of implementation program, supervision of construction schedule and general consultation to the implementation of the project.	F= 37.93 D= 1.98 Item 10 of Table 4-3		Refer to Table 3-2 of Construction Schedule
Civil works	Designing, Preparation of specification for foundation plan of building, machinery, facilities and supervision	F= 2.08 D= 0.21 Item 6 of Table 4-3	F= 17.62 D= - Item 11 of Table 4-3	
Machinery equipment and facilities	Lay-out planning and designing of above mentioned equipment, preparation of specification both for procurement of machinery, equipment, parts and tools, facilities and supervision.	F= 74.70 D= - Item 10 of Table 4-3	F= 29.35 D= 17.35 Item 11 of Table 4-3	
Electricities	Lay-out planning and designing of above mentioned equipment, preparation of specification both for procurement of electricities and supervision.	F= 26.88 D= - Item 2 of Table 4-3	F= 77.25 D= 23.94 Item 11 of Table 4-3	
Piping works	Designing, Preparation of specification for procurement and supervision.	F= 1.01 D= - Item 10 of Table 4-3	F= 7.72 D= - Item 11 of Table 4-3	
Training for testrun	Supervision for machine operators at machinery erecting intervals type of machinery for supervision listed in item.		F= 5.17 D= - Item 11 of Table 4-3	

Table 4-7 Equipment Planning Bases (INDRA)

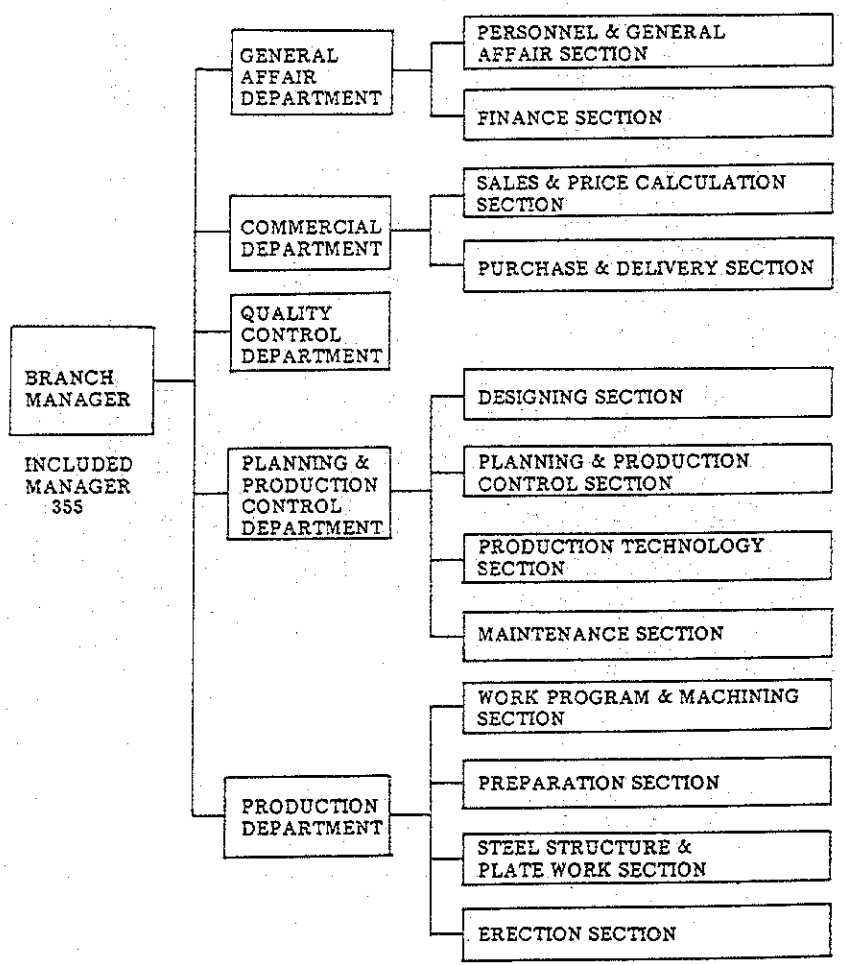
NO.	MACHINE NAME	SELECTION BASE	PRODUCT	LOADING FACTOR (%)
1.1	HEAVY DUTY UNIVERSAL LATHE MACHINE	TO RENEW OBSOLETE EQUIPMENT AND TO IMPROVE ACCURACY AND EFFICIENCY	PARTS/MACHINE	62
1.3	VERTICAL BORING & TURNING MILL MACHINE	TO REINFORCE FACILITIES FOR MACHINING SMALL AND MEDIUM PRODUCTS	PARTS/MACHINE	83
1.4	HEAVY DUTY RADIAL DRILLING MACHINE	TO REINFORCE FACILITIES FOR INCREASING PRODUCTION	GENERAL STRUCTURE, PARTS/MACHINE	82
1.9	HORIZONTAL BORING & MILLING MACHINE	TO RENEW OBSOLETE EQUIPMENT	GENERAL STRUCTURE, PARTS/MACHINE	91
1.10	UNIVERSAL MILLING MACHINE	TO REINFORCE FACILITIES FOR INCREASING PRODUCTION	PARTS/MACHINE	56
1.11	PLANING MACHINE	TO REINFORCE FACILITIES FOR PRODUCING NEW TYPES OF PRODUCTS	PARTS/MACHINE, PIPE WORKS & PLATE WORKS	74
1.19	HEAVY DUTY HYDRAULIC PRESS MACHINE	TO REINFORCE FACILITIES FOR PLATE WORK	PIPE WORKS, PLATE WORKS	79
1.26	MECHANICAL PLATE BEND ROLLING MACHINE	TO RENEW OBSOLETE EQUIPMENT	PIPE WORKS, PLATE WORKS	58
4.3	SAND BLASTING MACHINE	TO IMPROVE LAYOUT AND REINFORCE FACILITIES FOR INCREASING PRODUCTION	GENERAL STRUCTURES	-

Table 5-1 Training Plan

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

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

(EXCEPT FOUNDRY & SERIE PRODUCT SHOP)



	TOTAL PERSONNEL	SECTION MANAGER	ENGINEER S/V & OFFICER	DIRECT WORKER	INDIRECT WORKER
GENERAL AFFAIR DEPARTMENT	36	2	22		12
COMMERCIAL DEPARTMENT	27	2	22		3
QUALITY CONTROL DEPARTMENT	12		3	9	
PLANNING & PRODUCTION CONTROL DEPARTMENT	57	1	9		
		1	16		
		1	6		
		1	2		20
PRODUCTION DEPARTMENT	217	1	6	22	20
		1	2	59	
		1	2	96	
		1	6		
TOTAL	349	12	96	186	55

MACHINE NO. AND MACHINE NAME LIST OF Fig. 3-1 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 PILLAR 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 WHEELS)
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

SMALL MACHINE WORKS

LARGE MACHINE WORKS

FOUNDRY

GENSET PLAN

CONCRETE MIXER

CUTTING PLAN

27 x @4 000 = 108 000

15 x @7 600 = 114 000

2 350

STEEL STRUCTURE

STORAGE

EXISTING COMPRESSOR (RABC-RBAC) 1.39.0 ~ 1.39.12

STEEL STRUCTURE

MARKING & CUTTING

PLATE WORKS

MARKING & CUTTING

MARKING & CUTTING

10 x @4 000 = 40 000

14 x @4 900 = 68 600

11 800

5 500

16 500

45 500

21 000

13 000

10 500

15 700

29 100

12 300

16 800

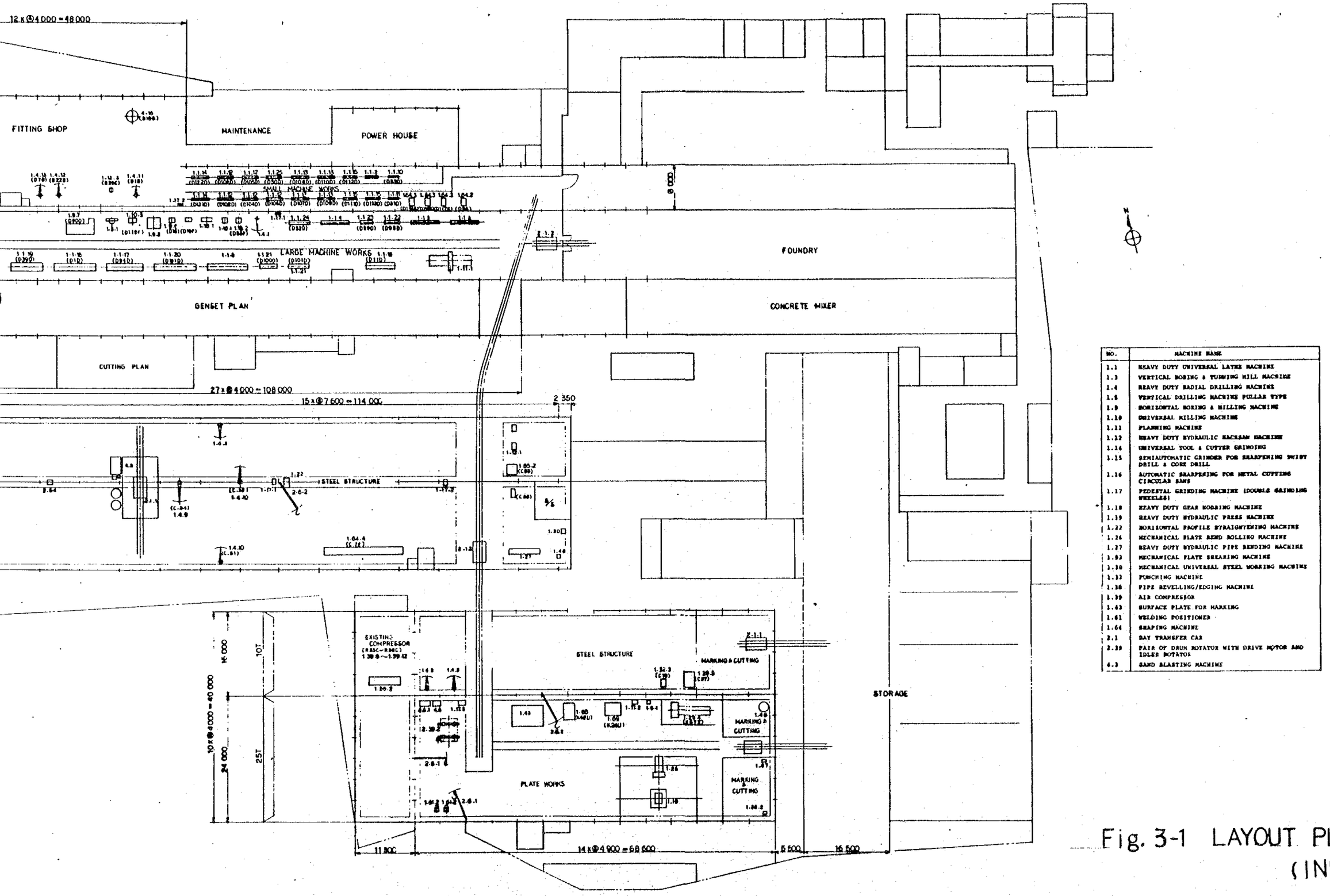
25T

15T

5T

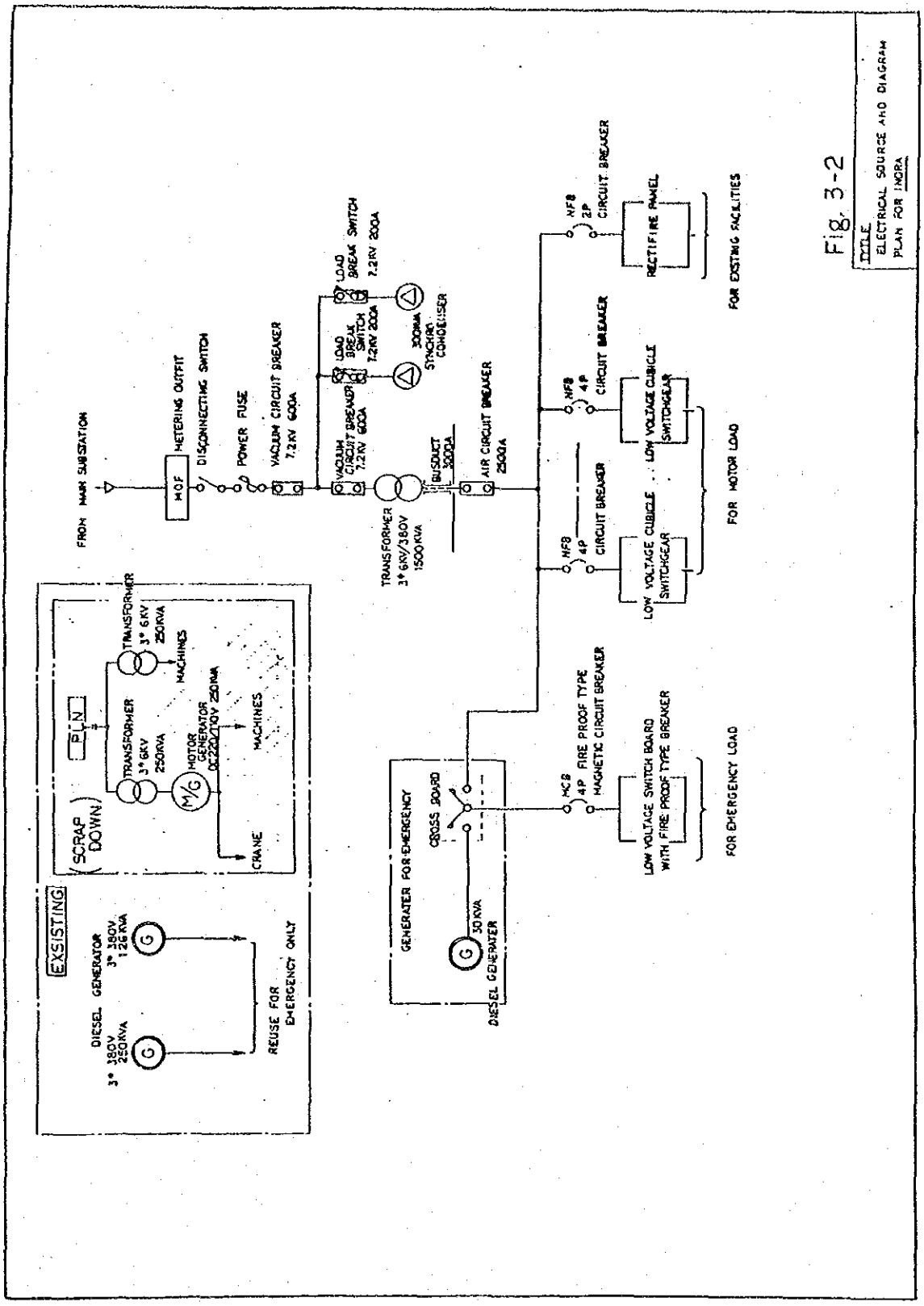
8T

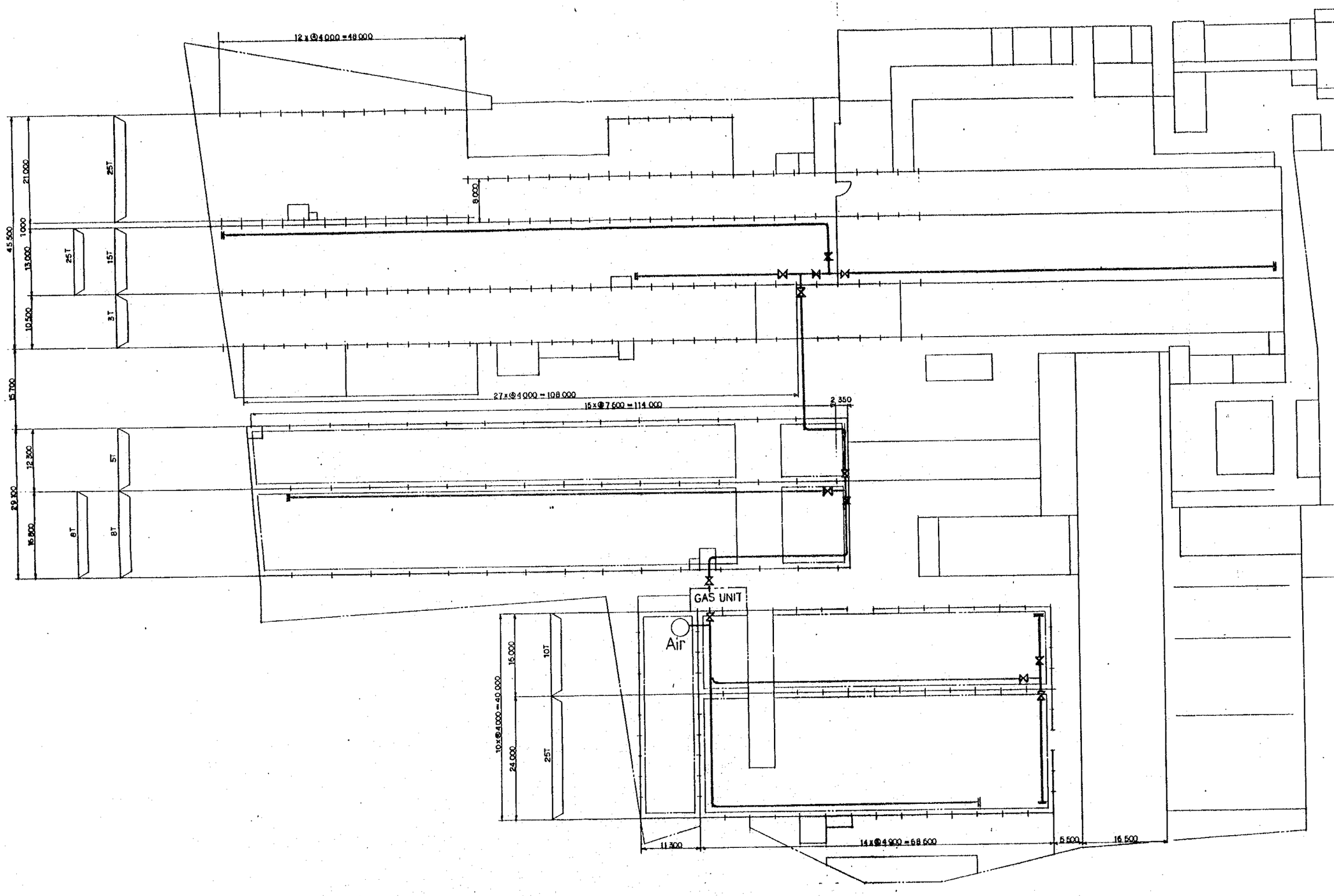
6 000

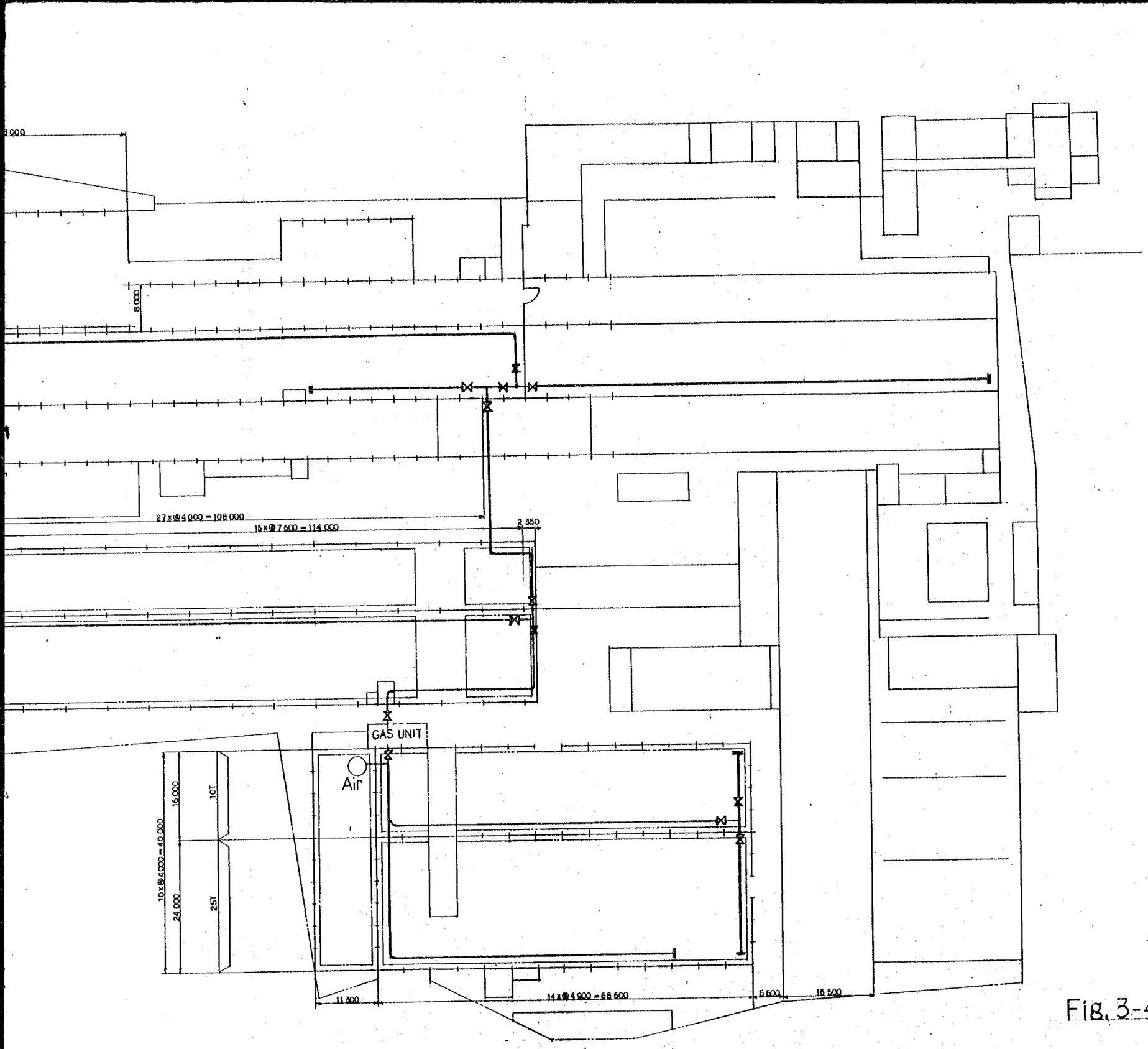


NO.	MACHINE NAME
1.1	HEAVY DUTY UNIVERSAL LATHE MACHINE
1.3	VERTICAL BORING & TURNING MILL MACHINE
1.4	HEAVY DUTY RADIAL DRILLING MACHINE
1.6	VERTICAL DRILLING MACHINE PULLAR TYPE
1.9	HORIZONTAL BORING & MILLING MACHINE
1.10	UNIVERSAL MILLING MACHINE
1.11	PLANNING MACHINE
1.12	HEAVY DUTY HYDRAULIC HACKSAW 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 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
1.32	MECHANICAL PLATE SHEARING MACHINE
1.36	MECHANICAL UNIVERSAL STEEL WORKING MACHINE
1.37	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
2.38	PAIR OF DRUM ROTATOR WITH DRIVE MOTOR AND IDLER ROTATOR
4.3	SAND BLASTING MACHINE

Fig. 3-1 LAYOUT PLAN (INDRA)


EXISTING
SCRAP DOWN
PLN
DIESEL GENERATOR 3φ 380V 126 KVA
DIESEL GENERATOR 3φ 380V 250KVA
TRANSFORMER 3φ 6KV 250KVA
TRANSFORMER 3φ 6KV 250KVA
MOTOR GENERATOR DC220/70V 250KVA
MACHINES
MACHINES
CRANE
REUSE FOR EMERGENCY ONLY
FROM MAIN SUBSTATION
M.O.F
METERING OUTFIT
DISCONNECTING SWITCH
POWER FUSE
VACUUM CIRCUIT BREAKER 7.2KV 600A
VACUUM CIRCUIT BREAKER 7.2KV 600A
LOAD BREAK SWITCH 7.2KV 200A
LOAD BREAK SWITCH 7.2KV 200A
300KVA SYNCHRO CONDENSER
TRANSFORMER 3φ 6KV/380V 1500KVA
BUSDUCT 3000A
AIR CIRCUIT BREAKER 2500A
NFB 4P CIRCUIT BREAKER
NFB 4P CIRCUIT BREAKER
NFB 2P CIRCUIT BREAKER
LOW VOLTAGE CUBICLE SWITCHGEAR
LOW VOLTAGE CUBICLE SWITCHGEAR
RECTIFIRE PANEL
FOR MOTOR LOAD
FOR EXISTING FACILITIES
GENERATER FOR EMERGENCY
CROSS BOARD
30KVA
DIESEL GENERATER
MCB 4P FIRE PROOF TYPE MAGNETIC CIRCUIT BREAKER
LOW VOLTAGE SWITCH BOARD WITH FIRE PROOF TYPE BREAKER
FOR EMERGENCY LOAD
Fig. 3-2
TITLE
ELECTRICAL SOURCE AND DIAGRAM PLAN FOR INDRA


12 x @4 000 = 48 000
9 000
45 500
21 000
1 000
13 000
10 500
25T
25T
15T
3T
15 700
27 x @4 000 = 108 000
15 x @7 600 = 114 000
2 350
29 300
12 300
16 800
5T
6T
8T
GAS UNIT
Air
10 x @4 000 = 40 000
16 000
24 000
10T
25T
11 300
14 x @4 900 = 68 600
5 500
16 500



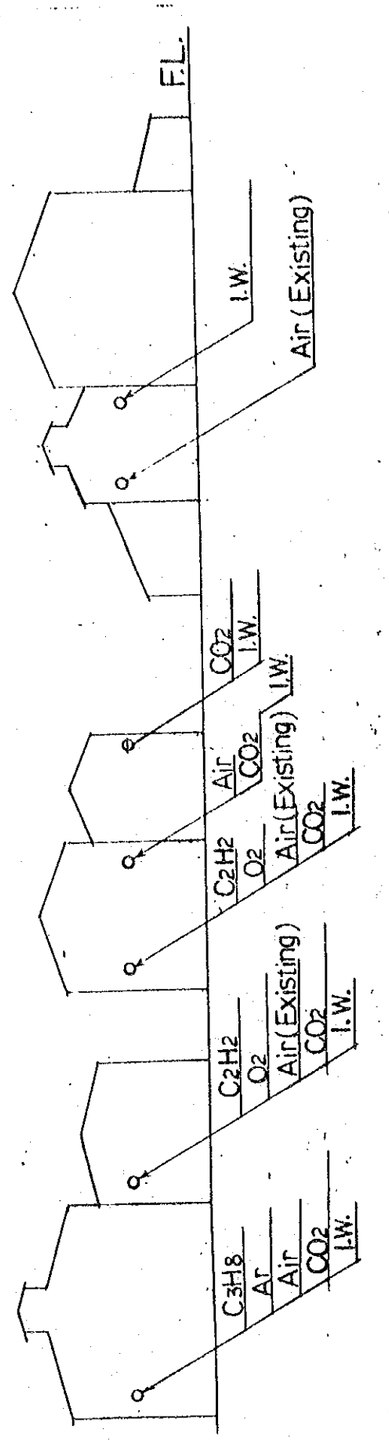
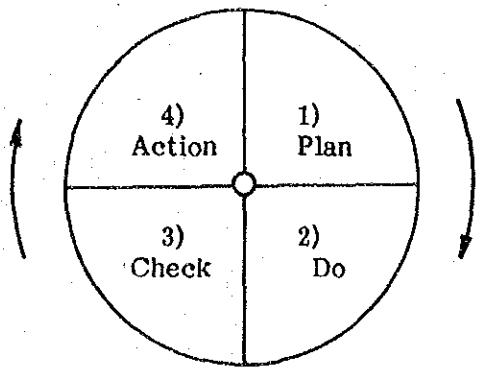


Fig. 3-4 UTILITY PIPING PLAN
(INDRA)



(1) Plan a job. (Plan)

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

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

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

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

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

UNIT: 1,000,000 YEN

TRAINING ITEM \ YEAR		1985	1986	1987	1988	1989	1990
FOR ENGINEER 1. PRODUCTION CONTROL 2. PRODUCTION TECHNIQUE 3. QUALITY CONTROL					INTO OPERATION F: 2.84 D: 2.16	SUPERVISOR BY TECHNICAL LICENSE 2 YEARS F: 17.06 D: 12.94	F: 14.21 D: 10.79
FOR WORKER 1. MACHINE WORKER 2. WELDING 3. FORMING 4. INSPECTION, ETC			BY COMPANY'S OWN SYSTEM		SUPERVISOR BY MACHINE SUPPLIER F: 5.17 D: -		
TRAINING COST	FOREIGN				8.01	17.06	14.21
	DOMESTIC				2.16	12.94	10.79

LIST 1-1
LIST OF EXISTING MACHINE/TOOL

MILL NAME: BBI-INDRA SECTION: Small Machine (1/7)

No.	Code	Machine Item	Q'ty	Supplier Purchased Data	Main Specification	Motor Power	Machine Condition					
							Loading %	Tolerance	Workability	Maintenance	Moderni-zation	Conclusion
1	D9S	Shaper	1	Heineman Type K500 1952	Working surface of table: 500 x 320 Max travel of table: - Vertical travel : 210 - Horizontal travel: 350 Max. stroke : 260	2.2kW 1440 RPM	40	II	II	II	o	o
2	D75H	Thread cutter	1	Landis Machine & Co.	Trapozoidal threads 4 1/2 to 12 inner thread 9/16" to 1 7/8" outer threads 1/2" to 2" 4 blade	Flat Belt	-	-	-	-	-	x
3	D19F	Universal Milling	1	Wanderer Werk A.G. Munchen Type 1 F.U. No. 5442 1952	Working surface of table: 305 x 1250 Max. travel of table: - Vertical travel : 340 - Horizontal travel: 300 - Cross travel : 550 Table can travel to the spindle axis at an angle 45°-0-45° Available power : 5kW	Flat Belt	60	II	II	II	x	x
4	D79F	Vertical Milling	1	Okuma Iron Works Nagoya	Working surface of table: 266 x 1346 Max. travel of table: - Vertical travel : 460 - Horizontal travel: 280 - Cross travel : 610 Range of spindle space 20 to 423		10	III	III	III	x	x

LIST 1-1
LIST OF EXISTING MACHINE/TOOL

MILL NAME: BBI-INDRA SECTION: Small Machine (2/7)

No.	Code	Machine Item	Q'ty	Supplier Purchased Data	Main Specification	Motor Power	Machine Condition					
							Loading %	Tolerance	Workability	Maintenance	Moderni-zation	Conclusion
5	D33F	Vertical Milling	1	Nomura Tool Machines, Japan Column & Knee No. 1283	Working surface of table: 420 x 1560 Max. travel of table: - Vertical travel : 420 - Horizontal travel: 380 - Cross travel : 650 Range of spindle speed: 13 to 508 (rpm)	3.7kW RPM	10	III	III	III	x	x
6	D80S	Slotter	1	Wakayama Iron Works, Ltd, Japan 1948	Working surface of table: 457 Max. travel of table: - Lognitudinal travel: 305 - Cross travel : 254 Max. stroke of arm : 200 Height of work piece : 260		60	II	III	III	x	x
7	D72D	Turning Lathe (Turret)	1	Schuecke Olen Heinemann Type B32 1940	Height of centre: 80	1.1kW 220/280	20	III	III	III	x	x
8	DJ2D	Turning Lathe	1	American Face Maker Landis Machine Co. Production No. 62579-41 1941	Chuck diameter : 304 Distance of centre : 1,000 Height of centre : 120 Range of spindle speed: 25 to 1500 (rpm)	1.1kW 1500 RPM 220/380	65	II	III	III	o	o

LIST 1-1
LIST OF EXISTING MACHINE/TOOL

MILL NAME: BBI-INDRA SECTION: Small Machine (3/7)

No.	Code	Machine Item	Q'ty	Supplier Purchased Data	Main Specification	Motor Power	Machine Condition					
							Loading %	Tolerance	Workability	Maintenance	Moderni-zation	Conclusion
9	D31D	Turning Lathe	1	Le Bond USA Type NB No. 347	Chuck diameter ; 320 Distance of centre : 914 Height of centre : 110 Range of spindle speed: 20 to 600	1.1kW RPM 220/380	60	II	II	II	o	o
10	D44D	Turning Lathe	1	Cardiff Lathe & Tool Works Ltd. Wales Type BRC/100972 No. 110 1951	Chuck diameter : 254 Distance of centre : 914 Height of centre : 110 Range of spindle speed: 27 to 757 (rpm)	1,8kW 1440 RPM	-	-	-	-	-	x
11	D21	Turning Lathe	1	Cardiff Lathe & Tool Works Ltd. Wales Type: BRC/108972	Chuck diameter : 254 Distance of centre : 914 Height of centre : 110 Range of spindle speed: 27 to 757 (rpm)	1.8kW 1440 RPM	-	-	-	-	-	x
12	D20	Turning Lathe	1	Triumph 1952	Chuck diameter : 250 Distance of centre : 1150 Height of centre : 120 Range of spindle speed: 30 to 600 (rpm)	1.1kW 1400 RPM	-	-	-	-	-	x

LIST 1-1
LIST OF EXISTING MACHINE/TOOL

MILL NAME: BBI-INDRA

SECTION: Small Machines (4/7)

No.	Code	Machine Item	Q'ty	Supplier Purchased Data	Main Specification	Motor Power	Machine Condition					
							Loading %	Tolerance	Workability	Maintenance	Moderni-zation	Conclusion
13	D102	Universal Turning Lathe	1	3 M.M. Type C. 1B No. 351.165 1965	Chuck diameter : 250 & 480 Distance of centre : 2000 Height of centre : 150 Range of spindle speed: 16 to 2000 (rpm)		65	II	I	II	o	o
14	D103	Universal Turning Lathe	1	idem	idem		65	II	I	II	o	o
15	D104	Universal Turning Lathe	1	idem	idem		65	II	I	II	o	o
16	D105	Universal Turning Lathe	1	idem	idem		65	II	I	II	o	o
17	D106D	Universal Turning Lathe	1	3 M.M. Type C 11B No. 351/65	Chuck diameter : 250 & 480 Distance of centre : 2000 Height of centre : 150 Range of spindle speed: 16 to 2000 (rpm)		65	II	I	II	o	o

LIST 1-1
LIST OF EXISTING MACHINE/TOOL

MILL NAME: BBI-INDRA SECTION: Small Machine (5/7)

No.	Code	Machine Item	Q'ty	Supplier Purchased Data	Main Specification	Motor Power	Machine Condition					
							Loading %	Tolerance	Workability	Maintenance	Moderni-zation	Conclusion
18	D107D	Universal Turning Lathe	1	Machine Tool Plant Sofia Type C5B	Chuck diameter : 380 Distance of centre : 2110 Height of centre : 155 Range of spindle speed: 35 to 1600 rpm	4kW 1140 RPM 220/380	65	II	II	II	o	o
19	D108D	Universal Turning Lathe	1	Same as above Type No. 488/65	Chuck diameter : 380 Distance of centre : 2110 Height of centre : 155 Range of spindle speed: 35 to 1600 rpm	4kW 1440 RPM 220/380	65	II	II	II	o	o
20	D109D	Universal Turning Lathe	1	Same as above Type C5B No. 570/65	Chuck diameter : 380 Distance of centre : 2110 Height of centre : 155 Range of spindle speed: 35 to 1600 rpm	4kW 1440 RPM 220/380	65	II	II	II	o	o
21	D110D	Universal Turning Lathe	1	Same as above No. 444/65	Chuck diameter : 380 Distance of centre : 2110 Height of centre : 155 Range of spindle speed: 35 to 1600 rpm		65	II	II	II	o	o

LIST 1-1
LIST OF EXISTING MACHINE/TOOL

MILL NAME: BBI-INDRA SECTION: Small Machines (6/7)

No.	Code	Machine Item	Q'ty	Supplier Purchased Data	Main Specification	Motor Power	Machine Condition					
							Loading %	Tolerance	Workability	Maintenance	Moderni-zation	Conclusion
22	D121D	Universal Turning Lathe	1	3 H.M. Type C 10 B 1965	Chuck diameter : 480 Distance of centre : 2150 Height of centre : 265 Range of spindle speed: 16 to 2000 rpm		40	II	II	III	×	○
23	D122D	Universal Turning Lathe	1	Same as above	Same as above		65	II	II	II	○	○
24	D117S	Shaper	1	Mashtroi Troyan Bulgaria Type 5E No. 491 1965	Working surface of table: 340 x 500 Max. stroke of arm : 450 Max. travel of table : - Vertical travel : 335 - Horizontal travel : 560		65	II	II	II	○	○
25	D116S	Shaper	1	idem	idem		40	II	II	III	○	○
26	D115S	Shaper	1	idem	idem		40	II	II	III	○	○
27	D114D	Universal Milling	1	Kazanlik Bulgaria Type FU 32 - Y 320 No. 659 1965	Working surface of table: 320 x 1325 Max. travel of table: - Vertical travel : 380 - Horizontal travel : 230 - Cross travel : 635		0	-	III	III	×	×

LIST 1-1
LIST OF EXISTING MACHINE/TOOL

MILL NAME: BBI-INDRA SECTION: Small Machines (7/7)

No.	Code	Machine Item	Q'ty	Supplier Purchased Data	Main Specification	Motor Power	Machine Condition					
							Loading %	Tolerance	Workability	Maintenance	Moderni-zation	Conclusion
28	D29D	Turning Lathe	1	Pedestal No. 8031 1951	Chuck diameter : 160 Distance of centre : 490 Height of centre : 70 Range of spindle speed: I. 275 to 1100 rpm II. 555 to 2200 rpm		-	-	-	-	-	×
29	D27D	Turning Lathe	1	Artillerie Inrichtingeht Hamburg, Nederland Pedestal No. 8035 1951	Chuck diameter : 160 Distance of centre : 490 Height of centre : 70 Range of spindle speed: I. 275 to 1100 rpm II. 555 to 2200 rpm	Flat Belt	-	-	-	-	-	×
30	D113D	Universal Turning Lathe	1	Machine Tool Plant Sofia Type C5B No. 353/65	Chuck diameter : 380 Distance of centre : 1570 Height of centre : 165 Range of spindle speed: 35 to 1600	4kW 1440 rpm 220/380	60	II	II	II	○	○
31	D112D	Universal Turning Lathe	1	idem	idem	Same as above	40	II	II	II	○	○
32	D111D	Universal Turning Lathe	1	idem	idem	Same as above	65	II	II	II	○	○

LIST 1-1
LIST OF EXISTING MACHINE/TOOL

MILL NAME: BBI-INDRA SECTION: Machine Work (1/6)

No.	Code	Machine Item	Q'ty	Supplier Purchased Data	Main Specification	Motor Power	Machine Condition					
							Loading %	Tolerance	Workability	Maintenance	Modernization	Conclusion
1	D18D	Vertical Turning Lathe	1	Schuchar & Schutte 1910	Chuck diameter : 1000 Distance of column : 940 Range of table speed : 2.2 to 54	Flat Belt	60	II	III	III	×	×
2	D17	Horizontal Boring & Milling	1	Geo Richard & Co. Broad Heid Manchester 1907	Working surface of table I: 838 x 1295 Working surface of table II: 838 x 838 Chuck diameter : 711	Flat Belt	60	II	II	II	×	×
3	D16	Horizontal Boring & Milling	1	idem 1902	Working surface of table I: 760 x 1055 Working surface of table II: 760 x 760 Chuck diameter : 510	5.5kW 1435 rpm 220/380	40	II	III	III	×	○
4	D15D	Horizontal Boring & Milling	1	idem 1907	Working surface of table I: 838 x 1295 Working surface of table II: 838 x 838 Chuck diameter : 711	Flat Belt	60	II	II	III	×	×

LIST 1-1
LIST OF EXISTING MACHINE/TOOL

MILL NAME: BBI-INDRA

SECTION: Machine Work (2/6)

No.	Code	Machine Item	Q'ty	Supplier Purchased Data	Main Specification	Motor Power	Machine Condition					
							Loading %	Tolerance	Workability	Maintenance	Moderni-zation	Conclusion
5	D79D	Vertical Milling	1	Okuma Iron Work Ltd., Nagoya	Working surface of table: 266 x 1346 Max. travel of table: - Vertical travel : 460 - Horizontal travel : 280 - Cross travel : 610 Range of spindle speed: 19 to 770		-	-	-	-	-	x
6	D12D	Horizontal Milling	1	J.E. Reinecker Chemnitz	Working surface of table: 876 x 3810 Distance of column : 1016	Flat Belt	60	II	III	III	x	x
7	D10D	Turning Lathe	1	H. Broad Bent Ltd. 1907	Chuck Diameter : 1520 Distance of centre : 4100 Height of centre : 540	Flat Belt	50	II	III	III	x	x
8	D11D	Turning Lathe	1	Mills Bement Pond	Chuck diameter : 1070 Distance of centre : 4400 Height of centre : 475	11kW 400/1600 RPM DC MOTOR	65	II	II	II	x	o
9	D94D	Turning Lathe	1	Wohlenberg Hannover Type R4 No. 13058 1927	Chuck diameter : 1225 Distance of centre : 5000 Height of centre : 540 Speed of main drive : 1,5 - 84	11kW 1276 RPM 110	60	III	III	II	x	o

LIST 1-1
LIST OF EXISTING MACHINE/TOOL

MILL NAME: BSI-INDRA SECTION: Machine (3/6)

No.	Code	Machine Item	Q'ty	Supplier Purchased Data	Main Specification	Motor Power	Machine Condition					
							Loading %	Tolerance	Workability	Maintenance	Moderni-zation	Conclusion
10	D6D	Turning Lathe	1	Wohlenberg Hannover No. 5227 1904	Chuck diameter : 1060 Distance of centre : 5000 Height of centre : 475	Flat Belt	65	III	III	II	×	×
11	D7D	Turning Lathe	1	Wohlenberg Hannover No. 4023 1900	Chuck diameter : 1060 Distance of centre : 5000 Height of centre : 475	Flat Belt	65	III	III	II	×	×
12	D5D	Turning Lathe	1	H. Broad Bent Ltd. 1902	Chuck diameter : 1530 Distance of centre : 4000 Height of centre : 535	Flat Belt	65	III	III	III	×	×
13	D4D	Turning Lathe	1	H. Borad Bent Ltd. 1902	Chuck diameter : 1530 Distance of centre : 4000 Height of centre : 535	Flat Belt	50	III	III	III	×	×
14	D3D	Facing Lathe	1	J. Burton & Co. Leads 1885	Chuck diameter : 2130 Distance of centre : 610 Height of centre : 920	Flat Belt	-	-	-	-	-	×
15	D2D	Facing Lathe	1	Saech-Kf-Richard Hartmon 1904	Chuck diameter : 2500 Distance of centre : 800 Height of centre : 1000	Flat Belt	60	III	III	III	×	×

LIST 1-1
LIST OF EXISTING MACHINE/TOOL

MILL NAME: BBI-INDRA SECTION: Machine Work (4/6)

No.	Code	Machine Item	Q'ty	Supplier Purchased Data	Main Specification	Motor Power	Machine Condition					
							Loading %	Tolerance	Workability	Maintenance	Moderni-zation	Conclusion
16	D1D	Turning Lathe	1	Niles-Lement-Pond Plainfield Newjersey 1916	Chuck diameter : 1270 Distance of centre : 5890 Height of centre : 475	15kW 400/800 rpm 110V	65	II	II	II	×	○
17	D40D	Horizontal Boring	1	Thomas Smanons & Co. Jonnatons Near Glasgow	Chuck diameter : 1556 Distance of centre : 4550 Height of centre : 490	Flat Belt	65	II	II	III	×	×
18	D45D	Turning Lathe	1	Lodge & Shipley Cincinati Ohio USA No. 728 Type 18	Chuck diameter : 560 Distance of centre : 4230 Height of centre : 205	Flat Belt	-	-	-	-	-	×
19	D82D	Turning Lathe	1	The American Tool Works & Co. Cincinati USA Type MP24 1919	Chuck diameter : 540 Distance of centre : 4700 Height of centre : 210	Flat Belt	50	II	III	III	×	×
20	D39D	Turning Lathe	1	H. Broad Bent Ltd. Sowercy Brudge Yorks 1907	Chuck diameter : 1524 Distance of centre : 4800 Height of centre : 340	11kW 220V DC Motor	60	II	III	III	×	○

LIST 1-1
LIST OF EXISTING MACHINE/TOOL

MILL NAME: BBI-INDRA SECTION: Machine Wirk (5/6)

No.	Code	Machine Item	Q'ty	Supplier Purchased Date	Main Specification	Motor Power	Machine Condition					
							Loading %	Tolerance	Workability	Maintenance	Moderni-zation	Conclusion
21	D131D	Turning Lathe	1	Germany MOAG 1926	Chuck diameter : 1100 Distance of centre : 6500 Height or centre : 530		65	II	II	III	×	○
22	D95D	Vertical Boring	1	Berthirer 1928	Table size : 4500 Length of arm : 3000 Range of table speed : 0.34-8.4	5.3kW 115V	50	II	II	III	○	○ TO WAHANA
23	D90D	Horizontal Boring and Milling	1	Droope Rein Bieveld 1926	Table size I : 4500 x 3000 " II: 2500 x 1500 Vertical moving : 2500 Horizontal moving : 900 Lifting height : 1500 Rotation table : 360° Range of spindle speed: 5.8 to 155	8kW 1080 rpm	65	II	II	III	○	○
24	D100D	Universal Turning Lathe	1	3 M.M. Type C 13K 1965	Chuck diameter : 630 Distance of centre : 2800 Height of centre : 165 Range of spindle speed: 8 to 1000	9.6kW	65	II	I	I	○	○

LIST 1-1
LIST OF EXISTING MACHINE/TOOL

MILL NAME: BBI-INDRA SECTION: Machine Work (6/6)

No.	Code	Machine Item	Q'ty	Supplier Purchased Data	Main Specification	Motor Power	Machine Condition					
							Loading %	Tolerance	Workability	Maintenance	Moderni-zation	Conclusion
25	D101	Universal Turning Lathe	1	idem 1965	Chuck diameter : 630 Distance of centre : 2800 Height of centre : 165 Range of spindle speed: 8 to 1000	9.6kW	65	II	I	I	○	○
26	D99D	Turning Lathe	1	Lodge and Shipley Cincinati Ohio USA 1930	Chuck diameter : 432 Distance of centre : 1778 Height of centre : 150 Range of spindle speed: 3 to 354	3.7kW 940 rpm 220/380	-	-	-	-	-	×
27	D98D	Turning Lathe	1	VDF Schrerer Germany 1930	Chuck diameter : 508 Distance of centre : 1524 Height of centre : 165 Range of spindle speed: 9.6 to 500	2.6kW 940 rpm 220/380	65	II	II	II	×	○
28	D59D	Turning Lathe	1	VDF Gebruder Bochringen 1930	Chuck diameter : 530 Distance of centre : 750 Height of Centre : 180 Range of spindle speed: 8 to 1000	kW 1455 rpm 220/380	65	II	II	II	×	○

LIST 1-1
LIST OF EXISTING MACHINE/TOOL

MILL NAME: BBI-INDRA

SECTION: Machine Work (1/3)

No.	Code	Machine Item	Q'ty	Supplier Purchased Data	Main Specification	Motor Power	Machine Condition					
							Loading %	Tolerance	Workability	Maintenance	Modernization	Conclusion
29	D52D	Turning Lathe	1	VDF Goburuder Bochringen GmbE No. 70.0951.542.001 1953	Chuck diameter : 660 Distance of centre : 2700 Height of centre : 220 Range of spindle speed: 6 to 600	9.5kW	65	II	II	II	○	○
30	D50D	Turning Lathe	1	Martin No. 18.147	Chuck diameter I : 200 " II : 430 Distance of centre : 1590		65	I	II	II	○	○
31	D53F	Gear Hobbing Machine	1	Lorent A.C. No. 6860 1953	Table size : 730 Range of Hob spindle speed: 22 to 140 Modul: 0.35 to 4.48	5.5kW 1420 rpm	60	II	II	II	○	○
32	D119F	Universal Milling	1	UhC Cugir Metalurgical Work Rumania 1963	Table size: 1325 x 325 Vertical table movement: 530 Horizontal " : 510 Table rotation : 180° Range of hob spindle speed: 30 to 1500	5.5kW 1450 rpm 220/380	50	II	III	III	×	○
33	D132D	Turning Lathe	1	Schiess	Chuck diameter : 897 Distance of centre : 5300 Height of centre : 650		65	II	III	III	×	×

LIST 1-1
LIST OF EXISTING MACHINE/TOOL

MILL NAME: BBI-INDRA SECTION: Machine Work (2/3)

No.	Code	Machine Item	Q'ty	Supplier Purchased Data	Main Specification	Motor Power	Machine Condition					
							Loading %	Tolerance	Workability	Maintenance	Modernization	Conclusion
34	D119D	Universal Milling	1	UhC Cugir Metalurgical Work Rumania 1963	Working surface of table: 1325 x 325 Max. travel of table : - Vertical travel : 530 - Horizontal travel : 510 - Cross travel : 220	5.5kW 1440 rpm 220/380	-	-	-	-	-	x
35	D26S	Shaper	1	Geo Richard Co., Ltd. Broad Hied Manchester 1900	Working surface of table: 500x 770 Length of arm : 930 Height of work piece : 830 Max. stroke : 3600	Flat Belt	-	-	-	-	-	x
36	D25S	Shaper	1	idem	idem	Flat Belt	50	III	III	III	x	x
37	D24S	Shaper	1	idem	idem	Flat Belt	50	III	III	III	x	x
38	D23S	Shaper	1	London Brothers, Glasgow 1902	Working surface of table: 445 x 395 Length of arm : 670 Max. stroke : 2300 Height of work piece : 830	Flat Belt	50	III	III	III	x	x

LIST 1-1
LIST OF EXISTING MACHINE/TOOL

MILL NAME: BBI-INDRA

SECTION: Machine Work (3/3)

No.	Code	Machine Item	Q'ty	Supplier Purchased Data	Main Specification	Motor Power	Machine Condition					
							Loading %	Tolerance	Workability	Maintenance	Moderni-zation	Conclusion
39	D13	Shaper	1	Chiba Seisa Co. Ltd., Japan Type CC 24	Working surface of table: 630 x 400 Max. travel of table: - Vertical travel : 390 - Horizontal travel : 530 Max. stroke : 550	—	60	III	II	II	×	×

LIST 1-1
LIST OF EXISTING MACHINE/TOOL

MILL NAME: BBI-INDRA SECTION: Maintenance (1/2)

No.	Code	Machine Item	Q'ty	Supplier Purchased Data	Main Specification	Motor Power	Machine Condition					
							Loading %	Tolerance	Workability	Maintenance	Moderni-zation	Conclusion
1		Cutting Tools Grinder	1			1 HP	20	II	II	III	×	○
2		Water Pump	1	Indra, Type TA-25-5		5 HP	100	-	-	III	×	○
3		Drill Press	1	Jones & Shipmann Ltd.		1 HP	-	-	-	-	-	×
4		Tools Sharpener Grinding Machine	1	F.W. Reynolds & Co.		1 HP	20	II	II	II	×	○
5		Circular Saw Sharpener	1	GE Reineke & Co. Chemnits			40	II	II	II	○	○
6		Turning Lathe	1	London Brothers Glasgow No. H.W. 21	Height of centre : 23 Distance of centre : 2400	2 HP	-	-	-	-	-	×
7		UP Right Drill	1	Robco No. 2446060		1.5 HP	-	-	-	-	-	×

LIST 1-1
LIST OF EXISTING MACHINE/TOOL

MILL NAME: BBI-INDRA SECTION: Maintenance (2/2)

No.	Code	Machine Item	Q'ty	Supplier Purchased Data	Main Specification	Motor Power	Machine Condition					
							Loading %	Tolerance	Workability	Maintenance	Moderni-zation	Conclusion
8		Up Right Drill	1	Walker-Turner Co. Plainfield, USA		0.3 HP	-	-	-	-	-	×
9		Electric Furnace	1	Industrie			100	-	-	-	○	○
10		Turning Lathe	1	H.P. & John Barnes, Rockford	Height of centre : 228 Distance of centre : 2030	2 HP	-	-	-	-	-	×
11		Turning Lathe	1	Alfred und Schutte Nr. G.W. 6355		2 HP	-	-	-	-	-	×
12		Shaper	1			2 HP	-	-	-	-	-	×
13		Grinder	1	Mizuko		2 HP	-	-	-	-	-	×
14		Cooling Water Pump	1	Norwoodsworks USA		3 HP	-	-	-	-	-	×
15		"	1	"		3 HP	-	-	-	-	-	×
16		Up Right Drill	1	Triumph, Brussel 1951			-	-	-	-	-	×

LIST 1-1
LIST OF EXISTING MACHINE/TOOL

MILL NAME: BBI-INDRA — *SECTION:* Plate Shop (1/3)

No.	Code	Machine Item	Q'ty	Supplier Purchased Data	Main Specification	Motor Power	Machine Condition					
							Loading %	Tolerance	Workability	Maintenance	Moderni-zation	Conclusion
1	K7SB	Radial Drill	1	Kolb 1927	Max. hole diameter : 2"	1.1kW	-	-	-	-	-	×
2	K12U	Plate Rolling	1	De Industrie 1947	Max. thickness of Plate: 20mm Roll diameter : 210 Length of roll : 2300 mm	Flat Belt	-	-	-	-	-	×
3	K48U	Plate Straighten-ing	1	Etna 1929	Max. of wide : 2060 mm Roll diameter : 280	11 kW 600 rpm	20	II	II	II	×	o
4	K57Z	Plate Shearing	1	-	Max. thickness of plate: 15 mm Max. width of plate : 1640 mm	10.9kW 1580 rpm	80	II	II	II	×	o
5	51	Radial Drill	1	-			-	-	-	-	-	×
6	K25U	Plate Rolling	1	Ruschworth & Co. 1904	Length of roll : 3680 Roll diameter : 380 Plate size : 3/4"	11.04kW 600 rpm	80	II	II	III	×	o
7	K24U	Combined Punch & Shearing Machine for Rivet	1	Schuchart & Shuttle	Max. thickness of plate: 7/8" Max. hole diameter : 1" Width : 1640 Length : 3000 Max. profile: 100 x 100 x 12		80	II	II	II	×	o

LIST 1-1
LIST OF EXISTING MACHINE/TOOL

MILL NAME: BBI-INDRA SECTION: Plate Shop (2/3)

No.	Code	Machine Item	Q'ty	Supplier Purchased Data	Main Specification	Motor Power	Machine Condition					
							Loading %	Tolerance	Workability	Maintenance	Modernization	Conclusion
8	K50P	Punching	1		Max. hole diameter : 7/8" Thickness of plate : 1/2"	18 kW	-	-	-	-	-	×
9	K8A	Grinding	1	Maier und Schmidt of Fenbach 1909	-		-	-	-	-	-	×
10	K71N	Hydraulic Riveting	1	Oeking Bakker 1924	-	3.7 kW	-	-	-	-	-	×
11	K80P	Pneumatic Hammer	1	Beche 1915	Capacity of hammer : 150 kg	11 kW 960 rpm	60	II	II	II	×	○
12	K81	Pneumatic Hammer	1	Pneumatic 1902	Capacity : 150 kg		40	II	II	III	×	○
13	K90P	Pneumatic Hammer	1	Eumuco 1920	Capacity : 200 kg	18.4 kW 600 rpm	-	-	-	-	-	×
14	K23A	Oven	5	My Tor Verva-ardiging van gas motoren. Dordrecht	Oven diameter : 620 Height of oven : 640	1.25 kW 1430 rpm 220/380	40	II	II	II	×	×

LIST I-1
LIST OF EXISTING MACHINE/TOOL

MILL NAME: BBI-INDRA SECTION: Plate Shop (3/3)

No.	Code	Machine Item	Q'ty	Supplier Purchased Data	Main Specification	Motor Power	Machine Condition					
							Loading %	Tolerance	Workability	Maintenance	Moderni-zation	Conclusion
15	K23	Ball Front Shape (Press Machine)	1	De Industrie 1937	Max. thickness of plate: 15 mm Ball front diameter : 2100 mm Pressing force : 350 ton		40	II	II	III	×	×
16	R35C	Compressor	1	Chicago Pneumatic Tool Co. Type N-SB CP 12 x 12	Max. pressure : 8.7kg/cm^2	52.9 kW 850 rpm	40	II	II	III	×	○
17	R36C	Compressor	1	Worthington USA No. 502972	Max. pressure :8.7kg/cm^2	52.9 kW 960 rpm 220/380	60	II	II	III	×	○
18	R37C	Compressor	1	Demag S2Z 090 No. 7008	Max. pressure : 7 atm Capacity : 8 m^3/min	55.2 kW 1450 rpm	60	II	II	III	×	○
19	R38C	Compressor	1	-	-	50 kW 975 rpm 435 V	30	II	II	III	×	○

LIST 1-1
LIST OF EXISTING MACHINE/TOOL

MILL NAME: BBI-INDRA SECTION: Steel Construction Shop (1/2)

No.	Code	Machine Item	Q'ty	Supplier Purchased Data	Main Specification	Motor Power	Machine Condition					
							Loading %	Tolerance	Workability	Maintenance	Modernization	Conclusion
1	C44	Plate Shearing	1	1928	Max. width of plate : 800 Max. thickness of plate: 10	Flat Belt	90	II	II	II	×	×
2	C53	Shaper	1	Rotterdam Machine Handle Esmeyer & Co., Rotterdam	Max. stroke : 700 Table size : 470x380	2 kW 1420 rpm	-	-	-	-	—	×
3	C19	Punch	1	Original Pedding Haus 1952	Max. thickness of plate: 10 mm Max. hole diameter : 19 mm	2.9 kW 1420 rpm	20	II	III	III	×	○
4	C15	Punch	1	Pedding Haus 1952	Max. thickness of plate: 10 mm Max. hole diameter : 19 mm	2.9 kW 1420 rpm	-	-	-	-	—	×
5	C32	Up Right Drill	1	Progress & Drilling Machine Works Ltd. England 1953	Max. hole diameter : 25 mm Table size : 680x398	0.74 kW	-	-	-	-	—	×
6	C47	Up Right Drill	1	Progress & Drilling Machine Works Ltd. England	Max. hole diameter : 25 mm Table size : 455 x 455	0.74 kW	-	-	-	—	—	×
7	C34	Radial Drill	1	Asquith Drilling Machine - England 1926	Max. hole diameter : 38 Radius of arm : 3500 Table size : 900x1300	3.7 kW	80	II	II	II	×	○

LIST 1-1
LIST OF EXISTING MACHINE/TOOL

MILL NAME: BBI-INDRA SECTION: Steel Construction Shop (2/2)

No.	Code	Machine Item	Q'ty	Supplier Purchased Data	Main Specification	Motor Power	Machine Condition					
							Loading %	Tolerance	Workability	Maintenance	Moderni-zation	Conclusion
8	C51	Radial Drill	1	Asquith-England 1952	Table size : 1800 x 2000 Max. radius of arm : 2400 Max. hole diameter : 38	3.7 kW 1430 rpm	60	II	II	III	×	○
9	C18	Radial Drill	1	Asquith-England 1952	Table size : 1800 x 2000 Max. radius of arm : 2400 Max. hole diameter : 38	3.7 kW 1430 rpm	60	II	II	II	×	○
10	C39	Profile Shearing	1	1924	Max. profile : 120 x 10	8.1 kW 1410 rpm	70	II	III	III	×	○
11	C37	Plate Shearing	1	1924	Max. width of plate : 2000 Max. thickness of plate: 20	18.4 kW 1200 rpm DC	80	II	II	II	×	○
12	C36	Side Type Plate Shaping Machine (Special Shaping Machine)	1	Willem Smitt 1924	Max. stroke : 10.000mm Stroke/mnt : 300mm Table size : 10,460 x 430 x 325	18.4 kW DC	-	II	III	III	×	○
13	C48	Electric Riveting	1	Naxos Union Mod. BST 600		0.74 kW 1300 rpm DC	-	-	-	-	-	×
14	-	2 Units Submerged arc Welding	1	Lincoln	Full Automatic arc welding				II	II	○	○
15	-	6 Units Inner Shield Arc Welding	1	Lincoln	Semi Automatic Arc Welding				II	II	○	○

LIST 1-1
LIST OF EXISTING MACHINE/TOOL

MILL NAME: BBI-INDRA SECTION: Fitting Shop (1/2)

No.	Code	Machine Item	Q'ty	Supplier Purchased Data	Main Specification	Motor Power	Machine Condition					
							Loading %	Tolerance	Workability	Maintenance	Moderni-zation	Conclusion
1	B1B	Radial Drill	1	Asguith. Type: CD. No. OR 17878 1952	Working surface of table I. 920 x 1290 II. 920 x 1450 Max. hole diameter : 100 Max. radius of arm : 1360 Range of spindle speed : 31-830	0.1 kW 1000 rpm 0.5 kW 1380 rpm 2.2 kW 1420 rpm	65	II	II	II	o	o
2	B29E	Hack Saw	1		Max. stroke : 350		50	II	II	II	o	o
3	B33B	Up Right Drill	1	Cordin En Sluiter Type: T 115 No. : 214266	Working surface of table I. 360 x 300 II. 270 x 260 Max. hole diameter : 18	300 - 800 rpm	-	-	-	-	-	x
4.	B30B	Up Right Drill	1	Cordin En. Sluiter Type: T 123 No. : 215283 1952	Working surface of table I. 360 x 300 II. 270 x 260 Max. hole diameter : 18	1 kW 200 - 1450 rpm	-	-	-	-	-	x
5	B22B	Radial Drill	1	Kalb Roterdam 1930	Working surface of table: I. 690 x 550 II. 1830 x 1060 Max. hole diameter : 75 Max. radius of arm : 1950 Range of spindle speed : 9.5-180	2.2 kW 950 rpm	60	II	II	II	x	o

LIST 1-1
LIST OF EXISTING MACHINE/TOOL

MILL NAME: BBI-INDRA

SECTION: Fitting Shop (2/2)

No.	Code	Machine Item	Q'ty	Supplier Purchased Data	Main Specification	Motor Power	Machine Condition					
							Loading %	Tolerance	Workability	Maintenance	Moderni-zation	Conclusion
6	B7B	Radial Drill	1	Reinford Cincinati USA. 1916	Working surface of table: I. 840 x 635 II. 1430 x 1060 Max. hole diameter : 75 Max. radius of arm : 1450 Range of spindle speed : 135-202	2.2 kW 940 rpm	65	II	II	II	×	○
7	B11B	Bend Type Sawing Machine	1	Do All Metal Master Cant. No.364,1605 1941	Working surface of table: 1250 x 750 Thickness of plate : 10	0.75 kW 1420 rpm	-	-	-	-	-	×
8	B4B	Bench Type Drill	1				-	-	-	-	-	×
9	B31B	Bench Type Drill	1				-	-	-	-	-	×
10	B5B	Bench Type Drill	1				-	-	-	-	-	×
11	B19B	Vertical Rotary Shrink Fitted Oven	1	De Industrie 1911	Max. work piece diameter: 1500	600 rpm	65	II	II	II	×	○
12	B16B	Heating Oven for Quenching	1	All Days & Union Makers Birmingham 1939			-	-	-	-	-	×

LIST 1-1
LIST OF EXISTING MACHINE/TOOL

MILL NAME: BSI-INDRA SECTION: Machinery (1/3)

No.	Code	Machine Item	Q'ty	Supplier Purchased Data	Main Specification	Motor Power	Machine Condition					
							Loading %	Tolerance	Workability	Maintenance	Moderni-zation	Conclusion
1	B7	Up Right Drilling	1	England, Type 4E	Max. hole diameter : ϕ23 mm Up/Down movement of arm: 750 mm	1.5 kW	-	-	-	-	-	×
2	B8	Up Right Drilling	1	Sidney, Australia	Max. hole diameter : ϕ25 mm Up/Down movement of arm: 750 mm	2.9 kW	-	-	-	-	-	×
3	B10	Radial Drilling	1	-	Max. hole diameter : ϕ2" Up/Down movement of arm: 2,000mm	7.4 kW	-	-	-	-	-	×
4.	B15	Radial Drilling	1	Osaka	Max. hole diameter : ϕ2" Up/Down movement of arm: 1,000mm		-	-	-	-	-	×
5	D2	Turning Lathe	1	Harison	Chuck diameter : 500 Distance of centre : 1000		-	-	-	-	-	×
6	D33	Turning Lathe	1	Rumania SN320	Chuck diameter : 315 Distance of centre : 750		-	-	-	-	-	×
7	E2	Air Riveting	1	-	Max. hole diameter : ϕ1"		-	-	-	-	-	×

LIST 1-1
LIST OF EXISTING MACHINE/TOOL

MILL NAME: BBI-INDRA SECTION: Machinery (2/3)

No.	Code	Machine Item	Q'ty	Supplier Purchased Data	Main Specification	Motor Power	Machine Condition					
							Loading %	Tolerance	Workability	Maintenance	Moderni-zation	Conclusion
8	E4	Air Riveting	1	German	Max. hole diameter : ϕ1"		-	-	-	-	-	×
9	G10	Hack Saw	1	-	Max. stroke : 400 mm	0.74 kW	-	-	-	-	-	×
10	M3	Plate Shearing	1	Frankfurt A.M.G.	Max. ϕ plate : 15 mm		-	-	-	-	-	×
11	M4	Plate Shearing	1	-	Max. ϕ plate : 15 mm		-	-	-	-	-	×
12	M5	Plate Shearing	1	-	-		-	-	-	-	-	×
13	N2	Profile Cutting	1	-	Max. round bar : ϕ1" - ϕ2" ϕ 1" - ϕ 2"		65	II	II	II	O	O
14	N3	Plate Cutting	1	-	Max. plate : 6 mm		-	-	-	-	-	×
15	P4	Forging	1	-			-	-	-	-	-	×
16	P5	Punch	1	Rotterdam	Max. hole diameter : 2.3 mm	2.3 kW	-	-	-	-	-	×

LIST 1-1
LIST OF EXISTING MACHINE/TOOL

MILL NAME: BBI-INDRA SECTION: Machinery (3/3)

No.	Code	Machine Item	Q'ty	Supplier Purchased Data	Main Specification	Motor Power	Machine Condition					
							Loading %	Tolerance	Workability	Maintenance	Moderni-zation	Conclusion
17	P6	Punch	1	Rotterdam	Max. hole diameter : ø1"	2.9 kW	-	-	-	-	-	×
18	R13	Compressor	1	PN Boma NR 100	-		-	-	-	-	-	×
19	R13	"	1	"	-		-	-	-	-	-	×
20	S5	Shaping	1	-	Max. travel of arm : 150 mm	3.7 kW	-	-	-	-	-	×
21	S6	Shaping	1	-	Max. travel of arm : 500 mm		-	-	-	-	-	×
22	All	Grinding Cutter	1	Japan	Grinding stone : ø12" x 9/64"		-	-	-	-	-	×

LIST 1-1
LIST OF EXISTING MACHINE/TOOL

MILL NAME: BBI-INDRA

SECTION: Small Machine & Machine Work (Add)

No.	Code	Machine Item	Q'ty	Supplier Purchased Data	Main Specification	Motor Power	Machine Condition					
							Loading %	Tolerance	Workability	Maintenance	Moderni-zation	Conclusion
	D38S	Slotter	1	D.New & Co.Engineer London 1893		Flat Belt	65	II	III	II	x	x
	D85S	Shaper	1	Shutte & Co.		Flat Belt	40	II	III	II	x	x
	D86S	Shaper	1	Esmeyer & Co 1925		Flat Belt	30	III	III	II	x	x
	D91S	Shaper	1	Geo Richard Ltd. Manchester 1926		Flat Belt	30	III	III	II	x	x

P.T. BOMA BISMA INDRA: INDRA UNIT

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

( ); shown usable existing machine Code No.

1. MACHINE TOOLS & WELDING MACHINES

NO.	TYPE OF MACHINE		QUANTITY
1.1	HEAVY DUTY UNIVERSAL LATHE MACHINE		
1.1.2	Max. turning diameter Distance between center	350 mm 1500 mm	1
1.1.3	Max. turning diameter Distance between center	450 mm 4000 mm	2
1.1.4	Max. turning diameter Distance between center	550 mm 4000 mm	1
1.1.5	Max. turning diameter Distance between center	1100 mm 6000 mm	1
1.1.10 (D32D)	Chuck diameter Distance of center Height of center Range of spindle speed	304 mm 1000 mm 120 mm 25 to 1500 rpm	1
1.1.11 (D31D)	Chuck diameter Distance of center Height of center Range of spindle speed	320 mm 914 mm 110 mm 20 to 600 rpm	1
1.1.12 (D102) (D103) (D104) (D105) (D106)	Chuck diameter Distance of center Height of center Range of spindle speed	250 & 480 mm 2000 mm 150 mm 16 to 2000 rpm	5
1.1.13 (D107D) (D108D) (D109D) (D110D)	Chuck diameter Distance of center Height of center Range of spindle speed	380 mm 2110 mm 155 mm 35 to 1600 rpm	4

NO.	TYPE OF MACHINE		QUANTITY
1.1.14 (D121D) (D122D)	Chuck diameter Distance of center Height of center Range of spindle speed	480 mm 2150 mm 265 mm 16 to 2000 rpm	2
1.1.15 (D113D) (D112D) (D111D)	Chuck diameter Distance of center Height of center Range of spindle speed	380 mm 1570 mm 165 mm 35 to 1600 rpm	3
1.1.16 (D11D)	Chuck diameter Distance of center Height of center	1070 mm 4400 mm 475 mm	1
1.1.17 (D94D)	Chuck diameter Distance of center Height of center Speed of main drive	1225 mm 5000 mm 540 mm 1.5 - 84 rpm	1
1.1.18 (D1D)	Chuck diameter Distance of center Height of center	1270 mm 5890 mm 475 mm	1
1.1.19 (D39D)	Chuck diameter Distance of center Height of center	1524 mm 4800 mm 340 mm	1
1.1.20 (D131D)	Chuck diameter Distance of center Height of center	1100 mm 6500 mm 530 mm	1
1.1.21 (D100D) (D101)	Chuck diameter Distance of center Height of center Range of spindle speed	630 mm 2800 mm 165 mm 8 to 1000 rpm	2
1.1.22 (D98D)	Chuck diameter Distance of center Height of center Range of spindle speed	508 mm 1524 mm 165 mm 9.6 to 500 rpm	1
1.1.23 (D59D)	Chuck diameter Distance of center Height of center Range of spindle speed	530 mm 750 mm 180 mm 8 to 1000 rpm	1

NO.	TYPE OF MACHINE		QUANTITY
1.1.24 (D52D)	Chuck diameter Distance of center Height of center Range of spindle speed	660 mm 2700 mm 220 mm 6 to 600 rpm	1
1.1.25 (D50D)	Chuck diameter I " II Distance of center	200 mm 430 mm 1590 mm	1
1.3	VERTICAL BORING & TURNING MILL MACHINE		
1.3.1	Max. turning diameter Max. turning height	1000 mm 1000 mm	1
1.4	HEAVY DUTY RADIAL DRILLING MACHINE		
1.4.1	Max. drilling capacity	35 mmø	5 3; For site
1.4.2	Max. drilling capacity	50 mmø	1
1.4.3	Max. drilling capacity	65 mmø	1
1.4.9 (C34)	Max. hole diameter Radius of arm Table size	38 mm 3500 mm 900 x 1300 mm	1
1.4.10 (C51) (C18)	Table size Max. radius of arm Max. hole diameter	1800 x 2000 mm 2400 mm 38 mm	2
1.4.11 (B1B)	Working surface of table I II Max. hole diameter Max. radius of arm Range of spindle speed	 920 x 1290 mm 920 x 1450 mm 100 mm 1360 mm 31 - 830 rpm	1
1.4.12 (B22B)	Working surface of table I II Max. hole diameter Max. radius of arm Range of spindle speed	 690 x 550 mm 1830 x 1060 mm 75 mm 1950 mm 9.5 - 180 rpm	1

NO.	TYPE OF MACHINE		QUANTITY
1.4.13 (B7B)	Working surface of table		1
	I	840 x 635 mm	
	II	1430 x 1060 mm	
	Max. hole diameter	75 mm	
	Max. radius of arm	1450 mm	
	Range of spindle speed	135 - 202 rpm	
1.5	VERTICAL DRILLING MACHINE PILLAR TYPE		
1.5.1	Max. drilling capacity	35 mmϕ	1
1.9	HORIZONTAL BORING & MILLING MACHINE		
1.9.2	Heavy duty horizontal boring & milling machine (Table type)		1
	Spindle diameter	160 mm	
	Table size	2000 x 2500 mm	
		3000 x 4500	
1.9.6 (D16)	Working surface of table		1
	I	760 x 1055 mm	
	II	760 x 760 mm	
	Chuck diameter	510 mm	
1.9.7 (D90D)	Table size I	4500 x 3000 mm	1
	" II	2500 x 1500 mm	
	Vertical moving	2500 mm	
	Horizontal moving	900 mm	
	Lifting height	1500 mm	
	Rotation table	360°	
	Range of spindle speed	5.8 to 155 rpm	
1.10	UNIVERSAL MILLING MACHINE		
1.10.1	Table size	1800 x 560 mm	1
1.10.2 (D114D)	Working surface of table	320 x 1325 mm	1
	Max. travel of table		
	- Vertical travel	380 mm	
	- Horizontal travel	230 mm	
	- Cross travel	635 mm	

NO.	TYPE OF MACHINE		QUANTITY
1.10.3 (D119F)	Table size Vertical table movement Horizontal table movement Table rotation Range of hob spindle speed	1325 x 325 mm 530 mm 510 mm 180° 30 to 1500 rpm	1
1.11	PLANING MACHINE		
1.11.1	Heavy duty double column planing machine Table size	 4000 x 2000 mm	1
1.12	HEAVY DUTY HYDRAULIC HACKSAW MACHINE		
1.12.1	Max. cutting diameter	280 mmø	1
1.12.3 (B29E)	Max. stroke	350 mm	1
1.14	UNIVERSAL TOOL & CUTTER GRINDING		
1.14.1	Swing Distance between workhead and tailstock Table size	265 mm 910 mm 180 x 1320 mm	1
1.14.3 (-)	-		1
1.15	SEMIAUTOMATIC GRINDER FOR SHARPENING TWIST DRILL & CORE DRILL		
1.15.1	Range drills diameter Point angle	10 - 100 mm 80 1/4 - 170 1/4	1
1.15.2 (-)	-		1

NO.	TYPE OF MACHINE		QUANTITY
1.16	AUTOMATIC SHARPENING FOR METAL CUTTING CIRCULAR SAWS		
1.16.2 (-)	-		1
1.17	PEDESTAL GRINDING MACHINE (DOUBLE GRINDING WHEELS)		
1.17.1	Pedestal grinding machine Wheel size	 150 x 25 x 51 m	2
1.17.2	Pedestal grinding machine Wheel size	 300 x 40 x 76 mm	3
1.17.3	Pedestal grinding machine Wheel size	 500 x 60 x 127mm	1
1.18	HEAVY DUTY GEAR HOBBING MACHINE		
1.18.1	Max. module 22/30 mm, max. workpiece dia. with grinding machine	500 - 800 mm	1
1.18.2 (D53F)	Table size Range of hob spindle speed Modul	730 mm 22 to 140 rpm 0.35 to 4.48	1
1.19 1.19.2	HEAVY DUTY HYDRAULIC PRESS MACHINE Power Table area Stroke Daylight	 500 Tons 1500 x 2000 mm 500 mm 1200 mm	1
1.22	HORIZONTAL PROFILE STRAIGHTENING MACHINE Force Throat depth Stroke Daylight Table block size	 200 tons 235 mm 750 mm 600 mm 450 x 1,700 mm	1

NO.	TYPE OF MACHINE		QUANTITY
1.26	MECHANICAL PLATE BEND ROLLING MACHINE		
1.26.2	Max. plate thickness bending capacity	17 mm	1
	Max. plate width	2000 mm	
	Min. bending diameter	550 mm	
1.26.8 (K25U)	Length of roll	3680 mm	1
	Roll diameter	380 mm	
	Plate size	3/4 inch	
1.27	HEAVY DUTY HYDRAULIC PIPE BENDING MACHINE		1
	Max. bending capacity of pipe	4 inch ϕ	
1.29	MECHANICAL PLATE SHEARING MACHINE		
1.29.4 (K57Z)	Max. thickness of plate	15 mm	1
	Max. width of plate	1640 mm	
1.29.5 (C37)	Max. width of plate	2000 mm	1
	Max. thickness of plate	20 mm	
1.30	MECHANICAL UNIVERSAL STEEL WORKING MACHINE		1
	Flat shear max.	250 x 22 mm	
	Bar stock shear	65 mmϕ	
	Square stock shear	55 mm	
	Punch max. 38 in thickness	27 mm	
	Notching	16 mm	
1.31	HAND NIBBLING MACHINE		1
	Max. nibbling capacity	8 mm	
	Smallest radius	300 mm	
1.32	PUNCHING MACHINE		1
1.32.3 (C19)	Max. thickness of plate	10 mm	
	Max. hole diameter	19 mm	

NO.	TYPE OF MACHINE		QUANTITY
1.33	HANDY HEAVY PNEUMATIC RIVETING HAMMER		2
	Max. rivet diameter Steel construction Boiler construction	 up to 37 mm up to 33 mm	
1.38	PIPE BEVELLING/EDGING MACHINE		
1.38.2	Portable handy electric bevelling machine		1
	Max. material thickness	32 mm	
1.39	AIR COMPRESSOR		
1.39.1	Mobile air compressor with diesel power		1
	Max. pressure Capacity	10 bar 20 m^3/min	
1.39.2	Static air compressor		1
	Max. pressure Capacity	8.8 bar 15 m^3/min	
1.39.9 (R35C)	Max. pressure	8.7 kg/cm^2	1
1.39.10 (R36C)	Max. pressure	8.7 kg/cm^2	1
1.39.11 (R37C)	Max. pressure Capacity	7 atm 8 m^3/min	1
1.39.12 (R38C)	Max. pressure		1
1.42	CUTTING TOOLS		1

NO.	TYPE OF MACHINE		QUANTITY
1.43	SURFACE PLATE FOR MARKING		1
	Dimension	4000 x 6000 mm x 400 mm	
	Max. load	10 tons	
1.46	AUTOMATIC GAS CUTTING MACHINE (CIRCULAR)		1
	Max. cutting thickness	150 mm	
	Circle cutting range diameter	60 - 2000 mm	
	Cutting speed range	80 - 1000 mm/min.	
1.47	PORTABLE FLAME CUTTING MACHINE		1
	Cutting capacity	150 mm	
1.48	PIPEEND BEVELLING FLAME CUTTING MACHINE		1
	Effective pipe diameter	150 - 1000 mm	
	Pipe thickness	5 - 50 mm	
1.49	MANUAL FLAME CUTTING		9
	Max. cutting machine	150 mm	3; For site
1.50	SEMIAUTOMATIC GAS METAL ARC WELDING MACHINE		
1.50.1	Max. welding current	600 Amp	3
	Max. wire diameter	1.6 mm	
1.50.2 (-)	-		3
1.50.3 (-)	Inner shield arc welding		6

NO.	TYPE OF MACHINE		QUANTITY
1.52	AUTOMATIC SUBMERGED ARC WELDING MACHINE		
1.52.1	1500 Amp. max. wire diameter	6 m	2
1.52.2 (-)	-		4
1.53	AC ARC WELDING MACHINE		
1.53.1	Max. welding current Duty cycle	500 Amp. 60% at 500 Amp. AC	10
1.53.2 (-)	Max. welding current	300 - 500 Amp.	15
1.54	DC ARC WELDING MACHINE		
1.54.1	Max. welding current Duty cycle	500 Amp. 60% at 450 Amp. DC	6
1.54.2 (-)	Max. welding current	300 - 500 Amp.	12
1.55	DC MOTOR GENERATOR WELDING MACHINE		
	Max. welding current Duty cycle	600 Amp. 60% at 600 Amp.	3
1.56	DC DIESEL GENERATOR WELDING MACHINE		3; for site
1.56.1	Max. welding current Duty cycle	600 Amp. 60% at 600 Amp.	
1.57	T.I.G. WELDING MACHINE		
1.57.2 (-)	Max. welding current	500 Amp.	7

NO.	TYPE OF MACHINE		QUANTITY
1.59	DIESEL GENERATOR		1
	Continuous output 3 phase alternating current (AC)	250 KVA 380/220 Volt, 50 Hz	
1.60	CARBON ARC AIR GOUGING MACHINE		1
	Rated current Duty cycle Usable carbon diameter	DC 600 Amp. 100% 5 - 11 mm	
1.61	WELDING POSITIONER		
1.61.2	Rotated and tilting table		2
	Table size diameter Max. load on table in horizontal position	500 mm 500 kg	
1.64	SHAPING MACHINE		
1.64.2 (D9S)	Working surface of table Max. travel of table - Vertical travel - Horizontal travel Max. stroke	500 x 320 mm 210 mm 350 mm 260 mm	1
1.64.3 (D117S) (D116S) (D115S)	Working surface of table Max. stroke of arm Max. travel of table - Vertical travel - Horizontal travel	340 x 500 mm 450 mm 335 mm 560 mm	3
1.64.4 (C36)	Max. stroke Stroke/mnt Table size	10,000 mm 300 mm 10,460 x 430 x 325 mm	1
1.65	PROFILE CUTTING MACHINE		1
1.65.2 (C39)	Max. profile	120 x 10 mm	

NO.	TYPE OF MACHINE		QUANTITY
1.65.3 (N2)	Max. round bar	ϕ1" - ϕ2" ϕ1" - ϕ2"	1
1.67 (-)	WATER PUMP		1
1.68 (K48U)	PLATE STRAIGHTENING Max. of wide Roll diameter	 2060 mm 280.mm	1
1.69 (K24U)	COHBINED PUNCH & SHEARING Max. thickness of plate Max. hole diameter Width Length Max. profile	 7/8 inch 1 inch 1640 mm 3000 mm 100 x 100 x 12mm	1
1.70	PNEUMATIC HAMMER		
1.70.1 (K80P)	Capacity of hammer	150 kg	1
1.70.2 (K81)	Capacity of hammer	150 kg	1

2. ASSEMBLY EQUIPMENTS & MATERIAL HANDLING

NO.	TYPE OF MACHINE		QUANTITY
2.1	BAY TRANSFER CAR		
2.1.1	Capacity	10 tons	2
2.1.2	Capacity	20 tons	2
2.6	HOIST		
2.6.1	Hoist	1 ton x 6 m	2
2.6.2	Hoist	2 ton x 6 m	2
2.25	MANUAL SCREW JACK		2
	Lifting capacity Stroke 150 mm Collapsed height	10 tons 150 mm 280 mm	
2.26	HAND PUMP HYDRAULIC JACK 10 TONS		1
	Stroke Closed height	150 mm 330 mm	
2.27	HAND PUMP HYDRAULIC JACK 35 TONS		1
	Stroke Closed height	300 mm 545 mm	
2.28	HAND PUMP HYDRAULIC JACK 100 TONS		1
	Stroke Closed height	300 mm 598 mm	

NO.	TYPE OF MACHINE		QUANTITY
2.36	CHAIN BLOCK PULLEY		1
	Max. load and lifting capacity	5 tons and 3000 mm	
2.37	CHAIN BLOCK PULLEY		1
	Max. load and lifting capacity	10 tons and 3400 mm	
2.38	CHAIN BLOCK PULLEY		1
	Max. load and lifting capacity	25 tons and 3500 mm	
2.39	PAIR OF DRUM ROTATOR WITH DRIVE MOTOR AND IDLER ROTATOR		
2.39.2	Max. load Adjustable rotating speed Drum diameter	10 tons 1000 - 5000 mm	1
2.42	HEAVY DUTY PORTABLE ANGLE GRINDER		5
	Wheel diameter Drive motor	175 mm Approx. 1.5 kW	
2.43	HEAVY DUTY VERTICAL SANDER		2
	Wheel sander Drive motor	175 mmϕ 1.5 kW	
2.44	POWER CABLE PULLERS		2
	Max. pulling power With drive motor	2 tons	

NO.	TYPE OF MACHINE		QUANTITY
2.45	HAND WINCH (TOTALLY ENCLOSED TYPE)		2
	Capacity	1000 kg	
	Length	50 m	
2.46	CABLE FISH- TAPE BLOWER VACUUM		2
	Tube in diameter bo ve vacuum	19 - 31 mm	
2.47	CABLE SHEAVE & ROLLER SEVERAL TYPE		2
	Max. power of pulley	1 ton	
	Range diameter of cable to be pulled	2 - 15 mm	
2.48	COMPLETE SET CABLE GRIPS (WIRE & CABLE CRIMPING TOOL)		2
	Max. safety load	1000 kg	
	Range of strip copper wire cable	5 - 150 mm	
2.49	COMPACT HYDRAULIC CABLE BENDER		2
	Bend capacity	250 up to 1000 MCM	
2.50	MANUAL TACHET CABLE BENDER		2
	Universal bending shoe fits all cable size	500 MCM	
2.51	MANUAL HYDRAULIC CABLE CUTTER		2
	Max. cable diameter to be cut 2"		

NO.	TYPE OF MACHINE		QUANTITY
2.52	CABLE STRIPPER		2
	Range capacity of cable stripper	6 up to 20 AWG	
2.53	CABLE STRIPPER		2
	Range capacity of cable stripper	4 AWG up to 1000 MCM	
2.54	PORTABLE HYDRAULIC CABLE CUTTER		2
	Max. cable diameter to be cut	100 mm	
2.55	CABLE LUG PRESSURE (CRIMPER MANUAL)		2
	Range capacity	1.25 - 8 mm	
2.56	CABLE LUG PRESSURE (CRIMPER MANUAL)		2
	Range capacity	5.5 - 14 mm	
2.57	CABLE LUG PRESSURE (CRIMER HYDRAULIC)		2
	Range capacity Power	14 - 150 mm 10 tons	
2.58	PRECISION CURRENT TRANSFORMER		1
	Primary rating	10/15/30/50/100 250/300/500/750 /1000A	
2.59	PRECISION AMPERE METER (AMMETER)		1
	Range	100/200/500/ 1000MA	

NO.	TYPE OF MACHINE		QUANTITY
2.60	PRECISION AMMETER (LINE CURRENT TESTER)		1
	Full scale valve	15/30/75/150 /300 A	
2.61	PRECISION VOLT METER		1
	Range	30/75/150/300 V	
2.62	INSULATION TESTER		1
2.63	AIR-LESS PAINTING SPRAYING UNIT COMPLETE MOBILE TYPE		1
	Suitable for high pressure design for heavy viscosity of paint		

3. QUALITY ASSURANCE & TESTING UNIT

NO.	TYPE OF MACHINE	QUANTITY
3.7	ELECTRO MAGNETIC PAINT THICKNESS TESTER Complete with recommended standard accessories.	1

4. AUXILIARY UNIT

NO.	TYPE OF MACHINE		QUANTITY
4.3	SAND BLASTING MACHINE		1
	Moveabl type		
	Tank content	140 liters	
	Working pressure	8 bar	
4.5	WELDING ELECTRODE OVEN		
4.5.1	Dimension	2000 x 2000 x 1000 mm	1
		500 kg	
	Adjustable temperature, range	Max. 100°C	
4.5.2	Capacity	100 kg	1; for site
4.6	SUBMERGED ARC FLUX DRYING OVEN		2 1; for site
4.10	SPECIAL EQUIPMENT/JIGS & FIXTURES		1
4.11	MEASURING DEVICES		1
4.12 (~)	ELECTRIC FURNACE		1
4.13 (B19B)	VERTICAL ROTARY SHRINK FITTED OVEN		1
	Max. work piece diameter	1500 mm	

4.6 B. B. I. WAHANA Sub Unit

4.6.1 Technological Diagnosis

Technological diagnosis was conducted to Wahana Sub Unit of P.T. BOMA, BISMA, INDRA through July and August, 1984. This Chapter describes results of the diagnosis on technical problems and counter-measures to be planned.

(1) Overview and brief summary of sub-unit

1) "DE BROMO" N.V. founded in 1965, "DE NDUSTRIE" N.V. founded in 1878 and "DE VULKAAN" C.V. founded in 1918 merged into P.T. B.B.I. The company has been supplying spare parts to sugar plants. At present, the company fabricates diesel engines and small agricultural tools among others under licenses of KHD and SHW.

2) Products currently manufactured by Wahana Sub Unit are assemblage of wagon carriages for sugar plants under license of RAMAFER of France, and water gates.

(2) Present production

1) Quantity of annual production of Wahana sub-unit

Assemblage of wagon carriage	3,960 T/Y
Water gates	180 T/Y
TOTAL	4,140 T/Y

2) Surveys on the spot didn't reveal any clear relationship with the target industries (cement, sugar, fertilizer, paper/pulp and palm oil).

Investigations were made to find if there are any among the products of Indra unit that could be transferred to Wahana sub-unit. A product mix was created for Wahana sub-unit with corresponding relationships made to the target industries.

(3) Production facilities and technology

1) Present production facilities

(1) Present fabrication works of wagon carriages and water gates are continued as existing facilities condition.

(2) The building for wagon carriages assembly is 1,864 m^2 in dimension with 4 bay and building for water gates. Fabrication works is 300 m^2 with 1 bay.

2) Production technology

(1) Codes and standards the Sub-unit has ever experienced.
JIS, ASME, API and Indonesian Standards.

(2) Experienced material.
Carbon steel.

(3) Survey was made to find out production period normally required after placement of order on ex-work basis. But no detailed records were available.

(4) Summation of production costs, detailed table for works for large-size orders and slips for construction works are available.

3) Recommendation based on survey

(1) Present production facilities and buildings for wagon carriages is not improved. But, the building for water gates manufacturing is removed out.

(2) When products of higher quality are to be manufactured, present level of production technology must be improved.

(4) Management and personnels

The Wahana unit when completed, will become an independent unit from Indra unit, but at present it is only a site with small factory. The existing Wahana sub-unit is under control of Indra unit. Its control organization is the same as of the Indra unit which is described in the item on Indra unit 4.5.1 (4).

1) Management system and personnels

Refer to 4.5.1 (4) 1).

2) Production control system

Refer to 4.5.1 (4) 2).

3) Quality control system and inspection

Refer to 4.5.1 (4) 3).

4) Maintenance system

It is recommended to establish the Maintenance Section in Wahana unit as is the case with the Indra unit. It is all the more necessary, particularly because lots of new machinery are to be purchased and data are to be collected extensively.

(5) Layout, buildings and transportation facilities

Omitted. Refer to 4-6-3 "Basic Plan and Overview for Renovation" for the new factory.

(6) Utility

Omitted. Refer to 4-6-3 "Basic Plan and Overview for renovation" for the new factory.

4.6.2 Technological Assumptions

This chapter describes assumptions for achieving the renovation plan.

(1) Plant location

1) Renovation plan for Wahana Sub-unit of PT. B.B.I. shall be implemented by moving the Fabrication Department to the Wahana unit and making new product mix and increasing outputs in the new plant.

2) It is a prerequisite for the Wahana project that the plant premises are adequately spacious for a plant, soil structure of the land is stable and that costs for land preparation don't contribute to the additional costs to the plant management.

3) Though it was found as a result of the investigation that the land is not altogether inferior for a plant, still soil exchange and build-up of land by 0.7 m are necessary to prevent flood of waters in rainy season.

(2) Selection criteria for production facilities

The major items to be produced at the Wahana unit are process equipment for fertilizer plant and pulp/paper plant as well as the kinds of equipment which have been produced. Therefore, the production facilities are selected according to the criteria and guidelines stated below.

1) The facilities are at such technical level which can be handled by the factory's current employees at their improved technical skills and provide adequate machining accuracy and capabilities. The facilities are planned with JIS.

2) Because repeated and/or mass produced products are not covered in this renovation plan, manufacturing facilities do not have higher numerically controlles systems such as CAD/CAM machines.