3.5.4 Pulp and Paper Plant

Table 3-54 shows the pulp and paper plant processing equipment by the ENAA's Function classification, assuming the standard production capacity to be 90 thousand t/y, with further classification into local manufacture and import.

Table 3-54 Equipment of Pulp & Paper Plant by ENAA Classification

(Unit: T)

Classification of ENAA	Local	Import	Total	Remarks
Equipment	1,890.4	305.6	2,196.0	
-Towers	46.9	15.0	61.9	
-Vessels	396.2	70.6	466.8	
-Tanks	1404.0	190.0	1594.0	
-Heat Exchangers	43.3	30.0	73.3	
-Air Cooled Exchangers				
-Furnace				
Rotating Machines	-	345.7	345.7	
-Pumps	-	119.7	119.7	
-Compressors				
-Turbines				
-Blowers/Fans				
-Speed Transmissions	-	226.0	226.0	
-Diesel Engines				
Miscellaneous Equipment	731.5	1,090.1	1,821.6	
-Agitators	16.0	80.0	96.0	
-Filters	-	230.0	230.0	
-Centrifuges	-	10.0	10.0	
-Decanters				
-Screens				
-Thickners	-	48.0	48.0	
-Cyclones	13.9	1.0	14.9	
-Dryers	95.0	17.0	112.0	
-Conveyors	238.6	110.0	348.6	
-Feeders	368.0	584.3	952.3	
-Crushers				
-Granulators				

(Unit: T)

Classification of ENAA	Local	Import	Total	Remarks
-Ejectors				
-Weighers	-	9.8	9.8	
-Dust Collectors				
-Flares				
-Cooling Towers				
Package Units	89	-	89	
-Pelletizers				
-Deminelizers				
-Softners				
-Boilers				
-Air Dryer Package Units	89	-	89	
Piping	1,432.9	250.9	1,683.8	
-Pipe Fittings	1.046.3	38.6	1,084.9	
-Valves	-	102.3	102.3	
-Accessories	267.5	-	267.5	
-Others	119.1	110.0	229.1	
Instrumentation	-	308	308	
-Board Instruments				
-Field Instruments				
-Detectors, Gauges and Switches				
-Control Valves and Accessories				
-Instrument Panels				
-Materials for Instruments Installation Works				

(Unit: T)

Classification of ENAA	Local	Import	Total	Remarks
Electorical	500	1,179	1,679	
-H/V Switch Board				
-Power Transformer				
-Motors				
-Control Source				
-Control Panel				
-Local Equipment				
-Motor Speed Control Panel				
-Lighting Fixtures				
-Fire Alarm System				
-Paging System				
-Electrical Materials				
Civil and Architecture	2,621.4	71.0	2,692.4	
-Building Facilities	2,621.4	71.0	2,692.4	
Others	23	-	23	
-Fire Fighting System	23	-	23	
-Labo. & Machine Shop				
Items Not Classified by ENAA				
Total	6,788.2	3,550.3	10,338.5	

3.5.5 Palm Oil Plant

Table 3-55 shows the palm oil plant equipment by the ENAA's Function classification, assuming the standard production capacity to be 30TFFB/H, with further classification into local manufacture and import.

Since there is no palm oil plant in Japan, Japanese manufacturers have less experience in palm oil plant. Therefore, the classification was made based on the available published data and information.

The standard unit capacity of palm oil plant was set at 30 TFFB/H according to the hearing result in the site survey. The annual plant construction prospects, which is described later, were given on the basis of this capacity. When larger unit capacity, 40 TFFB/H for instance, is employed, the number of plants reduces. Therefore, the influence on the annual plant processing equipment demand is considered to be small.

Table 3-55 Equipment of Palm Oil Plant by ENAA Classification

(Unit: T)

Classification of ENAA	Local	Import	Total	Remarks
Equipment	92	-	92	
-Towers				
-Vessels	74	-	74	
-Tanks	18	-	18	
-Heat Exchangers				
-Air Cooled Exchangers				
-Furnace				
Rotating Machines	3	5	8	
-Pumps	-	2	2	
-Compressors	-	1	1	
-Turbines				
-Blowers/Fans	3	-	3	
-Speed Transmissions	-	2	2	
-Diesel Engines				
Miscellaneous Equipment	137.1	2.1	139.2	
-Agitators	0.1	-	0.1	
-Filters	4	-	4	
-Centrifuges				
-Decanters				
-Screens				
-Thickners				
-Cyclones				
-Dryers	17	-	17	
-Conveyors	19	-	19	
-Feeders	70	-	70	
-Crushers	27	-	27	
-Granulators				

(Unit: T)

Classification of ENAA	Local	Import	Total	Remarks
-Ejectors	-	0.1	0.1	
-Weighers	-	2	2	
-Dust Collectors				
-Flares				
-Cooling Towers				
Package Units	40	-	40	
-Pelletizers				
-Deminelizers				
-Softners				
-Boilers	40	-	40	
-Air Dryer Package Units				
Piping	16	0.5	16.5	
-Pipe Fittings	4	-	4	
-Valves	-	0.5	0.5	
-Accessories				
-Others	12	-	12	
Instrumentation				
-Board Instruments				
-Field Instruments				
-Detectors, Gauges and Switches				
-Control Valves and Accessories				
-Instrument Panels				
-Materials for Instruments Installation Works				

(Unit: T)

Classification of ENAA	Local	Import	Total	Remarks
Electorical	-	3.5	3.5	
-H/V Switch Board				
-Power Transformer				
-Motors				
-Control Source				
-Control Panel				
-Local Equipment				
-Motor Speed Control Panel				
-Lighting Fixtures				
-Fire Alarm System				
-Paging System				
-Electrical Materials				
Civil and Architecture				
-Building Facilities				
Others				
-Fire Fighting System				
-Labo. & Machine Shop				
Items Not Classified by ENAA				
Total	288.1	11.1	299.2	

3.5.6 Plant Equipment Configuration and Localization (Summary)

The plant equipment configuration and the localization plan were summarized on the basis of the result of the above study.

(1) ENAA's Category classification

Each plant processing equipment indicated by the ENAA's Function classification above is summarized according to the ENAA's Category classification here as shown in Table 3-56. The localization rate for each plant is shown below.

Plant	Localization Rate (%)
- Cement Plant	52.4
- Sugar Plant	70.7
- Fertilizer Plant	65.6
- Pulp & Paper Plant	67.2
- Palm Oil Plant	96.3

(2) Classification by kinds of work

Table 3-57 shows each plant processing equipment classified and summarized according to the kinds of work consisting of the structure work, plate work and machine work.

Table 3-56 Summary of Localization Plan by ENAA Classification

(1/3)

(Unit: T)

Classification of ENAA	Cement Plant			Sugar Plant			Ammonia Plant			Urea Plant		
	Local	Import	Total	Local	Import	Total	Local	Import	Total	Local	Import	Total
Equipment	767	1,939	2,706	2,224	171	2,395	1,658	1,509	3,167	993	812	1,805
Rotating Machines	11	283	294	96	384	480	38	497	535	17	329	346
Miscellaneous Equipment	2,414	6,589	9,003	870	434	1,304	-	5	5	16	59	75
Package Units				545	1,156	1,701	62	195	257	35	168	203
Piping	697	945	1,642	537	158	695	2,500	452	2,952	1,050	224	1,274
Instrumentation							-	300	300	-	200	200
Electrical	880	767	1,647	191	190	381	400	1,200	1,600	250	700	950
Civil & Architecture	7,606	188	7,794	2,047	38	2,085	3,200	100	3,300	1,200	60	1,260
Others				1	161	162	370	40	410	200	20	220
Items not Classified by NEAA	27	542	569				1,780	2,230	4,010			
Total	12,402 (52.4%)	11,253 (47.6%)	23,655 (100%)	6,511 (70.7%)	2,692 (29.3%)	9,203 (100%)	10,008 (60.5%)	6,528 (39.5%)	16,536 (100%)	3,761 (59.4%)	2,572 (40.6%)	6,333 (100%)

Notes) 1) Cement Plant: 1.5 million T/Y
2) Sugar Plant: 4,000 TCD
3) Ammonia Plant: 1,000 T/D
4) Urea Plant: 1,725 T/D
5) ZA Plant: 200,000 T/Y
6) Phosphoric Acid Plant: 625 TP_2O_5/D
7) TSP Plant: 500,000 T/Y
8) Pulp & Paper Plant: 90,000 T/Y
9) Palm Oil Plant: 30 TFFB/H

(2/3)

(Unit: T)

Classification of ENAA	ZA Plant			Phosphoric Acid Plant			TSP Plant			Fertilizer Total		
	Local	Import	Total	Local	Import	Total	Local	Import	Total	Local	Import	Total
Equipment	1,563	-	1,563	452	-	452	460	34	494	5,126	2,355	7,481
Rotating Machines	64	312	376	5	56	61	44	17	61	168	1,211	1,379
Miscellaneous Equipment	83	1,177	1,260	23	8	31	144	312	456	266	1,561	1,827
Package Units	70	-	70	50	-	50	90	-	90	307	363	670
Piping	410	107	517	168	33	201	487	63	550	4,615	879	5,494
Instrumentation	-	110	110	-	70	70	-	130	130	-	810	810
Electrical	120	400	520	80	220	300	100	250	350	950	2,770	3,720
Civil & Architecture	1,900	90	1,990	1,600	80	1,680	2,000	100	2,100	9,900	430	10,330
Others	160	20	180	240	30	270	180	20	200	1,150	130	1,280
Items not Classified by ENAA												
Total	4,370 (66.4%)	2,216 (33.6%)	6,586 (100%)	2,618 (84.0%)	497 (16.0%)	3,115 (100%)	3,505 (79.1%)	926 (20.9%)	4,431 (100%)	24,262 (65.6%)	12,739 (34.4%)	37,001 (100%)

(3/3)

(Unit: T)

Classification of ENAA	Pulp & Paper Plant			Palm Oil Plant		
	Local	Import	Total	Local	Import	Total
Equipment	1,890	306	2,196	92	-	92
Rotating Machines	-	346	346	3	5	8
Miscellaneous Equipment	732	1,090	1,822	137	2	139
Package Units	89	-	89	40	-	40
Piping	1,433	251	1,684	16	1	17
Instrumentation	-	308	308			
Electrical	500	1,179	1,679	-	4	4
Civil & Architecture	2,621	71	2,692			
Others	23	-	23			
Items not Classified by ENAA						
Total	7,288 (67.2%)	3,551 (32.8%)	10,839 (100%)	288 (96.3%)	11 (3.7%)	299 (100%)

Table 3-57 Summary of Localization Plan by Kinds of Works

(Unit: T)

Plant	Structure Work			Plate Work			Machine Work			Total			Remarks
	Local	Import	Sub-total	Local	Import	Sub-total	Local	Import	Sub-total	Local	Import	Total	
Cement	7,606 (100%)	- (0%)	7,606 (100%)	2,123 (32.5%)	4,412 (67.5%)	6,535 (100%)	1,793 (23.3%)	5,886 (76.7%)	7,679 (100%)	11,522 (52.8%)	10,298 (47.2%)	21,820 (100%)	excl. electrical and instrumentation
Sugar	2,408 (98.4%)	38 (1.6%)	2,446 (100%)	3,267 (68.3%)	1,518 (31.7%)	4,785 (100%)	644 (40.5%)	945 (59.5%)	1,589 (100%)	6,319 (71.6%)	2,501 (28.4%)	8,820 (100%)	excl. electrical and instrumentation
Fertilizer													
Ammonia	4,280 (88.8%)	540 11.2%)	4,820 (100%)	5,690 (50.9%)	5,491 (49.1%)	11,181 (100%)	38 (7.1%)	497 (92.9%)	535 (100%)	10,008 (60.5%)	6,528 (39.5%)	16,536 (100%)	
Urea	1,660 (86%)	270 (14%)	1,930 (100%)	2,083 (51.4%)	1,972 (48.6%)	4,055 (100%)	17 (4.9%)	329 (95.1%)	346 (100%)	3,760 (59.4%)	2,571 (40.6%)	6,331 (100%)	
ZA	2,220 (91.7%)	200 (8.3%)	2,420 (100%)	2,086 (55%)	1,704 (45%)	3,790 (100%)	64 (17%)	312 (83%)	376 (100%)	4,370 (66.4%)	2,216 (33.6%)	6,586 (100%)	
Phosphoric Acid	1,900 (93.6%)	130 (6.4%)	2,030 (100%)	713 (69.6%)	311 (30.4%)	1,024 (100%)	5 (8.2%)	56 (91.8%)	61 (100%)	2,618 (84%)	497 (16%)	3,115 (100%)	
TSP	2,410 (93.8%)	160 (6.2%)	2,570 (100%)	1,051 (58.4%)	749 (41.6%)	1,800 (100%)	44 (72.1%)	17 (27.9%)	61 (100%)	3,505 (79.1%)	926 (20.9%)	4,431 (100%)	
Sub-total	12,610 (90.7%)	1,300 (9.3%)	13,910 (100%)	11,623 (53.2%)	10,227 (46.8%)	21,850 (100%)	168 (12.2%)	1,211 (87.8%)	1,379 (100%)	24,261 (65.6%)	12,738 (34.4%)	36,999 (100%)	
Pulp & Paper	3,358 (94.9%)	181 (5.1%)	3,539 (100%)	3,930 (56.5%)	3,023 (43.5%)	6,953 (100%)	- (0%)	346 (100%)	346 (100%)	7,288 (67.2%)	3,550 (32.8%)	10,838 (100%)	
Palm Oil	80 (98.8%)	1 (1.2%)	81 (100%)	147 (94.8%)	8 (5.2%)	155 (100%)	61 (96.8%)	2 (3.2%)	63 (100%)	288 (96.3%)	11 (3.7%)	299 (100%)	
Total	26,062 (94.5%)	1,520 (5.5%)	27,582 (100%)	21,090 (52.4%)	19,188 (47.6%)	40,278 (100%)	2,666 (24.1%)	8,390 (75.9%)	11,056 (100%)	49,678 (63.1%)	29,098 (36.9%)	78,776 ((100%)	

3.6 Total Demand Prospects of Plant Processing Equipment

The total demand of plant processing equipment was forecasted according to the result of plant construction prospects for five designated plants in Section 3.3 and the result of the study in Section 3.5. Regarding the demand of the local contents of plant processing equipment, the demands of the equipment which is now manufactured by or will be able to be manufactured in the future by BABIBO are forecasted in addition to the plant processing equipment for five designated plants.

3.6.1 Forecast of Plant Processing Equipment Demand for Five Designated Plants

Table 3-58 shows the plant processing equipment demand until 1998 classified into structure work, plate work and machine work using Table 3-57 and the plant construction prospects for five designated plants shown in Section 3.3. The equipment demand here treats all equipment quantity whose demand arises in the year when the construction starts. Therefore, it differs from the product mix of the equipment in each year actually manufactured by BABIBO.

The average total annual production quantity is 64,400 t/y in PELITA IV, 74,500 t/y in PELITA V and 77,200 t/y in PELITA VI. In these Five Year Plans, the plant equipment demand is estimated to be around 70,000 t/y.

Table 3-58 Total Demand Prospects of Plant Processing Equipment

(1/2)

(Unit: T)

Plant	Products	PELITA IV					PELITA V					PELITA VI				
		1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Cement Plant	Steel Structure	7,606	7,606	7,606	7,606			7,606	7,606	7,606	7,606	7,606		7,606		7,606
	Plate Works	6,535	6,535	6,535	6,535			6,535	6,535	6,535	6,535	6,535		6,535		6,535
	Machine Works	7,679	7,679	7,679	7,679			7,679	7,679	7,679	7,679	7,679		7,679		7,679
	Sub-total	21,820	21,820	21,820	21,820			21,820	21,820	21,820	21,820	21,820		21,820		21,820
Sugar Plant	Steel Structure	7,338	7,338	7,338	7,338	7,338	9,784	9,784	9,784	9,784	9,784	12,230	12,230	12,230	12,230	12,230
	Plate Works	14,355	14,355	14,355	14,355	14,355	19,140	19,140	19,140	19,140	19,140	23,925	23,925	23,925	23,925	23,925
	Machine Works	4,767	4,767	4,767	4,767	4,767	6,356	6,356	6,356	6,356	6,356	7,945	7,945	7,945	7,945	7,945
	Sub-total	26,460	26,460	26,460	26,460	26,460	35,280	35,280	35,280	35,280	35,280	44,100	44,100	44,100	44,100	44,100
Ammonia Plant	Steel Structure	4,820		4,820			4,820			4,820			4,820			4,820
	Plate Works	11,181		11,181			11,181			11,181			11,181			11,181
	Machine Works	535		535			535			535			535			535
	Sub-total	16,536		16,536			16,536			16,536			16,536			16,536
Urea Plant	Steel Structure	1,930		1,930			1,930			1,930			1,930			1,930
	Plate Works	4,055		4,055			4,055			4,055			4,055			4,055
	Machine Works	346		346			346			346			346			346
	Sub-total	6,331		6,331			6,331			6,331			6,331			6,331
ZA Plant	Steel Structure			2,420				2,420				2,420				2,420
	Plate Works			3,790				3,790				3,790				3,790
	Machine Works			376				376				376				376
	Sub-total			6,586				6,586				6,586				6,586

(2/2)
(Unit: T)

Plant	Products	PELITA IV					PELITA V					PELITA VI				
		1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Phosphoric Acid Plant	Steel Structure			2,030				2,030						2,030		
	Plate Works			1,024				1,024						1,024		
	Machine Works			61				61						61		
	Sub-total			3,115				3,115						3,115		
TSP Plant	Steel Structure		2,570		2,570			2,570			2,570			2,570		
	Plate Works		1,800		1,800			1,800			1,800			1,800		
	Machine Works		61		61			61			61			61		
	Sub-total		4,431		4,431			4,431			4,431			4,431		
Pulp & Paper Plant	Steel Structure		2,922		2,922		2,922		2,922		2,922		2,922		2,922	
	Plate Works		7,570		7,570		7,570		7,570		7,570		7,570		7,570	
	Machine Works		346		346		346		346		346		346		346	
	Sub-total		10,838		10,838		10,838		10,838		10,838		10,838		10,838	
Palm Oil Plant	Steel Structure	891	891	891	891	891	648	648	648	648	648	648	648	648	648	648
	Plate Works	1,705	1,705	1,705	1,705	1,705	1,240	1,240	1,240	1,240	1,240	1,240	1,240	1,240	1,240	1,240
	Machine Works	693	693	693	693	693	504	504	504	504	504	504	504	504	504	504
	Sub-total	3,289	3,289	3,289	3,289	3,289	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392
Total	Steel Structure	22,585	21,327	27,035	21,327	8,229	20,104	25,058	20,960	24,788	23,530	22,904	22,550	25,084	15,800	29,654
	Plate Works	37,831	31,965	42,645	31,965	16,060	43,186	33,529	34,485	42,151	36,285	35,490	47,971	34,524	32,735	50,726
	Machine Works	14,020	13,546	14,457	13,546	5,460	8,087	15,037	14,885	15,420	14,946	16,504	9,676	16,250	8,795	17,385
	Total	74,436	66,838	84,137	66,838	29,749	71,377	73,624	70,330	82,359	74,761	74,898	80,197	75,858	57,330	97,765
Yearly Average	Steel Structure			20,101					22,888					23,198		
	Plate Works			32,093					37,927					40,289		
	Machine Works			12,206					13,675					13,722		
	Total			64,400					74,490					77,209		

3.6.2 Demand Forecasts of Plant Processing Equipment for Localization

(1) Demand forecasts of plant processing equipment for localization for five designated plants

Demand forecasts of the plant processing equipment for localization for the five designated plants are shown in Table 3-59.

The average annual demand is about 20,000 t/y (46.5%) for structure work, about 19,000 t/y (43.9%) for plate work, about 4,000 t/y (9.6%) for machine work, and about 43,000 t/y in total in PELITA IV. The ratio of these three kinds of work is almost the same in PELITA V and VI. The total average annual demand is about 49,000 t/y in PELITA V and about 52,000 t/y in PELITA VI.

Table 3-59 Demand Prospects of Plant Processing Equipment for Localization

(1/2)

(Unit: T)

Plant	Products	PELITA IV					PELITA V					PELITA VI				
		1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Cement Plant	Steel Structure	7,606	7,606	7,606	7,606			7,606	7,606	7,606	7,606	7,606		7,606		7,606
	Plate Works	2,123	2,123	2,123	2,123			2,123	2,123	2,123	2,123	2,123		2,123		2,123
	Machine Works	1,793	1,793	1,793	1,793			1,793	1,793	1,793	1,793	1,793		1,793		1,793
	Sub-total	11,522	11,522	11,522	11,522			11,522	11,522	11,522	11,522	11,522		11,522		11,522
Sugar Plant	Steel Structure	7,224	7,224	7,224	7,224	7,224	9,632	9,632	9,632	9,632	9,632	12,040	12,040	12,040	12,040	12,040
	Plate Works	9,801	9,801	9,801	9,801	9,801	13,068	13,068	13,068	13,068	13,068	16,335	16,335	16,335	16,335	16,335
	Machine Works	1,932	1,932	1,932	1,932	1,932	2,576	2,576	2,576	2,576	2,576	3,220	3,220	3,220	3,220	3,220
	Sub-total	18,957	18,957	18,957	18,957	18,957	25,276	25,276	25,276	25,276	25,276	31,595	31,595	31,595	31,595	31,595
Ammonia Plant	Steel Structure	4,280		4,280			4,280			4,280			4,280			4,280
	Plate Works	5,690		5,690			5,690			5,690			5,690			5,690
	Machine Works	38		38			38			38			38			38
	Sub-total	10,008		10,008			10,008			10,008			10,008			10,008
Urea Plant	Steel Structure	1,660		1,660			1,660			1,660			1,660			1,660
	Plate Works	2,083		2,083			2,083			2,083			2,083			2,083
	Machine Works	17		17			17			17			17			17
	Sub-total	3,760		3,760			3,760			3,760			3,760			3,760
ZA Plant	Steel Structure			2,220				2,220				2,220				2,220
	Plate Works			2,086				2,086				2,086				2,086
	Machine Works			64				64				64				64
	Sub-total			4,370				4,370				4,370				4,370

(2/2)

(Unit: T)

Plant	Products	PELITA IV					PELITA V					PELITA VI				
		1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Phosphoric Acid Plant	Steel Structure			1,900				1,900						1,900		
	Plate Works			713				713						713		
	Machine Works			5				5						5		
	Sub-total			2,618				2,618						2,618		
TSP Plant	Steel Structure		2,410		2,410			2,410			2,410			2,410		
	Plate Works		1,051		1,051			1,051			1,051			1,051		
	Machine Works		44		44			44			44			44		
	Sub-total		3,505		3,505			3,505			3,505			3,505		
Pulp & Paper Plant	Steel Structure		2,741		2,741		2,741		2,741		2,741		2,741		2,741	
	Plate Works		4,547		4,547		4,547		4,547		4,547		4,547		4,547	
	Machine Works		0		0		0		0		0		0		0	
	Sub-total		7,288		7,288		7,288		7,288		7,288		7,288		7,288	
Palm Oil Plant	Steel Structure	880	880	880	880	880	640	640	640	640	640	640	640	640	640	640
	Plate Works	1,617	1,617	1,617	1,617	1,617	1,176	1,176	1,176	1,176	1,176	1,176	1,176	1,176	1,176	1,176
	Machine Works	671	671	671	671	671	488	488	488	488	488	488	488	488	488	488
	Sub-total	3,168	3,168	3,168	3,168	3,168	2,304	2,304	2,304	2,304	2,304	2,304	2,304	2,304	2,304	2,304
Total	Steel Structure	21,650	20,861	25,770	20,861	8,104	18,953	24,408	20,619	23,818	23,029	22,506	21,361	24,596	15,421	28,446
	Plate Works	21,314	19,139	24,113	19,139	11,418	26,564	20,217	20,914	24,140	21,965	21,720	29,831	21,398	22,058	29,493
	Machine Works	4,451	4,440	4,520	4,440	2,603	3,119	4,970	4,857	4,912	4,901	5,565	3,763	5,550	3,708	5,620
	Total	47,415	44,440	54,403	44,440	22,125	48,636	49,595	46,390	52,870	49,895	49,791	54,955	51,544	41,187	63,559
Yearly Average	Steel Structure			19,449					22,165					22,466		
	Plate Works			19,025					22,760					24,900		
	Machine Works			4,091					4,552					4,841		
	Total			42,565					49,477					52,207		

(2) Demand forecasts of plant processing equipment for other than five designated plans

The study so far has been related to the five designated plants. Actually, however, there are other plant processing equipment which is now manufactured or which can be manufactured by BABIBO. Among such items, the demand of the equipment of the following major plants that can be localized was forecasted.

- Oil refinery/petrochemical plants
- Power generation/transmission facilities
- Boilers
- Water gates/bridges

1) Oil refinery/petrochemical plants

At present no large-scale refinery/petrochemical plant project exists in Indonesia except for the projects being rephased (Table 3-60).

Table 3-60 Rephased Project

Project	Location	Product	Capacity
Olefin Center	Lho Seumawe	Ethylene	350,000 t/y
		LDPE	120-150,000 t/y
		HDPE	70,000 t/y
		CAP	160,000 t/y
		VCM	240,000 t/y
		PVC	72,000 t/y
Aromatic Center	Plaju	Benzene	421,300 t/y
		Toluene	1,100 t/y
		P. Xylene	174,500 t/y
		O. Xylene	4,000 t/y

Here, the demand of plant processing equipment of refinery, petrochemical plants for localization was forecasted assuming restarting of the rephased projects in PELITA V and the same scale of projects in PELITA VI. The result is shown in Table 3-61.

Table 3-61 Demand of Plant Processing Equipment of Refinery and Petrochemical Plants for Localization

(Unit: T/Y)

		Plate						
PELITA	Structure	Tanks	Vessels	H/E	Others	Sub-total	Machine	Total
IV	1,000	200	200	200	500	1,100	100	2,200
V	2,000	500	500	500	1,000	2,500	300	4,800
VI	2,000	500	500	500	1,000	2,500	300	4,800

2) Power generation/transmission facilities

Table 3-62 show the transition and forecast of the power generation capacity of the PLN. The power generation capacity of the PLN in 1983 was about 3,900 MW. Expansion of about 5,300 MW and 6,200 MW are planned for PELITA IV and PELITA V, respectively.

Table 3-62 Power Generation Capacity of PLN

(Unit: MW)

	PELITA II (1974-78)		PELITA III (1979-83)		PELITA IV (1984-88)		PELITA V (1989-93)	
	Capacity	Incremental	Capacity	Incremental	Capacity	Incremental	Capacity	Incremental
Hydro Power	350.7	72.0	537.5	186.8	2,012.5	1,475.0	3,864	1,851.5
Diesel	499.4	269.1	793.0	293.6	1,893.0	1,100.0	2,508	615
Gas	882.0	820.0	996.4	114.4	996.4	0	272.4	-724
Geothermal	-	-	30.0	30.0	250.0	220.0	940	690
Thermal	556.3	331.3	1,556.0	999.7	4,016.0	2,460.0	7,821	3,805
-Coal-fired	-		-		1,830.0	1,830.0	5,555	3,725
-Oil-fired	556.3	331.3	1,556.0	999.7	2,186.0	630.0	2,266	80
Total	2,283.4	1,487.4	3,912.9	1,629.5	9,167.9	5,255.0	15,405.4	6,237.5

Source: PLN

The degree of electrification in Indonesia is said to be about 12%. The PLN is trying to develop electrification and expand the generation/ transmission facilities in the future.

The kinds of power generation facilities that can be localized are as follows:

- Hydraulic power plant: Water gate
- Mini-hydraulic power plant: Turbine, hydraulic steel piping, penstock, water gate, etc.
- Thermal power plant: Tank, heat exchanger, steel structure, etc.

As the transmission facilities, steel structures for transmission towers can be localized.

Table 3-63 shows the summary of the demand forecast of equipment for localization.

3) Boiler

Table 3-64 shows the boiler importation record in the past three years in Indonesia. As averaged over three years, about 8,100 tons of boilers have been imported. Table 3-65 shows the demand of boilers considering the imported ones and the boilers domestically manufactured by Boma Stork, etc.

Table 3-63 Demand of Equipment of Power Generation/Transmission Facilities for Localization

PELITA	Item	Structure	Plate					Machine	Total
			Tanks	Vessels	H/E	Others	Sub-total		
IV	Hydro								
	Mini Hydro	290				1,330	1,330	120	1,740
	Hydro	520						50	570
	Sub-total	810				1,330	1,330	170	2,310
	Thermal								
	Oil-fired	630	315	60	250	190	815	30	1,475
	Coal-fired	2,200	180	180	730	370	1,460	90	3,750
	Sub-total	2,830	495	240	980	560	2,275	120	5,225
	Diesel		1,760				1,760		1,760
	Transmission Tower	81,280							81,280
	Total	84,920	2,255	240	980	1,890	5,365	290	90,575
V	Hydro								
	Mini Hydro	290				1,330	1,330	120	1,740
	Hydro	660						70	730
	Sub-total	950				1,330	1,330	190	2,470
	Thermal								
	Oil-fired	80	40	8	32	24	104	4	188
	Coal-fired	4,470	373	373	1,490	745	2,981	186	7,637
	Sub-total	4,550	413	381	1,522	769	3,085	190	7,825
	Diesel		980				980		980
	Transmission Tower	81,300							81,300
	Total	86,800	1,393	381	1,522	2,099	5,395	380	92,575
VI	Hydro								
	Mini Hydro	290				1,330	1,330	120	1,740
	Hydro	730						70	800
	Sub-total	1,020				1,330	1,330	190	2,520
	Thermal								
	Oil-fired								
	Coal-fired	5,400	450	450	1,800	900	3,600	220	9,220
	Sub-total	5,400	450	450	1,800	900	3,600	220	9,220
	Diesel		800				800		800
	Transmission Tower	81,300							81,300
	Total	87,720	1,250	450	1,800	2,230	5,730	410	93,860

Table 3-64 Import of Boilers

	1981	1982	1983	Yearly Average
Fire Tube Boilers				
-No.	240	202	241	228
-Weight (T)	1,264	2,433	2,167	1,955
Water Tube Boilers				
-No.	145	197	44	129
-Weight (T)	4,628	7,745	3,685	5,353
Hybrid Boilers				
-No.	51	49	42	47
-Weight (T)	510	347	1,596	818
Total				
-No.	436	448	327	404
-Weight (T)	6,402	10,525	7,448	8,126

Source: Impor

Table 3-65 Demand of Boilers

PELITA	T/Y
IV	8,900
V	9,790
VI	10,770

4) Water gates/bridges

As regards the water gates and bridges, the required production volume varies greatly from project to project. The grasp of the demand of such equipment is very difficult. Table 3-67 shows the demand of water gate/bridge forecasted on the basis of the past experience of water gate/bridge production by BABIBO companies (Table 3-66).

Table 3-66 Experience of Water Gate/Bridge Production

(Unit: T/Y)

	Water Gate	Bridge
BARATA	700	-
BBI	1,000	400
Others*	1,500	400
Total	3,200	800

* : Estimate

Table 3-67 Demand of Water Gate/Bridge for Localization

(Unit: T/Y)

PELITA	Structure	Machine	Total
IV	4,200	300	4,500
V	4,200	300	4,500
VI	4,200	300	4,500

5) Total demand of plant processing equipment for localization for other than five designated plants (summary)

Table 3-68 shows the total demand of plant processing equipment for localization for other than five designated plants.

Table 3-68 Total Demand for Localization for Other Than Five Designated Plants

(1/3)

(Unit: T/Y)

PELITA	Item	Structure	Plate					Machine	Total	Remarks
			Tanks	Vessels	H/E	Others	Sub-total			
IV (1984-88)	Refinery/Petchemi.	1,000	200	200	200	500	1,100	100	2,200	These figures are merely estimates and subject to revision.
	Power Generation									
	-Hydro									
	Mini Hydro	290				1,330	1,330	120	1,740	50 MW/5 YR
	Hydro	520						50	570	1,425 MW/5 YR
	Sub-total	810				1,330	1,330	170	2,310	1,475 MW/5 YR
	-Thermal									
	Oil-fired	630	315	60	250	190	815	30	1,475	630 MW/5 YR
	Coal-fired	2,200	180	180	730	370	1,460	90	3,750	1,830 MW/5 YR
	Sub-total	2,830	495	240	980	560	2,275	120	5,225	
	-Diesel		1,760				1,760		1,760	1,100 MW/5 YR
	-Transmission Tower	81,280							81,280	
	Sub-total	84,920	2,255	240	980	1,890	5,365	290	90,575	
	Boilers									
	-Fire Tube					2,400	2,400		2,400	
	-Water Tube					5,500	5,500		5,500	
	-Hybrid					1,000	1,000		1,000	
	Sub-total					8,900	8,900		8,900	
	Water Gate & Bridge									
	-Water Gate	3,200						300	3,500	
	-Bridge	1,000							1,000	
	Sub-total	4,200						300	4,500	
	Total	90,120	2,455	440	1,180	11,290	15,365	690	106,175	

(2/3)
(Unit: T/Y)

PELITA	Item	Structure	Plate					Machine	Total	Remarks
			Tanks	Vessels	H/E	Others	Sub-total			
V (1989-93)	Refinery/Petchemi.	2,000	500	500	500	1,000	2,500	300	4,800	
	Power Generation									
	-Hydro									
	Mini Hydro	290				1,330	1,330	120	1,740	50 MW/5 YR
	Hydro	660						70	730	1,800 MW/5 YR
	Sub-total	950				1,330	1,330	190	2,470	1,850 MW/5 YR
	-Thermal									
	Oil-fired	80	40	8	32	24	104	4	188	80 MW/5 YR
	Coal-fired	4,470	373	373	1,490	745	2,981	186	7,637	3,725 MW/5 YR
	Sub-total	4,550	413	381	1,522	769	3,085	190	7,825	3,805 MW/5 YR
	-Diesel		980				980		980	615 MW/5 YR
	-Transmission Tower	81,300							81,300	
	Sub-total	86,800	1,393	381	1,522	2,099	5,395	380	92,575	
	Boilers									10% higher than PELITA IV
	-Fire Tube					2,640	2,640		2,640	
	-Water Tube					6,050	6,050		6,050	
	-Hybrid					1,100	1,100		1,100	
	Sub-total					9,790	9,790		9,790	
	Water Gate & Bridge									
	-Water Gate	3,200						300	3,500	
	-Bridge	1,000							1,000	
	Sub-total	4,200						300	4,500	
	Total	93,000	1,893	881	2,022	12,889	17,685	980	111,665	

(3/3)
(Unit: T/Y)

PELITA	Item	Structure	Plate					Machine	Total	Remarks
			Tanks	Vessels	H/E	Others	Sub-total			
VI (1994-98)	Refinery/Petchemi.	2,000	500	500	500	1,000	2,500	300	4,800	
	Power Generation									
	-Hydro									
	Mini Hydro	290				1,330	1,330	120	1,740	50 MW/5 YR
	Hydro	730						70	800	2,000 MW/5 YR
	Sub-total	1,020				1,330	1,330	190	2,520	2,050 MW/5 YR
	-Thermal									
	Oil-fired									
	Coal-fired	5,400	450	450	1,800	900	3,600	220	9,220	4,500 MW/5 YR
	Sub-total	5,400	450	450	1,800	900	3,600	220	9,220	4,500 MW/5 YR
	-Diesel		800				800		800	500 MW/5 YR
	-Transmission Tower	81,300							81,300	
	Sub-total	87,720	1,250	450	1,800	2,230	5,730	410	93,860	
	Boilers									10% higher than PELITA V
	-Fire Tube					2,900	2,900		2,900	
	-Water Tube					6,660	6,660		6,660	
	-Hybrid					1,210	1,210		1,210	
	Sub-total					10,770	10,770		10,770	
	Water Gate & Bridge									
	-Water Gate	3,200						300	3,500	
	-Bridge	1,000						0	1,000	
	Sub-total	4,200						300	4,500	
	Total	93,920	1,750	950	2,300	14,000	19,000	1,010	113,930	

(3) Plant repair and rehabilitation demands

The demand of equipment for newly constructed plants has so far been forecasted. There is such demand as plant repair, spare parts production and plant rehabilitation. Especially with regard to sugar plants, mill roll reshelling, shell replacement and rehabilitation of existing plants are conceivable. Following is the potential demand concerning the repair related equipment of sugar plant:

(Unit: T/Y)

	PELITA IV			PELITA V			PELITA VI		
	S	P	M	S	P	M	S	P	M
Reshelling	-	-	3,900	-	-	4,700	-	-	5,800
Rehabilitation	5,000	5,000	500	5,000	5,000	500	5,000	5,000	500
Total	5,000	5,000	4,400	5,000	5,000	5,200	5,000	5,000	6,300

Production of spare parts for various plants can also be expected, but quantitative grasp of all these demands is difficult. Therefore, the demand forecast of the plant processing equipment in this market study deals with only new plants and maintenance of sugar plants. The product mix prepared in the technical study includes the production quantity for repair in a reasonable range.

(4) Demand forecast of plant processing equipment for localization (Summary)

Table 3-69 shows the demand of plant processing equipment for localization as the summary of (1), (2) and (3). The demand of the plant processing equipment for the five designated plants is insufficient to cover the production capacity of BABIBO, so it is necessary to intensively develop the market of plant processing equipment in other fields.

Here, the demand in the petrochemical, power generation and other fields was forecasted, but it will be necessary in the future to explore the market of equipment for the gas related plants, steel-making plants, plywood plants, etc.

Table 3-69 Potential Demand for Localization

(Unit: 1,000 T/Y)

PELITA	5 Designated Plants				Other than 5 Designated Plants*				Total			
	S	P	M	Sub-total	S	P	M	Sub-total	S	P	M	Total
PELITA IV (1984-88)	19.4	19.0	4.1	42.5	95.1	20.4	5.1	120.6	114.5	39.4	9.2	163.1
PELITA V (1989-93)	22.2	22.8	4.6	49.6	98.0	22.7	6.2	126.9	120.2	45.5	10.8	176.5
PELITA VI (1994-98)	22.5	24.9	4.8	52.2	98.9	24.0	7.1	130.0	121.4	48.9	11.9	182.2

* : including

1) equipment of refinery and petrochemical plants
2) equipment of power plants and transmission tower
3) boilers
4) water gate and bridge
5) rehabilitation of sugar plant and reshelling of mill rolls

3.7 Receiving Order Plan of Each BABIBO Company

The products allocation for plant processing equipment for five designated plants is as follows.

- BARATA: Cement plant and sugar plant
- BBI: Fertilizer plant, and pulp and paper plant
- BOMA STORK: Sugar plant and palm oil plant

Table 3-70 shows the work allocation with further classification into kinds of work in each factory. The receiving order quantity for each BABIBO company was determined by establishing the reasonable share to the potential demand in Table 3-69, and the result was evolved to the product mix which is described in the technical part. Table 3-71 shows the demand prospects and the product mix.

The quantity of received order as viewed from the product mix shall be about 85 thousand tons every year. To maintain this level of order, market development of the plant processing equipment not described herein is necessary in addition to organizing the powerful marketing force. The fields for market development should be as follows:

- Iron/steel making plants
- Coal/ore mining development projects
- Nonferrous metal plants
- Petroleum/gas development projects
- Plywood related plants
- Agriculture related plants
- Construction projects

Table 3-70 Work Allocation Summary

Company	Works	Cement Plant			Sugar Plant			Fertilizer Plant			Pulp & Paper Plant			Palm Oil Plant		
		S	P	M	S	P	M	S	P	M	S	P	M	S	P	M
BARATA	Surabaya			○			○									
	Gresik	○△	○△		○△	○△										
	Tegal		○	○	○	○	○									
	Jakarta				○△	○△										
BBI	Indra							○△		○	○△					
	Wahana							○	○△		○	○△				
BOMA STORK	Pasuruan				○△	○△	○△							○	○	○

Note) ○ : Shop Work
△ : Site Work
S : Structure Work
P : Plate Work
M : Machining

Table 3-71 Demand Prospects and Product Mix

(Unit: 1,000 T/Y)

		PELITA V				PELITA VI				PELITA VII			
		S	P	M	Total	S	P	M	Total	S	P	M	Total
Demand Prospects (Yearly Average)	5 Designated Plants												
	Cement Plant	6.1	1.7	1.4	9.2	4.6	1.3	1.1	7.0				
	Sugar Plant	9.6	13.1	2.6	25.3	12.0	16.3	3.2	31.5				
	Fertilizer Plant	4.3	4.1	0.1	8.5	4.2	4.3	0	8.5				
	Pulp & Paper Plant	1.6	2.7	0	4.3	1.1	1.8	0	2.9				
	Palm Oil Plant	0.6	1.2	0.5	2.3	0.6	1.2	0.5	2.3				
	Sub-Total	22.2	22.8	4.6	49.6	22.5	24.9	4.8	52.2				
	Others	98.0	22.7	6.2	126.9	98.9	24.0	7.1	130.0				
	Total	120.2	45.5	10.8	176.5	121.4	48.9	11.9	182.2				
Product Mix	Year	1989				1994				1999			
	BARATA												
	Surabaya	0	0.1	3.3	3.4	0	0.2	5.0	5.2	0	0.2	6.1	6.3
	Gresik	7.1	8.3	0	15.4	9.4	11.1	0	20.5	9.4	11.1	0	20.5
	Tegal	1.4	1.5	1.1	4.0	1.5	1.6	1.7	4.8	1.7	1.9	1.9	5.5
	Jakarta	5.3	5.6	0	10.9	7.0	7.4	0	14.4	7.0	7.4	0	14.4
	Sub-total	13.8	15.5	4.4	33.7	17.9	20.3	6.7	44.9	18.1	20.6	8.0	46.7
	BBI												
	Indra	8.4	0.8	1.5	10.7	11.3	1.0	2.0	14.3	11.3	1.0	2.0	14.3
	Wahana	0.1	9.4	0	9.5	0.1	12.6	0	12.7	0.1	12.6	0	12.7
	Sub-total	8.5	10.2	1.5	20.2	11.4	13.6	2.0	27.0	11.4	13.6	2.0	27.0
	Boma Stork	3.1	6.2	0.7	10.0	3.1	7.4	0.7	11.2	3.1	7.4	0.7	11.2
	Total	25.4	31.9	6.6	63.9	32.4	41.3	9.4	83.1	32.6	41.6	10.7	84.9

3.8 Marketing Study

It is vitally important in carrying out the marketing study that a careful investigation has to be made concerning the current BABIBO's marketing organization and marketing situation as well as Indonesian business manners and customs. The existing problems will be found in course of the investigation, and then the improvement measures will be given. In undertaking such a study, a lot of work and time will be required. In this sense, the marketing study itself can be an independent study apart from this feasibility study.

The objective of this feasibility study is to investigate the viability of the renovation project in terms of market, technology, and finance and economics. Therefore, a comprehensive marketing study is beyond the scope of this feasibility study and the general description is only given in this section concerning the reform and rationalization of the marketing process and organization.

The BABIBO shops after completion of the renovation can be said "newly constructed shops" which are quite different from ones before the renovation in view of their production capacity, production facilities and variety of products. The production capacity is greatly increased; the quality is improved; and the products are varied and sophisticated. In line with this, the marketing force to deal with such products has to be reformed and reinforced to great extent. The passive business attitude—just waiting for orders—should be changed and an active business attitude is required to explore potential customers.

"To reform the marketing structures" is easy to say, but it is very difficult to achieve it. However, if the marketing force is as it is after the renovation, the significant increase of product sales could not be expected and the company management might fall into a serious trouble.

The process from the initial contact to the actual commercial negotiation and the process from the negotiation to the conclusion of a contract vary case by case. However, the frequent negotiations by person-to-person-contact are applied to all marketing activities. When recognizing this negotiation attitude in fundamentals, the clue to improve the marketing activities is obtained. There are some occasions to lose business opportunities in marketing, even when doing business with great efforts. There

are many cases that the various kinds of meetings including meetings for making strategy result in only loss of time and the desk work are consumed just to take unnecessary formalities in a company. The commercial negotiation is one of the most important marketing business; it is necessary to try to convert the time for unnecessary jobs to the negotiation.

Bearing in mind that the fundamental marketing activities are the frequent commercial negotiation, the effective reform and rationalization have to be made for the marketing division.

Following are the procedure to achieve the reform and rationalization:

- Establishment of objectives for improvement and rationalization
- Investigation of current situation
- Analyzing current situation
- Identification of problems
- Establishment of targets and making execution plan
- Establishment of methodology
- Execution
- Review of results

3.8.1 Preparation of Information on Company and Products

The shop facilities, production capacity, products quality, company organization, etc. will be greatly developed after the renovation is completed. The BABIBO companies should make such information known and recognized to the potential customers in detail. Each shop will be able to produce sophisticated products. In line with this, the catalogs incorporating in-depth technology description are required. Furthermore, the sales promotion can be made effectively by making an active P.R. to the potential customers by inviting them to the shops to show their facilities and participating in some exhibitions as required.

Since the products will be sophisticated and hence the technology level will be more stressed, the preparation of in-depth technical information is of importance to respond customers' requirements. The training of sales engineers is also necessary to appropriately explain the products and technology to the customers.

In addition, the comparison of products competitiveness should be reasonably

studied for each product in terms of price, quality, reliability, delivery period, after sales service, etc. Then the advantages and disadvantages for their own products can be recognized. It is necessary to try to improve the disadvantages of the products as well.

3.8.2 Exploration of Customers

It is often said that "to lose customers is easy, but to get them is far more difficult". How to get new customers is of great importance as well as how to promote sales to the existing customers. The prospective big customers are not only the five designated industries but also PLN, PERTAMINA, Krakatau Steel, etc. Active sales approach should be taken especially to PERTAMINA as a prospective customer of plant processing equipment such as tanks, towers and vessels, pressure vessels and heat exchangers, because it engages in oil and gas exploration and operation of refineries and major petrochemical plants in Indonesia.

While, the frequent approach to engineering companies and contractors overseas are also important in view of their purchase of domestic products and getting jobs as a sub-contractor.

(1) Exploration of new customers

Potential customers list should be made first. The list is reviewed to find new potential customers with whom the company has no sales experience. The investigation is made for such customers concerning products purchased from competitors. Furthermore, their competitiveness is examined for the products, and the sales power of competitors is studied for comparison in terms of sales technology, experience, products knowledge, organization, personal connection and P.R. Taking these aspects into account, the sales strategy stressing the sales points of their own products and the company is established. Especially for big customers and prospective customers, sales promotion should be made extensively utilizing whole company organizations.

(2) Sales promotion for existing customers

The steady method to increase the present sales volume is to establish a sales strategy and make an increased sales target for each existing customer. Each strategy should be executed to achieve the sales target. The company should prepare

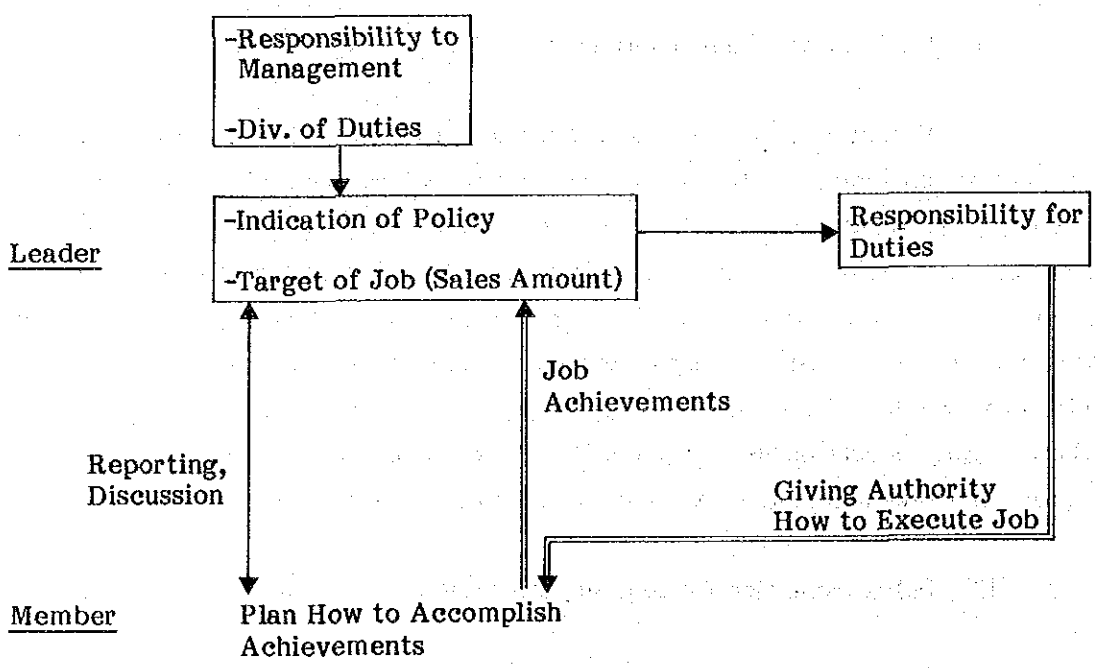
potential customers list especially to grasp the customers' purchasing system and identify the personal connection so that it can obtain required information promptly.

After-sales-service should be firmly carried out by periodical review of received-order list for each company in order to cope with customer's requirement. By doing so, repeat order and order of spare parts can be expected.

3.8.3 Job Management

The main objective of job management is to achieve the targets of sales volume and profits. The frequent communication is required between the leader and the members regarding the job progress. The members are given the authority from the leader to do the job by their own manner and judgment. In return for it, the members have to bring about remarkable results with efforts by executing the plan which is made by themselves.

This explained by using following figure.



The leader takes charge of responsibility of his own in management. For instance, he is responsible for the achievement of targets of sales volume and profits.

In realizing the targets, he makes his own policy. The policy can be the base how to proceed with the job for each member. It can be also the guideline for the scope of the job and the job structure. It gives the job instructions including the job assignment for the members.

In other words, the leader gives authority for job achievement to his members. The members in return, should accomplish the job with great effort by self-management. In this case, however, the responsibility for the job will be taken by the leader. Thus, the order in the division is maintained.

The members have to keep informed to their leader concerning the progress of the job. What the management and manager are seeking at are when the job makes money and what is the probability. In the meetings with the leader, it is important to discuss what should be done now for achieving the plan as well as to report the job progress.

3.8.4 Review, Evaluation and Countermeasure of Job Achievements

In reviewing the job achievements in marketing division, two aspects, one is a total aspect and the other a partial aspect, should be considered. The total aspect means the achievements in the marketing division as a whole and the partial aspect means those of persons in charge, products, territory, etc. Both aspects should be reviewed for further development.

The evaluation should be made not only in comparison of the achievements with the targets but also in reviewing the marketing process from the beginning of the commercial negotiation to the result. The latter is more important since it can be of great help for the future marketing planning.

Fig. 3-8 shows relationship between management of marketing & sales and review of achievement.

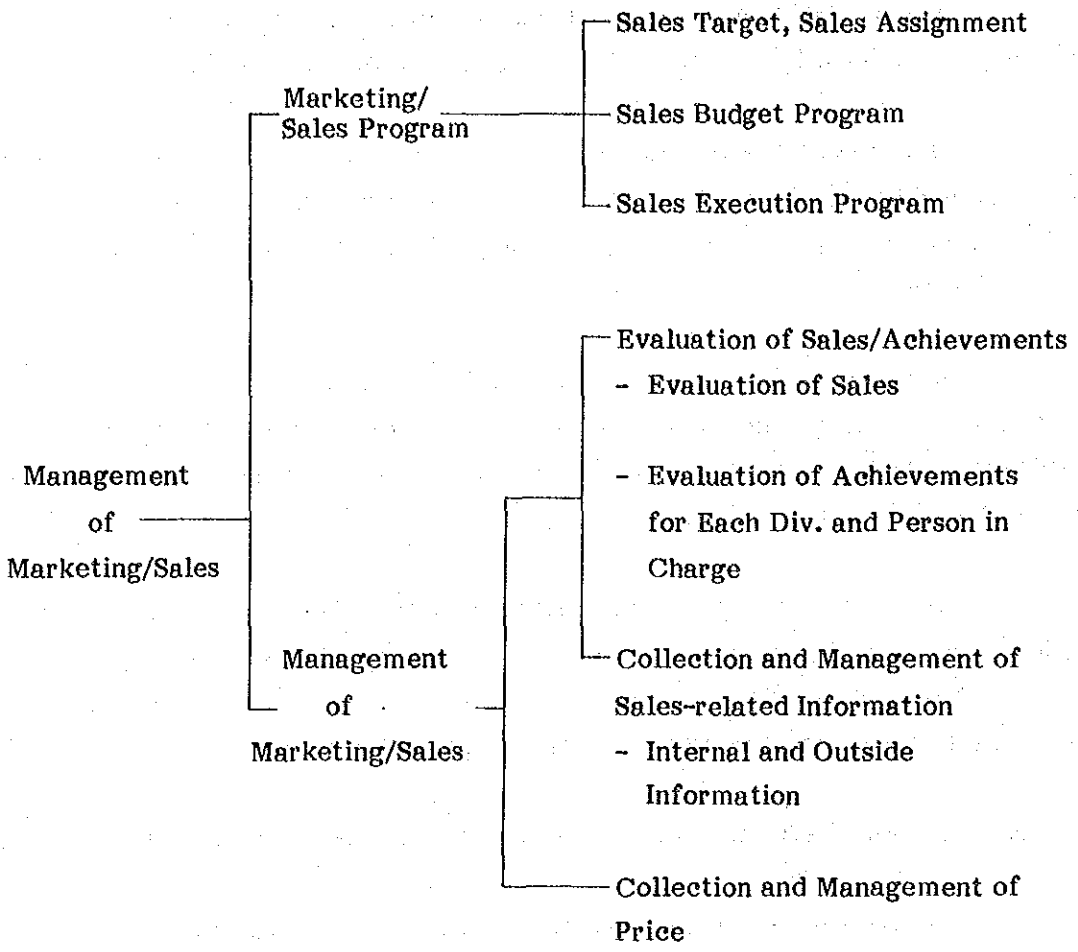


Fig. 3-8 Relationship between Management of Marketing & Sales and Review of Achievements

The achievements of the division are further divided, for evaluation, into those of department, section and person in charge. A fair and impartial evaluation without a biased view should be made so that the members can be motivated and given future prospects.

3.8.5 Organization

The marketing organization should be improved and developed along with the completion of the renovation project which results in increase of products in quantity and their improvement in quality.

In order to accomplish the target, the marketing division should remove inflexible and bureaucratic structures so that the organization can be easily adjusted to the varied objectives and function dynamically.

The following three principles should be considered in developing marketing structures:

- To function effectively to achieve the target
- Simple system for command and direction
- To enable education of successor and reasonable evaluation of capabilities of personnel

3.8.6 Development of Human Resources and Capabilities

Since the potential customers will increase in number in various industries along with the varied product range after the renovation, the sales personnel has to possess much knowledge on products and develop its sales technology. Therefore, the comprehensive training and development of capabilities are required. Fig. 3-9 shows a sheet of education and training program for sales personnel.

In carrying out the education and training, instructors with ample experience should be assigned. As mentioned above, the products to be sold will be varied. Since it seems that there is no sales personnel having expertise in this field in BABIBO companies, it is advised that the instructors from overseas are invited for the training.

The training can be classified into "on the job training (OJT)" and "off the job training (Off-JT)". For the training of marketing personnel, it is advised to conduct "family training" which incorporates the education and training into the daily business activities. The training by standardized curricula is less effective and does not last long for the marketing division, because the experience and job assignment are different each other, and the sales personnel has different morals and principles. It is important for the personnel to consider how to achieve the job while getting the education and to accomplish the achievements while getting the training. It is also important that the consensus of training should be given and the family training atmosphere should be created in the company.

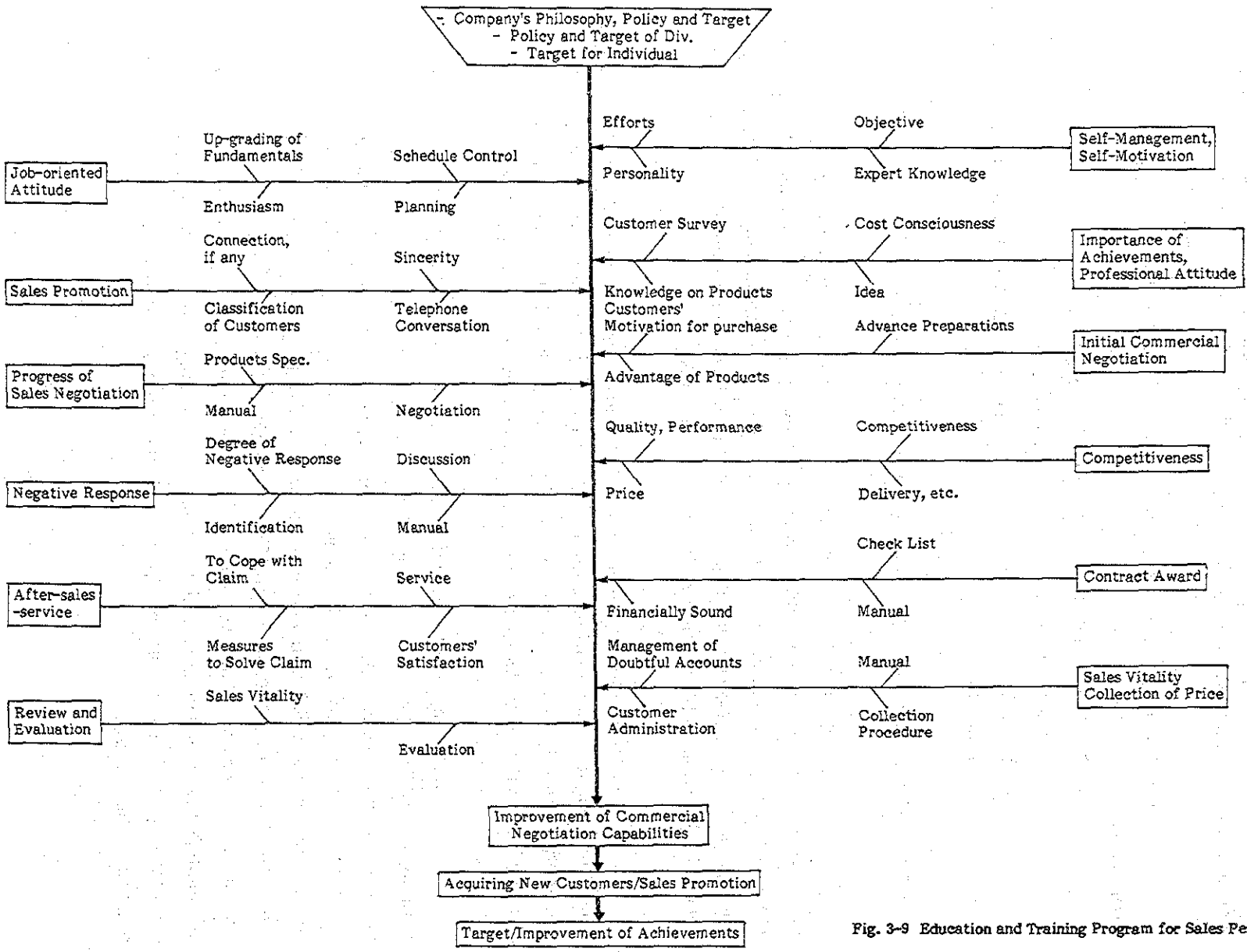


Fig. 3-9 Education and Training Program for Sales Personnel

Chapter 4

DIAGNOSIS OF EACH SHOP, DEVEROPMENT PLAN, AND IMPLEMENTATION PLAN

Chapter 4. Diagnosis of Each Shop, Development Plan and Inpelementation Plan

4.1 P.T. Barata Indonesia, Surabaya Machine Shop

4.1.1 Technical Diagnosis of Objective Shop

(1) History and production condition of shop

In 1901, P.T. Barata Indonesia was established for the purpose of providing sugar plants and other plantation installations with maintenance service and spare parts.

Surabaya Machine Shop has gradually developed its own production techniques and extended its production field through the manufacture of equipment and installation work by co-work and sub-contracts in cooperation with overseas engineering companies and plant suppliers. At present, Surabaya Machine Shop comprises the steel construction shop, cast iron foundry, road roller shop, machine shop and machine tool rehabilitation center. This chapter summarizes the survey report and renovation plan mainly for the machine shop and machine tool rehabilitation center. Unfortunaley, these plants have not yet been materialized.

Surabaya Machine Shop has not experienced marked renovation not modernization over a long period only except regular maintenance. This results in markedly obsoleted equipment and buildings of the whole shop, with poor efficiency. During this period, P.T. Barata Indonesia and Surabaya Machine Shop have repeatedly proposed renovation and expansion plans. Unfortunalely, these plants have not yet been materialized.

Under these conditions, Surabaya Machine Shop has taken a means of establishing Machine Tool Rehabilitation Center in order to restrict reduction in the accuracy of the obsoleted equipment to a minimum, while making effort to accumulate its own production technique. At present, Surabaya Machine Shop mainly manufactures sugar plant equipment, micro-water-turbines, which are supplemented by parts manufacture for iron and steel industry and railway industry to achieve the target of manufacture. On the other hand, Machine Tool Rehabilitation Center is established as an independent accounting entity by obtaining the order of machine repair and reforms from the outside of Surabaya Machine Shop as well as the machine service inside the Shop.

(2) Present production capacity and production techniques

The production results of Machine Shop in the past five years are as shown in Table 1-1. The annual average production only registers less than 2,000 tons by weight. As stated above, the main products include sugar plant equipment, particulary micro-water-turbines and replacement of cane mill rolls. The replacement is made out of the season of sugar plants and substantial work is centered to this season. This means that Machine Shop is subject to seasonal fluctuations and variations in machine loads. Table 1-2 Summarizes the problems of the production equipment and production techniques. It is evident that the buildings should be scaled up, the transportation capacity improved and large-scale machine introduced to keep up with a general tendency to scale up plants and products and to solve the problem of overall obsoleted buildings and equipment. In addition, this table suggests that hardening equipment is indispensable for grading up the quality of the products and extending the service life.

At present, Surabaya Machine Shop has too many deficient factors both in equipment and in techniques to meet the demand tendency in the general market - bulk purchase of high-quality and large-size products. In addition, emphasis is placed on completed and sufficient equipment and tools to meet quality control requirements. It is our understanding that Machine Tool Rehabilitation Center is a newly established organization and project and as such, novel equipment has been introduced, additional equipment supplied slowly but steadily, with mastered production techniques.

(3) Managerial and personnel organization

The managerial organization of P.T. Barata Indonesia is a kind of matrix organization as shown in Fig. 1-1. In other words two functions are combined; one is the management function relating to market and product groups and the other is the control function relating to the factory and production.

Surabaya Machine Shop is managed by the machine & foundry business group according to the organization. On the other hand, for example, it is controlled by the project group as for the production process of equipment for specified project equipment. In other words, Surabaya Machine Shop features general service in that not only it has its own products such as micro water turbines and sugar cane mills but also it

carries out machining consigned by the foundry and plate work shops. This feature forms a difficult point in management because Machine Shop is required to have knowledges both on products and on machining. Figures 1-2, 1-3 and Tables 1-3, 1-4 show the function and personnel organizations of Surabaya machine Shops and Machine Tool Rehabilitation Center. Problems to be pointed out in the personnel organization are shown below.

1) **Machine shop**

Table 1-3 shows that the total number of persons in classifications (1) - (4) is 71, which accounts for 14.5% of the total persons in the Branch, 489 persons. This indicates that the Branch has extremely fewer engineers. Table 1-3 also shows that the total number of persons in classifications (5) and (8) is 59, which accounts for only 14.1% of 418 workers, the total workers in the Branch. This means that Machine Shop has extremely fewer field control and indirect workers. In other words, such personnel organization indicates a weak point of production techniques such as improvement and development in machining techniques, review of drawings for products easy to machine. It is true that the less ratio of indirect workers indicates higher production efficiency in one meaning. However, direct workers are actually engaged in indirect work and particulary skilled workers cannot fully serve with their own skill, as shown in Table 1-3.

In addition, Table 1-3 shows that Machine Shop has as many as 23 maintenance workers (See (6) Skilled (e) maintenance). This is nothing but the evidence of obsoleted equipment in Machine Shop.

2) **Machine tool rehabilitation center**

Table 1-4 shows that the total number of direct workers is 47, which accounts for only 51% of total 92 workers in the Branch. In addition, 20 direct workers out of 47 are engaged in maintenance service of the whole shops of P.T. Barata Indonesia. As a result, only less than 30 direct workers are directly engaged in repairing and reforming machines and tools. In fact, these workers have actually repaired or reformed 125 units of machines for the inside and outside of the

shops. In addition, they are engaged in manufacturing the beds of new machine tools delivered to other companies.

It is concluded that design numbers are too few to achieve expected jobs such as preparation of parts drawings, considering thate axles, gears and bearings required for repair and reform are not locally available.

(4) Production control system

1) Production order flow

Fig. 1-4 shows the production order flow in Surabaya Machine Shop. The Production Planning & Control Section (hereinafter referred to as PPC) has the function of the production control center.
The flows (1) through (6) in Fig. 1-4 is substantially reviewed by Factory Manager. PPC consists of three Sub-section managers and 31 persons in charge.

On the other hand, Quality control Section is under direct control of Branch Manager of Machine Shop. This Section consists of one manager and five persons in charge. Judgement is made that the above system and personnel organization are sufficient to conduct business since machining is mainly for Machine Shop and is subjected to the voluntary inspection by machine operators. However, if Machine Shop has to deal with increased assembly work as is the case with sugar cane mills and micro-water turbines, the function of Quality Control Section is to be inevitably strengthened. Increase in production and expansion of products fields involve an information source capable of judging whether to accept orders from the viewpoint of schedule. This requires that PPC be under the direct control of such an information source or an decision maker, that is, Branch Manager. It cannot be denied that a function and engineers are too weak to develop and improve machining techniques through a discussion at site and as a duty specified by the organization chart. The system

should be so improved as to enable this function to organically co-work with PPC and the quality control function.

2) Material procurement system

(1) The procurement system for materials and machining by subcontractors is as extremely complicated as in the case with other national enterprise.

The standard to approve purchase (procurement) is classified as follows.

Case A : Price > 10 million RP
- approved by group manager

Case B : 10 million RP > Price > 5 million RP
- subject to Tender and evaluation

Case C : Price < 5 million RP
- subject to market check (comparison and review of estimation)

In Case B, Branch Manager assigns ten members picked up from departments involved such as finance, design, PPC, quality control to compare estimations, decide contractors, and follow up the quality and process of products ordered. The duty of this task force ends with the delivery and acceptance of the products.

(2) Steel material are purchased in the following patterns, which are extremely complicated.

i) Steel plate

Case I : direct purchase from National Krakatau Iron & Steel Works

Case II : direct import by P.T. Barata Indonesia
Note; P.T. Barata Indonesia has not a right to sell steel materials but has a right to import.

Case III : purchase of Krakatau products or import through local suppliers

Case IV : supply by purchase when P.T. Barata Indonesia is a sub-contractor.

ii) Steel bars

Case I : direct import by P.T. Barata Indonesia

Case II : supply by purchaser when P.T. Barata Indonesia is a sub-contractor

iii) Other materials

Case I : purchase mostly from local suppliers, whether materials are imported or locally manufactured.

Case II : direct import by P.T. Barata Indonesia in the case of special specification or special order.

iv) Sub-contract (outside order)

Surabaya Machine Shop and Machine Tool Rehabilitation Center have registered sub-contractors as outlined in Tables 1-5 and 1-6 respectively.

Principally, the Supervisor is assigned by the section involved to stay in a sub-contractor's factory during an overall period from the issue of an order sheet to delivery

and acceptance for the purpose of controlling expedition and quality.

The above system will cause no problems on condition that the purchase (import) of equipment and outside manufacturing by sub-contractors remain small as at present. However, this system should be reviewed if the purchase and outside production increase over a wide range.

(5) Layout, handing equipment, buildings and auxiliary equipment

1) Layout

Surabaya Machine Shop comprises Machine Shop, Machine Tool Rehabilitation Center, Steel Construction Shop, Cast Iron Foundry, Road Roller Shop and Office.

The existing layout is as outlined in Fig. 1-5, Existing Layout; the features and survey results are as shown below.

(1) In the total factory area, a space of about 10,400 m^2 is occupied by Machine Shop and machine Tool Rehabilitation Center between the office and Cast Iron Foundry.

(2) In the total factory area, a space of about 12,200 m^2 is occupied by Steel Construction Shop and the bonded warehouse at the northern part of the office.

(3) The layout becomes extremely complicated as a result of repeated additional construction and reform, causing the flow of product machining to be extremely poor.

(4) The premises have been so narrowed as not to permit further expansion of factory buildings. Nevertheless, employee's residence occupies a considerable area in between the factory front and Jln. Ngagel.

2) Handling equipment

The existing handing equipment is as outlined in Fig. 1-5, Existing Layout; the features and survey results are as shown below.

(1) The overhead traveling crane has been totally obsoleted to an extent that some units can no longer achieve their specified function, as in the case with the buildings.

(2) Two 2-tons forklifts and rail carriages are in use other than the overhead travel crane.
Carriage rails are settled and prevent smooth transport.

3) Buildings and auxiliary equipment

The features of existing buildings and auxiliary equipment are as shown below.

(1) The buildings were first constructed in 1924, and additionally constructed or added in sequence. They are too old.

(2) Exteriors, roof materials in particular have bear corroded to a great extent that water leakage is not prevented.

(6) Infrastructures, electric installations and utilities

The existing infrastructures, electric installations, and utilities has been surveyed for layout, specifications, and present condition. The survey results together with supplementary description are as shown in Tables 1- 7 and 1-8.

Table 1-1 Production Record

Surabaya machine workshop

Unit: despatched weight ton

	1979	1980	1981	1982	1983	Average
A. Parts supply to Sugar mills						
(a) milling rolls	35pcs	25pcs	40pcs	50pcs	60pcs	42pcs
(delivery 3 months)	420	300	480	600	720	504
(b) Others	227	544	940	625	1215	710
B. Parts supply for Cement plant	0	0	0	0	0	
C. Others						
(a) microhydro, etc. (delivery 6 months)	910	840	332	850	660	718
TOTAL OF Surabaya machine workshops	1,557	1,684	1,752	2,075	2,595	1,932

In addition above production record, the machines rehabilitated in Surabaya machine tools rehabilitation center has recently accumulated to 125 units including the rehabilitation order from outside of P.T. Barata Indonesia.

Table 1-2
Production Analysis

Name of Factory: Surabaya Machine Shop

Category of Plant	Name and Specification of Typical Component	Average Production per annum (pcs)	Drawings Source: Own Design	Drawings Source: Sub-contract	Drawings Source: Under License	Bottleneck Facility	Critical Path in Procedure	Bottleneck Technique	Remarks
Sugar	Mill cheek		o		o	Boring	Cast steel 4T Cast steel 9T	Measurement & inspection	
	Gear/Pinion		o		o	Hobbing. Sawing	Hardening		
	Roll/Shell		o				Lathe efficiency		
	Evaporator tube sheet					Drilling		Position setting in drilling	
Cement	Kiln shell			o					Plate work only
Water turbine	Runner		o*	o		Balancing machine		Welding of Casing	* Escherwiss Tech Collaboration
	Shaft		o	o		Shaft lathe		BC Metal	Casting by own O/C
Common	Bolt		o	o	o	Threading lathe			
M.R.C	Machine rehabilitation		o					Measurement tool and device	

Table 1-3 Personnel and Manpower

Surabaya Machine & Foundry Branch

CLASSIFICATION	COMMON FUNCTION IN SURABAYA	MACHINE WORK SHOP	FOUNDRY
(1) Manager	1		
(2) Engineer			
(a) Design	2		
(b) Control	1		
(c) Production	2		
(3) Staff/Clerk	54		
(4) Draft man	11		
(5) Foreman/General Foreman			
(a) Production		11/3	6/2
(b) Maintenance		2/1	-
(c) Site erection		-	-
(6) Skilled			87
(a) Machining		102	
(b) Assembling (including shrinkage fitting)		72	
(c) Inspection		-	
(d) Welding		5	
(e) Maintenance		23	
(f) Heat Treatment		-	
(g) Tool Shop		23	
(h) Bolt & Nut		16	
(7) Unskilled	-	-	
(8) Indirect:			
(a) Production control & ware House	32		
(b) Quality Control	10		
T O T A L	113	258	95

Table 1-4 Personnel and Manpower

Surabaya machine tools rehabilitation center

Classification	Common function in Surabaya	Machinetools Rehabili center
(1) Manager	4	
(2) Engineer		
(a) Design	2	
(b) Control	-	
(c) Production	-	
(3) Staff/Clerk	14	
(4) Draft man	9	
(5) Foreman		
(a) Production	-	
(b) Maintenance	3	
(c) Site Erection	3	
(6) Skilled		
(a) Machining		9
(b) Assembling		8
(c) Inspection		3
(d) Welding		1
(e) Fitting		-
(f) Cutting		-
(g) Maintenance		17
(h) Painting		-
(i) Site Erection		2
(j) Heat treatment		-
(7) Unskilled		7
(8) Indirect	10	
T o t a l	45	47

Table 1-5 Specialized Subsupplier/Subcontractor

Barata Surabeya machine shop

	Name of Company	Address and Telephone No.	Available Scope of Specialized work	Main Facility
Machining	CABANG SWAGERAK(BARATA)	Jln. Ngagel 109 Surabaya.	- Gear Machining (Milling, Lathe)	- Gear Hobbing, Machine Tool
	CABANG PUSPAM (BARATA)	Jln. Ngagel 109 Surabaya.	- Machining	- Machine Tool
Gear	BENGKEL BERSAUDARA	Moro Krembangan, Surabaya	- Gear	- Gear Hobbing
Cast steel	CABANG GRESIK (BARATA)	Jln. Veteran Km. 14 GRESIK	- Cast Steel	- Electric Furnace
X-ray				
Dynamic Balance	PT. KARPINDO	Jln. Ahmad Yani, Surabaya	- Dynamic Balancing	- Dynamic Balancer
	PECON (PETRO KIMIA)	GRESIK	- Dynamic Balancing	- Dynamic Balancer

Table 1-6 Specialized Subsupplier/Subcontractor

Barata Surabaya machine tool rehabilitation Center

	Name of Company	Address and Telephone No.	Available Scope of Specialized work	Main Facility
Machining	1. TJOKRO BERSAUDARA	17-19 : Gembong Tebasan Phone : 313884- Surabaya	Excentric Shaft	Crank Shaft CRINDING Machine
Gear	1. TJOKRO BERSAUDARA	17-19 : Gembong Tebasan Phone : 313884- Surabaya	Spur Gear, Worm Gear, Worm Shaft	Gear Hobbing, Induction Frequency, Gas Carburizing
Cast steel	1. BARATA GRESIK 2. JATIM STEEL	Gresik Sepanjang		
X-ray	1. SUCOFINDO	Kedungsari-Surabaya Phone : 43856, 43857 Telex : 31533 suco		
Dynamic Balance	1. PETRO KIMIA	Jl. Jend. A. Yani Gresik Phone : 81811, 81814		

Table 1-7 Infra Structure

ITEM	SURVEY RESULT	REMARKS
1.7.1 Transportation		
(1) Name and location of port	Tanjung Perak	
(2) Capacity of pier	35,000 T	
(3) Capacity of loading/unloading equipment	300 T (floating crane)	
(4) Distance to loading/unloading port	20 km	
(5) Minimum width of road	-	
(6) Hight clearance of overbridge structure	3.5 m	
(7) Limitation of cargo size	2.5 mw x 12 ml	
(8) Limitation of load over access road	12 T	
1.7.2 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	TELCOM	
(4) Availability of public facsimile system	-	
1.7.3 UTILITY		
(1) Availability of public water supply system	PDAM	Water from its own well is also utilized.
(2) Junction of site drainage with public waterway	Public Canal	
(3) Junction of site sewage with public sewageway	-	

Table 1-8 Electrical and Utility Facilities (1/3)

ITEM	SURVEY RESULT	REMARKS
1.8.1 Power supply system		
(1) Power source	P.L.N.	
(2) Capacity of power source	Contract; 2,000 kVA	
(3) Voltage		
1) Receiving voltage	6 kv, 3 phase, 50 Hz	
2) Distribution voltage (HV)	6 kv, 3 phase, for substation	
3) Service voltage (LV)	380 v, 3 phase, for motor 220 v, 1 phase, for LTG. & OUTLET	
(4) Consumption	160,000 KWH/Mo.	
(5) Emergency generator	None.	
1.8.2 Lighting system (Illumination level)		
Location	Illumination Level / Kind of Lamp	
(1) Work shop	0 - 70 Lux. / Mercury vapor lamp.	
(2) Office	300 Lux. / Fluorescent lamp.	
1.8.3 Communication system		
(1) PABX system (Telephone)	Trunk line - 5 lines Local - 56 lines Manufacturer - Philips (1968)	No capacity for expansion.
(2) Inter phone system	Total 60 sets of local lines (Seperated by 5 groups)	

Table 1-8 Electrical and Utility Facilities (2/3)

ITEM	SURVEY RESULT	REMARKS
1.8.4 Air conditioning/ventilation system		
(1) Office building	Unit Type	
(2) Work shop	Natural ventilation	
1.8.5 Fire-fighting system		
Fire extinguisher	Total Approx. 50 sets. (ABC Type)	
1.8.6 Compressed-air supply system	Portable type compressers.	

Table 1-8 Electrical and Utility Facilities (3/3)

ITEM	SURVEY RESULT		REMARKS
1.8.7 Water supply system			
(1) Water source (well or public water)	PDAM	WELL (4 wells)	
(2) Capacity of water source			
1) Supply pump capacity	1 1/2" pipe x 2	7.5-10 hp pump each	
2) Storage tank capacity		6 ton each	
(3) Consumption of water	3000 Ton/Mo	- Ton/Mo,	
(4) Service pressure		3 kg/cm^2	
	For office water	For industrial water	
(5) Water treatment for special purpose	Boiling	-	

Fig. 1-1 Barata Organization

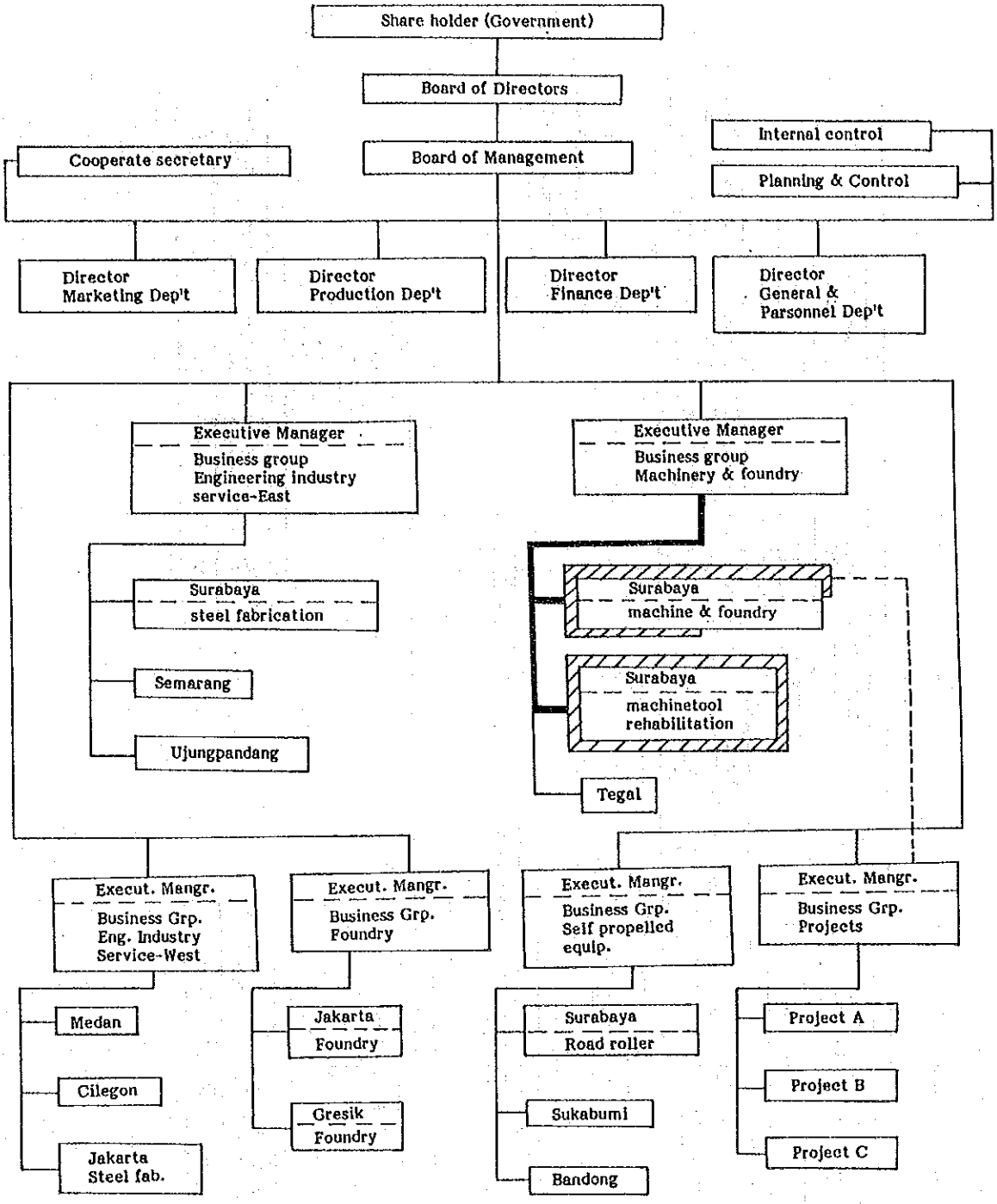


Fig. 1-2 Organization Chart

Surabaya Machine Work Shop

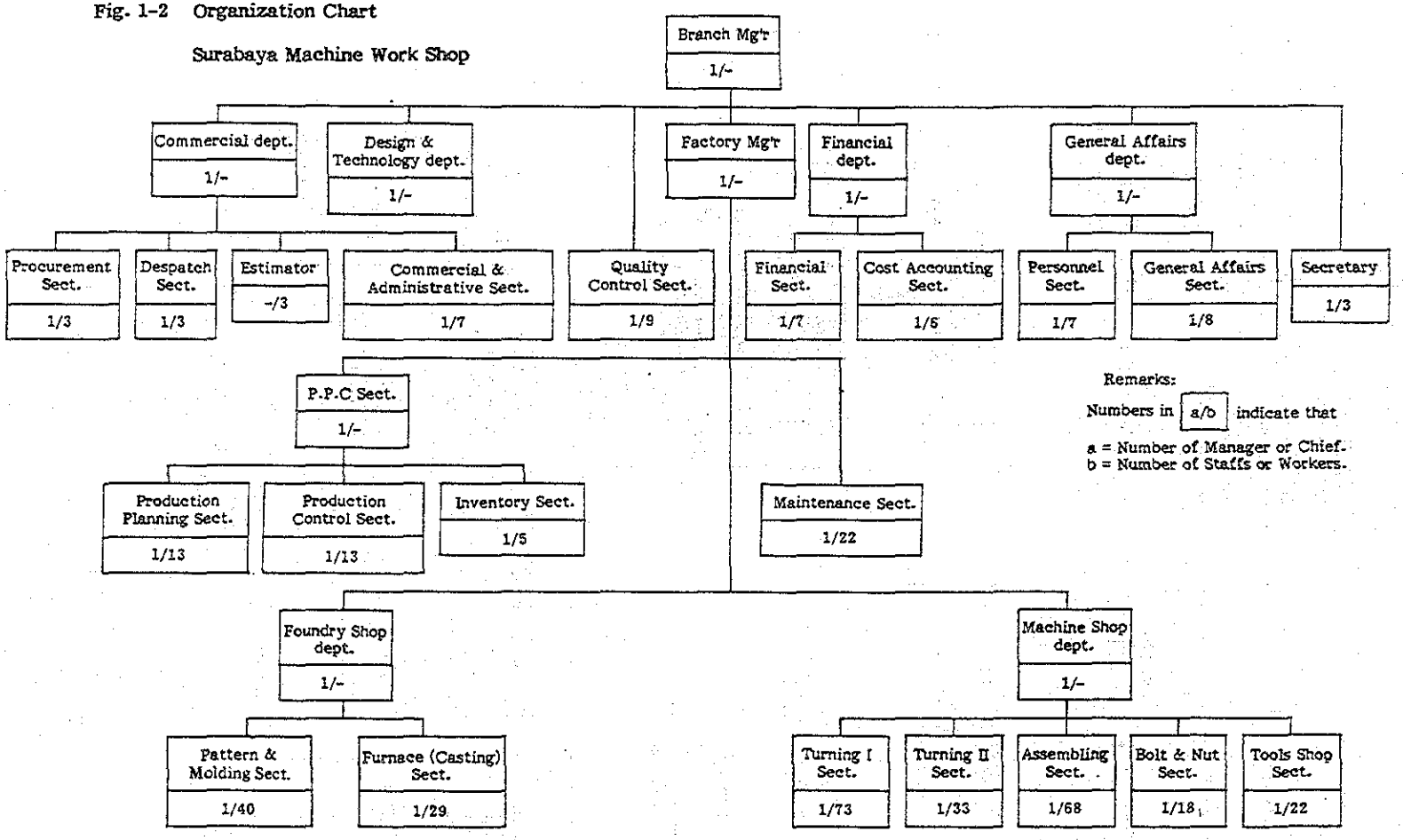


Fig. 1-3 Organization Chart

Machinetools Rehabilitation Center

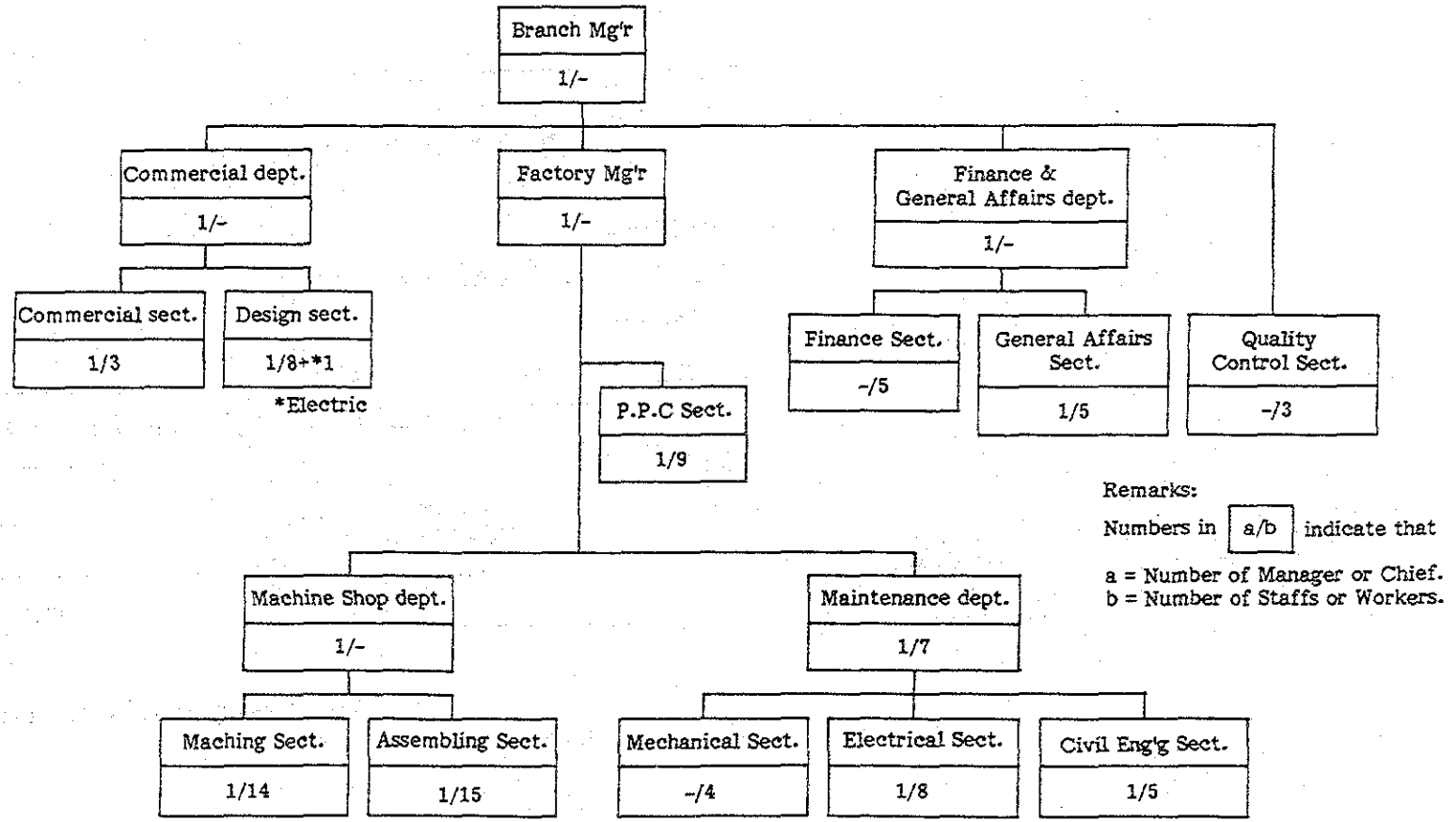
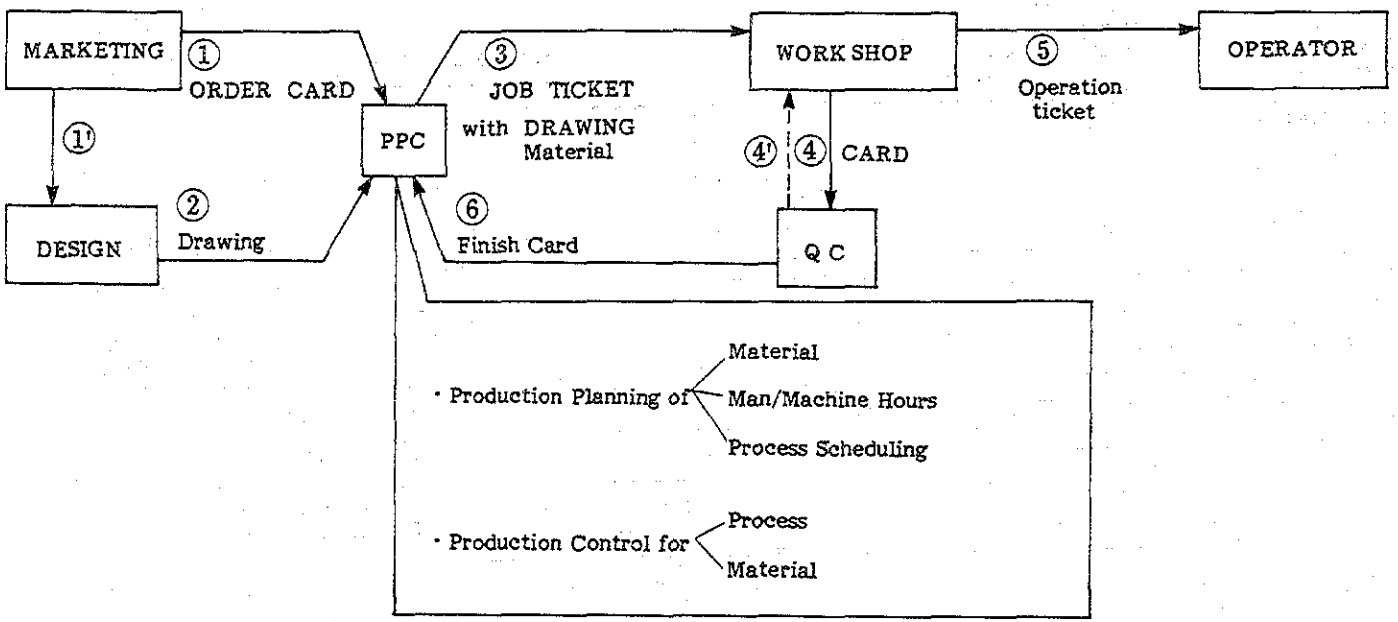


Fig. 1-4 Production Order Flow



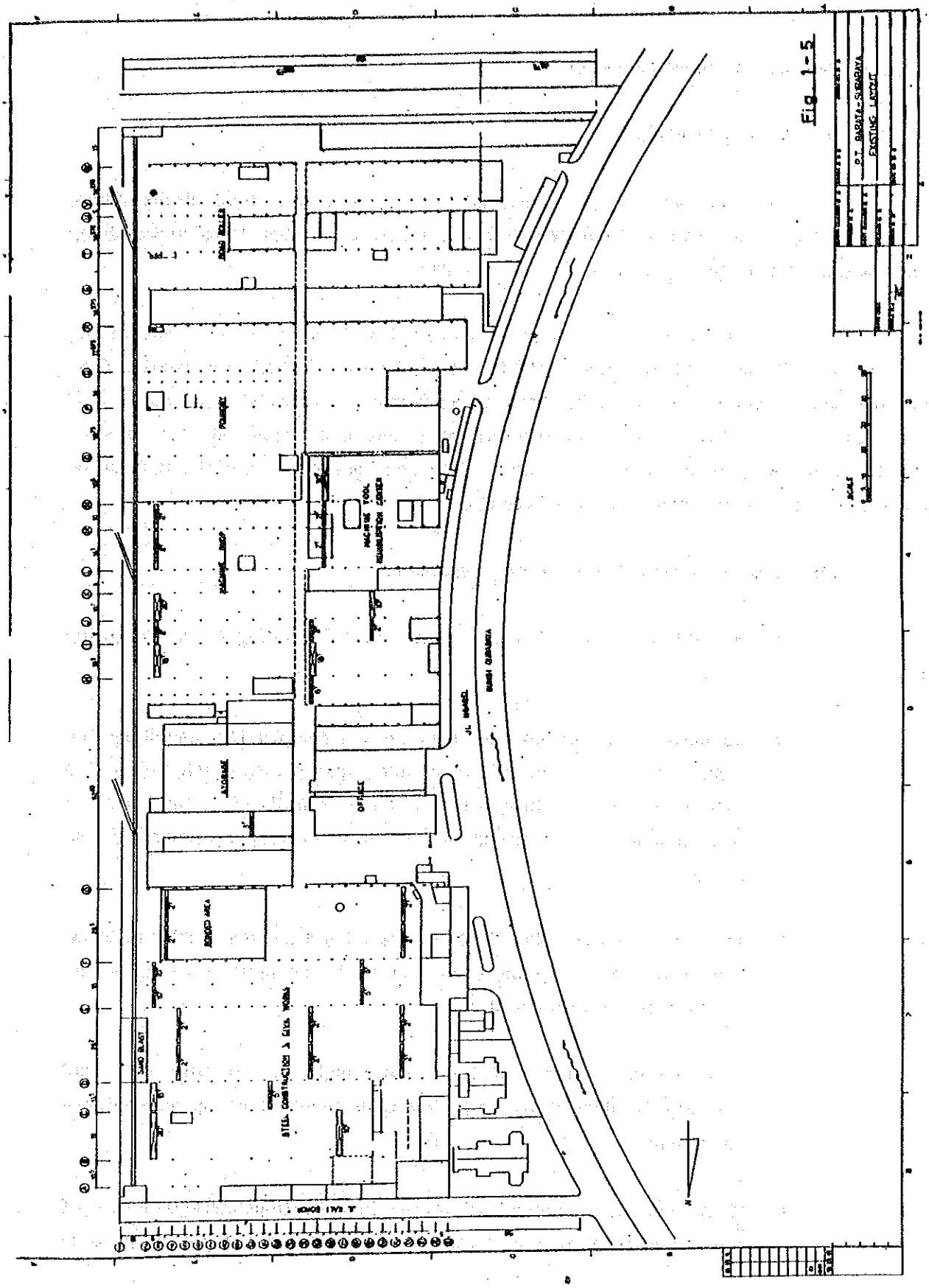


Fig 1-5
P.T. BARATA - SURABAYA
EXISTING LAYOUT
SCALE
ROAD ROLLER
POWDER
MACHINE SHOP
MACHINE TOOL
ASSEMBLE
OFFICE
JL. RAYA GUBENG
WELDED AREA
SAND BLAST
STEEL CONSTRUCTION & CIVIL WORKS
JL. RAYA GUBENG

4.1.2 Technical Premise Condition

(1) Factory location

Surabaya Machine Shop consists of 5 branches: Road Roller Shop, Foundry, Machine Shop, Machine Tool Rehabilitation Center, and Steel Construction Shop in the same premises, which permit no further expansion.

New premises are now required for additional machine equipment and an assembly area. The premises are only available in the premises of Steel Construction Shop which has been decided by P.T. Barata Indonesia to remove to another place where it is newly constructed. After Steel Construction Shop has been removed, the existing buildings should be utilized as far as possible. However, one building at least must be reformed considering the capacity, etc. of cranes.

(2) Criteria of selecting production equipment

The production equipment are to be selected according to the following policy.

1) Emphasis is placed on the equipment necessary for machining the component for the cement plant and sugar plant, which fall in the basic products according to the guideline established by the Indonesia Government. The scale-up of new or additional equipment is also considered.

2) The new equipment should be automated and provided with numerical control, progressively and strategically, in the light of strengthening the overall production system.

3) The equipment for machining with high repeatability and load stability is planned by emphasizing a function of special-purpose equipment.

4) If any existing equipment allows re-use or continuous use by means of repair and reform, it is effectively utilized for the limited purpose

and applications.

5) The power receiving equipment is reviewed for renewal in consideration of the necessary power consumption according to the machining and handling equipment plan.

Power supply must be stabilized to introduce numerically controlled equipment. This is taken into consideration to review power receiving and distribution sequence and equipment specifications.

(3) Transport limit

Surabaya Machine Shop is located in an urban area about 20 km away from Tanjung Perak port, where products can be shipped, and faces Jln. Ngagel. Tanjung Perak port allows ocean vessels up to 35,000 DWT to approach but lacks cargo handling equipment. A floating crane or a mobile crane should therefore be provided in the port.

The traffic authorities set a limit for inland transport; 3.5H × 2.5W × 12L m by size with the vehicle loaded and about 12 tons by product weight.

The market requirements for scaled-up plant capacity must be taken into consideration in planning plant equipment, particularly buildings and overhead traveling cranes. The assembly condition of the equipment before being divided for transport must also be reviewed.

4.1.3 Basic Renovation Plan

(1) Production program

The products mix and production program in Surabaya Machine Shop, P.T. Barata Indonesia are laid out on the basis of the order and sales plan developed on market research, as shown in Table 3-1, Production Program.

The basic construction of the production plan is as shown below,

1) The production program of equipment and parts for cement and sugar plants is in accordance with the market research, and marketing plan prepared by local content on the basis of the market research. Some parts and/or machinery in this field require major plate work. The production plan is made on condition that they are machined in respective plate work shop.

2) Surabaya Machine Shop has registered considerable manufacture results of water turbines. The production program is laid out in consideration of the results and the demand tendency on the basis of the market research.

   The plate work to form water turbines is totally carried out by Surabaya Machine Shop in accordance with the production allotment regulation by Branch in P.T. Barata Indonesia.
   Bevel gears, etc. for the gate winch relevant to water turbines are manufactured by Surabaya Machine Shop in the form of parts supply.

3) The miscellaneous products are included in the manufacture or contract machining of various machined parts; these jobs should be borne to Surabaya Machine Shop in charge of machining. However, the miscellaneous products are subject to many and unspecified orders and difficult to practically specify into the limited items. For the convenience to set forth the production program, the miscellaneous products are deemed small parts for the sugar plant which have registered highest sales result.

The following items are pointed out as items to be considered or the premise to achieve the above production program.

(1) Equipment for machining, assembly, testing, and inspection and relevant equipment for handling parts in shops should be arranged. More particularly, the equipment program given in the later Section should be achieved.

(2) Market demand should be connected to acceptance of orders in Surabaya Machine Shop.

(3) The skill of workers and control system should be in order sufficiently to carry out machining, assembly, testing, and inspection. In other words, the production control system and training given in the later Section should be exercised at least.

(4) Materials necessary for machining and manufacturing such as cast iron and cast steel should be locally available. In particular, the requirements of cast iron and cast steel should be satisfied by the capacity of local foundries in weight per piece of casting and in total required quantity. These castings must also meet the quality requirements.

In the course of reviewing the production program, the above items 1) - 4) have been carefully taken into consideration. The production program has been laid out by assuming the manufacture item of P.T. Barata Indonesia, Surabaya Machine shop on the basis of the localization concept obtained from the market research.

(2) Load plan and required equipment

1) Load plan

The production program in the previous Section is subdivided into the load plan by process as shown in Table 3-2.

This Table indicates plate work in man-hour and machining in machine-hour. Both in the plate work and in the machining, expected factors of improvement in productivity have been added; such factors based on improved efficiency and effect of work familiarity after renovation.

2) Policy of selecting new equipment

The policy of selecting new equipment in Surabaya Machine Shop is established as shown below.

(1) As a rule, new equipment is limited to such equipment relating to priority products emphasized in Surabaya Machine Shop in future.

(2) The new equipment is modernized equipment in terms of products mix and productivity.

Automation and numerical control in Surabaya Machine Shop should start with the renovation plan proposed at this time. For example, a floor type boring/milling machine and a vertical lathe are so specified to be provided with an NC device. Basically each capacity in the new equipment is set to meet the large-scale and high-accuracy requirements, a general tendency in the future.

(3) New equipment is required for the manufacture process of the parts newly localized and for supplementing the part that the existing equipment lacks.

A typical example is the introduction of a high-quality gear cutter and a high-frequency induction hardening unit. This will meet the requirements of reduction gears for the sugar plant and other various types of gears required by National Krakatau Iron Works.

④ Surabaya Machine Shop should be provided with equipment having an ample capacity to a possible extent because it is the department in charge of manufacturing products such as sugar plant components and water turbines as well as manufacturing and machining parts from the inside and outside the shops.

In the light of the above concept, the existing "applicable" equipment should be utilized as it is or by means of repair and reform, with rough machining and countermeasures at a load peak taken into consideration.

⑤ Some of the old equipment for re-use have lower load ratio and are not so important for the machining process. Such equipment is planned so as not to be operated by fixed workers but by temporarily arranged workers as required.

(3) Plan of improving the existing shop

Here shown is the reform plan required for ensuring the production equipment corresponding to 3-1, Production Program and Load Plan.

1) Production facilities and inspection equipment

Field survey is followed by the diagnosis of the existing facilities. As a result, the existing facilites are divided into three groups:

① Workable facilities that can be re-used, facilities to be modernized that can be re-used after repair and reform, and facilities to be scrapped that cannot be used for the future production purpose. This classification is shown in Table 3-3, Summary of Existing Facilities.

② The reform and repair for facilities to be modernized are outlined in Table 3-4, Facility Plan (Machine Rehabilitation and Relocation).

The reform and repair work is carried out under supplier's responsibility of facilities as shown below.

i) The supplier sends a supervisor who check the existing facilities for points to be reformed or repaired.

ii) The supplier manufactures and supplies parts required as a result of the check by his supervisor.

iii) The reform and repair are carried out by the maintenance members of Surabaya Machine Shop under the direction of a supervisor sent by the supplier.

(3) Table 3-5, Facility Plan (new machine tool) shows the summarized specifications and quantity of utilities to be newly purchased in order to satisfy the requirements of kinds and quantity of facilities proposed by the load plan.

2) Handling equipment

(1) Cranes in the Shop are required according to the product flow and product handling weight on the basis of the survey result of the existing facilities and the production program.

The cranes are as shown in the layout and should be newly purchased.

o Overhead traveling crane	50/10 tons	1 unit
o - do -	20/ 5 tons	1 unit
o Wall crane	2 tons	2 units
o Pole type jib hoist	1.5 and 0.5 tons	6 units

(2) The existing carriage rail must be reformed and the following vehicles purchased for the purpose of transport between buildings in the Shop and cartage within a short distance.

o Forklift	5 tons	1 unit
o Forklift	2 tons	1 unit
o Transfer carriage	10 tons	1 unit
o - ditto -	5 tons	1 unit
o - ditto -	2 tons	1 unit

(3) The handling equipment such as cranes newly purchased is outlined in Table 3-6. Facility Plan (Handling equipment).

3) Buildings and auxiliary facilities

The following reform work is required for installing the production equipment, inspection equipment and handling equipment as planned. The reform work is outlined in Table 3-7, Facility Plan (Building & auxiliary facilities).

(1) Reform work of bay D - E
The existing buildings are reformed to allow installing a 50-tons crane by removing the existing roof truss to assemble large-scale products.

(2) Sub-station buildings (3 buildings)

(3) Partition work for sand-blasting area.

(4) Reinforcement of columns for jib hoists.

(5) Assembling floor surface with rails (about 600 m^2)

(6) Improvement of railway for transfer carriage.

It is recommended that the exteriors for the existing buildings be reformed on schedule by being annual-budgeted as maintenance and repair work.

4) Electrical/utility facilities

The following reform and renewal work is required to enhance the capacity of the existing facilities and prevent obsolescence in the course of achieving the production program. The outline is as shown in Table 3-8, Facility Plan (Infrastructure/electrical/utility facilities).

(1) Payment to power supply company (P.L.N.)

Payment is required for increasing the power receiving capacity to about 2,500 KVA. The receiving voltage is also increased from 6 KV to 20 KV.

(2) Substation work

The existing substation is totally renewed because of increase in the receiving capacity and obsolescence of the existing facilities.

(3) Power wiring work

Power source wiring is involved by the installation of new machine tools and equipment and by the transfer or removal of the existing facilities.

The trunk line has been obsoleted and is totally reformed except those in Road Roller Shop and Cast Iron Foundry.

(4) Lighting equipment

Workability and safety require additional lighting equipment. The place of additional work and illuminance are as shown below.

1)	Marking-off area	200Lux
2)	Main passway in shop	50Lux

(5) Communication facilities

The expansion of the machine shop requires enhanced communication facilities. At this time, a new telephone switchboard is installed for the purpose of introducing a new

method to cope with future OA. The existing telephone switchboard has been obsoleted, being incapable of additional facilities.

The new telephone switchboard is capable of accommodating and operating various types of OA machines (such as facsimiles, word processors, personal computers, data terminal equipment). This switchboard will be an effective means for the future office automation.

⑥ Dust collector for sandblast
A dust collector for sandblast is newly installed for the purpose of improving work environment.

(4) Shop construction work and installation work

This renovation plan requires to determine the detailed specifications of machinery, and to determine or design the detail specifications of the infrastructure, handling equipment, and electric/utility facilities to be enhanced or reformed, in accordance with the basic plan shown in the feasibility study. The procurement of machinery and field work must then be consigned to contractors.

The content of the above detailed design (so-called D/D) has great influence on the total investments of the renovation and the process. Therefore, a consultant should be employed who has a general engineering capability with accumulated experience on similar projects to this renovation plan.

This renovation plan includes many items to be designed at site such as foundations for machinery and building reform from considerations for the process and conditioning for the present situation, and involves partial work supervision by designers. Indonesian designers with experience of this type of service should be employed to work under the D/D consultant's responsibility.

The practical content of the D/D service offered by the consultant is as shown below.

a. Detailed survey of the existing facilities.

b. Understanding of feasibility study and correction as required.

c. Preparation of specifications for the procurement of new machinery and tools and installation works

d. Preparation of reform specifications of existing machinery and tools.

e. Preparation of specifications for the procurement of handling equipment and installation works

f. Design of building reform work and preparation of purchase specifications.

g. Design of electric/utility facilities work and preparation of purchase specifications.

h. Preparation of the renovation plan.

i. Consulting on procurement of various items and orders of work and contract procedures.

j. Approval for drawings and purchase specifications of machinery.

k. Design of machinery foundation work and preparation of purchase specifications.

l. Inspection of major machines and supervision for main erection.

Note: Supervision in installing and test-running main machinery and facilities is within the scope of the procurement of the machinery and facilities, and is beyond the scope of the D/D service.

BARATA SURABAYA MACHINE SHOP

Table 3-1 Production Program

REMARK 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	100			100	1.5	300			300	1.5	400			400
PARTS SUPPLY		100			100		100			100		200			200
SUGAR															
4000 T/D PLANT	2	350			350	2	1,288			1,288	3	2,000			2,000
SPARE CANE MILL ROLL	116	1,604			1,604	138	1,909			1,909	138	1,909			1,909
PARTS SUPPLY	50	63			63	100	125			125	150	188			188
PLANT REHABILITATION	3	300			300	3	300			300	3	300			300
WATER TURBINE															
FRANCIS 1500KW						1	9	9		18	1	9	9		18
FRANCIS 750KW											1	5	5		10
FRANCIS 300-400KW	30	90	90		180	50	150	150		300	50	150	150		300
PARTS SUPPLY		50			50		50			50		50			50
OTHERS															
MISCELLANEOUS		620			620		733			733		883			883
TOTAL		3,277	90		3,367		4,964	159		5,123		6,094	164		6,258

BARATA SURABAYA MACHINE SHOP

Table 3-2 Production Load Plan

YEAR	CATEGORY of PRODUCTS	TOTAL PRODUCTION in WEIGHT TON	TOTAL PRODUCTION in M/M HOURS within own shop	TOTAL PRODUCTION in M/M HOURS by sub-con. & site fabri.	BREAKDOWN of MAN/MACHINE HOURS within OWN WORKSHOP: PLATE WORK MARK'G CUTTING VEBEL'G	PLATE WORK BENDING FORMING	PLATE WORK FITTING WELDING	PLATE WORK OTHERS	PLATE WORK TOTAL	MACHINING LATHE group	MACHINING BORING FACING group	MACHINING DRILL	MACHINING OTHERS	MACHINING TOTAL
	CEMENT PLANT COMPONENTS	200	2,530							700	960	840	30	2,530
1989	SUGAR PLANT COMPONENTS	2,317	121,370							89,710	11,870	5,270	14,520	121,370
	WATER TURBINES	230	18,920		2,360	4,000	10,900		17,260	1,140	260	230	30	1,660
	OTHERS	620	53,650							33,640	5,300	2,420	12,290	53,650
	TOTAL	3,367	196,470		2,360	4,000	10,900		17,260	125,190	18,390	8,760	26,870	179,210
	CEMENT PLANT COMPONENTS	400	4,020							1,110	1,520	1,340	50	4,020
1994	SUGAR PLANT COMPONENTS	3,622	139,450							97,910	14,330	6,750	20,460	139,450
	WATER TURBINES	368	31,000		3,870	6,550	17,860		28,280	1,870	420	370	60	2,720
	OTHERS	733	49,260							18,340	4,190	1,570	25,160	49,260
	TOTAL	5,123	223,730		3,870	6,550	17,860		28,280	119,230	20,460	10,030	45,730	195,450
	CEMENT PLANT COMPONENTS	600	5,280							1,460	2,000	1,760	60	5,280
1999	SUGAR PLANT COMPONENTS	4,397	144,400							99,500	15,090	7,250	22,560	144,400
	WATER TURBINES	378	34,170		4,260	7,220	19,690		31,170	2,060	460	410	70	3,000
	OTHERS	883	71,380							26,580	6,070	2,280	36,450	71,380
	TOTAL	6,258	255,230		4,260	7,220	19,690		31,170	129,600	23,620	11,700	59,140	224,060

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

COMPANY WORKS: BARATA/SURABAYA MACHINE SHOP

MACHINE NAME	MAX. CAPACITY/SIZE	YEAR A.D. When machine was manufactured	Q'TY	RESULT OF SURVEY			REMARKS
				TO BE SCRAPPED	TO BE MODERNIZED	WORKABLE	
LATHE MACHINE	CENTER DISTANCE : 14,660 mm	1970 -	-	-	-	-	
	TURNING DIAMETER : ø1,000 mm	1950 - 1969	10	-	10	-	
	CENTER HEIGHT ABOVE BED : 640 mm	1930 - 1949	17	1	14	2	
		- 1929	19	-	19	-	
BORING & MILLING MACHINE	MACHINE OVER RAIL HEIGHT : 4,900 mm	1970 -	-	-	-	-	
	SPINDLE LONG TRAVEL MAX : 1,560 mm	1950 - 1969	2	1	1	-	
	HEAD STOCK VERTICAL TRAVEL : 3,900 mm	1930 - 1949	11	2	8	1	
	MAX. CROSS TRAVEL : 3,480 mm	- 1929	-	-	-	-	
TURNING MACHINE	TABLE DIAMETER : ø3,030 mm	1970 -	-	-	-	-	
	TURNING HEIGHT : 3,500 mm	1950 - 1969	-	-	-	-	
	TURNING DIAMETER : ø3,400 mm	1930 - 1949	2	-	2	-	
		- 1929	3	1	2	-	
DRILLING MACHINE	DRILLING HEIGHT : 1,800 mm	1970 -	-	-	-	-	
	DISTANCE SPINDLE CENTER TO COLUMN MAX : 2,900 mm	1950 - 1969	1	-	-	1	
		1930 - 1949	8	-	8	-	
		- 1929	4	-	4	-	

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

COMPANY WORKS: BARATA/SURABAYA MACHINE SHOP

MACHINE NAME	MAX. CAPACITY/SIZE	YEAR A.D. When machine was manufactured	Q'TY	RESULT OF SURVEY: TO BE SCRAPPED	RESULT OF SURVEY: TO BE MODERNIZED	RESULT OF SURVEY: WORKABLE	REMARKS
PLANOMILLER & PLANER	TABLE LENGTH : 6,400 mm TABLE WIDTH : 1,250 mm PLANING HEIGHT : 1,100 mm PLANING WIDTH : 1,350 mm TABLE LONG TRAVEL : 6,000 mm TOOL ROTARY ANGLE : 45°	1970 -	-	-	-	-	
		1950 - 1969	-	-	-	-	
		1930 - 1949	2	-	2	-	
		- 1929	1	-	1	-	
SHAPER & SLOTTER	RAM TRAVEL : 610 mm SHAPING HEIGHT : 550 mm TABLE TRAVEL : 480 mm TABLE WIDTH : 405 mm TOOL ROTARY ANGLE : 45°	1970 -	-	-	-	-	
		1950 - 1969	-	-	-	-	
		1930 - 1949	5	-	5	-	
		- 1929	3	-	3	-	
OTHER MACHINES		1970 -	3	-	3	-	GRINDING M/C ETC.
		1950 - 1969	4	-	4	-	
		1930 - 1949	40	10	29	1	
		- 1929	17	5	12	-	
CUTTING EQUIPMENT		1970 -	-	-	-	-	
		1950 - 1969	-	-	-	-	
		1930 - 1949	1	-	1	-	
		- 1929	-	-	-	-	

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

COMPANY WORKS: BARATA/SURABAYA MACHINE SHOP

MACHINE NAME	MAX. CAPACITY/SIZE	YEAR A.D. When machine was manufactured	RESULT OF SURVEY Q'TY	TO BE SCRAPPED	TO BE MODERNIZED	WORKABLE	REMARKS
FORMING MACHINE		1970 -	-	-	-	-	
		1950 - 1969	-	-	-	-	
		1930 - 1949	3	-	3	-	
		- 1929	1	-	1	-	
HEAT TREATING FURNACE		1970 -	2	-	2	-	
		1950 - 1969	5	-	3	2	
		1930 - 1949	-	-	-	-	
		- 1929	-	-	-	-	
PLATE WORK OTHER MACHINES		1970 -	-	-	-	-	BOLT NUT SHOP MACHINE, ETC.
		1950 - 1969	-	-	-	-	
		1930 - 1949	10	10	-	-	
		- 1929	4	4	-	-	
OTHER FACILITY & EQUIPMENT		1970 -	2	-	-	2	
		1950 - 1969	-	-	-	-	
		1930 - 1949	-	-	-	-	
		- 1929	-	-	-	-	

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

COMPANY WORKS: BARATA/SURABAYA MACHINE SHOP

MACHINE NAME	MAX. CAPACITY/SIZE	YEAR A.D. When machine was manufactured	Q'TY	RESULT OF SURVEY: TO BE SCRAPPED	RESULT OF SURVEY: TO BE MODERNIZED	RESULT OF SURVEY: WORKABLE	REMARKS
TRANSPORTATION EQUIPMENT	O.H.T CRANE : 20 tons	1970 -	-	-	-	-	
		1950 - 1969	19	-	19	-	
		1930 - 1949	-	-	-	-	
		- 1929	-	-	-	-	

BARATA SURABAYA MACHINE SHOP

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

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
	D-1 (1 set)	Vertical Boring & Milling Machine (Reform and overhaul specifications) 1. Enhancement of the table speed and cutting ability through the change of the belt drive system to the motor and reduction gears drive system. 2. Replacement and adjustment of bearing metals and bearings in each part. 3. Fitting and accuracy conditioning of worn sliding surfaces and connections and, replacement and adjustment of worn parts. 4. Check of electric, hydraulic, air, and lubricating oil systems (including cutting oil pump unit if required.). Restoration conditioning of lost functions and parts. 5. Replacement or correction of lead screws and replacement and adjustment of internal screws (including feed screws). 6. Restoration, reassembly, test-run, and cutting test of overall machine. 7. Correction, restoration, and finish painting of other exterior items.	This is the major machine among existing turning machines. The reform and overhaul shown in the left are carried out because of the belt drive system and severe overall deterioration. This work will contribute to coping with increased capability requirements at a peak load.	
	D-42 (1 set)	Spur Gear Shaping Machine (Overhaul specifications) 1. Overhaul. Replacement and adjustment of bearing metals and bearings for each part. 2. Fitting and accuracy improvement of worn sliding surface in each part and connections. Replacement and adjustment of worn parts. 3. Check of electric, hydraulic, air, and lubricating oil (including cutting oil unit). Restoration and conditioning of lost functions and parts.	This overhaul contributes to enhanced capability at a peak load in order to remedy the present deterioration and to meet market requirements.	

BARATA SURABAYA MACHINE SHOP

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

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
	D-42	Spur Gear Shaping Machine (Overhaul specifications) (cont'd) 4. Check, service, and finish of master gears for indexing. (Replace if not applicable to rough gear cutting.) 5. Check and supplement of spare gears for indexing. 6. Replacement or correction of lead screws. Replacement and adjustement of internal screws (including feed screws). 7. Restoration, reassembly, test-run, and cutting test. 8. Correction, restoration, and finish painting of other exterior items.		
	D-58 (1 set)	Lathe Machine (Reform and overhaul specifictions) 1. Enhancement of spindle speed and cutting ability through the change of belt drive system into motor and reduction gears system. 2. Replacement and adjustment of bearing metals and bearings in each part. 3. Fitting and accuracy adjustment of each worn sliding surface and connection. 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, reassembly, test-run, and cutting test. 7. Correction, restoration, and finish painting of other exterior items.	Deterioration and markedly reduced accuracy require this overhaul, which contributes to increasing the capability at a peak load.	

BARATA SURABAYA MACHINE SHOP **Table 3-4 Facility Plan (Machine Rehabilitation & Relocation) (3/6)**

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
	D-91, 92 (2 sets)	Lathe Machine 1. Total overhaul. 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 systems (including cutting oil pump unit). Restoration and conditioning of lost functions and parts. 4. Replacement or correction of lead screws. Replacement and adjustment of internal screws (including feed screws). 5. Total restoration, reassembly, test-run, and cutting test. 6. Correction, restoration, and finish painting of other exterior items.	These machines are the machines to finish the circumferential groove of cane mill rolls. Insufficient floor foundations and reduced accuracy of the machine require earlier overhauling, which allows planing to diverse the machine for rough circumferential machining of the above roll.	The machines are relocated at the Bay D-E in the place having been utilized as Steel Construction Shop.
	D-90 (1 set)	Lathe Mchine (Reform and overhaul specifications) 1. Change of belt drive system into motor and reduction gear drive system to enhance spindle speed and cutting ability. 2. Total overhaul. Replacement and adjustment of bearing metals and bearings. 3. Fitting and accuracy adjustment of worn sliding surfaces and connections in each part. 4. Check of electric, hydraulic, air, and lubricating oil systems (including cutting oil unit). Restoration and conditioning of lost funcitons and parts. 5. Replacement or correction of lead screws. Replacing and adjustment of internal screws (including feed screws). 6. Funciton improvement and accuracy adjustment of milling attachment for sugar roll chevron grooves.	This special purpose machine once reformed for the shaping of cane mill roll chevron groove has been extremely deteriorated and reduced its capability. Therefore the earlier improvement and overhaul is required to cover the peak-load.	

BARATA SURABAYA MACHINE SHOP

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

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
	D-90	Lathe Machine (Cont'd) 7. Total overhaul, restoration, reassembly, test-run, and cutting test. 8. Correction, restoration, finish painting of other exterior items.		
	D-99 (1 set)	Duplex Milling Machine (Reform specifications) 1. Extention of inside width between columns to 1,000 mm A space block 200-300 mm wide is inserted into the connection part between column and bed together with enlargement on replacement of the related parts. 2. Extention of the projection stroke of the milling head on both sides. (Replacement with a longer sleeve or whole milling head). 3. Check of electric, hydraulic, air, lubricating oil, and cutting oil systems. Restoration and conditioning of lost functions and parts. 4. Total restoration reassembly test-run, and cutting test. 5. Correction, restoration, and finish painting of other exterior items.	This machine has narrower width, causing less milling ability (due to less milling width) and less frequency in use. This reform will serve to more capacity requirement at a peak load.	

BARATA SURABAYA MACHINE SHOP **Table 3-4 Facility Plan (Machine Rehabilitation & Relocation) (5/6)**

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
	T-73 (1 set) T-74 T-75 (2 sets)	Surface Grinding M/C, Tool Grinding M/C (Overhaul specifications) 1. Total overhaul. Replacement and adjustment of bearing metals and bearings in each part. 2. Fitting and accuracy adjustment of worn sliding surfaces and connections. Replacement and adjustment of worn parts. 3. Check of electric, hydraulic, air, lubricating oil, and cutting oil systems. Restoration and conditioning of lost functions and parts. 4. Replacement and correction of lead and feed screws. Replacement and adjustment of internal screws. 5. Total restoration, reassembly, test-run, and cutting test. 6. Correction, restoration, finish painting of other exerior items.		
	Others (80 units)	Machine Tool & Plate Work Equipment (Overhaul and partial repair) Required repair specifications is to be determined after detailed rechecks at the time of Detailed Design.		

BARATA SURABAYA MACHINE SHOP

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

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
	D.90	Lathe Machine	The layout of these machines is changed to rationalize the cane mill roll machining line.	Relocated within Bay J - K.
	D.93	Lathe Machine		
	D.94	Lathe Machine		
	B.201	Radial Drilling Machine	After the above layout is changed, these machines are concentrated to Steel Construction Bays D and E to meet increased capacity requirements at a peak load, and used as a large item machining line other than the sugar roll line.	Removed from Bay J - K to Bay E - F.
	D.92	Lathe Machine		
	D.91	Lathe Machine		
	D.18	Planing Machine (Open Side Type)		
	D.89	Lathe Machine		
	D.98	Lathe Machine		
	D.95	Lathe Machine		Removed from Bay H - I to Bay E - F.
	D.96	Lathe Machine		
	D.97	Lathe Machine		
	D.8	Horizontal Boring & Milling Machine (Table Type)		
	D.9	Horizontal Boring & Milling Machine (Table Type)		
	D.87	Lathe Machine	The layout is changed to rationalize the machining line for round bar items and gears.	Removed from Bay J - K to Bay H - I.
	D.88	Lathe Machine		
	D.40	Bevel Gear Shaping Machine		Removed from Bay I - J to Bay H - I.
	D.42	Spur Gear Shaping Machine		
	D.38	Gear Milling Machine		
	D.37	Gear Milling Machine		
	D.36	Gear Milling Machine		Removed from Bay J - K to Bay H - I.
	D.	(Barata made machine)		
	D.99	Duplex Milling Machine		

BARATA SURABAYA MACHINE SHOP. **Table 3-5 Facility Plan (New Machine Tool) (1/36)**

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
L-7	BL (5 sets)	Heavy Duty Large Lathe with Boring System			These are new and powerful machines with special-purpose specifications for bearing the cane mill roll, one of the major products.	Cane Mill roll
		1. Technical specifications				
		(1) Swing over bed	mm	2,200		
		(2) Swing over carriage	mm	1,650		
		(3) 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. Optional accessories		1 set		
		(1) Boring guide support	520 - 1150 mm dia. (1 set)			
		(2) Boring bar head	450 - 860 mm dia. (1 set)			
L-14	L (1 set)	Heavy Duty High Speed Lathe				
		1. Specifictions			This is middle-size, high-efficiency machine installed to cover the large numbers and multi-sorts of load.	
		(1) Swing over bed	mm (in)	630 (24 3/4)		
		(2) Swing over carriage	mm (in)	400 (15 3/4)		
		(3) Swing in gap	mm (in)	900 (35 1/2)		
		(4) Distance between centers	mm (in)	1,000 (38 2/3)		
		(5) Main drive motor	kw (HP)	4P.75 or 11 (10 or 15)		

BARATA SURABAYA MACHINE SHOP

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

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
L-14	L	Heavy Duty High Speed Lathe (Cont'd)				
		2. Standard accessories		1 set		
		3. Special accessories		1 set		
L-15	L (9 sets)	Heavy Duty Lathe			These high efficiency machines are most suitable to cover the increasing machining load for circumferential grooves on cane mill rolls.	
		1. Specifications				
		(1) Swing over bed	mm (in)	1,600 (63)		
		(2) Swing over carriage	mm (in)	1,200 (40)		
		(3) Distance between centers	mm (in)	6,000 (236 1/4)		
		(4) Motors				
		Main drive	AC 4P 45 kW (60 HP)			
		2. Standard accessories		1 set		
		3. Special accessories		1 set		
L-16	L (1 set)	Heavy Duty Lathe			This is a new and powerful machine for finishing the cane mill roll circumferences and axes to meet increased requirements of of cane mill rolls.	
		1. Specifictions				
		(1) Swing over bed	mm (in)	2,600 (102 3/8)		
		(2) Swing over carriage	mm (in)	2,200 (86 5/8)		
		(3) Distance between centers	mm (in)	8,000 (296 3/4)		
		(4) Motors				
		Main drive	AC 4P 45 kW (60 HP)			

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

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
L-16	L	Heavy Duty Lathe (cont'd)				
		2. Standard accessories		1 set		
		3. Special accessories		1 set		
L-17	L (2 sets)	Heavy Duty Lathe			These lathes are specially considered to enhance the cutting efficiency of chevron groove of cane mill roll by using a special attachment.	
		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		
L-12	LV (1 set)	Vertical Boring & Turning Mill				
		1. Specifications				
		(1) Table diameter	mm (in)	5,000 (197)		
		(2) Max. turning diameter	mm (in)	6,500 (256)		

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

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
L-12	LV	Vertical Boring & Turning Mill (cont'd)			The existing machine with less capacity is inefficient due to deterioration and old-type belt drive system. This newly introduced machine is a newest and powerful machine and equipped with a newest MNC device to meet the requirements of large-size products in the future.	
		(3) Max. turning height above table	mm (in)	4,000 (157)		
		(4) Max. table load	kgf (lbs)	100,000 (220,000)		
		(5) Vertical travel of turning head ram	mm (in)	2,000 (78)		
		(6) Vertical travel of milling head ram	mm (in)	1,250 (69)		
		(7) Table drive motor power	kw (HP)	90 (120)		
		(8) Spindle drive motor power	kw (HP)	15 (20) 37(50)		
		2. Standard accessories		1 set		
		3. Optional accessories		1 set		
		(1) Angle head for milling head		(1 set)		
		(2) D.R.O (X,Y) for turning head		(1 set)		
		(3) MNC system		(1 set)		
L-13	LV (1 set)	Vertical Boring & Turning Mill			This is a new and powerful machine capable of meeting the increased requirements and scaled-up products in the future.	
		1. Specifications				
		(1) Table diameter	mm (in)	1,600 (63)		
		(2) Max. workpiece diameter	mm (in)	2,000 (78.7)		
		(3) Max. workpiece height	mm (in)	1,500 (59)		
		(4) Rail-head cross travel	mm (in)	-100 - 1,000 (-3.9 - 39)		
		(5) Rail-head ram vertical travel	mm (in)	1,000 (39.4)		
		(6) Rail-head swivel angle (right & left)		30°		

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

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
L-13	LV	Vertical Boring & Turning Mill (cont'd)				
		(7) Cross-rail vertical travel	mm (in)	1,000 (39.4)		
		(8) Max. table load	kgf (lbs)	8,000 (17,640)		
		2. Standard accessories		1 set		
		3. Special accessories		1 set		
		(1) Thread-cutting attachment		(1 set)		
		(2) Taper-turning device (with 4 change gears for half-face angle of 15°)		(1 set)		
		(3) Electric copying device		(1 set)		
		(4) Digital readout system (diametral indications in 0.01 mm increments)		(1 set)		
		4. Motors				
		(1) Main motor	kw (HP)	AC 4P 30 (40)		
B-2	BT (2 sets)	Table-Type Horizontal Boring & Milling Machine			These machines substitute for the existing middle-and small-size milling machines or deteriorated planers. These new and powerful machines are installed to meet scaled-up products in the future.	
		1. Machine Specifications				
		(1) Spindle diameter	mm (in)	110 (4.3)		
		(2) Spindle taper		ISO 7/24 taper No.50		
		(3) Milling spindle diameter	mm (in)	225 (8.86)		
		(4) Main motor output	kw (HP)	DC 15 (20)		
		(5) Spindle extension	mm (in)	630 (248)		

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

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
B-2	BT	Table-Type Horizontal Boring & Milling Machine (cont'd) (6) Spindle head vertical travel (Y-axis) mm (in) 1,500 (59) (7) Table cross travel (X-axis) mm (in) 1,800 (70.9) (8) Table longitudinal travel (Z-axis) mm (in) 1,450 (-150 - 1,300) (57 (-5.9-51.1)) (9) Table working area mm (in) 1,400 x 1,600 (55' x 63) (10) Max. load on table kgf (lbs) 6,300 (13,860) 2. Standard Accessories 1 set 3. Optional Accessories 1 set (1) Angle head (ISO No.50) (1 set)		
B-3	BF (1 set)	Floor-Type Horizontal Milling & Boring Machine 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 & spindle mm (in) 1,000 (39.4)	This machine is installed to meet the scale-up of Sugar plant components and simultaneously to mitigate the present complicated situation of existing floor type boring/milling machine which is the only large-size machine with a great deal of and various sorts of load and of which floor surface has been frequently occupied with the marking work in lieu of marking table. This new machine with its special accessoried such as MNC device, broad	Mill cheeks, roller beds, and sugar roll shafts for sugar plants.

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

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
B-3	BF	Floor-Type Horizontal Milling & Boring Machine (cont'd)			floor surface, rotary table, angle plate, etc. is expected to cover the various sorts of machining in remarkable accuracy and high efficiency condition.	
		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)				
		For spindle head vertical travel (Y axis)		2.8 kw (4 HP)		
		For spindle and sliding sleeve travel (Z axis)				
		(3) MDI-NC system				
		3. Machine Dimensions in Relation to Column Horizontal Travel and Spindle Head Vertical Travel				
		(1) Column horizontal travel	mm (in)	9,000 (354)		
		(2) Spindle head vertical travel	mm (in)	3,500 (138)		
		4. Standard accessories		1 set		
		5. Optional accessories		1 set		
		(1) Angle head		(1 set)		
		(2) Universal head		(1 set)		
		(3) Rotary table (various types)		(1 set)		
		(4) Floor plate and jack screws for level adjustment 1,600 x 2,400 x 300 mm (63 x 94 x 39.5")		(6 sets)		
		(5) Angle plate: 1,500 mm x 2,500 mm x 4,000 mm (59" x 98.4" x 157.5")		(2 pcs/1 set)		
		6. MDI-System		(1 set)		

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

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
P-2	PL/PM (1 set)	Heavy Duty Double Housing Planer			This machine is equipped with accessories permitting both cutting and milling for the purpose of increasing capacity and enhancing accuracy and efficiency.	
		1. Main specifications				
		(1) Capacity				
		. Effective length of table	mm	8,000		
		. Effective width of table	mm	1,000		
		. Height of cutter	mm	2,000		
		. Effective width for cutting	mm	3,000		
		(2) Motors				
		. for driving table	kw	DC 55		
		. for elevating cross rails	kw	5.5		
		2. Special specifications for combined milling				
		(1) Capacity				
		. Height of cutter (Thickness of cutter)	mm	1,880		
		. Effective width for cutting	mm	3,000		
		(2) Motors				
		. for driving table (Mill feed)	kw	DC 2.2		
		. for driving table (Rapid milling feed)	kw	3.7		
		(3) Specifications				
		. Motor for driving the spindle	kw	11 & 15		
		3. Accessories				
		(1) Standard accessories		1 set		
		(2) Optional accessories		1 set		
		. Milling unit		(1 set)		

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

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
P-3	PL/PM (1 set)	Heavy Duty Open Side Planer			This machine augments the capacity of existing machines, and meets heavy-duty requirements.	
		1. Main specifications				
		(1) Capacity				
		. Working area of table	mm	1,500 x 6,000		
		. Planing height	mm	1,800		
		. Planing width (For usage of side cutter head)	mm	2,600		
		. Max. stroke	mm	6,500		
		(2) Motors				
		. Table drive motor	kw	DC30/AC30		
		. Cross rail elevation motor	kw	3.7		
		2. Specification of combined milling machine (Optionals)				
		(1) Capacity				
		. Milling height (cutter thickness)	mm	1,675		
		. Milling width	mm	2,130		
		(2) Motors				
		. Table drive motor (milling feed)	kw	1.5		
		. Table drive motor (milling rapid feed)	kw	2.2		
		(3) Others				
		. Main motor	kw	7.5		
		3. Standard accessories		1 set		
		4. Optional accessories		1 set		

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

NO.	FACILITY	DESCRIPTION		BASIS OF PLAN	REMARKS
M-1	HM (1 set)	Horizontal Milling Machine		Augmentation of capacity and enhancement of efficiency.	
		1. Specifications			
		(1) Table			
		. Max. travel (longi., cross, vert.)	560 x 200 x 400 (mm)		
		. Working surface	1,100 x 260		
		(2) Motors			
		. Spindle drive motor	2.2 kw		
		2. Standard accessories	1 set		
		3. Optional accessories	1 set		
		(1) Vertical attachment	(1 set)		
		(2) Machine vice (125)	(1 set)		
		(3) Round table (300)	(1 set)		
		(4) Universal dividing head (200)	(1 set)		
M-2	VM (1 set)	Vertical Milling Machine		Augmentation of capacity and enhancement of efficiency.	
		1. Specifications			
		(1) Table			
		. Max. travel (longi x cross x vert.)	900 x 300 x 400 (mm)		
		. Working surface (length x width)	1,550 x 300		
		(2) Motors			
		. Main motor	5.5 kw		
		. Table feed motor	2.2 kw		

BARATA SURABAYA MACHINE SHOP **Table 3-5 Facility Plan (New Machine Tool) (11/36)**

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
M-2	VM	Vertical Milling Machine (cont'd)				
		2. Standard accessories		1 set		
		3. Optional accessories		1 set		
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)		

BARATA SURABAYA MACHINE SHOP **Table 3-5 Facility Plan (New Machine Tool) (12/36)**

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
D-2	DR	Radial Drills (cont'd)				
		2. Standard accessories		1 set		
		3. Special accessories		1 set		
Z-1	HOB (1 set)	Gear Hobbing Machine			This is a machine for meeting increase in order booking of pinions and gears for sugar cane mill rolls. Worm wheels, etc. can also be machined by utilizing accessories.	Pinions, gears, etc. for sugar plants.
		1. Specifications				
		(1) Max. diameter of gear to be hobbed	mm	2,500		
		(2) Max. diameter of gear to be cut with milling cutter	mm	4,300		
		(3) Max. module of gear to be hobbed		25		
		(4) Max. module of gear to be cut with milling cutter		35		
		(5) Min. number of teeth in gear to be cut		10		
		(6) Center distance between hob and work arbor				
		Min. distance	mm	230		
		Max. distance	mm	2,310		
		(7) Max. hob dimensions				
		Diameter	mm	380		
		Length	mm	510		
		(8) Max. weight of work piece	kg	10,000		
		(9) Main motor (DC motor)	kw	18.5		

BARATA SURABAYA MACHINE SHOP

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

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
Z-1	HOB	Gear Hobbing Maching (cont'd)				
		2. Standard accessories		1 set		
		3. Optional accessories		1 set		
Z-2	BGS (1 set)	Bevel Gear Shaper			This machine substitutes for the existing machine, which is subject to failure. High efficiency is expected.	Bevel gears for irrigation gate 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	mm	20		
		(5) Min. number of teeth				
		Ratio 8:1	mm	10		
		Ratio 1:1	mm	14		
		(6) Pitch cone angle of bevel gear				
		Max.		83°		
		Min.		7°		
		(7) Max. ratio of gear		8:1		
		2. Dimensions				
		(1) Distsance from face plate to apex				
		Max.	mm	521		
		Min.	mm	51		

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

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
Z-2	BGS	Bevel Gear Shaper (cont'd)				
		(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		
S-2	SH (1 set)	Shaper			Substitution	
		1. Specifications				
		(1) Max. stroke	mm	650		
		(2) Max. shaping width	mm	650		
		(3) Vertical travel of table	mm	310		
		(4) Max. distance between table surface and ram		430		
		(5) Table dimensions (L x H x W)	mm	610 x 400 x 400		
		(6) Vertical travel at tool holder	mm	200		
		(7) Motor	kw x p	2.2 x 4		
		2. Standard accessories		1 set		
		3. Optional accessories		1 set		

BARATA SURABAYA MACHINE SHOP

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

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
SL-1	SL (1 set)	Heavy Duty Precision Slotting Machine			Capacity enhancement and scaling-up.	Machining of key ways on habs of gears, etc.
		1. Specifications				
		(1) Ram				
		. Max. stroke	mm	615		
		. Forward tilt of ram		0 - 10°		
		. Vertical adjustment of ram	mm	800		
		. 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		
		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)		

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
G-1	U.T.G (2 sets)	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 equipment & tool cabinet		1 set		
		3. Optional accessories		1 set		
G-2	DHG (2 sets)	High Speed Double Head Grinding Machine				
		1. Specifications				
		(1) Wheel size (O.D x W x I.D)	mm	ø355 x 50 x ø31.70		
		(2) Motor for wheel head	kw	2.2/0.75		
		(3) Peripheral velocity (50 Hz/60 Hz)	m/min	1,617/1,951		
		(4) Spindle speed (50 Hz/60 Hz)	r.p.m.	1,500/1,800		

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

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
G-2	DHG	High Speed Double Head Grinding Machine (cont'd)				
		2. Standard accessories		1 set		
		3. Optional accessories		1 set		
		(1) *Grinding wheel* (ø355 x 50 x ø31.75) (10 pcs)		(1 set)		
BA-1	BAM (1 set)	*Hard-Bearing Universal Balancing Machine*			This is a newly installed machine to meet the market requirements for correcting dynamic balance of rotary vane wheels, etc. in water turbine rotors, water treatment pumps, etc.	Water turbines, pumps, etc.
		1. Specifictions				
		(1) Max. weight on roller carriages	kg	13,000		
		Occasional overload up to	kg	18,000		
		(2) Max. weight in sleeve Bearings	kg	16,000		
		Occasional overload up to	kg	20,000		
		(3) Max. rotor dia. over machine bed	mm	2,500		
		(4) Journal dia. range on roller carriages (standard)	mm	50 - 200		
		2. Accessories		1 set		
		(1) Printers		(1 set)		
		(2) Roller bearings (200 - 400 mm)		(1 set)		
		(3) Counter roller bearings (2 pcs)		(1 set)		
		(4) Test loader (500 kg) & test weights		(1 set)		

BARATA SURABAYA MACHINE SHOP

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

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
WZ-5	Portable flame cutting machine (1 set)	Semi Automatically Cuts Straight Lines and Bevels			Enhancement of efficiency and improvement of quality in plate work for water turbine parts, etc.	
		1. Specifications				
		(1) Overall dimensions (L x W x H)	mm (in)	440 x 205 x 215 (17 x 8 x 8 1/2)		
		(2) Motor - Condenser induction motor		9W/10W AC 100 V or 200 V		
		(3) Cutting capacity (thickness)	mm (in)	5 - 100 (1/5 - 4)		
		2. Standard accessories		1 set		
		3. Options		1 set		
WZ-6	Portable flame cutting machine (1 set)	Semi Automatically Cuts Straight Lines Circles and Bevels			Enhancement of efficiency and improvement of quality in plate work for water turbine parts, etc.	
		1. Specifications				
		(1) Overall dimensions (L x W x H)	mm (in)	460 x 120 x 240 (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		

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

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
BR-1	Bending roller (1 set)	Pinch Pyramid Type Plate Bending Rolls			This is a machine for augmenting plate work capacity, mainly aiming at converting products from casting to steel fabrication.	Plate work for water turbine parts, etc.
		1. Specifications				
		(1) Bending capacity				
		. Materials of steel plates to be bent				
		. Material	JIS SS41 eqt steel plate			
		. Max. pre-bending capacity				
		. Width		2,000 mm		
		. Thickness		6 mm		
		. Inside diameter		300 mm		
		. Edge flat for the plate thickness	2.5 x plate thickness			
		. Max. rolling capacity				
		. Width		2,000 mm		
		. Thickness		10 mm		
		. Inside diameter		350 mm		
		. Min. bending capacity				
		. Width		2,000 mm		
		. Thickness		3 mm		
		. Inside diameter		500 mm		
		(2) Motors				
		. Main drive motor	7.5 kw 6P	1 set		
		. Bottom roll adjusting motor	3.7 kw 6P	2 sets		
		2. Spare parts & others		1 set		

BARATA SURABAYA MACHINE SHOP

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

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
HP-1	Hydraulic press. (1 set)	800 Ton Ram Head Type Hydraulic Press.			This machine meets the requirements of conversion of products in the same way as BR-1.	Plate work for water turbine parts, etc.
		1. Mechanical specifications				
		(1) Max. pressing capacity		800 Ton		
		(2) Lifting capacity (Net)		30 Ton		
		(3) Stroke		1,000 mm		
		(4) Day light		1,500 mm		
		(5) Die space		500 mm		
		(6) Main ram diameter		700 mm		
		(7) Effective working area of bed		4,000 x 1,300 mm		
		(8) Effective working area of ram head		1,600 x 1,000 mm		
		(9) Motor for hydraulic pump		30 kW 6P		
		2. Accessories		1 set		
		3. Special spare parts		1 set		
W-1	Welding machine (2 sets)	Submerged Arc Welder			This is a new welder to meet the requirements of automated welding and higher quality for products having larger diameter such as water turbine casing for power plants.	Large-diameter products such as a water turbine.
		1. Specifications				
		(1) Max. welding current	A	1,500		
		(2) Welding wire diameter	mm	3.2 - 6.4		

BARATA SURABAYA MACHINE SHOP

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 (cont'd)					
		(3) Control system	Solid state variable speed control				
		(4) Travel speed	cm/min	0 - 100			
		(5) Wire reel		Magazine type			
		(6) Capacity of flux hopper	l	6			
		(7) Adjustable rangs of nozzle	mm	Vertical	50		
			mm	Horizontal	50		
		2. Standard accessories		1 set			
W-2 W-3	Welding machine (2 sets) (2 sets)	A.C Arc Welders					
		1. Specifications					
		(1) Secondary current	A	500	300		
		(2) Primary input	KVA-KW	62-23	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			

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
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-P	380 -3		
		(7) Frequency	Hz	50/60		
		(8) Input at rated load	kVA, kW	42, 33.5		
W-5	Diesel welder (1 set)	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		

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

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
W-5	Diesel welder	Engine Welder (cont'd)				
		. 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	l	19		
		. Starting system		Cell motor		
		. Battery		12 V - NS-60		
		. Dimensions (L x W x H)	mm	1340x675x890		
		. Weight	kg	375		
WP-1	Welding positioner (1 set)	Positioner			Improvement in efficiency and quality in fitting and welding of plate work.	
		1. Specifications				
		(1) Loading capacity	kg	5,000		
		(2) R.P.M of table 60 Hz	rpm	0.0125-0.25		
		(3) Table tilting angle		0 - 135°		
		(4) Table dimension	mm	1400 x 1400		
		(5) Motor for table turning	kW	2.2		
		(6) Motor for table tilting	kW	3.7		
		(7) Input voltage	V	AC 3ø 200		
		(8) Height x width x depth	mm	1550x1400x2290		
		(9) Weight	kg	3,600		

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

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
WP-1	Welding positioner	Positioner (cont'd) 2. Standard accessories (1) Tool kits (1 set)		
WD-1	Welding rod dryer (1 set)	Drying Oven for Electrodes 1. Specifications (1) Total welding rod weight treatable: 200 kg (2) Max. operating temperature: 400°C (3) Number of shelves: 5 tiers 2 rows (4) Max. power consumption: 6.0 kW (5) Power supply: 3 phase 200 V (6) Temperature regulator: electrically controlled (7) Max. welding rod length treatable: 550 mm (8) Agitating fan: x (9) Thermometer: o (10) Wheeled or not: Not wheeled (11) Overall dimensions (HxWxD): 975x750x680 mm (12) Capacity (HxWxD): 450x650x570 mm (13) Weight: 200 kg	This dryer is indispensable to ensuring weld quality.	
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	This dryer is indispensable to ensuring weld quality.	

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

NO.	FACILITY	DESCRIPTION		BASIS OF PLAN	REMARKS
WD-2	Welding flux dryer	Drying Oven for Electrodes Flux (cont'd)			
		(4) Max. power consumption	6 kW		
		(5) Power supply	200 V 3 phase		
		(6) Temperature regulator	Electrically controlled		
		(7) Mode of drying	Rotary drum		
		(8) Temperature	Provided		
		(9) Overall dimension (HxWxD)	1,200x1,550x950 mm		
WD-3	Welding rod Oven (1 set)	Welding Rod Oven		This dryer is indispensable to ensuring weld quality.	
		1. Specifications			
		(1) Total welding rod weight treatable	200 kg		
		(2) Max. operating temperature	120°C		
		(3) Number of chambers	5 tiers 2 rows		
		(4) Max. power consumption	3.6 kW		
		(5) Power supply	220 V		
		(6) Temperature regulator	Electrically controlled		
		(7) Max. welding rod length treatable	550 mm		
		(8) Wheeled or not	Not wheeled		
		(9) Overall dimension (HxWxD)	1,255x850x800 mm		
		(10) Weight	200 kg		
HF-1	Gear hardening equipment (1 set)	High Frequency Hardening Equipment		This equipment meets surface hardening requirements in the market and keeps up with increased orders of gears for sugar mills and steel-making machine parts.	Gears and axles for sugar plants and steel-making machines.
		1. Specifications and Accessories			
		(1) Motor-generator & panel out-put	150 kW-8kHz 1 set		

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

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
HF-1	Gear hardening equipment	High Frequency Hardening Equipment (cont'd)			Note: The high frequency hardening equipment requires extremely high skill and familiarity and is introduced on condition that an instructor stays for training at least one year	
		(2) Generator control & matching panel		1 set		
		(3) H.F output transformer output	150 kW-8Hz	1 pc		
		(4) Hardening M/C for gear & pinion		1 set		
		(5) Control desk board		1 set		
		(6) Wiring cable & lead & lead cover		1 set		
		(7) Heating coil		1 set		
		(8) Spare parts		1 set		
		. Bearing for motor generator		(1 set)		
		. Fuse		(3 pcs)		
		. Condenser		(2 pcs)		
		. Output power lead		(2 pcs)		
		. Relay		(5 pcs)		
		. Timer		(1 pc)		
		. Pilot lamp		(5 pcs)		
		. Pressure S.W		(2 pcs)		
		. Flow S.W		(2 pcs)		
		(9) Quenching water facility		1 set		
		(10) Inspection instrument		1 set		
		(11) Magnetic particle meter & device		1 set		
		(12) Tempering furnace		1 set		
		(13) Working tools		1 set		

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
QF-1	Tools quenching furnace (2 sets)	Box-Type Electric Furnace 1. Specifications (1) Capacity: weights (2) Capacity: dimensions (3) Temperature (1030 - 1050°C) (4) Temperature rise time (5) Temperature difference (6) Heat source (metal heater) (7) Power supply (8) Temperature control (9) Furnace effective dimensions	 300 kg/batch 600ø x 100 - 150 H mm 400W x 600L x 100-150H mm Max. 1100°C ~ 1100°C/15 Hr ±5°C 3ø 220 V 60 Hz 45 kW thermostat x 2 - PID control 600W x 800L x 250H mm		Improvement in quality and life of the cutting tools.	
BM-1	Tools brazing machine	Electric Brazing Machine 1. Specifications (1) Power supply (2) Capacity 2. Accessories (1) Work tools	 2.0 kVA - 20 A 100 V 25 x 30 mm 1 set			
IE-1	Inspection equipment & measuring tools	1. Measuring tools (1) Block gauge sets class A (2) Accessories for blockgauge (3) Angle block gauge sets	 (103 pcs) (standard) (standard)	 1 set 1 set 1 set	These tools are important in every respect for the improvement of inspection fulfilment.	

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
IE-1	Inspection equipment & measuring tools	1. Measuring tools (cont'd)				
		(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	(6ø - 600ø) 1 set		
		(10)	Surface measuring instrument	1 set		
		(11)	Surface roughness scale sets	(4 types x 1 pc) 1 set		
		(12)	Hardnester	(standard H_S H_{Rc} 8 types x 1 pc) 1 set		
		(13)	External micrometers	(0-25mm - 475-500mm 20 sizes) 20 pcs		
		(14)	Micrometer with interchangeable anvil	(0-100mm - 900-1000mm 11 sizes) 11 pcs		
		(15)	Point micrometer	(0-25mm - 75-100mm 4 sizes) 4 pcs		
		(16)	Vernier caliper	(150mm-1/500, 200mm-5/100, 300mm-5/100, 600mm-5/100, 1000mm-5/100 5 sizes) 43 pcs		
		(17)	Steel rule	(150mm, 300, 600, 1000, 1500, 2000, 6 sizes) 110 pcs		
		(18)	Universal bevel protractor	(150mm, 300mm, 2 sizes) 6 pcs		

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

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
IE-1	Inspection equipment & measuring tools	1. Measuring tools (cont'd)				
		(19)	Square	(150mmx100, 300x200, 600x350, 1000x550 4 sizes) 14 pcs		
		(20)	Cylindrical square	(ø150 x 400L x ±4u) 1 pc		
		(21)	Precision square level	(JIS 1 class, 200mmx200) 1 pc		
		(22)	Cast iron surface plate	(JIS 1 class 1200 x 2400 x 320) 1 set		
		(23)	Steel V block	(25 - 100 mm 5 sizes) 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 - 40mm x 30 sec) 1 set		
		(28)	Plumb bob	(Brass made) 3 pcs		
		(29)	Weld-thickness gauge sets	5 sets		
		(30)	Jointed inside micrometer	(2 m - 5 m) 1 set		
		(31)	Tubular type inside micrometers	(50-75mm - 475-500mm) 18 sets		
		(32)	Precision straight edge	(A class 1000 x 60 x 12) 1 pc		
				(A class 3000 x 120 x 20) 1 pc		
		(33)	Dial caliper gauge	(10 types) 1 set		
		(34)	Depth micrometer	(0-50 - 75-100 11 sizes) 1 set		
		(35)	Depth gauge	(A type 150-1000 7 sizes) 1 set		
		(36)	Gear tooth vernier	(M1.5-12, 2.5-25 2 sizes) 1 set		
		(37)	Thickness & Taper gauge	(No.65M, No.150MZ No.245M) 3 types 1 set		

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

NO.	FACILITY	DESCRIPTION			BASIS OF PLAN	REMARKS
IE-1	Inspection equipment & measuring tools	1. Measuring tools (cont'd)				
		(38) Calipers	(3 types 100 mm - 1000 mm)	total 300 pcs		
		(39) Screw thread limit gauge		1 set		
		(40) Hardness tester	(Shore type, Brinnel type)	1 set		
		(41) Thermometer	(0-200°C, -30-100°C mercury stick type)	10 pcs		
		(42) Digital thermometer	(-50 - 1200°C)	2 sets		
		(43) Noise indicators		1 set		
		(44) Vibration meters		1 set		
		(45) Tester		1 set		
		(46) Thickness meter		1 set		
		(47) Photoelectric counter		1 set		
		(48) Handy digital tachometer		1 set		
		(49) Stop watch		1 pc		
		(50) Precision spring testing machine		1 set		
		(51) Transit		1 set		
		2. Nondestructive testing machine & tools			The machine and tools are used for inspecting internal defects or surface defects in castings and welds.	
		(1) Magnetic particle meter		1 set		
		(2) Ultrasonic detector		1 set		
MT-1	Machining tools	1. Machining tools			These machine-tools/cutting tools are provided for the continuous operation of machines and the improvement of machining efficiency.	
		(1) For B-2 & 3 machining tools		x 3 sets		
		. Milling cutter & tips	(6" - 10" 2 pcs & 6 sets)			
		. Taper drills	(10ø - 80ø 111 pcs)	(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 (cont'd)			
		. Super drills, center drill & blades	(80ϕ - 120ϕ)	(40 sets)	
		. Chucking reamers	(10ϕ - 80ϕ 111 pcs)	(1 set)	
		. End mills	(10ϕ - 50ϕ 158 pcs)	(1 set)	
		. Taps	(M10 - M80 x 30 sets & 15 pcs)	(1 set)	
		. Cutter arbars, Drill sleeve & sockets		(1 set)	
		. Tappers		(1 set)	
		(2) For L-2 machining tools		x 2 sets	
		. Standard brazed tools	(4 sizes x 16 pcs)	(1 set)	
		(3) For L-3 machining tools		1 set	
		. Standard brazed tools	(4 sizes x 16 pcs)	(1 set)	
		(4) For L-15 machining tools		x 10 sets	
		. Standard brazed tools	(4 sizes x 16 pcs)	(1 set)	
		(5) For L-14 machining tools		1 set	
		. Standard brazed tools	(4 sizes x 16 pcs)	(1 set)	
		(6) For L-13 machining tools		1 set	
		. Standard brazed tools	(4 sizes x 16 pcs)	(1 set)	
		(7) For L-12 machining tools		1 set	
		. Milling cutter & tips	(6" - 12" 2 pcs)	(8 sets)	
		. Taper drills	(10ϕ - 80ϕ 111 pcs)	(1 set)	
		. Super drills, center drill & blades	(80ϕ - 120ϕ)	(40 sets)	
		. Chucking reamers	(10ϕ - 80ϕ 111 pcs)	(1 set)	

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

NO.	FACILITY	DESCRIPTION		BASIS OF PLAN	REMARKS
MT-1	Machining tools	1. Machining tools (cont'd)			
		. Taps	(M10 - M80 x 20 sets & 15 pcs) (1 set)		
		. Cutter arbors, Drill sleeve & sockets		(1 set)	
		. Tappers		(1 set)	
		(8) For L-7 machining tools		x 5 sets	
		. Standard brazed tools	(5 sizes x 16 pcs)	(1 set)	
		(9) For M-1 & 2 machining tools		x 2 sets	
		. Milling cutter & tips	(3", 4" 2 sizes x 2)	(1 set)	
		. End mills	(1ø - 20ø 94 pcs)	(1 set)	
		(10) For Z-1 machining tools		1 set	
		. Gear hobs	(M5 - M25 16 pcs)	(1 set)	
		(11) For Z-2 machining tools		1 set	
		. Straight bevel gear generating cutter	(M2 - M25 10 sizes)	(1 set)	
		(12) For P-3 machining tools		1 set	
		. Milling cutter & tips	(6" - 12" 8 pcs)	(1 set)	
		. End mills	(10ø - 50ø 158 pcs)	(1 set)	
		(13) For P-2 machining tools		1 set	
		. Milling cutter & tips	(6" - 10" 6 pcs)	(1 set)	
		(14) For S-2 machining tools		1 set	
		. Standard brazed tools	(4 sizes x 11 pcs)	(1 set)	
		(15) For SL-1 machining tools		1 set	
		. Standard brazed tools	(10 pcs)	(1 set)	

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

NO.	FACILITY	DESCRIPTION		BASIS OF PLAN	REMARKS
MT-1	Machining tools	1. Machining tools (cont'd)			
		(16) For D-2 machining tools	x 2 sets		
		. Taper drills	(10ϕ - 90ϕ 116 pcs) (1 set)		
		. Reamers	(10ϕ - 85ϕ 116 pcs) (1 set)		
		. Taps	(M10 - M70 18 sets/15 pcs) (1 set)		
		. Boring tool bits	(50 pcs) (1 set)		
FA-1	Fitting & assembly tools	Fitting and Assembly Tools			The tools enhance efficiency in finishing assembly and stabilize quality.
		(1) Working table	5 sets		
		. Dimensions	(1500mmW x 2500mmL x 800mmH)		
		(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	(10-13ϕ - 55-60ϕ) (2 sets)		
		. Socket wrench set	(5 sets)		
		. 45° double offset wrench	(5 sets)		
		. Torque wrench	(0-230 - 0-10,000 cm-kg) (1 set)		

NO.	FACILITY	DESCRIPTION		BASIS OF PLAN	REMARKS
FA-1	Fitting & assembly tools	Fitting and Assembly Tools (cont'd)			
		. Adjustable angle wrench	(150, 200, 250, 300, 375 mm) (10 sets)		
		. Open ended spanners with double end type	(5.5x7 - 55x60 mm) (10 sets)		
		. Open ended spanners with single end type	(5.5 - 38 mm) (10 sets)		
		. 6 set wrench	(5.5x7 - 22x24 mm) (10 sets)		
		(4) Electrical and pneumatic tools	1 set		
		. Potable 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)		
		(5) Hydraulic tools	1 set		
		. Hydraulic jack with detected pump	(20 tons, 30 tons, 50 tons) (4x3 sets)		
		. Hydraulic oil jack	(2, 5, 7, 10, 15, 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) (7 x 2 sets)		
		. Ratchet lever hoist	(3/4, 1 1/2, 3, 6 tons) (4 x 2 sets)		

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		The tools augment steel construction welding capacity.	
		(1) Gas cutting & welding tools	1 set		
		. Cutting trestle	(2500mmW x 5000mmL x 300mmH) (3 sets)		
		. Gas welder	(10 sets)		
		. Gas & oxygen hose	(10 sets)		
		. Gas regulator	(20 sets)		
		(2) Crane & handling tools	1 set		
		. Shackles	(1 - 15 tons) (1 set)		
		. Steel wire rope	(10ϕ x 2m - 18ϕ x 8m) (1 set)		
		. Hang clamp	(0-35mm - 3 tons, 0-50mm - 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) (5 sets)		
		. Holder	(300A, 500A) (15 sets)		
		. Gouging torch	(600 A) (3 sets)		
		. Air tools (Pneumatic multiple jet chisel etc.)	(2 x 1 set)		
		(4) Fitting tools			
		. Disc sander (Air type)	(4 sets)		
		. Ratchet level hoist	(1.5, 3, 6 tons) (2 sets)		
		. Air hose	(3/4ϕ x 20 M) (1 set)		
		. Impact wrench	(1 set)		
		. Hydraulic jack	(15, 25, 50, 100 tons) (1 set)		
		. Magnetic drill press	(25ϕ x 32ϕ) (1 set)		
		. Spare parts etc.	(1 set)		

NO.	FACILITY	DESCRIPTION		BASIS OF PLAN	REMARKS
PT-1	Plate working tools	Plate working tools (cont'd)			
		(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 One B class) (1 set)		
		. Vernier caliper	(300mm x 10 pcs) (1 set)		
		. Tempered steel rule	(150mm, 1m, 2m) 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	(590Wx600Hx540D x 5 stages) (27 sets)		
		. Tool cabinet	(750Wx1100Hx700D x 9 stages) (9 sets)		
		. Tool rack	(1200Wx1800Hx450D, 875Wx1800Hx450D) (18 sets)		
		(7) Hydraulic pump	($10kg/cm^2$, 2 ℓ/min. Air type) 2 sets		

BARATA SURABAYA MACHINE SHOP

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

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
	50/10T O.H.C. (1 set)	Major Specifications 1) Lifting capacity Main : 50 TON Aux. : 10 TON 2) Lifting height : 13 M 3) Crane span : 23 M 4) Operation method : By directly or radio	Scaling-up of fabricated parts and improvement in assembling work.	Location: Bay D-E
	20/5T O.H.C. (1 set)	Major specifications 1) Lifting capacity Main : 20 TON Aux. : 5 TON 2) Lifting height : 13 M 3) Crane span : 23 M 4) Operation method : By radio	Installation in the new building.	Location: Bay D-E
	2T wall crane (2 sets)	Major specifications 1) Lifting capacity : 2 TON 2) Lifting height : 8 M 3) Arm length : 10 M 4) Operation method : By pendant-switch	Enhancement of assembling work efficiency.	Location: Bay D-E
	1T Jib hoist (4 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 efficiency.	Location: C-16, D1-16, 19, 21

BARATA SURABAYA MACHINE SHOP

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

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
	0.5T Jib hoist (2 sets)	Major specifications 1) Lifting capacity : 0.5 TON 2) Lifting height : 7 M 3) Arm length : 5 M 4) Operation method : By pendant-switch		Location: D-17, J-4
	5T Forklift (1 set)	Major specifications 1) Type : Front lifting type 2) Rated capacity : 5 TON 3) Engine : Diesel engine	Enhancement of transport efficiency.	
	2T Forklift (1 set)	Major specifications 1) Type : Front lifting type 2) Rated capacity : 2 TON 3) Engine : Diesel engine	Enhancement of transport efficiency.	
	10T Transfer carriage (1 set)	Major specifications 1) Type : Low-bed type 2) Rated capacity : 10 TON 3) Engine : Diesel engine	Enhancement of transport efficiency.	
	5T Transfer carriage (1 set)	Major specifications 1) Type : Low bed type 2) Rated capacity : 5 TON 3) Engine : Diesel engine	Enhancement of transport efficiency.	

BARATA SURABAYA MACHINE SHOP.

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

NO.	FACILITY	DESCRIPTION		BASIS OF PLAN	REMARKS
	2T Transfer carriage (1 set)	Major specifications 1) Type 2) Rated capacity 3) Engine	 : Low-bed type : 2 TON : Gasoline engine	Enhancement of transport efficiency.	

BARATA SURABAYA MACHINE SHOP

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

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
BW-01	Rebuilt of Bay D-E	Major specifications 1) Dimension : (Total 3,000 M^2) Width : 25 M Length : 120 M Height : 18 M (Eaves height) 2) Structure Column/beam : Steel structure Wall/roof : C.G.I.S. 3) Aux. facilities a) Crane girder/rail for 50/10 TON O.H.C. b) Crane girder/rail for 2 TON wall crane:	Purpose a) Heavy duty machining b) Large equipment assembling	Details are shown on Fig. 3-1
BW-02	Substation buildings (3 buildings)	Major specifications: 1) Location a) No.1 substation : Bay A-B, Column 21 - 25 b) No.2 substation : Bay H, Column 22 - 24 c) No.3 substation : Bay S-T, Column 26 - 27 2) Dimension Name of S.S. Width x Length No.1 Substation : 15 x 20 No.2 Substation : 11 x 10 No.3 Substation : 5 x 14.3 3) Structure Column : Steel structure Wall : C.G.I.S.		

BARATA SURABAYA MACHINE SHOP

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

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
BW-03	Partition work for sand blast area	Major specifications 1) Dimension Width : 9 M Length : 20 M Height : 6 M 2) Structure Column : Steel structure Wall/Ceiling : C.G.I.S.	Required due to removal of sandblast area.	Location: Bay A-C Column 1-2
BW-04	Reinforcement of column for Jib hoist (Total 6 places)	Major specifications 1) Capacity of Jib hoist : 1 TON - 5 M 4 sets 0.5 TON - 5 M 2 sets		Location: C-16, D1-16, 19, 21 D-17, J-4
BW-05	Assembling floor surface	Major specifications 1) Dimension : (Total 600 M^2) Width : 12 M Length : 50 M	Enhancement of assembling work efficiency.	Location: Bay D1 - D2 Column 14 - 24
BW-06	Improvement of rail way for transfer carriage	Major specifications 1) Total length : Approx. 400 M		Location: Bay Column 1 - 2

BARATA SURABAYA MACHINE 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 : 380 V, 220 V, 3 phase 3) Capacity a) No.1 Substation : 1,000 kVA b) No.2 Substation : 1,500 kVA c) No.3 Substation : 1,000 kVA 4) Aux. equipment/materials/work a) Power capacitors for power factor improvement b) Foundation work for substation equipment c) Installation work including testing d) Spare parts and maintenance tools	This sub-station meets the requirements of increase in power consumption involved by augmentation of equipment, and of stabilized power supply for numerical control.	Details are shown on Fig. 3-2

BARATA SURABAYA MACHINE SHOP

Table 3-8 Facility Plan

(Infra-Structure/Electrical/Utility Facilities) (2/2)

NO.	FACILITY	DESCRIPTION	BASIS OF PLAN	REMARKS
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 : 600 V PVC insulated b. Panelboard : Metal enclosed, wall hanging type		Details are shown on Fig. 3-3
UW-04	Lighting system	Major specifications 1) Lighting fixtures : Mercury vapor lamp (130 sets) 2) Wiring method : Overhead conduit 3) Panelboards : Metal enclosed, wall hanging type	Illumination level Marking area 200 Lux Main walk way 50 Lux	
UW-05	Communication system	Major specifications 1) Type of telephone exchanger : Digital time division switching computalized P.A.B.X 2) System plan a) Line capacity : C.O. trunk line : 5 Lines Extention : 150 Lines b) Attendant control : 2 sets c) Service features : Standard features		Details are shown on Fig. 3-4
UW-06	Duct collector for sand blast	Major specifications 1) Capacity : 700 m^3/min. 2) Static pressure : 300 mmAq. 3) Dust : Iron, rust, sand, etc.		

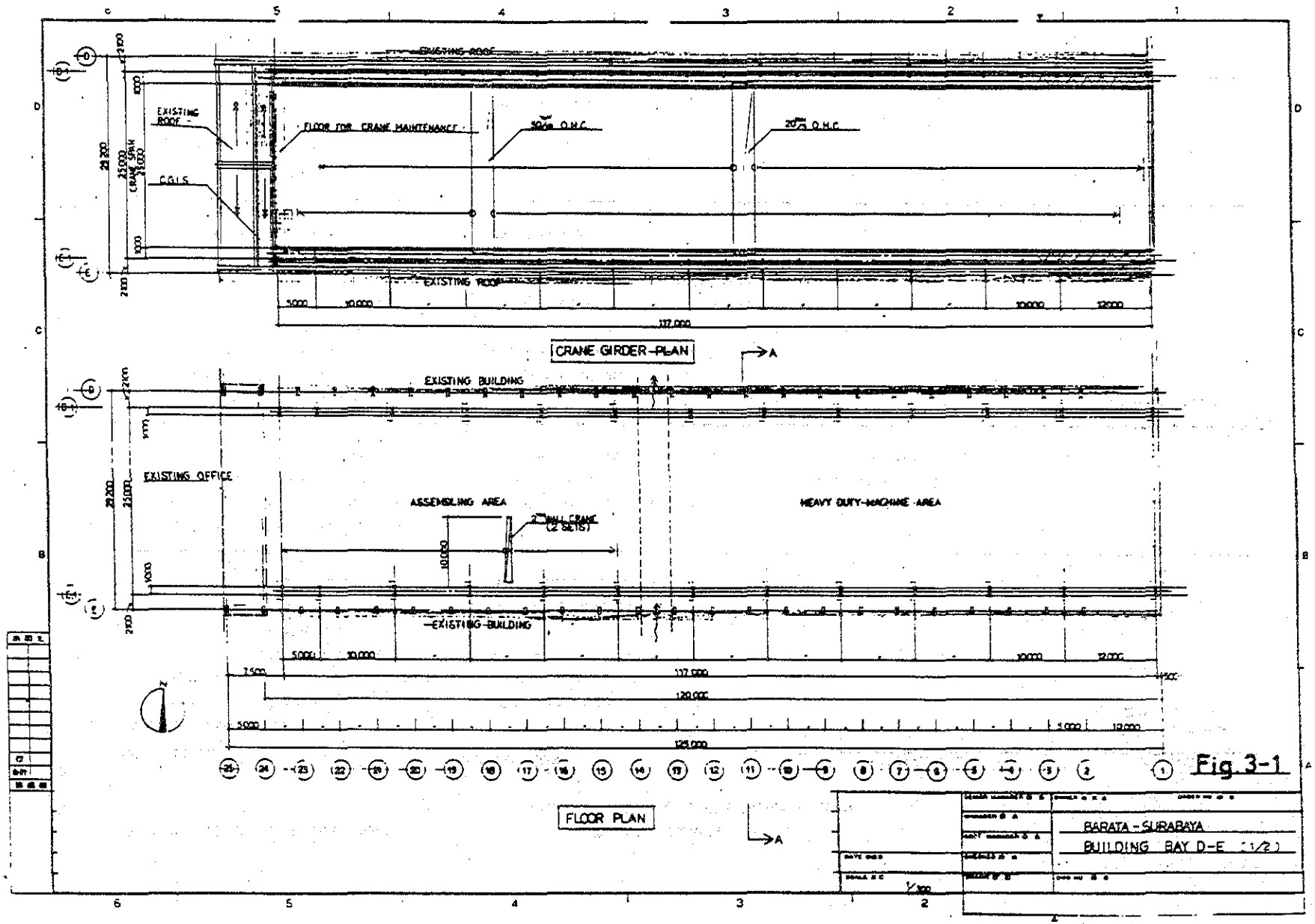

EXISTING ROOF
EXISTING ROOF
FLOOR FOR CRANE MAINTENANCE
50ton O.H.C.
20ton O.H.C.
C.G.I.S.
EXISTING ROOF
CRANE GIRDER-PLAN
EXISTING BUILDING
EXISTING OFFICE
ASSEMBLING AREA
HEAVY DUTY-MACHINE AREA
EXISTING BUILDING
FLOOR PLAN
PARATA - SURABAYA
BUILDING BAY D-E

Fig. 3-1

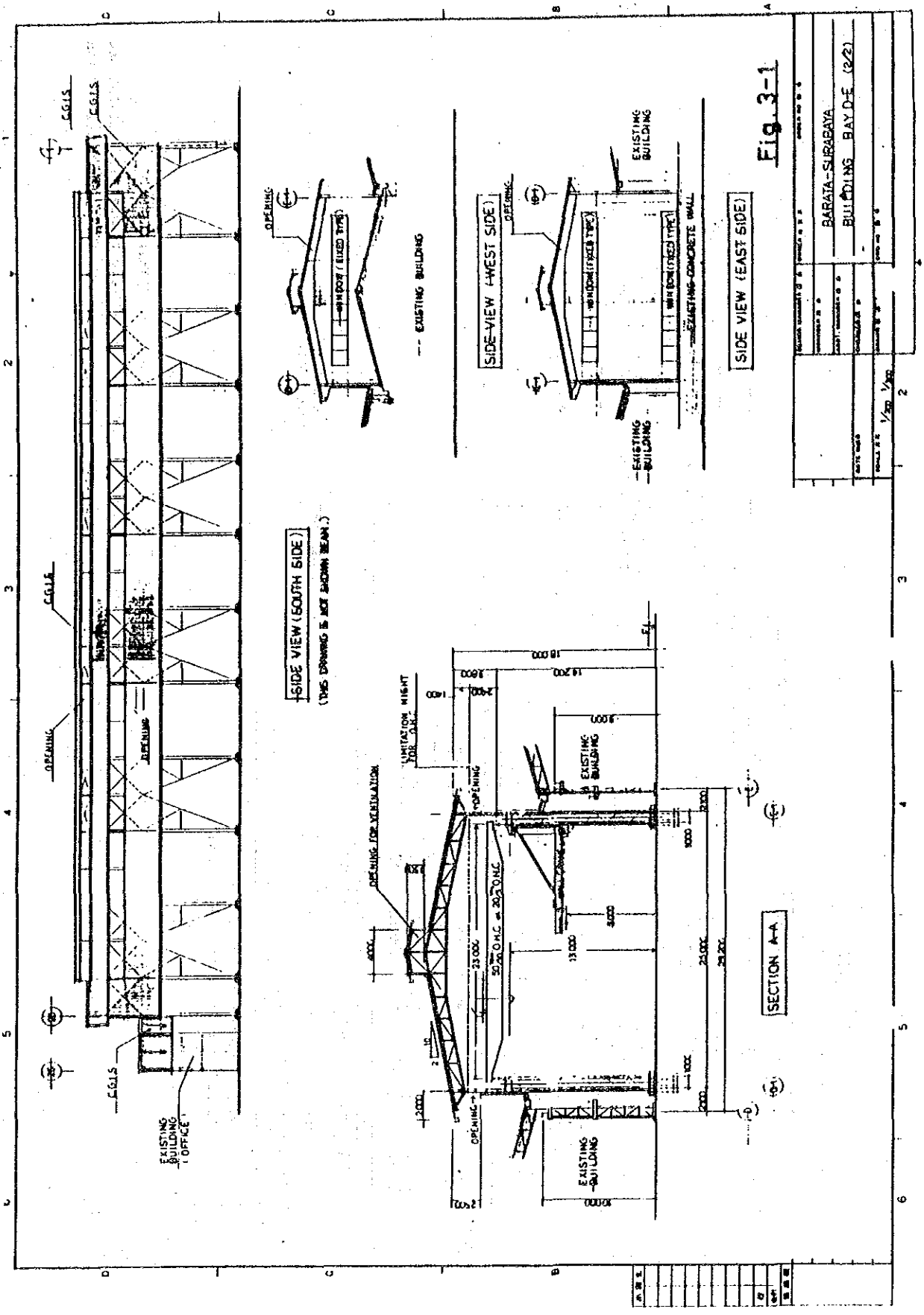


Fig 3-1
BARATA-SURABAYA
BUILDING BAY D-E (2/2)
SIDE VIEW (SOUTH SIDE)
(THIS DRAWING IS NOT SHOWN BEAM.)
SIDE VIEW (WEST SIDE)
SIDE VIEW (EAST SIDE)
SECTION A-A
EXISTING BUILDING
EXISTING BUILDING (OFFICE)
EXISTING CONCRETE WALL
OPENING
OPENING FOR VENTILATION
LIMITATION HEIGHT FOR CRANE
WINDOW (FIXED TYPE)
WIN DOW (TILTED TYPE)

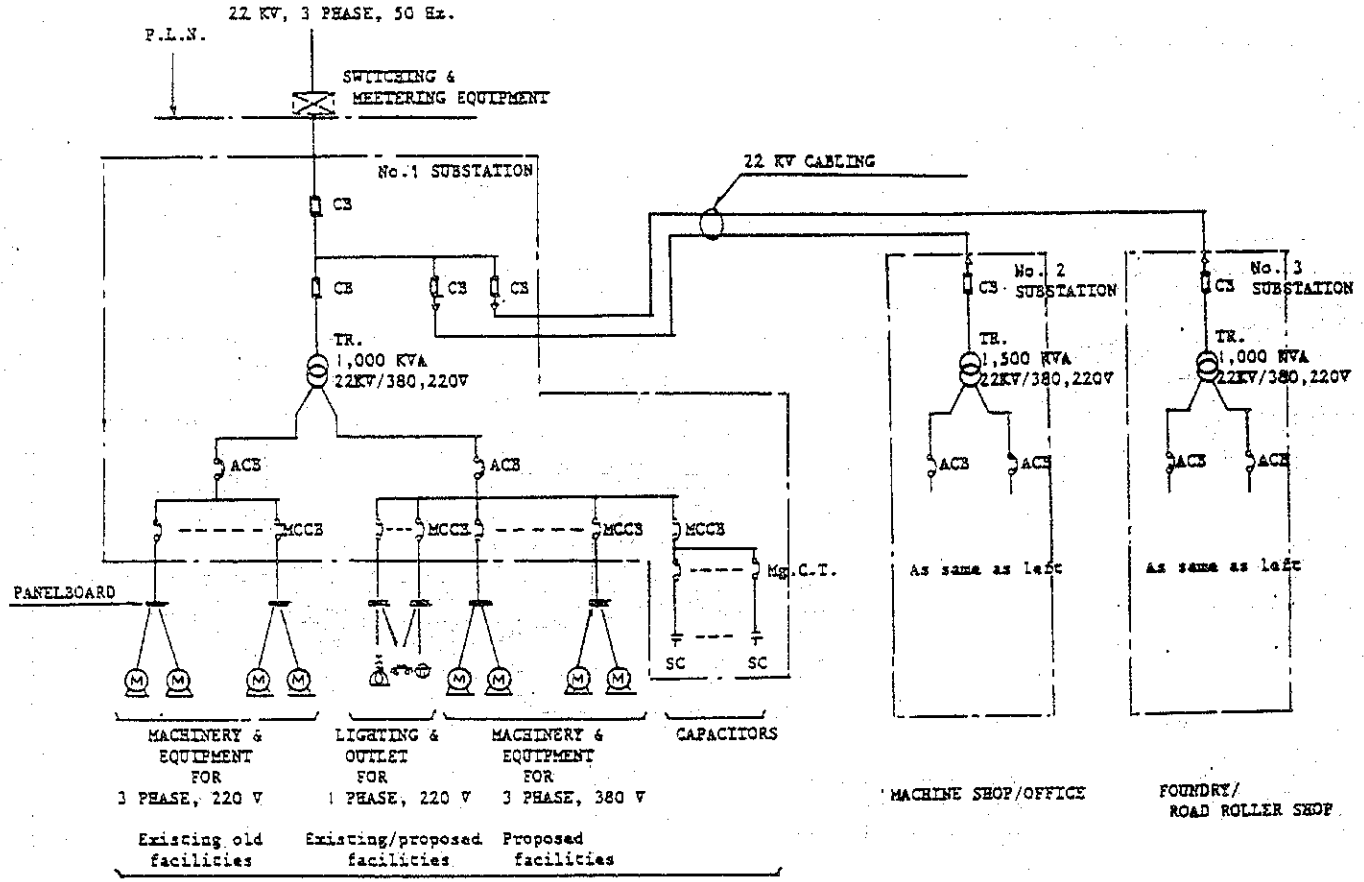


Fig. 3 - 2

BARATA SURABAYA MACHINE SHOP

PROPOSED SUBSTATION SYSTEM

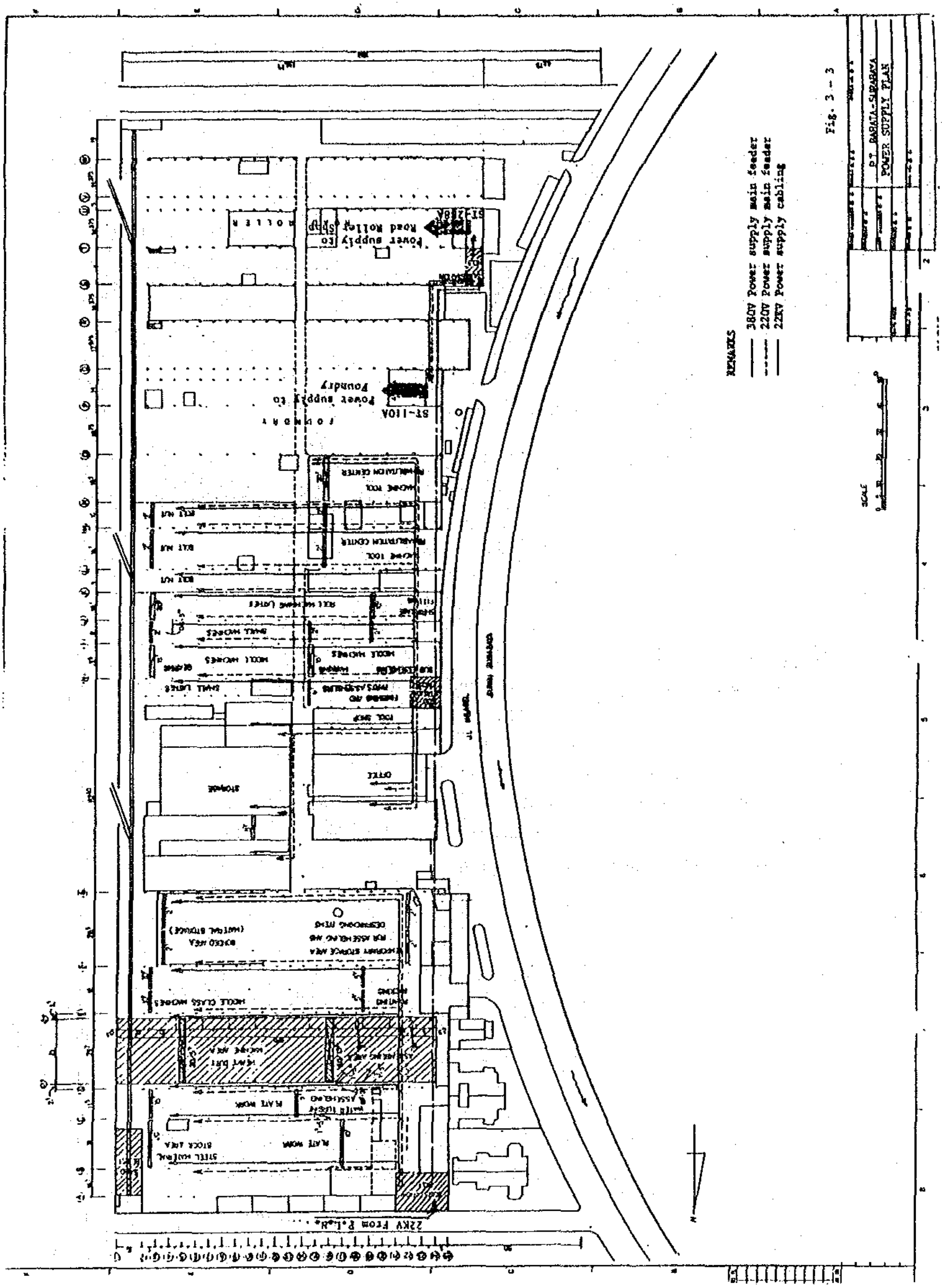
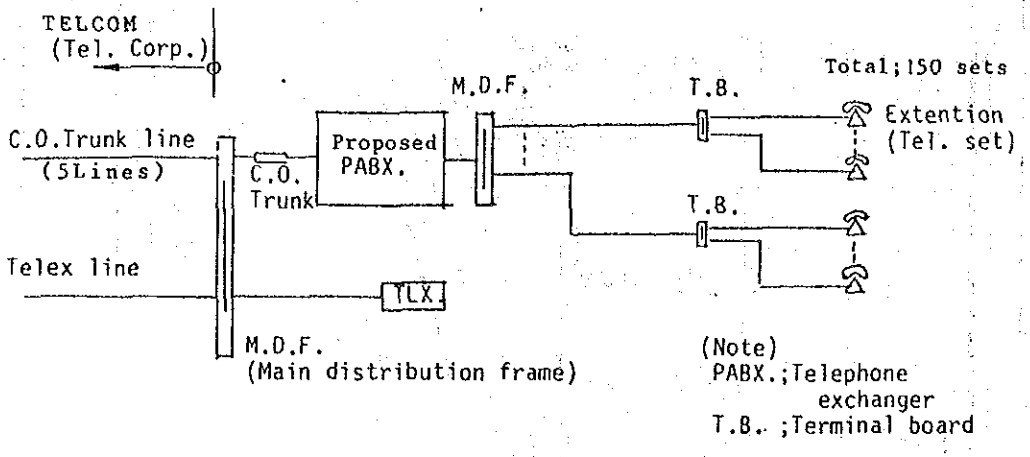

REMARKS
380V Power supply main feeder
220V Power supply main feeder
22KV Power supply cabling
Fig. 3 - 3
PT BARATA-SURABAYA
POWER SUPPLY PLAN
22KV From P.L.N.
Power supply to Foundry
Power supply to Road Roller Shop
ST-110A
FOUNDRY
ROLLER
STORAGE
OFFICE
TOOL SHOP
PLATE WORK

Fig.3 - 4 TELEPHONE SYSTEM



MAJOR SPECIFICATIONS

1. Type of PABX ; Full computerlized, Digital timedivision switching PABX.

2. System plan

a. Line capacity ; C.O.Trunk line : 5 Lines
Extention : 150 Lines

b. Attendant console ; 2 Sets

4.1.4 Renovation Implementation Plan

(1) Outline and design conditions of renovation

1) Basic renovation plan

Diagnosis on the present layout and, estimated product mix and production have led to a new layout plan, which is summarized as shown below.

① Improvement in products and material flow
The layout of facilities in each Bay is planned in such a way as to place emphasis on short-circuiting and simplifying the existing manufacture process.

② Installation of material yard
The material yard must be re-evaluated as a starting point of the production process. The yard contributes to reduction in workpieces in progress through timely material supply.

③ Completion of handling system
Materials are carried in and between Bays efficiently by the introduction of the railless carriage, forklift, wall crane, jib crane, etc., as well as the overhead crane and rail carriage. A more flexible handling system is thus established.

④ Newly built assembling area
A scaled-up assembling area is newly built to cope with the scaling-up of products - a general market tendency -, increase in assembling work and increase in arrangement work of various machinery caused by plant contract.

2) Detailed layout of buildings and machines

The layout of buildings and machines including utilites and auxiliary equipment is planned in accordance with the above basic layout plan,

as shown in Fig. 4-1, Proposed Layout. The detailed Layout of machinery within Bays is shown in Fig. 4-2, Detailed Layout.
The concept on the above layout is summarized as shown below.

(1) Bay D - E is reformed to heavy duty machinery bays including an assembling area.

i) The heavy duty machine area is provided with heavy duty floor type boring/milling machines, vertical lathes, etc. that serve to machining products of large-size and heavy weight.

In addition, a series of shaft/cyliner machine tools is provided to keep up with the scaling-up of sugar rolls and other discrete products to be machined. The machine tools also machine roll shafts and roll shells.

ii) The assembling area is provided with a rail embedded surface plate and two 2-ton wall cranes.

Those kinds of equipment are required for assembling products of large size and heavy weight such as mill stands and reduction gears for sugar plants, with high efficiency and high accuracy.

iii) Bay D - E are equipped with a 50/10-ton overhead traveling crane and a 20/5-ton one, which enable the Bay to meet the scaling-up of plant in the future.

iv) The production and delivery of products with large size and heavy weight are proposed on condition that the residence on the west side of the Bay is removed and that a new road is constructed to be connected to the public road Jl. Ngagel.

(2) Bay C - D is alloted the steel construction and assembling of Francis water turbines; the existing buildings and overhead traveling crane are applied for the future use.

In particular, water turbines with a capacity of 300-400 KW are intended to produce through a mass-production system with high efficiency. This requires a series of machines such as those for steel structure and plate work, welding, assembling and dynamic balancing etc.

(3) Bay E - F is provided with medium-size machines, the painting area, and packing area. When products and parts caused by plant contract increase and require more temporary storage area, the adjacent Bay F - G join for cooperation.

(4) Bay J - K is utilized, as it is, for special-purpose service for sugar rolls. However, obsolete machines are renewed and the layout of machines is improved to enhance productivity.

(5) Other Bays are limitedly reformed to the extent that some obsolete machines are renewed and relocated. The existing buildings and overhead traveling crane are kept unchanged for the future use.

(6) Renewal and relocation of sub-station

The total renewal of the sub-station is propesed to keep up with increase in power capacity resulting from the expansion of machine shops, and to cope with obsolscence of the existing sub-station equipment.

For the purpose of efficient power supply, new sub-station units are strategically distributed in three points, as shown in Fig. 4.1 Proposed Layout.

(7) Removal of sandblast chamber

The reform of Bay D - E involves the withdrawal of the existing

sandblast chamber, which is removed to a place shown in Proposed Layout.

When removed, the sandblast chamber is improved by additional installation of a dust collector or other appropriate means to prevents dust and dirt from flowing out of the sandblast chamber.

3) Effects of improvements-comparison of proposal to present situation

To compare the production flow in this proposal to the present flow, here taken two typical example from major products in Surabaya Machine Shop: the roll and water turbine for sugar plants.

(1) Production flow of sugar roll

The production flow before the improvement is shown in Fig. 4-3, Existing Production Flow; the flow after the improvement in Fig. 4-4, Proposed Production Flow.

The comparison is summarized below.

i) The production flow is successfully shortened and simplified by this proposal.

Machines and tools are strategically relocated along a series of machining process from materials to finished products, thus shortening a route on which materials flow.

ii) Bay D - E joins to cooperate with existing Bay J - K.
This allows keeping up with increase in production and in the weight of scaled-up rolls.

For example, a roll for a sugar plant of 10,000-tons (TCD) weighs more than 20 tons. Such a roll is impossible to be handled with the overhead traveling crane in Bay J - K.

iii) The expansion of the material yard serves to the efficient utilization of working space, with a handling loss reduced to a minimum.

In the present layout, the material yard has only a limited space and materials are distributed around each machine. This causes a complicated flow line together with a handling loss.

iv) A newly installed marking surface plate assures much more efficient marking work, with enhanced accuracy.

At present, materials are marked off on the floor. This causes lowered workability accompanied by waste of time to seek a marking place and a handling loss.

v) Obsolete machines are renewed to a great extent, with improvement in machining efficiency.

In particular, several machines are limitedly used for special purpose; boring of shell inside diameter, outer surface finishing after shrinkage fitting, circumferential grooving, chevron grooving, etc. This assures improved efficiency.

The number of machines for each process is, of course, set on the basis of respective machine-hour to achieve satisfactory line balance.

(2) Production flow of water turbine

The existing production flow is shown in the Fig. 4-3 Existing Production Flow, while the production flow proposed in the Fig. 4-4 Proposed Production Flow.

A comparison of the two production flows proves improvment effects as summarized below.

i) Special-purpose Bay C - D is installed to produce the water turbine to shorten and simplify the production flow.
Mass-production effect is thus expected to water turbines, those of 300-400 kW capacity in particular.

ii) Introduction of new machines ensures a consistent production system ranging from steel structure and plate work to completion of assembly including dynamic balancing.
The introduction of a new dynamic balancing machine eliminates the need of order from sub-contractors and ensures inshop machining, because such a type of machine is absent at present.

Additional effects are expected on the production term, cost, and control system.

iii) Utilization of Bay D - E allows meeting the requirements of manufacturing and assembling large-size water turbines (expected to range from market demand level to a level of 1,500 kW).

(2) Renovation investment

The detailed cost in this renovation investment is shown in Table 4-1, Summary of Investment Cost.

However, the following costs are excluded from the renovation investment cost: (1) the cost required for using the existing facilities of Shop during the term of this renovation and, (2) the personal expenditure for trainees during the term of technical job training.

(3) Renovation project promotion plan

1) The person or functional group responsible for this project is as detailed below.

① Promotion principal.

② D/D consultant

③ Machine and material contractor
Contractor who supplies machine tools, steel structures and plate work products, tools, cranes, steel frame materials, electric installations and materials, parts for machines to be reformed, etc.

④ Local work contractor
Local contactor who is engaged in work such as foundation, steel frame fabrication, buildings, electricity, utilities, and crane/machine installation.

⑤ Instructor in job training

2) Promotion principal

The promotion principal of P.T. Barata Indonesia must be established before the consultant responsible for D/D service is selected, in order to smoothly accomplish the purpose of this renovation project.
The promotion principal should be composed of at least three specialists, who must be properly selected to carry out the following business and service.

① Service to select the D/D consultant.
② Instructions to and cooperation with the D/D consultant.
③ Approval of the renovation implementation plan.
④ Service to select contractors supplying machinery, tools, and equipment.
⑤ Service to select local work contractors.
⑥ Supervision of contractors and local work contractors (excluding technical supervision).
⑦ Coordination of contractors and local work contractors.
⑧ Instructions to and cooperation with the job training instructors.

It should be noted that only the promotion principal could not perform all business and service listed above without assistance given by personnel engaged in the routine business, in regard to procurement and contract procedures, payment, and acceptance inspection of purchased items.

(4) Management of renovation work

During the term of the renovation, P.T. Barata Indonesia authorizes the promotion principal to supervise contractors and local work contractors as a rule, with assistance given by the existing organization as indicated in (3). However, the following service should be consigned to the D/D consultant.

A. Service for contractors of machinery and equipment.
   a. In-plant witness inspection of major machines.
   b. Approval of manufacturer's specifications and working drawings.

B. Service for local work contractors.
   a. Schedule control.
   b. Quality inspection of major work.
   c. Instructions on steel work fabrication.

(5) Implementation schedule of renovation work

The implementation schedule, the basic condition of this F/S, is shown in Fig. 4-5. It is basically considered that the selection of D/D consultant starts at early May in 1985 and that contracts with each contractor of machinery and equipment become effective at the end of June in 1986.

Table 4-1 Summary of Investment Cost

BARATA SURABAYA MACHINE SHOP

ITEM	FOREIGN PORTION (MIL.YEN)	DOMESTIC PORTION (MIL. YEN)	TOTAL (MIL. YEN)	Details are Specified in
1. Machine tool	2,682.9	324.0	3,006.9	Table 4-2
2. Steel fabrication equipment	125.7	9.8	135.5	Table 4-2
3. Miscellaneous equipment, tool etc.	574.3	5.4	579.7	Table 4-2
4. Handling equipment	151.0	7.8	158.8	Table 4-2
5. Machinery reforming	172.7	96.4	269.1	Table 4-3
6. Building & miscellaneous facilities	59.1	309.2	368.3	Table 4-4
7. Electrical & utility facilities	180.7	141.0	321.7	Table 4-4
(Subtotal-1)	(3,946.4)	(893.6)	(4,840.0)	
8. Detailed designing	84.5	36.3	120.8	Table 4-5
9. Implementing body	-	37.4	37.4	
10. Training	144.6	54.4	199.0	
(Subtotal-2)	(229.1)	(128.1)	(357.2)	
11. Contract tax	-	609.3	609.3	
12. Contingency				
12-1 Physical	125.3	71.5	196.8	
12-2 Escalation	260.5	438.6	699.1	
(Subtotal-3)	(385.8))	(1,119.4)	(1,505.2)	
T O T A L	4,561.3	2,141.1	6,702.4	

BARATA SURABAYA MACHINE SHOP

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

	FACILITY	Q'TY	FOREIGN PORTION (MIL. YEN) FOB	OCEAN FREIGHT	INSURANCE	SUPERVISION	SUB TOTAL	DOMESTIC PORTION (MIL. YEN) CUSTOM TRANSPORTS	FOUNDATION	INSTALLATION	LOCAL EXPENSE	SUB TOTAL	TOTAL (MIL. YEN)
Machine tool	Lathe	18	1,544.2	28.7	5.0	26.6	1,604.5	7.5	90.7	54.9	1.3	154.4	1,758.9
	Vartical lathe	2	319.7	6.5	1.1	2.8	330.1	1.7	44.2	32.2	0.1	78.2	408.3
	Boring machine	3	167.0	2.6	0.6	4.2	174.4	0.7	19.6	8.1	0.2	28.6	203.0
	Planer/planomiller	4	228.5	5.0	0.7	3.7	237.9	1.3	21.8	22.1	0.2	45.4	283.3
	Drilling machine	2	20.6	0.5	0.1	1.1	22.3	0.1	0.5	0.2	-	0.8	23.1
	Gear cutting machine	2	179.2	1.7	0.6	2.8	179.3	0.5	6.1	2.9	0.1	9.6	188.9
	Others	7	131.1	0.9	0.3	2.1	134.4	0.2	4.0	2.7	0.1	7.0	141.4
	(Subtotal)	(38)	(2,585.3)	(45.9)	(8.4)	(43.3)	(2,682.9)	(12.0)	(186.9)	(123.1)	(2.0)	(324.0)	(3,006.9)
Steel fabrication equipment	Cutting equipment	2	0.5	-	-	-	0.5	-	-	-	-	-	0.5
	Bending equipment	2	82.5	3.5	0.3	4.1	90.4	0.9	5.5	3.1	0.2	9.7	100.1
	Welding equipment	10	10.1	-	0	-	10.1	0	-	-	-	-	10.1
	Others	3	24.1	0.5	0.1	-	24.7	0.1	-	-	-	0.1	24.8
	(Subtotal)	(17)	(117.2)	(4.0)	(0.4)	(4.1)	125.7	(1.0)	(5.5)	(3.1)	(0.2)	(9.8)	(135.5)
Miscelleneous equipment, tools	Heat treatment facility	3	406.0	0.7	1.3	2.0	410.0	0.2	3.5	0.7	0.1	4.5	414.5
	Marking/inspection plate Inspection equipment/tools	1	24.2	-	0.1	-	24.3	0	0	0.9	-	0.9	25.2
	Tools	4	139.6	-	0.4	-	140.0	-	-	-	-	-	140.0
	(Subtotal)	(8)	569.8	0.7	1.8	2.0	574.3	0.2	3.5	1.6	0.1	5.4	579.7
Handling equipment	Overhead travelling crane	2	87.8	9.4	0.3	1.7	99.2	2.5	-	2.3	0.1	4.9	104.1
	Wall crane	2	15.9	3.2	0.1	-	19.2	0.8	-	0.8	-	1.6	20.8
	Jib hoist	6	5.8	0.4	-	-	6.2	0.1	-	0.6	-	0.7	6.9
	Forklift/transfer carriage	5	23.9	2.4	0.1	-	26.4	0.6	-	-	-	0.6	27.0
	(Subtotal)	(15)	(133.4)	(15.4)	(0.5)	(1.7)	151.0	(4.0)	(-)	(3.7)	(0.1)	(7.8)	(158.8)
	TOTAL	78	3,405.7	66.0	11.1	51.1	3,533.9	17.2	195.9	131.5	2.4	347.0	3,880.9

BARATA SURABAYA MACHINE SHOP

Table 4-3 Investment Cost Estimation (Machinery Reforming)

REHABILITATION & RELOCATION		Q'TY	FOREIGN PORTION (MIL. YEN) FOB	OCEAN FREIGHT	INSURANCE	SUPERVISION	SUB TOTAL	DOMESTIC PORTION (MIL. YEN) CUSTOM TRANSPORTS	HANDLING	IMPROVEMENT	FOUNDATION	ERECTION	LOCAL EXPENSE	SUB TOTAL	TOTAL (MIL. YEN)
MACHINE TOOL	IMPROVEMENT OVERHAUL	85	146.3	0.8	0.1	6.9	154.1	0.8		51.7			0.3	52.8	206.9
"	RELOCATION	7	12	0.3		6.3	18.6	0.3		6	3	8.5	0.3	18.1	36.7
"	REMOVAL	17							25.5					25.5	25.5
STEEL FABRICATION EQUIPMENT	REMOVAL	5	INCLUDED IN ABOVE												
"	RELOCATION	2													
	TOTAL	116	158.3	1.1	0.1	13.2	172.7	1.1	25.5	57.7	3	8.5	0.6	96.4	269.1

BARATA SURABAYA MACHINE SHOP

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

CONSTRUCTION WORK		Q'TY	FOREIGN PORTION (MIL. YEN) FOB	OCEAN FREIGHT	INSURANCE	SUPERVISION	SUB TOTAL	DOMESTIC PORTION (MIL. YEN) CUSTOM TRANSPORTS	FABRICATION	FOUNDATION	ERECTION	LOCAL EXPENSE	SUB TOTAL	TOTAL (MIL. YEN)
Building & miscelleneous facilities	Rebuilt of Bay D-E		49.1	5.3	0.2	-	54.6	3.2	42.4	42.0	160.0		247.6	302.2
	Substation building						-			2.5	14.5		17.0	17.0
	Partition work for sand blast area						-			2.0	16.0		18.0	18.0
	Reinforcement of columns for Jib hoist						-			1.2	3.4		4.6	4.6
	Assembling floor surface		4.2	0.3	-		4.5			9.0	3.0		12.0	16.5
	Improvement of transfer carriage rail						-			5.0	5.0		10.0	10.0
	(Subtotal)		(53.3)	(5.6)	(0.2)		(59.1)	(3.2)	(42.4)	(61.7)	(201.9)		(309.2)	(368.3)
Electrical & utility facilities	Connection fee to P.L.N.						-					39.0	39.0	39.0
	Substation system		93.5	4.7	0.3	6.0	104.5	1.2			18.8	0.3	20.3	124.8
	L.V. Power supply system		28.1	2.8	0.1		31.0	0.7			59.8		60.5	91.5
	Lighting system		9.2	2.3	-		11.5	0.6			7.9		8.5	20.0
	Communication system		12.9	0.8		3.0	16.7	0.2			7.3	0.2	7.7	24.4
	Dust collecter for Sand blast		15.9	1.0	0.1		17.0	0.2			4.8		5.0	22.0
	(Subtotal)		(159.6)	(11.6)	(0.5)	(9.0)	(180.7)	(2.9)	-	-	(98.6)	(39.5)	(141.0)	(321.7)
	TOTAL		212.9	17.2	0.7	9.0	349.8	6.1	42.4	61.7	300.5	39.5	450.2	690.0