4.3.5 生産管理と教育訓練

本節に示す内容は、前節までに述べたリノベーション計画を達成するために必要なソフトウエアに関する基本的な事項を述べたものである。従って以下に示す生産管理体制, 品質管理体制, 教育訓練等が満足されて始めてリノベーション計画が達成される条件が備わる。

(1) 生産管理体制

4.3.1 (4), 2)項に示した技術的診断結果から, 下記の対策が必要である。

1) 製品が計画通りに作られるように管理する目的で生産管理システムを作る必要がある。このシステムには各製造ステップで日程計画をチェックし、日程に遅れが生じた場合には、その遅れを取り戻すための対策(例えば残業)が立案出来る体制及び部品の納期チェックを含める必要がある。

2) 納期遅れを防止する一手段として, 工場全体または各職種毎の工事量を把握する目的で山積計画をつくるべきである。

この山積計画により, 工程のネックになる機械または職種が早期に把握され, 対策が立て易くなる。

3) Fig. 5−1にPDCA管理サークルを示すが, 特に, C:チェックまたはフォロー, A:アクションの所が不充分になるのでこの点を十四した生産管理を行う必要がある。次に, 生産技術について述べれば, プロダクトミックスの変化に伴い, 素材は厚板が使用される。このため, 成型加工, 熱処理, 溶接方法と溶接材料の選択及び溶接割れ防止等の技術が重要になる。

この生産管理及び生産技術を強化するため, スタッフの増強と教育が必要であり, ｃｋその教育指導は外国のスーパーバイザーによるのが良く, スーパーバイザーの派遣費用は, (9)項に示す。

(2) 品質管理体制

4.3.1 (4) 3)項で述べたように, Jakarta 工場は, 既に品質管理マニュアルが完成している。今後管理者は, このマニュアルの内容を作業者に到るまで徹底し, 守ることである。このためには前項で述べた Fig. 5−1 の管理サークルを廻すことが必要である。

次に技術面から検討すると, 素材の中に厚板が出てくるため,

1)非破壊検査の増大への対応

2)溶接割れ等の溶接欠陥防止の対策

が重要である。このため, 前者には, 現在外注している検査業務の内作化, 即ち, 有資格検査員の増強が必要であり, 後者には納入する製品の品質を保証するために材料及び加工に精通した品質管理者が必要である。

また, 製品の品質保証のため, 仕損やクレームの資料は大切であり, 収集と整理を行う必要がある。

これらの技術者の指導及びそれに要する費用は後掲(9)項に示す。

(3) 安全管理体制

Jakarta 工場の天井走行クレーン能力は,従来の最大 10 トンから 25 トンへと能力が増加する。また,可燃性ガスの使用量の増大による工場内配管を設置するので,安全管理はより重要になる。このため,下記の項目を重点とした安全管理体制が必要である。

1)安全の基本は,整理,整頓及び清掃であるが,現状では,必ずしも良いとは言えない。先ず,作業者を含む全員の整理,整頓意識を身につけさせる必要がある。

2)人身災害を防止するため,クレーン,玉掛作業者の教育,感電防止及びガス爆発防止のための教育指導が必要である。

(4) メインテナンス

新設備及び流用設備の稼働を高めるため,下記に示すメインテナンスシステムを確立し,実施する必要がある。

1)機械,装置及び計器を,種類別に日常点検及び定期点検を行うよう点検マニュアルの作成と実施が必要である。

この中には,点検項目及び時期の明確化と不良ヶ所の修理の実行を含む体制を確立することが重要である。

2)器具,工具の整備点検は,製品の品質及び能率の向上につながるので,作業者が日常点検を行うように教育指導が必要である。

(5) アフターサービス

既納製品のアフターサービスは,営業面から見ると

1)修理,改造工事の受注

2)増設,新規工事の受注

に結びつくと共に,技術面から見れば,

3)設計,エンジニアリング部門へのフィードバック。

4)品質管理,工作部門へのフィードバックにより,エンジニアリング力の向上や,品質管理,工作上の問題点の把握による技術力の向上をもたらす。従って,今後,営業部門の中に製品知識を持つ営業技術者を育成する必要がある。

(6) エンジニアリング

Jakarta 工場は，従来の建屋，設備が大巾に拡充される。それに伴う，生産能力の増加と生産品目の解題を円滑に行う方法として，下記が考えられる。

1)熱交換器や圧力容器等の新しい生産技術は，経験豊富な外国企業と技術援助契約を結び，技術力強化を図る。

2)既製作品についても，設計，エンジニアリング能力強化のため製造技術を含めた技術を導入する。

3)安くて作り易い製造方法にするための生産設計を含めた設計能力の増強を図る。

4)製品の材質の選定，製品に必要な寸法精度を図面に指示出来る設計技術者の養成及び指導を行う。

これらに要する費用は，後掲(9)項で述べる。

(7) 教育訓練

管理及び技術者に対する管理力及び技術力の向上については，4.3.5 (1)～(6)項で述べた通りである。

作業者については，Table 4－5 及び Table 5－1に示す教育計画を推奨する。生産量の増大に対処し，また，新設備を使いこなすために，作業者の技能のレベルアップは急務である。

(8) 組織と人員

Table 5－2 に Jakarta工場の組織と人員計画を示す。

1)組織は，4.3.1 (4)項の技術的診断結果及び前掲 Table 1－1を基にして，下記の主要点を主体に作成した。

① Jakarta 工場は本社に近いので，一般管理部門は，本社の力を利用し，その組織を簡素化した。

② 品質管理部門は現在，営業部門に所属している。しかし，今後は熱交換器や圧力容器の製作が増加するため，品質管理が重要になるので独立の部とした。

2)人員計画

人員計画は下記のようにした。

① 直接作業者数は，4.3.3(2)2)項に示した手順に基き決定した。

② 間接人員は，経験から決定した。一般管理部門は推定により定めた。

(9) 教育訓練費用

Fig. 5−2には(1)，(2)，(6)項の生産管理体制，生産技術及び，4.3.4 (5) 2)項の機械加工の訓練費用と期間を示している。

教育訓練は，新工場の運営に大きな影響を与えるので，充分な体制で取組む必要がある。

Table 1-1 Existing Organization Chart of P.T. Barata Surabaya Factory

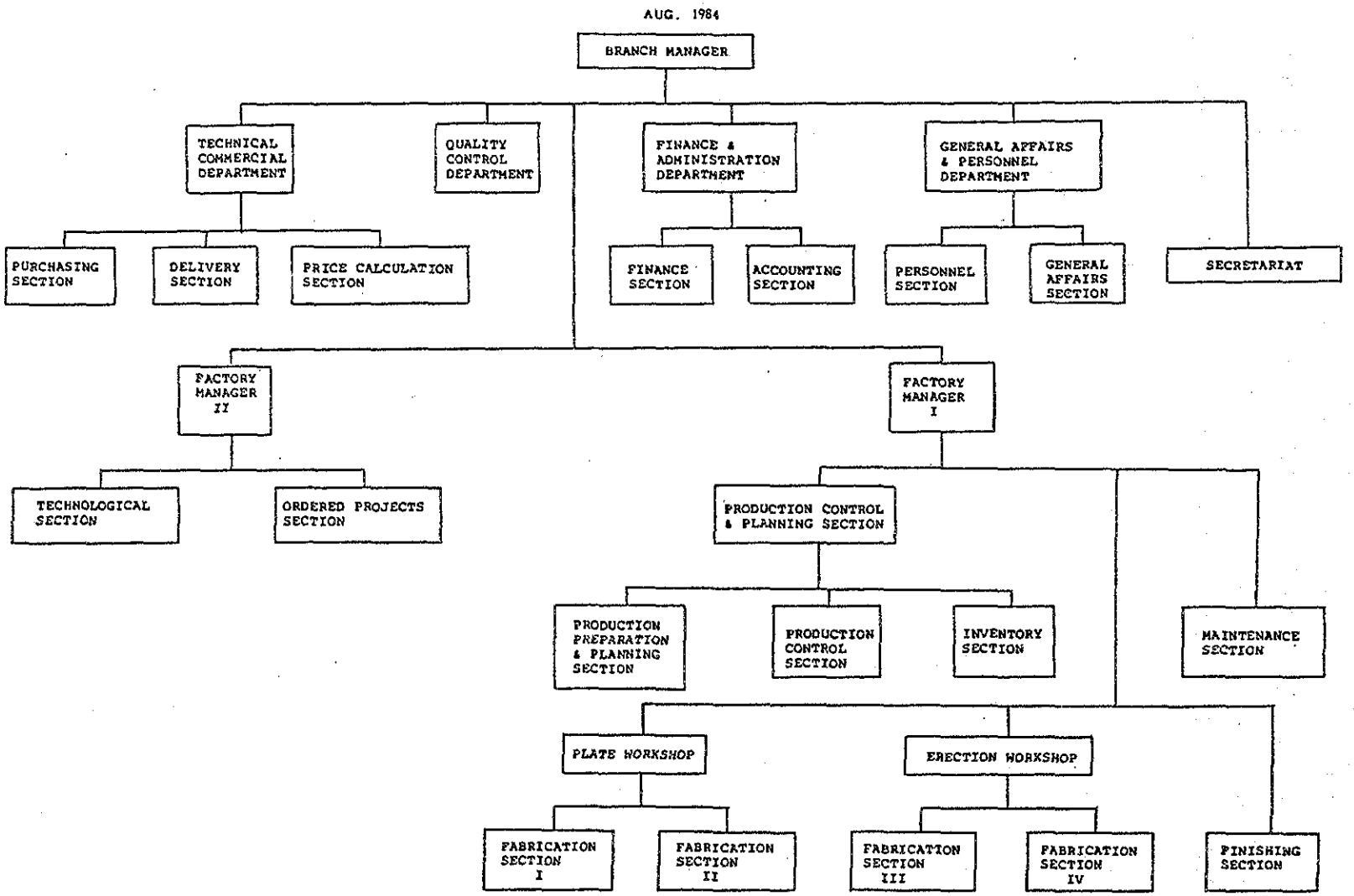


Table 1-2 Existing Number of Employees for P.T. Barata Jakarta Factory

Aug. 1984

		NO. OF PERSONNEL
1.	ENGINEERS	
	DESIGN	2
	MECHANICAL	1
	METALLURGICAL	-
	WELDING	1
	OTHERS (SCHEDULE CONT., QC, ETC.)	-
	SUB-TOTAL	4
2.	DRAFTMAN	6
3.	DIRECT WORKERS	
	WELDERS	25
	(QUALIFIED)	(16)
	IRON WORKERS	72
	FITTERS	20
	MECHANICIANS	8
	INSPECTORS	4
	OTHERS	15
	SUB-TOTAL	144
4.	INDIRECT WORKERS	34
	SUCH AS CRANE OPERATORS WAREHOUSE KEEPERS, MECHANICIANS FOR SHOP FACILITIES MAINTENANCE, ETC.	
5.	OTHER STAFFS AND CLERKS	37
	TOTAL EMPLOYEES	225

TABLE 3-1 FORECAST OF PRODUCT MIX — P.T. BARATA: JAKARTA FACTORY — ANNUAL PRODUCT CONDITION IN 1989 ~ 1993

UNIT: TON/YEAR

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

Table 3-2

Construction Schedule

P.T. BARATA, JAKARTA FACTORY

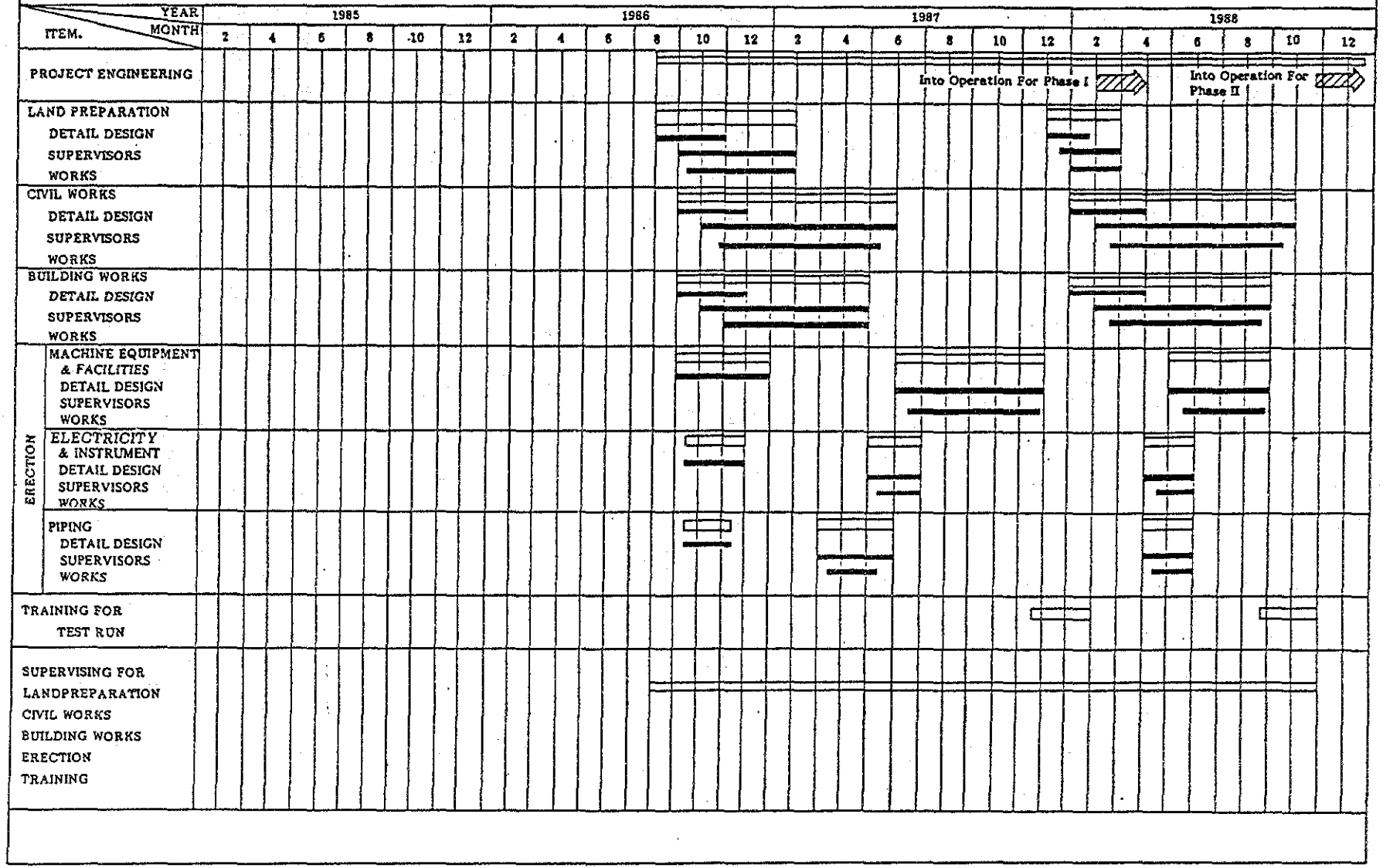


Table 4-1 Product Model for P.T. Barata Jakarta

	TYPE OF PRODUCT	THICK-NESS (mm)	PRODUCT SIZE (ID x LENGTH WIDTH x LENGTH)(mm)	DESIGN PRESSURE (kg/cm^2)	MATERIAL	WEIGHT (Ton)
1	GENERAL STRUCTURE	6-50	W H L 500 x 2,000 x 10,000	-	C.S.	25
2	BRIDGES	6-50	W H L 500 x 2,000 x 10,000	-	C.S.	25
3	INDUSTRIAL STRUCTURE	6-50	W H L 500 x 2,000 x 10,000	-	C.S.	25
4	WATER GATES AND STRUCTURE FOR WATER ENGINEERING	6-30	W L 3,000 x 4,000	-	C.S	25
5	CONVEYORS	6-12	W H L 2,000 x 1,500 x 10,000	-	C.S	5
6	PALM OIL PLANT EQUIPMENT	4-12	ϕ L 2,000 x 3,000	10	C.S SUS	10
7	SUGAR PLANT EQUIPMENT	4-12	ϕ L 2,000 x 3,000	10	C.S SUS	10
8	FERTILIZER AND PETROCHEMICAL INDUSTRY	6-38	ϕ L 3,000 x 6,000	50	C.S SUS CLAD	25
9	POWER PLANT EQUIPMENT	6-30	ϕ L 2,400 x 6,000	50	C.S	30
10	AIR FIN COOLERS	6-30	W H L 4,000 x 1,000 x 1,200	50	C.S.	15

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

Table 4-2 Necessary Area of Each Shop for P.T. Barata Jakarta

UNIT: m^2

NO	SHOP NAME	AREA
1	CUTTING PLAN ROOM	450
2	PREPARATION AREA	1,250
3	FORMING AREA	1,362
4	MACHINING AREA	1,090
5	ASSEMBLY AREA (INCLUDED WELDING)	4,812
6	RADIO GRAPHIC EXAMINATION ROOM	245
7	SAND BLASTING PAINTING AND ACID CLEANING ROOM	900
8	RAW MATERIAL STORAGE AREA	400
9	TOOL ROOM	108
10	PARTS STORAGE AREA	693
11	MAIN PASSAGE AND OTHERS	2,210
	Total	13,520

Table 4-3 Summary of Investment Cost for P.T. Barata Jakarta

UNIT: 1,000,000 YEN

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

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

Table 4-4 Implementation Project System for P.T. Barata Jakarta Factory

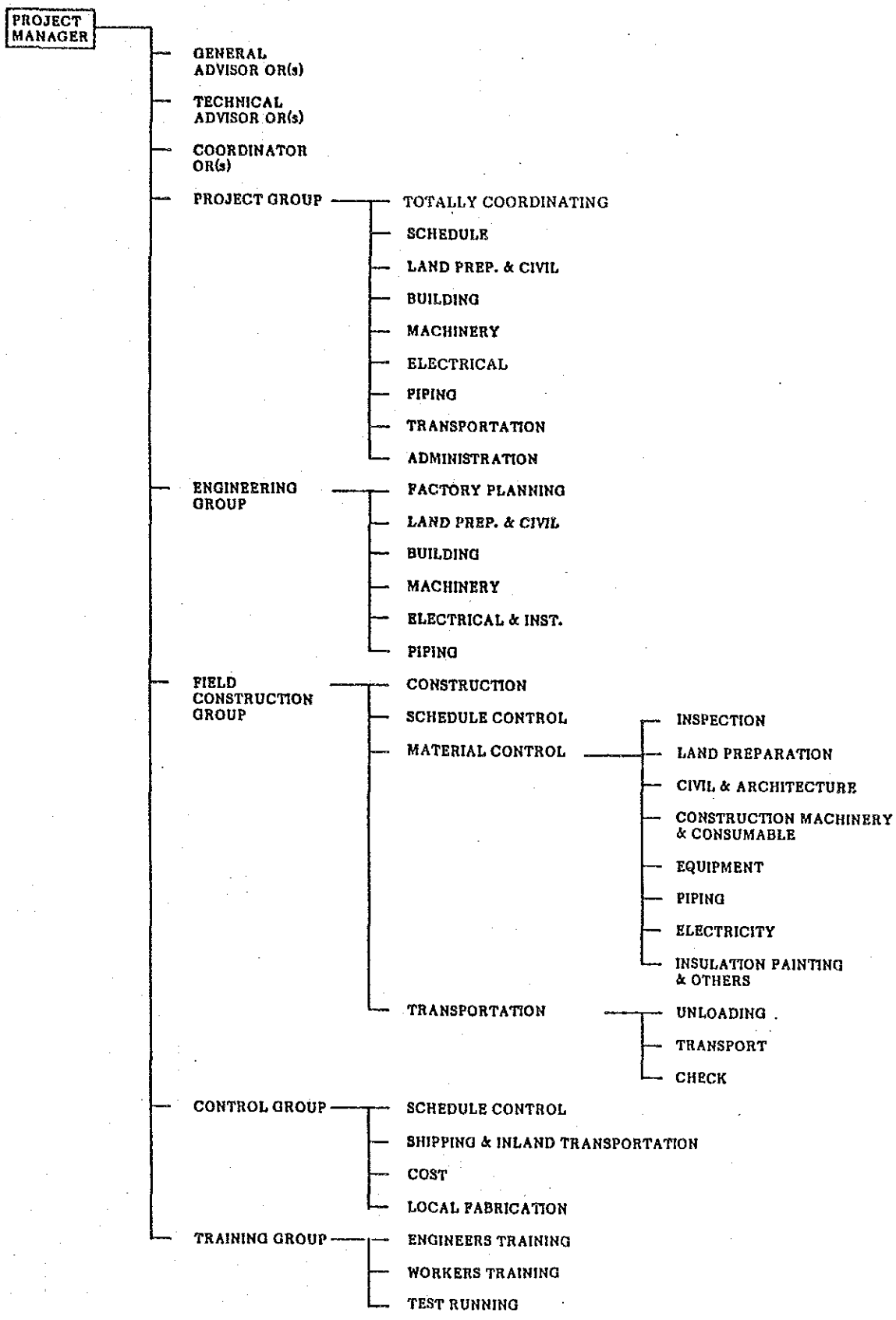


Table 4-5 Training Plan of Worker

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 BARATA JAKARTA Unit: 1,000,000YEN

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=103.47 D= 5.37 Item 10 of Table 4-3		Refer to Table 3-2 of Construction schedule
Land preparation	Lay-out planning and designing, preparation of specification both for working and supervision.	F= 0.64 D= 0.07 Item 3 of Table 4-3	F= 33.58 D= -	
Civil works	Designing, Preparation of specification for foundation plan of building, machinery, facilities and supervision	F= 4.93 D= 0.55 Item 6 of Table 4-3	Item 11 of Table 4-3	
Building works	Designing, Preparation of specification for procurement of building materials, site fabrication and supervision.	F= 16.33 D= 1.82 Item8,9 of Table 4-3	F= 58.91 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=196.71 D= - Item 10 of Table 4-3	F= 92.93 D= 39.08 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=122.13 D= 38.10 Item 11 of Table 4-3	
Piping works	Designing, Preparation of specification for procurement and supervision.	F=104 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= 23.91 D= - Item 11 of Table 4-3	

Table 4-7 Equipment Planning Bases (JAKARTA)

NO.	MACHINE NAME	SELECTION BASE	PRODUCT	LOADING FACTOR (%)
1.1	HEAVY DUTY UNIVERSAL LATHE MACHINE	TO RENEW OBSOLETE EQUIPMENT	PETROCHEMICAL PLANT, WATER GATES	52
1.2	HEAVY DUTY FACING LATHE MACHINE	TO PEINFORCE FACILITIES FOR PRODUCING LARGE PRODUCTS	DITTO	61
1.3	VERTICAL BORING & TURNING MILL MACHINE	TO REINFORCE FACILITIES FOR PRODUCING LARGE PRODUCTS AND INCREASING PRODUCTION	DITTO	58
1.4	HEAVY DUTY RADIAL DRILLING MACHINE	TO REINFORCE FACILITIES FOR INCREASING PRODUCTION	AIR FIN COOLER, GENERAL STRUCTURES	92
1.9	HORIZONTAL BORING & MILLING MACHINE	DITTO	DITTO	87
1.10	UNIVERSAL MILLING MACHINE	TO RENEW OBSOLETE EQUIPMENT	PTROCHEMICAL PLANT	68
1.11	PLANING MACHINE	DITTO	AIR FIN COOLER, PETROCHEMICAL PLANT	81
1.23	HORIZONTAL CYLINDRICAL SHELL STRAIGHTENING MACHINE	TO STRAIGHTEN CYLINDRICAL SHELLS AFTER LONGITUDINAL WELDING	PETROCHEMICAL PLANT	58
1.24	HEAVY DUTY HEAD FLANGING MACHINE	TO FORM HEADS	PETROCHEMICAL PLANT, SUGAR PLANT	62
1.25	HEAVY DUTY HYDRAULIC PRESS MACHINE	TO DISH HEADS AND TO FORM THICK PLATES	DITTO	81
1.26	MECHANICAL PLATE BEND ROLLING MACHINE	TO REINFORCE FACILITIES FOR PRODUCING LARGE PRODUCTS	DITTO	61
1.40	MECHANICAL TUBE FINNING MACHINE	TO PRODUCE FINNED TUBES FOR AIR FIN COOLERS	AIR FIN COOLER,	93
1.44	COPIER GAS CUTTING MACHINE	TO REINFORCE FACILITIES FOR INCREASING PRODUCTION	INDUSTRIAL STRUCTURES, GENERAL STRUCTURES	75
3.1	PORTABLE COBALT UNIT AND PORTABLE IRIDIUM UNIT	TO DETECT INTERNAL DEFECTS IN THICK-WALL WELDS	PETROCHEMICAL PLANT	-
3.3	COMPLETE SET PORTABLE MAGNETIC PARTICLE INSPECTION EQUIPMENT	TO DETECT SURFACE DEFECTS IN RAW MATERIALS AND WELDS	DITTO	-
3.4	PORTABLE ULTRASONIC TESTING UNIT	TO DETECT INTERNAL DEFECTS IN RAW MATERIALS AND WELDS	DITTO	-
3.5	RADIOGRAPHIC X-RAY TESTING UNIT	TO DETECT DEFECTS IN WELDS	DITTO	-
3.6	HICH PRESSURE WATER PUMP	TO MAKE HYDROSTATIC TEST OF PRESSURE VESSELS	DITTO	-
3.8	UNIVERSAL TESTING MACHINE	TO CONDUCT MECHANICAL TEST FOR GUARANTEE OF PPODUCTS	DITTO	-
4.1	BOGIE HEARTH FURNACE	FOR HOT FORMING AND POSTWELD HEAT TREATMENT	DITTO	-
4.2	SHORT GRIT COMPARTMENT UNIT	TO REINFORCE SURFACE TREATMENT FACILITIES FOR PRODUCING NEW TYPES OF PRODUCTS	PETROCHEMICAL PLANT	-
4.7	ACID CLEANING EQUIPMENT	TO CLEAN RAW MATERIALS, PARTS AND COMPLETED PRODUCTS	PETROCHEMICAL PLANT	-
4.8	DRYING CHAMBER	FOR AIR FIN CCOLERS	AIR FIN COOLER	-
4.9	PAINTING CHAMBER	DITTO	DITTO	-

Table 5–1 Training Plan

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

Table 5-2 New Organization and Personnel for P.T. Barata Jakarta Factory

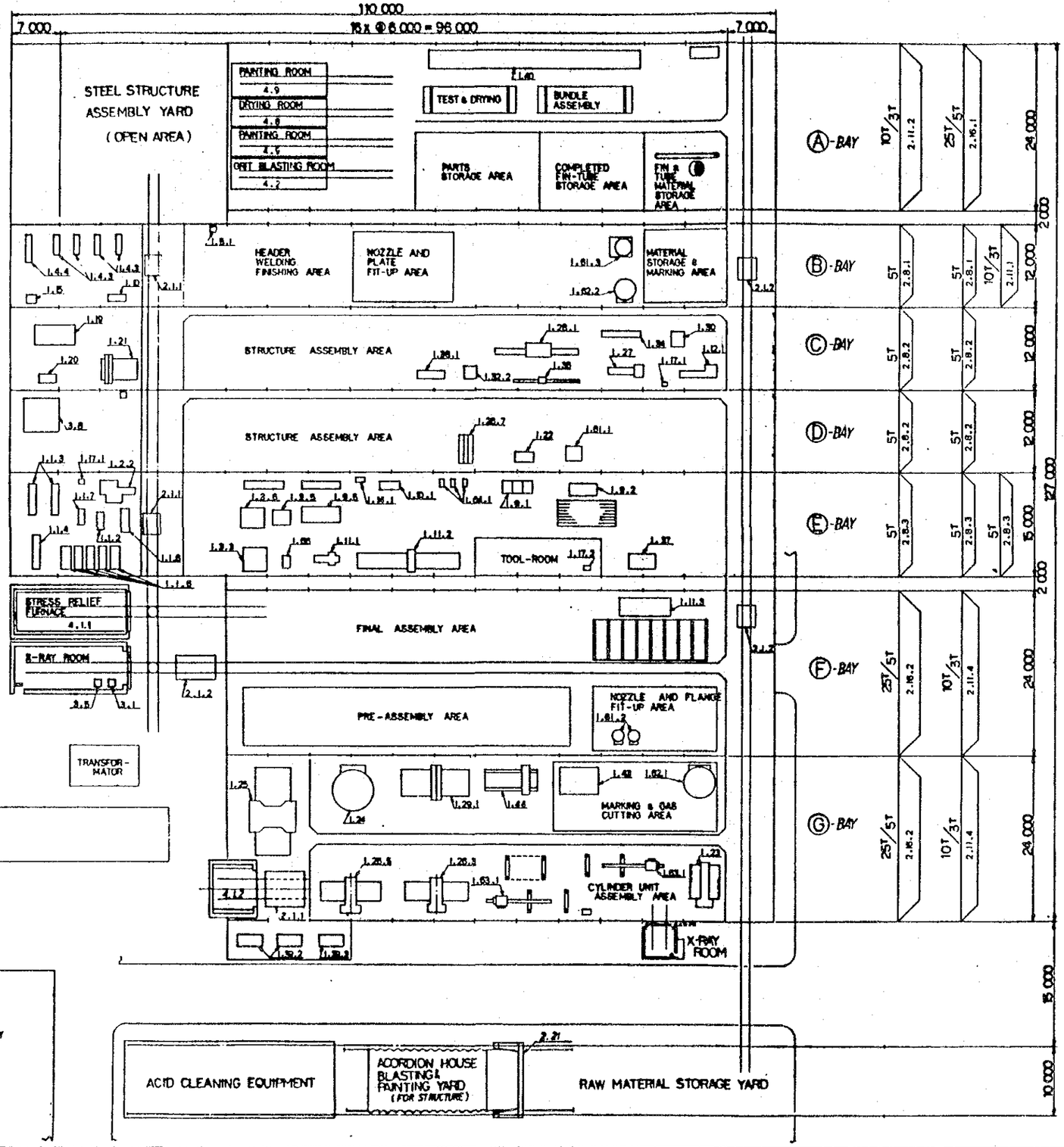
(EXCEPT FOUNDRY)

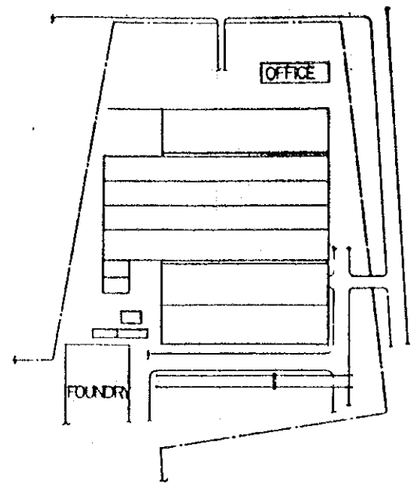
ORGANIZATION		TOTAL PERSONNEL	SECTION MANAGER	ENGINEER S/V & OFFICER	DIRECT WORKER	INDIRECT WORKER
BRANCH MANAGER						
INCLUDED MANAGER 545						
GENERAL AFFAIR DEPARTMENT	PERSONNEL & GENERAL AFFAIR SECTION	35	2	21		12
	FINANCE SECTION					
COMMERCIAL DEPARTMENT	SALES & PRICE CALCULATION SECTION	17	2	12		3
	PURCHASE & DELIVERY SECTION					
QUALITY CONTROL DEPARTMENT		13		3	10	
PLANNING & PRODUCTION CONTROL DEPARTMENT	DESIGNING SECTION	70	1	12		
	PLANNING & PRODUCTION CONTROL SECTION		1	18		
	PRODUCTION TECHNOLOGY SECTION		1	7		
	MAINTENANCE SECTION		1	2		27
PRODUCTION DEPARTMENT	WORK PROGRAM & MACHINING SECTION	404	1	7	34	24
	PREPARATION SECTION		1	3	102	
	STEEL STRUCTURE SECTION		1	2	58	
	PLATE WORK SECTION		1	3	158	
	ERECTION SECTION		1	8		
TOTAL		539	13	98	362	66

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

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

NO.	MACHINE NAME
1.40	MECHANICAL TUBE FINNING MACHINE
1.43	SURFACE PLATE FOR MARKING
1.44	COPIER GAS CUTTING MACHINE
1.61	WELDING POSITIONER
1.62	TURNING TABLE FOR GAS CUTTING
1.63	BOOM TYPE WELDING MACHINE
1.64	SHAPING MACHINE
1.66	SLOTTING MACHINE
2.1	BAY TRANSFER CAR
2.5	30 TONS HYDRAULIC TELESCOPIC TRUCK CRANE
2.8	OVERHEAD TRAVELLING CRANE 5 TONS
2.11	OVERHEAD TRAVELLING CRANE 10/3 TONS
2.16	OVERHEAD TRAVELLING CRANE 25/5 TONS
2.21	GANTRY CRANE 25/5 TONS
2.39	PAIR OF DRUM ROTATOR WITH DRIVE MOTOR AND IDLER ROTATOR
2.40	PAIR OF IDLER DRUM ROTATOR WITHOUT DRIVE MOTOR
3.1	PORTABLE COBALT UNIT AND PORTABLE IDIDIUM UNIT
3.3	COMPLETE SET PORTABLE MAGNETIC PARTICLE INSPECTION EQUIPMENT
3.4	PORTABLE ULTRASONIC TESTING UNIT
3.5	RADIOGRAPHIC X-RAY TESTING UNIT
3.6	HIGH PRESSURE WATER PUMP
3.8	UNIVERSAL TESTING MACHINE
4.1	BOGIE HEARTH FURNACE
4.2	SHOT GRIT COMPARTMENT UNIT
4.3	SAND BLASTING MACHINE
4.7	ACID CLEANING EQUIPMENT
4.8	DRYING CHAMBER
4.9	PAINTING CHAMBER

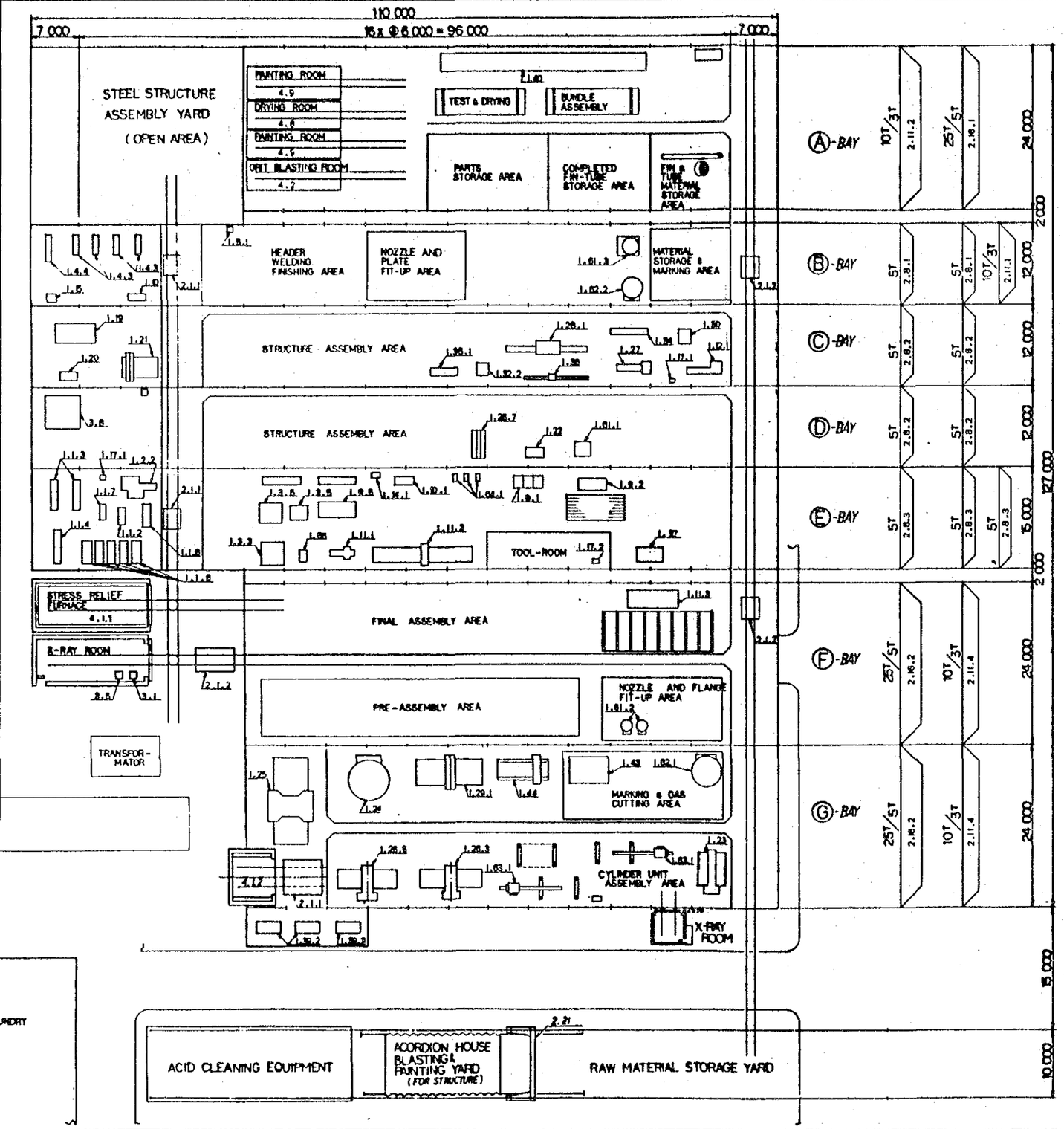


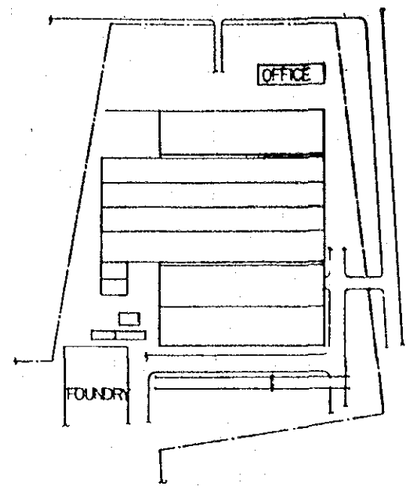


KEY PLAN

NO.	MACHINE NAME	NO.	MACHINE NAME
1.1	HEAVY DUTY UNIVERSAL LATHE MACHINE	1.61	WELDING POSITIONER
1.2	HEAVY DUTY FACING LATHE MACHINE	1.62	TURNING TABLE FOR GAS CUTTING
1.3	VERTICAL BORING & TURNING MILL MACHINE	1.63	BOOM TYPE WELDING MACHINE
1.4	HEAVY DUTY RADIAL DRILLING MACHINE	1.64	SHAPING MACHINE
1.5	VERTICAL DRILLING MACHINE PILLAR TYPE	1.66	SLOTTING MACHINE
1.6	PORTABLE UNIVERSAL RADIAL DRILLING MACHINE WITH SWIVEL RAM AND HEAD	2.1	BAY TRANSFER CAR
1.7	HORIZONTAL BORING & MILLING MACHINE	2.2	30 TONS HYDRAULIC TELESCOPIC TRUCK CRANE
1.10	UNIVERSAL MILLING MACHINE	2.8	OVERHEAD TRAVELLING CRANE 5 TONS
1.12	HEAVY DUTY HYDRAULIC HACKSAW MACHINE	2.11	OVERHEAD TRAVELLING CRANE 10/3 TONS
1.14	UNIVERSAL TOOL & CUTTING GRINDING	2.16	OVERHEAD TRAVELLING CRANE 25/5 TONS
1.15	SEMIAUTOMATIC GRINDER FOR SHARPENING TWIST DRILL & CORE DRILL	2.21	GANTRY CRANE 25/5 TONS
1.17	PEDESTAL GRINDING MACHINE (DOUBLE GRINDING WHEELS)	2.39	PAIR OF DRUM ROTATOR WITH DRIVE MOTOR AND IDLER ROTATOR
1.18	HEAVY DUTY HYDRAULIC PRESS MACHINE	2.40	PAIR OF IDLER DRUM ROTATOR WITHOUT DRIVE MOTOR
1.20	HYDRAULIC STRAIGHTENING PRESS MACHINE FOR SHAFT	3.1	PORTABLE COBALT UNIT AND PORTABLE IRIDIUM UNI
1.21	HYDRAULIC PRESS BRAKE MACHINE	3.3	COMPLETE SET PORTABLE MAGNETIC PARTICLE INSPECTION EQUIPMENT
1.22	HORIZONTAL PROFILE STRAIGHTENING MACHINE	3.4	PORTABLE ULTRASONIC TESTING UNIT
1.23	HORIZONTAL CYLINDRICAL SHELL STRAIGHTENING MACHINE	3.5	RADIOGRAPHIC X-RAY TESTING UNIT
1.24	HEAVY DUTY HEAD FLANGING MACHINE	3.6	HIGH PRESSURE WATER PUMP
1.25	HEAVY DUTY HYDRAULIC PRESS MACHINE	3.8	UNIVERSAL TESTING MACHINE
1.26	MECHANICAL PLATE BEND ROLLING MACHINE	4.1	BOGIE HEARTH FURNACE
1.27	HEAVY DUTY HYDRAULIC PIPE BENDING MACHINE	4.2	SHOPT GRIT COMPARTMENT UNIT
1.28	HYDRAULIC BENDING MACHINE	4.3	SAND BLASTING MACHINE
1.29	MECHANICAL PLATE BEARING MACHINE	4.7	ACID CLEANING EQUIPMENT
1.30	MECHANICAL UNIVERSAL STEEL WORKER MACHINE	4.8	DRYING CHAMBER
1.32	PUNCHING MACHINE	4.9	PAINTING CHAMBER
1.34	MECHANICAL PLATE FORMING MACHINE		
1.36	UNIVERSAL FILLING AND BAND SAW MACHINE		
1.37	SET SEATING MACHINE		
1.38	PIPE BEVELLING/EDGING MACHINE		
1.39	AIR COMPRESSOR		
1.40	MECHANICAL TUBE FINNING MACHINE		
1.43	SURFACE PLATE FOR MARKING		
1.44	COPIER GAS CUTTING MACHINE		

Fig. 3-1 LAYOUT PLAN (JAKARTA





KEY PLAN

NO.	MACHINE NAME	NO.	MACHINE NAME
1.1	HEAVY DUTY UNIVERSAL LATHE MACHINE	1.61	WELDING POSITIONER
1.2	HEAVY DUTY FACING LATHE MACHINE	1.62	TURNING TABLE FOR GAS CUTTING
1.3	VERTICAL BORING & TURNING MILL MACHINE	1.63	BOOM TYPE WELDING MACHINE
1.4	HEAVY DUTY RADIAL DRILLING MACHINE	1.64	SHAPING MACHINE
1.5	VERTICAL DRILLING MACHINE PILLAR TYPE	1.65	SLOTTING MACHINE
1.6	PORTABLE UNIVERSAL RADIAL DRILLING MACHINE WITH SWIVEL BAR AND HEAD	2.1	BAY TRANSFER CAR
1.9	HORIZONTAL BORING & MILLING MACHINE	2.9	30 TONS HYDRAULIC TELESCOPIC TRUCK CRANE
1.10	UNIVERSAL MILLING MACHINE	2.0	OVERHEAD TRAVELLING CRANE 5 TONS
1.12	HEAVY DUTY HYDRAULIC HACKSAW MACHINE	2.11	OVERHEAD TRAVELLING CRANE 10/3 TONS
1.14	UNIVERSAL TOOL & CUTTING GRINDING	2.16	OVERHEAD TRAVELLING CRANE 25/5 TONS
1.15	SEMIAUTOMATIC GRINDER FOR SHARPENING TWIST DRILL & CORE DRILL	2.21	GANTRY CRANE 25/5 TONS
1.17	PEDESTAL GRINDING MACHINE (DOUBLE GRINDING WHEELS)	2.39	PAIR OF DRUM ROTATOR WITH DRIVE MOTOR AND IDLER ROTATOR
1.19	HEAVY DUTY HYDRAULIC PRESS MACHINE	2.40	PAIR OF IDLER DRUM ROTATOR WITHOUT DRIVE MOTOR
1.20	HYDRAULIC STRAIGHTENING PRESS MACHINE FOR SHAFT	3.1	PORTABLE COBALT UNIT AND PORTABLE IRIDIUM UNIT
1.21	HYDRAULIC PRESS BRAKE MACHINE	3.3	COMPLETE SET PORTABLE MAGNETIC PARTICLE INSPECTION EQUIPMENT
1.22	HORIZONTAL PROFILE STRAIGHTENING MACHINE	3.4	PORTABLE ULTRASONIC TESTING UNIT
1.23	HORIZONTAL CYLINDRICAL SHELL STRAIGHTENING MACHINE	3.5	RADIOGRAPHIC X-RAY TESTING UNIT
1.24	HEAVY DUTY HEAD FLANGING MACHINE	3.6	HIGH PRESSURE WATER PUMP
1.25	HEAVY DUTY HYDRAULIC PRESS MACHINE	3.8	UNIVERSAL TESTING MACHINE
1.26	MECHANICAL PLATE BEND ROLLING MACHINE	4.1	BOGIE HEARTH FURNACE
1.27	HEAVY DUTY HYDRAULIC PIPE BENDING MACHINE	4.2	SHOTT GRIT COMPARTMENT UNIT
1.28	HYDRAULIC BENDING MACHINE	4.3	SAND BLASTING MACHINE
1.29	MECHANICAL PLATE BEARING MACHINE	4.7	ACID CLEANING EQUIPMENT
1.30	MECHANICAL UNIVERSAL STEEL WORKER MACHINE	4.8	DRYING CHAMBER
1.31	PUNCHING MACHINE	4.9	PAINTING CHAMBER
1.34	MECHANICAL PLATE FORMING MACHINE		
1.36	UNIVERSAL FILLING AND BAND SAW MACHINE		
1.37	KEY SEATING MACHINE		
1.38	PIPE BEVELLING/EDGING MACHINE		
1.39	AIR COMPRESSOR		
1.40	MECHANICAL TUBE FINNING MACHINE		
1.43	SURFACE PLATE FOR MARKING		
1.44	COPIER GAS CUTTING MACHINE		

Fig. 3-1 LAYOUT PLAN (JAKARTA)

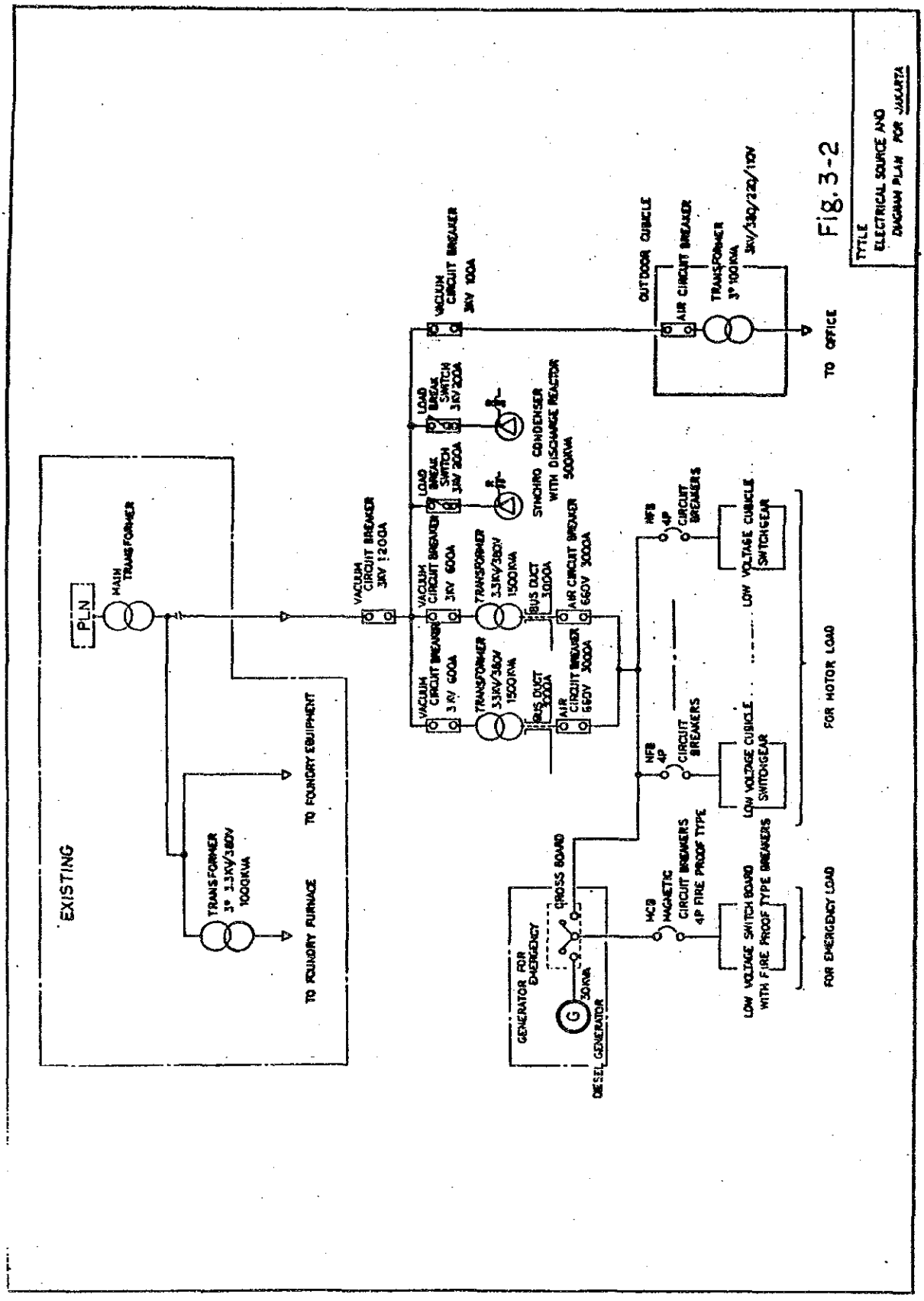
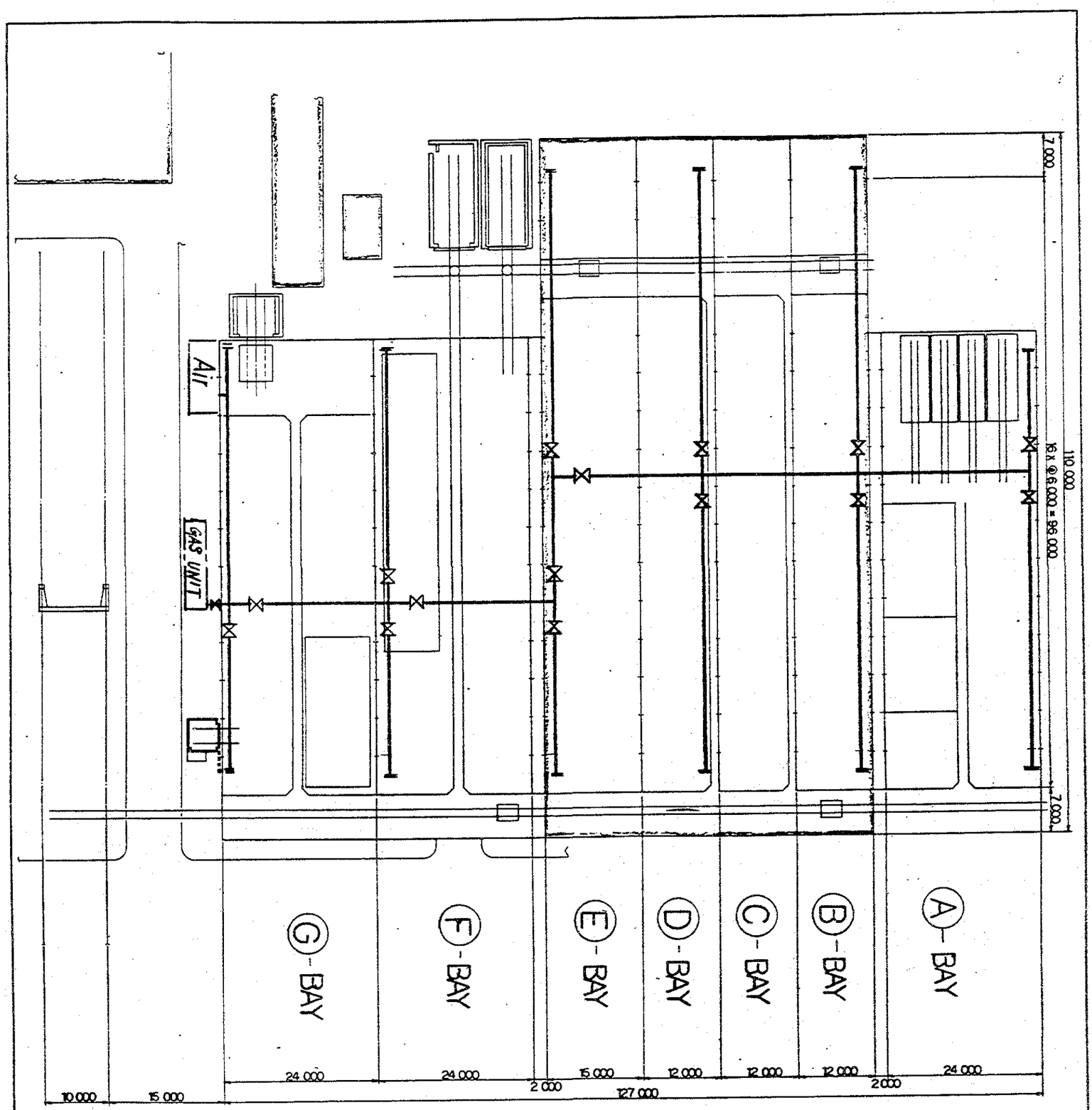

EXISTING
PLN
MAIN TRANSFORMER
TRANSFORMER 3φ 3.3KV/380V 1000KVA
TO FOUNDRY FURNACE
TO FOUNDRY EQUIPMENT
VACUUM CIRCUIT BREAKER 3KV 1200A
VACUUM CIRCUIT BREAKER 3KV 600A
TRANSFORMER 3.3KV/380V 1500KVA
BUS DUCT 3000A
AIR CIRCUIT BREAKER 660V 3000A
VACUUM CIRCUIT BREAKER 3KV 600A
TRANSFORMER 3.3KV/380V 1500KVA
BUS DUCT 3000A
AIR CIRCUIT BREAKER 660V 3000A
LOAD BREAK SWITCH 3KV 200A
LOAD BREAK SWITCH 3KV 200A
SYNCHRO CONDENSER WITH DISCHARGE REACTOR 500KVA
VACUUM CIRCUIT BREAKER 3KV 100A
OUTDOOR CUBICLE
AIR CIRCUIT BREAKER
TRANSFORMER 3φ 100KVA 3KV/380/220/110V
TO OFFICE
NFB 4P
CIRCUIT BREAKERS
LOW VOLTAGE CUBICLE SWITCHGEAR
NFB 4P
CIRCUIT BREAKERS
LOW VOLTAGE CUBICLE SWITCHGEAR
FOR MOTOR LOAD
CROSS BOARD
GENERATOR FOR EMERGENCY
30KVA
DIESEL GENERATOR
MCB MAGNETIC CIRCUIT BREAKERS 4P FIRE PROOF TYPE
LOW VOLTAGE SWITCH BOARD WITH FIRE PROOF TYPE BREAKERS
FOR EMERGENCY LOAD
TITLE
ELECTRICAL SOURCE AND DIAGRAM PLAN FOR JAKARTA

Fig. 3-2



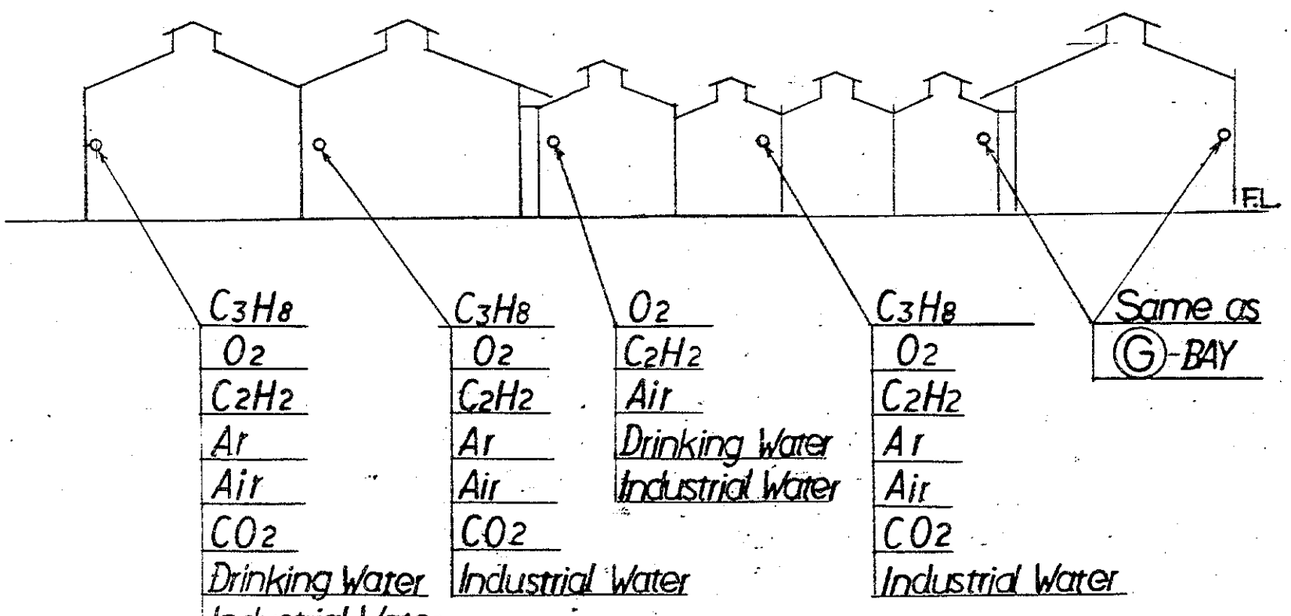
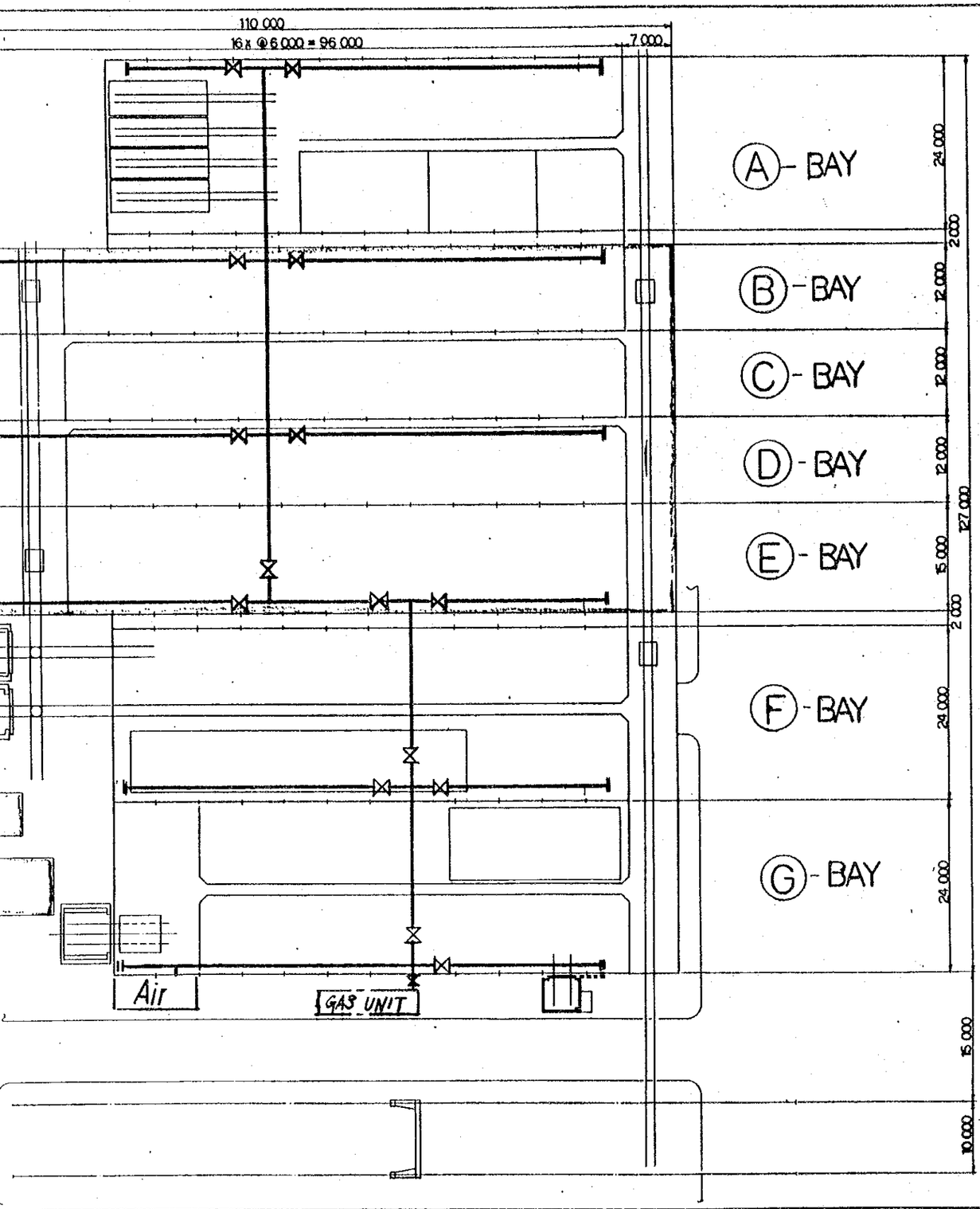


Fig.3-4 UTILITY PIPING



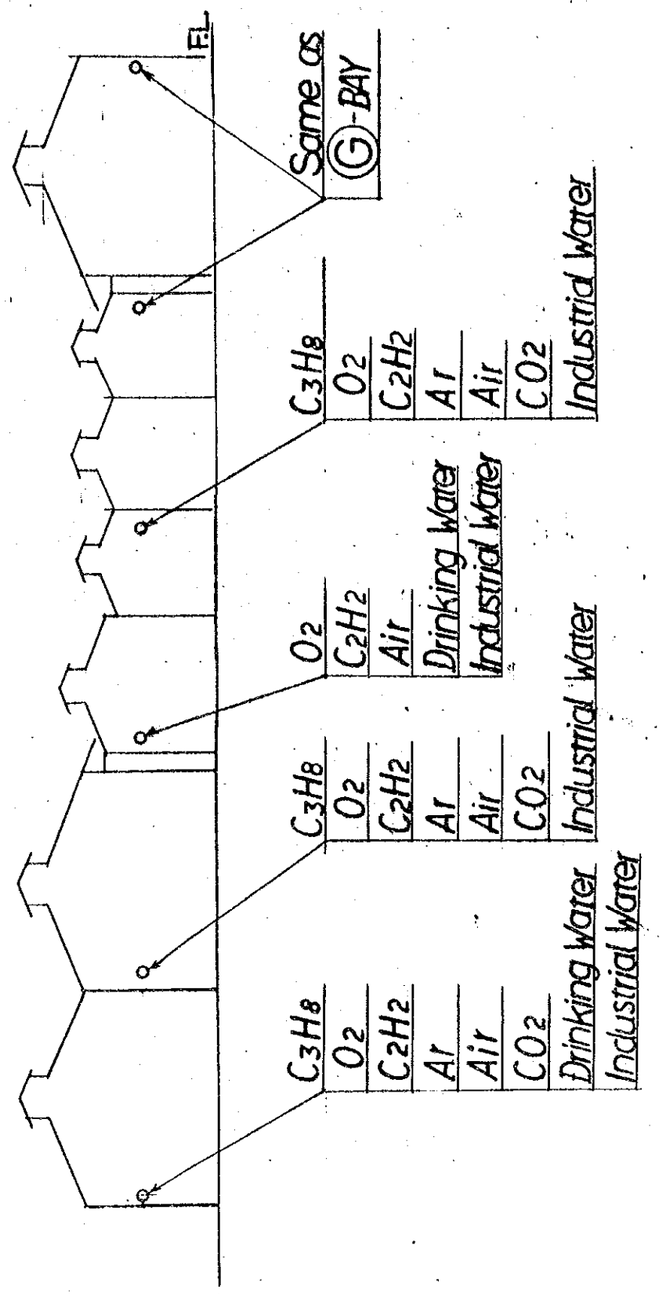
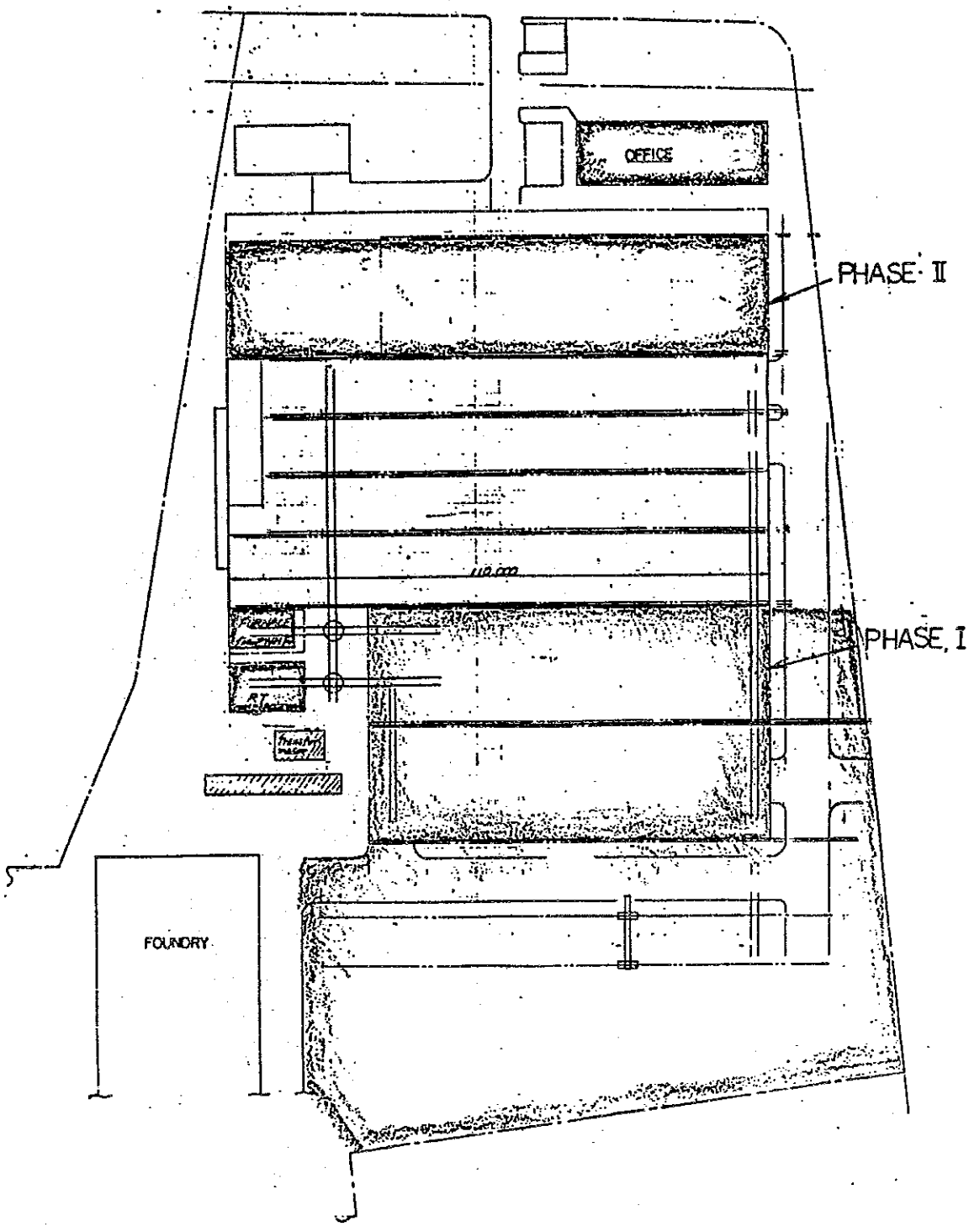


Fig.3-4 UTILITY PIPING PLAN
(JAKARTA)

Fig.3-5 LAND :PREPARATION PLAN
(JAKARTA)



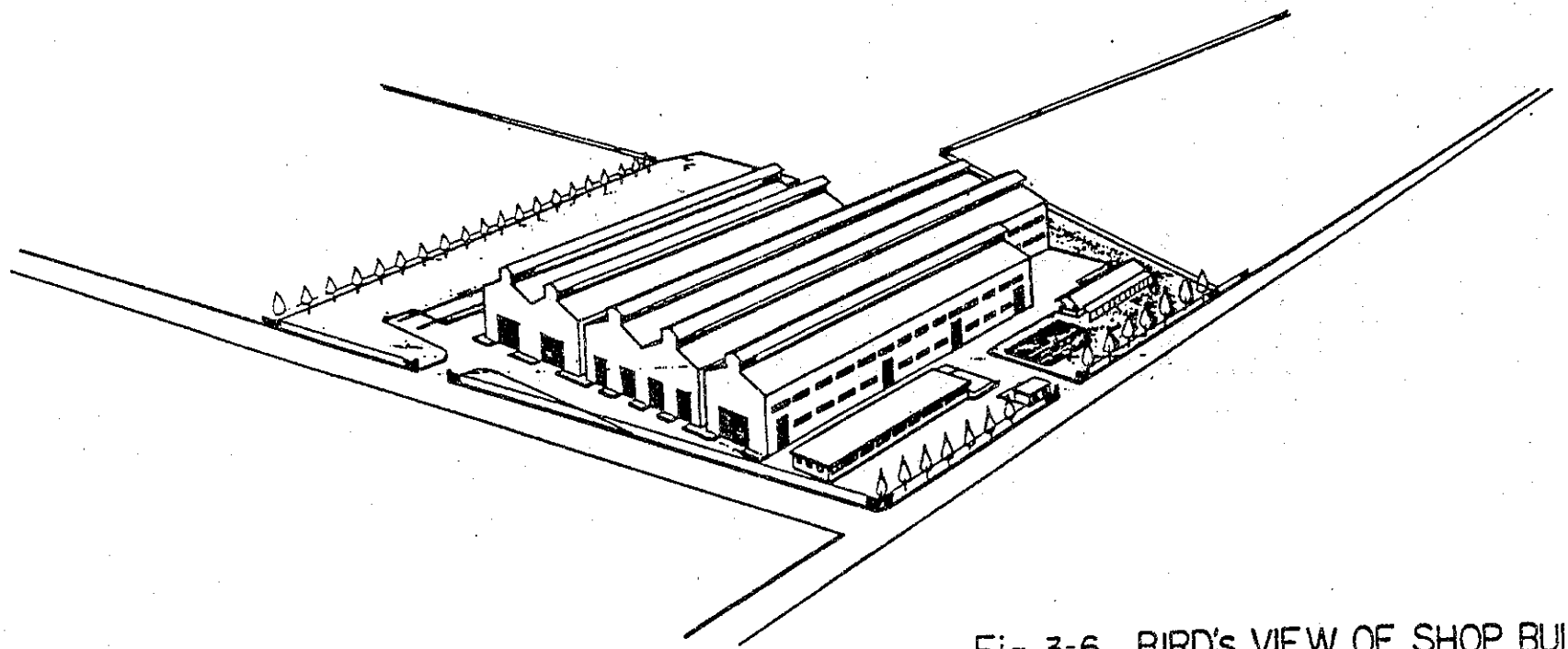
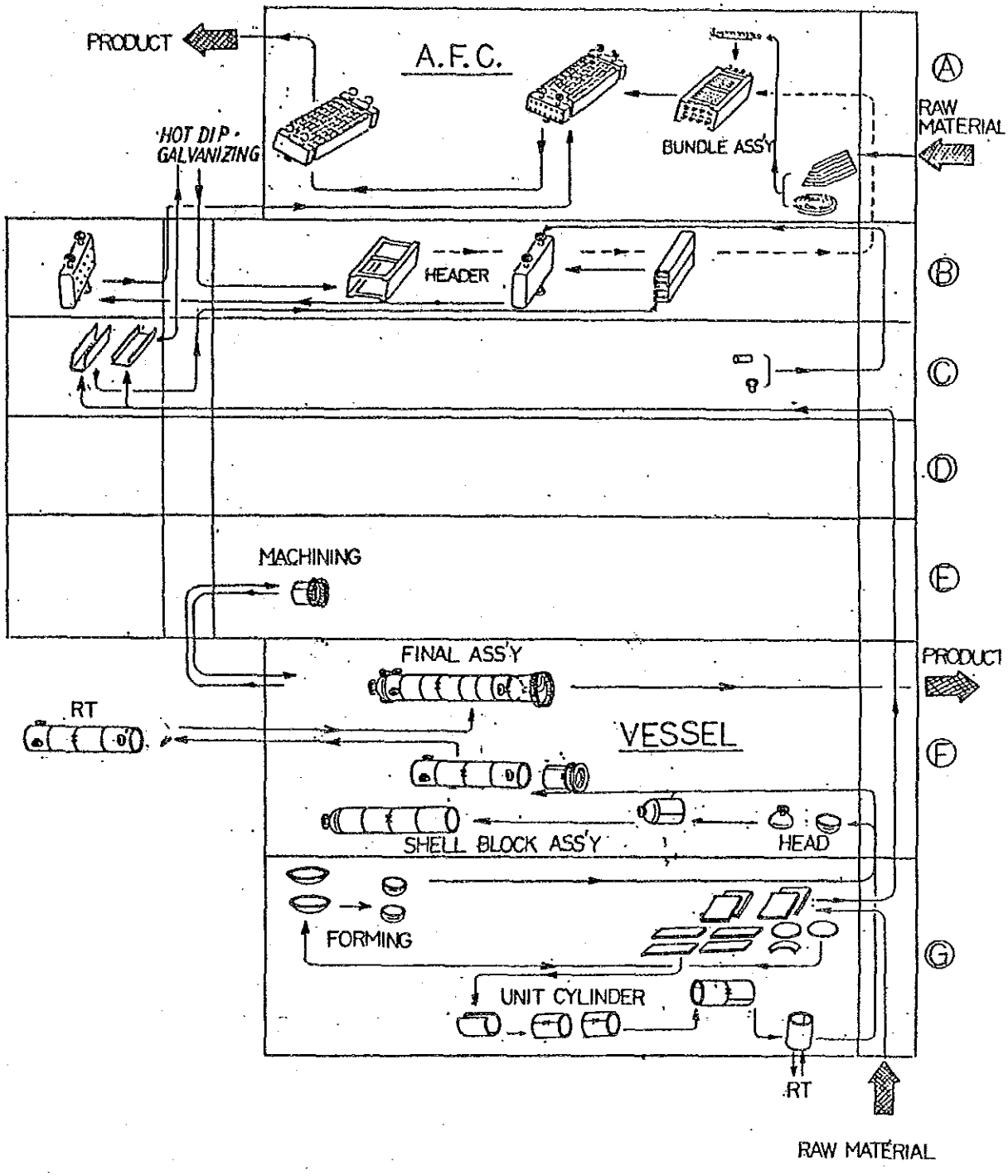
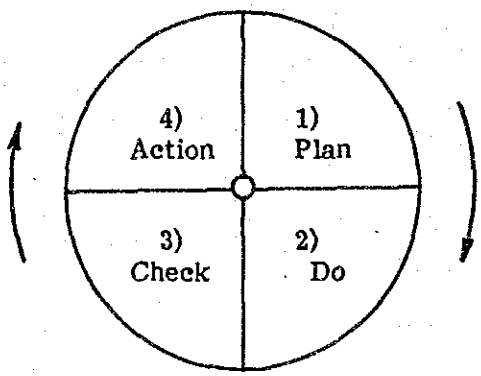


Fig. 3-6 BIRD's VIEW OF SHOP BUILDING
(JAKARTA)

Fig.4-1 MANUFACTURING PROCESS FLOW

(JAKARTA)





(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. BARATA INDONESIA JAKARTA FACTORY

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: 9.48 D: 7.19	SUPERVISOR BY TECHNICAL LICENSE 2 YEARS F: 56.85 D: 43.15	F: 47.38 D: 35.95
FOR WORKER 1. MACHINE WORKER 2. WELDING 3. FORMING 4. INSPECTION, ETC			BY COMPANY'S OWN SYSTEM	F: 12.82 D: -	SUPERVISOR BY MACHINE SUPPLIER F: 11.09 D: -		
TRAINING COST	FOREIGN			12.82	20.57	56.85	47.38
	DOMESTIC			-	7.19	43.15	35.95

LIST 1-1
LIST OF EXISTING MACHINE/TOOL

MILL NAME: BARATA JAKARTA Machine Item: 5 Cutting Equipment

No.	Code	Machine Item	Q'ty	Supplier Purchased Data	Main Specification	Motor Power	Machine Condition					
							Loading %	Tolerance	Workability	Maintenance	Moderni-zation	Conclusion
1	MRL. 84	PLATE CUTTING MACHINE	1	- Efrest - Germany	Max. plate thickness : 3 mm Max. length of plate : 2500 mm	3 HP	70	II	II	II		o
2	MRL. 80	CIRCULAR SAWING MACHINE	1	- Heller Hydraulic	Saw. blade diameter : ϕ770 mm Max. sawing capacity : 230 mm Vertical moving : 250 mm	10,8 HP 1440 RPM	40	III	II	III		x
3	MPF. 85	PROFILE CUTTING MACHINE	1	- Warszawa fabryka. Polandia. - Warszawa Wlochy - N.V.13. - No. Serie 61460 - 1960	Max. Cutting capacity : ϕ100 mm (rotary saw)	25.8 HP	80	II	II	III	o	o
4	MGR. 81	HACK SAWING MACHINE	1	- Rumania - No. Serie 1171 - 1963	Blade size : 370 mm Max. cutting capacity : 5 inch	2.5 HP 1500 RPM	40	III	II	II		o
5	MGR. 82	HACK SAWING MACHINE	1	- Rumania - No. Serie 1172 - 1963	Blade size : 370 mm Max. cutting capacity : 5 inch	2.5 HP 1500 RPM	40	III	II	II		o
6	MGR. 83	HACKSAWING MACHINE	1	- Rocine	Max. cutting capacity : ϕ200 mm Max. hack moving : 150 mm	1 HP 920 RPM	0	III	III	III	x	x
7	MPP 87	ROLLING CUTTING MACHINE					10	III	II	II		x
8	MP 55	PRESS STRAIGHTEN-NING MACHINE					30	III	III	III		x

LIST 1-1
LIST OF EXISTING MACHINE/TOOL

MILL NAME: BARATA JAKARTA Machine Item: 6 Forming Machine

No.	Code	Machine Item	Q'ty	Supplier Purchased Data	Main Specification	Motor Power	Machine Condition					
							Loading %	Tolerance	Workability	Maintenance	Moderni-zation	Conclusion
1	MRL. 50	PLATE ROLLING MACHINE	1	- Donald Johns - tone - No. 38/22.	Max. plate thickness : 1 inch Max. length of plate : 2500 mm	35 HP 485 RPM	30	III	III	II		×
2	MRL. 51	PLATE ROLLING MACHINE	1	- Plate Frons	Max. plate thickness : 0.5 inch Max. length of plate : 2000 mm	7.5 HP 1450 RPM	70	III	II	II	○	○
3	MRL. 52	PLATE ROLLING MACHINE	1	-	Max. plate thickness : 3/8 mm Max. length of plate : 2000 mm	3 HP	20	III	II	III		×
4	MRL. 53	ZINC ROLLING MACHINE	1	-	Max. plate thickness : 2 mm Max. length of plate : 2500 mm	5.5 HP 710 RPM	5	III	II	II		×

LIST 1-1
LIST OF EXISTING MACHINE/TOOL

MILL NAME: BARATA JAKARTA Machine Item: 10 Machinery - I

No.	Code	Machine Item	Q'ty	Supplier Purchased Data	Main Specification	Motor Power	Machine Condition					
							Loading %	Tolerance	Workability	Maintenance	Moderni-zation	Conclusion
1	B. 10	LATHE MACHINE	1	- Rumania - S.N. 400 - No. Serie 635088 - 1963	Max. centre distance : 1500 mm Centre height above machine bed : 200 mm Centre height above carriage : 110 mm Spindle bore : ϕ 50 mm	10.2 HP 1500 RPM	50	III	II	II	o	o
2	B. 11	LATHE MACHINE	1	- Rumania - S.N. 400 - No. 635084 - 1963.	Max. centre distance : 1500 mm Centre height above machine bed : 200 mm Centre height above carriage : 110 mm Spindle bore : ϕ50 mm	10.2 HP 1500 RPM	50	III	II	II	o	o
3.	B. 12	LATHE MACHINE	1	- Rumania - S.N. 400 - No. serie 635079 - 1963	Max. centre distance : 1500 mm Centre height above machine bed : 200 mm Centre height above carriage : 110 mm Spindle bore : ϕ50 mm	10.2 HP 1500 RPM	50	III	II	II	o	o
4	B. 13	LATHE MACHINE	1	- Rumania - S.N. 400 - No. 635092 - 1963	Max. centre distance : 1500 mm Centre height above machine bed : 200 mm Centre height above carriage : 110 mm Spindle bore : ϕ 50 mm	10.2 HP 1500 RPM	50	III	II	II	o	o
5	B. 14	LATHE MACHINE	1	- Rumania - S.N. 400 - NO. 635082 - 1963	Max. centre distance : 1500 mm Centre height above machine bed : 200 mm Centre height above carriage : 110 mm Spindle bore : ϕ50 mm	10.2 HP 1500 RPM	50	III	II	II	o	o

LIST 1-1
LIST OF EXISTING MACHINE/TOOL

MILL NAME: BARATA JAKARTA Machine Item: 10 Machinery - 2

No.	Code	Machine Item	Q'ty	Supplier Purchased Data	Main Specification	Motor Power	Machine Condition					
							Loading %	Tolerance	Workability	Maintenance	Moderni-zation	Conclusion
6	B. 15	LATHE MACHINE	1	- Bulgaria - 3 MM Sofia - C.S.B.No.170 - 1965	Max. centre distance : 1000 mm Centre height above machine bed : 215 mm Centre height above gap: 330 mm Centre height above Carriage : 160 mm Spindle bore : -	5.5 HP 1440 RPM	-	-	-	-	-	×
7	B. 16	LATHE MACHINE	1	- Rumania - S.N. 400 - No. 635087 - 1963	Max. centre distance : 1500 mm Centre height above machine bed : 200 mm Centre height above carriage : 110 mm Spindle bore : ø50 mm	10.2 HP 1500 RPM	50	III	III	II	O	O
8	B. 17	LATHE MACHINE	1		Max. centre distance : 1380 mm Centre height above machine bed : 185 mm Centre height above gap: 325 mm Centre height above carriage : 135 mm Spindle bore : ø52 mm	2 HP 1500 RPM	0	III	III	III	×	×
9	B. 18	LATHE MACHINE	1		Max. centre distance : 1380 mm Centre height above machine bed : 185 mm Centre height above gap: 325 mm Centre height above carriage : 135 mm Spindle bore : ø52 mm	3 HP 950 RPM	0	III	III	III	×	×

LIST 1-1
LIST OF EXISTING MACHINE/TOOL

MILL NAME: BARATA JAKARTA Machine Item: 10 Machinery - 3

No.	Code	Machine Item	Q'ty	Supplier Purchased Data	Main Specification	Motor Power	Machine Condition					
							Loading %	Tolerance	Workability	Maintenance	Moderni-zation	Conclusion
10	E. 19	Turret lathe	1	- Cheveland Ohio - Warner & Swasey - Lot NO. 195	Distance chuck to the turret end : 490 mm Centre height above machine bed : 225 mm Centre height above carriage : 120 mm	3 HP 1000 RPM	10	III	II	II	○	○
11	B. 21	LATHE MACHINE	1	- Nederland (Den Haag)	Max. centre distance : 1360 mm Centre height above machine bed : 230 mm Centre height above gap: 430 mm Centre height above carriage : 150 mm Spindle bore : ϕ53 mm	3 HP 950 RPM	0	III	III	III	×	×
12	B. 22	LATHE MACHINE	1	- Ikegai	Max. centre distance : 3000 mm Centre height above machine bed : 390 mm Centre height above gap: - Centre height above carriage : 250 mm Spindle bore : ϕ100 mm	25 HP	30	III	II	II		○
13	B. 23	LATHE MACHINE	1	- R.S. Stockvis & Zonen - Rotterdam - Lodge & Shipley 25" lathe	Max. centre distance : 2860 mm Centre height above machine bed : 340 mm Centre height above carriage : 250 mm Spindle boar : ϕ70 mm	25 HP 1465 RPM	70	III	II	III		○

LIST 1-1
LIST OF EXISTING MACHINE/TOOL

MILL NAME: BARATA JAKARTA Machine Item: 10 Machinery - 4

No.	Code	Machine Item	Q'ty	Supplier Purchased Data	Main Specification	Motor Power	Machine Condition					
							Loading %	Tolerance	Workability	Maintenance	Moderni-zation	Conclusion
14	B. 24	LATHE MACHINE	1		Max. centre distance : 2500 mm Centre height above machine bed : 285 mm Centre height above gap: 445 mm Centre machine above carriage : 215 mm Spindle bore : ϕ54 mm	4 HP 960 RPM	30	III	II	III		×
15	BB. 43	FACING LATHE MACHINE	1		Max. centre distance : 2400 mm Centre height above machine bed : 950 mm	10 HP 250 RPM	5	III	III	III	○	○
16	KRS. 41	VERTICAL BORING MILL MACHINE	1		Table diametre : ϕ1200 mm Max. turning diametre : ϕ1270 mm Max. turning height : 900 mm	6 HP 1440 RPM	25	III	III	III		○
17	KRS. 42	VERTICAL BORING MILL MACHINE	1	- O.M. Ltd.	Table diametre : ϕ1250 mm Max. turning diametre : ϕ1600 mm Max. turning height : 1030 mm Max. loading weight : 4000 Kgs	24 HP 1450 RPM	Full	II	I	I	○	○
18	K. 36	HORIZONTAL BORING & MILLING MACHINE	1	- Luccas Preise -	Max. head travel : na. Max. table long. travel: Max. workpiece width : 1850 mm Max. spindle travel :	10 HP 1465 RPM	80	III	II	III		○
19	SKR. 39	PLANING MACHINE	1		Table length : 2860 mm Table width : 800 mm Max. planing height : 1000 mm Max. planing length : 2620 mm Max. planing width : 1200 mm	5 HP	80	III	II	II		○

LIST 1-1
LIST OF EXISTING MACHINE/TOOL

MILL NAME: BARATA JAKARTA Machine Item: 10 Machinery - 5

No.	Code	Machine Item	Q'ty	Supplier Purchased Data	Main Specification	Motor Power	Machine Condition					
							Loading %	Tolerance	Workability	Maintenance	Moderni-zation	Conclusion
20	SKR. 40	PLANING MACHINE	1		Table length : 3300 mm Table width : 760 mm Max. planing height : 780 mm Max. planing length : 3000 mm Max. planing width : -	3 HP	30	III	II	III		×
21	SKR. 32	SHAPING MACHINE	1	- Bucharest masine - Rumania - Infratirea - 1963	Table length : 420 mm Table width : 310 mm Max. tool-head travel : 420 mm Max. table vertical travel : 280 mm Max. table longitudinal travel : 480 mm	2.2 KW 940 RPM	90	III	II	I	○	○
22	SKR. 31	SHAPING MACHINE	1	- Bucharest masine - Rumania - Infratirea - No. Setie 2015 - 1963	Table length : 420 mm Table width : 310 mm Max. tool-head travel : 420 mm Max. Table vertical travel : 280 mm Max. table longitudinal travel : 480 mm	2.2 KW 940 RPM	90	III	II	I	○	○
23	SKR. 30	SHAPING MACHINE	1	- Bucharest masine - Rumania - Infratirea - No. Setie 2015	Table length : 420 mm Table width : 310 mm Max. tool-head travel : 420 mm Max. Table vertical travel : 280 mm Max. table longitudinal travel : 480 mm	2.2 KW 940 RPM	90	III	II	I	○	○
24	BOR. 59	COLUMN DRILLING MACHINE	1	- Carl schliper - Ramscheld	Table length : 240 mm Table width : 230 mm Max. drilling height : 160 mm		-	III	II	I		×

LIST 1-1
LIST OF EXISTING MACHINE/TOOL

MILL NAME: BARATA JAKARTA Machine Item: 10 Machinery - 6

No.	Code	Machine Item	Q'ty	Supplier Purchased Data	Main Specification	Motor Power	Machine Condition					
							Loading %	Tolerance	Workability	Maintenance	Moderni-zation	Conclusion
25	BOR. 63	RADIAL DRILLING MACHINE	1	- Cincinnati Ohio - U.S.A. - The Cincinnati - Bickford Tool & Co.	Table length : 850 mm Table width : 660 mm Max. drilling height : 330 mm Max. distance spindle to column : 1860 mm Max. vertical travel of head : 1180 mm	7.5 HP 970 RPM	0	III	III	III	×	×
26	BOR. 64	COLUMN DRILLING MACHINE	1	- Rotterdam - Blau & Co.	Table diametre : ϕ750 mm Max. drilling height : 260 mm Distance spindle to column : 400 mm Table vertical travel : 540 mm	3 HP 700 RPM	20	III	II	III		○
27	BOR. 65	COLUMN DRILLING MACHINE	1	- Bulgaria - Kazanlik B.Y.20 - No. Serie 2449 - 1965	Table length : 350 mm Table width : 300 mm Max. drilling height : 140 mm Distance spindle to column : 265 mm	1 HP 960 RPM	20	III	II	II		×
28	BOR. 66	COLUMN DRILLING MACHINE	1	- Bulgaria - Kazanlik B.Y.32 - No. Serie 1778 - 1965	Table length : 400 mm Table width : 400 mm Max. drilling height : 250 mm Distance spindle to column : 325 mm	1 HP 920 RPM	20	III	II	II		×
29	BOR. 67	COLUMN DRILLING MACHINE	1	- Bulgaria - Kazanlik B.Y.20 - No. Serie 2427 - 1965	Table length : 350 mm Table width : 300 mm Max. drilling height : 140 mm Distance spindle to column : 265 mm	1 HP 920 RPM	20	III	II	III		×

LIST 1-1
LIST OF EXISTING MACHINE/TOOL

MILL NAME: BARATA JAKARTA Machine Item: 10 Machinery - 7

No.	Code	Machine Item	Q'ty	Supplier Purchased Data	Main Specification	Motor Power	Machine Condition					
							Loading %	Tolerance	Workability	Maintenance	Moderni-zation	Conclusion
30	BOR. 70	COLUMN DRILLING MACHINE	1	- Buffalo	Table length : 300 mm Table width : 270 mm Max. drilling height : 130 mm Distance spindle to column : 215 mm Table vertical travel : 700 mm	3 HP	75	III	II	III		O
31	BOR. 71	BENCH TYPE DRILLING MACHINE	1	- Rumania - Infratirea - No. serie 10418 - 1963	Max. drilling height : 80 mm Distance spindle to column : 200 mm Head vertical travel : 190 mm	1 HP 920 RPM	75	III	II	II		×
32	BOR. 72	COLUMN DRILLING MACHINE	1	- Buffalo	Table length : 300 mm Table width : 300 mm Max. drilling height : 150 mm Distance spindle to column : 230 mm Table vertical travel : 530 mm	1 HP 920 RPM	90	III	II	III		×
33	BOR. 73	COLUMN DRILLING MACHINE	1	- Gosiqer - Ohio U.S.A.	Table length : 560 mm Table width : 470 mm Max. drilling height : 155 mm Distance spindle to column : 300 mm Table vertical travel : 290 mm Head vertical travel : 250 mm	1 HP 920 RPM	0	III	II	III	×	×
34	BOR. 74	RAIL DRILLING MACHINE	1		Max. drilling height : 200 mm	-	30	III	II	III		×
35	BOR. 75	RAIL DRILLING MACHINE	1		Max. drilling height : 200 mm	-	30	III	II	III		×
36	BOR. 76	RAIL DRILLING MACHINE	1		Max. drilling height : 200 mm	-	30	III	II	III		×

LIST 1-1
LIST OF EXISTING MACHINE/TOOL

MILL NAME: BARATA JAKARTA Machine Item: 10 Machinery - 8

No.	Code	Machine Item	Q'ty	Supplier Purchased Data	Main Specification	Motor Power	Machine Condition					
							Loading %	Tolerance	Workability	Maintenance	Moderni-zation	Conclusion
37	BOR. 77	RAIL DRILLING MACHINE	1	-	Max. drilling height : 200 mm	-	30	III	II	III		×
38	BOR. 38	COLUMN DRILLING MACHINE	1	- Hamburg wansbek - Germany - Otto Hafner ixion	Table length : 420 mm Table width : 390 mm Max. drilling height : 100 mm Distance spindle to column : 280 mm	1 HP 1420 RPM	0	III	III	III	×	×
39	BOR. 89	RADIAL DRILLING MACHINE	1	-	Max. drilling height : 340 mm Distance spindle to column :1250 mm Arm vertical travel : 930 mm	20 HP 1440 RPM	0	III	III	III	×	×
40	FRS. 38	MILLING MACHINE	1	- U.S.A. - Milwauke	Max. Milling height : 600 mm Max. table longitudinal travel : 400 mm Table length :1200 mm	10 HP 710 RPM	0	III	III	III	×	×
41	DM. 29	DUPLEX MILLING MACHINE	1	- Japan - Hitachi Seiki - 1975	Max. table longitudinal travel : 800 mm Distance centre spindle to table : 50 - 450mm Working area 300 x 1,35 mm	55 KW	-	-	-	-	-	×
42	STK. 33	SLOTING MACHINE	1	- Alfred & Schute	Table diametre : ϕ700 mm Max. ram travel : 300 mm	5 HP 950 RPM	40	III	II	II		○
43	BOR. 68	COLUMN DRILLING MACHINE	1	- Imperator - G.A. 50226	Max. drilling diametre : ϕ17 mm	1 HP 920 RPM	60	III	II	II		×
44	BOR. 69	COLUMN DRILLING	1	- Infratirea - Type 24U 1016 - No. 10418 - 1963	Max. drilling diametre : ϕ12 mm	1 HP 920 RPM	-	-	-	-	-	×

LIST 1-1
LIST OF EXISTING MACHINE/TOOL

MILL NAME: BARATA JAKARTA Machine Item: 12 Surface Preparation

No.	Code	Machine Item	Q'ty	Supplier Purchased Data	Main Specification	Motor Power	Machine Condition					
							Loading %	Tolerance	Workability	Maintenance	Moderni-zation	Conclusion
1	GRD. 60	PEDESTAL GRINDING MACHINE	1	- Rumania - Infratirea	Grindstone size :	2 HP 2500 RPM	-	-	-	-	-	o
2	GRD. 61	PEDESTAL GRINDING MACHINE	1	- Union	Grindstone size :	1.5 HP 2500 RPM	FULL	II	II	II		o
3	GRD. 62	PEDESTAL GRINDING MACHINE	1		Grindstone size :	0.75 HP 2500 RPM	FULL	II	II	II		o
4	SL. 46	TOOL GRINDER MACHINE	1	- Gotha - Rumania	Grindstone size :	1 HP 2250 RPM	-	-	-	-	-	o
5	SL. 47	TOOL GRINDER MACHINE	1		Grindstone size :	1 HP 920 RPM	-	-	-	-	-	o

LIST 1-1
LIST OF EXISTING MACHINE/TOOL

MILL NAME: BARATA JAKARTA Machine Item: 14 Utility Equipment

No.	Code	Machine Item	Q'ty	Supplier Purchased Data	Main Specification	Motor Power	Machine Condition					
							Loading %	Tolerance	Workability	Maintenance	Moderni-zation	Conclusion
1	KOM. 91	AIR COMPRESSOR	1	- Fuyi	Working pressure : 2.5 atm 500 RPM	6 HP						o
2	KOM. 92	AIR COMPRESSOR	1	- Fuyi	Working pressure : 2.5 atm 500 RPM	6 HP						o
3	KOM. 93	AIR COMPRESSOR	1	- Fuyi	Working pressure : 2.5 atm 500 RPM	6 HP						o
4	KOM. 90	AIR COMPRESSOR	1	- Ingersol Rand	Working pressure : 8 atm 1500 RPM	-						o
5	KOM 99	AIR COMPRESSOR	1	- Spuit Techniet	Working pressure : 5 atm 1425 RPM	1 HP						o

LIST 1-1
LIST OF EXISTING MACHINE/TOOL

MILL NAME: BARATA JAKARTA Machine Item: 15 Transportation Equipment

No.	Code	Machine Item	Q'ty	Supplier Purchased Data	Main Specification	Motor Power	Machine Condition					
							Loading %	Tolerance	Workability	Maintenance	Moderni-zation	Conclusion
1	OC. 150	OVERHEAD TRAVEL-LING CRANE	1	- Demag S.W.L.	Max. lifting height : 7.5 mtrs. Between crane transverse: 15 mtrs. Safe working load : 10 tons	10.2 HP						×
2	OC. 151	OVERHEAD TRAVEL-LING CRANE	1	- Demag - 1971	Max. lifting height : 7.5 mtrs. Between crane transverse: 15 mtrs. Safe working load : 5 tons	8.84 HP						×
3	OC. 152	OVERHEAD TRAVEL-LING CRANE	1	- Verlende	Max. lifting height : 8 mtrs. Between crane transverse: 12 mtrs. Safe working load : 5 tons	10.2 HP						×
4	OC. 153	OVERHEAD TRAVEL-LING CRANE	1	- Verlende	Max. lifting height : 8 mtrs. Between crane transverse: 12 mtrs. Safe working load : 5 tons	8.84 HP						×
5	OC. 154	OVERHEAD TRAVEL-LING CRANE	1	- Ex. Barata	Max. lifting height : 8 mtrs. Between crane transverse: 12 mtrs. Safe working load : 5 tons	8.84 HP						×

P.T. BARATA: JAKARTA FACTORY

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		
1.1.1	Max. turning diameter Distance between center	290 mm 1000 mm	1 For site
1.1.2	Max. turning diameter Distance between center	350 mm 1500 mm	1
1.1.3	Max. turning diameter Distance between center	450 mm 4000 mm	2
1.1.4	Max. turning diameter Distance between center	550 mm 4000 mm	1
1.1.6 (B.10) (B.11) (B.12) (B.13) (B.14) (B.16)	Max. center distance Center height above machine bed Center height above carriage Spindle bore	1500 mm 200 mm 110 mm 50 mm	6
1.1.7 (B.19)	Distance chuck to the turret end Center height above machine bed Center height above carriage	490 mm 225 mm 120 mm	1
1.1.8 (B.22)	Max. center distance Center height above machine bed Center height above gap Center height above carriage Spindle bore	3000 mm 30 mm - 250 mm 100 mm	1
1.1.9 (B.23)	Max. center distance Center height above machine bed Center height above carriage Spindle bore	2860 mm 340 mm 250 mm ϕ70 mm	1

NO.	TYPE OF MACHINE		QUANTITY
1.2	HEAVY DUTY FACING LATHE MACHINE		
1.2.2 (B.B.43)	Max. center distance Center height above machine bed	2400 mm 950 mm	1
1.3	VERTICAL BORING & TURNING MILL MACHINE		
1.3.3	Max. turning diameter Max. turning height	2350 mm 2550 mm	1
1.3.5 (KRS. 41)	Table diameter Max. turning diameter Max. turning height	1200 mmø 1270 mmø 900 mm	1
1.3.6 (KRS.42)	Table diameter Max. turning diameter Max. turning height Max. loading weight	1250 mmø 1600 mmø 1030 mm 4000 kgs	1
1.4	HEAVY DUTY RADIAL DRILLING MACHINE		
1.4.2	Max. drilling capacity	50 mmø	1
1.4.3	Max. drilling capacity	65 mmø	4
1.4.4	Max. drilling capacity	80 mmø	1
1.4.7 (BOR.64)	Table diameter Max. drilling height Distance spindle to column Table vertical travel	750 mmø 260 mm 400 mm 540 mm	1
1.4.8 (BOR.70)	Table length Table width Max. drilling height Distance spindle to column Table vertical travel	300 mm 270 mm 130 mm 215 mm 700 mm	1

NO.	TYPE OF MACHINE		QUANTITY
1.5	VERTICAL DRILLING MACHINE PILLAR TYPE		
1.5.1	Max. drilling capacity	35 mmø	1
1.8	PORTABLE UNIVERSAL RADIAL DRILLING MACHINE WITHSWIVEL RAM AND HEAD		
	Max. drilling capacity	45 mmø	1
1.9	HORIZONTAL BORING & MILLING MACHINE		
1.9.1	Heavy duty horizontal boring & milling machine - (Table Type)		1
	Spindle diameter	130 mm	
	Table size	1520 x 1700 mm	
1.9.3	Heavy duty horizontal boring & milling machine - (Floor Type)		
	Spindle diameter	130 mm	1
	Floor size	4000 x 4000 mm	
1.9.5 (K36)	Max. head travel		1
	na.		
	Max. tablelong. travel		
	Max. workpiece width	1850 mm	
	Max. spindle travel		
1.10	UNIVERSAL MILLING MACHINE		1
	Table size	1800 x 560 mm	
1.11	PLANING MACHINE		
1.11.2	Heavy duty double column planing machine		1
	table size	8000 x 1400 mm	
1.11.3	Heavy duty open side planing machine		1
	table size	6000 x 2000 mm	

NO.	TYPE OF MACHINE		QUANTITY
1.12	HEAVY DUTY HYDRAULIC HACKSAW MACHINE		
1.12.1	Max. cutting	280 mmø	1
1.12.2 (MGR81) (MGR82)	Blade size Max. cutting capacity	370 mm 5 inch	2
1.14	UNIVERSAL TOOL & CUTTING GRINDING		
1.14.1	Swing Distance between workhead and tailstock Table size	265 mm 910 mm 180 x 1320 mm	1
1.14.2 (SL46) (SL47)	Grindstone size		2
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
1.17	PEDESTAL GRINDING MACHINE (DOUBLE GRINDING WHEELS)		
1.17.1	Pedestal grinding machine wheel size	150x25x51mm	2
1.17.2	Pedestal grinding machine wheel size	300x40x76mm	3
1.17.3	Pedestal grinding machine wheel size	500x60x127mm	1
1.17.4 (GRD60) (GRD61) (GRD62)	Grindstone size		3

NO.	TYPE OF MACHINE	QUANTITY
1.19	HEAVY DUTY HYDRAULIC PRESS MACHINE	
	Power 900 Tons Table area 4800 x 2000 mm Stroke 600 mm Daylight 1500 mm	1
1.9.1	Example of cold forming capacity 1. 1000 mmR x 3000 mmL at plate thickness 35 mm 2. 1000 mmR x 4500 mmL at plate thickness 25 mm	
1.20	HYDRAULIC STRAIGHTENING PRESS MACHINE FOR SHAFT	
	Max. force 40 Tons Piston stroke 300 mm Max. length of shaft 2000 mm Throat depth 250 mm Table size 1000 x 300 mm	1 For site
1.21	HYDRAULIC PRESS BRAKE MACHINE	
	Power press 750 Tons Max. plate width 4000 mm Throat depth 400 mm Day light 650 mm Stroke 350 mm	1
1.22	HORIZONTAL PROFILE STRAIGHTENING MACHINE	
	Force 200 Tons Throat depth 235 mm Stroke 750 mm Day light 600 mm Table block size 450 x 1700 mm	1
1.23	HORIZONTAL CYLINDRICAL SHELL STRAIGHTENING MACHINE Force 800 Tons Day light 650 mm Stroke 200 mm Max. plate width 4000 mm	1
1.24	HEAVY DUTY HEAD FLANGING MACHINE	
1.24.2	Max. head diameters 3000 mm (Range of plate thickness: 8-18 mm) Min. head diameter 800 mm (Range of plate thickness: 4.5-12 mm)	1
1.25	HEAVY DUTY HYDRAULIC PRESS MACHINE	
1.25.2	Force 2000 Tons Table area 6000 x 3000 mm stroke 1000 mm Day light 2000 mm Example of cold forming capacity 1. 1000 mmR x 3000 mmL at plate thickness 80 mm 2. 1000 mmR x 6000 mmL at plate thickness 45 mm	1

NO.	TYPE OF MACHINE		QUANTITY
1.26	MECHANICAL PLATE BEND ROLLING MACHINE		
1.26.3	Max. plate thickness bending capacity	22 mm	1
	Max. plate width	4000 mm	
	Min. bending diameter	650 mm	
1.26.5	Max. plate thickness bending capacity	38 mm	1
	Max. plate width	4000 mm	
	Min. bending diameter	850 mm	
1.26.7 (MRL51)	Max. plate thickness	0.5 inch	1
	Max. length of plate	2000 mm	
1.27	HEAVY DUTY HYDRAULIC PIPE BENDING MACHINE		1
	Max. bending capacity of pipe	4 inch ϕ	
1.28	HYDRAULIC BENDING MACHINE		
	Max. bending for :		1
	Pipe ST.37 (diameter x thickness)	216 x 5.8 mm	
	Square solid bar	110 mm	
	Round bar	120 mm	
1.29	MECHANICAL PLATE SHEARING MACHINE		
1.29.1	Max. plate thickness	16 mm	1
	Plate width	4000 mm	
1.29.3 (MRL84)	Max. plate thickness	3 mm	1
	Max. length of plate	2500 mm	
1.30	MECHANICAL UNIVERSAL STEEL WORKER MACHINE		
	Flat shear max.	250 x 22 mm	1
	Bar stock shear	65 mmϕ	
	Square stock shear	55 mm	
	Punch max. ϕ38 in thickness	27 mm	
	Notching	16 mm	

NO.	TYPE OF MACHINE		QUANTITY
1.31	HAND NIBBLING MACHINE		
	Max. nibbling capacity	8 mm	1
	Smallest radius	300 mm	
1.32	PUNCHING MACHINE		
1.32.2	Mechanical heavy duty punching machine		1
	Max. punching capacity	30 mmø	
	Thickness	25 mm	
1.33	HANDY HEAVY PNEUMATIC RIVETING HAMMER		
	Max. rivet diameter :		
	Steel construction up to	37 mm	3
	Boiler construction up to	33 mm	
1.34	MECHANICAL PLATE FORMING MACHINE		
	Max. plate thickness	8 mm (light metal St.37)	1
	Depth of gap horizontal	675 mm	
1.35	TUBE EXPANDER		
	Max. pipe diameter	10 - 45 mm	4
1.36	UNIVERSAL FILING AND BAND SAW MACHINE		
	Stroke of blade of file	0 - 120 mm	1
	Table	400 x 400 mm	
1.37	KEY SEATING MACHINE		
	Width of key	3 - 70 mm	1
	Max. key way length	500 mm	

NO.	TYPE OF MACHINE		QUANTITY
1.38	PIPE BEVELLING/EDGING MACHINE		
1.38.1	Edge cutting machine Cutting length	 8000 mm	1
1.38.2	Portable handy electric bevelling machine Max. material thickness	 32 mm	1
1.39	AIR COMPRESSOR		
1.39.1	Mobile air compressor with diesel power Max. pressure Capacity	 10 bar 20 m^3/min.	1
1.39.2	Static air compressor Max. pressure Capacity	 8.8 bar 15 m^3/min.	2
1.39.3	High pressure air compressor Max. pressure Capacity Motor	 : 200 atm : 22 m^3/Hr : 11 kW	1
1.39.4 (KOM91)	Working pressure	2.5 atm 500 rpm	1
1.39.5 (KOM92)	Working pressure	2.5 atm 500 rpm	1
1.39.6 (KOM93)	Working pressure	2.5 atm 500 rpm	1
1.39.7 (KOM90)	Working pressure	8 atm 1500 rpm	1
1.39.8 (KOM99)	Working pressure	5 atm 1425 rpm	1

NO.	TYPE OF MACHINE		QUANTITY
1.40	MECHANICAL TUBE FINNING MACHINE		
	Max. tube outside diameter	25 mm	1
	Max. height of fins	50 mm	
1.41	INDUCTION HEATING EQUIPMENT		
	Welding current	600 Amp	2
	Duty cycle	100% at 600 Amp	
	Output voltage	60 - 80 volts	
1.42	CUTTING TOOLS		1
1.43	SURFACE PLATE FOR MARKING		
	Dimension	*4000 x 6000 mm x 400 mm*	2
	Max. load 10 tons		
1.44	COPIER GAS CUTTING MACHINE		
	4 cutting torches		1
	Max. plate thickness	150 mm	
	Effective cutting	*6000 x 3000 mm*	
1.45	PLASMA CUTTING MACHINE		
1.45.1	Max. cutting thickness alloy steel	70 mm	1
1.45.2 (-)			2
1.46	AUTOMATIC GAS CUTTING MACHINE (CIRCULAR)		
	Max. cutting thickness	150 mm	1
	Circle cutting range diameter	60 - 2000 mm	
	Cutting speed range	80 - 1000 mm/min.	

NO.	TYPE OF MACHINE		QUANTITY
1.47	PORTABLE FLAME CUTTING MACHINE		
	Cutting capacity	150 mm	3
1.48	PIPEEND BEVELLING FLAME CUTTING MACHINE		
	Effective pipe diameter Pipe thickness	150 - 1000 mm 5 - 50 mm	2
1.49	MANUAL FLAME CUTTING		
	Max. cutting thickness	150 mm	10
1.50	SEMIAUTOMATIC GAS METAL ARC WELDING MACHINE		
1.50.1	Max. welding current Max. wire diameter	600 Amp 1.6 mm	10
1.51	SUBMERGED-ARC AUTOMATIC TANK WELDING MACHINE		
	1400 Amp. Max. wire diameter Max. vertical height	6 mm 4200 mm	3
1.52	AUTOMATIC SUBMERGED ARC WELDING MACHINE		
1.52.1	1500 Amp. Max. wire diameter	6 mm	10
1.52.2 (-)	-		2
1.53	AC ARC WELDING MACHINE		
1.53.1	Max. welding current Duty cycle	500 Amp 60% at 500 Amp. AC	20
1.53.2 (-)	Max. welding current	300 - 500 Amp	15

NO.	TYPE OF MACHINE		QUANTITY
1.54	DC ARC WELDING MACHINE		
1.54.1	Max. welding current Duty cycle	500 Amp. 60% at 450 Amp. DC	10
1.54.2 (-)	Max. welding current	300 - 500 Amp	10
1.55	DC MOTOR GENERATOR WELDING MACHINE		
	Max. welding current Duty cycle	600 Amp. 60% at 600 Amp	8
1.56	DC DIESEL GENERATOR WELDING MACHINE		
1.56.1	Max. welding current Duty cycle	600 Amp. 60% at 600 Amp.	3
1.56.2 (-)	Max. welding current	500 Amp.	1
1.57	T.I.G. WELDING MACHINE		
1.57.1	Output current Duty cycle	DC Max. 500 Amp. 60% at 500 Amp.	3
1.57.2 (-)	Max. welding current	500 Amp.	2
1.59	DIESEL GENERATOR		
	Continuous output 3 phase alternating current (AC)	250 KVA 380/220 Volt, 50 Hz	1
1.60	CARBON ARC AIR GOUGING MACHINE		
	Rated current Duty cycle Usable carbon diameter	DC 600 Amp. 100% 5 - 11 mm	4

NO.	TYPE OF MACHINE		QUANTITY
1.61	WELDING POSITIONER		
1.61.1	Rotated and tilting table Table size Max. load on table in horizontal position.	 1500 x 1500 mm 4 Tons	1
1.61.2	Rotated and tilting table Table size diameter Max. load on table in horizontal position	 500 mm 500 kg	2
1.61.3	Welding positioner· Rotated and tilting table Table size diameter Max. load on table in horizontal position	 1000 mm 1000 kg	1
1.62	TURNING TABLE FOR GAS CUTTING		
1.62.1	Turning table for gas cutting Effective cutting diameter Max. load	 5000 mm 15 tons	1
1.62.2	Turning table for gas cutting Effective cutting diameter Max. load	 4000 mm 10 Tons	1
1.63	BOOM TYPE WELDING MACHINE		
1.63.1	Boom type automatic submerged arc welding machine Automatic welding carrier Vertical, Horizontal Sub-merged arc welding machine	 4000 mm 5000 mm 1200 Amp 4.8 mm	2
1.63.2	Boom type automatic gas metal arc welding machine Automatic welding carrier Vertical Horizontal Gas metal arc welding machine	 1000 mm 5000 mm 500 Amp. 1.6 mm	1

NO.	TYPE OF MACHINE		QUANTITY
1.64	SHAPING MACHINE		
1.64.1 (SKR32) (SKR31) (SKR30)	Table length Table width Max. tool-head travel Max. table vertical table Max. table longitudinal travel	420 mm 310 mm 420 mm 280 mm 480 mm	3
1.65	PROFILE CUTTING MACHINE		
1.65.1 (MPF85)	Max. cutting capacity (Rotary saw)	100 mmφ	1
1.66 (STK33)	SLOTTING MACHINE		
	Table diameter Max. ram travel	700 mmφ 300 mm	1

2. ASSEMBLY EQUIPMENTS & MATERIAL HANDLING

NO.	TYPE OF MACHINE		QUANTITY
2.1	BAY TRANSFER CAR		
2.1.1	Capacity	10 Tons	3
2.1.2	Capacity	20 Tons	3
2.2	FORKLIFT TRUCK 3 TONS		1
2.3	FORKLIFT TRUCK 5 TONS		1
2.5	30 TONS HYDRAULIC TELESCOPIC TRUCK CRANE		
	Wheel type		1
2.6	HOIST		
2.6.1	Hoist	1 Ton x 6 m	6
2.6.2	Hoist	2 Tons x 6 m	6
2.7	JIB CRANE 1 TON		
	Lifting height	5 meters	2

NO.	TYPE OF MACHINE		QUANTITY
2.8	OVERHEAD TRAVELLING CRANE 5 TONS		
2.8.1	Lifting height Rail span	6 meters 12 meters	2
2.8.2	Lifting height Rail span	7 meters 12 meters	4
2.8.3	Lifting height Rail span	7 meters 15 meters	3
2.11	OVERHEAD TRAVELLING CRANE 10/3 TONS		
2.11.1	Lifting height Rail span	7 meters 12 meters	1
2.11.2	Lifting height Rail span	10 meters 24 meters	1
2.11.4	Lifting height Rail span	12 meters 24 meters	2
2.16	OVERHEAD TRAVELLING CRANE 25/5 TONS		
2.16.1	Lifting height Rail span	10 meters 24 meters	1
2.16.2	Lifting height Rail span	12 meters 24 meters	2
2.21	GANTRY CRANE 25/5 TONS		
	Lifting height Rail span	12 meters 10 meters	1
2.23	PULLERS WITH LOAD LIMITER		
	Pulling capacity Cable diameter	Approx. 3000 kgs 5/8"	1

NO.	TYPE OF MACHINE		QUANTITY
2.24	UNIVERSAL THEODOLITE COMPLETE SET		1
2.25	MANUAL SCREW JACK		
	Lifting capacity	10 Tons	2
	Stroke	150 mm	
	Collapsed height	280 mm	
2.26	HAND PUMP HYDRAULIC JACK 10 TONS		
	Stroke	150 mm	2
	Closed height	330 mm	
2.27	HAND PUMP HYDRAULIC JACK 35 TONS		
	Stroke	300 mm	2
	Closed height	545 mm	
2.28	HAND PUMP HYDRAULIC JACK 100 TONS		
	Stroke	300 mm	2
	Closed height	598 mm	
2.29	HAND PUMP HYDRAULIC JACK COMPLETE SET 500 TONS		
	Stroke	150 mm	1
	Closed height	473 mm	
2.30	HAND PUMP HYDRAULIC SPREAD CYLINDER SPRING RETURN		
	Lifting capacity	1 Ton	2
	Max. stroke	±150 mm	

NO.	TYPE OF MACHINE		QUANTITY
2.31	HAND PUMP HYDRAULIC SPREAD CYLINDER SPRING RETURN		
	Lifting capacity Max. stroke	3 Tons ±250 mm	2
2.32	HAND PUMP HYDRAULIC PIPE BENDER COMPLETE SET		
	Max. pipe to be bend	1/2"ϕ up to 4"ϕ	2
2.33	ELECTRIC WINCH COMPLETE WITH PANEL CONTROL		
	Max. lifting capacity	15 Tons	2
2.34	ELECTRIC WINCH COMPLETE WITH PANEL CONTROL		
	Max. lifting capacity	25 Tons	1
2.35	ROPE PULLEY		
	Max.	250 kg	3
2.36	CHAIN BLOCK PULLEY		
	Max. load and lifting capacity	5 Tons and 3000 mm	2
2.37	CHAIN BLOCK PULLEY		
	Max. load and lifting capacity	10 Ton and 3400 mm	2
2.38	CHAIN BLOCK PULLEY		
	Max. load and lifting capacity	25 Tons and 3500 mm	2

NO.	TYPE OF MACHINE		QUANTITY
2.39	PAIR OF DRUM ROTATOR WITH DRIVE MOTOR AND IDLER ROTATOR		
	Adjustable rotating speed Drum diameter	1000 - 5000 mm	
2.39.1	5 Tons		2
2.39.2	10 Tons		3
2.39.3	20 Tons		3
2.39.4	50 Tons		2
2.40	PAIR OF IDLER DRUM ROTATOR WITHOUT DRIVE MOTOR		
	Max. load Drum diameter	5 Tons 1000 - 3000 mm	2
2.41	YOKE OR CHAIN PIPE VISE WITH TRIPOD STAND		
	Max. pipe diameter	100 mm	3
2.42	HEAVY DUTY PORTABLE ANGLE GRINDER		
	Wheel diameter Drive motor	175 mm Approx. 1.5 kW	15
2.43	HEAVY DUTY VERTICAL SANDER		
	Wheel sander Drive motor	175 mmø 1.5 kW	2
2.44	POWER CABLE PULLERS		
	Max. pulling power With drive motor	2 Tons	2

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

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

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

3. QUALITY ASSURANCE & TESTING UNIT

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

NO.	TYPE OF MACHINE	QUANTITY
3.7	ELECTRO MAGNETIC PAINT THICKNESS TESTER	
	Complete with recommended standard accessories	1
3.8	UNIVERSAL TESTING MACHINE	
	For tensile test, compression test, transverse test and bending test	1

4. AUXILIARY UNIT

NO.	TYPE OF MACHINE		QUANTITY
4.1	BOGIE HEARTH FURNACE		
4.1.1	Effective chamber	6000 x 6000 x 18000 mm	1
		100 Ton	
	Working temperature	Max. 750°C	
4.1.2	Max. charge weight	25 Tons	1
	Working temperature	Max. 950°C	
	Effective chamber	6000 x 6000 x 3000 mm	
4.2	SHOT GRIT COMPARTMENT UNIT		
	Size	6000 x 4500 x 15000 mm	1
	Compelte with dust collector		
4.3	SAND BLASTING MACHINE		
	Movable type		1
	Tank content	140 Liters	
	Working pressure	8 bar	
4.5	WELDING ELECTRODE OVEN		
4.5.1	Dimension	2000 x 2000 x 1000 mm	2
		500 kg	
	Adjustable temperature, range	Max. 100°C	
4.5.2	Capacity	100 kg	2 For site
4.6	SUBMERGED-ARC FLUX DRYING OVEN		4 2: For site

NO.	TYPE OF MACHINE	QUANTITY
4.7	ACID CLEANING EQUIPMENT	
4.7.1	Acid cleaning equipment	1
4.7.2	Acid cleaning equipment for AFC	1
4.8	DRYING CHAMBER	1
4.9	PAINTING CHAMBER	1
4.10	SPECIAL EQUIPMENT/JIGS & FIXTURES	1
4.11	MEASURING DEVICES	1

4.4 P.T. Barata Indonesia , Tegal General Workshop

4.4.1 対象工場の技術的診断

(1) 工場の沿革と生産状況

P.T. Barata Indonesia の Tegal general work shopは Java 中部地区における砂糖工場の maintenance並びに rehabilitation Centerとして 1920 年に建設されおり,この地区における砂糖工場の古いものは既に 1835 年から操業を startしている。

当工場は, 1920 年以来,これと云った renovation 或いは modernizationを経験しておらず,必然的に crane設備や工作機械は極めて旧式且つ非能率なものである。又工作機械の maintenanceは Surabaya の Machine tool rehabilitation Center に依存しているが,必ずしも満足な rehabilitation が行われているとは云えない。即ち,工場の関係者は深い関心と保守努力を持っているにも拘らず, 設備の老巧化は著しく,精度も十分に期待出来ないのが実状である。

当工場の生産品目は主として

1) Java 中部地区における砂糖工場の maintenance並びに spare parts supply 。

Tegal 工場は原則として Java 中部地区にある砂糖工場のうち,現在, 23 ～ 28 工場の maintenanceを担当している。

2) Water Gate, water tray等この地区における irrigation 用設備の製作・供給

3) P.T. Barata Indonesia が Java 中部地区で据付を請負った Plantの steel structure の一部を主として Site fabrication にて製作

斯くの如く Tegal work shopは, Sugar cane mill用の spare roll の製作を主体とし乍らも, P.T. Barata Indonesia の Java 中部地区における General Work Shopとしての性格を兼ね備えている。

1984 年を含む過去5年間における Tegal work shopの生産実績は Table 1−1 " Production Record" の如くであるが,砂糖工場の maintenance work は cane off season即ち 12 月～4 月頃に限定されるため, Tegal work shop就中(particularly)機械加工の一年を通じての season 別操業変動は極めて重大な問題である。

(2) 現状の生産能力と生産技術

Tegal work shop は前節でも述べた如く, Suger cane mill用 roll の加工・製作を主体とする機械加工部門と irrigation 用鉄構造物／機器を主体とする製缶(plate work)部門からなっており,いずれも依然として旧式(old fashion)で老巧な設備にたよっているのが現状である。

機械加工部門は Table 1－1"Production record"に示す如く,過去の実績では約 200 Ton／year であるが,これは Sugar plant maintenance工事における季節変動が大きく影響しているものであり,年間を通じて constant な仕事量(work load)を与えれば少くとも 400～ 500 Ton／年の machining capacity は期待出来よう。但し, 老巧設備であるための故障修理や精度補正と云った機械の休転時間をも十分に考慮する必要がある。

他方, plate work 部門は, 殆んどと云って良い程, 加工設備を有しておらず, 旧態依然とした手作業が主体であり,加工対象も中厚板から薄板(light guage plate)が中心である。

更に,当工場において生産能率の向上を妨げている原因の一つが運搬設備(handling facilities)の貧弱さであると云えよう。

以上述べた如き設備面の弱体・不備は隠し切れないが,作業者の技量と現場管理の充実で以ってこれを coverしていると云っても過言ではなかろう。一例を挙げれば, irrigation用 gate の巻上げ装置に使う傘歯車(Bevel gear)の加工は,専用の歯切盤(hopping machine)がないため,罫書き(marking)…… Shaper 加工……鑢(file)による手仕上げ(manual finishing)と云う全く handy craftないし芸術作品的生産工程を採っているが,出来栄えの品質は十分に満足されるものである。

当工場における設備面及び生産技術(production technique)面の問題点(bottle neck points)を整理(summarize)すると Table 1－2"Production analysis"の如くであり,製品毎の製造工程(manufacturing procedure)において多くの key procedure が bottle neck ないし critical になっている実状が明白である。

(3) 管理体制及び人員構成

1)組織及び人員

Tegal work shop の P. T. Barata Indonesia における組織上の位置付けは, Figure 1−1 " Barata Organization"に示す如く Machinery & foundry business group に属しており, Suger plant 用機器の加工・製作を Surabaya machine shop と共同して担当する傍ら General work shop としての性格付けをも負っており, java 中部地区における plate work や Site constructionに関して他の business group をも Support している。

当工場の管理体制(managerial organization)は Figure 1−2 "Organization chart"に示す通りであり, その人員構成は Table 1−3" Personnel"に示す如くである。Direct workers 104 人中 78 人即ち 75 %が skilled workersであり, skilled workersの構成比率の高さと共に skilled workers自体の年令の高さ・skill の高さが容易にうかがえる。

2)生産管理(production control)システム

Tegal work shop の生産管理システムにおける現状を整理すると次の通りである。

① Production order flow と production scheduling

Tegal work shopが受注を受けてから, その製作作業指示が作業者(operator)に徹底するまでの指示系統 (sequence)は Figure 1−3 (a)" Production Control system"の如くであり, Quality control section にて図中⑥ Finish cardが Production planning & con− trol section(以下 PPCと呼ぶ)に feed backされて作業完了となる。

当工場における Production schedulingは PPCが握っており, その機能的構成は Figure 1−3 (b)" Production control system"の如くである。Production time schedule は Net−work 手法により作成され, この sheetには, 次の事項が明示されている。

i)夫々の工程における start日, 完了日及び所要日数

ii)工程(procedure)における critical path

iii)夫々の工程における作業内容及び設備 code number

iv)夫々の工程における man−hours／machine hours

PPC はこの Production time schedule を base に進捗(progress)follow－up 及び expedition を行うと同時に，man－hours／machine hours の実績に対する control及び recordingを行っている。

② Quality control

Tegal work shop におけるQuality control は Section managerを含む３人の memberによって遂行されている。従って，検査の対象範囲は，客先(client)支給又は自社設計の図面に指示されている許容値(tolerance)に対して，機械加工された又は plate work された製品・部品の寸法(dimensional)検査に限定されているのが現状である。

換言すれば，当工場における品質管理は

ⅰ)直接作業者の skillに対する信頼性

ⅱ)購入又は支給された材料の品質に対する信頼性に依存していると云っても過言ではない。

更に，加工精度の品質責任を委ねられた形の各作業者(operator)は，極めて貧弱な inspection toolに頼っており，当に skillと experience のみが唯一の信頼性基盤になっている。

猶，Erection site におけるsite fabricationの場合，その品質管理は全て，Erection supervisor によって conductされており，Quality control section は実質的に関与していない。

③ 設備保全(facility maintenance)

Tegal work shop における設備保全の実態は概略次の通りである。

ⅰ)設備を使っている operator より日々指摘される troubleに対してmaintenance section の８人が対応し，処置している。

ⅱ)Maintenance section では，上記に加えて，自から設備の general inspection を定期的に実行し preventive maintenance に努めている。

ⅲ)更に，Surabaya machine tool rehabilitation Centerの maintenance chief が６ヶ月毎にTegal work shopに来て，設備の特別診断を行い，その診断結果は Top managementに report されている。

ⅳ)部品取替・精度出し修正加工等を要する修理工事は全てSurabaya machine tool rehabilitation に送って施工されている。

ⅴ)各個の機械／設備の maintenance record はcardにして記録・保管されている。

以上のような maintenance system で運営されているが, Tegal work shop における 1984 fiscal year の maintenance budget amountは only 13 million Rp にすぎず, 平均使用年数 50 年と云う老巧設備の maintenanceに対しては, mainte－nance 要員数及び予算共に些か少な過ぎると考えられる。

④ 材料調達

当工場における材料調達はその routeの観点より次の通りに大別することが出来る。

i)自社の鋳造工場主として Surabaya foundry からの入手

ii)他社／外部からの購入

他社からの購入に関しては, 国営製鉄所からの直接購入と local distributorからの購入の２通りあるが, いずれの場合も, Tegal work shop のBranch managerが指名・組織する“Material Receiving Team”によって購入仕様／条件／価格が吟味され, 又, 検収に当っては品質のcheckが行われている。

他方, 自社鋳造工場からの入手については Suger cane mill用 spare roll shell の Cast iron材を例として次の通り理解した。

a)Marketing memberが担当砂糖工場に赴いて, 毎年８～９月に取替え roll c予約内示を受けて来る。

b)PPCにて Production Scheduleを樹て, Surabaya foundry に Shellの鋳造予約を行う。

c)12 月から４月頃の cane off seasonに砂糖工場から取替えるべき古い roll を取外して持ち帰って来る。

d)古い shellを除去して, b)で予約鋳造した新しい shellと差換えて焼嵌め(shrinkage filling)し, 機械加工の上, 相手先砂糖工場のcane season start即ち４月頃迄に納入し再組立(re－installation)を行う。

この場合, Surabaya foundry からTegal work shop への納入は全くの as cast あり, 品質検査は殆んど行われていない状態である。

前々項②品質管理でも述べたように, 品質面で特に留意を要する鋳造材の品質検査が事前に十分に行われておらず, 加工途上で欠陥(defect)が発見され, しかも補修(remedial work)不能な場合は, 納期(delivery schedule)上もtrouble 発見までの加工 cost 面からも極めて seriousな問題となることが予想される。

(4) レイアウト, 運搬設備, 建物及び付帯設備

1)レイアウト

現状レイアウトの概要は Fig. 1−4 Existing Layoutに示す通りであり, その特徴及び調査結果を以下に示す。

① 工場, 敷地のトータル面積は約 13,000 ㎡であるが, すでに, その大部分は工場建物及び付帯設備により占められており, 増設／改造のための拡張余地は無い。

② 罫書き, 切断面の位置が明確にされていないために生じる作業スペースの混乱, 又, 駐車場を工場内に設置する等, 作業スペースの有効活用がなされていない。

③ 製缶工場が2ヶ所に分散されており, 製品の加工フローが複雑となり, 非能率となっている。

2)運搬設備

現状運搬設備の概要を Fig. 1−4 Existing Layoutに示す。又, 設備の特徴及び調査結果を下記に示す。

① 天井走行クレーンの内, 数台は老巧化し, 所定の機能を発揮できないものがある。

② ベイ間搬送設備はレール台車のみである。

3)建物及び付帯設備

工場建物は 1920 に建設され, 以後順次増築されてきたが, いずれにせよ非常に古いものである。しかし, 屋根は数年前に改修され, 操業上支障は無い。

(5) インフラ, 電気及び Utility設備

既設のインフラ, 電気及び Utility設備の配置, 仕様, 状態等を調査した結果の補足説明と共に, Table 1−4 Infra−structure及び Table 1−5 Electrical and utility facilitiesに示す。

Table 1-1 Production Record

TEGAL WORKSHOP UNIT: DESPATCHED WEIGHT (TON)

CATEGORY	1980	1981	1982	1983	1984 (partially forecasted)	AVERAGE
(a) Sugar plant maintenance	125	135	130	288	320	198
(b) Plate work	600	625	620	248	310	486
(c) Steel structure for site erection	48	40	50	135	160	87
TOTAL	773	800	800	671	790	771

Table 1-2

Name of Factory : Tegal. P. T. Barata Indonesia

Production Analysis

Category of Plant	Name and Specification of Typical Component	Average Production per annum	Drawings Source			Bottleneck Facility	Critical Path in Procedure	Bottleneck Technique	Remarks
			Own Design	Sub-contract	Under License				
		(pcs)							
Sugar	Roll shell	30	○	○	—	Lathe (internal bore) *	Shrinkage fitting *		Horizontal positior with Impact hammer
	Roll pinion	15	○	○	—	Slotting machine (key way)			
	Square coupling	5	○	○	—				
Irrigation	Gate	100	○	○	—	——			
	Bevel gear	600	○	○	—	Gear cutting mach'n *			Marking Shaping & Hand finishing (present process)
Pump	Casing (machining)								
Boggy	Shaft (machining)								Foreign material

Table 1-3 Personnel

TEGAL WORKSHOP (in 1984)

Classification	Numbers	Remarks
1) Manager	1	Branch manager
2) Engineers		
a) University graduated	4	Including sectional managers.
b) High school graduated	81	
3) Employees	53	Financial, accountants, typist, etc.
4) Direct workers		
a) Skilled	78	
b) Unskilled	26	Helpers.
5) Indirect workers	28	Security, drivers, time-keeper, etc.
6) Total	271	

Table 1-4 Infrastructure

ITEM	SURVEY RESULT	REMARKS
1.1 Transportation		
(1) Name of port	Cirebon	
(2) Capacity of pier	150 Ton (Pontoon)	
(3) Capacity of loading/unloading equipment	-	
(4) Distance to loading/unloading port	75 km	
(5) Minimum width of road	-	
(6) Hight clearance of overbridge structure	3.5m	
(7) Limitation of cargo size	2.5 MW x 12 ML	
(8) Limitation of load over access road	30 Ton	
1.2 Electrical/Communication system		
(1) Availability of power supply system	P.L.N.	
(2) Availability of public telephone system	TELCOM	
(3) Availability of public telex system	-	
(4) Availability of public facsimile system	-	
1.3 Utility		
(1) Availability of public water supply system	P.D.A.M	Water from P.L.N and own well are also utilized.
(2) Junction of site drainage with public waterway	Public side ditch along highway.	

Table 1-5 Electrical and Utility Facilities (1/3)

ITEM	SURVEY RESULT	REMARKS
1.1 Power supply system		
(1) Power source (Power Corp./Own power plant)	P.L.N.	
(2) Capacity of power source Capacity of main transformer (KVA)	200 KVA x 1 set for 220V 100 KVA x 1 set for 380V	380V power is utilized only for latest machine (D-64)
(3) Voltage 1) Receiving voltage (HV/UHV) 2) Service voltage (LV)	6 KV, 3 Phase, 50 Hz 220/380 V, 3 Phase - for Motor 220/110 V, 1 Phase - for LTG. & Outlet	
(4) Consumption	19,000 KWH/Mo.	
(5) Emergency Generator	None	
(6) Allowance of public substation		
1.2 Lighting system (Illumination level)		
Location	Illumination Level	Kind of Lamp
(1) Work shop	0 - 50 Lux -	Mercury vapor lamp
(2) Office	300 Lux -	Fluorescent lamp

Table 1-5 Electrical and Utility Facilities (2/3)

ITEM		SURVEY RESULT	REMARKS
1.3	Communication system		
	(1) Direct Line (Telephone)	2 Lines	
	(2) Inter phone system	12 Local sets	
1.4	Air conditioning/ventilation system		
	(1) Office building	Unit type air-conditioner (Total 10 sets)	
	(2) Work shop	Natural ventilation	
1.5	Fire-fighting system		
	(1) Fire extinguisher	12 sets of ABC type	
1.6	Compressed air supply system		
	Compressor		
	Q'ty:	2 sets	
	Capacity:	150 CFM each.	
	Pressure:	7.4 kg/cm^2	

Table 1-5 *Electrical and Utility Facilities (3/3)*

ITEM		SURVEY RESULT		REMARKS
1.7	Water supply system			
	(1) Water source	P.D.A.M.	P.L.N.	Well
	(2) Capacity of water source			
	1) Supply pump capacity	- Ton/H	2" pipe	1 HP Pump
	2) Storage tank capacity	1 Ton	20 Ton	0.75 Ton
	(3) Consumption of water	25 Ton/Mo.	-	
	(4) Service pressure	- Kg/cm^2	10 kg/cm^2	2 kg/cm^2
		Purchased daily Tank by Tank	Supplied by PLN's head tank without any payment	Used for only one toilet
	(5) Water treatment for special purpose	Boiling		

Fig. 1-1 Barata Organisation

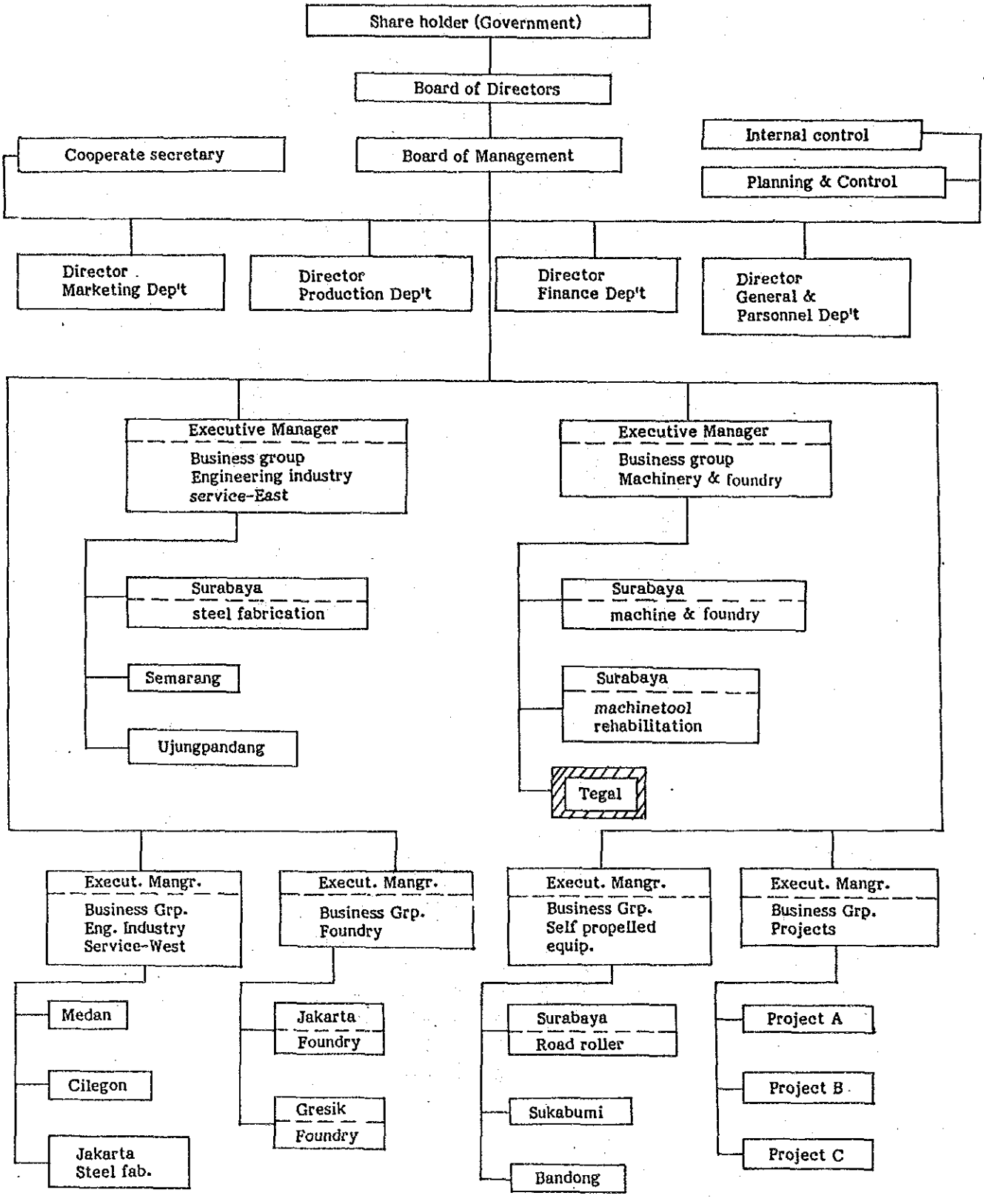


Fig. 1-2 Organization Chart

Tegal Factory (in 1984)

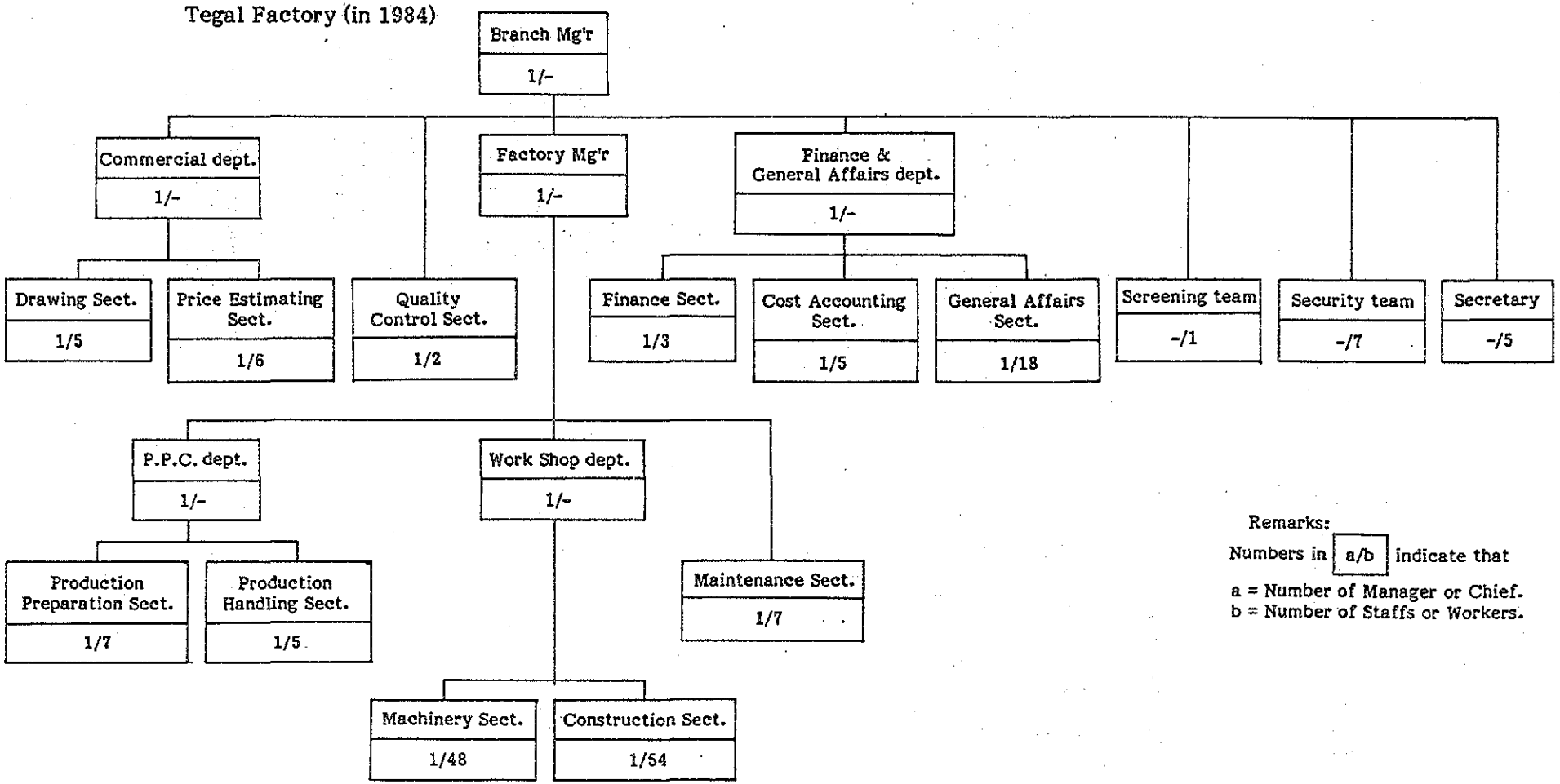
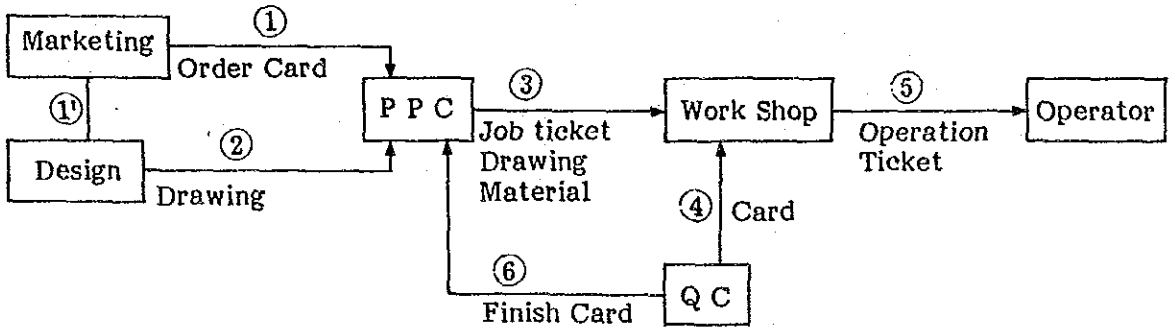
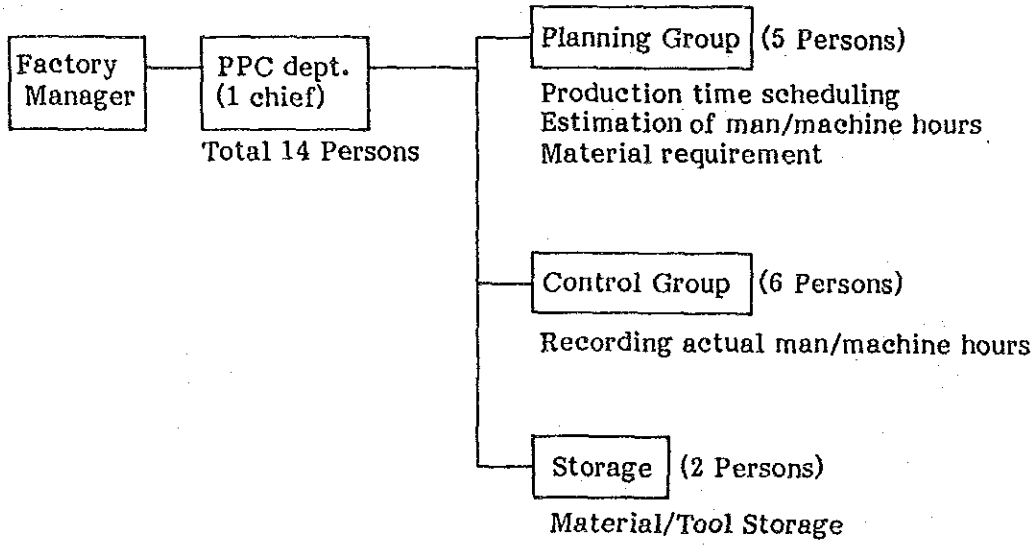


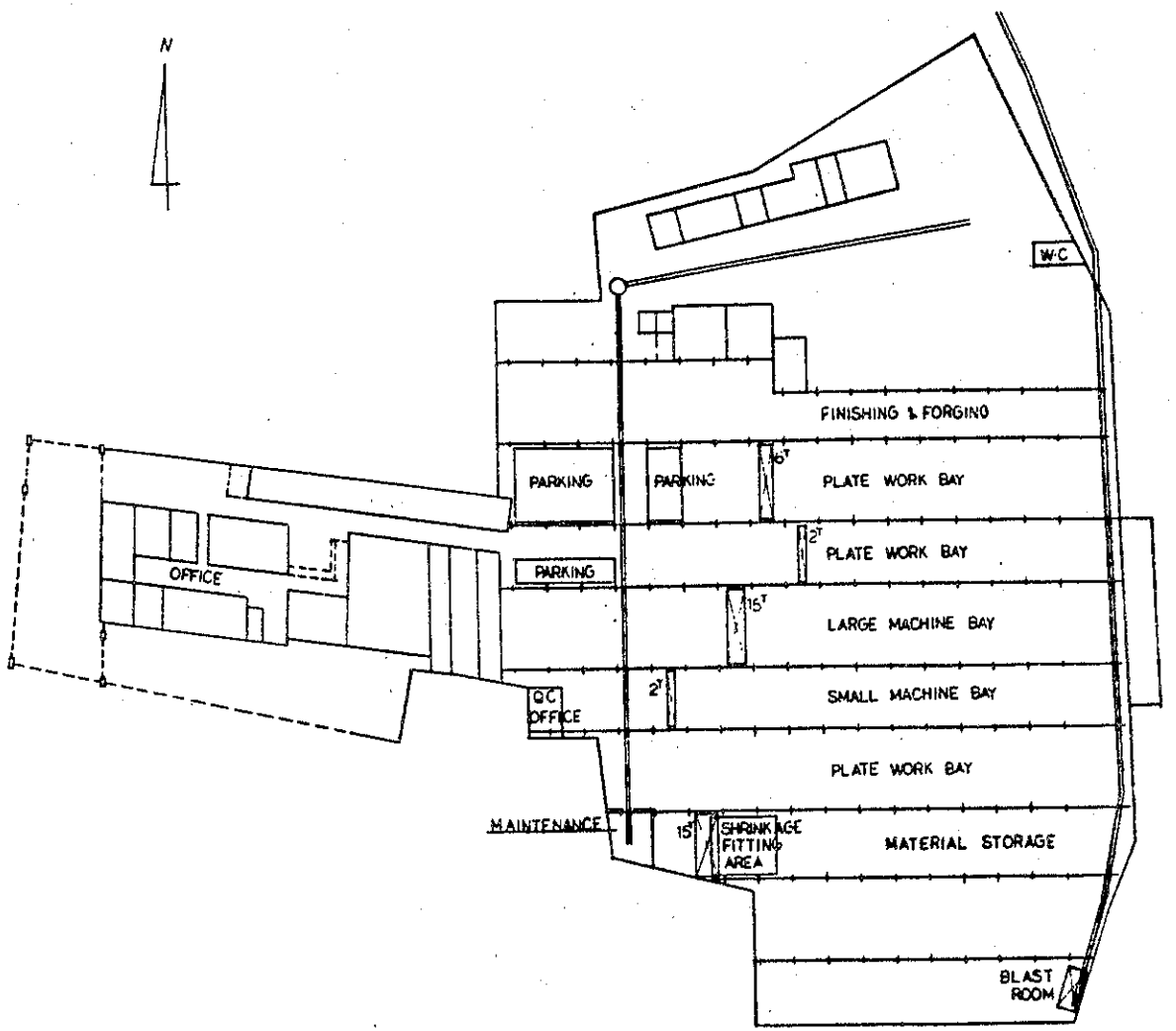
Fig. 1-3 Production Control System in Barata Tegal Work Shop

(a) Production Order Flow



(b) Functional Organization





SCALE

0 5 10 20 30m

Fig. 1-4

P.T. BARATA-TEGAL

EXISTING LAYOUT

4-4-17

4.4.2 技術的前提条件

(1) 工場立地

Tegal work shop は市街地の中心部にあり，工場敷地は既に道路及び隣接建物に囲まれており拡張の余地は全くない。更に，工場敷地内には，僅かバレーコート一面分の空地を残し，工場建屋及び事務所が占拠して，増築の余地はない。

しかし，工場建屋内には一部従業員用駐車場に当てられており，又，天井クレーンがなく活用されていないスペースもある。

従って，既設工場の一部分改築と工場内レイアウトの思い切った変更を以って建屋全体の有効活用を計り，生産能力の増強と生産性の向上を指向する必要がある。

(2) 生産設備の選定基準

当工場における基幹製品は砂糖工場のメインテナンス用 spare parts であり，次いで，Irrigation 用機器である事を前提に，機械加工(machining)設備及び製缶(plate work)設備の両面を強化する必要がある。

但し，工場建屋構造及び P. T. Barata Indonesia における当工場の性格付けから考えて，設備の大型化を標榜する必要はない。

設備計画の基本方針を次の通り考える。

1) cane mill roll 及び irrigation 用 gate 巻上装置部品等繰返し生産品目に対しては専用機を検討する。

2) plate work に対しては現在欠如している plate forming 設備を検討する。又，自動溶接機の導入についても検討する。

3) 当工場は負荷の季節変動が極めて大きい事を考慮して，peak時用に既存設備を可能な範囲で残しておくことが必要と考え，必要な修理･改造を検討する。

4) 電源は既に仕様的にも問題があるので，今回のリノベーションに留らず，将来の設備更新をも考慮した受変電設備を検討する。

5) 工場敷地･建屋面積等の制約を考慮し，砂糖工場の修理･改造や irrigation 用に要求される簡単な steel structure は，外注ないし現地(erection field site)加工を検討する。

(3) 輸送限界

製品の積出しは,75km離れた Cirebong 港より 150 Ton 積バージを利用するか, 320km 離れた Jakartaの Priok 港, 470km 離れた Surabaya の Perak 港まで内陸輸送するかであるが, Tegal work shop の製品構成及び性格より考えて, Cirebong 港で十分であると判断される。

内陸輸送の制限は,警察の許認可を前提に,車輌積載状態で 3.5mH × 2.5mW × 12mL までとなっており,又,製品重量としては約30ton 迄である。

従って, Tegal work shop の場合,輸送限界による工場設備計画への制約は特にないものと判断する。

4.4.3 リノベーションの基本計画

(1) 生産計画

1) 基本方針

P. T. Barata Indonesia は, Tegal work shop を Java 中部地区における General work shop として develop することを志向しており, その基本構想を次の通り考えている。

① 主たる任務は, Java 中部地区における Suger plant のmaintenance service 及び spare parts supply であることは変えない。

② Irrigation用のplate work は, 中厚板及び薄板に限定する。

③ Cement plant, suger plant の新設工事又は修理改造工事を P. T. Barata Indonesia が受注した場合は, 地理的輸送条件が許す限り, その構成器械・部品の製作, 修理工事を Site fabrication を含めて分担させる。

④ 上記①の工事が Suger cane off season に集中するため, 機械加工の負荷変動を少しでも緩和するため, Gresik foundry で鋳造する台車用の車軸, Jakarta foundryで鋳造する pump 用 casing の機械加工を夫々Tegal work shop に移す。

2) 生産計画(production program)

Tegal work shop の生産計画は, Market research の結果及び前節 1)で述べた基本方針を base にTable 3−1 "Production program"の如く設定した。

① Sugar cane mill roll の spare supply

Tegal work shop の基幹品目であり, Java中部地区における現在のmarket share 15%を少くとも倍以上に伸ばすことが必至である。

更には, 加工時期の集中化を可及的に緩和することが望まれ, ために, 客先である Sugar plant から Spare roll の予約注文を出来る限り早い時期に受けるような交渉努力が必要である。

② Other machining work

台車用車軸, pump casing 等繰返して受注・生産している品目については, 客先の予約注文を受ける交渉努力と併せて, P. T. Barata Indonesia としてもある程度の見込生産を考え, 通年負荷の平準化・安定化を計る必要があろう。

③ Plate work

従来, Plate workの主体が irrigation 用であったが, これも季節変動要素の大きい品目であるため, Cement plant 用及び Sugar plant用の plate work itemを受注してゆくことが必要である。

④ Steel structure

Sugar plant 新設工事, 修理改造工事及び Irrigation 用の Steel structure は Plate work item の附帯工事として, 主として site fabrication item として施工すべきものである。

3) local contents

Market research の結果に基づく 1 million ton／year Cement plant 用及び 4000 Ton／day Sugar plant 用構成器械·部品の localization は, 設備能力の計画 base としての観点から検討した。

但し localization の真の具現は, 設備能力のみならず, 製造技術(Design and production engineering)及び material availability, price competitiveness 等の要因が重要な factor になっている。

(2) 負荷計画と所要設備

1) 負荷計画

前節で示した生産計画を工程別の負荷として, Man-Machine Hour に展開した結果を Table 3−2 PRODUCTION LOAD PLAN に示す。

本表中, Plate work に関しては, Man-Hourで, Machining に関しては, Machine-Hour で表示している。

何れもリノベーション前後における設備能率の差異, 及び作業習熟効果等による生産性向上要因を加味したものである。

猶, 限られた工場面積を可及的有効に活用し, 付加価値を高めることを狙いとして, 生産計画における Steel structure 及び, 極めて単純な light gauge plate work は, Erection field site での加工又は加工外注とすることを原則とした。

2) 新設備選定方針

Tegal general work shop の新設備選定方針は以下の通り考えた。

① 原則として, 当工場における今後の重点製品に係るものついて新設する。

② 新設備は, 製品構造, 生産性を考え近代的なものにする。

例えば, 主として Sugar 用 roll の軸端部を加工する Floor type boring／milling machine を NC 装置付の仕様としたこと等である。

③ 新しくローカル化を図るものの製作工程上必要なもので，現存の設備に欠けているものを補う。

例えば，傘歯車歯切盤，油圧プレス等である。

④ 猶，当工場は将来とも負荷の季節変動は避け難く，負荷ピーク時の対策をも考え，現存設備のうち「流用可」なるは，そのまま又は改造修理して使用する。

⑤ 上記旧設備再使用の分の一部については，負荷率も低く，コンスタントな作業員を配置すること無く，必要時のみ，他機械の作業員によって稼動させることを前提とした。

(3) 現工場の改善計画

上記の4.4.3 (1)生産計画及びの4.4.3 (2)負荷計画に対応する生産設備を確保するために必要な現工場の改造計画を下記に示す。

1) 生産設備及び検査設備

① 現地調査の結果，現存機械の診断を行ない，使用可能なもの，改造・修理により使用可能なもの，及び今後の生産計画上使用できないものの3グループに分類した表を，Table 3−3 Summary of existing facilities に示す。

② 改造・修理により使用可能な機械については，改造・修理の概要をTable 3−4 Facility plan(Machine rehabilitation relocation)に示す。

尚，改造・修理工事に関しては，機械設備サプライヤーのスコープとして以下の通り実施する。

i) サプライヤーの派遣するスーパーバイザーが現物をチェックし，改造・修理ポイントを摘出する。

ii) 上記に基づき，サプライヤーが必要部品の製作・供給を行なう。

iii) 改造・修理はTegal work shopのメインテナンス メンバーがサプライヤーの派遣するスーパーバイザー指導下にて施工する。

③ 負荷計画により決定された，必要な機械設備類の種類と数量を満足させるために，新規に購入すべき機械設備の概略仕様と数量を Table 3−5 Facility plan(New machine tool)に示す。

2）運搬設備

① 既存設備の調査結果と生産計画に基づく，製品フロー及び，製品の取扱い重量より，レイアウトに示されるような，工場内クレーン類が必要となり，下記を新規に購入することとなる。

・天井走行クレーン	15T	4台
・　〃	6T	1台
・　〃	2T	2台
・壁付ジブホイスト	1T	2台

② 同様に，工場内の棟間運搬及び棟内での近距離運搬のために，下記車両の購入が必要である。

・フォークリフト	2T	1台
・無軌道台車	15T	1台
・　〃	2T	1台

③ 新規購入のクレーン等運搬設備の概要を Table 3−6 Facility plan(Handling equipment) に示す。

3）建物及び付帯設備

計画された生産設備，検査設備及び運搬設備を設置するために，下記の改造工事が必要である。その概要はTable 3−7 Facility plan(Building Auxiliary facilities)に示す。

① D−E棟(Bay D−E)増強工事

大型工作機械エリアとして，15 TON 天井走行クレーン搭載可能な工場とするために，主柱，基礎の補強及びクレーンガーダー／レールを更新する。

② B−C棟(Bay B−C)増強工事

2 TON 天井走行クレーン新設に伴ない，クレーンガーダー及びレールを新設する。

③ 電気室工事

④ 食堂間仕切変更工事

⑤ パーキングエリア用間仕切変更工事

⑥ 柱ジブクレーン用柱補強工事

4）電気及びユーティリティ設備

生産計画を満足させるために，既設々備の能力増強及び老巧化対策として，下記の改造及び更新工事が必要である。その概要は，Table 3－8 Facility plan(Infrastructure／Electrical／Utiliy facilities)に示す。

① 電力会社(P. L. N)に対する受電負担金

受電容量を約500 KVAに増強するための費用。又，受電々圧も6 KVより22KVに変更される。

② 受電設備工事

受電要領アップ及び既設々備の老巧化の理由により今回，受変電設備を全面的に更新する。

③ 動力配線工事

新設工作機械／設備の設置及び既設々備の移設又は，撤去に伴ない，電源配線工事を行なう。又，既設地中埋設配線は，極力流用する。

④ 照明設備

作業性及び安全上の理由より，照明増設工事を行なう。

増設場所及び照度は下記の通り。

i）ケガキ場　　200 Lux.

ii）工場内主通路　　50 Lux.

(4) 工場建設工事と据付計画

本リノベーションを実施するためには，まず，F／Sに示された基本計画を従って，機器類の詳細仕様の決定及び，必要なインフラ，運搬設備，建屋，電気及びユーティリティ設備の増強または改造に関する詳細仕様の決定または設計を行い，機器調達及び現地工事を外部に委託しなければならない。

上記の，いわゆるD／D業務の内容が，リノベーションの全体投資額及び工程に大きく影響するため，本リノベーションの類似プロジェクトの経験豊かで，総合的なエンジニアリング能力を持つコンサルタントを採用するのが望ましい。

また，本リノベーションにおいて設計すべきものも多く，また，設計者による部分的工事監理も不可欠であり，インドネシアにおいて，この種の業務に経験を有する設計者をD／Dコンサルタントの責任下で活用する必要がある。

コンサルタントに要求されるD／D業務の具体的内容は下記のとおりである。

1）現状設備の詳細調査

2）F／Sの理解と必要な場合の修正

3）新設機器，工具類の購入及び据付工事仕様書の作成

4）既設機器，工具類の改造仕様書の作成

5）運搬設備購入及び据付仕様書の作成

6）建屋改造工事の設計及び発注仕様書の作成

7）電気及びユーティリティ設備工事の設計及び発注仕様書の作成

8）リノベーション実施計画書の作成

9）各調達及び工事発注及び契約手続きに関するコンサルティング

10）購入機器類に関する図書及び詳細仕様の承認

11）機器基礎工事の設計及び発注仕様書の作成

12）主要機器の検査及び主要工事監理

但し，主要機器，設備類の据付，試運転のためのS／Vは，各機器，設備類調達の範囲内とし，D／D業務とはしないものとする。

BARATA TEGAL GENERAL WORK SHOP

Table 3-1 Production Program

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

UNIT: Ton

PRODUCT	1989					1994					1999				
	Q'TY	M	P	S	TOTAL	Q'TY	M	P	S	TOTAL	Q'TY	M	P	S	TOTAL
CEMENT															
1 mil. T/Y PLANT	1.5		650		650	1.5		650		650	1.5		650		650
PARTS SUPPLY		25	100		125		50	200		250		50	200		250
SUGAR															
4000 T/D PLANT	2		560	420	980	2		560	420	980	3		840	630	1,470
SPARE CANE MILL ROLL	50	690			690	80	1,100			1,100	80	1,100			1,100
PARTS SUPPLY		10	200		210		10	200		210		10	200		210
PLANT REHABILI-TATION	3			600	600	3			600	600	3			600	600
OTHERS															
IRIGATION GATE etc.		11		400	411		16		500	516		16		500	516
MISCELLANEOUS		368			368		568			568		677			677
TOTAL		1,104	1,510	1,420	4,034		1,744	1,610	1,520	4,874		1,853	1,890	1,730	5,473

BRATA TEGAL GENERAL WORK SHOP

Table 3-2 Production Load Plan

YEAR	CATEGORY of PRODUCTS	TOTAL PRODUCTION			BREAKDOWN of MAN/MACHINE HOURS within OWN WORKSHOP									
					PLATE WORK					MACHINING				
		in WEIGHT TON	in M/M HOURS within own shop	in M/M HOURS by sub-con. & site fabri.	MARK'G CUTTING BEVEL'G	BENDING FORMING	FITTING WELDING	OTHERS	TOTAL	LATHE group	BORING FACING group	DRILL	OTHERS	TOTAL
	CEMENT PLANT COMPONENTS	775	27,520	3,0230	3,890	3,330	18,610		25,830	440	580	560	110	1,690
1989	SUGAR PLANT COMPONENTS	2,480	149,280	120,180	17,920	10,080	84,000		112,000	27,310	3,770	1,820	4,380	37,280
	OTHERS	779	71,970	28,800	4,320	-	24,480		28,800	29,370	4,510	3,190	6,100	43,170
	TOTAL	4,034	248,770	179,210	26,130	13,410	127,090		166,630	57,120	8,860	5,570	10,590	82,140
	CEMENT PLANT COMPONENTS	900	34,260	36,500	4,840	4,150	23,160		32,150	550	730	690	140	2,110
1994	SUGAR PLANT COMPONENTS	2,890	149,760	108,160	16,130	9,070	75,600		100,800	35,860	4,940	2,390	5,770	48,960
	OTHERS	1,084	83,590	32,400	4,860	-	27,540		32,400	34,830	5,340	3,790	7,230	51,190
	TOTAL	4,874	267,610	177,060	25,830	13,220	126,300		165,350	71,240	11,010	6,870	13,140	102,260
	CEMENT PLANT COMPONENTS	900	30,440	34,230	4,300	3,690	20,580		28,570	490	650	610	120	1,870
1999	SUGAR PLANT COMPONENTS	3,380	175,200	107,900	21,500	12,100	100,800		134,400	29,890	4,120	1,990	4,800	40,800
	OTHERS	1,193	77,940	28,800	4,320	-	24,480		28,800	33,430	5,130	3,640	6,940	49,140
	TOTAL	5,473	283,580	170,930	30,120	15,790	145,860		191,770	63,810	9,900	6,240	11,860	91,810

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

COMPANY WORKS: BARATA/TEGAL

MACHINE NAME	MAX	CAPACITY/ SIZE	YEAR A.D. When machine was manufactured	Q'TY	RESULT OF SURVEY TO BE SCRAPPED	TO BE MODERNIZED	WORKABLE	REMARKS
LATHE MACHINE	CENTER DISTANCE	: 8,000 mm	1970 -	1	-	-	1	
	CENTER HEIGHT ABOVE BED	: 550 mm	1950 - 1969	9	-	2	7	
			1930 - 1949	11	3	2	6	
			- 1929	3	-	-	3	
BORING & MILLING MACHINE	CENTER OF SPINDLE HEIGHT ABOVE TABLE	: 500 - 1,600 mm	1970 -	-	-	-	-	
			1950 - 1969	1	-	-	1	
	SPINDLE STROKE	: 950 mm	1930 - 1949	6	1	-	5	
	TABLE LENGTH	: 3,200 mm	- 1929	3	1	-	2	
DRILLING MACHINE	TABLE LENGTH	: 2,020 mm	1970 -	-	-	-	-	
	TABLE WIDTH	: 1,210 mm						
	DRILLING DEPTH	: 360 mm	1950 - 1969	2	2	-	-	
	DISTANCE SPINDLE TO COLUMN	: 1,500 mm	1930 - 1949	4	-	2	2	
			- 1929	-	-	-	-	
PLANOMILLER & PLANER	TABLE LENGTH	: 4,000 mm	1970 -	-	-	-	-	
	TABLE WIDTH	: 1,400 mm	1950 - 1969	1	1	-	-	
	PLANING LENGTH	: 3,700 mm	1930 - 1949	2	1	-	1	
	PLANING HEIGHT	: 1,200 mm	- 1929	-	-	-	-	

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

COMPANY WORKS: BARATA/TEGAL

MACHINE NAME	MAX	CAPACITY/ SIZE	YEAR A.D. When machine was manufactured	Q'TY	RESULT OF SURVEY TO BE SCRAPPED	TO BE MODERNIZED	WORKABLE	REMARKS
SHAPER & SLOTTER	TABLE DIAMETER	: ϕ 600 mm	1970 -	-	-	-	-	
	LONGITUDINAL TRAVEL	: 350 mm	1950 - 1969	3	1	-	2	
	TRANSVERSE TRAVEL	: 450 mm	1930 - 1949	1	-	-	1	
			- 1929	1	-	-	1	
OTHER MACHINES			1970 -	-	-	-	-	
			1950 - 1969	-	-	-	-	
			1930 - 1949	2	2	-	-	
			- 1929	-	-	-	-	
SURFACE PREPARATION			1970 -	2	-	-	2	
			1950 - 1969	1	1	-	-	
			1930 - 1949	-	-	-	-	
			- 1929	1	-	-	1	
CUTTING EQUIPMENT	CUTTING THICKNESS	: 16 mm	1970 -	-	-	-	-	
			1950 - 1969	3	-	-	3	
			1930 - 1949	1	1	-	-	
			- 1929	-	-	-	-	

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

COMPANY WORKS: BARATA/TEGAL

MACHINE NAME	MAX	CAPACITY/ SIZE	YEAR A.D. When machine was manufactured	Q'TY	RESULT OF SURVEY TO BE SCRAPPED	TO BE MODERNIZED	WORKABLE	REMARKS
FORMING MACHINE	PLATE LENGTH	: 2,400 mm	1970 -	-	-	-	-	
	PLATE THICKNESS	: 3/8"	1950 - 1969	-	-	-	-	
			1930 - 1949	3	1	1	1	
			- 1929	-	-	-	-	
WELDING EQUIPMENT			1970 -	9	6	-	3	
			1950 - 1969	3	-	1	2	
			1930 - 1949	3	1	-	2	
			- 1929	-	-	-	-	
OTHER FACILITY & EQUIPMENT			1970 -	2	1	-	1	BLOWER MACHINE, AIR COMPRESSOR, ETC.
			1950 - 1969	4	2	-	2	
			1930 - 1949	-	-	-	-	
			- 1929	-	-	-	-	
TRANSPORTATION EQUIPMENT	O.H.T. CRANE	: 15 tons	1970 -	-	-	-	-	
			1950 - 1969	-	-	-	-	
			1930 - 1949	6	-	1	5	
			- 1929	-	-	-	-	

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

COMPANY WORKS: BARATA/TEGAL

MACHINE NAME	MAX CAPACITY/ SIZE	YEAR A.D. When machine was manufactured	Q'TY	RESULT OF SURVEY TO BE SCRAPPED	TO BE MODERNIZED	WORKABLE	REMARKS
VOID		1970 -					
		1950 - 1969					
		1930 - 1949					
		- 1929					
		1970 -					
		1950 - 1969					
		1930 - 1949					
		- 1929					

Table 3-4 Facility Plan (Machine Rehabilitation & Relocation) (1/5)

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
	D4 (1 set)	Lathe Machine (Reform and overhaul specifications) 1. Change of belt drive system to motor and reduction gears drive system to increase spindle speed and cutting ability. 2. Replacement and adjustment of bearing metals and bearings in each part. 3. Fitting and accuracy adjustment of worn sliding surfaces and connections. Replacement and adjustment of worn parts. 4. Check of electric, hydraulic, air, lubricating oil systems (including cutting oil pump unit). Restoration and conditioning of lost functions and parts. 5. Replacement or correction of lead screws. Replacement and adjustment of internal screws (including feed screws). 6. Total restoration, reassembling, test run, and cutting test. 7. Correction, restoration, finish painting of other exterior items.	The drive system is totally changed from the belt system to the motor system, and functions with lowered accuracy are restored, thus serving to augmenting capacity to meet the requirements at a peak load.	
	D5 (1 set)	Lathe Machine (Reform and overhaul specifications) 1. Change of belt drive system to motor and reduction gears drive system to increase spindle speed and cutting ability. 2. Replacement and adjustment of bearing metals and bearings in each parts. 3. Fitting and accuracy adjustment of worn sliding surfaces and connections. Replacement and adjustment of worn parts. 4. Check of electric, hydraulic, air, lubricating oil systems (including cutting oil pump unit). Restoration and conditioning of lost functions and parts. 5. Replacement or correction of lead screws. Replacement and adjustment of internal secrews (including feed screws). 6. Total restoration, reassembling, test run, and cutting test. 7. Correction, restoration, and finish painting of other exterior items.	as above	

BARATA TEGAL GENERAL WORK SHOP

Table 3-4 Facility Plan (Machine Rehabilitation & Relocation) (2/5)

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
	D7 (1 set)	Lathe Machine (Reform and overhaul specifications) 1. Change of belt drive system to motor and reduction gears drive system to increase spindle speed and cutting ability. 2. Replacement and adjustment of bearing metals and bearings in each part. 3. Fitting and accuracy adjustment of worn sliding surfaces and connections. Replacement and adjustment of worn parts. 4. Check of electric, hydraulic, air, and lubricating oil systems (including cutting oil pump unit). Restoration and conditioning of lost functions and parts. 5. Replacement or correction of lead screws. Replacement and adjustment of internal screws (including feed screws). 6. Total restoration, reassembling, test run, and cutting test. 7. Correction, restoration, finish painting of other exterior items.	The drive system is totally changed from the belt drive system to the motor system, and functions with lowered accuracy are restored, thus serving to augmenting capacity to meet the requirements at a peak load.	
	D56 (1 set)	Horizontal Milling Machine (Reform and overhaul specifications) 1. Change of belt drive system to motor and reduction gears drive system to increase spindle speed and cutting ability. 2. Replacement and adjustment of bearing metals and bearings in each part. 3. Fitting and accuracy adjustment of worn sliding surfaces and connections. Replacement and adjustment of worn parts. 4. Check of electric, hydraulic, air, and lubricating oil systems (including cutting oil pump unit). Restoration and conditioning of lost functions and parts. 5. Replacement or correction of lead screws. Replacement and adjustment of internal screws (including feed screws). 6. Total restoration, reassembling, test run, and cutting test. 7. Correction, restoration, finish painting of other exterior items.	*as above*	

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

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
	D52 (1 set)	Planing Machine (Reform and overhaul specifications) 1. Change of belt drive system to motor and reduction gears drive system to increase spindle speed and cutting ability. 2. Replacement and adjustment of bearing metals and bearings in each part. 3. Fitting and accuracy adjustment of worn sliding surfaces and connections. Replacement and adjustment of worn parts. 4. Check of electric,hydraulic, air, and lubricating oil systems (including cutting oil pump unit). Restoration and conditioning of lost functions and parts. 5. Replacement or correction of lead screws. Replacement and adjustment of internal screws (including feed screws). 6. Total restoration, reassembling, test run, and cutting test. 7. Correction, restoration, finish painting of other exterior items.	The drive system is totally changed from the belt drive system to the motor drive system, and functions with lowered accuracy are restored, thus serving to augmenting capacity to meet the requirements at a peak load.	
	D23 (1 set)	Lathe Machine (Overhaul specifications) 1. Total overhaul and check. Replacement and adjustment of bearing metals and bearings in each part. 2. Fitting and accuracy adjustment of worn sliding surfaces and connections in each part. Replacement and adjustment of worn parts. 3. Check of electric, hydraulic, air, and lubricating oil systems (including cutting oil pump unit). Restoration and adjustment of lost functions and parts. 4. Replacement or correction of lead screws. Replacement and adjustment of internal screws (including feed screws). 5. Total restoration, reassembling, test run, and cutting test. 6. Correction, restoration and finish painting of other exterior items.	Inferior accuracy, due to deterioration require overhaul, which serves to augmenting capacity at a peak load. (particularly, noise is large at present.)	

BARATA TEGAL GENERAL WORK SHOP

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

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
	D1 (1 set)	Lathe Machine (Overhaul specifications) 1. Total overhaul and check. Replacement and adjustment of bearing metals and bearings in each part. 2. Fitting and accuracy adjustment of worn sliding surfaces and connections in each part. Replacement and adjustment of worn parts. 3. Check of electric, hydraulic, air, and lubricating oil systems (including cutting oil pump unit). Restoration and adjustment of lost functions and parts. 4. Replacement or correction of lead screws. Replacement and adjustment of internal screws. 5. Total restoration, reassembling, test run, and cutting test. 6. Correction, restoration, and finish paintings of other exterior items.	Obsolescence and badly lowered accuracy require overhaul, which serves to augmenting capacity at a peak load.	
	Others (4 units)	Cutting machine and plate work equipment (Overhaul and partial correction) Required correction specifications are determined after detailed check on Detailed Design.		

BARATA TEGAL GENERAL WORK SHOP

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

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
	C120	Air Hammer Machine	Required by change in layout	Bay A-B ⟶ Bay I-J
	C121	Blower		
	C109	Profile Cutting Machine		
	C125	Air Hammer Machine		
	C106	Riveting Machine	as above	Bay D-E ⟶ Bay F-G
	B78	Sawing Machine		
	D76	Column Drilling Machine		
	D23	Lathe Machine	as above	Bay D-E ⟶ Bay F-G
	D2	Lathe Machine		
	D52	Planing Machine		
	D55	Horizontal Boring Machine		
	D5	Lathe Machine		
	D6	Lathe Machine		
	D40	Slotting Machine		
	D8	Lathe Machine		
	D22	Lathe Machine		
	D1	Lathe Machine		
	D60	Milling Machine		

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Table 3-5 Facility Plan (New Machine Tool) (1/36)

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
L-7	BL (2 sets)	Heavy Duty Large Lathe with Boring System			This machine substitutes the badly deteriorated existing machine. This is a new, special purpose machine manufactured with special specifications to bore the sugar roll, one of the major products.	
		1. Technical Specifications				
		(1) Swing over bed	mm	2,200		
		(2) Swing over carriage	mm	1,650		
		(3) Max. distance between center line of main spindle and inside face of tool post	mm	1,200		
		(4) Max. distance between center (O, D Cutting)	mm	5,000		
		2. Main power				
		(1) Main drive motor	kw	DC55		
		3. Standard accessories		1 set		
		4. Optionals accessories		1 set		
		(1) Boring guide support 520-1150 mm dia.		(1 set)		
		(2) Boring bar head 450-860 mm dia.		(1 set)		

BARATA TEGAL GENERAL WORK SHOP

Table 3-5 Facility Plan (New Machine Tool) (2/36)

NO.	FACILITY	DESCRIPTION				BASIS OF PLAN	REMARKS
L-8	L (1 set)	Heavy Duty Lathe				This machine is newly installed to serve as a special-purpose machine for finish-machining the sugar roll (shaft & shell) after shrinkage fit.	
		1. Specifications					
		(1) Swing over bed	mm (in)	1,600	(63)		
		(2) Swing over carriage	mm (in)	1,200	(48)		
		(3) Distance between centers	mm (in)	8,000	(314 3/4)		
		(4) Motors					
		• Main drive	kW (HP)	AC4P, 45 (60)			
		2. Standard accessories			1 set		
		3. Special accessories			1 set		
L-10	L (3 sets)	Heavy Duty High Speed Lathe				This machine serves to machine axles of the rail boggy.	
		1. Specifications					
		(1) Swing over bed	mm (in)	630	(24 3/4)		
		(2) Swing over carriage	mm (in)	400	(15 3/4)		
		(3) Swing in gap	mm (in)	900	(35 1/2)		
		(4) Distance between centers	mm (in)	2,000	(78 3/4)		
		(5) Main drive motor	kW (HP)	4P 7.5 or 11 (10 or 15)			

BARATA TEGAL GENERAL WORK SHOP

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

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
		2. Standard accessories: 3 sets		
		3. Special accessories: 3 sets		
L-17	L (1 set)	Heavy Duty Lathe 1. Specifications (1) Swing over bed: mm (in) 2,000 (78 3/4) (2) Swing over carriage: mm (in) 1,600 (63) (3) Max. distance between centers: mm (in) 10,000 (393 3/4) (4) Motors • Main drive : AC 4P 45 kW (60 HP) • Helical driving geared motor : AC 3.7 kW • Milling cutter driving motor : AC 2.2 kW 2. Standard accessories: 1 set 3. Special accessories: 1 set	This machine is a new, powerful, and special-purpose machine mainly used for chevron-grooving the sugar cane roll.	

Table 3-5 Facility Plan (New Machine Tool) (4/36)

NO.	FACILITY	DESCRIPTION				BASIS OF PLAN	REMARKS
L-9	LV (1 set)	Vertical Boring & Turning Mill				This machine is newly installed to substitute the existing obsoleted machine, and mainly used for machining the sugar pinion.	
		1. Specifications					
		(1) Table diameter	mm (in)	2,000	(78.7)		
		(2) Max. Swing	mm (in)	4,000	(157)		
		(3) Max. work height	mm (in)	2,000	(79)		
		(4) Vertical travel of rail head	mm (in)	1,000	(39.4)		
		(5) Horizontal travel of side head ram	mm (in)	500	(19.6)		
		(6) Swivel angle of rail head (both in and out)	30^{o}				
		(7) Vertical travel of cross rail	mm (in)	1,450	(57)		
		(8) Max, table load	kgf (lbs)	16,000	(35,300)		
		(9) Main motor	AC 4P 37 kW		(50 HP)		
		2. Standard accessories		1 set			
		3. Special accessories		1 set			
L-11	LV (1 set)	Vertical Boring & Turning Mill				This machine is mainly used for machining, before gear cutting, the axle for the rail boggy and the bevel gear for irrigation.	
		1. Specifications					
		(1) Table diameter	mm (in)	1,600	(63)		
		(2) Max. workpiece diameter	mm (in)	2,000	(78.7)		
		(3) Max. work height	mm (in)	1,500	(59)		
		(4) Rail- head cross travel	mm (in)	-100 to 1,000	(-3.9 to 39)		
		(5) Rail-head ram vertical travel	mm (in)	1,000	(39.4)		
		(6) Rail-head swivel angle (right & left)	30^{o}				
		(7) Cross-rail vertical travel	mm (in)	1,000	(39.4)		
		(8) Max, table load	kgf (lbs)	8,000	(17.64)		
		(9) Main motor	AC 4P 30 kW		(40 HP)		

BARATA TEGAL GENERAL WORK SHOP

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

NO.	FACILITY	DESCRIPTION		BASIS OF PLAN	REMARKS
		2. Standard accessories	1 set		
		3. Special accessories	1 set		
		(1) Digital read out system (axis XY)	(1 set)		

Table 3-5 Facility Plan (New Machine Tool) (6/36)

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
B-1	BF (1 set)	Floor-Type Horizontal Milling & Boring Machine	This is a new, powerful machine mainly used for machining the key way on the sugar roll shaft and the sugar roll shaft end to a rectangular shape. This machine is equipped with an NC device, and attachments such as a special-purpose floor plate, rotary table, angle plate. This machine is capable of a wide range of machining, with high accuracy and efficiency.	

1. Machine specifications

(1) Spindle diameter	mm (in)	130	(5.12)
(2) Sliding sleeve diameter	mm (in)	340	(13.4)
(3) Milling spindle nose diameter	mm (in)	225	(8.86)
(4) Spindle taper	ISO 7/24 taper No. 50		
(5) Sliding sleeve travel	mm (in)	450	(17.7)
(6) Spindle travel	mm (in)	1,000	(39.4)
(7) Total travel of sliding sleeve and spindle	mm (in)	1,000	(39.4)

2. Electrical equipment

(1) Spindle drive motor: DC 18.5/25 kW (25/33 HP) cont. 30 min. rating

(2) Axis drive DC servo motor

For column horizontal travel	(X axis)	2.8 kW (4 HP)
For spindle head vertical travel	(Y axis)	
For spindle and sliding sleeve travel	(Z axis)	

(3) MDI-NC system

3. Machine dimensions in relation to horizontal travel and spindle head vertical travel

(1) Column horizontal travel	mm (in)	4,500	(177)
(2) Spindle head vertical travel	mm (in)	3,500	(138)

4. Standard accessories: 1 set

5. Optional accessories: 1 set

BARATA TEGAL GENERAL WORK SHOP

Table 3-5 Facility Plan (New Machine Tool) (7/36)

NO.	FACILITY	DESCRIPTION		BASIS OF PLAN	REMARKS
		(1) Angle head	(1 set)		
		(2) Universal head	(1 set)		
		(3) Rotary table (various type)	(1 set)		
		(4) *Floor plate and jack screws for level adjustment* 1600 x 2400 x 300 mm (63 x 94 x 39.5")	(4 sets)		
		(5) Angle plate 1500 x 2500 x 4000 mm (59 x 89.4 x 157.5")	(2 pcs/1 set)		
		(6) MDI-system	(1 set)		

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Table 3-5 Facility Plan (New Machine Tool) (8/36)

NO.	FACILITY	DESCRIPTION				BASIS OF PLAN	REMARKS
D-1	DR (2 sets)	Radial Drills				The purpose of this machine is mainly to drill screw holes at the end of the sugar cane roll shell.	
		1. Specifications					
		(1) Machining capacity					
		• Drilling solid steel	mm (in)	75	(3)		
		• Drilling cast iron	mm (in)	90	(3 5/8)		
		• Boring in steel	mm (in)	200	(7 7/8)		
		• Boring in cast iron	mm (in)	280	(11)		
		(2) Spindle					
		• Dia. of spindle and quil	mm (in)	75/95	(3,3 3/4)		
		• Vertical travel	mm (in)	400	(15 3/4)		
		• Morse-taper		No. 5			
		(3) Dimensions					
		• Max. distance, column surface to spindle center	mm (in)	1,620	(63 3/4)		
		(4) Motors					
		• Spindle drive	kW (HP)	7.5	(10)		
		• Arm elevation	kW (HP)	2.2	(3)		
		2. Standard accessories		1 set			
		3. Special accessories		1 set			
		(1) Leveling block		(1 set)			
		(2) Tilting table		(1 set)			

Table 3-5 Facility Plan (New Machine Tool) (9/36)

NO.	FACILITY	DESCRIPTION				BASIS OF PLAN	REMARKS
D-2	DR (2 sets)	Radial Drills				Augmentation of capacity.	
		1. Specifications					
		(1) Machining capacity					
		• Drilling solid steel	mm (in)	75	(3)		
		• Drilling cast iron	mm (in)	90	(3 5/8)		
		• Boring in steel	mm (in)	200	(7 7/8)		
		• Boring in cast iron	mm (in)	280	(11)		
		(2) Spindle					
		• Dia. of spindle and quil	mm (in)	75/95	(3,3 3/4)		
		• Vertical travel	mm (in)	400	(15 3/4)		
		• Morse-taper		No. 5			
		(3) Dimensions					
		• Max. distance, column surface to spindle center	mm (in)	2,020	(79 1/2)		
		(4) Motors					
		• Spindle drive	kW (HP)	7.5	(10)		
		• *Arm elevation*	kW (HP)	3.7	(5)		
		2. Standard accessories		1 set			
		3. Special accessories		1 set			
		(1) Leveling block		(4 pcs)			
		(2) Tilting table		(1 set)			

Table 3-5 Facility Plan (New Machine Tool) (10/36)

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
Z-2	BGS (1 set)	Bevel Gear Shaper			The existing machine is almost scrap. The function is difficult to restore because parts are inavailable. The new machine is newly installed to meet the mass-production requirements of the bevel gear for irrigation as shown in the future production program.	Bevel gears for irrigation winch, etc.
		1. Capacity				
		(1) Max. pitch diameter of work piece to be cut				
		Ratio 2 : 1 to 8 : 1	mm	610		
		Ratio 1 : 1	mm	610		
		(2) Max. cone distance of bevel gear	mm	525		
		(3) Max. width of tooth	mm	160		
		(4) Max. module		20		
		(5) Min. number of teeth				
		Ratio 8 : 1		10		
		Ratio 1 : 1		14		
		(6) Pitch cone angle of bevel gear				
		Max.		83°		
		Min.		7°		
		(7) Max. ratio of gear		8 : 1		
		2. Dimensions				
		(1) Distance from face plate to apex				
		Max.	mm	521		
		Min.	mm	51		
		(2) Diameter of face plate	mm	480		
		(3) Center height of work head	mm	343		
		3. Motors				
		(1) Main motor	kW	5.5		
		4. Standard accessories		1 set		
		5. Optional accessories		1 set		

Table 3-5 Facility Plan (New Machine Tool) (11/36)

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
S-1	SH (1 set)	Shaper			Augmentation of capacity.	
		1. Specifications				
		(1) Max. stroke	mm	550		
		(2) Max. shaping width	mm	600		
		(3) Vertical travel of table	mm	240		
		(4) Max. distance between table surface and ram	mm	350		
		(5) Table dimensions (L x H x W)	mm	420 x 370 x 355		
		(6) Vertical travel of tool holder	mm	170		
		(7) Motor	kW x p	1.8 x 4		
		2. Standard accessories		1 set		
		3. Optional accessories		1 set		
		(1) Automatic feed stop device		(1 set)		
SL-1	SL (1 set)	Heavy Duty Precision Slotting Machine			Augmentation of capacity. This machine is mainly used for machining the keyway of the sugar pinion.	
		1. Specifications				
		(1) Ram				
		· Max, stroke	mm	615		
		· Forward tilt of ram		0 – 10°		
		· Drive motor	kW x p	7.5 x 4		
		(2) Table				
		· Dia. of working surface	mm	1,000 dia.		
		· Longitudinal traverse	mm	650		
		· Cross traverse	mm	600		
		· Table center to column	mm	835 – 1,485		
		· Max. workpiece weight on the table	kg	3,500		

Table 3-5 Facility Plan (New Machine Tool) (12/36)

NO.	FACILITY	DESCRIPTION		BASIS OF PLAN	REMARKS
		2. Standard accessories	1 set		
		3. Special accessories	1 set		
		(1) Auto sizing device with ram top stopping & zero cutting device	(1 set)		
		(2) Working finish signal lamp	(1 set)		
		(3) Digital indicator for table travel	(1 set)		

BARATA TEGAL GENERAL WORK SHOP

Table 3-5 Facility Plan (New Machine Tool) (13/36)

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
G-1	U.T.G. (1 set)	Universal Cutter & Tool Grinder				
		1. *General specifications*				
		(1) Capacity				
		• Swing over table	mm (in)	250 (10)		
		• Distance between centers	mm (in)	700 (27 1/2)		
		• Distance between tailstock & workhead	mm (in)	580 (22 3/4)		
		(2) Table				
		• Working surface	mm (in)	135 x 940 (5 5/6 x 37)		
		(3) Motors				
		• Grinding wheel spindle motor	kW (HP)	0.75 (1)		
		(option)	kW (HP)	1.5 (2)		
		2. Standard accessories		1 *set*		
		3. Optional accessories		1 set		

BARATA TEGAL GENERAL WORK SHOP

Table 3-5 Facility Plan (New Machine Tool) (14/36)

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
G-2	D.H.G. (2 sets)	High Speed Double Head Grinding Machine				
		1. Specifications				
		(1) Wheel size (O.D x W x I.D)	mm	ϕ355 x 50 x ϕ31.75		
		(2) Motor for wheel head	kW	2.2/0.75		
		2. Standard accessories		1 set		
		3. Optional accessories		1 set		

Table 3-5 Facility Plan (New Machine Tool) (15/36)

NO.	FACILITY	DESCRIPTION		BASIS OF PLAN	REMARKS
WZ-1	Bader Machine (2 sets)	Bader Machine		The purpose of this machine is to finish weld beads, with enhanced efficiency.	
		1. Specifications			
		(1) Belt size (width x length)	75 x 3,350 mm		
		(2) Belt speed	2,000 m/min.		
		(3) Motor	200/220V 2P 5HP		
		2. Accessories (Standard)	1 set		
WZ-4	High Speed Cutting Machine (2 setes)	High Speed Cutting Machine (Cut Grinder)		The purpose of this machine is to cut shaped steels, with enhanced efficiency.	
		1. Specifications			
		(1) Wheel dimensions	510^{ϕ} x 4 x 30^{ϕ}mm		
		(2) Vise O.D.	250 mm		
		(3) Cutting capacity (Max.)	125^{ϕ} mm		
		(4) Motor power	5.5 kW		
		2. Accessories (Standard)	1 set		

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Table 3-5 Facility Plan (New Machine Tool) (16/36)

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
WZ-5	Portable Flame Cutting Machine (2 sets)	Semi Automatically Cuts Straight Lines and Bevels			The purpose of this machine is to improve cutting accuracy and achieve high efficiency.	
		1. Specifications		440 x 205 x 215		
		(1) Overall dimensions (L x W x H)	mm (in)	(17 x 8 x 8 1/2)		
		(2) Motor - Condenser induction Motor	9W/10W	A.C 100V or 200V		
		(3) Cutting capacity (thickness)	mm (in)	5 - 100 (1/5 - 4)		
		2. Standard accessories		1 set		
		3. Options		1 set		

Table 3-5 Facility Plan (New Machine Tool) (17/36)

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
WZ-6	Portable Flame Cutting Machine (2 sets)	Semi Automatically Cuts Straight Lines, Circles and Bevels			same as WZ-5	
		1. Specifications		460 x 120 x 240		
		(1) Overall dimensions (L x W x H)	mm (in)	(18 x 4 3/5 x 9 1/2)		
		(2) Motor (Universal motor AC.DC)	V	100 or 200		
		(3) Cutting capacity (thickness)	mm (in)	5 - 100 (1/5 - 4)		
		(4) Circle cutting range (diameter)	mm (in)	60 - 1,200 (2 - 47)		
		2. Construction & accessories		1 set		

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Table 3-5 Facility Plan (New Machine Tool) (18/36)

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
SM-1	Shearing Machine (1 set)	New Gapless Shears			Augmentation of capacity.	
		1. Specifications				
		(1) Cutting capacity	10 mm x 2,500 mm			
		(2) Shear angle	$2^{\circ}30'$			
		(3) Motor powers	11 kW	(15 HP)		
		2. Accessories		1 set		

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Table 3-5 Facility Plan (New Machine Tool) (19/36)

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
BR-2	Bending Roller (1 set)	Pyramid Type Plate Bending Rolls 1. Specifications (1) Bending capacity • Materials of steel plate to be bent Material: Steel plate • Max. bending capacity Width 3,000 mm Thickness 30 mm Inside diameter 700 mm (2) Motors • Main drive motor 37 kW 6P 1 set • Top roll adjusting motor 22 kW 6P 1 set • Top roll counter balance motor 3.7 kW 6P 1 set • Bearing swing down motor 2.2 kW 6P 1 set 2. Spare parts & others' 1 set	This machine is used for manufacturing sugar tanks and containers, with augmented capacity.	

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Table 3-5 Facility Plan (New Machine Tool) (20/36)

NO.	FACILITY	DESCRIPTION		BASIS OF PLAN	REMARKS
HP-4	Hydraulic Press (1 set)	360 Ton Hydraulic Press		This press is required in relation with BR-2 to augment capacity.	
		1. Specifications			
		(1) Max. pressing capacity	300 Ton		
		(2) Stroke	600 mm		
		(3) Daylight	1,100 mm		
		(4) Effective working area of table	3,100 x 1,200 mm		
		(5) Bolster dimensions	1,020 x 630 mm		
		(6) Main motor	11 kW x 4P		
		2. Accessories (Standard)	1 set		

Table 3-5 Facility Plan (New Machine Tool) (21/36)

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
W-1	Welding Machine (2 sets)	Submerged Arc Welder			This welder is used for welding cylindrical parts such as tanks and containers for the sugar plant. The purpose of this machine is to automate welding and improve weld quality. TR-2 turning roll and MP-1 manipulator is equipped as relevant equipment.	
		1. Specifications				
		(1) Max. welding current	A	1,500		
		(2) Welding wire diameter	mm	3.2 - 6.4		
		(3) Control system ..... Solid state variable speed control				
		(4) Travel speed	cm/min	10 - 100		
		(5) Wire reel		Magazine type		
		(6) Capacity of flux hopper	ltr.	6		
		(7) Adjustable range of nozzle	mm mm	Vertical 50 Horizontal 50		
		2. Accessories		1 set		
W-2 W-3	Welding Machine (2 sets) (2 sets)	A.C Arc Welders				
		1. Specifications		W-2 / W-3		
		(1) Secondary current	A	500 / 300		
		(2) Primary input	KVA-kW	43-23 / 24-13		
		(3) Secondary current range	A	80-510 / 50-300		
		(4) Max. secondary no-load voltage	V	85 / 80		
		(5) Duty cycle	%	60 / 40		
		(6) Electrode size	mm	3.2-8 / 2.0-6		
		2. Accessories		1 set		
W-4	Welding Machine (1 set)	Thyristor Controlled DC Power Supplies for Arc Air Gouging & Blasting				
		1. Specifications				
		(1) Rated output current	A	600		
		(2) Current range (single range)	A	100 - 600		
		(3) Arc voltage	V	46		
		(4) Duty cycle	%	60		
		(5) Open circuit voltage	V	15		
		(6) Input voltage phase	V	380 - 3		
		(7) Frequency	Hz	50/60		
		(8) Input at rated load	KVA-kW	42 - 33.5		

Table 3-5 Facility Plan (New Machine Tool) (22/36)

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
W-5	Diesel Welder (2 sets)	Engine Welder				
		1. Specifications				
		(1) Welding motor generator				
		• Nominal rating	kW	6.82		
		• Rated output current	A	220		
		• Rated voltage	V	31		
		• Current range	A	50 - 240		
		• Duty cycle	%	50		
		• Rotation frequency	rpm	3,000		
		• Electrode size	mm	2.6 – 4.0		
		(2) Alternating current generator				
		• Nominal rating (3 phase)	kVA	5		
		• Rated voltage	V	200		
		• Power factor		1.0		
		• Frequency	Hz	50		
		• Rating		Continuity		
		(3) Engine				
		• Nominal rating	PS/rpm	16/3000		
		• Displacement	c.c	751		
		• Fuel	Gas oil (JIS No. 2)			
		• Fuel tank capacity	ltr.	19		
		• Starting system		Cell motor		
		• Battery		12V-NS-60		
		• Dimensions (L x W x H)	mm	1,340 x 675 x 890		
		• Weight	kg	375		

Table 3-5 *Facility Plan (New Machine Tool)* (23/36)

NO.	FACILITY	DESCRIPTION		BASIS OF PLAN	REMARKS
TR-2	Turning Rolls (1 set)	Low Shaft Type Turning Rolls		Refer to W-1.	
		1. *Specifications*			
		(1) Loading weight	60,000 kg		
		(2) Work piece dia.	600 - 7,000 mm		
		(3) Roll peripheral speed	50 Hz/60 Hz 83-830^{rpm}/100-1000^{rpm}		
		(4) Roll outer dia. x width	ϕ400 x 260 mm		
		(5) Drive	Double wheels		
		(6) Motor	3ϕ 200V - 3.7 kW		
		2. Accessories (Standard)	1 set		
SR-1	Steel Rolls (4 sets)	Steel Rolls			
		1. Specifications			
		(1) Loading weight	20,000 kg		
		(2) Work piece dia.	600 - 7,000 mm		
		(3) Roll outer dia. x width	ϕ315 x 170 mm		
		(4) Drive	Nothing		
		2. Accessories (Standard)	1 set		

Table 3-5 Facility Plan (New Machine Tool) (24/36)

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
MP-1	Manipulators	Center Boom Manipulators	Refer to W-1.	
	(1 set)	1. Specifications		
		(1) Horizontal boom travel distance 3,000 mm		
		(2) Horizontal boom travel speed 150 - 1,500 mm/min.		
		(3) Vertical boom travel distance 3,000 mm		
		(4) Vertical boom travel speed 800 mm/min.		
		(5) Max. load capacity at boom's end 100 kg		
		2. Accessories (Standard) 1 set		

Table 3-5 Facility Plan (New Machine Tool) (25/36)

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
WD-1	Welding Rod Dryer (1 set)	Drying Oven for Electrodes 1. Specifications	Augmentation of equipment.	

(1)	Total welding rod weight treatable	200 kg
(2)	Max. operating temperature	400°C
(3)	Number of shevles	5 tiers 2 rows
(4)	Max. power consumption	6.0 kW
(5)	Power supply	3 phase 200V
(6)	Temperature regulator	electronically controlled
(7)	Max. welding rod length treatable	550 mm
(8)	Agitating fan	X
(9)	Thermometer	O
(10)	Wheeled or not	Not wheeled
(11)	Overall dimension (H x W x D)	975 x 750 x 680 mm
(12)	Capacity (H x W x D)	450 x 650 x 570 mm
(13)	Weight	200 kg

Table 3-5 Facility Plan (New Machine Tool) (26/36)

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
WD-2	Welding Flux Dryer (1 set)	Drying Oven for Electrodes Flux 1. Specifications (1) Weight of flux-cored wire treatable: 50 kg (2) Max. operating temperature: 300°C (3) Number of chambers: 1 (4) Max. power consumption: 6 kW (5) Power supply: 200 V 3 phase (6) Temperature regulator: Electronically controlled (7) Mode of drying: Rotary drum (8) Temperature: Provided (9) Overall dimension (H x W x D): 1,200 x 1,550 x 950 mm	Augmentation of equipment.	
WD-3	Welding Rod Oven (1 set)	Welding Rod Oven 1. Specifications (1) Total welding rod weight treatable: 200 kg (2) Max. operating temperature: 120°C (3) Number of chambers: 5 tiers 2 rows (4) Max. power consumption: 3.6 kW (5) Power supply: 220 V (6) Temperature regulator: Electronically controlled (7) Max. welding rod length treatable: 550 mm (8) Wheeled or not: Not wheeled (9) Overall dimension (H x W x D): 1,255 x 650 x 800 mm (10) Weight: 200 kg	Augmentation of equipment.	

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 (10 type)	1 set		
	(34)	Depth micrometer (0-50 - 75-100 11 size)	1 set		
	(35)	Depth gauge (A type 150 - 1,000 7 size)	1 set		
	(36)	Gear tooth vernier (M1.5-12, 2.5-25 2 size)	1 set		
	(37)	Thickness & taper gauge (No. 65M, No.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.	

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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)		

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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	580 lit/min		
		(4) Tank capacity	160 lit		
		2. Accessories (standard)	1 set		

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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

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	

BARATA TEGAL GENERAL WORK SHOP

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*			Location;
		1) Dimension	(Total 285 M^2)		Bay; H-I
		Width	; 19 M		Column; 1-4
		Length	; 15 M		
		Height	; 4 M		
		2) Structure			
		Wall	; C.G.I.S.		
		Ceiling	; board		
BW-05	Partition work for Parking area	Major specifications			*Location;*
		1) Dimension	(Total 413 M^2)		Bay; I-J
		Width	; 7 M		Column; 5-17
		Length	; 59 M		
		2) Outline works			
		a. New partition work along bay I			
		b. Removal of existing wall along bay J			
BW-06	Reinforcement of columns for Jib hoist (2 places)	Major specifications			Location; E-9, F-6
		Capacity of Jib hoist	; 1 TON - 5 M		

BARATA TEGAL GENERAL WORK SHOP

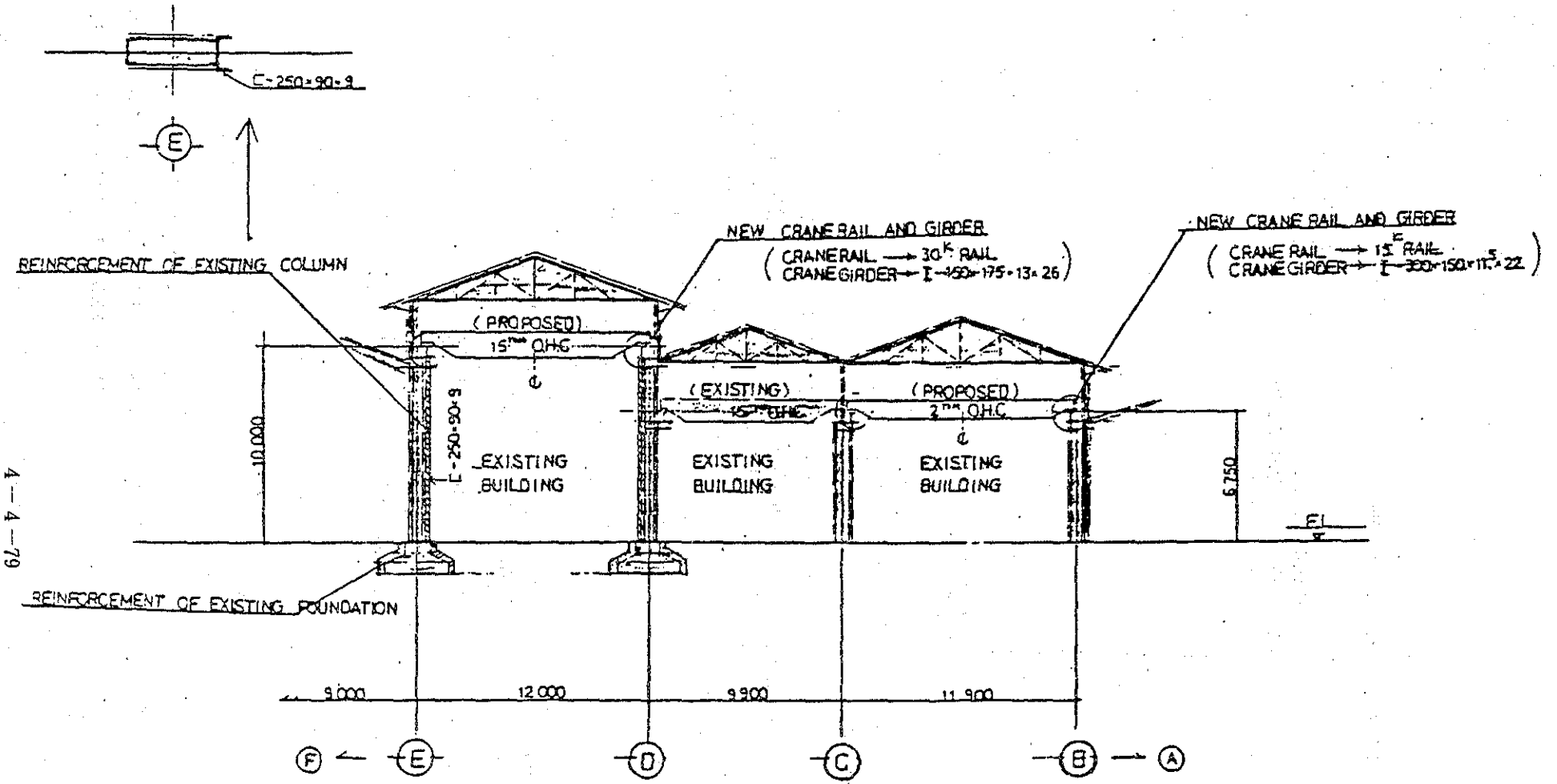
Table 3-8 Facility Plan (Infra-Structure/Electrical/Utility Facilities) (1/2)

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 Ⓑ~Ⓔ Scale 1/200

Fig. 3-1

BARATA -TEGAL
REINFORCEMENT OF BAY B-C & D-E

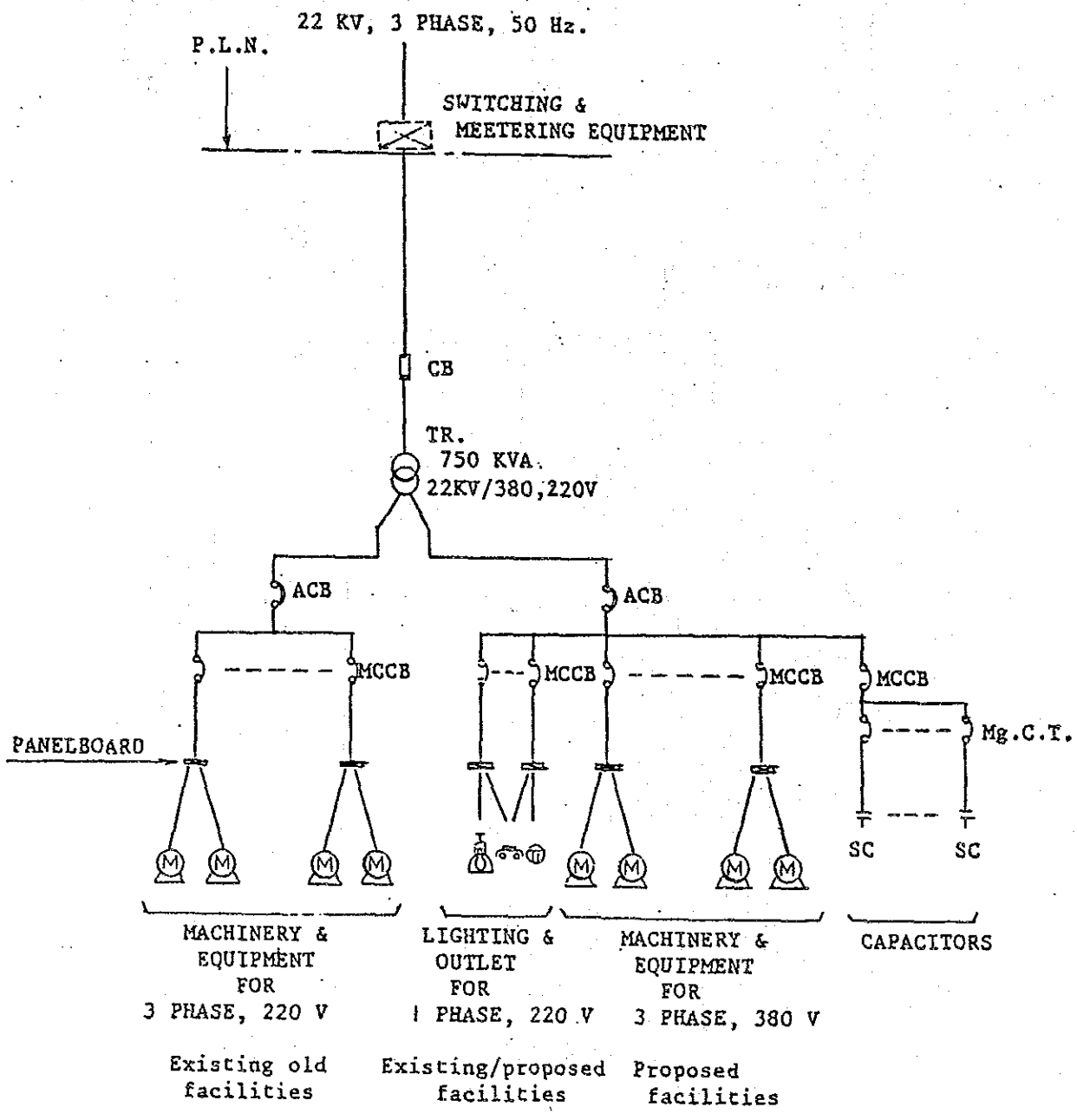


Fig. 3 - 2
BARATA TEGAL GENERAL WORK SHOP
PROPOSED SUBSTATION SYSTEM

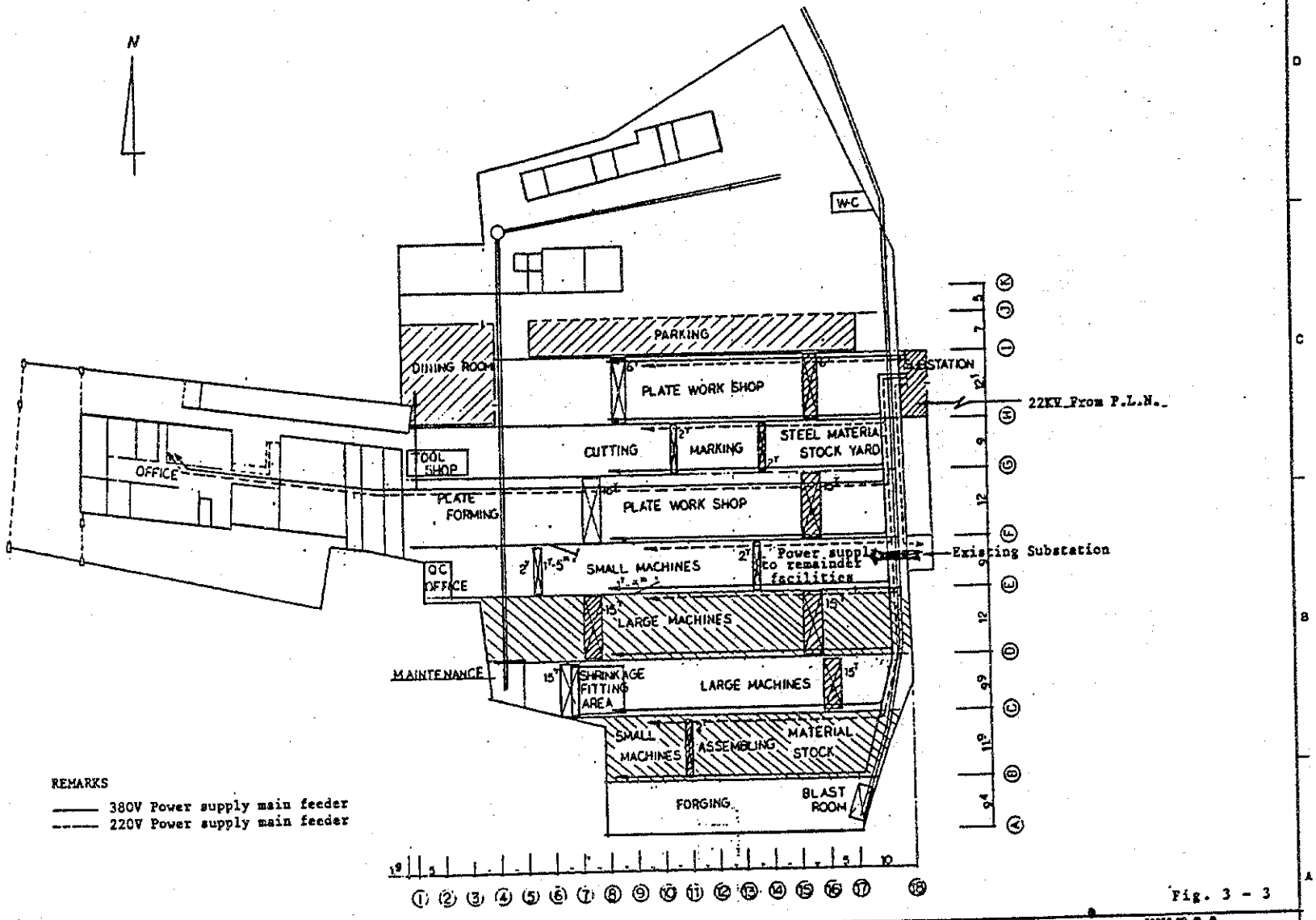

N
W-C
PARKING
DINING ROOM
PLATE WORK SHOP
SUBSTATION
22KV From P.L.N.
OFFICE
TOOL SHOP
CUTTING
MARKING
STEEL MATERIAL STOCK YARD
PLATE FORMING
PLATE WORK SHOP
QC OFFICE
SMALL MACHINES
Power supply to remainder facilities
Existing Substation
LARGE MACHINES
MAINTENANCE
SHRINKAGE FITTING AREA
LARGE MACHINES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

Fig. 3 - 3