(2) Organizational Structure and Employees of HIC

The organizational structure of HIC is given in Figure 3.2-1.

The number of employees of HIC, as of January, 1988, is as follows:

Headoffice	1,504
No.1 Heavy Industry	3,107
No.2 Heavy Industry	2,010
No.3 Heavy Industry	2,507
No.4 Heavy Industry	1,737
No.5 Heavy Industry	641
No.6 Heavy Industry	3,800
Total:	15,306

The organization of the headoffice and six factories are described below.

1) Headoffice

The headoffice consists of four departments which are managed respectively by the respective director in charge. The functions of each department are as follows:

a) Planning Department

Product design, development, production planning and control, quality control, facility planning and maintenance

b) Production Department

Sales, materials planning and procurement, warehousing and inventory control, and transportation

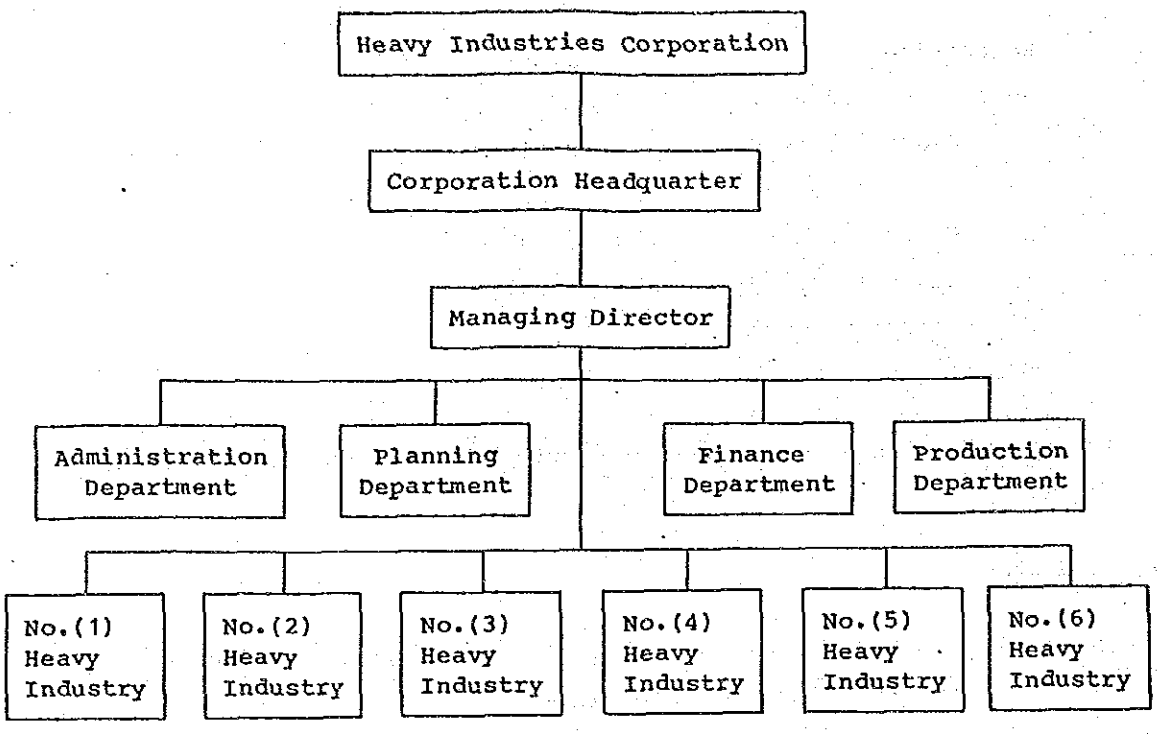
c) Finance Department

Budget control, production cost control, financing and accounting, and assets control

d) Administrative and Management Department

Administration, personnel control, and training

Figure 3.2-1 ORGANIZATION OF HEAVY INDUSTRIES CORPORATION



2) Factories

Each factory is managed by a factory superintendent and consists of four departments which are managed respectively by the respective deputy factory superintendent in charge. The functions of each department are as follows.

a) Planning Department

Production planning and statistics, facility maintenance, material control, quality control and product inspection, and distribution control

b) Production Department

Manufacturing and production control in the production shops

c) Finance Department

Financing and accounting

d) Administrative Department

Administration and personnel affairs including welfare, staff and workers training

The headoffice has a central function of supervising the factories. Management aspects including the production planning and control, procurement, personnel control, facilities planning, maintenance, distribution control, inter-factory coordination of production are centralized in the headoffice.

3-2-2 Outline of the Factories Related to the Four Industrial Projects

(1) Outline and Location of the Factories of HIC

Table 3.2-1 summarizes HIC's factories, and Figure 3.2-2 indicates the location of these factories on a map.

The factories are dispersed in several places over a wide area covering from Rangoon to about 500 km north along the Irrawaddy River; No.1 HI in Rangoon, No.6 HI at Thaton, about 200 km east of Rangoon, No.3 HI at Sinde, about 300 km north of Rangoon, No.4 HI at Htonbo, about 50 km south of Sinde, No.5 HI at Nyuangchidauk in between Sinde and Htonbo, and No.2 HI at Malun, about 200 km north of Sinde.

The factories excluding No.1 and No.6 HI are all located on the west bank of the Irrawaddy River. It was an undeveloped area where people lived in a peasant agriculture in the past, but nowadays the vicinity of the factories has substantially developed with the construction of infrastructure such as power supply system, roads, schools and hospitals as well as increase of immigrants induced by the general development of the area.

(2) Outline of the Factories Related to the Four Industrial Projects

Details of the organization and employees of the headoffice and four factories which are related to the Four Industrial Projects and subject to the diagnosis conducted in this study (i.e., No.1, No.3, No.4 and No.5 HI) are given in Figures 3.2-3(1) to 3.2-3(5). Layout drawings of these four factories are given in Figures 3.2-4(1) to 3.2-4(4).

No.1 HI is located in a fairly limited area within the city of Rangoon. So a number of shops are scattered in disorder within the site. As the site has no space for the expansion of facilities, HIC constructed a branch factory at Htauk Kyant, about 40 km from the site of No.1 HI, to which site the bus production plant was transferred. Another site located about 7 km from the No.1 HI site is under preparation for a new press shop.

Table 3.2-1 OUTLINE OF HIC FACTORIES

Factory		No.1 HI	No.2 HI	No.3 HI	No.4 HI	No.5 HI	No.6 HI
Location		Rangoon	Malun	Sinde	Htonbo	Nyuang-chidauk	Thaton
Factory Site (acres)		69	155	280	248	277	40
Total Floor Area of Buildings (acres)		21.8	13.8	17.7	12.2	4.6	13.1
Year of Foundation		1960	1966	1965	1970	1974	1978
Number of Employees		3,107	2,010	2,507	1,737	641	3,800
Main Products		Incandescent Lamps, Fluorescent Lamps, Dry Cell Batteries, Lighting Fixtures, Electric, Accessories, Radio, Home Electrical Appliances, Heavy Vehicles (Trucks, Buses)	Dry Cell Batteries, Tractors, Trailers	Watt Hour Meters, Lamps & Lighting Fixtures, Motors, Fans, Pumps, Power Tillers, Thresher, Pesticide Equipment, Diesel Generators	Light Vehicle (Light Trucks, Light Vans, 2 Ton Trucks, Jeeps)	Transformers	Tyres, Tubes
Investment Amount	Buildings	73.76	229.2	115.0	140.4	67.1	395.8
	Machinery	409.59	979.3	471.6	616.6	256.3	1024.3
	Others	29.18	69.3	12.6	16.9	17.4	43.6
	Total	512.53	1277.9	599.2	773.9	338.1	1463.7

Notes: 1) Including those products outside the scope of the Four Industrial Projects.
2) Investment Unit: Million K
3) Investment Amount: As of March, 1987
4) Number of Employees: as of January, 1988

Source: HIC

Figure 3.2-2 LOCATION OF HIs

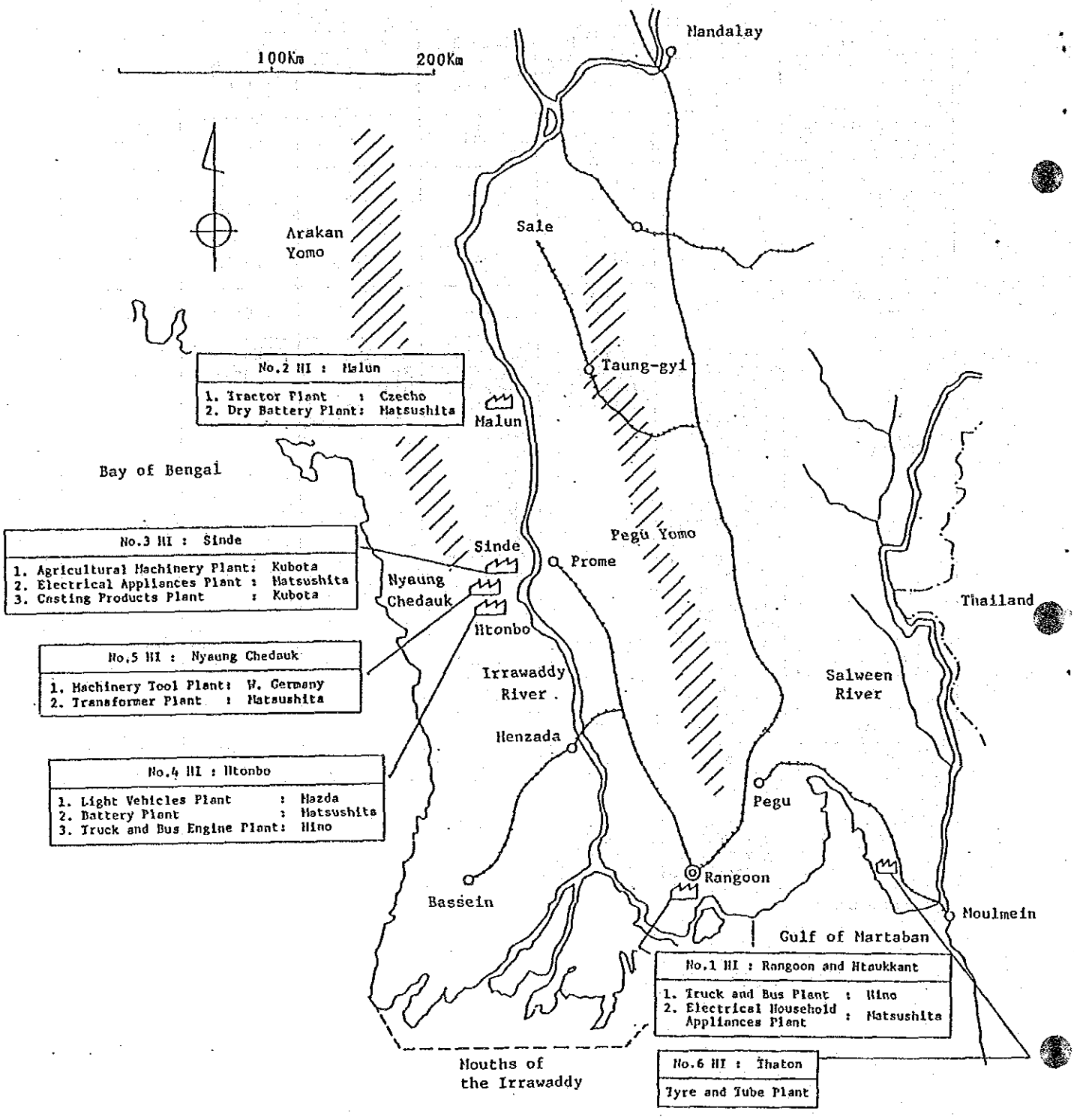
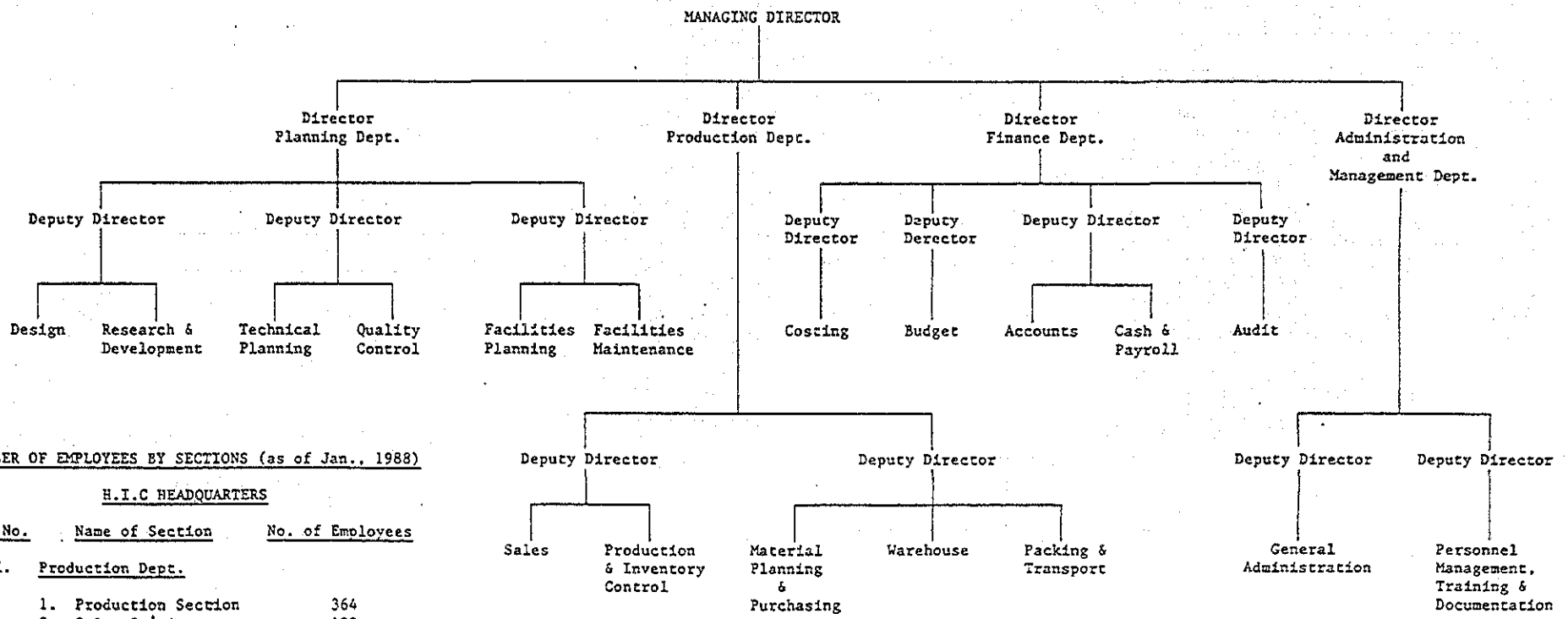


Figure 3.2-3(1) ORGANIZATION OF HEAVY INDUSTRIES CORPORATION HEADQUARTERS

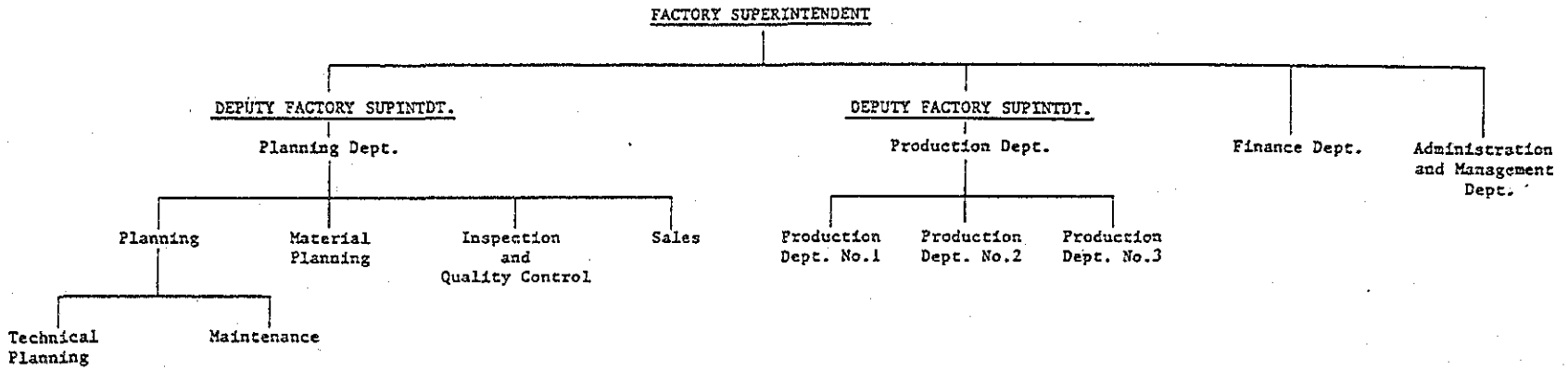


NUMBER OF EMPLOYEES BY SECTIONS (as of Jan., 1988)

H.I.C HEADQUARTERS

Sr. No.	Name of Section	No. of Employees
I.	Production Dept.	
	1. Production Section	364
	2. Sales Section	133
II.	Planning Dept.	
	1. Planning Office	109
	2. Design Section	133
	3. Maintenance (Electric & Service)	315
	4. Maintenance (Estate)	127
III.	Finance Dept.	186
IV.	Administration Dept.	137
	Total	1,504

Figure 3.2-3(2) ORGANIZATION OF NO.1 HI



Capital Investment (as of March, 1987)

(Unit: Million Kyakes)

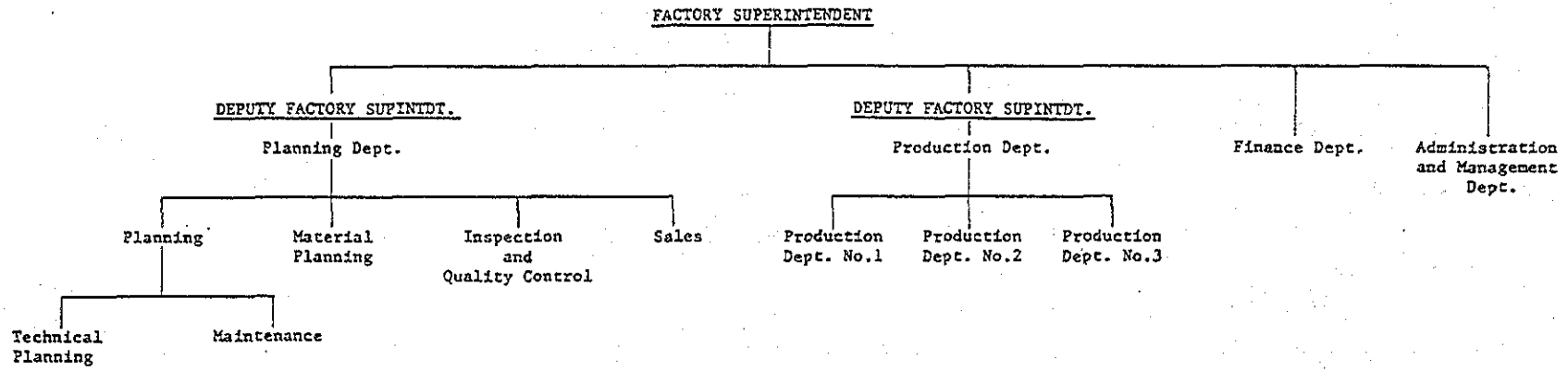
Sr. No.	Description	Local Cost Portion	Foreign Exchange Portion	Total
1.	Buildings	55.67	18.09	73.76
2.	Machinery and Equipment	153.48	256.11	409.59
3.	Technical Services	11.90	17.28	29.18
	Total	221.05	291.48	512.53

NUMBER OF EMPLOYEES BY SHOP (as of Jan., 1988)

No.1 HI

Sr. No.	Name of Shop	No. of Employees
I.	Production Dept. No.1	
1.	Production (1) Office	36
2.	Machine Shop	79
3.	Tool Shop	70
4.	Bicycle Chain & Cutlery Shop	38
5.	Precision Measurement Shop	17
6.	Plating Shop	42
7.	Heat Treatment Shop	21
8.	Die & Jig Manufacturing Shop	36
9.	Bicycle Manufacturing Plant	147
10.	Component Shop	83
11.	Die Casting Shop	16
12.	Razor Blade Manufacturing Shop	17
13.	Precision Investment Casting Shop	25
14.	Wood Working Shop	33
II.	Production Dept. No.2	
1.	Production (2) Office	14
2.	Incandescent Lamp & Fluorescent Lamp Shop	111
3.	Painting Shop	45
4.	Home Electrical Appliance Assembly Shop	83
5.	Bakelite Molding Shop	98
6.	Radio Assembly Plant	110
7.	Electronic Components No.1	65
8.	Electronic Components No.2	48
9.	Polishing	16
10.	Dry Cell Battery Plant	281
III.	Production Dept. No.3	
1.	Production (3) Office	79
2.	Heavy Vehicle Manufacturing Shop	161
3.	Light Vehicle Repair Shop	62
4.	Press Shop	107
5.	Bolt and Nut Manufacturing Shop	37
6.	Heavy Vehicle Component Shop	149
7.	Leaf Spring Shop	33
8.	Service Station No.1	47
9.	Bus Production Plant (Htauk Kyant)	81
10.	Heavy Vehicle Body Assembly Shop	65
11.	Heavy Vehicle Repair Shop	20
12.	Service Station No.2	30
IV.	Planning Dept.	
1.	Planning Office	104
2.	Maintenance (Electric & Service)	30
3.	Inspection Dept.	108
V.	Finance Dept.	55
VI.	Administration and Management Dept.	103
VII.	Assigned to Other Factories	305
	Total	3,107

Figure 3.2-3(3) ORGANIZATION OF NO.3 HI



Capital Investment (as of March, 1987)

(Unit: Million Kyats)

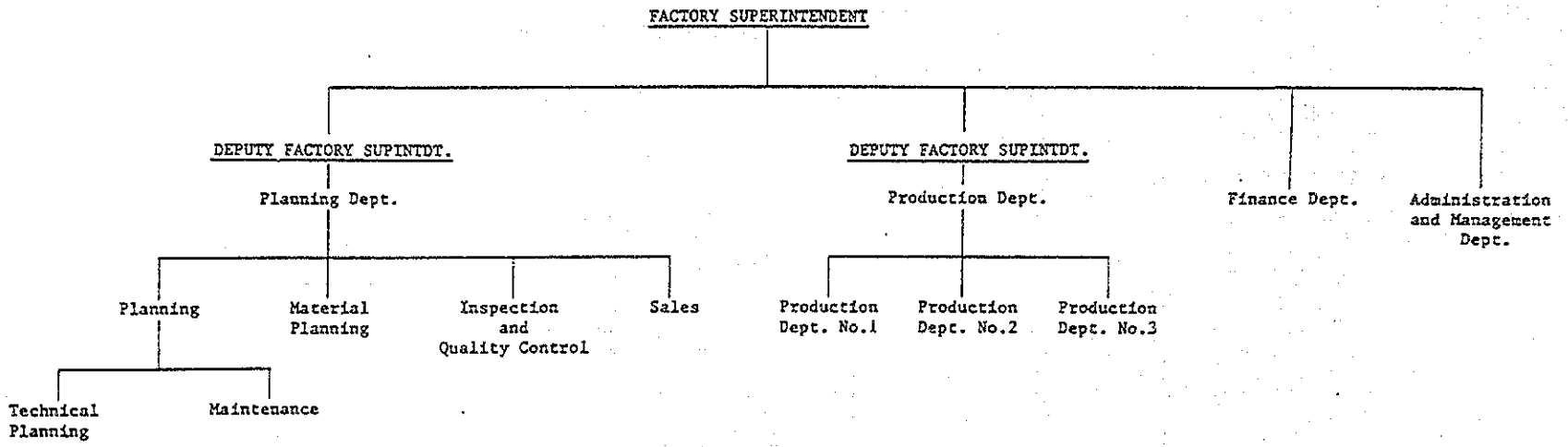
Sr. No.	Description	Local Cost Portion	Foreign Exchange Portion	Total
1.	Buildings	96.5	18.5	115.0
2.	Machinery and Equipment	109.0	362.6	471.6
3.	Technical Services	7.7	4.9	12.6
	Total	213.2	386.0	599.2

NUMBER OF EMPLOYEES BY SHOP (as of Jan., 1988)

No.3 HI

Sr. No.	Name of Shop	No. of Employees
I.	Production Dept. No.1	
1.	Production (1) Office	29
2.	A.M.E Component Manufacturing Shop No.2	183
3.	A.M.E Component Manufacturing Shop No.3	161
4.	A.M.E Component Manufacturing Shop No.4	87
5.	A.M.E Assembly Shop No.1	125
6.	A.M.E Assembly Shop No.2	35
7.	Press and Welding Shop	41
II.	Production Dept. No.2	
1.	Production (2) Office	47
2.	Forging Shop for Hand Tools	30
3.	Finishing Shop for Hand Tools	30
4.	Forging Shop for Mamootie	65
5.	Finishing Shop for Mamootie	20
6.	Saw Mill	10
7.	Die Reparing Shop	36
8.	Heat Treatment Shop	14
9.	Forging Shop for Light Vehicle Project	45
10.	Welding Electrode Manufacturing Shop	32
III.	Production Dept. No.3	
1.	A.M.E Component Manufacturing Shop No.1	151
2.	Watt Hour Meter Manufacturing Shop	104
3.	Torch Light & Dynamo Lamp Shop	94
4.	Lighting Fixture Shop	72
IV.	Production Dept. No.4 Foundry Shop	
1.	Production (4) Office	30
2.	Inspection & Quality Control	20
3.	Production A Line	59
4.	Production B Line	39
5.	Production C Line	26
6.	Production D Line	61
7.	Pattern Making Shop	17
8.	Sand Preparation Section	17
9.	Maintenance Section	13
10.	Fitting Section	38
V.	Planning Dept.	
1.	Planning Office	66
2.	Material Planning	103
3.	Design	11
4.	Maintenance (Electric & Service)	91
5.	Inspection	86
6.	Manufacturing Store	49
7.	Agricultural Machinery Research and Development Section	18
8.	Water Treatment Plant	24
9.	Construction Dept.	30
VI.	Finance Dept.	63
VII.	Administration and Mamangement Dept.	235
	Total	2,507

Figure 3.2-3(4) ORGANIZATION OF NO.4 HI



Capital Investment (as of March, 1987)

(Unit: Million Kyats)

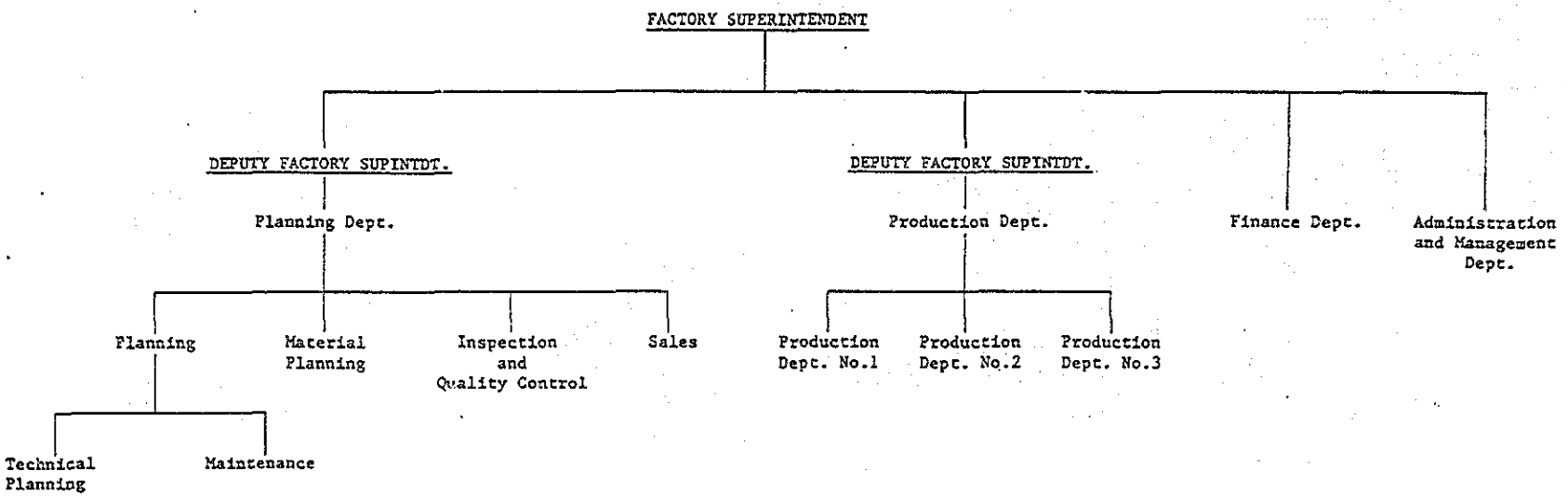
Sr. No.	Description	Local Cost Portion	Foreign Exchange Portion	Total
1.	Buildings	25.0	115.4	140.4
2.	Machinery and Equipment	430.1	186.5	616.6
3.	Technical Services	6.8	10.1	16.9
	Total	461.9	312.0	773.9

NUMBER OF EMPLOYEES BY SHOP (as of Jan., 1988)

No.4 HI

Sr. No.	Name of Shop	No. of Employees
I.	Production Dept. No.1	
1.	Painting and Vehicle Assembly Shop	172
2.	Body Assembly Shop	181
3.	Transportation Repair and Maintenance Shop	29
II.	Production Dept. No.2	
1.	Storage Battery Manufacturing Shops I & II	81
2.	Lead Power Shop and Container Manufacturing Shop	41
III.	Production Dept. No.3	
1.	Machine Shop	382
2.	Heat Treatment Shop	20
IV.	Production Dept. No.4	
1.	Piston & Piston Ring Manufacturing Shop	88
2.	Light Alloy Foundry Shop	73
3.	Plating	7
V.	Production Dept. No.5	
1.	Diesel Engine Manufacturing Plant	129
VI.	Planning Dept.	
1.	Planning Office	155
2.	Repair and Maintenance Shop	10
3.	Water Treatment Plant	22
4.	Design	4
5.	Material Planning	111
6.	Maintenance (Electric & Service)	62
VII.	Finance Dept.	49
VIII.	Administration and Management Dept.	121
	Total	1,737

Figure 3.2-3(5) ORGANIZATION OF NO.5 HI



Capital Investment (as of March, 1987)

(Unit: Million Kyats)

Sr. No.	Description	Local Cost Portion	Foreign Exchange Portion	Total
1.	Buildings	8.9	58.2	67.1
2.	Machinery and Equipment	160.4	95.9	236.3
3.	Technical Services	12.9	1.8	14.7
	Total	182.2	155.9	338.1

NUMBER OF EMPLOYEES BY SHOP (as of Oct., 1987)

No.5 HI

Sr. No.	Name of Shop	No. of Employees
I.	Production Dept. No.1	
1.	Machine Shop	115
2.	Assembly Shop	45
3.	Production Office	5
II.	Production Dept. No.2	
1.	Die Repair Shop	16
2.	Heat Treatment Shop	11
III.	Production Dept. No.3	
1.	Transformer Manufacturing Shop	60
2.	P.V.C Insulated Cable Plant	40
VI.	Planning Dept.	
1.	Planning Office	21
2.	Material Planning	50
3.	Design	36
4.	Maintenance	30
V.	Finance Dept.	13
VI.	Administration and Management Dept.	199
	Total	641

Figure 3.2-4(1) NO.1 HI (RANGOON)

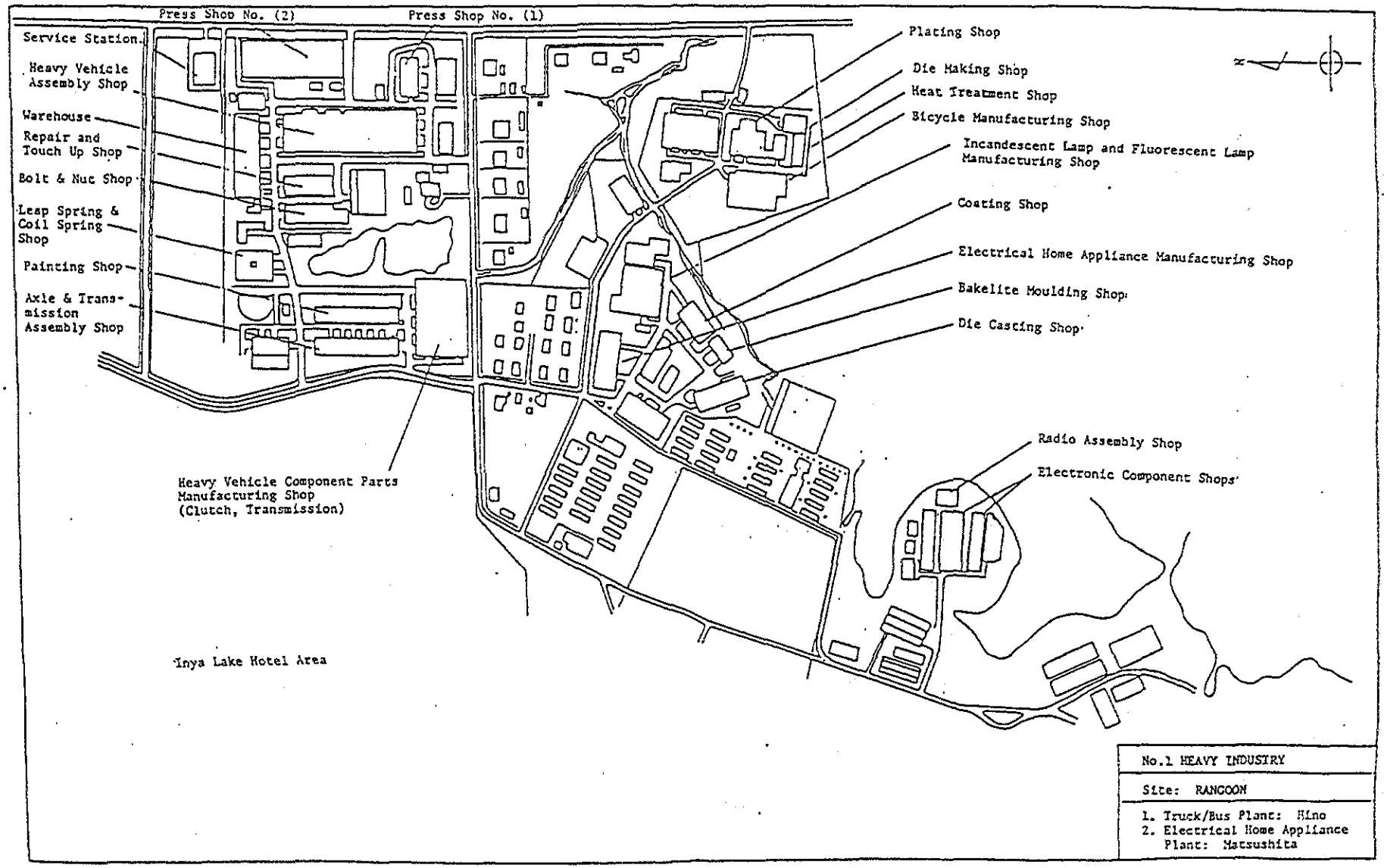


Figure 3.2-4(2) NO.3 HI (SINDE)

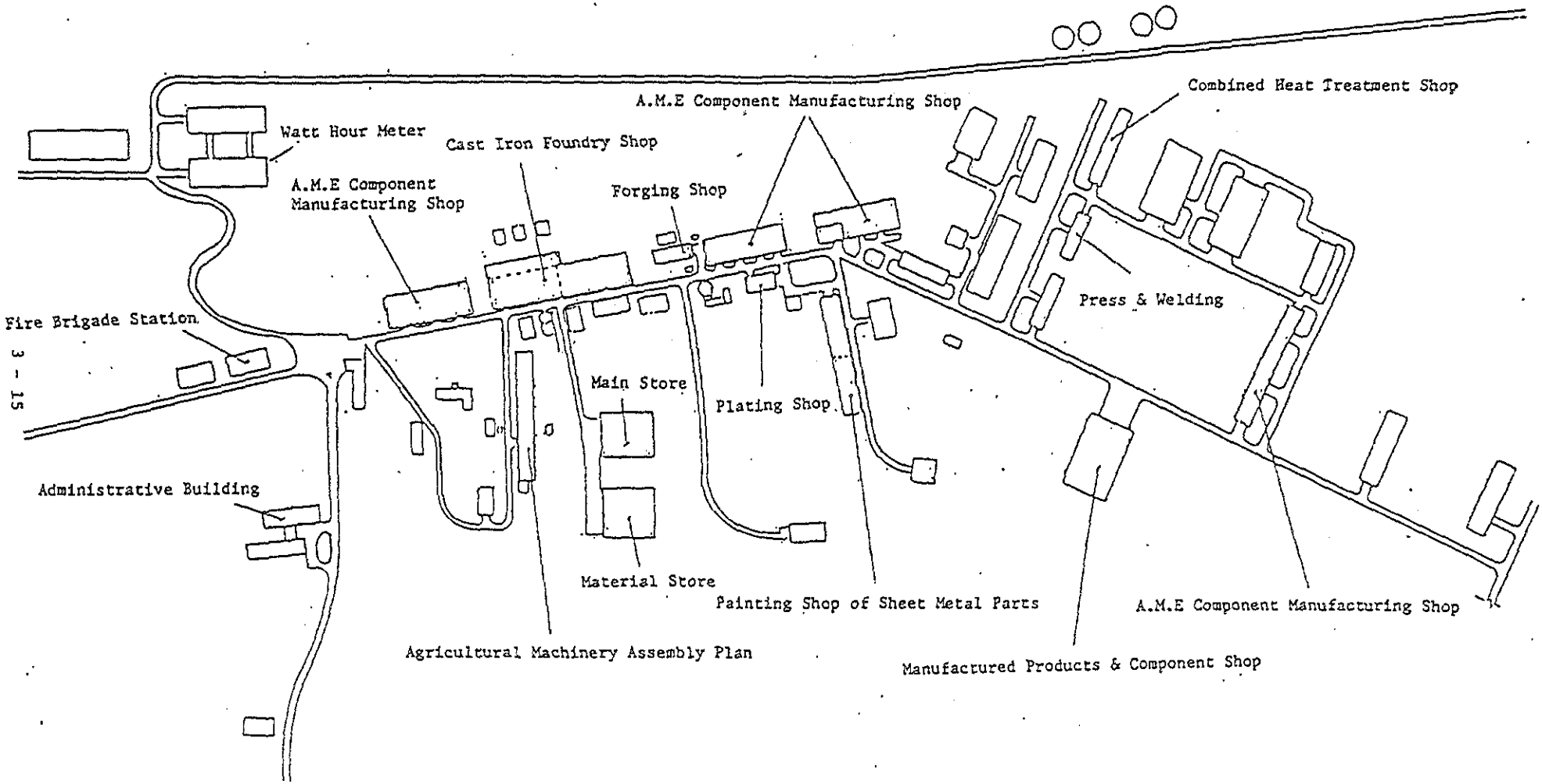


Figure 3.2-4(3) NO.4 HI (HTONBO)

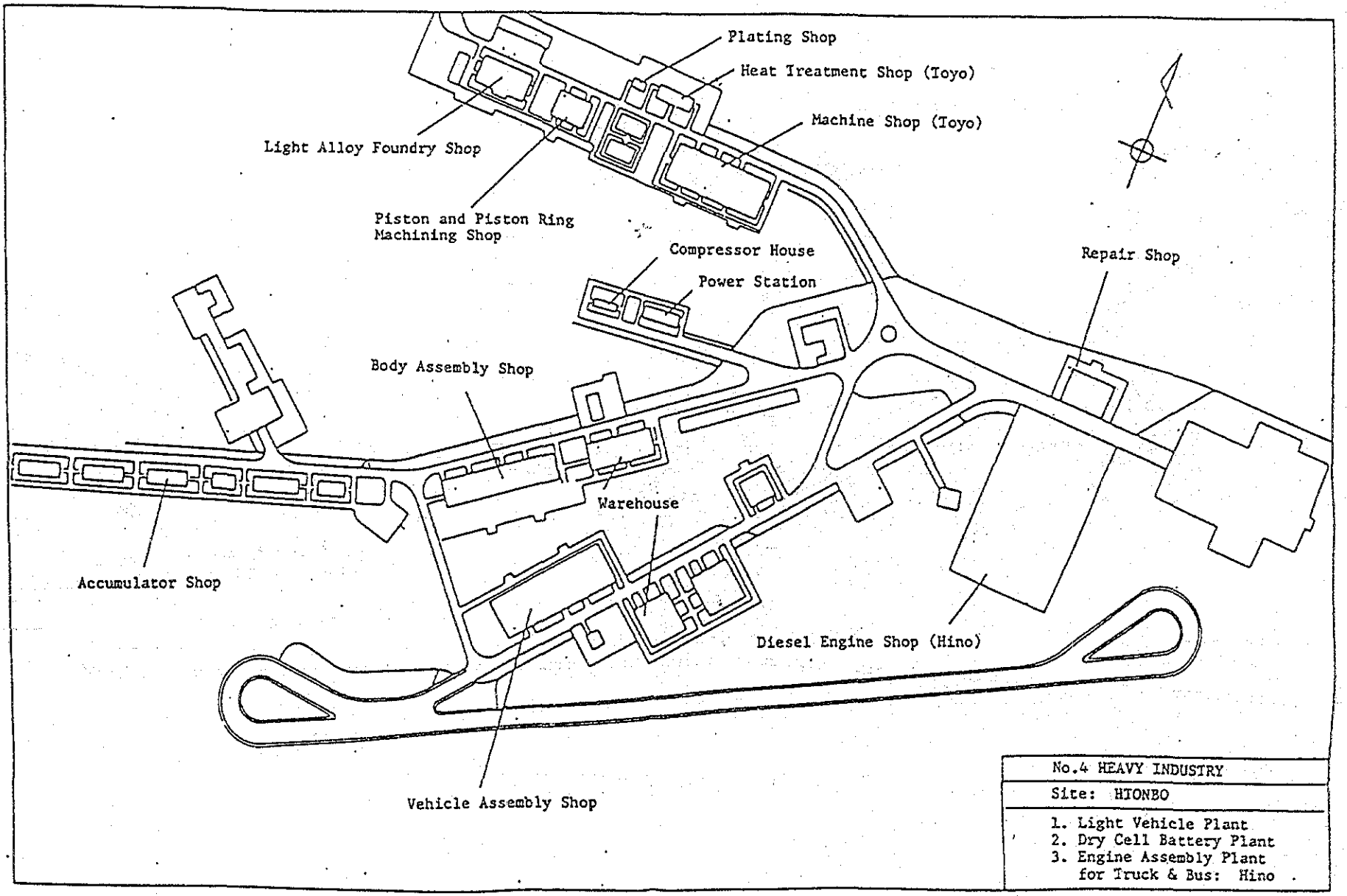
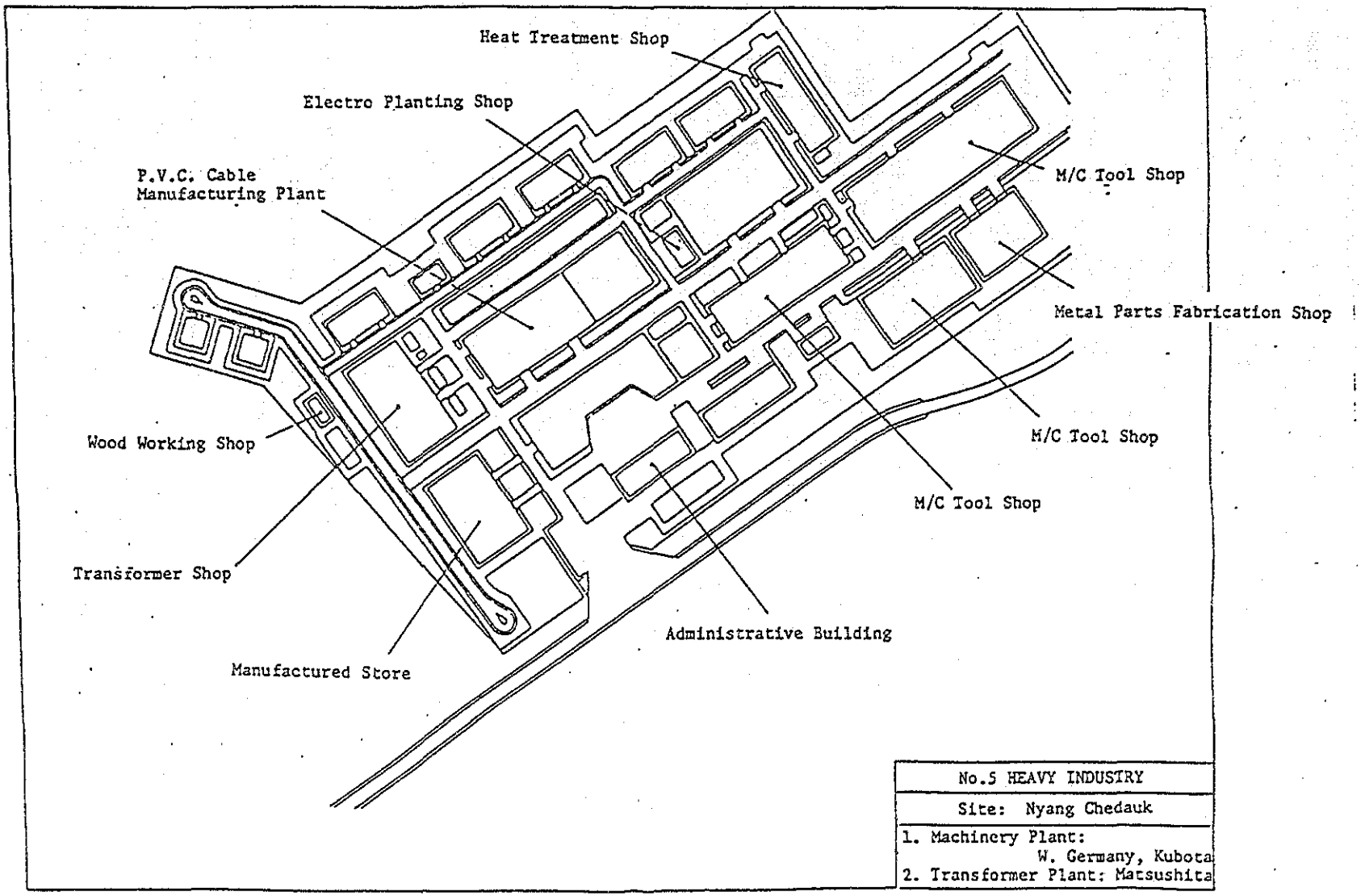


Figure 3.2-4(4) NO.5 HI (NYAUNG CHEDAUK)



No.5 HI comprises several shops each with adequate shop space and orderly layout. In contrast both No.3 and No.4 HI comprise a number of shops having small individual buildings scattered in the site, due to the fairly complicated topography of the site. The dispersed layout of the shops may have been based on security reasons. It is true, however, that this layout causes inconvenience or inefficiency in material movements, workers' job performance, operation control, and communication in the respective factory.

The main shops and plants manufacturing the products of the Four Industrial Projects in the aforesaid factories are listed in Table 3.2-2 (1) to 3.2-2 (2).

The electric and electronic products are produced at No.1 and No.3 HI, except the storage batteries manufactured at No.4 HI, distribution transformers at No.5 HI and dry cell batteries both at No.1 and No.2 HI. Most of the electric and electronic products presently produced are manufactured at individual shops equipped with specific manufacturing facilities designed for each product in an integrated process flow from raw materials preparation through finishing of the product.

The agricultural machinery and heavy and light vehicles are manufactured through several steps of manufacturing processes split into different factories. The final assembly is done, respectively, at No.3 HI for the agricultural machinery, at No.1 HI for the heavy vehicles and at No.4 HI for the light vehicles. The manufacturing of component parts do not correspond to the assembly of the final product, but is dispersed in the factories according to the craft used.

Figure 3.2-5 demonstrates the inter-factory flow of cast and forged parts, light metal cast parts, pistons and piston rings, and pressed parts in the processes of manufacturing performed by these factories.

All of cast iron and forged parts to be used as intermediates for manufacturing the component parts of agricultural machinery and heavy/light vehicles are manufactured at the Foundry Shop and Forging Shop of No.3 HI. These intermediates for the parts of agricultural machinery are supplied to the AME (Agricultural Machinery and

Table 3.2-2(1) MAIN SHOPS/PLANTS MANUFACTURING PRODUCTS RELATED TO FOUR INDUSTRIAL PROJECTS
(No.1 HI, No.3 HI, No.4 HI, No.5 HI)

Factories	Name of Main Shops/Plants	Main Products Manufactured
No.1 HI	1. Heavy Vehicles (HV):	
	1) HV Body Assmebly Shop	- Trucks (7 Types)
	2) Bus Production Plant (Htauk Kyant)	- Bus (2 Types)
	3) HV Manufacturing Shop/HV Component Shop	- Transmission and Chassis Parts
	4) Leaf Spring Shop	- Leaf Spring and Coil Spring
	2. Bolt and Nut Manufacturing Shop	- Bolt, Nut and Screw
	3. Press Shop	- Press Parts
	4. Electrical and Electronic Products (EP):	
	1) IL & FL Manufacturing Shop	- Incandescent Lumps (4 Types)
		- Fluorescent Lumps (2 Types)
		- Mercury Lumps (3 Types)
	2) Dry Cell Batteries Plant	- Dry Cell Batteries (3 Types)
	3) Radio Assembly Plant	- Radio (5 Types)
		- Color T.V. Receiver Set (4 Types)
	4) Home Electrical Appliance Assembly Shop/ Bakelite Molding Shop	- Lighting Fixtures (4 Types)
		- Fixtures for Mercury Lump (3 types)
		- Electric Accessories (32 Types)
		- Electric Iron (1 Type)
		- Hot Plate (1 Type)
		- Rice Cooker (2 Types)
		- Air Conditioner (1 Type)
		- Water Cooler (1 Type)
	5) Electronic Components Shops	- Electronic Components
		- Electronic Calculator (2 Types)
No.3 HI	1. Agricultural Machinery and Equipment (AME):	
	1) AME Component Manufacturing Shops, and AME Assembly Shops	- Diesel Engine Driven Pumping Sets (4 Types)
		- Pesticide Equipment (4 Types)
		- Power Tiller (1 Type)
		- Thresher (1 Type)
		- Portable Diesel Generator (2 Types)
		- Rotary Device (1 Type)
		- Spare Parts for Agricultural Machinery Including Gear
	2) Forging and Finishing Shops for Mamootie and Hand Tools	- Mamootie (3 Types)
		- Hand Tools (24 Types)
	2. Light Vehicle (LV):	
	- Forging Shop for LV	- Forging Parts for LV
	3. Foundry	- Casting Parts for AME, HV, LV and EP
	4. Electrical and Electronic Products (EP):	
	1) Watt Hour Meter Manufacturing Shop	- Watt Hour Meter (2 Types)
	2) Torch Light and Dynamo Lamp Shop	- Torch Lumps (3 Types)
		- Dynamo Lump (1 Type)
	3) Electric Appliances Manufacturing Shop	- Electric Motors (5 Types)
		- Electric Fans (3 Types)
	4) Lighting Fixture Shop	- Lighting Fixtures (2 Types)

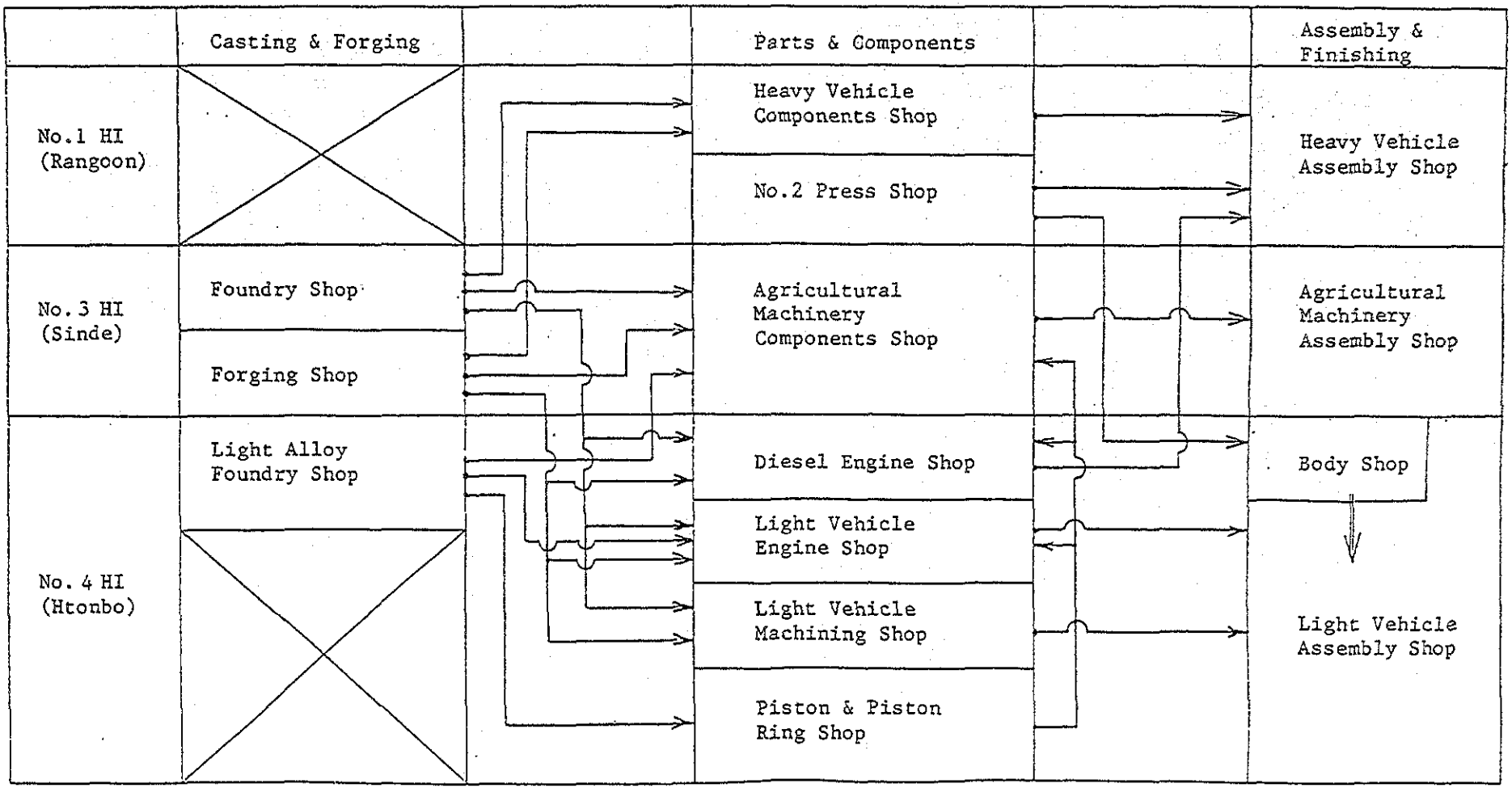
Table 3.2-2(2) MAIN SHOPS/PLANTS MANUFACTURING PRODUCTS RELATED TO FOUR INDUSTRIAL PROJECTS
(No.1 HI, No.3 HI, No.4 HI, No.5 HI)

Factories	Name of Main Shops/Plants	Main Products Manufactured
No.4 HI	1. Light Vehicles (LV):	
	1) Painting and Vehicle Assembly Shop/Body Assembly Shop/Machine Shop/Heat Treatment Shop	- 2000cc Gasoline Engine Vehicle (1 Type) - 600cc Gasoline Engine Vehicle (1 Type) (Including the Manufacturing of Engine, Transmission Chassis and Other Components)
	2) Piston and Piston Ring Manufacturing Shop	- Piston (14 Types) - Piston Ring (14 Types)
	3) Light Alloy Foundry Shop	- Light Alloy Casting Parts
	2. Heavy Vehicles (HV):	
	- Diesel Engine Manufacturing Plant	- Diesel Engine for HV
	3. Electrical Products (EP):	
	- Storage Battery Manufacturing Shops/Lead Power Shop & Container Manufacturing Shop	- Storage Batteries (5 types)
No.5 HI	Electrical Products (EP):	
	- Transformer Manufacturing Shop	- Distribution Transformer (6 Types)

Notes: 1) There is another dry cell battery manufacturing plant located in No.2 HI.
2) Products outside the scope of the Four Industrial Products manufactured in No.1 HI, No.3 HI and No.5 HI are as listed below:
No.1 HI: 1) Bicycle
2) Cutlery
3) Razor blade
4) Light engineering products
5) Machinery and equipment
No.3 HI: - Welding electrode
No.5 HI: 1) Machine tools
2) PVC insulated electric cable
3) Gas cylinders
4) General engineering products

Source: "Present Status of The Four Industrial Projects"; Oct., 1987 - HIC and other HIC's documents

Figure 3.2-5 PHYSICAL DISTRIBUTION BETWEEN FACTORIES OF MAIN PARTS FOR HEAVY AND LIGHT VEHICLES AND AGRICULTURAL MACHINERY



Equipment) Component Manufacturing Shop of No.3 HI for machining and subsequent processing, and then the thus manufactured parts are supplied to the AME Assembly Shop of No.3 HI. The materials for the parts of light vehicles are supplied to the LV (Light Vehicles) Machine Shop of No.4 HI for machining and subsequent processing to manufacture the parts. The manufacturing of parts which involves mainly machining and heat treatment through assembly of the final products are all performed at No.3 HI for the agricultural machinery, while for the light vehicles the manufacturing of parts, the assembly of engines and transmissions, the assembly of bodies and the final assembly are performed at No.4 HI. In the case of heavy vehicles, the manufacturing of the parts for engines and the assembly of engines are performed at No.4 HI, while the manufacturing of transmissions and parts excluding those for the engines, and the assembly of transmissions and bodies are performed at No.1 HI Production Plant located at Htauk Kyant. The engines for heavy vehicles assembled at No.4 HI are sent to No.1 HI.

The cast iron and forged products to be used for the parts of heavy vehicles are partly supplied to the HV (Heavy Vehicles) Diesel Engine Manufacturing Plant of No.4 HI for manufacturing the parts of engines and the remainder is supplied to the HV Component Shop of No.1 HI respectively for machining and subsequent processing.

The cast aluminium light alloy products to be used as intermediates for the parts of agricultural machinery and heavy/light vehicles are all manufactured at the Light Alloy Foundry Shop of No.4 HI. All of the pistons and piston rings required are manufactured at the Piston and Piston Ring Manufacturing Shop of No.4 HI. The thus manufactured cast aluminium light alloy products including pistons and piston rings are supplied, respectively, to the AME Assembly Shop of No.3 HI for the diesel generators, and the HV Diesel Engine Manufacturing Shop of No.4 HI for the diesel engines for heavy vehicles and to the LV Assembly Shop of No.4 HI for the engines for light vehicles.

All of the pressed parts for the heavy/light vehicles are manufactured at the Press Shop of No.1 HI. The pressed parts for the heavy

vehicles are sent to the HV Body Assembly Shop located within the same site and also to the Bus Production Plant at Htauk Kyant, while the parts for the light vehicles are supplied to the LV Assembly Shop of No.4 HI.

(3) Investments Made for the Four Industrial Projects

The total of investments made up to October, 1987 are as follows:

Total Investments of Four Industrial Projects

(in million Kyats)

Name of Project	Foreign Exchange Portion: Aid Finance from Japan*1)	Foreign Exchange Portion: HIC's Own Fund*2)	Local Currency Portion*3)	Total
1. Agricultural Machinery and Equipment	242.00	38.34	215.26	495.60
2. Heavy Vehicles	188.00	105.52	122.23	415.75
3. Light Vehicles	346.00	33.98	265.85	645.83
4. Electric and Electronic Products	201.00	26.23	123.00	350.23
Total Investments	977.00 (46.47 billion yen)	204.07 (US$26.23 million)	726.34	1,907.41

Notes: 1) Aid finances from Japan: Reparations funds, ETCA funds, and OECF loans

2) HIC's own foreign exchange funds

3) Finance from the Government of Burma

Source: "Present Status of Four Industrial Projects"
- HIC: October 10, 1987

3-2-3 Financial Status of HIC

The financial statements (balance sheet, and profit and loss statement) of HIC for the past three years (1984/85 to 1986/87) are shown in Tables 3.2-3(1) and 3.2-3(2). The key financial indicators tabulated or calculated from the figures of the financial statements are summarized below:

Table 3.2-3(1) FINANCIAL STATEMENTS: HEAVY INDUSTRIES CORPORATION
BALANCE SHEET AS AT 31-3-85, 31-3-86, 31-3-87

(Kyats in Thousand)

Particulars	1984-85		1985-86		1986-87	
Assets.						
Fixed Assets.		3,856,382.6		4,079,348.3		4,302,379.1
Machinery and Equipment	3,549,528.7		3,787,325.1		4,084,181.8	
Building Materials	807,413.9		887,758.5		912,000.9	
Office Equipment	7,834.7		7,911.4		8,151.2	
Office Furniture	28,232.1		28,308.8		28,606.9	
	4,393,009.4		4,711,303.8		5,032,940.8	
Less. Accumulated Depreciation	536,626.8		631,955.5		730,561.7	
Current Assets.						
Stocks:		1,544,366.5		1,599,328.1		1,390,590.2
Components & Raw Materials	1,344,976.8		1,389,055.1		1,250,649.5	
Work in Progress	91,131.4		96,929.9		94,120.0	
Finished Stocks	108,258.3		113,343.1		45,820.7	
Debtors & Debit Balances		385,490.0		377,594.9		331,252.1
Sales Debtors	84,174.3		75,719.2		156,019.0	
Goods and Services Tax	243,118.5		243,118.5		137,309.9	
State Contribution	35,859.9		35,859.9		14,372.4	
Advances					653.5	
Sundries	22,337.3		22,897.3		22,897.3	
Cash Balances		16,805.2		16,713.8		23,023.1
		5,803,044.3		6,072,985.1		6,047,244.5
Capital & Liabilities		1,001,378.1		997,271.8		993,165.5
Capital (UGCF)*1)	867,064.2		867,064.2		867,064.2	
Capital*2)	134,313.9		130,207.6		126,101.3	
Profit & Loss		185,748.3		213,429.8		263,567.3
Balances	160,867.2		185,748.3		213,429.8	
Profit for the Year	24,881.1		27,681.5		50,137.5	
Liabilities		4,615,917.9		4,862,283.5		4,799,511.7
Long Term Liabilities	3,384,223.5		3,549,103.4		3,593,258.9	
Short Term Liabilities	1,231,694.4		1,313,180.1		1,197,252.8	
		5,803,044.3		6,072,985.1		6,047,244.5

Notes: 1. Specified years are HIC's corporate fiscal years beginning on 1st April every year and ending on 31st March in the succeeding year.
2. *1) Corporate capital contributed by UGCF: Union Government Consolidated Fund
*2) Working capital provided by the government subject to repayment
*3) Contribution to state at 30% of net profit; income tax being exempted

Source: HIC

Table 3.2-3(2) FINANCIAL STATEMENTS: HEAVY INDUSTRIES CORPORATION
MANUFACTURING, TRADING PROFIT & LOSS ACCOUNT

(Kyats in Thousand)

Particulars	1984-85		1985-86		1986-87	
Total Sales for the Year	931,727.3		975,379.1		1,280,680.3	
Other Income for the Year	7,500.0		7,500.0		9,045.8	
		939,227.3		982,879.1		1,289,726.1
Less. Cost of Goods Sold		687,148.7		712,101.5		995,535.2
Gross Profit		252,078.6		270,777.6		294,190.9
Less.						
Administrative Expenses	19,818.2		19,618.0		22,136.6	
Sales Expenses	700.0		900.0		1,481.7	
Financial Expenses	108,513.4		122,715.6		93,139.0	
Goods & Services Tax	87,502.5		87,999.0		105,808.6	
		216,534.1		231,232.6		222,565.9
Net Profit		35,544.5		39,545.0		71,625.0
Less.						
Contribution to State*3)		10,663.4		11,863.5		21,487.5
Net Profit after Contribution to State		24,881.1		27,681.5		50,137.5

Notes: 1. Specified years are HIC's corporate fiscal years beginning on 1st April every year and ending on 31st March in the succeeding year.
2. *1) Corporate capital contributed by UGCF: Union Government Consolidated Fund
*2) Working capital provided by the government subject to repayment
*3) Contribution to state at 30% of net profit; income tax being exempted

Source: HIC

	1984/85	1985/1986	1986/87
(1) Profit/Loss (Million Kyats)			
a) Gross Income	939.2	982.9	1,289.7
(Total Sales)	(931.7)	(975.4)	(1,280.7)
b) Gross Profit*1)	252.1	270.8	294.2
c) Net Profit*2)	35.5	39.5	71.6
d) Net Profit after Contribution to State*3)	24.9	27.7	50.1
e) Accumulated Reserves (as of End of Year)	185.7	213.4	263.5
(2) Rates of Return (%)			
a) Rate of Return on Investment (R.O.I.)*4)	5.1	5.3	5.1
b) Rate of Return on Gross Capital*5)	3.2	3.5	3.4
c) Rate of Return on Equity Capital*6)	4.1	4.6	8.3
d) Rate of Return on Sales*7)	3.0	3.3	4.9
(3) Capital Turnover (%)			
a) Turnover of Equity Capital*8)	107.5	112.4	147.7
b) Turnover of Gross Capital*9)	20.4	20.5	26.4
(4) Long-term Liability Ratio to Net Worth (%)*10)	334.0	340.5	329.0

Notes:

1) Gross income (total sales plus other income) less cost of goods sold.

2) Gross profit less administrative expenses, sales expenses, financial expenses and excise tax.

3) Contribution to the state at 30% of net profit; income tax being exempted.

4) Rate of Return on Investment (R.O.I): Percentage of (i) the total of net profit, depreciation and financial expenses against (ii) the value of fixed assets before depreciation.

5) Rate of Return on Gross Capital: Percentage calculated in the following formula:

$$\frac{\text{Net Profit (plus Financial Expenses)}}{\text{(GCBY + GCEB) x 1/2}}$$

Here, - GCBY: Gross Capital at the Beginning of Year
- GCEY: Gross Capital at the End of Year
- Gross Capital: Total of Corporate Capital contributed by the Government (Union Government Consolidated Fund), Working Capital provided by the Government, and Long-term Liabilities

6) Rate of Return on Equity Capital: Percentage of net profit against the Corporate Capital (867,064,200 Kyats)

7) Rate of Return on Sales: Percentage of net profit (excluding other income) against total sales

8) Turnover of Equity Capital: Percentage of total sales against the Corporate Capital

9) Turnover of Gross Capital: Percentage of total sales against the Gross Capital

10) Long-term Liability Ratio to Net Worth: Percentage of (i) long-term liabilities including working capital provided by the Government against (ii) net worth consisting of the corporate capital and accumulated reserves.

HIC is allowed to sell its products at the prices set for each product based on the standard production cost plus a certain rate of profit margin sanctioned by the Government. Under this system, HIC is assured to gain a certain range of profit as long as the production is realized at costs not exceeding the standard costs. As shown above, HIC steadily gained profit during the given three years. The rates of return, however, were relatively low in view of the Return on Investment, Return on Gross Capital, and

Return on Equity Capital. This is because of a low rate of return on sales attributed to a small profit margin sanctioned by the Government. Under these situations, the accumulation of capital is small.

The ratio of long-term liabilities is situated in a sound range. Nevertheless, there is a possibility for the financial position to decline if a large amount of loans are borrowed to finance additional investments in the future, since the accumulated capital is very small to finance the investments. In view of the financial structure as mentioned above, it is recommended that HIC should consider stage-wise investments and also carefully examine the financing plan including the increase of corporate capital so that a sound equity - debt structure can be maintained.

3-2-4 Current Situation of Production and Production Costs of the Four Industrial Projects

(1) Production Capacity, Production Plan and Actual Production

1) Production Capacity and Actual Production

Tables 3.2-4(1) to 3.2-4(4) show the production capacity and the record of production for the past three years (1984/85 - 1986/87) pertaining to the products of the Four Industrial Projects. Table 3.2-5 shows a trend of capacity utilization realized for the production of major products in that period.

Salient points observed from a review of the production trend in comparison with the production capacity are summarized below:

a) As shown in Table 3.2-5, the production of the products, except for dry cell batteries, storage batteries and power tillers, maintained a steady or slightly upward trend for the last three years.

b) The production of dry cell batteries, storage batteries and power tillers recorded a declining trend. The decreases in the production of dry cell batteries resulted from frequent stoppages of operation of the dry cell battery plant of No.2 due to shortage of fuel oil to be used for smelting zinc which is the raw material

Table 3.2-4(1) PRODUCTION CAPACITY; PRODUCTION PLAN; ACTUAL PRODUCTION
(Expressed by Annual Quantities)

	Product Name	Production Capacity (A)	1984 - 85					1985 - 86					1986 - 87				
			Production Plan (B)	Production Actual (C)	Capacity-Result Ratio(%) B/A	Capacity-Result Ratio(%) C/A	Plan-Result Ratio (%) C/B	Production Plan (B)	Production Actual (C)	Capacity-Result Ratio(%) B/A	Capacity-Result Ratio(%) C/A	Plan-Result Ratio (%) C/B	Production Plan (B)	Production Actual (C)	Capacity-Result Ratio(%) B/A	Capacity-Result Ratio(%) C/A	Plan-Result Ratio (%) C/B
1	Heavy Vehicles																
(1)	6.5 Ton Diesel Truck												4				
	6.5 Ton Disel Truck Model TE-21A		500	408			82	450	532			118	550	330			60
	6.5 Ton Dump Truck Model TE		75	64			85	35	54			154	50	53			106
	Fuel Bowser Model TE		60	60			100	60	60			100	60	45			75
	Water Bowser Model TE	1,100	60	74			123	30	61			203	50	28			56
	Logging Truck Model TE-21 TLB		100	4			4	50	23			46	30	84			280
	Fire Engines and Other Special Vehicles Model TE		16	5			31	23	25			109	17	12			71
(2)	5 Ton, 4 Wheel Drive Truck (Model WA-211)		50	-			-	50	47			94	50	52			104
(3)	3.5 Ton Diesel Truck (Model KM-600)		150	91			61	123	164			133	150	219			146
(4)	25-Seats Medium Bus (Model BM-600)		100	69			69	100	74			74	70	75			107
(5)	33-Seats Bus Model BX-402		-	-			-	50	-			-	40	14			35
	Total	1,100	1,111	775	101	70	70	971	1,040	88	95	107	1,067	912	97	83	85
2	Light Vehicles																
(1)	B-600 Pick-up & Light Van	600	270	335	45	56	124	780	400	130	67	51	520	433	87	72	83
(2)	X-2000 Cross Country Vehicles	400	400	200	100	50	50	356	233	89	58	65	390	236	98	59	61
(3)	T-2000 (2) Ton Light Truck	200	300	198	150	99	66	325	297	163	149	91	300	340	150	170	113
	Total	1,200	970	733	81	61	76	1,461	930	122	78	64	1,210	1,009	101	84	83
3	Engines																
(1)	Diesel Engine for TE-Truck DS-70	1,200	961	704	80	59	73	798	848	67	71	106	847	894	71	75	106
(2)	Engine for B-600	1,300	370	422	28	32	114	880	373	68	29	42	620	520	48	40	84
(3)	Engine for X-2000 & T-2000	600	850	415	142	69	49	831	560	139	93	67	790	652	132	109	83

Source: HIC

Table 3.2-4(2) PRODUCTION CAPACITY; PRODUCTION PLAN; ACTUAL PRODUCTION
(Expressed by Annual Quantities)

	Product Name	Production Capacity (A)	1984 - 85					1985 - 86					1986 - 87				
			Production Plan (B)	Production Actual (C)	Capacity-Result Ratio(%) B/A	Capacity-Result Ratio(%) C/A	Plan-Result Ratio (%) C/B	Production Plan (B)	Production Actual (C)	Capacity-Result Ratio(%) B/A	Capacity-Result Ratio(%) C/A	Plan-Result Ratio (%) C/B	Production Plan (B)	Produciton Actual (C)	Capacity-Result Ratio(%) B/A	Capacity-Result Ratio(%) C/A	Plan-Result Ratio (%) C/B
4	Agricultural Machinery and Equipment																
(1)	Pumping Set																
	4" Pumping Set (SC4C x KND5B)		6,000	3,700			62	4,000	4,000			100	4,500	4,260			95
	4" Pump with Motor (SC4C x EMFB-4P3.7kW)		-	-			-	1,000	1			-	300	10			3
	4" Pumping Set (High Head) (SVO-102KB x KND7)		350	500			143	350	625			178	600	600			100
	4" Pump with Motor (SVO-102KB x EMFB4P7.5kW)	7,200	-	-	88	58	-	150	1	76	64	-	100	30	77	68	30
	6" Pumping Set (SVH-153AZ x ZET-50)		-	-			-	-	-			-	-	1			-
	8" Pumping Set IRRIZET-50		-	-			-	-	-			-	20	19			95
(2)	Light Agricultural Machinery																
	Power Tiller (Model: KMB-200 x KND7)	600	600	393	100	66	66	500	190	83	32	38	600	270	100	45	45
	Power Thresher (Model: ATA-4S x KND5B, PT-862 x KWD5B)	500	200	108	40	22	54	200	117	40	23	59	500	505	100	101	101
(3)	Diesel Generating Set																
	2 kVA Portable Generator (Model: BSK-120 x KND5B)	300	100	34	100	78	34	50	50	83	57	100	100	150	100	110	150
	4 kVA Portable Generator (Model: BSK-140 x KND7)		200	200			100	200	120			60	200	181			90
(4)	Pesticide Equipment																
	High Pressure Sprayer (H-2)	10,000	400	400	27	13	100	200	-	25	12	-	200	400	23	25	200
	Automatic Knapsack Sprayer (A-8)		2,000	825			41	2,000	945			47	2,000	2,000			100
	Hand Push Duster (Q-2)		200	-			-	200	200			100	-	-			-
	Rotavator (Model: FC-1800F)		50	50			100	50	50			100	50	70			140
(5)	Tools																
	Hand Tools (9-Types)	400,000	75,000	79,922	19	20	107	78,000	84,617	20	21	108	78,000	112,869	20	28	145
	Mamoocies (3-Types)	600,000	300,000	443,230	53	78	148	300,000	439,277	53	75	146	400,000	357,650	69	64	89
	Shovel		10,000	10,355			104	10,000	6,064			61	10,000	20,383			204
	Pick Axe		2,000	13,573			679	2,000	3,277			164	3,000	8,600			287
	Axe		3,000	2,100			70	3,000	1,000			33	-	140			-

Source: HIC

Table 3.2-4(3) PRODUCTION CAPACITY; PRODUCTION PLAN; ACTUAL PRODUCTION
(Expressed by Annual Quantities)

	Product Name	Production Capacity (A)	1984 - 85					1985 - 86					1986 - 87				
			Production Plan (B)	Production Actual (C)	Capacity-Result Ratio(%) B/A	Capacity-Result Ratio(%) C/A	Plan-Result Ratio (%) C/B	Production Plan (B)	Production Actual (C)	Capacity-Result Ratio(%) B/A	Capacity-Result Ratio(%) C/A	Plan-Result Ratio (%) C/B	Production Plan (B)	Productio Actual (C)	Capacity-Result Ratio(%) B/A	Capacity-Result Ratio(%) C/A	Plan-Result Ratio (%) C/B
6	Home Electrical Appliances and Electronic Products																
(1)	Lighting Equipment and Accessories																
①	Lamps																
	Incandescent Lamps (4-Types)	2,400,000	3,000,000	3,464,769	125	144	115	3,300,000	3,366,100	138	140	102	3,000,000	2,944,700	125	123	98
	Fluorescent Lamps (2-Types)	400,000	400,000	431,198	100	108	108	440,000	454,260	110	114	103	440,000	421,720	110	105	96
	Mercury Lamps (3-Types)	5,000	5,000	3,800	100	76	76	5,000	2,776	100	56	56	5,500	6,776	110	136	123
②	Fixtures																
	Fixture for Mercury Lamp (4-Types)	4,500	1,700	1,278	38	28	75	1,700	822			48	1,700	1,700			100
	Lighting Fixture (3-Types)	88,000	41,000 35,000	33,889 39,000	86	83	83 111	39,000 35,000	44,950 33,600	84	89	115 96	38,000 30,000	39,795 33,005	77	83	105 110
(2)	Dry Cell Battery (3-Types)	31,300,000	12,700,000	13,832,964			109	12,700,000	13,449,504			106	12,700,000	12,199,646			96
			8,000,000	5,080,804			64	8,000,000	6,191,945			77	8,000,000	20,220,058			25
	Total		20,700,000	18,913,768	66	60	91	20,700,000	19,641,449	66	63	95	20,700,000	14,221,704	66	45	68
(3)	Electric Power Distribution Equipment																
	Watt-Hour Meter (2-Types)	27,500	25,500	28,840	93	105	113	26,000	24,925	95	91	96	26,000	26,000	95	95	100
	Power Distribution Transformer (6-Types)	360	140	60	39	17	43	140	193	39	54	138	250	340	69	94	136
(4)	Electric Motor (5-Types)	2,000	1,100	1,074	55	52	98	1,100	750	55	38	68	1,200	1,475	60	74	123
(5)	Storage Battery (5-Types)	38,200	29,000	22,870	76	60	79	29,000	12,585	76	33	43	29,000	14,137	76	37	49
(6)	Home Electrical Appliances																
	Air Conditioner	1,200	500	-	42	-	-	500	600	41	50	120	800	816	67	68	102
	Refrigerator	1,200	-	200	-	17	-	200	200	17	17	100	300	327	25	27	109
	Electric Iron		10,000	9,224			92	10,000	11,633			116	10,000	10,000			100
	Electric Hot Plate	24,000	6,000	5,720	92	63	95	6,000	6,320	92	98	105	6,500	6,500	102	89	100
	Rice Cooker		6,000	154			3	6,000	5,685			95	8,000	4,825			60
	Electric Fan (4-Types)	2,000	2,600	3,812	130	191	147	2,600	2,000	130	100	77	2,600	3,027	130	151	116

Source: HIC

Table 3.2-4(4) PRODUCTION CAPACITY; PRODUCTION PLAN; ACTUAL PRODUCTION
(Expressed by Annual Quantities)

	Product Name	Production Capacity (A)	1984 - 85					1985 - 86					1986 - 87				
			Production Plan (B)	Production Actual (C)	Capacity-Result Ratio(%) B/A	Capacity-Result Ratio(%) C/A	Plan-Result Ratio (%) C/B	Production Plan (B)	Production Actual (C)	Capacity-Result Ratio(%) B/A	Capacity-Result Ratio(%) C/A	Plan-Result Ratio (%) C/B	Production Plan (B)	Production Acutal (C)	Capacity-Result Ratio(%) B/A	Capacity-Result Ratio(%) C/A	Plan-Result Ratio (%) C/B
(7)	Radio & Television Set																
	Radio (3-Types)	50,000	4,000	76	154	24	19	4,000	451	15	15	11	4,000	28	17	6	-
	Colour Television Receiver (2-Types)		2,500	1,137			45	2,500	3,649			146	3,000	2,286			76
	Electronic Calculator (2-Types)		1,200	-			-	1,200	3,500			292	1,500	750			50
(8)	Electric Accessories (32-Types)	1,250,000	740,500	848,056	59	68	115	829,000	887,248	66	71	107	747,000	840,620	60	68	113

Source: HIC

Table 3.2-5 PERCENTAGE OF ACTUAL PRODUCTION AGAINST PRODUCTION CAPACITY

(Unit: %)

	1984/85	1985/86	1986/87	Trend	Average (1984/85 -1986/87)
Heavy Vehicles	70	95	83	→	83
Light Vehicles	61	78	84	→	72
Engines					
DS70	59	71	75	→	68
B-600	32	21	40	↘↗	31
X/T-2000	69	93	109	→	90
Pumps	58	64	68	→	63
Power Tiller	66	32	45	→	47
Thresher	22	23	101	↗	48
Diesel Generators	78	57	110	↗	82
Incandescent Lamps	144	140	123	→	135
Fluorescent Lamps	108	114	105	→	109
Dry Cell Batteries	60	63	45	↘	56
Watt Hour Meters	105	91	95	→	97
Transformers	17	54	94	↗	55
Motors	52	38	74	↘↗	54
Storage Batteries	60	33	37	→	43
Fans	191	100	151	↘↗	149

for dry cell batteries. The decreases in the production of storage batteries were attributed to the deficiency of the supply of lead from the local supply source. The production of power tillers considerably decreased since 1985/86 onward. The production was compelled to reduce because the sales of this product currently decreased due to the present model, as mentioned in Chapter 2, being expensive and inconvenient to use for its heavy weight.

c) The production of 2000 cc engines, threshers, diesel power generators, incandescent lamps, flourescent lamps, watt-hour meters, distribution transformers and electric fans recorded a high capacity utilization of over 90% during the last three years in average, or even if less than 90% recorded an upturn to exceed 90% in 1985/86 or 1986/87. Of these the production of all the products except for watt-hour meters and distribution transformers recorded the production exceeding the capacity, either in average or in some of the past three years. This implies that effective efforts were made in some fields to guard the production from the operational contraints caused by the wear and deterioration of the manufacturing facilities.

d) The production of heavy and light vehicles, DS70 diesel engines, the engines for B-600, pumps, power tillers, dry cell batteries, motors and storage batteries remained at a comparatively low level of capacity utilization for the last three years. Of these the capacity utilization of heavy and light vehicles and DS-70 diesel engines was situated in an acceptable range, but the capacity utilization of other products was fairly low. The causes of the decreases in the production of dry cell batteries, storage batteries and power tillers have been stated above. The current production of other products will be more precisely reviewed by taking the production plans into consideration in the following section.

2) Production Plan and Actual Production

An analysis of the production of the products listed as the low capacity utilization items in the previous section is made by comparing it with the production plans shown in Tables 3.2-4(1) to 3.2-4(4). It is observed that there are three different cases resulting in the low capacity utilization, which are as follows:

a) Although the production was achieved at par or in excess of the plans, as the plans were set considerably lower than the capacity, it resulted in a low capacity utilization.

b) As the production failed to achieve the production plans set lower than the capacity, it resulted in a considerably low capacity utilization.

c) The production plans were set close to the capacity. As the production failed to achieve the plans, however, it resulted in the low capacity utilization.

HIC's annual production plan is subject to the sanction of the Government, and at the same time the allocation of foreign exchange required for the imports of raw materials and component parts is also made by the Government. There are cases where the production plan of some products is revised downward by the Government in the light of priority set in the annual national economic plan and also in consideration of foreign exchange situations. In recent years, HIC was compelled to reduce the production of some products due to stringent foreign exchange situations. When these conditions are taken into consideration, the case mentioned as a) above must be an admissible phenomenon. Careful attention must be paid to the causes of the cases mentioned as b) and c) above, because clarification is required in order to investigate appropriate measures for improvement.

The product items applicable to each of the cases mentioned above are listed below:

a) DS-70 engines, dry cell batteries, motors
b) Engines for B-600, pumps, storage batteries
c) Heavy vehicles, light vehicles, power tillers

The decreases in the production of dry cell batteries, storage batteries and power tillers, as stated earlier, were attributed to the causes unrelated to the problems of the production facilities or production control, but the decreases in the production of heavy vehicles, light vehicles, pumps and the engines for B-600 were caused by the problems of the production facilities and production control. It suggests that special attention must be paid to the lines of those products among others when investigations are made on measures to improve the production facilities and production control.

(2) Present Situation of the Localization of Raw Materials and Component Parts

The Four Industrial Projects require numerous types of raw materials and component parts, because a wide variety of products are produced. HIC has been greatly devoted to the expansion of the local production of raw materials and component parts required. Nevertheless, there are a number of component parts still relying on imports due to the constraints in existing production facilities and technology and also to economic reason that the local production has to pay a high cost penalty for the comparatively small scale production. Almost all of the raw materials are imported, except for pig iron which is supplied from thr local source for the manufacturing of ordinary cast iron. Locally made bulbs are used for incandescent lamps. As the quality of the bulbs is extremely poor, this has resulted in rejects up to 40 to 50% of the incandescent lamps manufactured.

The local manufacturing ratios of the products are shown in Tables 3.2-6(1) to 3.2-6(5).

Table 3.2-6(1) PRODUCTS AND LOCAL MANUFACTURING RATIO OF EACH FACTORY

Name of Factory and Location	Year of Establishment	Products Manufactured	Local Manufacturing Achieved (%)
No.(1) Heavy Industry Rangoon	1960	- Heavy Vehicles	
		1 6.5 ton Diesel Truck	76.3%
		2 3.5 ton Diesel Truck	26.2%
		3 Passenger Buses	61.55%
		4 Rail Bus	75.0%
		5 Leaf Springs and Coil Spring for Vehicles	100%
		- Electrical Home Appliances	
		1 Electric Iron	87.57%
		2 Electric Hot Plate	86.33%
		3 Electric Rice Cooker	74.11%
		4 Refrigerator	30.78%
		- Incandescent Lamps and Fluorescent Lamps	
		1 Incandescent Lamp	63.0%
		2 Fluorescent Lamps	71.2%
		- Lighting Fixture	96.67%
		- Mercury Lamps	23.3%
		- Fixture for Mercury Lamps	42.0%
		- Radios, Television Receivers Set, Wireless Equipment, Transceivers and Electronic Components	
		1 Radio	59.68%
		2 Colour TV Receiver	CKD
		3 Electric Accessories	96.56%

Source: HIC

Table 3.2-6(2) PRODUCTS AND LOCAL MANUFACTURING RATIO OF EACH FACTORY

Name of Factory and Location	Year of Establishment	Products Manufactured	Local Manufacturing Achieved (%)
		- Electronic Calculator	CKD
		- Dry Cell Batteries	81.85%
		- Bicycles	92%
		- Gear Manufacturing	
		- Light Engineering Products	
		- Cutlery and Razor Blades	
		1 Cutlery	100%
		2 Razor Blade	100%
		- Hospital Equipment	
		- Steel Cabinets	
		- Weighing Machines	
		- 25-50 Ton/day Rice Mill Complete Plants	
		- Candle Moulding Machine	100%
No.(2) Heavy Industry Malun	1966	- Tractors, Trailers	
		- Dry Cell Batteries	
		- 8" Agricultural Pumps	
		- Forging and Casting Parts	
		- Diesel Injection Pumps and Nozzles	
		- Agricultural Use Heavy Diesel Engines	
		- Gear Manufacturing	
No.(3) Heavy Industry Sinde	1965	- Water Pumping Sets	92.3%
		- Diesel Engines	84%
		- Power Tillers	70.8%
		- Portable Diesel Generator	78%
		- Rotary Device	20%

Source: HIC

Table 3.2-6(3) PRODUCTS AND LOCAL MANUFACTURING RATIO OF EACH FACTORY

Name of Factory and Location	Year of Establishment	Products Manufactured	Local Manufacturing Achieved (%)
		- Mamootie	
		- Pesticide Equipment	94.7%
		- Threshers	67.2%
		- Gear Manufacturing	
		- Agricultural Hand Tools (Hoes, Shovel, Pick Axe etc.)	100%
		- Hand Tools (Spanner, Screw Driver, Plier etc.)	100%
		- Watt Hour Meters	85%
		- Lighting Fixtures	96.67%
		- Electric Motors	95%
		- Electric Fans	92.6%
		- Torch Lamps	79.7%
		- Dynamo Lamps	64.9
		- Forging and Casting Parts	
		1 Forging Parts for Agricultural Machinery, Vehicles and Machine Tool	100%
		2 Casting Parts for Motors, Pumps, Diesel Engines and Others	100%
		3 Casting Parts for Agricultural Machinery	100%
		- Welding Electrodes	100%

Source: HIC

Table 3.2-6(4) PRODUCTS AND LOCAL MANUFACTURING RATIO OF EACH FACTORY

Name of Factory and Location	Year of Establishment	Products Manufactured	Local Manufacturing Achieved (%)
No.(4) Heavy Industry Htonbo	1970	- Light Vehicles	
		1 600cc Vehicles	75.9%
		2 2000cc Cross Country Vehicles	80.6%
		3 2000cc (2) Ton Trucks	50%
		- Automotive Gasoline Engines	
		1 600cc Gasoline Engine	90%
		2 2000Ccc Gasoline Engine	80%
		- Automotive Diesel Engines	
		1 140 HP Diesel Engine for Heavy Vehicles	91%
		- Pistons, Piston Rings	
		1 Piston (35ø - 105ø)	100%
		2 Piston Ring (35ø - 105ø)	100%
		- Light Alloy Casting Parts	
		- Storage Batteries	95.7%
No.(5) Heavy Industry Nyaungchidauk	1974	- Lathe Machines	63.6%
		- Milling Machines	72.2%
		- Drilling Machines	71.4%
		- Shapers	64.8%
		- Power Hack Saws	69.6%
		- Dual Spindle Grinders	
		- Abrasive Cutting Machines	
		- Manufacturing Aids	
		- Chemical Plant Equipment such as Vessels and Kettles	

Source: HIC

Table 3.2-6(5) PRODUCTS AND LOCAL MANUFACTURING RATIO OF EACH FACTORY

Name of Factory and Location	Year of Establishment	Products Manufactured	Local Manufacturing Achieved (%)
		- Mini Pulp and Paper Plants	
		- Mini Hydel Turbines	
		- General Engineering Products	
		- Distribution Transformers 50 KVA-300 KVA (11/0.4 KV, 6.6/0.4 KV)	68%
		- PVC Insulated Electric Cables (2mm sq - 10mm sq)	100%
		- Gas Cylinders for Oxygen, Nitrogen, Hydrogen, Acetylene, Chlorine, Propane, Butane	
		- Oil Field Equipment	
		- Sucker Rod Pumping Units	
No.(6) Heavy Industry Thaton	1978	- Tyres, Tubes and Flaps	

Source: HIC

(3) Production Costs of the Products

Tables 3.2-7(1) to 3.2-7(6) show the standard production costs of the products of the Four Industrial Projects for 1982/83 and 1987/88 which have been sanctioned by the Government. The structure of these production costs is illustrated in bar graphs in Figures 3.2-6(1) to 3.2-6(8).

The production costs broadly consist of three categories, the variable costs, fixed costs, and taxes and levies. The elements included in each category are listed below:

1) Variable Costs

a) Costs of imported raw materials (RM) and component parts (CP) (FOB prices plus ocean freight and marine insurance premium)

b) Costs of RM and CP procured from local sources

c) Utilities costs

2) Fixed Costs

a) Labor costs (direct and indirect labor costs)
b) Depreciation
c) Design fees
d) Administrative expenses
e) Sales expenses
f) Overhead (including interest of loans)

3) Taxes and Levies

a) Import duties imposed on the imported RM, CP, etc.
b) License fees for importation
c) Excise tax

The rate of import duties varies from item to item. The average rate of import duties paid by HIC for the raw materials and component parts imported for manufacturing specific products, which was calculated as the percentage of total import duties paid to the total costs (i.e., FOB prices

Table 3.2-7(1) PRODUCTION COST OF HIC PRODUCTS
(1982/83 AND 1987/88)

(Unit: Kyat/unit)

	Description	Dry Cell Battery (UM-1)		Fluorescent Lamp (40W, 4-ft.)		Incandescent Lamp (60W)		Watt-Hour Meter (TE-1)		Lighting Fixture (HIC-LF-F-41)	
		1982	1987	1982	1987	1982	1987	1982	1987	1982	1987
1.	Imported CP and RM Cost	1.01	1.36	8.71	5.76	2.327	1.85	168.64	288.98	85.62	119.90
1-1	F.O.B Price	0.94	1.24	8.07	5.33	2.155	1.72	156.15	267.58	79.28	111.01
1-2	Freight and Insurance	0.07	0.12	0.64	0.43	0.172	0.13	12.49	21.40	6.34	8.89
2.	Local CP and RM Cost	-	0.08	-	14.85	-	2.49	0.40	7.65	10.47	28.33
3.	Depreciation	0.015	0.02	0.696	0.696	0.067	0.067	25.78	28.18	4.02	4.02
4.	Utility Cost	0.018	0.02	0.108	0.108	0.027	0.027	19.17	19.17	0.76	0.76
5.	Import Duty and Import License Fee	0.330	0.47	5.53	2.04	1.54	0.74	56.18	109.91	40.17	35.33
6.	Unloading Cost	0.012	0.02	0.12	0.07	0.02	0.02	2.19	3.76	1.11	1.56
7.	Labor Cost	0.023	0.06	0.143	0.15	0.043	0.15	19.20	19.20	6.14	6.14
8.	Design Fees, etc.	-	-	-	-	-	-	2.50	2.50	3.80	3.80
9.	Overhead	0.013	0.01	0.157	0.157	0.028	0.028	8.79	11.18	2.05	3.35
10.	Adm. Cost and Sales Expenses	0.009	0.03	0.104	0.129	0.011	0.126	2.42	2.42	1.52	1.67
	Production Cost	1.43	2.07	15.57	23.96	4.07	5.50	305.27	492.95	155.66	204.86
11.	Mark-up/Profit	-	0.01		0.10	0.140	0.02	10.00	10.00	10.35	10.28
12.	Excise Tax	0.71	1.04	4.62	7.22	1.18	1.66	94.58	150.89	49.79	64.56
	Total	2.14	3.12	20.19	31.28	5.39	7.18	409.85	653.84	215.80	279.70
13.	Sales Price	2.15		20.05		5.10		409.85		215.80	

Notes: 1982: 1982/83 fiscal year
1987: 1987/88 fiscal year

Source: HIC

Table 3.2-7(2) PRODUCTION COST OF HIC PRODUCTS
(1982/83 AND 1987/88)

(Unit: Kyat/unit)

	Description	Electric Motor (EC-FB-4P(0.75KW))		Transformer (300KVA 6.6/0.4KV)		Elec. Accessories (9000)		Electric Fan (130Y0)		B-600 Pick-Up (BEA-33L)	
		1982	1987	1982	1987	1982	1987	1982	1987	1982	1987
1.	Imported CP and RM Cost	298.16	358.52	60533.18	72192.28	0.84	1.65	253.99	367.32	18669.40	25643.33
1-1	F.O.B Price	276.08	331.97	56049.24	66844.70	0.78	1.53	235.18	340.11	16972.18	23485.48
1-2	Freight and Insurance	22.08	26.55	4483.94	5347.58	0.06	0.12	18.81	27.21	1697.22	2157.85
2.	Local CP and RM Cost	251.99	255.87	-	-	0.05	0.05	-	249.93	290.80	2213.00
3.	Depreciation	32.83	36.79	16718.25	17650.95	0.343	0.343	37.27	37.27	4568.45	9440.20
4.	Utility Cost	7.47	7.47	750.00	750.00	0.017	0.017	23.16	23.16	1937.34	1937.34
5.	Import Duty and Import License Fee	112.73	129.07	29833.47	31565.51	0.49	0.87	103.98	183.30	8382.13	6351.78
6.	Unloading Cost	3.88	4.66	786.94	938.50	0.04	0.02	12.70	4.77	242.70	333.36
7.	Labor Cost	14.40	14.40	2913.60	2913.60	0.107	0.107	31.80	63.65	1207.98	1989.95
8.	Design Fees, etc.	7.00	7.00	-	-	0.03	0.03	-	-	429.79	429.79
9.	Overhead	36.80	36.80	19043.57	19043.57	0.381	0.381	170.79	103.75	1024.70	489.13
10.	Adm. Cost and Sales Expenses	10.86	10.86	1068.32	1068.32	0.05	0.05	25.06	30.07	522.23	574.45
	Production Cost	776.12	861.44	131647.33	146122.73	2.35	3.52	658.75	1063.22	37275.52	49402.33
11.	Mark-up/Profit	77.27	77.27	13106.46	13106.46	0.23	0.23	73.25	49.13	1841.48	988.05
12.	Excise Tax	170.66	187.74	43426.16	47768.76	0.77	1.15	439.20	667.40	11735.08	15117.12
	Total	1024.05	1126.45	188179.95	206997.95	3.35	4.90	1171.20	1779.75	50852.00	65507.50
13.	Sales Price	1024.05		188179.95		3.35		1171.20		50852.00	

Notes: 1982: 1982/83 fiscal year
1987: 1987/88 fiscal year

Source: HIC

Table 3.2-7(3) PRODUCTION COST OF HIC PRODUCTS
(1982/83 AND 1987/88)

(Unit: Kyat/unit)

	Description	B-600 Light Van (BEA-VDL)		T-2000 2 ton Light Truck (WT-22)		T-2000 1/4 ton Cross Country (XVA-44L)		X-2000 1/2 ton Cross Country (XV-1)		X-2000 1/2 ton Station Wagon (XV-1(SW))	
		1982	1987	1982	1987	1982	1987	1982	1987	1982	1987
1.	Imported CP and RM Cost	19610.57	25643.33	35398.41	57309.66	41477.53	55500.54	53137.53	64356.52	58451.05	71127.60
1-1	F.O.B Price	17827.79	23485.48	32180.37	47238.44	37706.85	49906.08	48306.85	57869.36	53137.32	63957.92
1-2	Freight and Insurance	1782.78	2157.85	3218.04	10071.22	3770.68	5594.46	4830.68	6487.16	5313.73	7169.68
2.	Local CP and RM Cost	520.40	2592.95	230.50	1876.05	365.50	7244.97	365.50	8001.17	365.50	8465.02
3.	Depreciation	4945.31	5021.47	9760.47	21320.64	9017.77	22680.85	9017.77	25946.55	9017.77	31649.68
4.	Utility Cost	1939.28	1939.28	1939.28	1939.28	1943.16	1943.16	1943.16	1943.16	1943.16	1943.16
5.	Import Duty and Import License Fee	8478.23	6351.78	18312.81	27669.28	19215.97	18146.24	21547.97	22245.86	23702.71	25458.01
6.	Unloading Cost	254.94	333.36	460.18	745.02	539.21	721.50	690.79	836.63	759.86	924.66
7.	Labor Cost	1884.98	1884.98	2432.19	3000.00	2138.97	3557.25	2138.97	4039.75	2138.97	6039.75
8.	Design Fees, etc.	430.22	430.22	490.00	490.00	540.00	540.00	540.00	540.00	540.00	540.00
9.	Overhead	2177.54	453.43	5071.50	1149.80	3818.18	1113.40	4553.56	1289.15	5870.49	1471.54
10.	Adm. Cost and Sales Expenses	1146.01	1146.01	573.00	630.30	914.65	1006.12	914.65	1006.12	914.65	1006.12
	Production Cost	41387.48	45796.81	74668.34	116130.03	79970.94	112454.03	94849.90	130204.91	103704.16	148625.54
11.	Mark-up/Profit	1072.52	915.94	4053.13	2322.60	3625.31	2249.08	4742.48	2604.00	5185.18	2972.51
12.	Excise Tax	25476.00	28027.65	23616.53	35535.77	25078.75	34410.94	29877.62	39842.70	32666.66	45479.40
	Total	67936.00	74740.40	102338.00	153988.40	108675.00	149114.05	129470.00	172651.61	141556.00	197077.45
13.	Sales Price	67936.00		102338.00		108675.00		129470.00		141556.00	

Notes: 1982: 1982/83 fiscal year
1987: 1987/88 fiscal year

Source: HIC

Table 3.2-7(4) PRODUCTION COST OF HIC PRODUCTS
(1982/83 AND 1987/88)

(Unit: Kyat/unit)

	Description	6.5 ton Diesel Truck (TE-21AZ)		6 ton Logging Truck (TE-21TLB)		Dump Truck (TE-21)		Oil Tanker (TE-21)		Water Bouser (TE)	
		1982	1987	1982	1987	1982	1987	1982	1987	1982	1987
1.	Imported CP and RM Cost	87145.73	101933.74	83588.90	93687.90	115640.77	134177.85	133676.75	157621.28	85933.55	107066.06
1-1	F.O.B Price	79223.39	92667.04	75989.90	85170.82	105127.97	121979.87	121524.32	143292.07	78121.40	97332.78
1-2	Freight and Insurance	7922.34	9266.70	7599.00	8517.08	10512.80	12197.98	12152.43	14329.21	7812.15	9733.28
2.	Local CP and RM Cost	1543.16	20023.09	300.00	17859.50	-	17206.09	-	17111.97	-	17111.97
3.	Depreciation	9788.71	19498.45	8304.70	19143.50	8375.20	20311.33	9192.02	21215.15	9972.88	19930.50
4.	Utility Cost	360.00	360.00	320.00	320.00	250.00	250.00	280.00	280.00	440.00	440.00
5.	Import Duty and Import License Fee	42387.96	39410.75	41155.92	37755.39	57138.79	55223.15	67732.25	70165.35	41434.16	40441.05
6.	Unloading Cost	1132.88	1325.15	1086.66	1217.96	1503.29	1744.31	1737.79	2049.07	1117.14	1391.87
7.	Labor Cost	1670.00	1931.10	1580.00	1895.95	1900.00	1966.20	2000.00	2106.65	2000.00	2106.65
8.	Design Fees, etc.	375.00	375.00	300.00	300.00	250.00	250.00	300.00	300.00	450.00	450.00
9.	Overhead	2408.23	1859.13	1026.31	1732.15	3714.86	2318.82	2342.09	2716.03	7116.77	1900.15
10.	Adm. Cost and Sales Expenses	960.00	1056.00	940.00	1034.00	685.00	753.50	685.00	735.50	980.00	1078.00
	Production Cost	147771.67	187772.41	138602.49	174946.35	189457.91	234201.25	217945.90	274301.00	149444.50	191916.25
11.	Mark-up/Profit	6807.56	3755.44	3374.43	3498.90	5535.14	4684.00	6031.00	5486.40	6784.82	3838.35
12.	Excise Tax	46373.77	57458.35	42593.08	53533.60	58497.95	71665.58	67193.10	83941.60	46868.68	58726.40
	Total	200953.00	248986.20	184570.00	231978.85	253491.00	310550.83	291170.00	363729.00	203098.00	254481.00
13.	Sales Price	200953.00		184570.00		253491.00		291170.00		203098.00	

Notes: 1982: 1982/83 fiscal year
1987: 1987/88 fiscal year

Source: HIC

Table 3.2-7(5) PRODUCTION COST OF HIC PRODUCTS
(1982/83 AND 1987/88)

(Unit: Kyat/unit)

	Description	Fire Fighting Engine (TE-21)		25 Passenger Bus (BM-40)		33 Passenger Bus (BX-402)	Water Pump (SC4C)		Water Pump (KND-5B)	
		1982	1987	1982	1987	1987	1982	1987	1982	1987
1.	Imported CP and RM Cost	343292.79	509012.32	115935.97	162454.25	341982.82	1601.85	1840.15	2218.66	2522.77
1-1	F.O.B Price	312084.35	462738.48	105396.33	147685.68	284985.68	1483.20	1703.84	2054.31	2335.89
1-2	Freight and Insurance	31208.44	46273.84	10539.64	14768.57	56997.14	118.65	136.31	164.35	186.85
2.	Local CP and RM Cost	-	17111.97	850.00	9511.64	20112.14	300.00	181.50	392.12	444.11
3.	Depreciation	21612.33	31988.85	9755.00	20129.00	35774.37	237.88	266.32	260.62	223.44
4.	Utility Cost	440.00	440.00	450.00	450.00	450.00	27.90	27.90	32.85	32.85
5.	Import Duty and Import License Fee	-	-	67869.16	66539.24	177875.00	250.45	392.42	492.55	562.94
6.	Unloading Cost	4462.81	6617.10	2000.00	2111.91	4445.77	17.53	23.92	28.84	32.79
7.	Labor Cost	2000.00	2106.60	2000.00	1755.55	1755.55	34.44	34.44	62.40	62.40
8.	Design Fees, etc.	450.00	450.00	400.00	400.00	400.00	-	-	-	-
9.	Overhead	3731.98	5688.06	4536.03	2644.31	17552.82	77.15	77.15	78.65	78.65
10.	Adm. Cost and Sales Expenses	980.00	1078.00	940.00	1081.00	1081.00	11.24	11.24	16.86	16.86
	Production Cost	376969.91	574492.90	204736.16	267076.90	601429.47	2558.44	2855.04	3583.55	3976.81
11.	Mark-up/Profit	6845.09	11489.85	4100.00	5341.55	21050.03	71.80	71.80	100.65	100.65
12.	Excise Tax	-	-	62650.84	81725.55	186743.85	526.06	585.36	1105.25	1223.24
	Total	383815.00	585982.75	271487.00	354144.00	809223.35	3156.30	3512.20	4789.45	5300.70
13.	Sales Price	383815.00		271487.00						

Notes: 1982: 1982/83 fiscal year
1987: 1987/88 fiscal year

Source: HIC

Table 3.2-7(6) PRODUCTION COST OF HIC PRODUCTS
(1982/83 AND 1987/88)

(Unit: Kyat/unit)

	Description	Power Tiller (KMB-200)		Thresher (PT-862)		Portable Generator (RSK-120)		X-2000 Engine		X-2000 Transmission	
		1982	1987	1982	1987	1982	1987	1982	1987	1982	1987
1.	Imported CP and RM Cost	7958.30	8509.89	674.73	2344.37	5768.47	6059.75	7085.03	12296.02	-	5954.25
1-1	F.O.B Price	7368.81	7879.52	624.74	2170.71	5341.17	5610.88	6440.94	11178.20	-	5412.96
1-2	Freight and Insurance	589.49	630.37	49.99	173.66	427.30	448.87	644.09	1117.82	-	541.29
2.	Local CP and RM Cost	-	457.00	2.88	2.88	-	1009.72	-	1688.18	-	210.00
3.	Depreciation	119.08	119.08	181.03	368.58	278.50	278.50	-	11507.10	-	5753.55
4.	Utility Cost	59.87	59.87	26.04	26.04	72.12	72.12	-	971.58	-	485.80
5.	Import Duty and Import License Fee	1674.45	1703.00	43.73	232.79	1317.01	868.81	3949.89	4674.28	-	1746.00
6.	Unloading Cost	103.38	110.57	13.73	30.47	74.99	78.78	425.10	159.84	-	77.40
7.	Labor Cost	67.09	67.09	42.24	42.24	86.78	86.78	407.55	1778.65	-	889.30
8.	Design Fees, etc.	-	-	-	-	-	-	-	270.00	-	135.00
9.	Overhead	-	-	50.44	153.58	280.06	280.06	5706.23	1692.50	-	775.45
10.	Adm. Cost and Sales Expenses	58.50	58.50	24.13	24.13	80.80	80.80	271.70	500.30	-	250.15
	Production Cost	10040.67	11085.00	1058.95	3225.08	7958.73	8815.32	17845.50	35538.45	-	16276.90
11.	Mark-up/Profit	-	-	52.95	161.25	568.81	568.81	-	1776.92	-	813.85
12.	Excise Tax	2008.13	2217.00	222.38	677.27	2558.26	2815.22	2125.50	11194.63	-	5127.25
	Total	12048.80	13302.00	1334.28	4063.60	11085.80	12199.35	19971.00	48510.00	-	22218.00
13.	Sales Price										

Notes: 1982: 1982/83 fiscal year
1987: 1987/88 fiscal year

Source: HIC

Figure 3.2-6(1) COST ANALYSIS OF ELECTRIC PRODUCTS IN 1987

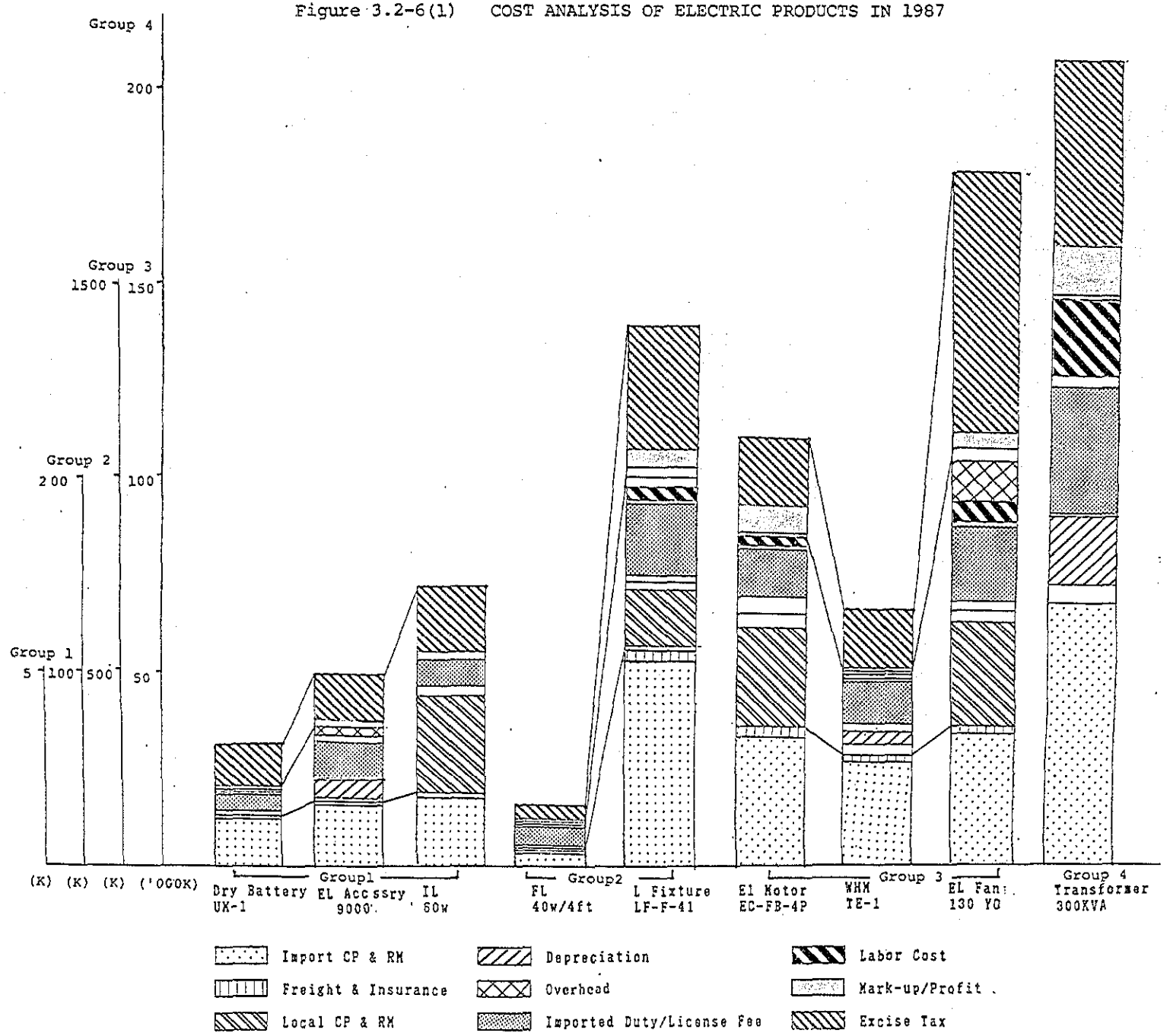


Figure 3.2-6(2) COST ANALYSIS OF AGRICULTURAL MACHINERY AND EQUIPMENTS IN 1987

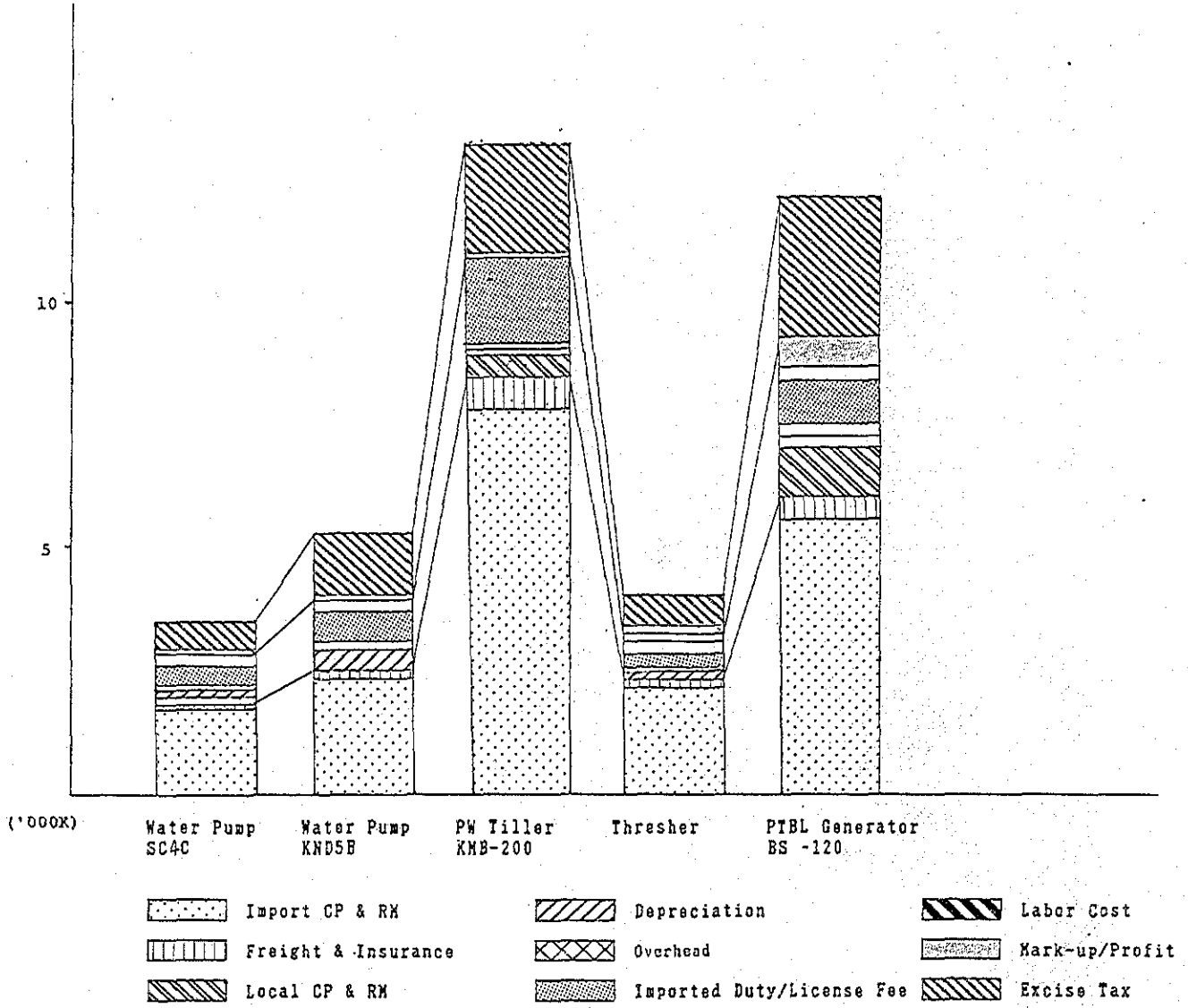


Figure 3.2-6(3) COST ANALYSIS OF LIGHT VEHICLE IN 1987

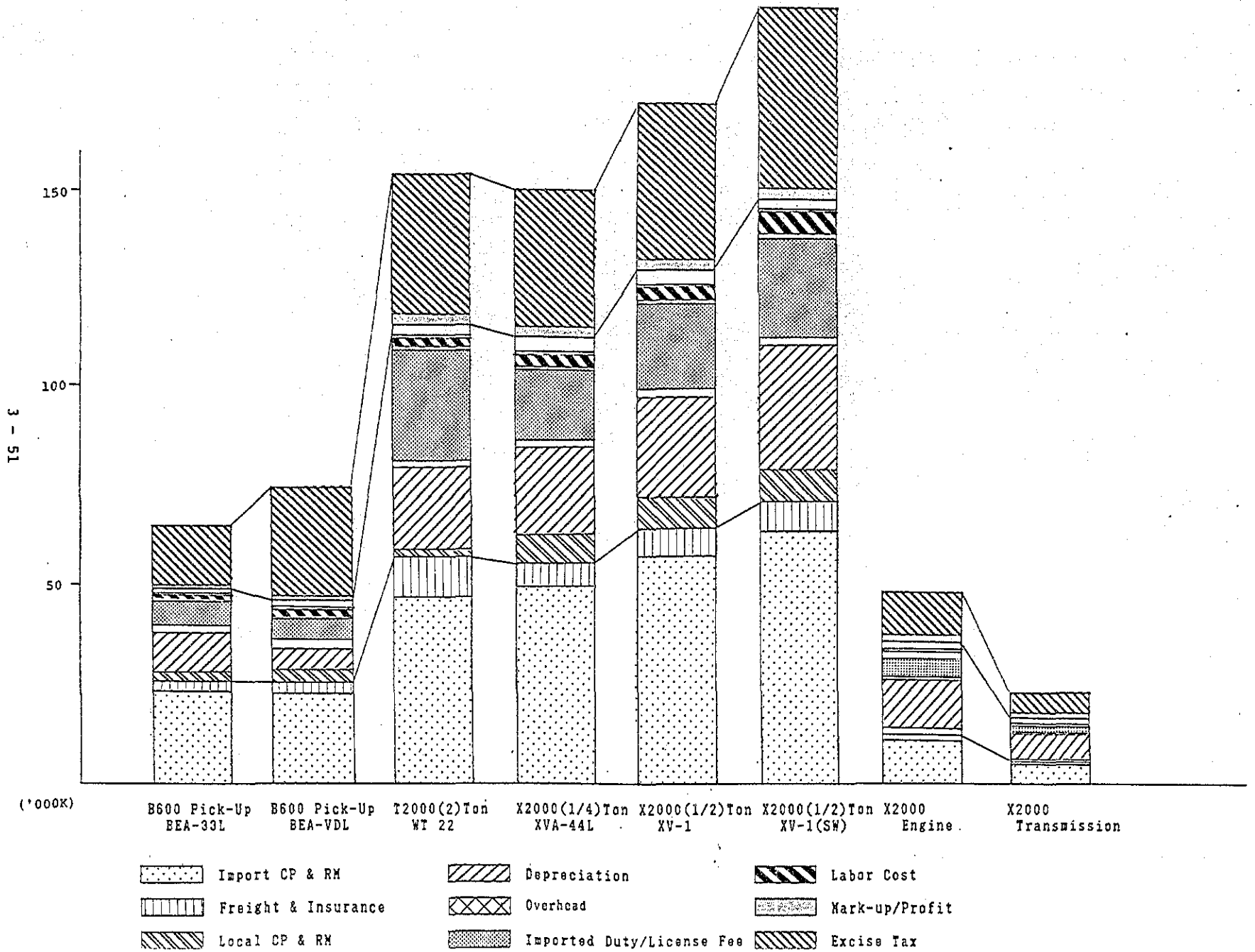


Figure 3.2-6(4) COST ANALYSIS OF HEAVY VEHICLE IN 1987

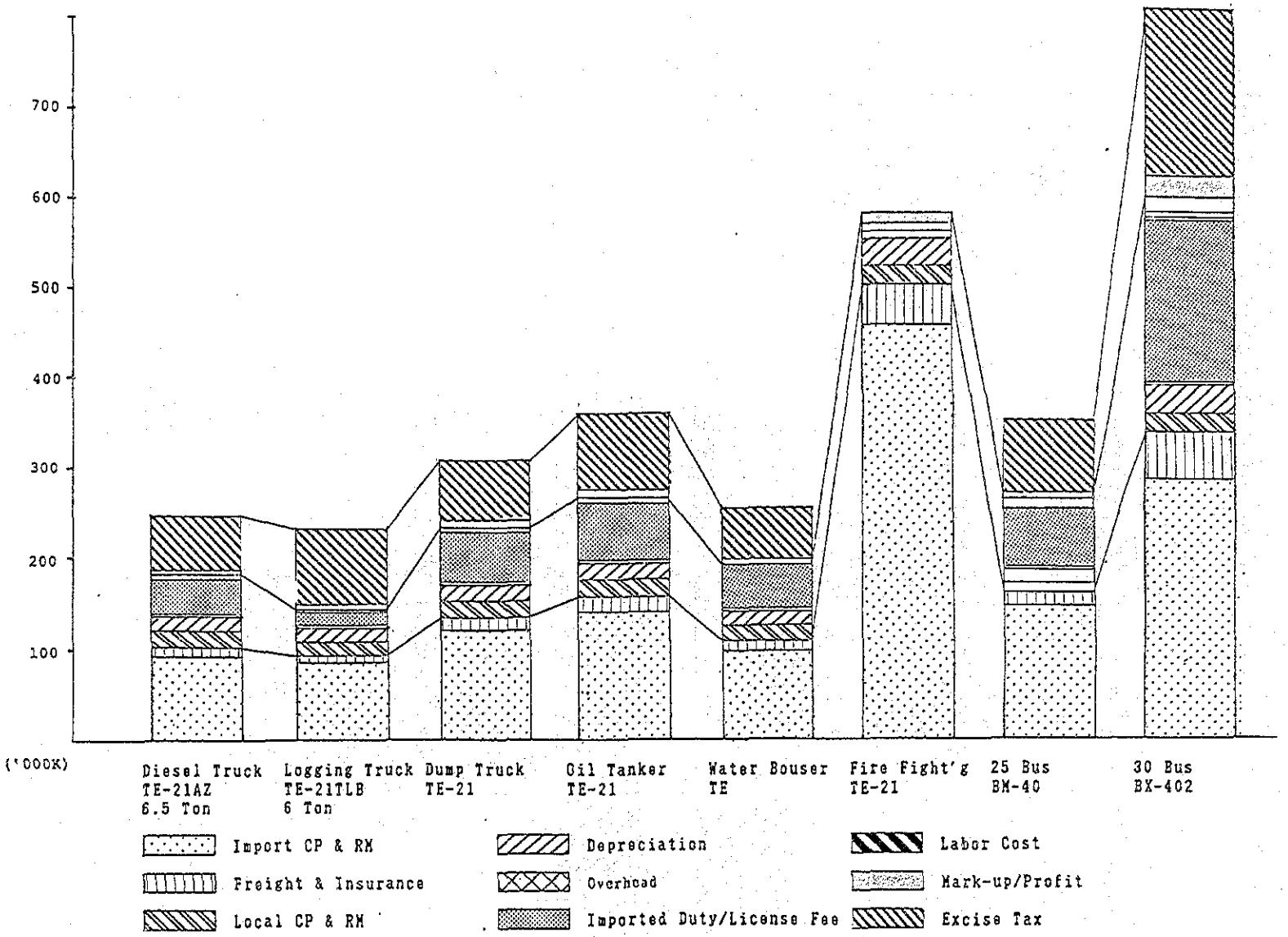


Figure 3.2-6(5) COST ANALYSIS OF ELECTRIC PRODUCTS IN 1982

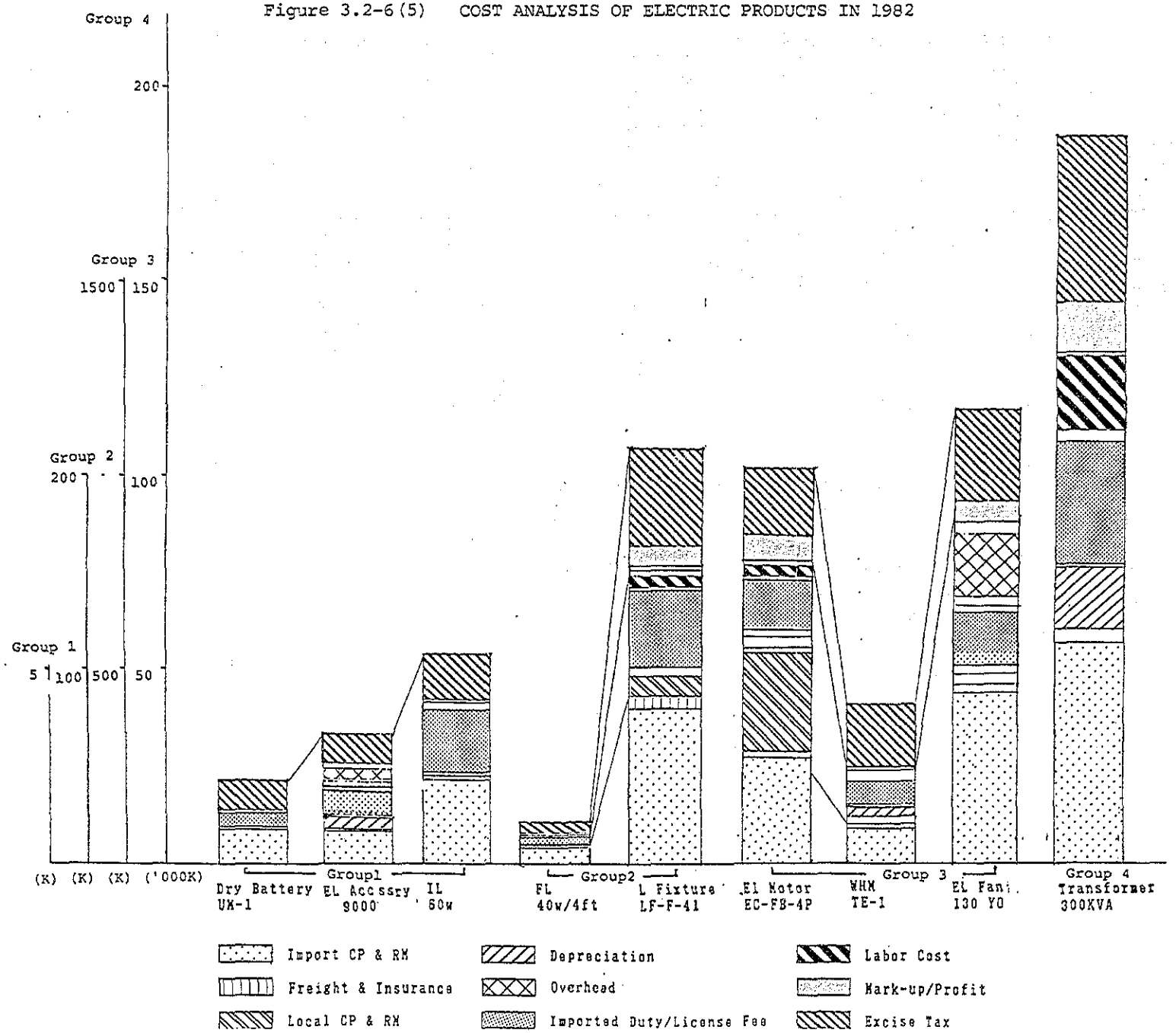


Figure 3.2-6(6) COST ANALYSIS OF AGRICULTURAL MACHINERY AND EQUIPMENTS IN 1982

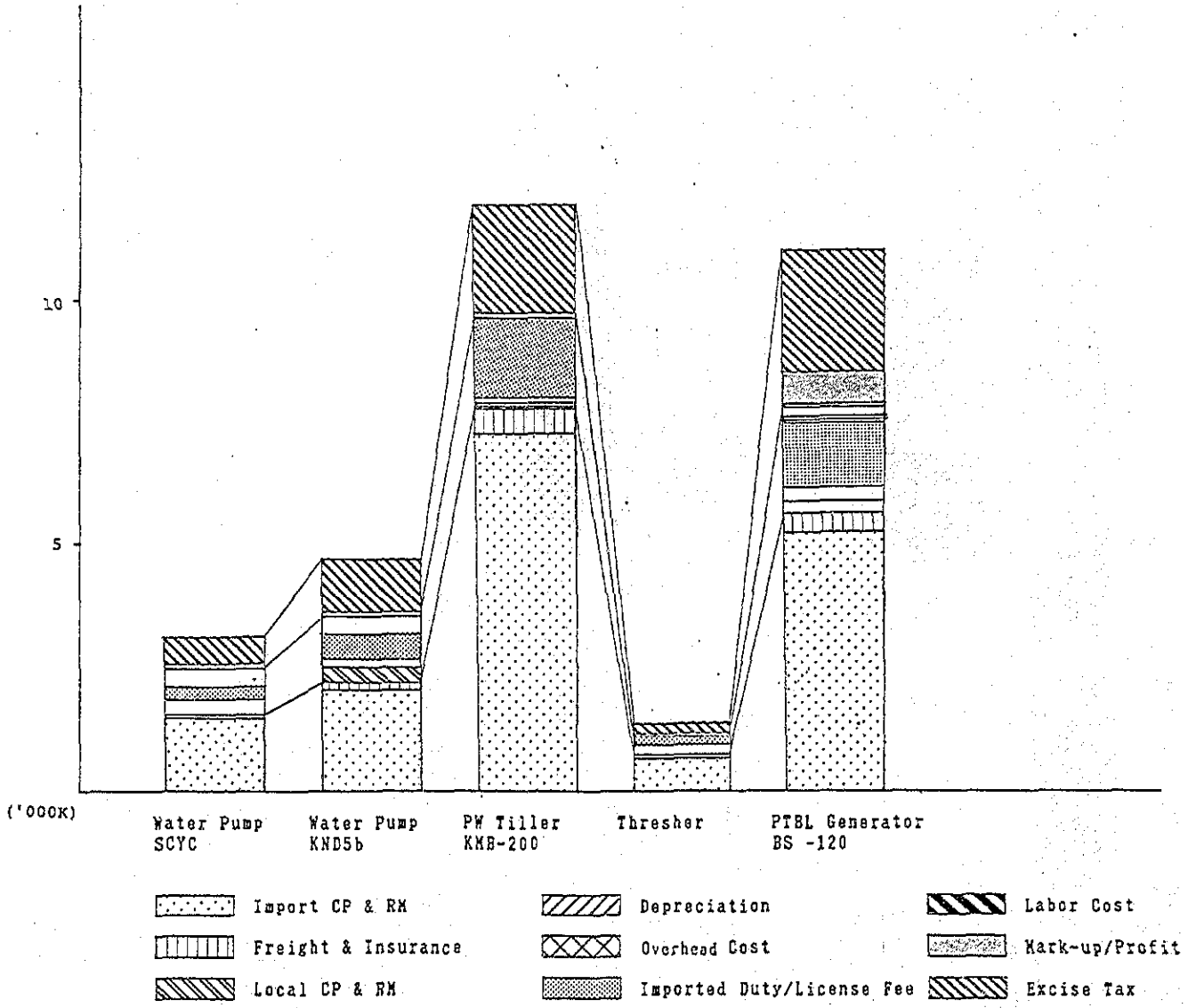


Figure 3.2-6(7) COST ANALYSIS OF LIGHT VEHICLE IN 1982

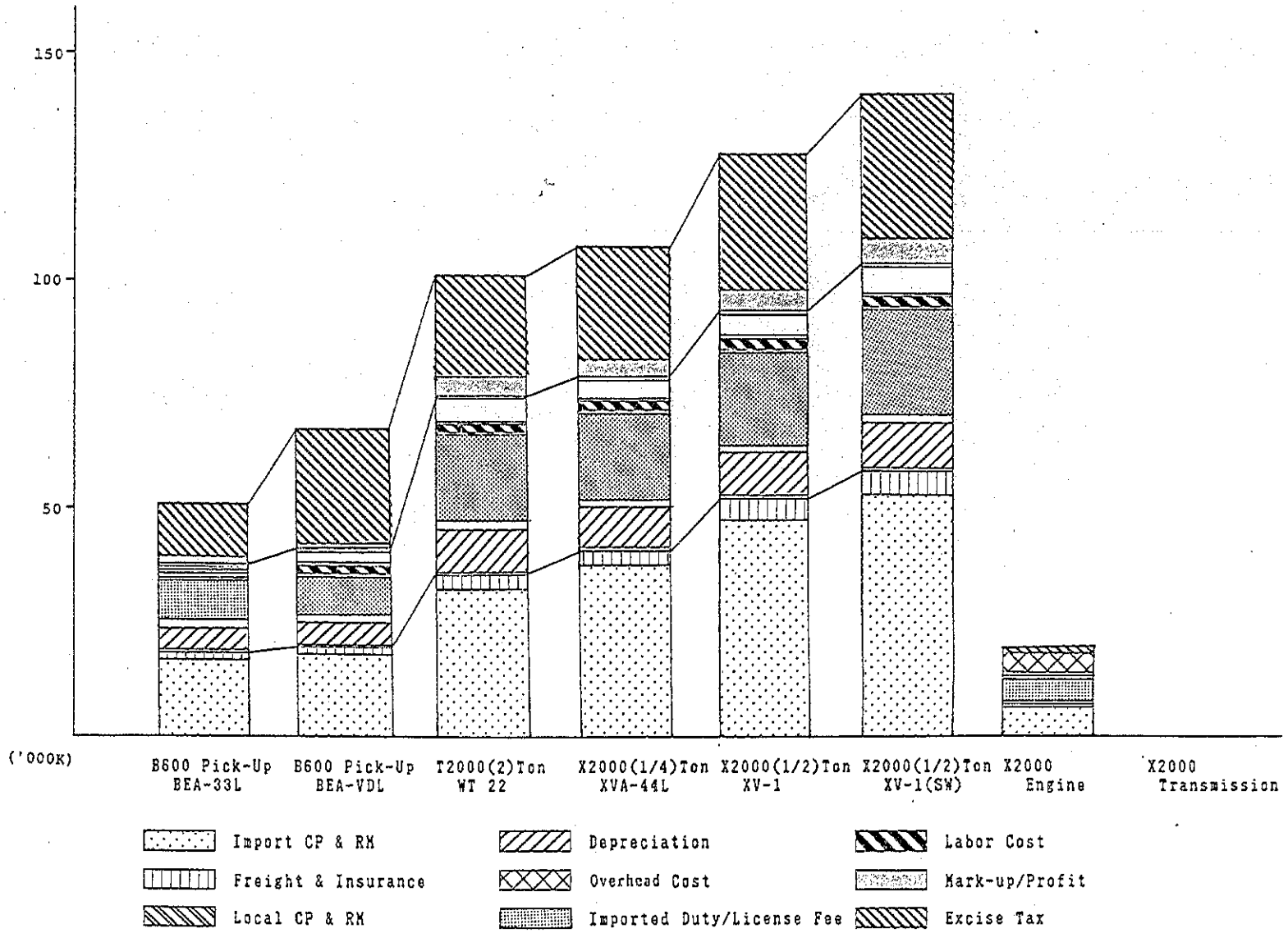
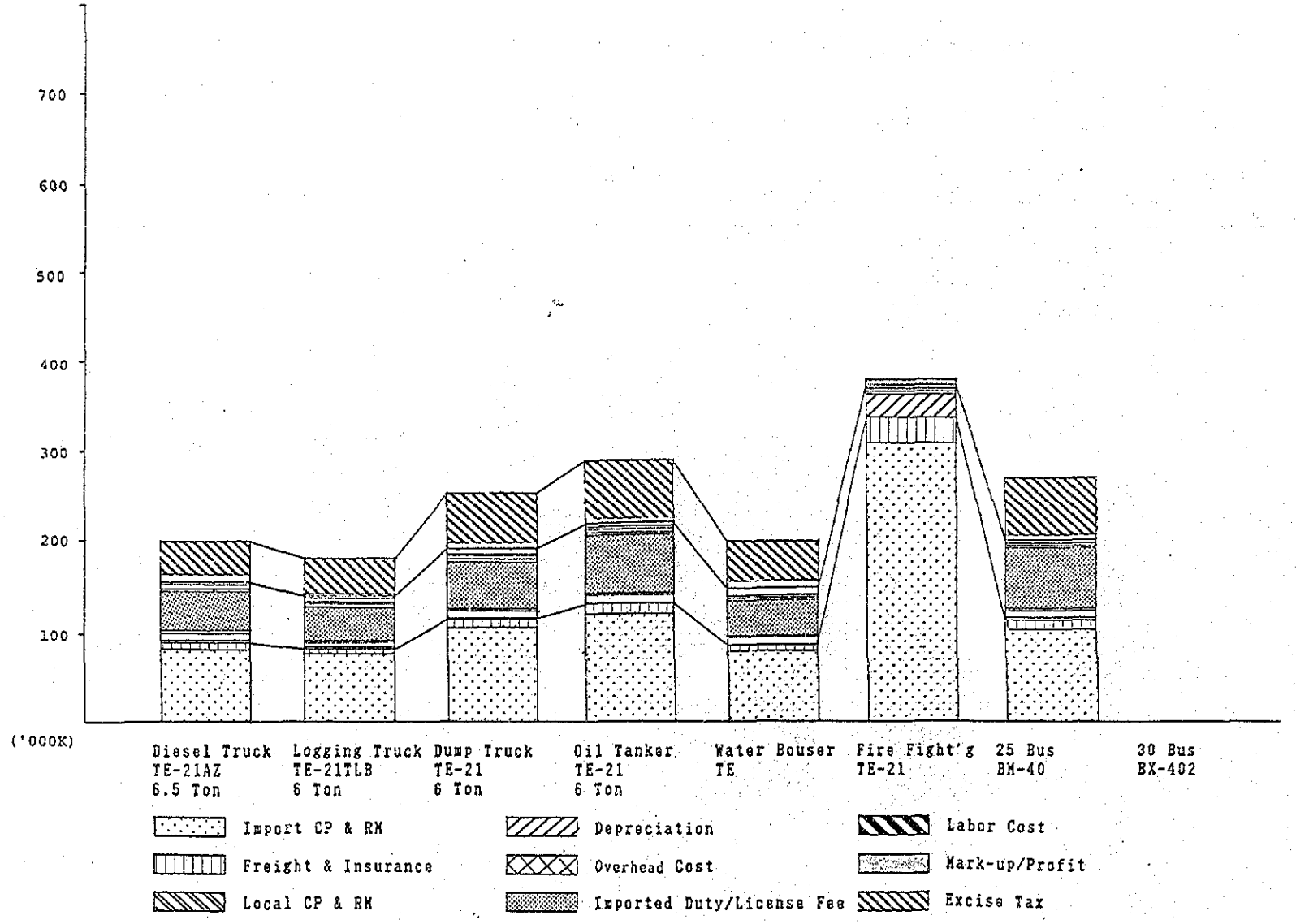


Figure 3.2-6(8) COST ANALYSIS OF HEAVY VEHICLE IN 1982



plus ocean freight and marine insurance premium) of RM and CP imported for manufacturing the respective product, ranged from 10 to 50% with a mean of 15%.

The excise tax is imposed on the standard production costs marked up with authorized profit margin varying from 0.4 to 10% of the production costs with an average of 3%. Although the applicable tax rate varies from product to product, the tax paid by HIC ranged from 10.3 to 37.5%, with a mean of 23%.

The value of fixed assets is depreciated by straight line depreciation of the following lives which is applied to 90% of the book value which remains after deducting 10% of the book value as scrap value.

1.	Machinery and equipment	15 (years)
2.	Jigs and dies	8
3.	Molds	5
4.	Steel construction	30
5.	Water treatment plant	25
6.	Power generating plant	12
7.	Welding machines and grinding machines	10
8.	Lathe machines	15
9.	Buildings	25

In view of the structure of the production costs, the costs of imported raw materials and component parts, taxes and levies, and depreciation account for the overwhelming majority of the costs for all the products. Given below are the percentages of these cost elements against the production costs marked up with profit margin, which is calculated as an average of 28 products, excluding fire engine out of 29 products shown in Tables 3.2-7(1) to 3.2-7(6):

	Cost Elements	Percentages to Total Costs (%)
1.	Costs of imported RM and CP	39.2
2.	Depreciation	8.1
3.	Taxes and levies (Import duties and excise tax)	36.4
4.	Other costs	16.3
	Total production costs (including Profit Margin)	100.0

The costs of imported raw materials and component parts and the taxes and levies account for about 75% of the total costs. When the depreciation is added, these three elements account for 83% of the total costs. The average cost percentages seem to indicate that the percentage of depreciation is comparatively small. However, the percentage of depreciation accounts for 10 to 15% of the costs of such products as vehicles manufactured through several steps of processing including machining and pressing, whereas it is only 1 to 2% in the case of dry cell batteries, incandescent lamps and fluorescent lamps which are manufactured in a comparatively large quantity. The high percentage of depreciation in the costs for vehicles is due to the heavy burden of the depreciation assumed by one unit of the products manufactured on a small scale.

As the Four Industrial Projects manufacture old models of vehicles, most of the component parts supplied from abroad are specially ordered items. Hence it is obvious that the prices of imported component parts would rise, and, as a consequence, the payments of import duties and excise tax would also increase. This situation implies that the production costs of those products will increase year after year. One of the counter-measures is to expand the local production of component parts so that the imports can be reduced. Depending on the type of parts, however, the local production may result in much higher costs because of the heavy burden of depreciation caused by a small scale production. Priority of the local production must be given to such parts which lends itself to volume production covering also the supply to the outside markets as spare parts. On the other hand, it is also important to improve the production efficiency so that the consumption of imported raw materials can be conserved to the maximum possible extent.

3-2-5 Fundamental Issues and Current Circumstances of the Four Industrial Projects

Summing up the activities and production of the Four Industrial Projects and the financial status of HIC reviewed in the previous sections and also in view of the current circumstances, the fundamental issues of the Projects are summarized below. Attention will be paid to these issues when the renovation plans are investigated.

1) Consideration of the Factors Affecting the Production of HIC

The annual production plan of HIC is submitted to the Ministry of Planning and Finance through the Ministry of Industry (2) directly controlling HIC. All the plans submitted by the state corporations, after the preparatory work of the Ministry of Planning and Finance, are submitted to the Economic Coordination Committee for their examination, and then finally sanctioned by the Cabinet with the approval of the People's Congress. The production plan prepared by HIC is revised in the course of the examination, in the light of the annual economic plan of the nation and the Government plan for the arrangement of the required foreign exchange. In recent years, the Government made downward revisions of the plans prepared by the corporations in order to curtail the imports of raw materials and component parts so as to cope with the stringent foreign exchange situation. HIC is allowed to undertake the production in accordance with the production plan thus sanctioned by the Government and within the amount of foreign exchange allocated for the imports of raw materials and component parts.

Under the above mentioned system, HIC is not allowed to perform any production in excess of the plan sanctioned by the Government, even if the production facilities have the capacities to produce more and also HIC has confidence to sell the products as produced. If the currently prevailing stringency of foreign exchange should continue and if, as a consequence, the Government should continue to enforce restriction on imports in the future, an immediate expansion of the production facilities would jeopardize the operation of HIC due to the heavy financial burden of investments which has to be assumed by lower capacity utilization of the expanded facilities.

The primary step should be concentrated on the rehabilitation of the existing facilities and the enhancement of institutional activities for the production control and facilities maintenance so as to improve the production efficiency while maintaining the capacity of the existing facilities, unless there is assurance that the imports of an adequate quantity of raw materials and component parts will be per-

mitted so as to maintain the high capacity utilization of the production facilities.

At the same time, priority must be given to the local production of the component parts which can be manufactured by utilizing the existing facilities to a large extent in order to contribute to the savings of foreign exchange, while priority be given also to the production of any products which can contribute directly or indirectly to the promotion of exports.

In the long term the expansion of the production facilities will be required along with increasing demands in the domestic markets. Even in such cases, it would be necessary to adopt two or three shifts operation so that the expansion of the facilities can be minimized.

2) Consideration of the Shortage of Fuel Supply

HIC used heavy oil as fuel for the factories. As stated in Section 1-2-2(4) of Chapter 1, the operation was hampered by the supply shortage of heavy oil. In order to supplement the shortage of heavy oil, HIC adopted to use LPG and methanol for some facilities. It is likely that the supply of methanol will be stopped in the near future because the present supply is provisional until the quantity of other uses already committed increases. On the other hand, the use of LPG causes a rise of production costs because of the high-priced LPG. Although natural gas is the most economical fuel, the installation of gas distribution pipelines is required for the use of the gas (see Section 1-2-2(4) of Chapter 1). It is recommended for HIC to make a comprehensive study on the economical and stable sources of fuel to be used.

3) Consideration of Inefficiencies Affected by the Characteristics of Production and Site Conditions

Summarized below are the characteristics of the Four Industrial Projects:

a) The production of a wide variety of products each on a fairly small scale.

b) Manufacturing of some products completed with the involvement of several factories scattered in several areas and, as a consequence, the movement of materials among the factories in the flow of manufacturing processes.

c) Self-sustaining type of operation under an undeveloped state of the peripheral industries specializing in supplemental or supporting functions.

The above characteristics and site conditions hinder an efficient operation. Nevertheless, if a theoretic approach is excessively applied in drawing the rationalization plan, it may draw an unrealistic plan which requires huge amounts of investments and drastic transfer of employees. It may be necessary to draw an economical plan which is realistically applicable for resolving the above problems.

3-3 Present Conditions and Underlying Problems of Machinery and Equipment and Direction of Improvement

3-3-1 Worn-out Conditions of Machinery, Equipment and Facilities, and Shortage of Spare Parts - Need of Establishing Appropriate Maintenance Systems

(1) Wear and Deterioration of Machinery, Equipment and Facilities

Since most of the production facilities related to the Four Industrial Projects have been constructed more than 20 years ago, the machinery and equipment have been worn out. There are a number of worn-out machines either running in deteriorated conditions or out of operation, including those left unrepaired due to lack of spare parts. These conditions cause inefficiency of operation and inferior quality of products manufactured. It is likely that the deterioration of machines will be expanded to such an extent that it would seriously hinder the production in the near future if no measures are taken to prevent it.

Among the machines in service, there are a number of machines the operation of which has been often interrupted by mechanical troubles. They may be inoperable in the near future. Under these conditions, the present capacity of the facilities may be 20 to 30% lower than the initially installed capacity. The capacity may be further reduced with the deterioration of machines in the future.

It is obvious that the wear and deterioration of machines are more extensive in older facilities. Nevertheless, even in the HV Diesel Engine Shop of No.4 HI which was constructed in 1970, later than other shops, the operation was stopped for 8% of the monthly working hours in average every month due to mechanical troubles.

As an example of the present conditions of the machines, the percentages of machines in mechanical troubles or out of operation of the total machines installed at the AME Component Manufacturing Shop of No.3 HI is summarized below (for details, see Chapter 4 of ANNEX 1).

These conditions cause inefficiency of operation and inferior quality of products manufactured. It is likely that the deterioration of machines will be expanded to such an extent that it would seriously hinder the production in the near future if no measures are taken to prevent it.

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It is obvious that the wear and deterioration of machines are more extensive in older facilities. Nevertheless, even in the HV Diesel Engine Shop of No.4 HI which was constructed in 1970, later than other shops, the operation was stopped for 8% of the monthly working hours in average every month due to mechanical troubles.

As an example of the present conditions of the machines, the percentages of machines in mechanical troubles or out of operation of the total machines installed at the AME Component Manufacturing Shop of No.3 HI in 1965 is summarized below (for details, see Chapter 4 of ANNEX 1).

Shops	(A) Total number of machines	(B) Number of machines in trouble or out of operation	Percentage affected (B/A x 100%)
AME No.1	143	16	11.1
AME No.2	190	45	23.7
AME No.3	143	12	8.4
AME No.4	92	16	17.4
Press/welding	43	11	25.6
Other shops	426	65	15.3
Total-AME Shops	1,037	165	15.9

For the 165 units of machines that were in trouble or out of operation as given above, the percentages by causes are as follows:

- Requiring replacement:	6.2%
- Unavailability of spare parts due to old models:	1.4%
- Waiting for arrival of spare parts already ordered:	27.9%
- Requiring repairs, although being in services:	60.5%
- Waiting for spare parts being manufactured within the factory:	4.0%
Total machines in trouble or out of operation: (165 units)	100.0%

Other shops also are situated in similar conditions.

In general, the performance, or the efficiency and precision of machines deteriorate with the age and wear of machines used for a long period of time. It is important to take appropriate measures for the maintenance of machines including preventive maintenance in order to eliminate the factors that cause the deterioration and also to prolong the life of machines.

HIC has performed preventive maintenance inadequately. It is one of the major causes which have led to the wear and deterioration of machines.

Some machines transferred from other factories and damaged during the transportation accelerated the wear and deterioration. There are some machines left in packages in open yards for a long period of time, during which they were damaged. In recent years, many of the machines have been operated without timely replacement of parts and timely lubrication due to the shortage of spare parts and lubricants. These factors have also caused the wear and deterioration. It is urgent to take preventive measures.

Jigs, dies, molds, tools, and the facilities for material handling and movements have also been considerably worn out and deteriorated. Most of the trucks and forklifts equipped for the handling and movement of materials in the factory are inoperable due to the wear of facilities and the shortage of spare parts.

(2) Shortage of Spare Parts

As the Government limits the allocation of foreign exchange to HIC under the current stringency of foreign exchange, HIC has to give priority to the imports of raw materials and component parts directly required for the production, so that adequate quantity of spare parts cannot be imported to maintain the necessary inventory.

Hence, having no inventory of spare parts, HIC has to make arrangements for purchasing the parts for repair every time that machines are broken down. Since it takes long time from application of foreign exchange, placing purchase orders, through the arrival of the ordered parts, the broken machines cannot be used for some duration until the parts arrive. HIC manufactures some parts for repair by using some of the machines installed for manufacturing the main products, because there are no machines for manufacturing parts for repair. This often disturbs the operation of the main production lines.

(3) Shortage of Lubricants

As the lubricants are not produced at the petroleum refineries in Burma, all of the requirements for lubricants are met by imports. In recent years, there is a shortage of lubricants due to the limits of imports of lubricants similarly as with the spare parts under the stringent foreign exchange situation. Such causes an inadequate lubrication of the machines.

(4) Direction of Countermeasures for Improvement

Under the situations stated above, the necessary measures should be the repair or replacement of worn-out machinery, equipment and facilities including jigs, dies, molds, tools and transportation facilities, and also the following measures:

1. Execution of appropriate preventive and break-down maintenance
2. Stable and adequate supply of necessary spare parts for repair
3. Stable and adequate supply of lubricants, and the execution of proper machine operation with timely lubrication

In order to perform appropriate preventive maintenance, it is necessary to establish the preventive maintenance system and, at the same time, establish the systems for a planned procurement of spare parts and materials for repair and maintenance and for inventory control of those parts and materials.

Another necessary measure is to establish the facilities to manufacture or repair spare parts, jigs, dies, molds and tools so that the imports of those items can be reduced. HIC may have to pursuade the Government to increase the allocation of foreign exchange required for the imports of spare parts and lubricants. To this end HIC should prepare a long-term procurement plan for these imports.

3-3-2 Deterioration of Equipment Accuracy - Need of Enhancing Facilities and Systems for Calibration of Measuring Equipment and Instruments

Long-use of machines has brought about the deterioration of machining accuracy which requires immediate repairs. There are some machines which require a long time for repairing. As these machines cannot be used during repair work, if a shutdown is not permitted by workload demand, a minimum number of stand-by equipment will have to be installed, in which case the repairing will be performed while the operation is continued with the newly installed equipment.

There are a number of worn-out jigs and dies which have caused production losses and inferior quality of products. The repair of jigs and dies is undertaken at No.3 HI, but it is limited to simple repairs because of poor equipment installed for repair work. It is necessary to establish a shop specializing in the repair of jigs and dies, equipped with requisite inspection instruments.

Measuring equipment and instruments also are worn-out and deteriorated in accuracy, to the extent of being no longer capable of assuring requisite accuracies. It is urgent to make the repair or replacement of those equipment. Periodical check and calibration of measuring equipment and instruments cannot be performed because of absence of equipment for these activities. It is necessary to install the required equipment for calibration.

3-3-3 Improvement of Bottlenecks in Production Lines

Despite the present capacity utilization being lower than the maximum, bottlenecks in production lines are observed. The following are the main causes of the bottlenecks:

1. Bottlenecks caused by deterioration of machines, interruption of the operation of some processes or steps due to mechanical troubles of machines.

2. Bottlenecks caused by excessive time required for a subsequent step of machining because of intermediates manufactured in poor precision or accuracy with deteriorated machines.

3. Bottlenecks caused by excessive workload imposed on the machinings in order to recover the progress of work disturbed due to delays in delivery of cast or forged intermediates.

The foregoing bottlenecks can be eliminated by taking measures for renovating the worn-out equipment as mentioned in Section 3-3-1, and for improving the production control system for the upstream parts as discussed in Section 3-5.

In addition, there are some parts of processing which are time-consuming. At the present operation level set on the relatively low side, there is no critical problem created by such parts. However, they may create bottlenecks if the production scale is increased in the future. The expansion of production must be carefully examined by taking these factors into account.

3-3-4 Rationalization of Production Lines

Most of the existing facilities related to the Four Industrial Projects have been operated without improvements or modifications after they have initially been constructed in accordance with the designs prepared by the four Japanese companies assisting the Projects. The rationalization as summarized below would be necessary along with the repair and replacement of worn-out machinery, equipment and facilities, including jigs, dies, molds, tools and transportation facilities as mentioned in the previous sections.

(1) Integration of Duplicated Equipment and Facilities

There are a number of equipment and processing steps installed in duplications among the HIC's factories. In order to minimize the duplication of additional investments, personnel assignments, technical control and the movement of raw materials and intermediates, it is necessary to examine rationalization in terms of possible integrations. Attention, however, must be paid to the facts that the factories scattered in different regions are individually engaged in the manufacture of different products and some of the components used for those products are manufactured by a system comprising a centralized manufacturing of the rough products of casting, forging, and pressing at certain factories and the subsequent machining and processing, and the final assemblies at other factories. Under these situations, if an ideal rationalization is pursued, it may involve huge amounts of investments and the transfer of a large number of employees because of drastic relocation of shops involved among the factories. Such type of rationalization may be unrealistic. It would be important to examine a practically implementable plan for rationalization.

(2) Utilization of Idle Machines

There are some machines left idle. Most of those machines remain unrepaired because of a shortage of spare parts, while a small number of machines are unused due to changes in processes.

It is important to pay maximum possible efforts to arrange for the procurement of adequate repair parts so that the machines presently left unrepaired can be repaired for use. At the same time possible diversion of the unused machines will be examined in the course of investigating the renovation plan.

3-4 Present Conditions and Underlying Problems of the Local Production of Raw Materials and Component Parts, and Direction of Necessary Preparedness for Expansion of the Local Production

3-4-1 Present Situation of the Local Production of Raw Materials and Component Parts

(1) Present Situation of the Local Production of Component Parts

HIC has strived for the expansion of the local production of component parts to be used in the Four Industrial Projects. The ratios of localization for the main products are shown in Tables 3.2-6(1) to 3.2-6(5). The figures shown in these tables reveal that the localization has progressed to a considerable extent. HIC is situated in a fairly high level of localization compared to similar manufacturers in other Asian countries.

Tables 3.4-1(1) to 3.4-1(5) show the present status of the local production of main component parts to be used for the agricultural machinery and the heavy/light vehicles. Ordinary iron castings and ductile iron castings are manufactured by using locally available pig iron at the HIC's foundry shop, while aluminum light alloy castings are manufactured by using imported aluminum ingot at the HIC's light alloy foundry shop. Steel for manufacturing forged products, except for mamootie (Burmese hoes), is imported, and steel plates for pressed parts also are imported. Some component parts are manufacturered by machining imported rough products. Electrical components, auxiliary parts for engines and instruments for agricultural machinery and vehicles are all dependent on imports. Local materials are used for making seats and decorating the interior coach of vehicles, while window glass and other glass parts are imported.

Glass bulbs manufactured by the Ceramic Industry Corporation belonging to the Ministry of Industry (1) are used for incandescent lamps. The use of the locally made bulbs caused a large extent of rejects. The corporation has manufactured glass tubes for fluorescent lamps for the purpose of trial use by HIC. However, HIC still uses imported tubes because of the inferior quality of the locally made tubes. For manufacturing other items of electric products, HIC manufactures some

Table 3.4-1(1) PRESENT STATUS OF LOCAL PRODUCTION OF COMPONENT PARTS

Light Vehicle: B600 Pick Up (1)

Main Component Parts		CP	RM	RSM	
Vehicle Mechanism	Name of Component Parts	Local Made or Imported	Local Made or Imported	Local Made or Imported	Remark
Engine	Cylinder Head	*	o		LAC
	Cylinder Block	*	o		LAC
	Piston	*	o		LAC
	Piston Ring	*	*		CI
	Connecting Rod	*	o		FIS
	Crank Shaft	*	*		CI
	Cam Shaft	*	*		CI
	In. Manifold	*	o		LAC
	Ex. Manifold	*	*		CI
	Metal Bearing	o			
	Bolt/Nut	x	o		Partly LM
	Gasket/Seal	o			
Clutch & Transmission	Clutch Housing	*	o		LAC
	Clutch Disc	o			
	Transmission Case	*	o		LAC
	Extension	*	o		LAC
	Main Shaft	*	o		FIS
	Gear	x	o		FIS
	Synchronizer Ring	o			
	Shift Fork	*	*		CI
	Changing Rod	*	o		FIS
	Metal Bearing	o			
	Bolt/Nut	x	o		Partly LM
	Gasket/Seal	o			

Legend: *: Local made
o: Imported
x: Local made except small items imported

CP: Component parts
RM: Raw materials
RSM: Rough-shaped materials
LAC: Light alloy casting
LM: Local made
FIS: Forging of imported steel
CI: Cast iron
PISS: Press of imported steel sheet
MIP: Machining of imported pipe
LP: Local processing

Table 3.4-1(1) PRESENT STATUS OF LOCAL PRODUCTION OF COMPONENT PARTS

Light Vehicle: B600 Pick Up (2)

Main Component Parts		CP	RM	RSM	
Vehicle Mechanism	Name of Component Parts	Local Made or Imported	Local Made or Imported	Local Made or Imported	Remark
Propeller Shaft, Axle, Differential	Propeller Shaft	*		o	MIP
	Universal Joint	o			
	Joint Yoke	o			
	R. Axle Shaft	*	o		FIS
	R. Axle Casing	o			
	Bearing Housing	*	o		FIS
	Brake Drum	*	*		CI
	Brake Shoe	o			
	Disc Wheel	*	o		PISS
	Brake Drum Cover	*	o		PISS
	Tire	*	*		LM
	Differential Carrier	*	*		CI
	Differential Case	*	*		CI
	Drive Pinion	*	o		FIS
	Ring Gear	*	o		FIS
	Differential Pinion	*	o		FIS
	Differential Side Gear	*	o		FIS
	Differential Spider/Shaft	*	o		FIS
	Metal Bearing	o			
	Bolt/Nut	x	o		Partly LM
	Gasket/Seal	o			

Legend: *: Local made
o: Imported
x: Local made except small items imported

CP: Component parts
RM: Raw materials
RSM: Rough-shaped materials
LAC: Light alloy casting
LM: Local made
FIS: Forging of imported steel
CI: Cast iron
PISS: Press of imported steel sheet
MIP: Machining of imported pipe
LP: Local processing

Table 3.4-1(1) PRESENT STATUS OF LOCAL PRODUCTION OF COMPONENT PARTS

Light Vehicle: BG00 Pick Up (3)

Main Component Parts		CP	RM	RSM	
Vehicle Mechanism	Name of Component Parts	Local Made or Imported	Local Made or Imported	Local Made or Imported	Remark
Steering, Suspension	Steering Wheel	o			
	Steering Shaft	*	o		FIS
	Steering Gear Housing	*	o		LAC
	Drag Link	*	o		FIS
	Idle Arm	*	o		FIS
	Pitman Arm	*	o		FIS
	Steering Knucle/ Knucle Arm	*	o		FIS
	Spring	*		o	LP
	Damper	o			
	Lock (U) Bolt	*	o		FIS
	Metal Bearing	o			
	Bolt/Nut	x			Partly LM
	Gasket/Seal	o			
Frame	Side Member	*	o		PISS
	Cross Member	*	o		PISS
	Bracket	*	o		PISS
	Mounting Rubber	o			
Body	Cabin	*	o		PISS
	Door	*	o		PISS
	Box	*	o		PISS
	Bolt/Nut	x			Partly LM

Legend: *: Local made
o: Imported
x: Local made except small items imported

CP: Component parts
RM: Raw materials
RSM: Rough-shaped materials
LAC: Light alloy casting
LM: Local made
FIS: Forging of imported steel
CI: Cast iron
PISS: Press of imported steel sheet
MIP: Machining of imported pipe
LP: Local processing

Table 3.4-1(1) PRESENT STATUS OF LOCAL PRODUCTION OF COMPONENT PARTS

Light Vehicle: B600 Pick Up (4)

Main Component Parts		CP	RM	RSM	
		Local Made	Local Made	Local Made	Remark
Vehicle Mechanism	Name of Component Parts	or Imported	or Imported	or Imported	
Equipment	Seat	*	*		LM
	Trim (Door Top)	x	*		Partly LM
	Head Lamp	o			
	Combination Lamp	o			
	Instrument Panel	o			
	Wiring	o			
	Battery	*	o		LM
	Radiator	o			
	Air Cleaner	o			
	Fuel Pump	o			
	Oil Pump	o			
	Distributor	o			
	Starter	o			
	Alternator	o			
	Carburettor	o			
	Wiper Motor	o			
	Wiper Brade	o			
	Window Washer	o			
	Wind Shield Glass	o			
	Back Window Glass	o			
	Door Glass	o			
	Weather Strip	o			
	Ornament	o			
	Fuel Tank	*	o		PISS

Legend: *: Local made
o: Imported
x: Local made except small items imported

CP: Component parts
RM: Raw materials
RSM: Rough-shaped materials
LAC: Light alloy casting
LM: Local made
FIS: Forging of imported steel
CI: Cast iron
PISS: Press of imported steel sheet
MIP: Machining of imported pipe
LP: Local processing

Table 3.4-1(2) PRESENT STATUS OF LOCAL PRODUCTION OF COMPONENT PARTS

Light Vehicle: X2000 Cross Country (1)

Main Component Parts		CP	RM	RSM	
		Local Made	Local Made	Local Made	Remark
Vehicle Mechanism	Name of Component Parts	or Imported	or Imported	or Imported	
Engine	Cylinder Head	*	*		CI
	Cylinder Block	*	*		CI
	Piston	*	o		LAC
	Piston Ring	*	*		CI
	Connecting Rod	*	o		FIS
	Crank Shaft	*	*		CI
	Cam Shaft	*	*		CI
	In. Manifold	*	*		CI
	Ex. Manifold	*	*		CI
	Metal Bearing	o			
	Bolt/Nut	x	o		Partly LM
	Gasket/Seal	o			
Clutch & Transmission	Clutch Housing	*	o		LAC
	Clutch Disc	o			
	Transmission Case	*	*		CI
	Extension	*	o		LAC
	Main Shaft	*	o		FIS
	Gear	x	o		Partly FIS
	Synchronizer Ring	o			
	Shift Fork	*	*		CI
	Changing Rod	*	o		FIS
	Metal Bearing	o			
	Bolt/Nut	x	o		Partly LM
	Gasket/Seal	o			

Legend: *: Local made
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CP: Component parts
RM: Raw materials
RSM: Rough-shaped materials
LAC: Light alloy casting
LM: Local made
FIS: Forging of imported steel
CI: Cast iron
PISS: Press of imported steel sheet
MIP: Machining of imported pipe
LP: Local processing

Table 3.4-1(2) PRESENT STATUS OF LOCAL PRODUCTION OF COMPONENT PARTS

Light Vehicle: X2000 Cross Country (2)

Main Component Parts		CP	RM	RSM	
		Local Made	Local Made	Local Made	Remark
Vehicle Mechanism	Name of Component Parts	or Imported	or Imported	or Imported	
Propeller Shaft,	Propeller Shaft	*		o	MIP
Axle, Differential	Universal Joint	o			
	Joint Yoke	*	o		FIS
	R. Axle Shaft	o			
	R. Axle Casing	o			
	Bearing Housing	*	o		FIS
	Brake Drum	*	*		CI
	Brake Shoe	o			
	Disc Wheel	o			
	Brake Drum Cover	*	o		PISS
	Tire	*	*		LM
	Differential Carrier	o			
	Differential Case	o			
	Drive Pinion	*	o		FIS
	Ring Gear	*	o		FIS
	Differential Pinion	*	o		FIS
	Differential Side Gear	*	o		FIS
	Differential Spider/Shaft	*	o		FIS
	Metal Bearing	o			
	Bolt/Nut	x	o		Partly LM
	Gasket/Seal	o			

Legend: *: Local made
o: Imported
x: Local made except small items imported

CP: Component parts
RM: Raw materials
RSM: Rough-shaped materials
LAC: Light alloy casting
LM: Local made
FIS: Forging of imported steel
CI: Cast iron
PISS: Press of imported steel sheet
MIP: Machining of imported pipe
LP: Local processing

Table 3.4-1(2) PRESENT STATUS OF LOCAL PRODUCTION OF COMPONENT PARTS

Light Vehicle: X2000 Cross Country (3)

Main Component Parts		CP	RM	RSM	Remark
Vehicle Mechanism	Name of Component Parts	Local Made or Imported	Local Made or Imported	Local Made or Imported	
Steering, Suspension	Steering Wheel	o			
	Steering Shaft	o			
	Steering Gear Housing	*	o		LAC
	Drag Link	*	o		FIS
	Idle Arm	o			
	Pitman Arm	o			
	Steering Knucle/ Knucle Arm	*	o		FIS
	Spring	*		o	LP
	Damper	o			
	Lock (U) Bolt	*	o		FIS
	Metal Bearing	o			
	Bolt/Nut	x			Partly LM
	Gasket/Seal	o			
Frame	Side Member	*	o		PISS
	Cross Member	*	o		PISS
	Bracket	*	o		PISS
	Mounting Rubber	o			
Body	Cabin	*	o		PISS
	Door	*	o		PISS
	Box	*	o		PISS
	Bolt/Nut	x			Partly LM

Legend: *: Local made
o: Imported
x: Local made except small items imported

CP: Component parts
RM: Raw materials
RSM: Rough-shaped materials
LAC: Light alloy casting
LM: Local made
FIS: Forging of imported steel
CI: Cast iron
PISS: Press of imported steel sheet
MIP: Machining of imported pipe
LP: Local processing

Table 3.4-1(2) PRESENT STATUS OF LOCAL PRODUCTION OF COMPONENT PARTS

Light Vehicle: X2000 Cross Country (4)

Main Component Parts		CP	RM	RSM	
		Local Made	Local Made	Local Made	
Vehicle Mechanism	Name of Component Parts	or Imported	or Imported	or Imported	Remark
Equipment	Seat	*	*		LM
	Trim (Door Top)	*	*		LM
	Head Lamp	o			
	Combination Lamp	o			
	Instrument Panel	o			
	Wiring	o			
	Battery	*	o		LM
	Radiator	o			
	Air Cleaner	o			
	Fuel Pump	o			
	Oil Pump	o			
	Distributor	o			
	Starter	o			
	Alternator	o			
	Carburettor	o			
	Wiper Motor	o			
	Wiper Brade	o			
	Window Washer	o			
	Wind Shield Glass	o			
	Back Window Glass	o			
	Door Glass	o			
	Weather Strip	o			
	Ornament	o			
	Fuel Tank	*	o		PISS

Legend: *: Local made
o: Imported
x: Local made except small items imported

CP: Component parts
RM: Raw materials
RSM: Rough-shaped materials
LAC: Light alloy casting
LM: Local made
FIS: Forging of imported steel
CI: Cast iron
PISS: Press of imported steel sheet
MIP: Machining of imported pipe
LP: Local processing

Table 3.4-1(3) PRESENT STATUS OF LOCAL PRODUCTION OF COMPONENT PARTS

Light Vehicle: T2000 Truck (1)

Main Component Parts		CP	RM	RSM	Remark
Vehicle Mechanism	Name of Component Parts	Local Made or Imported	Local Made or Imported	Local Made or Imported	
Engine	Cylinder Head	o			
	Cylinder Block	o			
	Piston	o			
	Piston Ring	o			
	Connecting Rod	o			
	Crank Shaft	o			
	Cam Shaft	o			
	In. Manifold	o			
	Ex. Manifold	o			
	Metal Bearing	o			
	Bolt/Nut	o			
	Gasket/Seal	o			
Clutch & Transmission	Clutch Housing	o			
	Clutch Disc	o			
	Transmission Case	o			
	Extension	o			
	Main Shaft	o			
	Gear	o			
	Synchronizer Ring	o			
	Shift Fork	o			
	Changing Rod	o			
	Metal Bearing	o			
	Bolt/Nut	o			
	Gasket/Seal	o			

Legend: *: Local made
o: Imported
x: Local made except small items imported

CP: Component parts
RM: Raw materials
RSM: Rough-shaped materials
LAC: Light alloy casting
LM: Local made
FIS: Forging of imported steel
CI: Cast iron
PISS: Press of imported steel sheet
MIP: Machining of imported pipe
LP: Local processing

Table 3.4-1(3) PRESENT STATUS OF LOCAL PRODUCTION OF COMPONENT PARTS

Light Vehicle: T2000 Truck (2)

Main Component Parts		CP	RM	RSM	
Vehicle Mechanism	Name of Component Parts	Local Made or Imported	Local Made or Imported	Local Made or Imported	Remark
Propeller Shaft, Axle, Differential	Propeller Shaft	o			
	Universal Joint	o			
	Joint Yoke	o			
	R. Axle Shaft	o			
	R. Axle Casing	o			
	Bearing Housing	o			
	Brake Drum	o			
	Brake Shoe	o			
	Disc Wheel	o			
	Brake Drum Cover	o			
	Tire	o			
	Differential Carrier	o			
	Differential Case	o			
	Drive Pinion	o			
	Ring Gear	o			
	Differential Pinion	o			
	Differential Side Gear	o			
	Differential Spider/Shaft	o			
	Metal Bearing	o			
	Bolt/Nut	o			
	Gasket/Seal	o			

Legend: *: Local made
o: Imported
x: Local made except small items imported

CP: Component parts
RM: Raw materials
RSM: Rough-shaped materials
LAC: Light alloy casting
LM: Local made
FIS: Forging of imported steel
CI: Cast iron
PISS: Press of imported steel sheet
MIP: Machining of imported pipe
LP: Local processing

Table 3.4-1(3) PRESENT STATUS OF LOCAL PRODUCTION OF COMPONENT PARTS

Light Vehicle: T2000 Truck (3)

Main Component Parts		CP	RM	RSM	
Vehicle Mechanism	Name of Component Parts	Local Made or Imported	Local Made or Imported	Local Made or Imported	Remark
Steering, Suspension	Steering Wheel	o			
	Steering Shaft	o			
	Steering Gear Housing	o			
	Drag Link	o			
	Idle Arm	o			
	Pitman Arm	o			
	Steering Knucle/ Knucle Arm	o			
	Spring	o			
	Damper	o			
	Lock (U) Bolt	o			
	Metal Bearing	o			
	Bolt/Nut	o			
	Gasket/Seal	o			
Frame	Side Member	o			
	Cross Member	o			
	Bracket	o			
	Mounting Rubber	o			
Body	Cabin	o			
	Door	o			
	Box	*	o		PISS
	Bolt/Nut	o			

Legend: *: Local made
o: Imported
x: Local made except small items imported

CP: Component parts
RM: Raw materials
RSM: Rough-shaped materials
LAC: Light alloy casting
LM: Local made
FIS: Forging of imported steel
CI: Cast iron
PISS: Press of imported steel sheet
MIP: Machining of imported pipe
LP: Local processing

Table 3.4-1(3) PRESENT STATUS OF LOCAL PRODUCTION OF COMPONENT PARTS

Light Vehicle: T2000 Truck (4)

Main Component Parts		CP	RM	RSM	
Vehicle Mechanism	Name of Component Parts	Local Made or Imported	Local Made or Imported	Local Made or Imported	Remark
Equipment	Seat	o			
	Trim (Door Top)	o			
	Head Lamp	o			
	Combination Lamp	o			
	Instrument Panel	o			
	Wiring	o			
	Battery	*	o		LM
	Radiator	o			
	Air Cleaner	o			
	Fuel Pump	o			
	Oil Pump	o			
	Distributor	o			
	Starter	o			
	Alternator	o			
	Carburettor	o			
	Wiper Motor	o			
	Wiper Brade	o			
	Window Washer	o			
	Wind Shield Glass	o			
	Back Window Glass	o			
	Door Glass	o			
	Weather Strip	o			
	Ornament	o			
	Fuel Tank	o			

Legend: *: Local made
o: Imported
x: Local made except small items imported

CP: Component parts
RM: Raw materials
RSM: Rough-shaped materials
LAC: Light alloy casting
LM: Local made
FIS: Forging of imported steel
CI: Cast iron
PISS: Press of imported steel sheet
MIP: Machining of imported pipe
LP: Local processing

Table 3.4-1(4) PRESENT STATUS OF LOCAL PRODUCTION OF COMPONENT PARTS

Heavy Vehicle: Truck/Bus (1)

Main Component Parts		CP	RM	RSM	Remark
Vehicle Mechanism	Name of Component Parts	Local Made or Imported	Local Made or Imported	Local Made or Imported	
Engine	Cylinder Head	*	*		CI
	Cylinder Block	*	*		CI
	Crank Shaft	*		o	LP
	Cam Shaft	*		o	LP
	Connecting Rod	*	o		FIS
	Bearing Cap	*	*		CI
	Ring Gear	*	o		FIS
	Case, Timing Gear	*	*		CI
	Clutch Housing	*	*		CI
	Piece, Timing Gear Case	*	*		CI
	Cover, Cylinder Head	*	o		PISS
	Cover, Starter	*	o		PISS
	Cover, Tappet Chamber	*	o		PISS
	Oil Pan	*	o		PISS
	Water Manifold	*	o		PISS
	Strainer	*	o		PISS
	Cooling Fan	*	o		PISS
	Cover, Timing Gear Case	*	o		PISS
Clutch	Cover, Clutch	*		o	LP
	Plate Pressure	*	o		CI
	Spring Clutch	*	o		LP
	Other 14 Items	o			
Transmission	Case, Gear	*	*		CI
	Counter Shaft	*	o		FIS
	Gear, Main Shaft 1st	*	o		FIS
	Other 16 Items	*	o		FIS
	Other 12 Items	o			

Legend: *: Local made
o: Imported
x: Local made except small items imported

CP: Component parts
RM: Raw materials
RSM: Rough-shaped materials
LAC: Light alloy casting
LM: Local made
FIS: Forging of imported steel
CI: Cast iron
PISS: Press of imported steel sheet
MIP: Machining of imported pipe
LP: Local processing

Table 3.4-1(4) PRESENT STATUS OF LOCAL PRODUCTION OF COMPONENT PARTS

Heavy Vehicle: Truck/Bus (2)

Main Component Parts		CP	RM	RSM	
Vehicle Mechanism	Name of Component Parts	Local Made or Imported	Local Made or Imported	Local Made or Imported	Remark
Propeller Shaft	Spider	*	o		FIS
	York Flange	*	o		FIS
	York Spline	*	o		FIS
	Other 5 Items	*	o		FIS
Flame, Suspension	Leaf Spring	*	o		LP
	Spring Bracket, Rear	*		o	LP
	Spring Bracket, Front	*		o	LP
	Other 7 Items	o			
Steering, Axle	Pitman Arm	*	o		FIS
	Stud Ball	*	o		FIS
	Link Drag	*	o		FIS
	Other 4 Items	*	o		FIS
	Other 9 Items	o			
Body	Press Parts for Buses	*	o		PISS
	Press Parts for Trucks	*	o		PISS

Legend: *: Local made
o: Imported
x: Local made except small items imported

CP: Component parts
RM: Raw materials
RSM: Rough-shaped materials
LAC: Light alloy casting
LM: Local made
FIS: Forging of imported steel
CI: Cast iron
PISS: Press of imported steel sheet
MIP: Machining of imported pipe
LP: Local processing

Table 3.4-1(5) PRESENT STATUS OF LOCAL PRODUCTION OF COMPONENT PARTS

Agricultural Machinery and Equipment (1)

Main Component Parts		CP	RM	RSM	Remark
Name of Product	Name of Component Parts	Local Made or Imported	Local Made or Imported	Local Made or Imported	
Power Tiller	Main Gear Case	*	*		CI
	Upper Cover	*	*		CI
	Main Case Cover	*	*		CI
	Axle Gear Case	*	*		CI
	Control Gear Case	*	*		CI
	Aux Gear Case	*	*		CI
	Main Shaft	*	o		FIS
	Shaft 1st	*		o	LP
	Gear 23-26	*	o		FIS
	Gear 2nd Shaft	*	o		FIS
	Axle Shaft	*		o	LP
	Shifter (B)	*		o	LP
	Shaft Rod	*		o	LP
	Clutch Pulley	*	*		CI
	Clutch Spring	*	o		PISS
	Clutch Plate	*	o		PISS
	Belt Cover	o			
	Main Handle	*	o		PISS
	Main Handle Cover	o			
Diesel Engine	Cylinder Frame	*	*		CI
	Cylinder Head	*	*		CI
	Crank Shaft	*	o		FIS
	Cam Rod	*	o		FIS
	Cam Shaft	*	o		FIS
	Fly Wheel	*	*		CI
	Piston	*	o		LAC
	Piston Ring	*	*		CI
	Liner	*		o	LP
	Fuel Tank	*	o		PISS
	Gears	*	o		FIS
	Bolt/Nut	*		o	LP
	Air Cleaner	o			

Legend: *: Local made
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x: Local made except small items imported

CP: Component parts
RM: Raw materials
RSM: Rough-shaped materials
LAC: Light alloy casting
LM: Local made
FIS: Forging of imported steel
CI: Cast iron
PISS: Press of imported steel sheet
MIP: Machining of imported pipe
LP: Local processing

Table 3.4-1(5) PRESENT STATUS OF LOCAL PRODUCTION OF COMPONENT PARTS

Agricultural Machinery and Equipment (2)

Main Component Parts		CP	RM	RSM	
Name of Product	Name of Component Parts	Local Made or Imported	Local Made or Imported	Local Made or Imported	Remark
Thresher	KD Parts	o			
	Small Parts	*		o	LP
Sprayer	Cylinder	*		o	LP
	Tank	*	o		PISS
Pump	Casing	*	*		CI
	Casing Cover	*	*		CI
	Main Shaft	*		o	LP
	Suction Cover	*	*		CI
	Impeller	*	*		CI
Generator	Yoke	*		o	LP
	Common Bed	*		o	LP

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x: Local made except small items imported

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RM: Raw materials
RSM: Rough-shaped materials
LAC: Light alloy casting
LM: Local made
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LP: Local processing

metal parts or plastic parts by processing imported metal plates and synthetic resin pellets. Manganese dioxide and zinc used for dry cell batteries are imported.

Up to the present HIC has relied entirely on the four Japanese companies assisting the Projects for the product design of the Four Industrial Projects. The local production of component parts has also been expanded step by step in accordance with the designs and specifications provided by them together with their technical guidance for manufacturing. The component parts requiring a high level of technology or large-sized equipment and also those costly by local production on a small scale are still dependent on imports.

(2) Quality of Parts Manufactured by HIC and Procured from Other Local Sources, and Other Problems Underlying in the Manufacturing of Products

1) Quality of Raw Materials and Rough Products

No.3 HI's foundry uses domestically produced pig iron. The percentage of defectives found in ordinary iron castings and ductile iron castings is around 20% in average, although the defective rates vary depending on the products. Cast products for piston rings produced at No.4 HI have defectives from 10 to 25%. The defectives of aluminium light alloy castings manufactured at No.4 HI extensively varies from 3 to 50% depending on the products manufactured.

Steel materials for forged products are imported for the most part. Although the average defective rate of rough forged products is around 5%, the defectives of machined products vary between 0 to 20% depending on the types of parts. Poor precision control on the dies is largely responsible for the inferiority of the forged products.

In view of the defective rates as enumerated above, it is observed that the HIC's present level is still below the level that can ensure a stable supply of high quality of cast and forged products.

For incandescent lamps, HIC uses bulbs manufactured by the Ceramic Industry Corporation. The use of the bulbs, however, caused 40 to 50% of rejects of the incandescent lamps manufactured due to inferiority of the bulbs.

2) Quality of Processed Products

Skills of workers engaged in processing seem to be fairly high. Nevertheless, there are several problems requiring improvement. Major problems are summarized below.

a) Machined Products

Precision of the machine tools and press machines, as stated earlier, has been deteriorated due to the wear and tear. Similarly, jigs, dies, tools and gauges are also deteriorated. These conditions cause inferiority of the machined products.

The pressed parts are particularly rough in precision because of the wear and deterioration of press machines and dies, and also there are some parts made by manual shearing and bending due to lack of press dies.

The use of these poor quality pressed parts results in the frequent occurrence of inferior products at the assembly shops. The cutting work is better performed, but some of the produced parts are poor in precision. In addition, bad practices in the storing of finished parts and semi-finished parts have caused deterioration of the quality of parts.

b) Deterioration of Quality Caused by Damages in Transportation or Storage

Pressed parts for light vehicles are manufactured at No.1 HI and delivered to No.4 HI where the assembly of light vehicles is performed. Many of the delivered parts are those deformed during the transportation from No.1 HI to No.4 HI and also rusted during storage. The rough products of cast iron to be used for the parts of engines are manufactured at No.3 HI and delivered to No.4 HI where the machining and subsequent processing of the parts and the assembly of engines are performed. As preventive treatments for rusting are insufficient, many of the delivered rough products have rust, causing the deterioration of quality. The assembled engines transmissions are stored in an inept manner, causing the performance of those engines and transmissions to deteriorate.

c) Welded Parts

The skill level of arc welding is generally low and the products have a rough finish. Apart from their poor appearance, these products have weakness against concentrated or repeated stress.

d) Assembly of Parts

There are some engines and transmissions assembled with the missing of some parts and the insufficient fitting of bolts and nuts.

e) Quality Test and Inspection of Parts

There are some testing facilities and measuring instruments which do not function because they are left unrepaired due to lack of spare parts or are used in a deteriorated condition. Under these conditions, the test and inspection for the precision and quality of the manufactured parts are insufficient. The inventory control of the parts is also inadequate. Some of the rejected parts are mixed in with the passed ones and also are used with inadequate adjustment, resulting in inferiority of the products.

3) Final Inspection and Performance Test

Most of the testing facilities and instruments are worn out, some of which are out of service because of lack of spare parts for repairing. Such being the conditions, the final inspection and performance test are inadequate. This results in unreliable assurance on the durability and safety of the vehicles.

4) Delay in Work Schedule

When a delay in work occurs in some process, no immediate reaction is taken to remedy it. Such a delay often affects the work in subsequent processing, and hampers the overall work schedule.

(3) Component Parts for Local Production

Most of the products manufactured at the Four Industrial Projects follow the original models introduced when the Projects started 20 years ago. Today such old models of products are manufactured only in

Burma. The foreign manufacturers supplying component parts for the Projects have retained the production facilities only for the purpose of manufacturing the parts to be supplied to the Projects. Under these situations, it is uncertain whether those component parts can be surely supplied by the foreign manufacturers in the future, and also it is likely that the prices for them should rise even if they are supplied. In view of these possibilities, HIC intends to expand the local production of component parts as much as possible. Tables 3.4-2(1) and 3.4-2(2) show the items of component parts on which HIC intends to undertake the local production. Among these some items require high technology and high precision for manufacturing. Besides those some items have to be commissioned to other state corporations as like as glass tubes for fluorescent lamps. In this event any measures for improving the quality are necessary. The direction of measures to be taken by HIC for expanding the local production of component parts is descibed below.

3-4-2 Measures for Immediate Improvement

(1) Improvement of Production Facilities and Enhancement of Production Control

The problems mentioned above are attributable to the inadequate conditions of production facilities and production control. Most of these problems would be improved by taking the measures discussed in Section 3-3, that is, (i) the repair or replacement of the worn-out machinery and equipment including measuring equipment and instruments, jigs, dies, molds and tools, (ii) the establishment and enhancement of the facilities and systems for manufacturing spare parts for maintenance, jigs, dies and molds; for repairing machines, jigs, dies and molds; and for calibrating measuring equipment and instruments, and (iii) the installation of additional machinery and equipment for expanding the local production of component parts. At the same time, as discussed in Section 3-5, it is important to enhance the systems for the production control including quality control and progress control and also for the maintenance of machinery, equipment and facilities. When the local production of component parts are expanded according to the plan formulated by HIC, a considerable variety of

Table 3.4-2(1) POTENTIAL COMPONENTS TO BE CONVERTED TO LOCAL SUPPLY FROM IMPORT

I. VEHICLES

1. 6.5 Ton Truck

- Side Frame, Disc Wheel, Radiator, Rear Axle Housing
- Rear Axle Shaft, Final Gear, Gear for Engine, Inlet and Exhaust Valve, Nozzle Holder, Knuckle Arm, King Pin
- Injection Pump, Inlet and Exhaust Manifold
- Cylinder Liner, Piston Pin, Water Pump
- U Bolts, Wheel Nut, Stud Bolt
- Rubber Parts
  Engine Mounting, Bumper-Spring, Weather Strip, Floor Mat

2. 33 Seater Passenger Bus

- Frame, Body Parts (i.e., Side Construction, Roof Construction, Front Construction, Rear Construction, Door Panel, etc.), Disc Wheel, Radiator, Rear Axle Housing
- Rear Axle Shaft, Final Gear, Gear for Engine, Inlet and Exhaust Valve, Nozzle Holder, Knuckle Arm, King Pin
- Injection Pump, Inlet and Exhaust Manifold
- Cylinder Liner, Piston Pin, Water Pump
- U Bolt, Wheel Nut, Stud Bolt, Tapping Screw
- Engine Mounting, Bumper-Spring, Weather Sprip, Inside Rubber Lining

3. X-2000 (Modified Version) Cross Country Vehicle

- Rear Axle Housing, Radiator, Disc Wheel, Side Frame
- Rear Axle Shaft, Inlet and Exhaust Valve
- Engine Mounting, Stopper, Weather Strip, Floor Mat

4. T-2000 2 Ton Truck

- Rear Axle Housing, Side Frame, Disc Wheel, Radiator, Side Panel, Cabin
- Rear Axle shaft, Inlet and Exhaust Valve, Front Axle
- Cam Shaft, Inlet and Exhaust Manifold, Oil Sump
- Transmission, Final Gear, Propeller Shaft

5. 600cc Vehicle

- Rear Axle Housing
- Inlet and Exhaust Valve
- Engine Mounting, Stopper, Floor Mat

Source: HIC

Table 3.4-2(2) POTENTIAL COMPONENTS TO BE CONVERTED TO LOCAL SUPPLY FROM IMPORT

II. AGRICULTURAL MACHINERY

1. Thresher
   - Side Frame
2. KND5P Engine
   - Injection Pump, Nozzle Holder, Inlet and Exhaust Valve
   - Air Cleaner
3. KND7 Engine
   - Injection Pump, Nozzle Holder, Inlet and Exhaust Valve
   - Air Cleaner
4. Power Tiller
   - Disc Wheel, Gear Case Cover, Bolt Guard

III. ELECTRICAL EQUIPMENT AND APPARATUS

1. Distribution Transformer
   - Fasteners Terminal Retaining Ring, Solderless Connecting Sleeve, Radiator Panel
2. Storage Battery
   - Cap
3. Fluorescent Lamp
   - Tube
4. Watt Hour Meter
   - Glass Cover, Digital Counter

Source: HIC

parts will be manufactured. The enhancement of quality control and progress control is indispensable.

(2) Enhancement of Functions to Collaborate with Other Related Entities

The bulbs for incandescent lamps are supplied by the Ceramic Industry Corporation, and the glass tubes for fluorescent lamps also will be supplied by the Corporation in the future. In order to improve the quality of the bulbs, HIC has attempted a trial manufacture of the molds to be used for manufacturing the bulbs and also has provided the Corporation with technical assistance for the renovation and improvement of the bulb manufacturing facilities. It is important for HIC to extend such technical collaboration to other related entities so that HIC can exert its technology and experience to these entities in their trial and commercial production of the component parts to be supplied to HIC in a view to improving the quality of those parts to an acceptable standard.

3-4-3 Direction of Institutional Development in Future

(1) Standardization of Products

As described earlier, the HIC's production is characterized by the production of a wide variety of products each in a small quantity, involving the handling of a large number of different parts. For example, there are two standards in use for the threads of bolts and nuts for vehicles, i.e., Whitworth and Meter.

Further, each final product employs a number of particular parts. Hence the variety of parts have been expanded to an excessively large extent. The standardization of the component parts and raw materials would contribute to the minimization of a variety of the component parts and raw materials used, and in turn to the simplification of production control and the reduction of production costs. It is important to unify the applied specifications to a practicable extent at the time when model changes are made on some products.

Although HIC has standard drawings of all basic metal parts which are based on such major standards as JIS and DIN, they are simply a

collection of standards serving no specific purpose. In view of future industrialization and increased domestic production, Burma must determine how to proceed with standardization at a national level. For example, there are currently 6 different plugs produced by HIC, ranging from 250V 3A to 250V 15A, which could be integrated to only 2 or 3 types by standardization. It is recommended that HIC should pursuade the Government authority to prepare industrial standards for gradual application.

(2) Development of Product Design Capability

Although the expansion of the local production substantially contributes to the promotion of import substitution, the present industries in Burma can supply very limited items of raw materials and almost all of the raw materials therefore should be imported. In order to promote the use of locally available raw materials, HIC should consider to perform the modification of designs and specifications of the products and component parts, at its own efforts. For these tasks, HIC should build up its design capability to enable the modification of product designs and specifications supported by technical justification. It is recommended that HIC should request the related Japanese companies to assist HIC in building up its design capability.

(3) Establishment of Systems for Small Model Changes and Product Development

HIC produces the products of the Four Industrial Projects for the most part in the original models without any modification since model changes necessitate the replacement of jigs and dies resulting in investments and cost increases. However, there are some products of which model changes may be effective for cost reduction, if the changes are made for integration of some parts, application of simplified mechanism and use of alternative or substitute materials and if such changes are implemented at the time when the replacement of the existing jigs and dies are inevitably required.

In order to promote the localization of raw materials and component parts, it is necessary to make model changes by applying the specifications that incorporate simple structures reflecting the current requirements in Burma and the use of locally available materials.

HIC recognizes the necessity of such model changes, and intends to investigate the possibility for the model changes of the products and parts as listed in Tables 3.4-3(1) and 3.4-3(2).

HIC has developed some modified products such as rail buses, cross country vehicles and station wagons with a long wheel-base, and self-priming pumps, based on the products of the Four Industrial Projects. HIC's design and product development activities, however, are still in a formative stage and the developed products require improvements to become completely reliable products.

HIC has the Design and Product Development Section in the Headoffice. This section has about 130 staff, but 100 persons are draftsmen. The engineers engaged in this section are only 26 persons consisting of 21 mechanical engineers, 3 electrical engineers and 2 civil engineers. In view of the scale of HIC's activities, it is obvious that the number of engineers assigned to the design and product development is inadequate. HIC should have to enhance this function so as to be able to realize the improvement and development of the products by themselves.

Table 3.4-3(1) MATERIALS/PARTS/PRODUCTS URGENTLY REQUIRING A CHANGE OR DEVELOPMENT OF MODEL/DESIGN FOR PRODUCTIVITY IMPROVEMENT AND MATERIAL COST REDUCTION

Sr. No.	Description	Objective	Measure
I.	Items Urgently Required to Change or Develop		
1.	Ballast fan 2 feet lighting fixture	(1) Material saving (2) Improvement of productivity	Change of ballast design to climate the step down transformer presently installed
2.	Stand fan/Table fan	(1) Foreign currency saving (2) Improvement of productivity	Change of fan blade, fan motor cover, stand from metal to plastic
3.	Electric Accessory - Square toggle switch Model: W 3011 to WS 3001-8	(1) Reduction of parts	Change the design of metal parts and bakelite parts
II.	Items to Change and Develop in Near Future		
1.	B-600 Pick-up	(1) Material saving (2) Improvement of productivity (3) Reduction of imported cost (4) Improvement of reliability and performance	- Standardization of imported part with current production model in Japan - Improvement of steering linkage and chassis part - Improvement of high tension distribution system - Widening of body - Lengthening of wheel base

Source: HIC

Table 3.4-3(2) MATERIALS/PARTS/PRODUCTS URGENTLY REQUIRING A CHANGE OR DEVELOPMENT OF MODEL/DESIGN FOR PRODUCTIVITY IMPROVEMENT AND MATERIAL COST REDUCTION

Sr. No.	Description	Objective	Measure
2.	X-2000	(1) Material saving (2) Improvement of productivity	- Improvement of bonnet design - Standardization of imported part with current production model in Japan
3.	Power tiller	(1) Simplification (2) Cost reduction	Change the tiller design from 5 speed to 3 speed system
4.	Watt hour meter	(1) Foreign currency saving (2) Improvement of productivity	Standardization of imported parts with the current model produced in Japan
5.	Electric motor (1.5 kW, single phase)	(1) Improvement of productivity	Change the design of motor casing
6.	6.5 ton TE truck	(1) Material saving (2) Improvement of productivity	- Change of cabin design from present design to to forward control type - Widening of wheel tread same as BX
7.	Material for hand tool - Spanner, screw driver, etc.	Foreign currency saving	Now using alloy steel for whole part, it is to be changed to friction welding of alloy steel and carbon steel. Alloy steel for tip, carbon steel for handle.

Source: HIC

3-5 Present Systems and Underlying Problems of Production Control, and Direction of Improvement

3-5-1 General

HIC's annual production plan is determined with the Government's sanction. The Government allocates the foreign exchange to HIC for the imports of raw materials and component parts in accordance with the approved production plan. HIC is responsible for achieving the planned production with the allocated foreign exchange. The production plan originally prepared by HIC is often revised downward in the course of the Government's examination, in the light of the Government's annual economic plan and its plan for the arrangement of required foreign exchange. Hence, HIC is unable to increase the production due to the limitation of the foreign exchange available, even if the demand is large and the production facilities have a sufficient capacity to increase the production. On the other hand, there is a case that the production schedule is adversely affected by the delay in the arrival of imported raw materials and component parts.

In view of the production record for the last three years, as reviewed in Section 3-2-4, there are several products of which the production failed to attain the production plan. It is observed that such lower achievement in production should be partly attributable to the delay in the arrival of raw materials and component parts, but also to the weakness of the production planning and control systems presently practiced. The quality of the products and component parts manufactured by HIC, as reviewed in the previous section, should be improved, and it requires the enhancement of quality control.

The production will be more complicated with the expansion of the local production of component parts and the increase of the production of products. Hence the function of the production control is indispensable for ensuring the efficient operation. At the same time, it is also necessary to enhance the facility control and maintenance systems for the production facilities. Taking the above mentioned points into consideration, the present systems and underlying problems of the production control and the direction of improvement are discussed in the subsequent sections.

3-5-2 Production Planning

After the production plan is sanctioned by the Government, a notice called the Manufacture Order (MO) which specifies the annual production volume and delivery time is issued by the Planning Department of the Headoffice to the factories and relevant departments of the Headoffice. On receipt of the MO, the Planning Department of the respective factory instructs the annual production plan by means of its own MO to the Production Department and other relevant sections in the factory. The respective factory, with the initiative of the Production Department, prepares the monthly production plan which is submitted to the Planning Department of the Headoffice. The monthly production plans submitted by the factories are finalized by the Planning Department of the Headoffice with adjustments among the factories. Based on the thus prepared monthly production plans for the factories, the annual production plan is finalized. This annual plan, however, is not so precise as to serve as the basis for monitoring and making necessary adjustments of workload for each process, delay in work schedule and inventory of raw materials, intermediates, products in process and final products, but it simply indicates the target of the annual production to be achieved.

The Planning Department of the Headoffice convenes the senior staff of the factories every month to make necessary coordination among the factories to solve the problems arising in relation with the work progress, delivery time and product quality. The respective factory also frequently has similar meetings to make coordination among the shops to solve the problems.

Nevertheless, it is observed that the presently practiced production planning and coordination manner has the problems as summarized below. Recommendable direction of improvement on those problems is stated there for HIC's consideration.

1) Allowance of Excess Production

The production plan for component parts is prepared with 10% surplus in each process in consideration of possible defectives. For an example, the production plan of KND5B diesel engines for 1986/87 issued by the Headoffice called for the production of 5,300 units, and based on this plan the factory issued the order to produce 6,000 units.

Another example is the order of small pressed parts issued by No.4 HI to the Press Shop of No.1 HI in a quantity 10% higher than the quantity of the production plan issued by the Headoffice. In fact, No.4 HI received the indicated quantity of pressed parts from No. 1 HI. As a consequence, the 10% excess parts have been accumulated every year, increasing the inventory. A warehouse belonging to the shop concerned was constructed to store those accumulated excess pressed parts.

If such excess production is permitted, it will prevent the strict control in respect of actual production, the consumption of raw materials and intermediates, and product quality, leading to the waste of resources. It is recommended to change these practices to the manner best designed to grasp the actual record of production.

2) Equalization of Production Plan

Equalization of the production aims at adjusting differences in the progress of work in each process, equalizing daily workload and thereby promoting work efficiency. The HIC's monthly production target set in the production plan widely varies from month to month. There are several problems arising from such unequalized production plans. The followings are examples of those problems.

a) The change of dies for pressing is a time-consuming work. Hence the Press Shop of No.1 HI produces the pressed parts at one time in a quantity to meet the requirements for every six months by dividing the annual production requirements into two lots. As a consequence, the pressed parts are stored for a long period of time. There are some of the parts that got rusty or lost in the storage, causing a failure in supplying some of the required parts in time and hindering the schedule of the assembly work to be performed at No.4 HI.

b) The component parts to be used for the motors and electric fans which are manufactured at No.3 HI, are produced in an individually different volume, so that the assembly of these products cannot be performed until all the parts are completed and, on the other hand, a pile of parts in processing is accumulated in the machining shop.

In order to prevent such problems as mentioned above, it is advisable to set up the standard for monthly production which is applied to all the production lines such as the foundry and the forging sections, the machining lines and assembly lines for equalizing the production of these lines. The standard is generally one-twelfth of the annual production requirements, but in the case of the press shop one-sixth of the annual production requirements may be applied by taking the complicity of procedures for changing dies into consideration.

3) Adjustment of Production Plan and Fast Feedback

Most of the products of which the actual production has failed in attaining the planned production are those manufactured through the processes divided into more than one factory.

The meetings for production adjustment are held at the Headoffice once a month by the persons responsible for the production planning of the respective factories. However, no particular measures seem to have been taken for recovering any production shortage of a previous month in the following month.

Despite the production plan in 1987 set the target of production of cast products and other rough products at only 70% of the production capacity, the production achieved only 40 to 70% of the target although the percentage varied from line to line. Shortages or delays in the production of rough products such as cast iron products largely affect the subsequent processes, necessitating modification of the overall production plans.

Another example is the problems which have arisen at No. 1 HI and No. 4 HI in connection with the production of TE type trucks. The monthly production of TE type trucks at No.1 HI decreased to 52 units of vehicles against the target of 87 vehicles. In the meanwhile No.4 HI produced 100 units of engines a month as per the target and continued the production of 100 units in the next month without any adjustment of the production, so that the completed engines were piled up in the shop.

The lack of production adjustment among the relevant factories causes confusion at production lines with such diverse effects as the delayed

production of urgently required products and vice-versa, resulting in unnecessary stock piling of the manufactured parts. As to the products of which the production is made through the processes divided into several factories, in particular, it is recommended to improve the presently practiced systems so that appropriate monthly production adjustment be made by the Headoffice in time and instructions for such adjustments be promptly informed to the relevant shops and sections of the factories.

Nevertheless, there may be urgent cases where direct communications between the factories or shops concerned are required. Appropriate procedures should also be established to make direct communications and necessary adjustments between the factories concerned and thereby take immediate actions in response to the urgent requirements.

4) Monthly and Annual Reports

Daily, weekly and monthly production reports are submitted to the factory superintendent or the deputy superintendents of the respective factory. These reports only contain production volumes and do not include the description on the causes of any differences between the plan and the actual production or any measures taken to improve production activities. Nevertheless, the general report of No.4 HI submitted to the Headoffice included the description of reasons on any difference which occurred between the plan and actual production and also the proposal of measures to be taken for improvement. It is recommended that these reporting systems be widely adopted at all the factories.

The production of No.4 HI was hindered by a delay in the delivery of pressed parts supplied from No.1 HI. Under this background, No.4 HI proposed to consider the following measures in the aforesaid annual report submitted to the Headoffice.

1. The workload on the presses should be studied and the allocation of press work to other factories should be considered if the presses are found to be overloaded.

2. The use of special vehicles designed for transporting pressed parts should be considered so as to reduce damages during transportation.

3. Pressed parts should be inspected before shipping. (No inspection is conducted at No.1 HI.)

While it is certainly important to review the past production activities, it is more important to clarify those measures adopted to solve the problems and also to propose what measures should be taken in the following year in a view to reflecting such factors in the plan. Instead of blaming others for failure to fulfil the production targets, possible internal causes for the failure should be analyzed to take steps to rectify them. It is recommended that the weekly and monthly reports submitted to the factory superintendent from the shop managers should include the proposal for improvement of any problems encountered.

3-5-3 Production Control

(1) General

Production control means a series of activities to achieve the production plan by manufacturing good quality products in time and at possible lower costs using materials, facilities and manpower (the 3 factors of production) in an efficient manner. As any failure of one of these 3 factors leads to failure to achieve the plan, they must always function in harmony.

The present systems and problems of the following aspects and the direction of improvement are studied by taking the above viewpoints into consideration.

1. Production schedule control and procurement control

2. Material control

3. Quality control

(2) Production Schedule Control and Procurement Control

1) Establishment of Specific Unit Master

The specific unit master means the basic data defining the items and quantity of component parts and other materials, standard manpower requirements, lead time for processing, and the input position of individual parts and materials for manufacturing a specific product. In order to complete the specific product by a delivery time, based on the unit standard it must establish the standard work schedule of the respective process step, by defining the time requirements for processing, the time of obtaining rough products, and the time of issuing order for the production of rough products.

As no specific unit master nor standard work schedule is estabished yet, HIC has no practice to make systematic arrangements for the procurement of the rough products and component parts required. The following are examples:

a) No.4 HI issues the order of rough products and other parts required for one month production only at the beginning of every month.

b) According to the record in 1987, the supply of block and head for engines was delayed for one to four months due to a delay in the delivery of cast or forged rough products from No.3 HI.

If the standard work schedule is established, actual work schedule can be easily prepared by taking the optimum lot size for production into account. Since the HIC's products are standard ones, it may be easy to establish the standard work schedule. In addition, as the assembly of any HIC product can be completed within one day, it may be easy to define the respective dates for material arrangement, material delivery and commencement and completion of each step of work, based on the assembly date of a specific product.

In fact, No.3 HI prepares a standard process sheet named "Operation Process Sheet" for each product to clarify the standard process flow and the standard work time for each step of work. This should be extended to all of the factories, so that the unit standard can be

established at an early time. The specific unit master can also be used for inventory control. When defining the standard work schedule, it would be important to establish consensus through conference with the factories or shops supplying rough products or component parts.

2) Progress Control

It is a usual phenomenon that, even if the operation plan is well prepared with deliberation, it is often upset by unforeseen causes in the course of operation. Production activities can be hampered by several causes such as the breakdowns of machines, the sudden increase of defective products, delayed delivery of materials and sudden absence of workers. As the operation conditions are always changing, the operation is apt to deviate from the planned schedule. In order to achieve the planned production under these constraints, it is important to control the progress of daily work to meet the planned schedule on the basis of the specific unit master and standard work schedule as mentioned in the previous section.

To this end the progress control based on recording sheets is effective. It is a method for controlling the daily work so as to meet the planned schedule by checking whether the actual work is ahead or behind as compared with the planned schedule. At the HIC's factories, the staff assigned as the progress inspector are checking the progress of work in the respective shop. However, they never take action to rectify it even if there is a deviation of the work from the planned schedule. The important point of the progress control is to control the actual work so as to strictly conform to the planned schedule by taking such a resolute action as stopping the work if it is ahead of the planned schedule.

3) Delivery Control of Materials and Parts Procured from Outside Sources and of Rough Products and Component Parts Internally Manufactured

The Main items procured from outside sources are:

1. Imported raw materials and component parts
2. Imported auxiliary materials, tools and spare parts
3. Locally available raw materials, component parts and auxiliary materials

Besides those, some of the rough products and component parts are manufactured within the HIC's factories.

The procurement of raw materials and component parts from outside sources is performed by the Material Planning and Purchasing Section of the Production Department of the Headoffice in accordance with the finally adopted production plan. All of the imported raw materials and component parts are stored in the warehouse which is controlled by the Headoffice, and then supplied to the respective factories as required for achieving the planned production instructed with the MO. The procurement from local supply sources also is performed by the Headoffice, but the purchased materials are delivered directly to the warehouses of the respective factories. As the delivery of local materials is done in a fairly well organized manner, it does not bring about any problems hampering the production activities.

For the imports it takes about 16 months from the application of import to the arrival of purchased materials. Hence, in order to ensure a stable operation, it is necessary to maintain the inventory of imported raw materials and component parts for the production for six months. In actuality, however, it is impossible to maintain such a level of the inventory, since the imports are limited under the current stringency of foreign exchange. Under these situations, the production is affected by the availability of imported raw materials and component parts, because the operation is often discontinued due to the shortage of the raw materials and component parts until the next arrangements are made for the imports.

The raw materials and component parts procured from outside sources are supplied to the factories by the procedures described below.

Based on the MO, the Planning Department of the Headoffice issues the Technical Data and the Sanction for Raw Material and Component Part Issue to the Material Planning Sections of both the Headoffice and the factories. Meanwhile, on receipt of the MO, the Planning Department of the factories issues the Withdrawal Note for Raw Material and Component Part to the Material Planning Section requesting the delivery of the required raw materials and component parts.

With regard to the internally manufactured rough products and component parts such as the pressed parts manufactured at No.1 HI and supplied to No.4 HI, and cast or forged rough products manufactured at No.3 HI and supplied to No.4 HI, the Planning Department of the factory using these raw materials and component parts issues an order at the beginning of each month to the relevant factories in accordance with the monthly production plans.

The supply of the internally manufactured rough products and component parts are often delayed, and it upsets the work in the subsequent processes. The engine assembly line at No.4 HI came to a complete standstill due to the delay in the delivery of pressed parts for oil pans to be supplied from No.1 HI. The delay in the delivery of cast or forged rough products to be supplied from No.3 HI has also caused the stoppage of work in the machining section. Similar problems arose from within the same factory. For example, some parts for the watt-hour meters manufactured at the Watt-Hour Meter Manufacturing Shop of No.3 HI are plated at another shop in the same factory, and production is often hampered by the delay of the plating work.

In order to prevent such problems, the factory issuing the orders should confirm the strict observance of the delivery time at the time of order and an agreement should be made to change the delivery time if the supplying factory faces difficulty to meet the delivery time. It is important to repeatedly expedite the delivery after a delivery date has been thus fixed. In this context, the introduction of the come-up system should be useful. This system requires the filing of orders in the sequence of their delivery dates so that the order sheets are periodically checked to give advance warning to the supply side on a certain day before the delivery date.

(3) Material Control

This section describes only the warehouse control as the problems associated with the procurement have been mentioned in the previous section.

The main function of warehouses is to keep records of the items required to maintain the smooth production activities so as to be able

to respond to any requisition for the stored items. Another important function is to accurately feedback inventory information to the procurement section.

The Sanction for Raw Material and Component Part Issue and the Withdrawal Note for Raw Material and Component Part are used for the withdrawal of items from the warehouses. The warehouses ship the required items to the shop requiring the items. At the time of withdrawal, a Receipt, Issue and Expense Voucher is issued by the warehouse and signed by both parties, i.e., the warehouse and the receiving shop.

The major problems on the warehouse control are summarized below. These problems encompass the problems of storage and custody.

1) Inventory

One reason for failure to achieve a production plan is an inadequate inventory level. However, actual inventory levels vary extremely from zero to several times higher than the monthly requirement level depending on items. Since an appropriate inventory level is determined in due consideration of the production plan, production capacity and production record, it is difficult to discuss this aspect in broad terms. Nevertheless, in general, an appropriate inventory level should be the inventory of raw materials and component parts corresponding to the production for one and a half months to two months, assuming one month production as one-twelfth of the annual production.

2) Inspection upon Receipt

Although the incoming and outgoing checks are done on books, the actual verification is not strictly conducted. It is important to check the written records and the actual goods at the time of receipt so that all goods are ready for shipping on request. Apart from the confirmation of the received quantity, a visual inspection on the appearance should also be conducted at the time of receipt.

There are many cases where the defects of the component parts which were temporarily stored at the warehouses without the visual inspec-

tion on receipt are found at the time of use for assembling and it causes a delay in work to replace the defective parts with others. In order to prevent such problems it is recommended to adopt the system that the items not accompaning by a record of inspection on receipt will not be accepted for storing at warehouses.

In the main warehouse, a number of packages for the component parts imported from abroad are left unopened. They are opened just before the use for assembly. Even though there is a limit to storage space available, the check of the delivered quantity and the visual inspection of appearance should be conducted upon receipt.

3) Storage Conditions

Storing is improperly conducted at all the warehouses and shops. For example, finished or semi-finished parts are piled on the floor with their machining faces directly touching the floor, and thin plates for press, spring materials and wire rods for bolts and nuts are left outside for a long period of time. A large volume of pressed parts delivered from No.1 HI is piled on the floor at No. 4 HI and rust is highly noticeable.

It appears that some of the parts are unusable but they are still kept. Since the parts are not stored on a first-in first-out principle, there are some parts which have become unusable due to the deterioration of quality caused by lying in the lower layer for a long period of time. Possible measures to improve the storage conditions include the provision of storage shelves in the warehouses, prohibition of piling directly on the floor and the provision of pallets for the transportation and storage of component parts in the warehouses and shops. As no facility for moving materials and products is provided at any of the warehouses, the movement is conducted manually. It is recommended that monorail hoists be installed.

A system whereby the storage method, storage place, indication of quantity and indication of types of component parts are defined so as to practice "first-in, first-out", should be adopted.

4) Improvement of Movement Flow

Manufactured parts are currently temporarily stored at component storages in the shops and then supplied to the assembly shops on receipt of a withdrawal request issued by the assembly shops. This complicates the movement routes of materials and increases the transportation frequency, related paperwork and required manpower.

As there is no material handling equipment, such as pallets and containers, component parts are transported with no protective measures, resulting in the deterioration of quality. The movement routes of large and heavy component parts must be changed for rationalization as soon as possible. The recommendable system is that the workers of the assembly shops pick up the required component parts directly from the machine shops as required every time and the machine shops refill the component parts taken off by the assembly shops.

This system will not only eliminate the need for temporary storage but will also prevent the unnecessary accumulation of semi-finished products at assembly lines. In addition, as the number of unavailable parts can be clearly grasped, it will contribute to improve production efficiency.

(4) Quality Control

The Inspection and Quality Control Section of each factory's Planning Department is responsible for quality control. There are 108, 170 and 25 employees in these Sections at No.1, No.3 and No.4 HIs respectively, accounting for some 5% of all factory employees. The Inspection and Quality Control Section of No.3 HI has material test and material analysis laboratories. The staff and workers of the Inspection and Quality Control Section are assigned to shops in the factories and are engaged in inspection and Quality Control (QC) work in their respective locations.

Since no clear criteria on inferior products is provided, raw materials and component parts previously labelled as inferior are sometimes returned to production lines. The management's consciousness of QC should be improved in order to produce reliable products which are competitive in export markets.

The prevailing attitude towards QC is that it is a subject only for the Inspection and Quality Control Sections. Little consideration is given to the introduction of measures to prevent the deterioration of quality; such as the proper storage of imported materials and parts, protection of products during the transportation, prevention of rust and prevention of dust at the engine assembly line. The consciousness of QC is generally low. The QC should be performed at all stages from the receiving point of raw materials and component parts to the finishing process. The role and function of the Inspection and Quality Control Sections are to watch whether such activities are properly carried out or not.

The following are salient points of the underlying problems.

1) No Proper Utilization of Statistics on Inferior Products

Defective products found at the inspection stage should be either disposed of or remade. Although statistics are recorded on these, they do not serve any specific purpose. Statistics classifying the types and causes of defects should be prepared. Remedial measures to prevent the recurrence of defects should be implemented, starting with the most serious cause of those classified, in order to raise product quality.

2) No Implementation of Measures to Prevent Recurrence of Defects

Although HIC has a system that the discovered causes of defects are fed back to the responsible shops for correction, this system in fact, is not actually carried out. Although the Inspection and Quality Control Section should be responsible for the promotion of the system, no strict action is taken because the inspectors closely work with the shops belonging to the Production Department.

The Inspection and Quality Control Section should examine the QC system to be performed at the shops, guide them to perform the system and coordinate the shops to solve the problems related to the plural number of shops.

3) Lack of Work Standards

Only a few shops have their own work standards. While some shops have work standards provided by the Japanese companies assisting the Four Industrial Projects, most of these standards are not utilized. It is necessary to establish the work standards adaptable to the actual conditions.

4) Problems Resulting from the Provision of the 10% Allowance

Excluding large and/or expensive component parts, the shops are allowed to receive the raw materials, rough products and component parts with 10% surplus to fill the loss of defectives. If the defective rate is lower than the allowed 10%, the excess products can be later used to supplement any losses when the defective rate exceeds 10% so that the resultant defective rate will remain within 10%. As a result, there is no way of knowing the exact rate of defectives and this blocks the investigation of the causes of the defectives.

It is recommended to supply the raw materials and component parts without any allowance. Alternatively, for the shops where the production of defective parts is inevitable and the supply of parts to subsequent sections may be short, the provision of a special stock should be permitted so that any shortage can be supplemented by the special stock.

5) Unclearness of Quality Control Policy

There is a misunderstanding that QC means inspection. Quality can be interpreted to mean the quality of human actions, the results of which are embodied in products as good product quality. It is important to propagate this concept.

While stimulating workers to pay their efforts to improve their work at the shops, all the members led by managers always have to endeavour to think of work improvement measures and their implementation. In this context, it is necessary that the status of QC be clearly indicated in the management policy and that measures regarding product quality and QC activities be developed based on this policy.

As one of the QC activities, it would be effective to organize small groups of workers engaged in the same jobs in the specific shop which are led by the respective foreman and to stimulate their group activities to conceive and implement any measures for improving their work.

There are many examples of this activity successfully performed in Japan. For stimulating the attitude of employees, it is effective to introduce a system for employees' proposal on improvement which includes their presentation of the proposals to other employees and also awards for good ideas, thereby fostering the organized small groups to be active for the improvement.

To start with, it may be better to introduce this system into one or two shops, as a trial, rather than starting throughout all the factories. For an experiment, a model shop should be selected for review by all employees and then, the system should gradually be extended to other shops.

3-5-4 Facility Control and Maintenance System

The maintenance work is performed by the Electric and Service Group (E & S) of the Maintenance Section, which belongs to the Planning Department of each factory. This group is responsible for maintaining the production facilities and utility facilities (i.e., power, water, compressed air and fuel, etc.). Although these E & S Groups consist of a fairly large number of employees (30, 91 and 62 at No.1, No.3 and No.4 HIs respectively), they are engaged mainly in repair work and perform little periodical checks or preventive measures. Even when defective parts are found through the periodical checks, the replacement of worn-out parts is impossible due to lack of spare parts. As a result, all equipment is used until it actually breaks down.

Many spare parts are imported. Given the limited foreign exchange allocation, the purchase of spare parts tends to be considered of secondary importance, causing a chronic shortage of spare parts.

In addition, as the E & S Groups do not have their own workshops, they have to borrow the machines on production lines if the parts for repair are manufactured. This causes to disrupt the production.

It is essential to establish a comprehensive maintenance system, including the establishment of maintenance shops devoted solely to the manufacture of spare parts and repairing work and also the establishment of preventive maintenance system.

3-6 Present Conditions and Major Problems of Training and Personnel Control, and Direction of Improvement

3-6-1 Present Conditions and Problems of Training and Direction of Improvement

(1) Present Situations and Problems of Education and Training

The education and training activities conducted by HIC to develop its manpower are basically divided into O.J.T (On The Job Training) and Off.J.T. (Off The Job Training). In addition to general orientation at the time of employment, the necessary education and training are provided to the staff through O.J.T or Off.J.T depending on the technical and managerial requirements.

The O.J.T programs aim at the orientation of the required knowledge, technologies and discipline for the assigned job in consideration of the actual requirements of the work place. The trainers of the O.J.T programs are managers, supervisors or senior workers.

The Off.J.T programs are conducted to supplement the O.J.T programs, and take place not only within the organization of HIC but also at other educational institutions and companies both in Burma and overseas. One of the main training programs conducted by HIC is the training of technical skill for new employees who have just completed their secondary education.

All the factories have the Technical Training Center and trainees are assigned to the work place after two years of theoretical and practical training at these centers. Apart from the Technical Training Center, the Industrial Training Center was established in the vicinity of No.3 HI at Sinde under the grant aid of the Government of West Germany. This center has three year courses for students who graduated the secondary school to give training on the technical skills of machinery, electric and other fields. The graduates of this center are also employed by HIC.

The HIC's managers and senior staff have opportunities to receive the management training at the Central Institute of Public Services, the Trading Department Training School and the Management Course of the

Institute of Economics. Over 300 employees have been sent to more than 20 countries, including Japan, since 1973 to participate in technical or management training programs.

The problems of the training provided by HIC can be summarized as follows:

1. While the training of managers and senior staff is provided through the Off.J.T programs, including those held outside HIC, there is no clearly defined system to apply the newly acquired knowledge or technology to the actual work and, therefore, the results of training are not fully utilized.

2. The staff who have received training overseas tend to keep the newly acquired knowledge or technology to themselves.

3. Although all the training programs are planned by the Headoffice, they tend to fall short of fully reflecting the factory characteristics in terms of products and component parts, speciality of job, production facilities and organizational structure. In this context, the training programs seem to be inadequate. In addition, the sections responsible for conducting the training programs in the factories seem to be somewhat lacking in positiveness.

4. The training curriculums of the Technical Training Centers are oriented towards theory and the inadequate provision of textbooks and equipment makes it difficult to achieve the intended results. As only a few textbooks are available, only the teachers are provided with them, making the use of blackboards necessary. As a result, the teaching efficiency is poor and no sufficient preparatory or review work on the part of the trainees is possible.

5. In order to fully achieve the intended training results of the O.J.T. programs, the teaching side must have sufficient technical knowledge, training techniques and the ability to prepare proper training plans. However, these essential requirements are often lacking.

In general, the HIC's training activities are mainly on the training for the technical skill of workers, but little training for the managerial capability of managers, senior staff and field supervisors.

(2) General Problems of Employees

The general problems of employees are summarized below.

1. Managers must possess a thorough understanding of the nature of their work. In reality, however, HIC managers sometimes do not fully understand the required knowledge in such fields as worker control, job allocation, communication with subordinates and the promotion of job motivation, etc., leading to less care on effective control of workers. On the other hand, workers show little interest in proposing work improvement measures or making active efforts to improve their skills.

2. As the supervisors and foremen lack sufficient basic knowledge required for supervisory work, they tend to fail to motivate workers or to fully utilize their capabilities.

3. Due to insufficient knowledge of managers and senior staff regarding the required methods for industrial management, production activities in terms of product quality, cost and delivery time are inefficient.

4. As few technical training opportunities are provided for engineers after their employment, they have a limited scope of expertise for product development or improvement of production technologies, along with less accumulation of technologies.

5. Technicians are classified into secondary school graduates, Industrial Training Center (Sinde) graduates and those with previous work experience. The technical training provided immediately after the employment of these technicians is virtually their only training. As a result, their technical skills are not upgraded and their fields of work are not expanded. This situation has led to a decline of their morale and even to their moving to alternative employment, causing a shortage of skilled technicians.

(3) Direction of Improvement on Trainings

As already described, the discipline and attitude of employees are important to achieve high productivity. In order to upgrade the employees' capability and stimulate their attitudes, it is recommended that the following objectives be included in the HIC's training programs.

1. Improvement of managerial capability
2. Improvement of supervisory capability
3. Learning of control techniques
4. Improvement of skills
5. Improvement of engineers' technical expertise

3-6-2 Present Conditions and Major Problems of Safety Control and Environmental Control

(1) Underlying Problems Related to Safety Control and Environmental Control

The responsibility for safety and environment control is assigned to the Administration Department of each factory. There are no uniform safety standards and those standards prepared by each factory or department and approved by the Administration Department of the respective factory are enforced. Although managers and supervisors are responsible for the maintenance and improvement of work safety and the working environment, there is no internal communication system nor workshop programs for the uniform application of safety and/or environment standards. There are no safety and health statistics which are available for the safety and environmental control. No safety education is provided.

It appears that managers, supervisors and ordinary workers are not very concerned about safety consciousness, or giving safety the highest priority. For example, the need for protective goggles is well recognized by managers or supervisors but work is conducted without them being worn due to their shortage. This presents one typical problem to be considered by the managers or supervisors.