FINAL REPORT
FOR
THE STUDY
ON
THE RENOVATION OF
THE FOUR INDUSTRIAL PROJECTS
IN
THE UNION OF BURMA
(Volume IV)

Annex 2

DETAILS OF
PRODUCTION CONTROL DIAGNOSIS

April 1989

JAPAN INTERNATIONAL COOPERATION AGENCY
Tokyo, Japan

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Chapter 1 PRODUCTION SCHEDULE AND PRODUCTION CONTROL

1-1 Current Position of the Production System

1-1-1 Definition of Production Targets

Broadly speaking, the products of HIC consist of capital goods and consumer goods.

The capital goods of the company consist of vehicles, machinery and tools, agricultural machinery, pumps, transformers for substations, etc., and on the other hand the consumer goods consist of such home appliances as dry cell batteries, incandescent lamps, fluorescent lamps, irons, rice cookers, etc., as well as hoes and other hand tools.

The demand of these capital goods is forecasted based on the medium-term investment plans of the various corporations, data of the Equipment Control Committee, and data related to private and civilian demand published by the trade corporations and the Central Cooperative Society-Coop.

On the other hand, the demand of consumer goods is forecasted based on the annual demand projected by the Central Cooperative Society-Coop and by taking into consideration statistical data of the past.

The annual production schedule of the HIC is determined in the form of medium- and long-term schedules, on the basis of the aforementioned demand forecast data.

The required costs of various kinds should be estimated in conformity with the planned production for the sake of preparation to request budget to the various government offices concerned.

1-1-2 Approval of Production Targets, Raising of Financial Resources and Procurement of Materials

It is very important to obtain the approval of the financial resources to purchase raw materials and component parts, especially the quota of hard currency required for the purpose.

Since most of the products manufactured by HIC depend on a commodity loan from Japan for purchase of component parts and raw materials, the ultimate production plan remains undecided until the Yen loan is provided by Japan.

The production plan and the relevant budget is submitted, in the form of budget request, to the Ministry of Planning and Finance via the government office in charge of the matter (the Second Ministry of Industry).

Requests from the various ministries are sorted out at the Ministry of Planning and Finance and are submitted to the Economic Coordination Committee, and after being approved by the cabinet meeting and the People's Assembly the budget of the next following is homologated and the production plan is approved.

The procurement of materials and parts depending on commodity loan of Japan takes a long time because it requires a series of procedures ranging from the submittal of the loan application to the Government of Japan to the relevant agreement.

Approximately 16 months are required in average from the submittal of the commodity loan application to the arrival of the actual articles at the HIC's plants.

It is indispensable to keep an inventory corresponding to at least 4 months of production in order to maintain continuous and stable production.

It must be borne in mind, however, that as things stand the inventory is extremely small because production is given priority as long as materials are available.

Such being the case, production is conspicuously influenced by the epoch of arrival and the quantity of the required materials because during some

epochs the plant is forced to remain idle while awaiting the arrival of the materials.

1-1-3 Confirmation and Notification of the Production Schedule

The annual production schedule of HIC is decided after the approval of the government budget, and HIC is alloted with foreign currency required to import raw materials and component parts in conformity with the said production schedule, and then HIC carries out the production within the limits of the available raw materials and component parts. Directions referring to the annual production schedule are notified to the various internal sections of HIC according to the steps of procedure mentioned in the followings.

The INFORMATION FLOWCHART was obtained from HIC. (Figure AII-1-1-1(1)-(3).

The production schedule is notified in conformity with steps 1 and 2 of Figure AII-1-1-1(1).

In other words, the Sales Section of the Manufacturing Department signs the sales contract with the customer and then the relevant directions are given by issuing the Job Order/Work Order to the Technical Planning Section, the Economic Planning Section and the Production Department of the Head Office.

The Technical Planning section issues the Manufacturing Order (M.O.) in response to the said Job Order/Work Order, to give the sections concerned directions referring to the items and number of units to be manufactured, the term of delivery and other relevant details.

The sections indicated on the information flowchart which the M.O. must be distributed to are specified together with the Manufacturing Order, mentioned later on, issued independently by the plant.

The manufacturing order issued by the Head Office (called Main Manufacturing Order to distinguish it from the manufacturing order issued by the plant) should be distributed to the following sections.

Sections which manufacturing order should distributed to

1. No. ____ HI
2. Planning Department HIC
3. Production Department HIC
4. Finance Department HIC
5. Design HIC
6. Sales HIC
7. (____) Copy

In response to the Main Manufacturing Order of the head office the Planning Department of the plant issues its own manufacturing order to the manufacturing sections of the plant giving directions on the number of units to be turned out per year and the terms of delivery. As a result the annual production schedule is notified down to the smallest detail in companywide scale.

The Manufacturing Order issued by No.3 HI contains directions on the following matters.

Items included in the directions		
1. Name and quantity of the product	:	Diesel engine Model KND5B 6000 units
2. Points of production	:	Parts imported from Kubota, Ltd. of Japan and domestic parts should be used.
3. Points of the inspection	:	Total inspection should be carried out at the Inspection Department.
4. Place of delivery	:	No.3 HI Manufacture Store
5. Start of the production	:	Within 3 days after receiving the Manufacturing Order
6. Term of delivery	:	By the end of December 1986, with delivery starting July 1986.

The manufacturing orders issued by the plant are distributed to the following sections of the plant.

Sections which the manufacturing order should be sent to

(1) Production Department No. ( )/( )/( )
(2) Material Planning
(3) Material Store
(4) Inspection Section
(5) Technical Section
(6) Assembly Shop No. ( )
(7) Audit Section
(8) Office Copy

The sections of Figure AII-1-1-2 and Figure AII-1-1-3 encircled with rectangular frames are those ones on the organization chart to which the Manufacturing Order should be distributed to.

Figure AII-1-1-2 shows the sections which the Main Manufacturing Order issued by the Head Office should be distributed to, and Figure AII-1-1-3 shows the sections which the Manufacturing Order issued by the Plant should be distributed to.

There is discrepancy between Departments and/or Sections used in the Manufacturing Order and in the Organization Chart.

1-1-4 Implementation Plan of Production Schedule

The Planning Department of each plant determines an appropriate production lot size of each based on the annual production schedule, takes measures to level the operation load inside the plant, determines the monthly production schedule and submits it to the Planning Department of the Head Office.

The Planning Department of the Head Office holds monthly production coordination meetings with the plants with the object of realizing overall coordination and levelling off the operation. Based on the Monthly Production Schedule the Planning Department of the plant gives each shop directions in the form of Monthly Targets. Each shop defines the weekly schedule and the daily schedule and the shop manager gives daily directions to each line and each worker in the form of a daily quota.

According to the hearing survey carried out at HIC and the various plants the production schedule ought be converted into an implementation according

to the aforesaid steps of procedure, but the system in operation is actually different and various problems occur as a consequence. The problems are mentioned later on.

1-1-5 In-House Procurement of Raw Materials and Component Parts

The procurements of HIC are classified in 4 groups.

(1) Imported raw materials and component parts
(2) Imported auxiliary materials, tools and spare parts
(3) Domestic raw materials, component parts and auxiliary materials
(4) Internal production of HIC

These procurements are delivered to the plant according to the steps of procedure described in the following. The steps of procedure related to the stock control and the applicable slips are explained by referring to the information flowchart Figure AII-1-1-1(1)-(3). The steps of procedure in question correspond to steps 3-12 in the figure.

Based on the Manufacturing Order the Design Section of the Planning Department issues the Technical Data, Operational sequence and the Design to the Technical Planning Section, Production Department and Inspection Section. (Step 3 in the Figure)

The Technical Planning Section sends the Material Planning Data to the Manufacturing Department and at the same time it sends the Sanction for Material Issue and the Sanction for Component Issue to the Material Planning Section and the Production department. (Step 5)

The Manufacturing Department asks the Material Planning Section for withdrawal of materials and components by issuing the withdrawal note for material and the withdrawal note for component. (Step 6)

In turn, the Manufacturing Department asks the Material Planning Section and the Manufacture Store for withdrawal of domestic/imported parts by issuing the withdrawal note. (Step 12)

The various manufacture stores deliver the required quantities of required items to the manufacturing department, according to the request for delivery issued by the latter one. The imported raw materials are kept in the

main store of HIC, and are delivered to the various plants according to the request for delivery.

On the other hand, parts supplied by other plants of HIC (e.g. pressed parts delivered from No.1 HI to No.4 HI) are at once sent to the component store.

As for parts worked in the plant itself and used in the same plant, they are pooled once and then they are delivered to the assembly line according to the request of the line in question.

The aforementioned slips are used for the sake of warehousing and delivering a series of raw materials and component parts but besides them the view card and the stage card are the other slips related to production control used to notify the inspection results in process to the manufacturing department.

The view card is used to notify the inspection results of the finished parts, and the stage card is used to notify the inspection results at the work stage specified in the work instruction sheet. In general these inspections are carried out as one of the ordinary stages of the manufacturing process.

Tools, gauges, apparatuses and the like required for the production are delivered to the production department by means of the Department Stores Requisition.

The Outward Convoy Note is issued in correspondence to articles transported between plants to secure their safety.

Besides the aforementioned slips there are many others related to such aspects as quality control, repair of the equipment, etc.

Figure AII-1-1-1(1) INFORMATION FLOW CHART

Execution of Firm Orders & Production Inventory System of HIC

LEGEND: ○ Originate
● File
□ Action Taken

Step		Customer	Sales	Economic Planning	Technical Planning	Design	Production Dept.	Material Planning	Inspection	Manufacture Store
1.	Sales Order/ Sales Contract Job Order/Work Order									
2.	Manufacturing Order Work Order/Job Order									
3.	Issuance of Technical Data Operational Sequence and Design									
4.	Progress Chasing									
5.	. Issue of Material Planning Data . Sanction for Material Issue . Sanction for Component Issue									

Source: Information Flow Chart (HIC)

(Continued)

Figure AII-1-1-1(2)

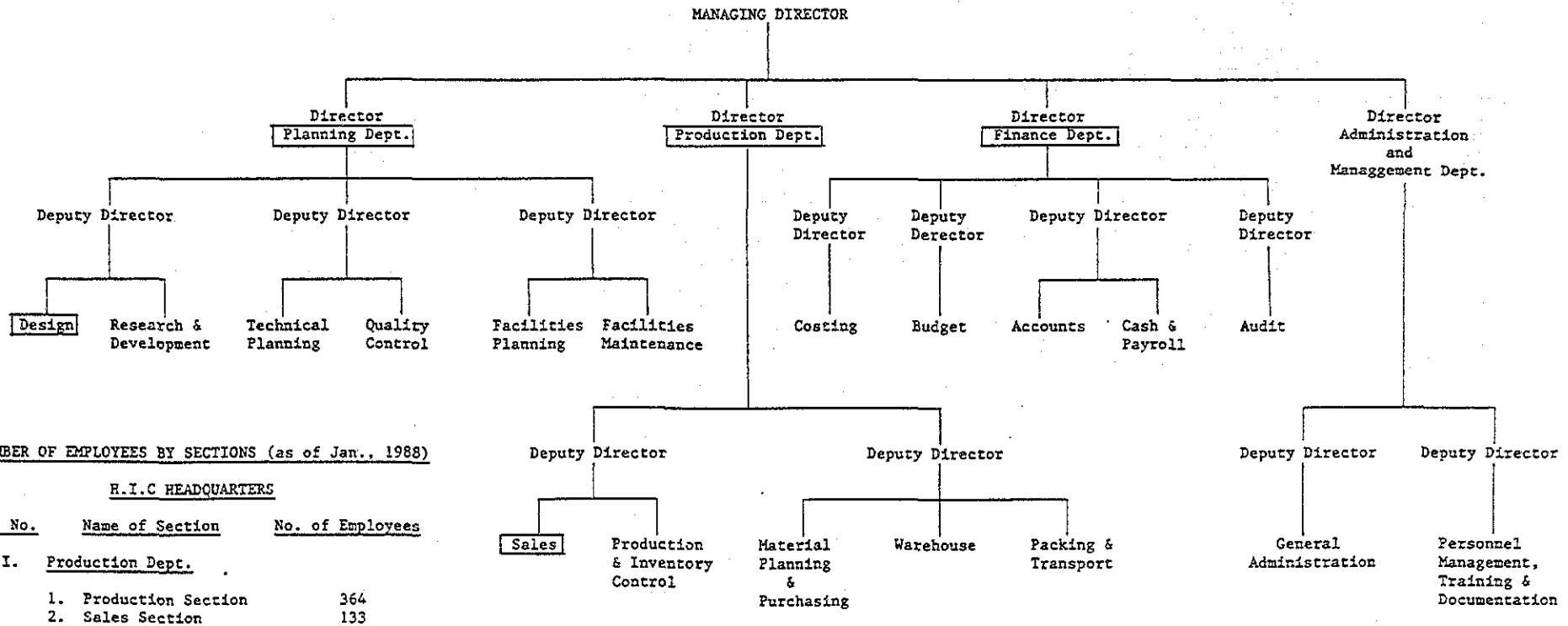
Step		Customer	Sales	Economic Planning	Technical Planning	Design	Production Dept.	Material Planning	Inspection	Manufac-ture Store
6.	Issuance of Material Withdrawal Notes for Withdrawing of Material based on Manufacturing Order/ Work Order									
7.	Withdrawal Notes for Withdrawing of Expendable Stores Booked on Factory Expense Service Order									
8.	Route Card (for Job Product)									
9.	Stage Card (for Mass Product)									
10.	View Card									
11.	Finished Component Issue Receipt Voucher									

(Continued)

Figure AII-1-1-1(3)

Step		Customer	Sales	Economic Planning	Technical Planning	Design	Production Dept.	Material Planning	Inspection	Manufac-ture Store
12.	Withdrawal Notes of Local Manufacture/ Foreign Imported Component									
13.	Inspection Certificate									
14.	Finished Product Issue Voucher									
15.	Costing									
16.	Issue of Finished Product									

Figure AII-1-1-2 SECTIONS WHICH THE MAIN MANUFACTURING ORDER (ISSUED BY THE HEAD OFFICE) SHOULD BE DISTRIBUTED TO (SECTIONS ENCIRCLED WITH RECTANGLES)



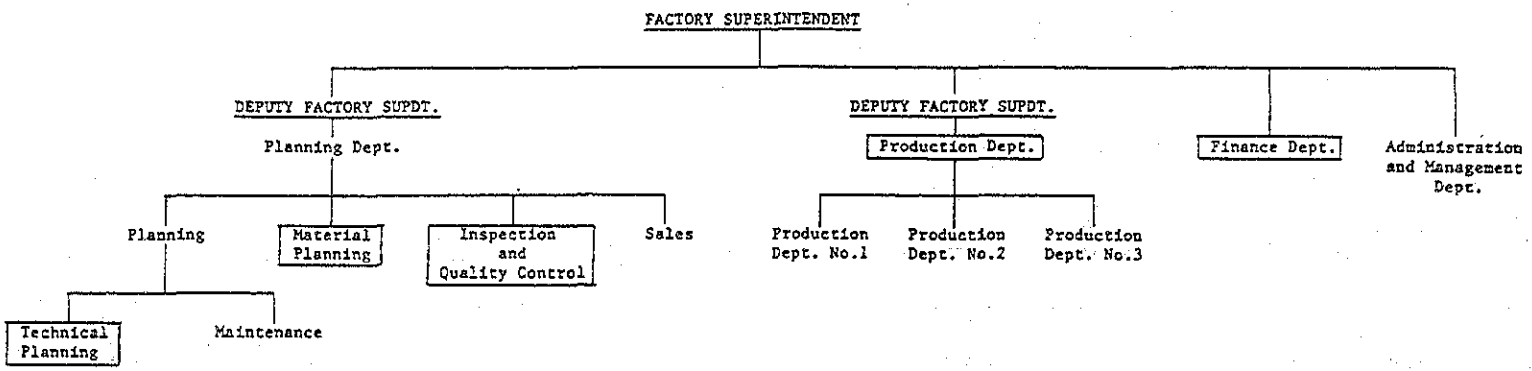
NUMBER OF EMPLOYEES BY SECTIONS (as of Jan., 1988)

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

Source: Organization Chart (HIC)

Figure AII-1-1-3 SECTIONS WHICH THE MANUFACTURING ORDER (ISSUED BY THE PLANT) SHOULD BE DISTRIBUTED TO (SECTIONS ENCIRCLED WITH RECTANGLES)



Capital Investment (as of March, 1987)

(Unit: Million Kyates)

Sr. No.	Description	Local Currency	Foreign Currency	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

Source: Organization Chart (No.3 HI)

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 Hant 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 Foundary 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

1-2 Problems of the Production Schedule

1-2-1 Production Schedule

(a) Compatibility and Sharing of the Production Schedule

Such "self-contained" commodities as dry cell batteries, incandescent lamps, fluorescent lamps, etc., that are turned out by means of an integrated manufacturing process ranging from raw materials to finished products present no major problems in connection with the production schedule, but such products as light vehicles and heavy vehicles, whose manufacture involves various plants of HIC, present problems related to the production schedule.

For example, pressed parts turned out at No.1 HI are manufactured in two massive 6-month lots coping with the whole annual production because changing the dies takes too much time.

Consequently, the vehicle assembly line of No.4 HI suffers stoppages and there are problems related to the production because some surplus pressed parts are piled up beside the assembly line whereas other necessary pressed parts are not supplied on time.

This is because there is not compatibility between the production plans of the various plants, and the line load is not properly shared.

(b) Coordination of the Production and Feedback

We were told that production coordination meetings are held every month between the various plants and the planning department of the head office with the purpose of examining such aspects as the revision of the production schedule of the current month based on the production performance of the previous month and the delivery plan based on the marketing information, but the reality seams to be different.

The production schedule and the actual production performance of Diesel engines of No. 5 Manufacturing Department (Diesel Engine Plant) of No.4 HI obtained through a hearing survey is shown in the next table (Table AII-1-2-1).

Table AII-1-2-1 PRODUCTION SCHEDULE/PRODUCTION PERFORMANCE OF DIESEL ENGINES IN '87/88

Unit: set

Production schedule/Production performance — Year	1987									1988
Month	4	5	6	7	8	9	19	11	12	1
Production schedule	96	120	120	100	100	80	96	54	43	29
Production achievement	67	100	100	79	50	60	42	11	14	9

As far as data contained in the table above is concerned, no efforts are being made in the Production Coordination Meeting to increase the production schedule of the current month or the next month to make up for the decline in the production performance of the previous month.

Diesel engines turned out at No.4 HI are used for the sake of final assembly of heavy vehicles at No.1 HI, but engines are assembled as planned at No.4 HI even when the pace of assembly of vehicles slows down, and as a consequence many engines are piled up at No.1 HI and No.4 HI as semi-finished products.

In particular, in No.4 HI there are 169 units of Diesel engines, including rejects, piled up without proper dust protection and anti-corrosive protection, and such quality deterioration problems as penetration of foreign matter from the openings, rusting, etc., occur.

The next table (Table AII-1-2-2) shows the output of heavy vehicles finished at No.1 HI and Diesel engines assembled at No.4 HI. The number of units of Diesel engines in progress between the two plants is not taken into consideration, but data considered shows there is overproduction of engines compared with the production of vehicles.

Table AII-1-2-2 COMPARISON OF THE PRODUCTION OF HEAVY VEHICLES AND ENGINES

Unit: set

Year	1987									1988
Month	4	5	6	7	8	9	10	11	12	1
Vehicles assembled	44	42	62	64	57	62	41	21	37	16
Engines assembled	67	100	100	79	50	60	42	11	14	9

When the final assembly line is operating behind schedule measures must be taken to make up for the delay, and when the said measures are impracticable prompt and proper steps must be taken to prevent overproduction from occurring in the previous process, and depending on the case directions must be given to stop the operation of the assembly line of the previous process.

(c) Directions for Production

The production schedule of Diesel engines for agricultural machinery in 1986 consists of 5300 units, but the manufacturing order issued by No.3 HI contains directions to assemble 6000 units of engines of this kind.

No.4 HI has taken steps for the No.1 HI press shop to produce 10% more small-sized pressed parts than originally stated in the production schedule. Thus production quantities in the manufacturing order are often different from those in the production schedule and as a consequence the shop is being forced to maintain a warehouse under its direct control called a sub store to store the surplus production.

Even if they were small-sized pressed parts, any quantity surpassing the production plan exerts a negative influence on the schedule as a whole. It contains negative factors from the standpoints of quality, transportation, etc., and it is particularly important to make efforts to eliminate each one of these factors and realize the production as planned.

(4) Stock and Production Plan

The relation between the production schedule and the quantity of imports is examined for the Diesel engine DS-70 for vehicles by making use of data obtained this time.

The next table (Table AII-1-2-3) shows the relation between the production schedule, number of imported units, production performance and delivery record in the last 3 years.

Table AII-1-2-3 RELATION BETWEEN PRODUCTION SCHEDULE/NUMBER OF IMPORTED UNITS/PRODUCTION PERFORMANCE

Unit: set

Year		1984-1985	1985-1986	1986-1987
Diesel Engin DS-70	Production schedule	961	798	847
	Stock	169	223	252
	Number of imported units	800	800	700
	Production performance	704	798	822
	Number of units delivered	746	769	786

The production schedule (961) for 1984-1985 shown in the table is larger than the number of units imported (800), but this is presumably attributable to the existence of the produced stock of the current year consisting of 169 units.

Such being the case, the production schedule is formulated in such a way to cover the number of units imported summed with the produced stock.

The production schedule of 1985-1986 ought to be larger by taking into consideration the produced stock.

The production schedule for 1986-1987 is formulated by taking into consideration the production stock accumulated up to the previous

year. As long as these data are concerned the production stock seems to be taken into consideration, in spite of some minor differences from year to year. As for the actual production performance, however, data of No.4 HI for the said 3-year period contain 122 less units than data obtained from the head office.

1-2-2 Procurement Control

(1) Timing of the Reception of Materials and Component Parts

It was learned that at the Diesel engine manufacturing department of No.4 HI the materials and parts required during the current month are received in one lump at the beginning of the month based on the production schedule.

On the other hand, from the standpoint of the state of supply of materials of No.3 HI, the production schedule of castings and the like are set at approximately 70% of the production capacity. It must be borne in mind, however, that the actual production performance is of the order of 40%-70% (there are fluctuations according to the line).

The influence of the said fact is shown in the next table (Table AII-1-2-4), in the form of surpluses of the parts' processing line.

Table AII-1-2-4 PROCUREMENT PERFORMANCE OF MATERIALS

Unit: lot of parts required for one vehicle

Year/ Month	1987												Annual total	Monthly average
	1	2	3	4	5	6	7	8	9	10	11	12		
Production schedule	100	100	120	96	120	120	100	100	80	96	54	43	1129	94
(C) Block	75	64	87	48	47	0	0	24	67	87	29	31	559	46
(C) Head	85	85	57	76	49	13	56	0	44	56	38	43	602	50
(C) T/G Case	47	0	158	57	14	58	20	43	34	59	61	75	626	52
(C) Clutch housing	97	113	54	91	48	19	31	34	58	79	57	67	748	62
(F) Con-Rod	54	70	137	34	110	260	26	0	0	0	0	4	695	57
(F) Ring gear	120	102	0	0	104	0	69	100	0	54	67	0	616	51

The said situation is attributable to various causes, but the most important factor is presumed to be the absence of a firmly established standard schedule.

It is necessary to determine how many days beforehand materials must be obtained to complete the production within the term of delivery, and how many days beforehand the required arrangements must be made to obtain the required materials on time. It is necessary to determine, for each products and for each parts, the date when the arrangements to procure the required materials must be made, the date when they must be received, the dates when the machining must be started and finished.

Inasmuch as products manufactured at HIC are massproduced once, the schedule can be automatically determined from the lot size once the specific "unit master" is prepared.

It is necessary to prepare as soon as possible basic data required for the sake of schedule control.

The specific "unit master" consists of the basic data defining the list of parts that compose 1 unit of the product, the required quantities, the standard number of man-hours, the lead time, the line which the parts must be supplied to, etc.

The document named "operation process sheet" is being prepared for each product at No.3 HI, in an attempt to identify the standard time. Should this initiative be expanded on a companywide scale, it would be possible to prepare the specific "unit master" within a relatively short time.

(2) Production Co-ordination with the Final Assembly Line

The aforementioned vehicle assembly line of No.4 HI is stopped because improper supply of pressed parts, because of the delay in the supply of machined parts in the assembly line of fans and Motors manufactured at No.3 HI, etc., and parts in progress are being kept at 42 places in the factory.

The said problem occurs because the required parts are not fed in accordance with the schedule of the final assembly line. It is particularly important to co-ordinate the production of parts in accordance with the schedule of the final assembly line.

The system using "unit master" makes it easy to co-ordinate the productions.

(3) Reminder of the Term of Delivery

In house production of HIC accounts for the most important problem in cases of delay in the delivery of received parts. Thus, the assembly of engines for vehicles becomes impracticable at No.4 HI due to the delay in the delivery of such pressed parts as oil pans, head covers and the like from No.1 HI, and as a consequence it becomes unavoidable either to stop the assembly line or to go on with the assembly process with some missing parts.

Delay in the term of delivery is not limited exclusively to products whose manufacture is spread throughout various plants. The same problem occurs also between different shops within the very same plant.

For example the base assembly, terminal cover and other parts of the watt-hour meter involves plating processes. The assembly process as a whole may be disturbed because the plating process is carried out at other shops, and in some cases the required parts are not delivered on time.

In general, exchange of information between the various plants of HIC is not active. Inasmuch as the flow of information takes place via head office it becomes outdated in most of cases. In urgent cases it is necessary to keep close contact between plants and between shops for the sake of prompt coordination and feedback.

The party issuing the order must make sure of the observance of the term of delivery specified on the occasion of the procurement, and moreover even when the term of delivery is agreed upon it is necessary to remind it prior to the delivery.

As things now stand the term is not being systematically reminded.

1-2-3 Schedule Control

(1) Perceptible Control

Every shop of the plants of HIC has a person named "progress" who identifies the daily production performance and reports it to the shop manager and the plant manager.

The shop manager submits a weekly report to the plant manager.

In turn, the plant manager submits a monthly report to the Technical Planning Section of the Planning Department.

The No.3 HI No. 1 Manufacturing Department issues daily, weekly and monthly reports using fixed forms. It is sufficient to check only the

production performance when everything is progressing as scheduled but it must be borne in mind that in actual manufacturing plants things do not progress as scheduled due to the influence of various factors. As control data was not available during our survey it is impossible to judge whether the actual progress of work is before or behind schedule was available in the plants visited.

Inasmuch as control data are being collected every day, it is highly recommendable to rearrange them in a visible form and to use them as control parameters.

(2) Lack of Attention to the Standard Man-Hours

The document named "process manual" is being used in the plants, but the control is being carried out mainly in terms of output because control data using time (or man-hours) as a factor are not properly arranged. Under the circumstances chronological control which consists of determining how to restore the system to normal state in the case of a delay is not being carried out systematically.

1-2-4 Control of Materials

(1) Stock

Insufficient stock of parts is one of the reasons why the production schedule is not realized.

Moreover, there is imbalance between the stocks of the various kinds of parts. Whereas some parts are running out of stock, there are other parts with stock mounting to various times the monthly production schedule.

Stock control is satisfactory as to stock listing in all stores, but in reality the stock ledgers are not being collated for verification with actual inventory.

In order to ensure perfect control of the stock, the actual goods must be collated with stock lists when warehousing them, and furthermore it is especially important to have perfect control of the situation also on the occasion of the delivery.

Conversely, accurate feedback of the stock to the procurement sections is another function of vital importance of the store section.

(2) Storage Control

There are some parts stored in the plants that are being placed directly on the floor with the machined side facing down or piled one on the other.

Some of these parts are badly rusted and beyond use.

Furthermore, such materials as steel plates for pressing, wire rods for bolts and nuts, etc., are rusted and their quality is deteriorating because they are being stored outdoors for long time.

It is necessary to establish an adequate storage system with proper handling of the stored goods in accordance with the first-in/first-out system.

(3) Control of Material Handling

In connection with the flow of the goods, it is necessary to modify the current system which consists of temporary storage of the machined parts in component store into a new system which consists of feeding them directly to the assembly line.

The said modification would not only reduce the frequency of transportation and the procedural steps relating to slip, but would also facilitate the introduction of a system direct dispatch to machine shop to take the parts required at the assembly line. Furthermore, as it will become unnecessary to pile up the product in progress, the quantities of parts in shortage will be clearly known, and the production efficiency is expected to make remarkable progress.

As things now stand the stores have practically to transportation equipment and most of the work is done by human power, and it is urgently desirable to install conveyance equipment also from the standpoint of safety.

Inasmuch as the parts are being transported bare because there is no material handling equipment such as pallets, containers and the like,

they are frequently subject to dents and other troubles, and there are frequently problems from the quality standpoint.

(4) Stocktaking

HIC takes an inventory at the store once a year and collates the stock ledgers with the actual goods.

It must be borne in mind, however, that there are goods obviously idle being kept in the store.

Idle goods must be disposed of and cancelled from the stock ledgers, and the stock should be limited exclusively to useful goods. Furthermore, once a year it is also necessary to take an inventory at the sub stores mentioned before.

(5) Receiving Inspection

Not only the quantities but also the appearance of the goods should be inspected without fail for dents, corrosion and other defects due to warehousing.

The parts is rectified when parts fed from the store to the assembly line are defective. It is recommendable to adopt a new system which consists of refusing to stock parts not accompanied with inspection record in order to avoid the said problem.

As things now stand parts imported from Japan are being stored in unopened crates, and they are unpacked right before the assembly. In this connection it is necessary to adopt a new system which consists of checking the quantity and inspecting the appearance without fail when they are received, and reporting the results to the parties concerned.

1-2-5 Information Control

(1) Insufficiency of Information Equipment

Transmission of information is the most important factor for the sake of production control.

As things now stand no copying device is working properly and when copies are needed they are either typewritten with carbon paper or handwritten.

There are few telephones in the company, and transceivers are being used for the sake of communication between plants.

Most of the communications between the various parties are done verbally because of the difficulty to convert the relevant contents into documents.

No information equipment is available at all in the offices of the various shops and in the offices of the stores.

Besides establishing the production system it is also necessary to take urgent measures to introduce information equipment.

(2) Shortage of Data

There are very few quality statistics and equipment statistics, and this is attributable to the lack of copying device.

It is necessary to make proper use of data for the sake of improvement and upgrading of the production activities.

For further details refer to CHAPTER 3 PLANT EQUIPMENT AND OFFICE EQUIPMENT and CHAPTER 4 QUALITY CONTROL of this document.

(3) Slips

Mixture of slips of both old type and new type seems to be in use, and there is too much variety and subdivision of slips.

Furthermore, too much manpower is required to handle the slips.

In every office used slips and data are bundled and piled up in racks, and it is very difficult to take them out when necessary.

Files and cabinets are insufficient and systematization of the office sections is be lated.

(4) Report of the Production Performance

As mentioned before, the production performance is notified to the executives in the form of daily reports, weekly reports and monthly reports. The contents of these reports consist of the number of finished units, number of scheduled units, number of delivered units, etc.

Daily report aside, in the weekly report and monthly report it is recommendable to improve the quality of the information contained therein by including such details as the causes of the difference between schedule and acual performance, particularly the state of the delays in terms of delivery, quality, etc., besides merely mentioning the number of units finished.

In this connection it is particularly important that the executives put the blame of the failure to attain the planned targets not only on third parties, but accept their own responsibility. If the monthly production coordination meetings could be held by taking into consideration information of the plant floor, they would be much more productive.

The report referring to the 1986 term submitted by No.4 HI to the head office mentions the causes of the discrepancy between the production schedule and the actual production performance and suggests means for improvement.

The report indicates the monthly production performance of light vehicles, storage batteries, engines for vehicles, piston/piston ring that are the products of No.4 HI and mentions the rate of attainment of the production schedule, the discrepancies between the production schedule and production performance, the cause of the discrepancies and the measures to improve the situation.

The discrepancies, their causes and the means to improve the situation are mentioned in the following.

1) Vehicles

a) Schedules for assembly and coating of the vehicles cannot be formulated due to delays in the delivery of pressed parts.
b) The pressed parts are not inspected before their delivery from No.1 HI.
c) The conveyance equipment are not sufficient.
d) The pressed parts are frequently damaged during the transportation.
e) The working load of the press machine of No.1 HI should be adjusted, and the possibility of transferring part of the work load to other plants should be examined if the capacity of the machinery is found insufficient.
f) The pressed part should be delivered at least 2 months before final assembly.
g) It is indispensable to inspect the press die and trimming die before delivering the pressed parts to No.4 HI.
h) It is necessary to consider the introduction of special-purpose vehicles for transportation of pressed parts.
i) Welding jigs and assembly jigs should be prepared for new design models.

2) Storage Battery

a) (Cause of the discrepancy between production schedule and actual production performance)
Only 41.2% of the required quantity of pure lead was delivered.
b) Only 37.8% of the required quantity of High Speed Diesel Oil (H.S.D.O.) was delivered.

Under the present circumstances, no sufficient measures have been taken yet for this recommendation.

1-2-6 Quality Control

See Chapter 4 for details.

1-2-7 Control of Equipment

See Chapter 3 for details.

1-3 Improvement of the System

Judging from the result of factory screening undertaken at this time, construction of the seven production systems described below is necessary.

In other words, it is necessary to improve the production systems so that given materials, equipment and personnel can be organically linked up to undertake efficient production activities with a view to attaining the annual production target coordinated for the entire company.

1-3-1 Production Schedule

Creates a system to formulate a co-ordinated production schedule compatible in companywide scale.

1-3-2 Procurement Control

Creates a system to feed the required materials at the required time in order to realize the production schedule.

1-3-3 Schedule Control

Creates a system to identify clearly the discrepancies between the production schedule and actual production performance and to take systematic actions to eliminate any discrepancies and attain the scheduled production targets.

1-3-4 Control of Materials

Creates a system to identify the location and the quantities of actual goods such as the materials, products in progress and finished products, to secure their stable supply to the next process, and to prevent deterioration of quality during storage.

1-3-5 Information Control

Revises the slips used in the production process and takes measures to simplify their flow in conformity with the availability of information equipment and the production system to be constructed.

A filing system should be set up as well.

1-3-6 Quality Control

See Chapter 4 for details.

Creates the system to reduce the reject rate and to improve quality, and takes measures to upgrade the level of consciousness relating to the quality.

1-3-7 Control of Equipment

See Chapter 3 for details.

Creates the system to maintain and to control the equipment in best condition in order to attain the goals of the production schedule.

Chapter 2 PLANT, FACILITIES, EQUIPMENT AND THEIR LAYOUT

2-1 Location and Arrangement of the Plant

As can be seen from Figure AII-2-1-1 (location of the plants), No.1 HI is located in the Rangoon district, and on the other hand No.2 HI is located in the Malun district approximately 300 kilometers to the north of Rangoon.

No.3 HI is located in the Sinde district approximately 200 kilometers to the north of Rangoon, and No.4 HI is located in the Htonbo district approximately 50 kilometers to the south of No.4 HI.

Furthermore, No.5 HI is located in the Nyaungchidank district approximately in the midway between No.3 HI and No.4 HI.

Finally, No.6 HI is located at the opposite shore of the Gulf of Martaban approximately 200 kilometers to the east of Rangoon.

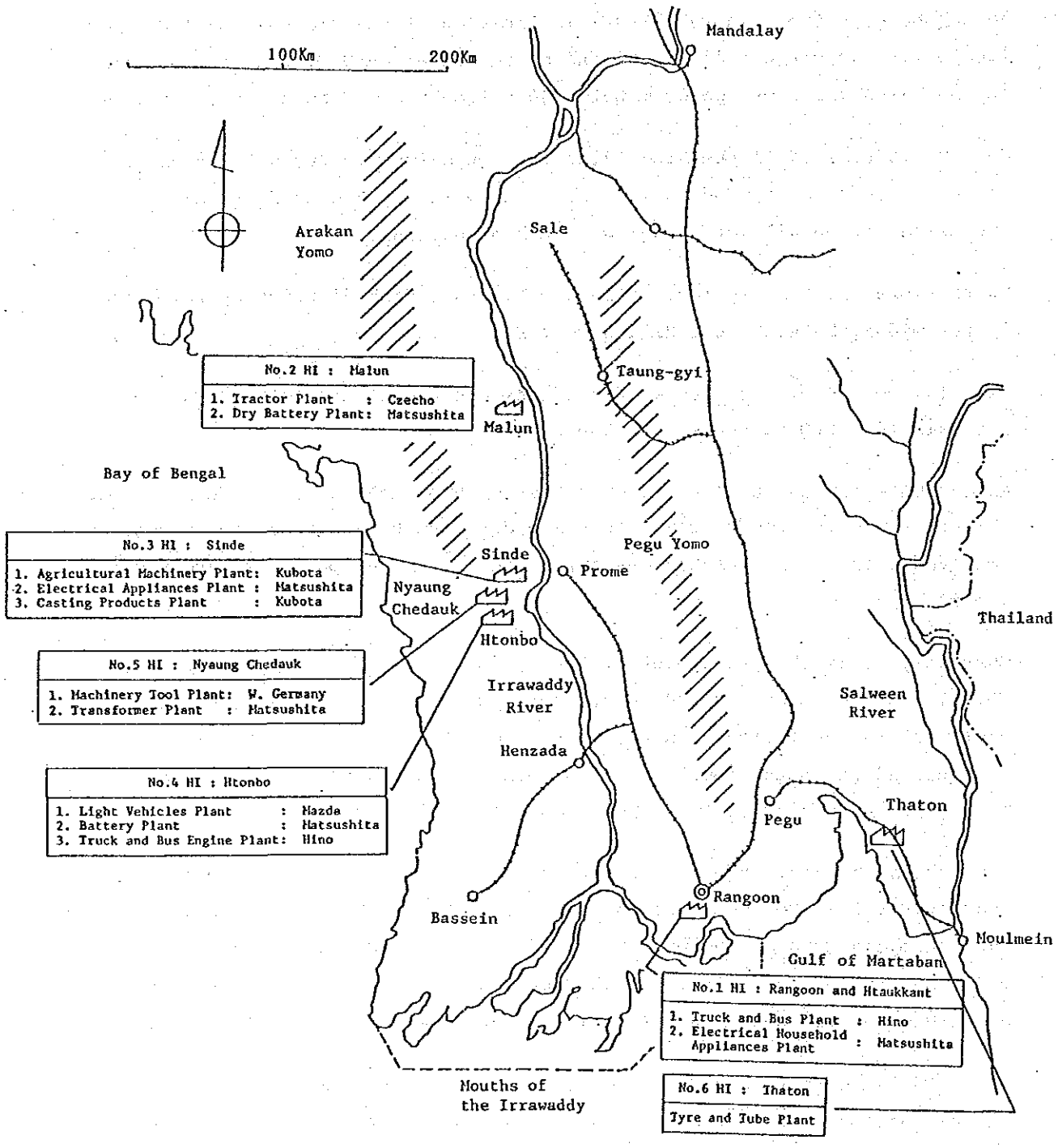
As can be seen, the 6 plants are scattered throughout a very wide area, but this is aimed at promoting the economic development and creating chances of employment in underpopulated areas for economic development of Burma as a whole.

Currently, from the standpoint of the production activities the dispersed location of the plants brings about such problems as redundancy of similar equipment in the various plants, dispersion of technology, expensive transportation costs, complicated administrative system, etc., that are factors contributing to lower the production efficiency.

Inasmuch as the layout of the plants make use of complicated topographical characteristics from the standpoint of security of industrial equipment, each shop consists of independent buildings. Such being the case, each building does not contain integrated production lines therein, and the complicacy of the conveyance system is a problem common to all plants.

The said facts must be understood as a situation of Burma in the past time, but rationalization of the conveyance and proper layout of the equipment are aspects to be examined with particular care when pondering about the introduction of new and additional equipment during the stage of implementation of the renovation plan considered this time.

Figure AII-2-1-1 LOCATION OF HIC



2-2 Current Position of Plant Equipment and Conveyance

2-2-1 Plant Equipment

Industrial equipment of the 4 projects were installed in various stages during the period ranging from 1964 to the recent years. Broadly speaking, the mechanical equipment were installed in two major lots in 1964 and in 1978/79, respectively.

These equipment and facilities were installed by manufacturers of each one of the 4 projects working independently according to the 4 categories of assembly lines concerned (electric equipment, light vehicles, heavy vehicles, agricultural machinery). The existing equipment are in conformity with the category of products they deal with, but many of them can be used in common by the various plants, and in reality there is considerable redundancy of equipment.

Generally speaking the plants of the 4 projects are dispersed in 4 districts, but such special equipment as foundries, forging and press machinery are being used in common. Since the various plants are separated from each other by long distances, however, it is indispensable to provide and to update conveyance equipment between the plants. Inside each plant there is frequent movement between shops with distinct functions, and also in this case it is necessary to provide conveyance and transportation equipment in the same way as between distinct plants.

The production functions in each plant of the 4 projects are broadly classified in forging/casting, pressing, heat treatment, plating, machining and assembly.

The distribution of each plant and shop by function and by type of product is shown in Table AII-2-2-1 attached to the present document.

(1) Forging and Casting Equipment

Besides the iron foundry of No.3 HI, the casting equipment consist of the light metal alloy foundry of No.4 HI and the die cast workshop of No.1 HI and No.3 HI which manufactures casting parts.

Parts for electric equipment are manufactured in the die cast workshop of No.1 HI and No.3 HI, and on the other hand pistons and piston rings

for engines of various kinds are manufactured at the light metal alloy foundry of No.4 HI, and these items are supplied to the various plants.

The forging shop is located mainly in No.3 HI, and the parts and components manufactured therein consist of such materials as parts for light vehicles, parts for agricultural machinery and hand tools.

(2) Press Machines

Press machines of HIC are located at 3 places, the #1 and #2 Press Shops of No.1 HI and the press shop of No.3 HI. The press shops of No.1 HI manufacture small-sized plate work for electric equipment as well as external plates for bodies of heavy and light vehicles, and the press shop of No.3 HI manufactures cover plates etc. for bodies of agricultural machinery.

The press shop of No.4 HI is manufacturing small-sized parts for light vehicles by means of the small-sized press machine transferred from No.1 HI, but outer plates for bodies of light vehicles are being transported from No.1 HI to the light vehicle assembly line of No.4 HI.

Besides the 3 press shops mentioned above, small-sized press machine is being used at the various plants to manufacture parts for such electric products as dry batteries, lighting fixtures, lamps, watt hour meters, etc.

(3) Heat Treatment Equipment

Heat treatment facilities are installed in the various HI's, and are in conformity with the products manufactured in each HI.

No.1 HI has heat treatment equipment at 2 places for parts of heavy vehicles and for leaf springs, No.3 HI has heat treatment shops for parts of Diesel engines, agricultural machines and pumps. No.4 HI has heat treatment shop for parts of light vehicles and high-frequency hardening equipment for crankshaft of heavy vehicles.

(4) Plating and Coating Equipment

Plating and coating equipment in conformity with products of various kinds are installed in each plant of HIC. It is presumed that some of the said plating and coating equipment can be used in common.

No.1 HI has a coating shop for lighting fixtures and the plating equipment of the bolt/nut shop, No.3 HI has plating shop for torch lamps and plating shop for agricultural machinery. No.4 HI has coating shop for light vehicles and plating shop for piston ring.

(5) Mechanical Equipment and Assembly Equipment

Mechanical equipment are installed in the various plants approximately in accordance with the products handled therein. In particular, the special-purpose lines of the heavy vehicle M/C shop of No.1 HI, the AME M/C shop of No.3 HI and the Diesel engine shop of No.4 HI are examples of mechanical equipment installed in accordance with the type of product handled therein.

There are many equipment that can be used in common in view of the similarity of the parts being worked therein, and it is presumably possible to eliminate bottlenecks through proper teamwork between these equipment. The existence of redundant machinery of the same kind is observed in connection with mechanical equipment for machining processes.

Assembly equipment are also located in accordance with the types of products being handled. It must be borne in mind, however, that delay and interruption in the assembly work is observed because the required parts and components are not supplied on time, and in this connection it is indispensable to realize close teamwork between the assembly shop, machine shop, foundry shops and component stores, and also to have proper conveyance equipment.

For further details refer to the results of diagnosis of each shop described in APPENDIX I.

2-2-2 Current Situation of Conveyance

(1) Conveyance between Distinct Plants

As mentioned in CHAPTER 1, conveyance between distinct plants is classified in 3 groups.

1. Imported goods (raw materials, parts, auxiliary materials, tools, etc.) delivered from the main store of HIC to the stores of the various plants.

2. Internally manufactured parts (pressed parts, forging parts and casting parts, etc.) that are distributed between the various plants.

3. Finished products sent from the various plants to the manufacture store of HIC.

1) According to the data of No.3 HI, contains regulations applicable to forging parts and casting parts delivered from No.3 HI to No.1 HI, No.4 HI and No.5 HI as well as the finished products sent to the manufacture store. The contents of the said regulations are described in the following.

a) Forging Parts and Casting Parts

No.1 HI delivers the required parts and components by regular weekly truck service. When additional deliveries besides the regular ones are required No.1 HI makes arrangements to secure the truck. Three times a week No.4 HI sends a truck to receive the required quantity of parts and components at No.3 HI. Once a week No.5 HI sends a truck to No.3 HI to receive the required quantity of parts and components. In urgent cases No.3 HI delivers the materials to the plant requesting them by making use of any available truck.

b) Finished Products

When the delivery direction is received by radio or by telephone from the Sales Section of the head office, the finished products in question are delivered to the main store by means of trucks

arranged by No.1 HI or HIC. In general the transportation of the finished products is carried out by Z craft. The transportation plan of Z craft is formulated by HIC.

2) Table AII-2-2-2(1)∿(2) and AII-2-2-3(1)∿(2) contains the regulations applicable to the means to transport the raw materials, component parts, forging parts and casting parts, etc., from the various plants and stores to No.4 HI.

(2) Conveyance Inside the Plants

The various shops that compose the plants are housed in independent buildings that are scattered throughout the premises of the plant. In general the buildings of the various shops are arranged according to the flow of the manufacturing process, but the conveyance system is very complicated because in the production system adopted by HIC the machined parts are once guarded in the component store. Furthermore, in some cases heat treatment shops, plating shops, etc., that are special processes, are generally located out of the flow route of the manufacturing process as a whole and in other cases they are located at places requiring back/forth movement of the workpieces. Such being the case the frequency and the distance of transportation become too large in many cases.

Table AII-2-2-1 DISTRIBUTION OF FUNCTIONS AND PRODUCTS AMONG SHOPS

Shop No.		Shop Name	Foundry & Forgery	Press Shop	Heat Treatment Shop	Plating & Coating Shop	Mechanical Shop	Assembly Shop
	72	IL, FL S.						EP
	73	Elect Home Appliance						EP
	74	Coating Shop				EP		
	75	Bake Lite Molding						EP
	76	Die Casting Shop	EP (Die C)					
	102	Radio Ass'y Shop						EP
	103	Elect CP M/C No.1					EP	
	104	Elect CP M/C No.2					EP	
No.1 HI	85	HV CP M/C			HV		HV	HV
	93	HV Ass'y S						HV
	94	Press S. No.1		EP				
	96	Press S. No.2		HV, LV				
	78	Machine CP mfg. S					AM, LV	
	98	Bolt & Nut mfg. S				o	o	
	124	Spring Shop	LV, HV	LV, HV	LV, HV			LV, HV
	A1	Dry Cell Battery	EP	EP				EP
	B1	Bus Ass'y S						HV
	3.03	AME Ass'y						AM
	3.05	AME CP mfg.	EP (Die C)	EP			AM	AM, EP
	3.07	Forging Shop (LVP)						
	3.12	Plant Shop & Seat Metal						
	3.17	AME CP mfg. No.2	AM				AM	
	3.18	AME CP mfg. No.3					AM	
	3.41	Press & Welding		AM				
No.3 HI	3.42	Combined Heat Treatment			LV, HV			
	3.47	AME CP mfg. No.4					AM	
	3.53	Lighting Fixture Shop		EP				EP
	3.57	Torch L & Dynam L Shop		EP				EP
	3.63	Watt-Hour Meter		EP				EP
	3.06	Cast Iron Foundry Shop	LV, HV, AM					
	3.14	Plating Shop No.1				AM		
	3.65	Plating Shop No.2				EP		
	1	Plating & Vechile Ass'y				LV		LV
	3	Body Ass'y						LV
	4	Machine Shop	LV	LV			LV	
	5	Heat Treatment S			LV			
	6	Light Alloy Foundry	LV, HV, AM (Incl. Die C)					
No.4 HI	47	Accumulator Shop 1						EP
	49	Accumulator Shop 2						EP
	55a	HINO Engine Shop					HV	HV
	57	Lead Powder & Container						EP
	59	Piston Ring & Piston					LV, HV, AM	
	60	Plating				LV, HV, AM		
No.5 HI	55	Transform mfg. S						EP

Note) LV : Light Vehicle
HV : Heavy Vehicle
AM : Agricultural Machinery
EP : Electric Products
o : All Products
Die C: Die-casting

Table AII-2-2-2(1)

TRANSPORTATION OF MATERIALS AND CP BETWEEN NO.4 HI AND OTHER HIs

Sr. No.	Factory No.	Sending Items	Transportation →	Manufacture Store Rangoon	No. 4 HI
1.	No. 1 HI Rangoon	Press parts Spring parts Bakelite parts Gear parts Bolt-nut Plating parts	By Truck		
2.	No. 2 HI Malun	Machining Forging	By Truck		
3.	No. 3 HI Sinde	Press parts Plating parts Casting parts Forging parts	By Truck		
4.	No. 6 HI Thaton	Tyre 2 items Tube 2 items	By Truck		

Source: Transportation and Items of Materials and CP from Other Factories (No.4 HI)

Table AII-2-2-2(2)

Sr. No.	Factory No.	Sending Items	Transportation →	Manufacture Store Rangoon	No. 4 HI
5.	Main Store Rangoon	RM/AM/CKD parts Local purchased parts, (pure lead, foam rubber lubricants, etc.)	By Z Craft / By Truck		

Table AII-2-2-3(1)

TRANSPORTATION FLOW CHART OF LOCAL MANUFACTURING PARTS IN NO.4 HI

Sr. No.	Description	Tech Store	Foundry Shop	Piston/ Ring Shop	Plating Shop	Machine Shop	Heat Treatment Shop	Body Ass'y Shop	Lead Powder Shop	Container Mfg. Shop	Accumulator Shop	Painting and Vehicle Shop
1.	Raw material/ Auxiliary material	●	→									
		●		→								
		●			→							
		●				→						
		●					→					
		●						→				
		●							→			
		●								→		
		●									→	
		●										→
2.	CKD parts	●				→						
		●						→				
		●									→	
		●										→
3.	Aluminium casting parts/As cast ring		→									
			●	→								
			●		→							
			●			→						
			●				→					

Source: Transportation Flow Chart of Local Manufacturing Parts from Respective Shops to Final Ass'y Shop

Table AII-2-2-3(2)

Sr. No.	Description	Piston/ Ring Shop	Plating Shop	Machine Shop	Heat Treatment Shop	Diesel Engine Plant	Body Ass'y Shop	Lead Powder Shop	Container Mfg. Shop	Accumulator Shop	Painting and Vehicle Ass'y	M. Store 4 HI
4.	Piston/Piston ring 14 items each											
5.	Engine/ Transmission/ Machining parts											
6.	Cabin/Box/Frame/ Sheet metal works											
7.	Lead powder											
8.	Container Mfg. shop											
9.	Storaged battery 5 kinds											

2-3 Problems and Improvements

2-3-1 Layout of the Equipment

For many items of equipment, the similar type of equipment is redundantly installed at each plant.

The dispersion of equipment of the same type in the various plants has the demerit which consists of the redundancy of investment, manpower, and maintenance/control (including transportation), but on the other hand it has the merits of cutting down transportation between the various plants, facilitating the production control, etc.

Such being the case, it may safely be said that the merits and demerits of the dispersed arrangement of equipment of the same kind in the various plants are determined by such factors as technical characteristics and scale of the equipment in question, the conditions of conveyance between distinct plants, etc. The problematic points observed in connection with the equipment are mentioned in the following.

(1) Machining Equipment

The machine shops of the plants submitted to diagnosis have the same kind of equipment with no exception. This is presumably attributable to the fact that the plants were designed and constructed by attaching importance to the autonomous production system by taking into consideration the problems related to transportation. In particular, turret lathes, high-speed lathes and gear cutting machines are installed in large quantities at each machine shop. Figure AII-2-3-1 No.1 HI Machine Component Manufacturing Plant OBJ 78, and Figure AII-2-3-2 AME Component Shop 03 OBJ 3.18 show the current state of things. Since these equipment are not operating equally at full capacity, some are almost out of operation, measures must be taken to make effective use of them. It must be borne in mind, however, that in the No.4 HI Body Assembly Shop there are 3 units of press machine transferred from No.1 HI, and they are being used to manufacture small-sized pressed parts. It is highly desirable to take measures of this kind to make effective use of the available machinery in HIC as a whole. As things now stand there are gear-cutting machines installed in No.1 HI, No.3 HI, No.4 HI and No.5 HI, but clean room is required

in view of the precision of gear products. Unified installation of these gear cutting machines leaves room for consideration from the technical standpoint related to such aspects as shared use of the measuring instrument, jigs, etc.

(2) Press Equipment

Press machines are installed in the following shops.

- No.1 HI No.94, EP Press Shop (pressed parts of electric parts)
- No.1 HI No.96, HV.LV Press Shop (pressed parts of parts of vehicles)
- No.1 HI No.124, Leaf Spring Shop (pressed parts of leaf springs)
- No.1 HI No.A1, Dry Cell Battery Shop (pressed parts of dry cell battery)
- No.3 HI No.3.05, AME Component Mfg Shop (pressed parts of EP and AM parts)
- No.3 HI No.3.41, AM Press Shop (pressed parts of AM and parts of automotive vehicles)
- No.3 HI No.3.53, Lighting Fixture Shop (pressed parts of lighting fixtures)
- No.3 HI No.3.57, Torch Lamp and Dynamo Lamp Shop (pressed parts)
- No.3 HI No.3.63, Watt-hour Meter Shop (pressed parts)

As each one of the aforementioned press shops deals with special materials and shapes, from the standpoint of manufacturing process there is no merit at all in changing the current layout.

Remarks: No. 94, 96, etc. are building No.

(3) Heat Treatment Facilities

- No.1 HI No.85, EP Press Shop
- No.1 HI No.124, HV, LV Press Shop

- No.3 HI No.3.42, Combined Heat Treatment Shop

- No.4 HI No.6, Light Alloy Foundry

Since heat treatment equipment are closely related with the previous and subsequent processes, the layout of the aforementioned equipment

is regarded as appropriate.

(4) Plating and Coating Equipment

Inasmuch as equipment of this kind require drain treatment equipment, it is recommendable to avoid as much as possible installing various equipment of this kind in the same plant. If the dispersed installation of equipment of this kind is not practicable, it is recommendable to install them as places making it possible to share as much as possible the drain treatment equipment. As things now stand there are many plating equipment, coating equipment and painting equipment that are not properly equipped with drain treatment equipment.

2-3-2 Problems of Conveyance

(1) Conveyance between Distinct Plants

The means of transportation used for the sake of conveyance between distinct plants consist mainly of trucks and Z-crafts navigating the Irrawaddy River, but there are many problems in this connection because the plants are scattered throughout a wide area. In view of the situation prevailing in Burma trucks cannot be used frequently because there is serious shortage of fuel oil, and regular truck services are restricted to one or two trips per week as mentioned before. Furthermore, the water level of the Irrawaddy River lowers considerably during the dry season, the Htonbo Harbor becomes impracticable for use due to the sedimentation of sand, and the Z-crafts are forced to use the Sinde Harbor located approximately 50 km above. Such being the case the transportation cost becomes expensive and furthermore the transportation time becomes long. The said restriction from the standpoint of transportation is a factor obstructing the production activities. Furthermore, the noxious influence long-distance transportation exerts on the quality is a serious problem pointed out as a result of the study carried out this time. Inasmuch as pressed parts delivered from No.1 HI to No.4 HI are subject to such damages as dents and deformation, most of the parts must be rectified before being used in No.4 HI. In particular, the parts are badly rusted and much time is required to cope with the problem.

1) Given below are some of the specific problems that have developed at No.3 HI.

a) Facts mentioned in connection with the transportation of parts

1. The number of pallets for transportation is extremely small.
2. The transported goods are being loaded/unloaded by human power.
3. The goods suffer frequent damage during their transportation.
4. Pallets for transportation of parts are badly needed.

b) Facts mentioned in connection with the transportation of finished products

1. The finished products are delivered with no protection at all because crates are not available due to the shortage of lumber.
2. The loading/unloading work to/from the trucks is carried out by means of fork lifts.
3. The loading/unloading work to/from the Z-crafts is carried out by means of cranes.
4. From time to time the finished products are subject to damage.
5. The introduction of container transportation is indispensable because it facilitates stevedorage and reduces damages.

2) Annual report of 1986, which is one of the materials obtained from No.4 HI, mentions the following problems in connection with conveyance. In examining these problems it must be remembered that the production activities at No.4 HI are being obstructed by such problems as delays in the delivery and bad quality of parts delivered from No.1 HI.

1. The transportation facilities are insufficient.
2. The pressed parts suffer frequent damages during the transportation.
3. The introduction of special vehicles for transportation of pressed parts must be taken into consideration.

In other words, practically the totality of the pressed parts delivered to No.4 HI are affected by such problems as deformations, dents, oxidations, etc., and repair of some kind is being required at No.4 HI.

And delays in the production process, impaired quality and other problems related to production control are occurring as a result.

Since long-distance transportation is unavoidable in view of the arrangement of the plants, conveyance between plants is an important problem.

(2) Conveyance within the Plants

Problems related to transportation equipment are omitted here because they are mentioned in CHAPTER 3. Broadly speaking problems related to the conveyance within the plants are classified in 3 groups.

1. The transportation distance is too long.
2. There is frequent transportation between the various buildings of the same plant.
3. The path for transportation is too narrow.

1) The Transportation Distance is Too Long

The transportation process in the plant, ranging from the delivery of the raw materials and component parts to the completion of the product, was examined on the occasion of the study carried out this time. The commodity object of study in the light vehicle of No.4 HI, and the pressed parts, raw materials of the piston, the forging parts and casting parts are selected as representative parts for the sake of study. The transportation process up to the completion of the product, according to materials related to the conveyance obtained from HIC, is shown in Figure AII-2-3-3. As can be seen, transportation is carried out in long distance throughout the vast premises of the plant every time the workpiece is taken from one shop to the other. It is obvious that immense transportation distances are involved when all parts and components of the light vehicle and the transportation inside each building is taken into consideration, because only the 3 parts mentioned above are taken into consideration in the figure. Furthermore, it may safely be said that decline in production efficiency caused by transportation losses is a serious problem since human power is being used to make up for shortage of transportation equipment.

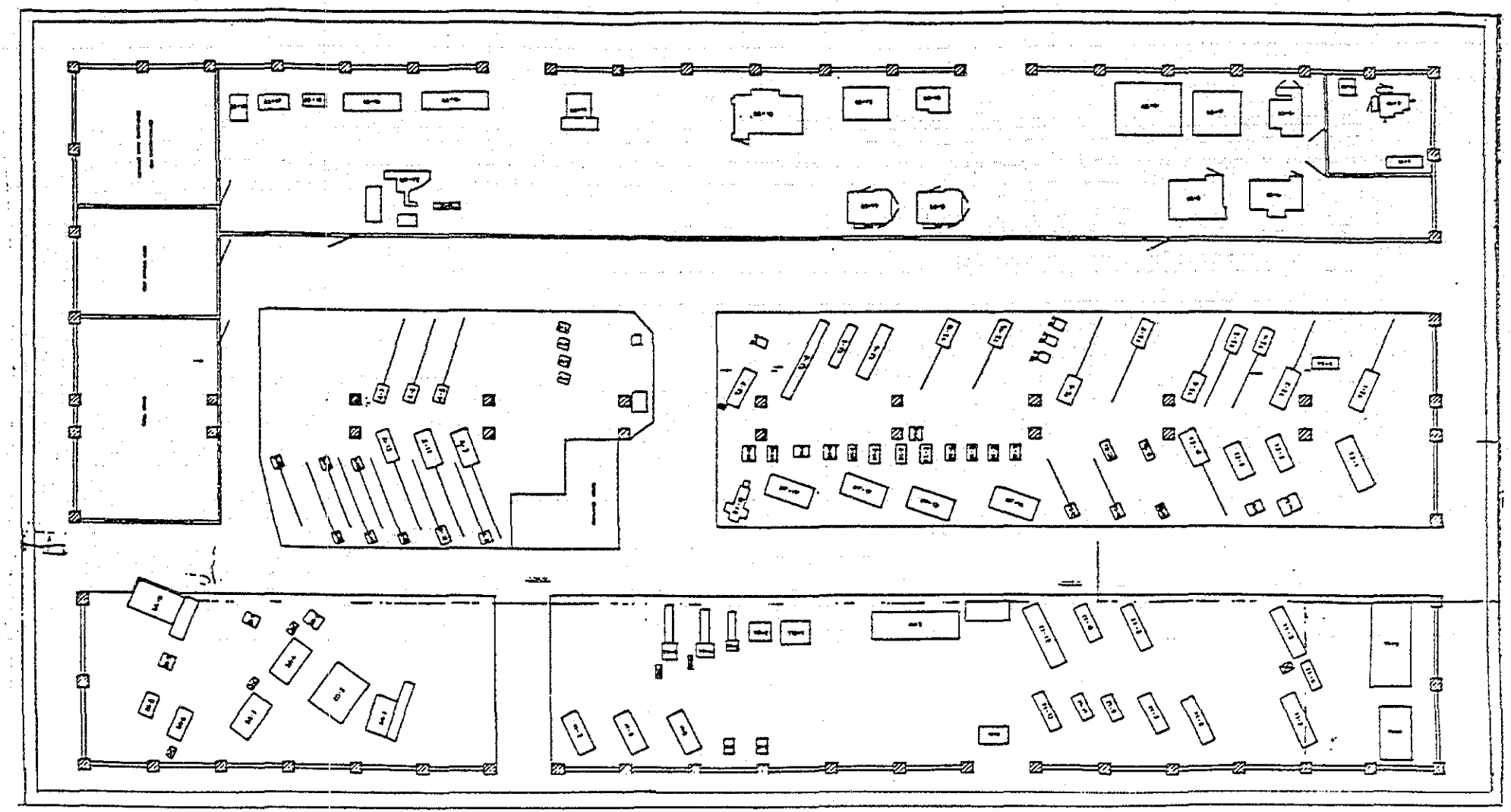
2) There is Too Much Transportation between Buildings

Frequent transportation between the various buildings is required because each shop is housed in an independent building. Although the current situation is unavoidable in view of the conditions of the country it would be ideal to house the whole line in one building, and there is room to take the matter into consideration when implementing the renovation plan. Laying rails between the building and using carts for the sake of transportation between them is a method to solve the problem. Transportation losses could be eliminated by adopting this system for transportation between distinct wings of the same building.

3) The Transportation Path is Too Narrow

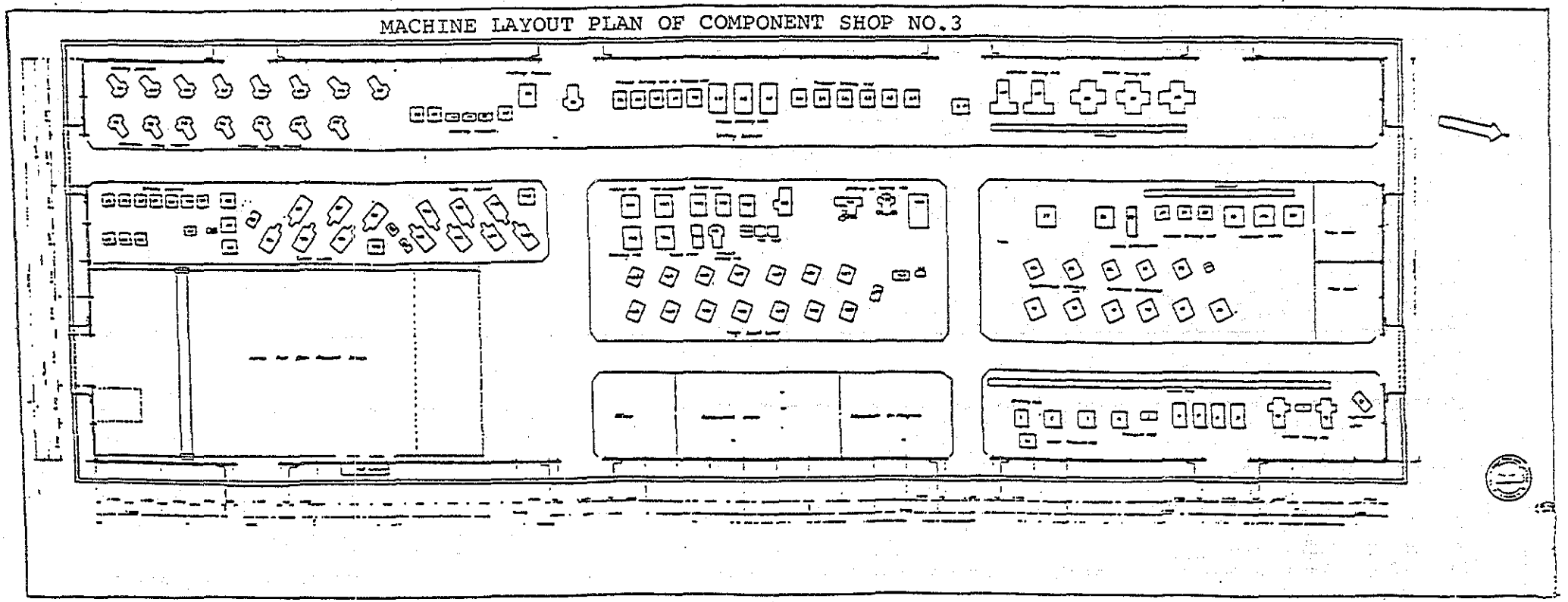
It is presumed that when the plants were erected the buildings and the equipment housed therein were arranged in a very orderly way, but as things now stand there are places with very narrow path for conveyance and the situation presumably attributable to the expansion of the buildings and the installation of additional equipment and machinery. For example, warehousing to and delivery from the sub store of the dry cell battery shop of No.1 HI are carried out via narrow passageway. The actual access to the sub store is being carried out through bypass routes because the doorways of the building are very narrow and furthermore there are very few doorways. It is indispensable to widen the passageways and to increase the number of doorways of the building. In the moulding floor of the electric accessories shop the efficiency of the transportation of materials and finished products is very low because the space between adjacent machines is very narrow. The space between adjacent machines must be arranged by taking into consideration the workability, and in particular utmost attention must be paid to the safety when conveyance is concerned.

Figure AII-2-3-1 No.1 HI MACHINE COMPONENT MANUFACTURE PLAN OBJ 78



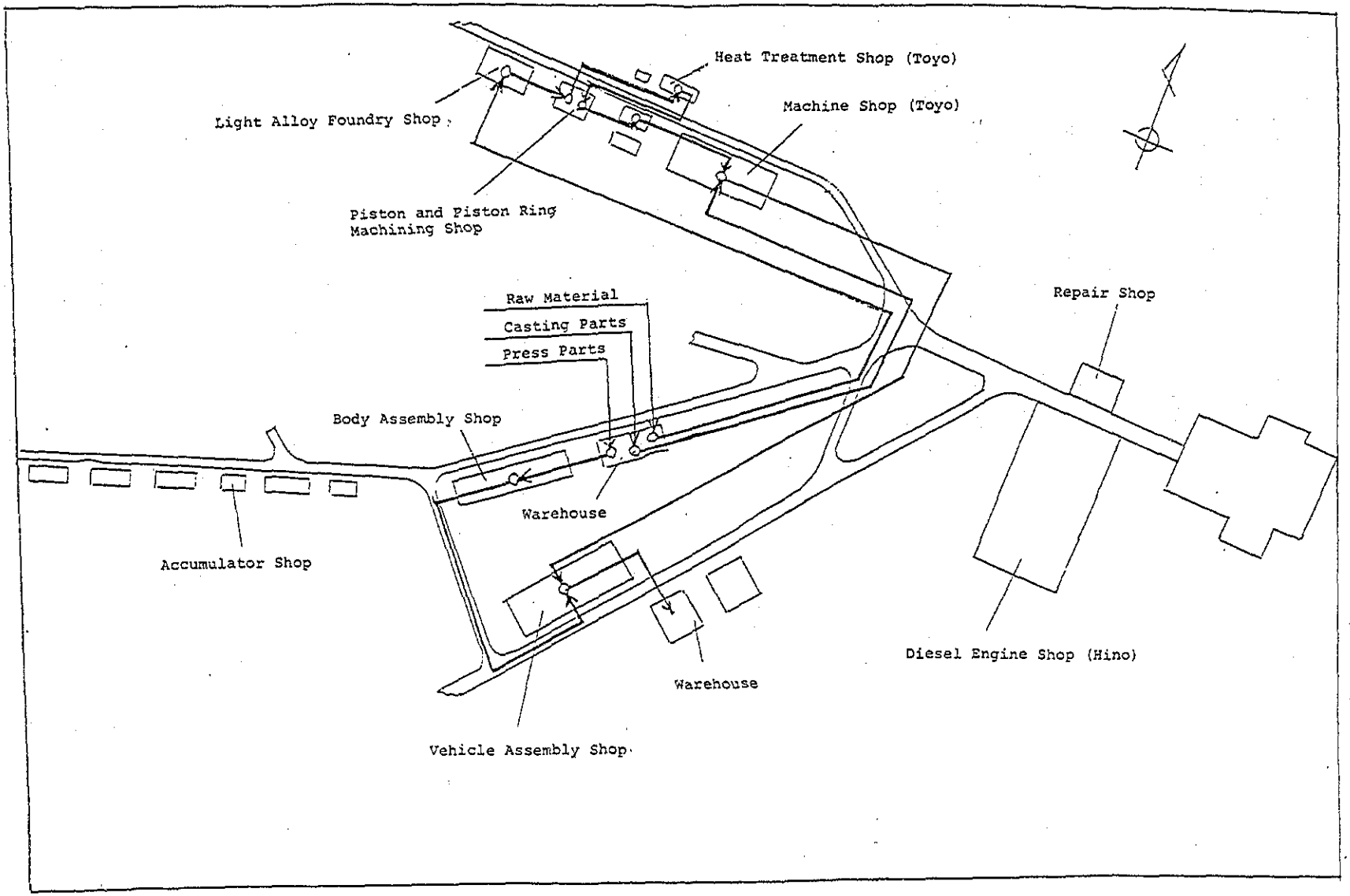
Source: Machine Layout Drawings (from HIC)

Figure AII-2-3-2 COMPONENT SHOP 03 OBJ 3.18



Source: Machine Layout Drawings (from HIC)

Figure AII-2-3-3 TRANSPORTATION ROUTE IN NO.4 HI



Source: General Layout of No.4 HI and Press Chart

2-4 Considerations Regarding New and Additional Equipment and the Layout of Plant Equipment

In connection with the products of the 4 projects, HIC has plans to taken an aggressive initiative to expand the domestic production of imported parts and spare parts, to increase the volume of production and to promote the future modernization through such measures as model change of the current products, development of new products, etc.

It was found, as a result of the field survey carried out this time, that updating of the existing equipment and introduction of new and additional equipment are indispensable for the purpose of renovation plan.

The points to be taken into consideration when introducing new and additional equipment and facilities are mentioned in the following, based on the results of the studies carried out this time.

(1) Points Related to the Equipment

1) Transference of redundant and idle equipment in companywide scale for the sake of effective use of the available physical resources.

2) Modification of the production map of the machined parts by making use of the existing equipment for the sake of improving the production efficiency.

3) The dispersed installation of such equipment as gear-cutting machines, whose concentrated installation is more advantageous from the technical and economical standpoints, must be avoided as much as possible.

(2) Points to be Taken into Consideration in Connection with the Automation

1) The high temperature and high humidity atmospheric conditions of the area in question must be taken into consideration without fail.

2) Automation must be carried out by taking into consideration the overall balance of the line so as to avoid the prominence of some specific processes.

3) When considering the introduction of automatic equipment it is desirable to attach importance to improving the quality and securing

the accuracy instead of reducing the number of man-hours required for machining.

(3) Points Related to the Conveyance

1) Long-distance transportation bring about not only decline in the production efficiency due to transportation losses, but also quality deterioration due to such problems as dent, deformation, etc., during the transportation.

2) Importance should be attached to arrange integrated lines in one building and to avoid as much as possible transportation between different buildings.

3) The layout of the machinery should be planned with sufficient space between them by taking into consideration the conveyance.

(4) Other Points to be Taken into Consideration

1) The shared use system should be adopted as much as possible for drain treatment equipment and other special equipment.

2) There are plants with poor lighting and this exerts noxious influence on the productivity and the quality. Sufficient lighting must be taken into consideration.

3) When renovation plans are made, the present capacity of the utilities must be taken into consideration.

The capacities of the utilities of the various plants are shown in Table AII-2-4-1.

Table AII-2-4-1 UTILITY CAPACITY

			No.1 HI	No.3 HI	No.4 HI	No.5 HI
I.	Electricity					
	Capacity	KVA	10,000	10MW	5,000	3,250
	Voltage	KV	6.6	6.6	6.6	6.6
	Peak Load	KW	-	5,100	2,500	604
	Normal Yearly Consumption	MWH/Y	-	1,132	544	1,758
II.	Compressed Air					
	Compressor Capacity	m^3/min	160	294	139	3.3
	Supply Pressure	kg/cm^2	6	5	7	7
	Motor Rated Output	KW	778	1,200	600	187
	Compressor Unit No.	-	13	11	4	2
III.	Industrial Water					
	Supply Pressure	kg/cm^2	4&2	3	2	4
	Supply Capacity	m^3/min	4.25	2	7.6	0.189
	Annual Consumption	$m^3 x 10^3$	477	1,023	3,150	35.5
IV.	Steam					
	Supply Pressure	kg/cm^2	-	5	10-13	-
	Boiler Capacity	tons/h	-	5.55	1.4	-
	Annual Consumption	tons	-	752	3,456	-
V.	Gas Annual Consumption					
	Nitrogen	m^3	2,748	-	781	12,200
	Oxygen	m^3	91,125	-	13,541	760
	Ammonia	kg	120	-	-	250
	Propane	ton	3,580m^3	-	86.4	3.67
	Acetylene	m^3	3,605	-	156	110
	Carbondioxyde	kg	-	-	5,658	1,090
VI.	Oil Annual Consumption					
	Fuel Oil	m^3	-	-	1,446	71.3
	Facility Oil	m^3	-	-	151	15.9

Source: (HIC)

Chapter 3 PLANT EQUIPMENT AND OFFICE EQUIPMENT

3-1 Current Position of the Plant Equipment

3-1-1 Organization Concerned

The total number of employee assigned to the maintenance of the equipment of the various plants of HIC are shown in Table AII-3-1-1. As can be seen, the head office and the plants have the section called Maintenance (Electric & Service) belonging to the Planning Department of the plant in question. (Hereinafter this section is called "E&S", according to the nomenclature adopted by HIC).

Furthermore, there is a section called "Estate" in the head office which takes charge of the maintenance of all buildings and constructions of HIC.

Of the total maintenance personnel 67% is concentrated at the head office. The maintenance section of No.1 HI is thinly manned because the head office is covering part of the duties.

The duties of the E&S of the various HI's consist of 2 parts, (1) maintenance of the manufacturing facilities, (2) operation of the service facilities (facilities for supply and/or storage of power, water, compressed air, fuel, etc.). The E&S section of the HIC head office is in charge of the maintenance of the service facilities, whereas the "Estate" section of the head office is in charge of the maintenance of the buildings and constructions.

3-1-2 Maintenance System for Equipment

The section in charge of the maintenance carries out the repair of the equipment when any trouble is reported from the manufacturing section. In other words, as things now stand the maintenance of the equipment is being carried out by means of the so-called break-down maintenance or after-the-fact system.

The periodic inspection system was introduced this year in the Diesel Engine Shop of the No.4 HI under the orientation of resident foreign experts, but it is presumed that maintenance systems of this kind have not been introduced in companywide scale yet. (Refer to Figure AII-3-1-1, Figure AII-3-1-2 about frequency of machine troubles.)

The maintenance work is being carried out by personnel of HIC without relying on third parties from outside, and orientation of resident foreign experts is provided whenever necessary. This in-house maintenance system is being adopted because maintenance personnel of third parties with proper technical qualification is not available in Rangoon, to say nothing of provincial areas, and furthermore calling technical personnel of overseas manufacturers of machinery is impracticable in view of the limited availability of foreign currency.

As for the technical skill of the maintenance, no case of complaint about the skill of the workers in charge of the matter was reported from the HIC side. Furthermore, as long as the repair work being carried out on the plant floor was observed, the technical skill of the personnel in charge of the maintenance seems to be up to the level required for the sake of the current maintenance work.

3-1-3 Equipment Deterioration

(1) State of Deterioration of the Manufacturing Equipment, Conveyance Equipment, etc.

To mention an example of deterioration of the equipment, the failure rate of mechanical equipment of No.3 HI mounts to 15.9% (refer to APPENDIX I, CHAPTER 2, Section 2-3(1)2)). Similar situation is occurring also in connection with the manufacturing equipments of other HI's.

Refer to Table AII-3-1-2 ∿ 3-1-4 for examples of state of failure of conveyance and transportation equipment.

Deterioration due to aging is regarded as the most important cause deterioration. The year when the operation of facilities of the 4 projects of HIC was started is shown below, and it is presumed that heavy deterioration is occurring after 20-25 years of operation.

No.1 HI 1960
No.3 HI 1965
No.4 HI 1970
No.5 HI 1970

(2) State of the Maintenance from the Epoch Erection to the Present Time

Imported equipment, contained in their export crates, were left outdoors during some time until the completion of the plant buildings at the time of erection of the plants, and this is presumed to be one of the causes of the failures. (In the worst case some equipment were left outdoors for 1-2 years. Refer to APPENDIX I, CHAPTER 2, Section 2-3(1)5)b)ii).)

(3) Problem of the Service Life of the Equipment Due to the Break-down Maintenance System

In general machine tools and equipment run until they fail when preventive maintenance activities are not carried out as seen in the various plants of HIC because the conditions of operation, the service life and other aspects of the plant facilities are not properly controlled.

Prolonged operation and high operation rate of the equipment is being secured in the industrialized countries by introducing and implementing preventive maintenance to cope with the said problems.

Urgent measures to introduce and to implement the preventive maintenance system must be taken as soon as possible to improve the current state of control of the equipment and facilities. (Refer to the modernization plan.)

(4) Shortage of Lubricating Oil and the Like

The current shortage of lubricating oil is a recent problem. For example, in No.4 HI the delivery of lubricating oil is lagging far behind the required amounts. The shortage of lubricating oil is attributable to the shortage of foreign currency.

According to HIC there is shortage occurring recently in lubricating oil of production facilities and equipment due to delays in the delivery. If the current state of supply and demand of lubricating oil should remain unchanged, there is risk of rapid deterioration of the mechanical equipment and facilities.

By the way, shortage of lubricating oil, cutting oil and hydraulic fluid has occurred also in the past. (Refer to APPENDIX I, CHAPTER 2, Section 2-3(1)5)b)ii).)

Table AII-3-1-1 MAINTENANCE DEPARTMENTS AND MANNING

HI	Total Employee	Maintenance Departments	
		Department in Charge	No. of Staff
Head Office	1,504	- Maintenance (Electric & Service)	315
		- Maintenance (Estate)	127
		Subtotal Head Office	442
No. 1	3,107	Maintenance (Electric & Service)	30
No. 3	2,507	Maintenance (Electric & Service)	91
No. 4	1,737	Maintenance (Electric & Service)	62
No. 5	641	Maintenance (Electric & Service)	30
Total	9,496		655

Source : Organization Chart of HIC and Each Plants.

Table AII-3-1-2 LIST OF FORKLIFTS IN NO.1 HI

Sr. No.	Nomenclature	Model	Capacity (ton)	Manufacturer & Manufacturing Date	Remarks
	Production Dept. 1				
1.	Forklift FG-20	FG-20-7	2		Serial No. 101808
2.	Forklift	FG-10-10	1		Serial No. 8677
	Production Dept. No. 2				
1.	Forklift	FG-10	1	(Komatsu)	Starter Motor Out of Order
2.	Forklift	FG-10	1	(Komatsu)	Running Condition
3.	Towing Tractor with Trailer	23110		(Toyota)	Starter Motor Out of Order
	Production Dept. No. 3				
1.	Forklift	FG-10	1		Press Shop
2.	Forklift	FG-10	1		Dynamo (Damaged)
3.	Forilift	FD-20	2		
4.	Side Fork	FGS-2-300	1.5	Shinko Electric Co., Ltd. 1971	Heavy Vehicle Production Plant Serial No. 12744
5.	Towing Tractor with Trailer	23010		(Toyota)	
6.	Forklift	FG-10	1	(Komatsu)	Serial No. 27354 Spring Shop
7.	Forklift	FG-15	1.5	Feb. 10. 1971 (Komatsu)	Engine, Hydraulic System and Clutch (Damaged) (Heavy Vehicle Component Mfg. Plant)
	Diesel Engine Forklift	3FG	3.5	(Toyota)	Vehicle Production Plant (Htauk Kyant)

Source: List of Forklifts (No.1 HI)

Table AII-3-1-3(1) TRANSPORT FACILITIES IN MANUFACTURING STORE IN NO.1 HI

Sr. No.	Nomenclature	Maker	Model No.	No. of Units	Remarks
1.	3.5 ton KM	Hino	KM 300	1 unit	Not Running Condition
2.	3.5 ton KM	Hino	KM 600	1 unit	Running Condition
3.	1½ ton	Mazda	D 1500	1 unit	Not Running Condition

Table AII-3-1-3(2) TRANSPORT FACILITIES IN PRODUCTION DEPARTMENT NO.3 IN NO.1 HI

Sr. No.	Description	Maker	Model No.	No. of Units	Remarks
1.	3.5 ton Diesel Truck	Hino	KM-300	3	
2.	6.5 ton Diesel Truck	"	TE-11 AZ	1	
3.	6.5 ton Diesel Truck	"	TE-21/SDG	1	
4.	6 ton Diesel Dump Truck	"	TE-11	1	
5.	4 ton Diesel Truck	Mazda	E-3800	1	Not Running Condition
6.	1.5 ton Tight Truck	"	D-1500	1	

Table AII-3-1-4(1) LIST OF MATERIAL HANDLING EQUIPMENT OUT OF SERVICE

Sr. No.	Types	Model No./Engine No.	Maker	Year of Manufacture	Remark
1.	20 ton Crane	KM-200 Engine No. DA-640-503568	Kubota		Serviceable, Rear Axle Shaft, Hydraulic Sys.
2.	10 ton Crane	KM-100-100381 Engine No. DA-120-534235	Kubota		Un-serviceable Steering Sys.
3.	4.8 ton Crane	1320-18130 Engine No. 107930	Kubota		Serviceable
4.	5 ton Forklift	D5-00043 Engine No. 2410	Yale		Serviceable
5.	3.5 ton Forklift	FD 35 Engine No. DA-220-279821	Komatsu		Under Repair
6.	3.5 ton Forklift	FD 35 Engine No. H-49427 Frame No. FD35-16781	Toyota		Un-serviceable, Engine
7.	3 ton Forklift	FD 30 Engine No. DA-220-521223	Komatsu	30-7-73	Un-serviceable, Engine & Hydraulic Sys.
8.	3 ton Forklift	FD 30 Engine No. DA-220-581222	Komatsu		Un-serviceable, Engine & Hydraulic Sys.
9.	2 ton Forklift	G2B-30570 Engine No. VA-A-52729	Yale		Serviceable, Oil Seals
10.	2 ton Forklift	G2B-30495 Engine No. VA-A-51199	Yale		Serviceable, Oil Seals
11.	1.5 ton Forklift	3FD15 Frame No. FD18-10788 Engine No. 2J-121676	Toyota	March-1979	Un-serviceable, Dynamo, Engine, Hydraulic Sys.
12.	1 ton Forklift	FG-10 Engine No. UA-1484-CC-S-380599	Yale		Un-serviceable, Hydraulic Sys.

Source: List of Equipment and Out of Service (No.4 HI)

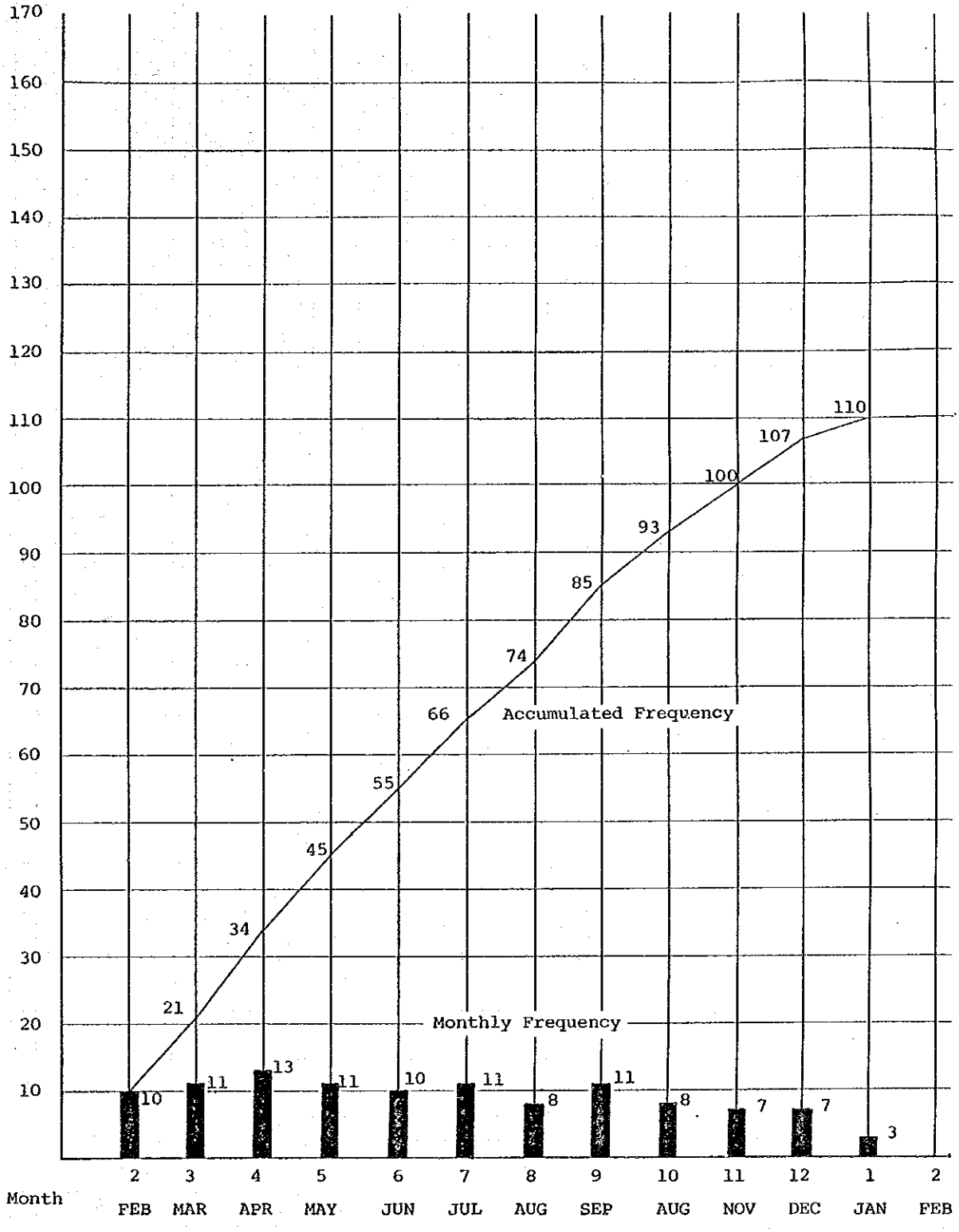
Table AII-3-1-4(2)

Sr. No.	Tyre	Model No./Engine No.	Maker	Year of Manufacture	Remarks
13.	1 ton Forklift	FG Engine No. D11-S28283	Komatsu	30-7-73	Un-serviceable, Tyres, Engine, Hydraulic Sys.
14.	1 ton Forklift	FG15 Engine No. D11-S28321	Komatsu		Un-serviceable, Tyres, Engine, Hydraulic Sys.

Figure AII-3-1-1

FREQUENCY OF MACHINE TROUBLE IN DIESEL ENGINE PLANT, NO.4 HI

(Feb. 1987 through Feb. 1988)



Source: Frequency of Machine Trouble (DS 70) (No.4 HI)

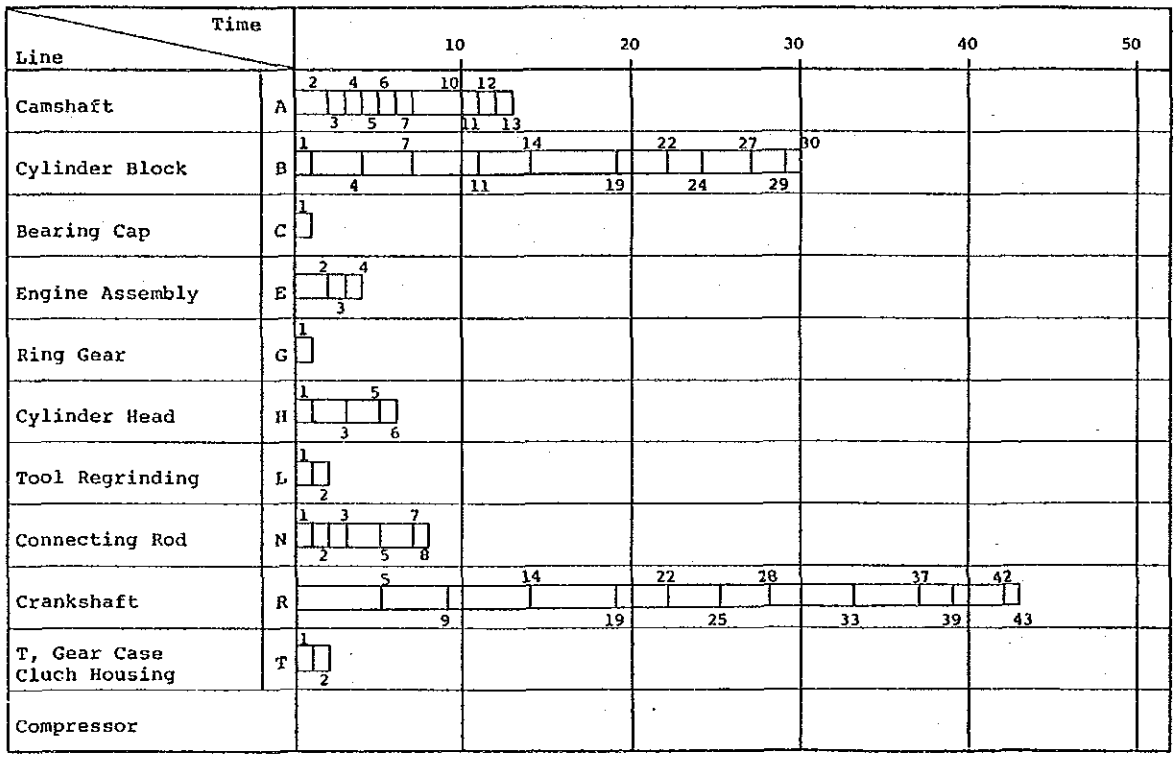
Figure AII-3-1-2

FREQUENCY OF MACHINE TROUBLE, DIESEL ENGINE PLANT, NO.4 HI

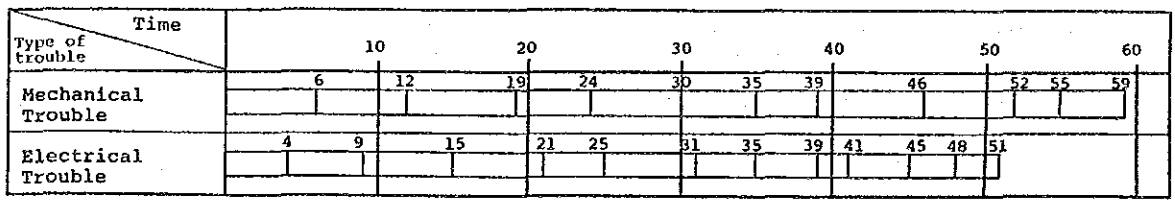
(MONTHLY FREQUENCY OF MACHINE TROUBLE)

Line \ Month		2	3	4	5	6	7	8	9	10	11	12	1	Total
Camshift	A	2	1		1	1	1	1	3		1	1	1	13
C, Block	B	1	3	3	4	3	5	3	2	3	2	1		30
B, Cap	C					1								1
E, Ass'y	E			1								1		4
R, Gear	G								1					1
C, Head	H	1		2			2			1				6
Tool, Reg	L			1						1				2
C, Rod	N	1	1	1		2					2		1	8
Crankshift	R	5	4	5	5	3	3	3	5	4	2	3	1	43
T, Gear Case Clutch Housing	T				1			1						2
Compressor														

(ACCUMULATED FREQUENCY OF MACHINE TROUBLE)



(ACCUMULATED FREQUENCY BY TYPE OF TROUBLE)



Source: Monthly Data of Machine Trouble (DS 70) (No.4 HI)

3-2 Problems of the Control of Equipment

3-2-1 Organization Concerned

As mentioned before, the following problems are recognized in connection with the organization concerned.

(1) Concurrent Execution of Both Operation of Services and Maintenance of the Various HIs by the Same Organization

The maintenance organizations of both head office and HIs belong to the Planning Department, and furthermore they are in charge of the operation of service equipment in addition to the maintenance work. It must be borne in mind that the current system has the merit of allowing easy communication and coordination between personnel of the same organization. As things now stand it is impracticable to draw a wholesale conclusion on the merits and demerits of the current system, but the possibility of dividing the organization in two separate parts should be examined from the standpoint of strengthening the responsibility and the authority of the section in charge of maintenance when pondering on the future of the maintenance system.

(2) Scope of Duty of the Maintenance Department of the Head Office

As things now stand the head office is in charge of the maintenance of the buildings and service facilities of the various plants.

This kind of organization was adopted by taking into consideration the shared use of spare parts and technology, and its merits from the administrative standpoint are understandable. Problems occurring in connection with the supply of services are attributable to the supplying side (power stoppage, depth of water at the intake of industrial water of No.4 HI, etc.) and no major trouble in the operation attributable to improper maintenance by the HIC side has been reported so far. Such being the case, there is no need to make immediate changes in the existing organization.

Inasmuch as assuming the responsibility for production and maintenance by considering each plant as an independent unit is regarded as more natural and more desirable when the problem is examined from the

standpoint of the principle of the maintenance of plants, however, it is indispensable to consider the reorganization of the system so as to carry out the maintenance plant by plant when pondering on the responsibility of the maintenance on future occasions.

(3) Absence of the Preventive Maintenance Section

There is no section in charge of preventive maintenance because the totality of the maintenance work is done in the form of break-down (after-the-fact) maintenance.

The aforementioned problem of the maintenance organization is inseparable from the maintenance system. Such being the case, the course for improving the maintenance organization will be examined in the next Section 3-2-2 System for Maintenance of the Equipment.

3-2-2 Maintenance System for Equipment

In view of the facts mentioned in the foregoings, there are two problems in the maintenance system.

(1) Break-down Maintenance

In general the down time of the equipment and facilities in the break-down maintenance system is longer compared with the preventive maintenance system, but as things now stand in HIC the decline in production due to stoppage caused by failure is absorbed by the surplus capacity of the equipment in question because the production load is small compared with the installed capacity (i.e., a decline in the production can be offset by subsequent boosting of production). Under the circumstances, proper importance is not being attached to the role of the maintenance for the sake of production.

In other words, the importance and the necessity of preventive maintenance "PM" is not being properly understood in companywide scale, and there is no sign suggesting the execution of any study aiming at introducing PM.

Inasmuch as the idea of PM has developed as a consequence of the necessity of keeping the operational rate of the equipment at a high

level, it is only natural that the concept of PM has not taken root in HIC because the existing installations are not operating at 100% of their capacity. It must be remembered, however, that the occurrence of a vicious circle consisting of the shortage of spare parts accompanying the rapid deterioration of the facilities and frequent stoppage due to failures will be unavoidable, and furthermore it is perfectly foreseeable that stoppages due to failure will be a serious obstacle to the realization of the goals of future production plans formulated by assuming 100% operational rate if the current maintenance system is not improved on time. Such being the case, it is desirable to start right now the formulation and the execution of medium- and long-term measures to strengthen the control system based on the aforementioned line of reasoning.

(2) Problem of Transfer of Control Technology

HIC has asked for advice of foreign technical experts in connection with operation and maintenance technology, but the system and technology related to the control have been implemented by making use of indigenous idea and criteria. Such being the case, also in connection with the maintenance work there is room for introduction and implementation of systems being used in industrialized countries.

3-2-3 Equipment Deterioration

Problems related to the matter are mentioned in Section 3-1-3 of this document.

3-2-4 Maintenance Costs

No systematic data referring to the maintenance costs has been available in HIC, but the expenditures consisting of the imported spare parts are presumed to account for most of the maintenance costs as mentioned before.

Inasmuch as the totality of the production equipment and facilities are imported from industrialized countries, it is unavoidable to import proprietary spare parts. It is necessary to wait for the upgrading of the domestic industry level of Burma for the sake of cutting down the costs required import repair materials.

The maintenance costs taken into consideration in the production cost consists of personnel expenditure, spare parts and repair materials.

(1) Personnel Expenditure

The personnel expenditure required for the sake of maintenance involves no cost with third parties hired from outside because the totality of the maintenance work is carried out by internal manpower without relying on third parties from outside as mentioned before.

The component of personnel expenditures, including the indirect ones, within the production cost is variable depending on the product as shown in Table AII-3-2-1 but anyway it is fairly small. Since the proportion of the maintenance personnel, including the administrative ones, within the total number of employees is approximately 7%, the maintenance costs is presumed to account for a very small percentage of the production costs.

(2) Costs of Repair Materials

Data referring to imported materials (steel materials, welding rods, etc.) are not available, but in general they account for sums that are far smaller than the costs of spare parts. Moreover, the costs of domestic materials is presumed to be far smaller than the imported ones. Such being the case, the cost of repair materials as a whole are presumed to account for a very small proportion of the production costs.

(3) Costs of Spare Parts

Tables AII-3-2-2(1) through (5) show the purchase record of spare parts.

Sorting out the aforementioned facts, most of the maintenance costs of the equipment consists of imported spare parts, and they exert decisive influence on the maintenance costs as a whole. The costs of the spare parts, excluding import tax and other duties, imported in the last 3 years mounts to ¥300-500 million yen year. It must be borne in mind, however, that the costs of spare parts that must be imported to secure proper maintenance state is presumed to be somewhat larger than

the said sum because as things now stand the import of spare parts is being restricted by the limited availability of foreign currency and not by the initiative to cut down the maintenance costs.

3-2-5 Spare Parts and Materials for Maintenance

During the hearing survey carried out in this study the shortage of imported spare parts and the lead time required to obtain them were frequently mentioned by HIC as the most serious problems they are facing in connection with the maintenance. The problems mentioned by HIC are summarized in 3 points.

(1) The faulty equipment cannot be repaired while such steps as application for foreign currency, execution of the formal procedures for import, arrival of the goods in question are being taken.

(2) Spare parts to cope with failures expected in the near future cannot be secured due to shortage of foreign currency.

(3) Even when internal manufacture of some spare parts is possible the regular production line must be used for the purpose and the production process is stopped as long as the parts in question are being made because there are no special-purpose machine tools.

Furthermore, according to results of the hearing survey carried out at the plants there is shortage of lubricating oil due to the deterioration of foreign currency, and this is presumed to accelerate the deterioration of equiment.

Control of spare parts and materials making use of such techniques as ordering point, economical ordering lot, etc., that are being used in industrialized countries, is not being implemented because in reality there is chronical shortage of spare parts. Improvement of stock control technology is regarded as indispensable concurrently with the modernization of the control system of equipments.

Table AII-3-2-1 RATIO OF LABOR COST TO TOTAL COST, as of 1987

PRODUCT	TOTAL COST(T) @ KYAT	LABOR COST(L) @ KYAT	RATIO L/T X 100 %
D/C BATTERY	3.12	0.06	1.92
FL. LAMP 40W	31.28	0.15	0.48
INC. LAMP 60W	7.18	0.15	2.09
WHM TE-1	653.84	19.20	2.94
LIGHT.FIX HIC-LF-F41	279.70	6.14	2.20
EL. MOTOR 0.75KW	1126.45	14.40	1.28
TRANSF 6.6KV 300KVA	206997.95	2913.60	1.41
EL.ACCESS. 9000-2	4.90	0.11	2.24
EL. FAN 52"	1779.75	63.65	3.58
B600 PICK-UP	65507.50	1989.95	3.04
B600 LIGHT VAN	74740.40	1884.98	2.52
T2000 2T TRUCK	153988.40	3000.00	1.95
X2000 1/2T CR.CTRY.	172651.70	4039.75	2.34
X2000 PATHFINDER	197077.45	6039.75	3.06
6.5T CARGO TRUCK	248986.20	1931.10	0.78
25 PASSENGER BUS	354144.00	1755.55	0.50
PUMP 4" NORMAL	3512.20	34.44	0.98
DIESL. ENG. KND5B	5300.70	62.40	1.18
POWER TILLER	13302.00	67.09	0.50
THRESHER	4063.60	42.24	1.04
(TOTAL)			(1.6)

Source: Cost Analysis for Products (1987) (HIC)

Table AII-3-2-2(1)

MACHINERY SPARE PARTS PURCHASED

FOR HEAVY INDUSTRIES CORPORATIONS

Amount in Million Yen

Sr. No.	Description	Amount FOB ¥ 1984	Amount FOB ¥ 1985	Amount FOB ¥ 1986	Total
1.	Heavy Vehicles	103.8	105.7	71.7	281.2
2.	Light Vehicles	117.3	141.9	137.4	396.6
3.	Agricultural Machinery and Equipment	140.4	110.0	112.2	362.6
4.	Electrical Home Appliance and Electronic Products	103.1	131.5	23.9	258.5
	Total	464.6	487.1	345.2	1298.9

Source: Machinery Spare Parts Purchased for Heavy Industries Corporation (HIC).

Table AII-3-2-2(2)

MACHINERY SPARE PARTS AND TOOLS PURCHASED

FOR HEAVY VEHICLES PRODUCTION

Amount in Million Yen

Sr. No.	Description	Amount FOB ¥ 1984	Amount FOB ¥ 1985	Amount FOB ¥ 1986	Total
1.	For No.1 Heavy Industry	21.5	41.9	45.4	108.8
2.	For No.2 Heavy Industry	-	0.1	-	0.1
3.	For No.3 Heavy Industry	-	-	-	-
4.	For No.4 Heavy Industry	0.2	9.0	-	9.2
	Total	21.7	51.0	45.4	118.1

Description	Amount FOB ¥ 1984	Amount FOB ¥ 1985	Amount FOB ¥ 1986	Total
Tools				
For No.1 Heavy Industry	31.2	50.3	2.3	83.8
For No.4 Heavy Industry	50.9	-	24.0	74.9
For No.3 Heavy Industry	-	4.4	-	4.4
Total	82.1	54.7	26.3	163.1

Source: Machinery Spare Parts Purchased under Heavy Vehicles (HIC)

Table AII-3-2-2(3)

MACHINERY SPARE PARTS AND TOOLS PURCHASED

FOR LIGHT VEHICLES PRODUCTION

Amount in Million Yen

Sr. No.	Description	Amount FOB ¥ 1984	Amount FOB ¥ 1985	Amount FOB ¥ 1986	Total
1.	For No.1 Heavy Industry	31.4	50.5	4.7	86.6
2.	For No.2 Heavy Industry	0.4	0.2	-	0.6
3.	For No.3 Heavy Industry	26.4	26.8	6.3	59.5
4.	For No.4 Heavy Industry	14.5	44.9	52.5	111.9
5.	For No.5 Heavy Industry	-	-	-	-
6.	For Production Dept.	-	4.1	42.8	46.9
	Total	72.7	126.5	106.3	305.5

Description	Amount FOB ¥ 1984	Amount FOB ¥ 1985	Amount FOB ¥ 1986	Total
Tools				
For No.1 Heavy Industry	6.8	4.4	-	11.2
For No.4 Heavy Industry	87.8	11.0	31.1	79.9
Total	44.6	15.4	31.1	91.1

Source: Machinery Spare Parts Purchased under Light Vehicles (HIC)

Table AII-3-2-2(4)

MACHINERY SPARE PARTS AND TOOLS PURCHASED

FOR AGRICULTURAL MACHINERY AND EQUIPMENT PRODUCTION

Amount in Million Yen

Sr. No.	Description	Amount FOB ¥ 1984	Amount FOB ¥ 1985	Amount FOB ¥ 1986	Total
1.	For No.1 Heavy Industry	-	0.1	0.9	1.0
2.	For No.2 Heavy Industry	0.7	1.3	0.9	2.9
3.	For No.3 Heavy Industry	78.0	68.0	66.9	212.9
4.	For No.4 Heavy Industry	-	1.0	-	1.0
5.	For No.5 Heavy Industry	19.2	0.4	-	19.6
6.	For Design Department	1.9	-	-	1.9
7.	For Electric & Services	6.2	2.0	-	8.2
	Total	106.0	72.8	68.7	247.5

Description	Amount FOB ¥ 1984	Amount FOB ¥ 1985	Amount FOB ¥ 1986	Total
Cutting Tools				
For No.1 Heavy Industry	1.8	-	-	1.5
For No.2 Heavy Industry	9.4	-	-	9.4
For No.3 Heavy Industry	23.5	37.2	43.5	104.2
Total	34.4	37.2	43.5	115.1

Source: Machinery Spare Parts Purchased under Agricultural Machinery and Equipment (HIC)

Table AII-3-2-2(5)

MACHINERY SPARE PARTS AND TOOLS PURCHASED

FOR ELECTRICAL APPLIANCE AND ELECTRIC PRODUCTS PRODUCTION

Amount in Million Yen

Sr. No.	Description	Amount FOB ¥ 1984	Amount FOB ¥ 1985	Amount FOB ¥ 1986	Total
1.	For No.1 Heavy Industry	66.5	119.7	22.4	208.6
2.	For No.2 Heavy Industry	-	8.2	-	8.2
3.	For No.3 Heavy Industry	9.3	1.0	0.6	10.9
4.	For No.4 Heavy Industry	6.7	2.6	-	9.3
5.	For No.5 Heavy Industry	18.7	-	-	18.7
6.	For Electric & Service Dept.	1.9	-	0.9	2.8
	Total	103.1	131.5	23.9	258.5

Source: Machinery Spare Parts Purchased under Electrical Appliance and Electric Products (HIC)

3-3 Improvements to be Made in Control of Equipment

3-3-1 Organization Concerned and Maintenance of Equipment

Improvement of the maintenance organization and improvement of the maintenance system must be approached from two standpoints, taking into consideration the recent progress and the proven record of systems adopted in the mechanical industry of advanced countries.

(1) Immediate improvement of the current problems of HIC.

(2) Improvement, in the medium- and long-range, of problems that are not apparent yet in HIC, but are expected to occur in the future.

It is recommendable to take the steps described in the following in correspondence to the facts mentioned in (1) and (2) above.

Gradual change is required to realize the switching from the break-down maintenance system adopted at the present time to the PM system. Concurrently, it is desirable to make gradual changes in the organization to cope with the introduction of PM.

As for the concrete modification method, it is recommendable to take the steps mentioned in the Renovation Plan, described in another section of this document, by taking into consideration the current technical level, the local customs and other relevant matters.

The presence of foreign advisors is regarded as indispensable in the various stages of implementation of the said modification.

3-3-2 Equipment Deterioration

Two points are regarded as indispensable to cope with the deterioration of equipment and facilities. Refer to the Renovation Plan for details.

(1) Availability of spare parts
(2) Preventive maintenance system

Besides the aforementioned points there is another problem requiring urgent solution.

(3) Supply of lubricating oil to stop the progress of the deterioration of the machinery

In connection with the said problem it is indispensabale to take proper measures for the Government of Burma to secure priority supply of lubricating oil, cutting oil and hydraulic fluid and other items to HIC.

3-3-3 Maintenance Costs

As can be seen from the aforestated considerations, it is indispensable to take steps to cut down the expenditures with imported spare parts in order to reduce the proportion of the maintenance costs within the production cost. This is possible by promoting the local production of spare parts (by expanding the scope of machining of materials in the plants of HIC).

As for the other costs, it is presumed that as things now stand there is no factor leading to substantial increases in the future.

3-3-4 Spare Parts and Materials for Maintenance

In view of the problems mentioned above, the course for improvement of the situation is summarized in the following.

(1) Improvements

1) Improvement Measures in the Short-Range

- Promotion of the import of spare parts
- Exhaustive survey of spare parts that can be used in common

2) Improvement Measures in the Medium- and Long-Range

- Construction of a new workshop to make spare parts
  Subsidiary requirement: To secure drawings and sketches of spare parts as well as materials to make them.

- Systematic procurement of spare parts and materials through gradual introduction of PM

  Subsidiary requirement: Introduction and implementation of techniques to control the stock of spare parts.

3-4 Office Equipment

3-4-1 Current Position and Problems

Data provided by HIC in connection with the office equipment and facilities of the head office and the various plants of HIC are shown in Tables AII-3-4-1-(1) through AII-3-4-1-(5).

Head Office

a) The design department is fairly equipped with drafting instruments, copier machine and typewriter. Furthermore, there is the center for photographing, development and storage of microfilms, which is a subsidiary section of the design department but is located in another building. These facilities are provided with relatively recent equipment, and there is surplus capacity.

b) The ordinary offices are fairly equipped with typewriters but there is not a single copier machine or word processor.

Plants

a) The administrative office of the plants is fairly equipped with typewriters but in the shop offices and store offices there is shortage of this kind of equipment.

   Furthermore, the typewriters are worn out due to excessive use.

b) No.3 HI is equipped with 5 outdated copier machines, and the other plants are provided with only 1 or 2 such copiers. However, most of these copiers are worn beyond repair and could not be used at all. At present, only 1 unit each is in operation at No.3 HI and No.5 HI, none at all at No.1 HI and No.4 HI.

c) As for drafting machines, each plant is equipped with 1 through 3 units. The plants are staffed with draftsmen, and as things now stand there is no shortage of drafting machines because the draftsmen are not designers in the true sense of the word.

The common problems referring mainly to the plants, identified from the aforesaid current position, are mentioned in the followings.

(1) Because the existing copiers are in extremely poor condition, this hampers dissemination of information. Under these circumstances, the lack of copiers is made up for by making multiple carbon copies on a typewriter or, in the worst case, making copies in longhand. However, drawings, graphics, etc. could not be reproduced and distributed because it is impossible to copy these materials by such methods.

Such problems as impracticability of making large-sized drawings (A2 or more) and impracticability of copying drawings, even when the original drawing is available, outside the head office are one of the reasons making it impracticable to carry out the design and drafting activities at the plants.

(2) Typewriters are concentrated at the administrative office of the plant, but they are being used very frequently and there are troubles from the practical standpoint. There is shortage of typewriters in the plants as a whole, and in some sections there is no choice but using handwritten documents.

(3) Calculators are old fashioned furthermore they are not available in sufficient quantity. HIC is manufacturing electric calculators. Whereas the production plan for 1986/87 was considering 1500 units, the actual production record mounted to barely a half of the planned total which was 750 units. Future plans are considering an annual production of 1000 units. It seems that calculators manufactured in the corporation are rarely being used in the corporation.

(4) Office Fixtures and Ancillaries

From the standpoint of giving play to the functions of the office there is basic shortage of the following items.

- Cabinets, racks
- Various kinds of file
- Paper articles (forms, slips, etc.)

As things now stand documents are being kept piled up one over the other, makeshift files are being manufactured of discarded cardboard boxes, handwritten slip forms are being manufactured by cutting ordinary paper sheets in slim strips, and people are making use of any available means to cope with the shortage of resources of various kinds.

(5) Others

- Drafting Machines

  Use of drafting machines will increase efficiency when producing large size or complicated drawings.

  However, it would not be said there is a shortage of drafting machine because design work load is not so heavy at present.

- Reference Literature and Catalogues of Equipment

  They are in shortage anyway.

  Foreign currency is required to purchase reference literature and other kinds of books, and their shortage is bringing about inconveniences because executives and staff of the head office and plants have no means to study and acquire new knowledge related to their job.
  In the plants there is no library to be used by the employees.

- No filing system exists to keep data and documents ready for access by any interested person and to facilitate discarding of outdated date and documents.

- Since no space suited for use as office is available in the buildings, there are many cases in which the interior of stores is

being used as office or desks and shelves are installed on the shop floor to secure office space. The situation involves problems related to keeping documents for long time because these spaces are exposed to dust.

3-4-2 Improvements to be Made

3-4-2-1 Items to be Procured from Overseas (Requiring Foreign Currency)

- Copier machines
- Typewriters (or Word processors)
- Electronic calculators
- Reference literature

Foreign currency allocation must newly be arranged to introduce these items. As for copiers and typewriters (to be replaced by word processors in the future) in particular, it is necessary to arrange for an adequate stock of service parts. Consideration to the availability of servicing techniques including adjustments and repairs is also necessary. In addition, it is important to study arrangements for supplies (paper, ink, ink ribbons, etc.).

It is believed that a service network is yet to be developed in Burma. Under these circumstances, it is desirable that a group of in-house skilled personnel capable of performing required service functions be trained at HIC to be ready to make rounds of inspection and respond to service calls.

For electronic calculators, it is considered available and advisable to use imports.

If foreign currency sufficient to purchase reference bibliography in large quantities is not available, it is recommendable to take measures to provide at least one library at the head office and one at each plant so as to keep the books under centralized control and to facilitate the access of the interested parties to these materials. It is necessary to reserve a permanent foreign currency budget to facilitate the purchase of books and literature from abroad so as to allow prompt decision and purchase within a fixed limit of the budget reserved for each section.

As for equipment to copy drawings with A2-size or more and equipment for microfilming and reproduction of drawings, a relatively modern system is

available at the HIC head office, and as far as the Rangoon district is concerned there is no problem in this regard. It is desirable to install facilities of this kind in No.3 HI or in No.5 HI because they are not available in the Sinde and Htonbo districts. The production technology center to be installed at the said places can also take charge of the operation and maintenance of these facilities.

3-4-2-2 Items to be Procured Domestically

The matters related to the items to be procured domestically are mentioned in the followings.

(1) Ofice Supplies

- Cabinets
- Shelves
- Files
- Forms

(2) Wooden Shelves and Cabinets

(3) Steel cabinets can be made by using leftovers of thin steel plates used in the press shop of HIC, and furthermore shelves can be made by using leftovers of shape steel.

(4) The form of the slips, that are the kind of document used most frequently, should be established in the HIC and should be made by simplified priting.

3-4-2-3 Streamlining of the Office Work

Written directives and an assortment of slips which are most frequently used in daily routine are prepared in standardized format. However, various internal provisions at HIC are not completely established.

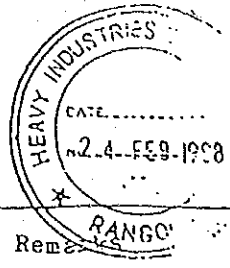
No provisions governing the standard procedures for preservation of documents and materials exist, either.

It is recommended that Administration Department at the Head Office of HIC take the initiative in drawing up plans for the streamlining of office work including the introduction of the filing system.

In this case, it is important that the representative of Administration Department at each plant also participate in the planning to study various methods appropriate for actual conditions, and establish and operate internal office work control provisions.

A substantial number of personnel are engaged in general office work both at the Headoffice and HIs. The offices of the warehouses are also staffed with many clerical workers. These workers should promote the streamlining of their work and study the assignment of available personnel to production control and direct work on the principle of the right person in the right place.

Table AII-3-4-1(1) LIST OF OFFICE EQUIPMENT AT HIC (HEAD OFFICE)



Sr. No.	Description	Qty	Remarks
1.	Drawing Board	50	
2.	Copier (Plain paper) (1) NP 60 - 1 (2) NP 50 - 1 (3) NP 155- 2	4	
3.	Copier (Blue-F) (1) Metem 223 R - 1 (2) Automatic 6006 - 1 (3) Este Kombi 3000 - 1	3	
4.	Microfilm Camera (1) 16 mm Camera Model : 161G Type B Maker : Cannon	1	
	(2) 35 mm Camera Model : FMAC 500L Maker : Fuji	1	
5.	Microfilm Reader/Printer		
	(1) 16 mm reader/printer Model : NP-Matic Printer 200 Maker : Cannon	1	
	(2) 35 mm reader/printer Model : NP Matic Printer 600 Max: Paper Size : A.2 Maker : Cannon	1	
6.	Duplicating Machine (Fulscap size)	7	1 No Unserviceable
7.	Duplicating Machine (Brief size)	3	1 No Unserviceable
8.	Typewriter (Burmese)	13	
9.	Typewriter (English)	17	
10.	Personal Computer	15	
	Detail as per attached list		

Source: Document dated Feb. 24th 1988 provided by HIC Head Office

Table AII-3-4-1(2)

TYPEWRITERS AND ELECTRONIC CALCULATORS POSSESSED BY NO.1 HI

SR.NO.	DESCRIPTION	Q'TY
1	Type Writer Burmese Olympia 18"	4.Nos
2	" " " 24"	2.Nos
3	Type Writer English Olympia 15"	1.Nos
4	" " " 18"	2.Nos
5	" " " 28"	1.Nos
6	Calculater Facit 1004	1.nos
7	" " CI (13)	1.Nos
8	" National 737787	1.Nos
9	" Panasonic Electronic JE 2061 U	7.Nos
10	" " " JE2801 P	2.Nos

Source: No.1 HI Document 1.14

Table AII-3-4-1(3) OFFICE EQUIPMENT OF NO.3 HI

Sr. No.	Department	Typing Machine		Drawing Board	Gestemer Copy M/C	Copying M/C	White Printing M/C
		English	Burmese				
1.	Admin	1	2	-	1	-	-
2.	Tech. Planning Dept	2	1	3	-	2	1
3.	Material Planning Dept	1	1	-	1	-	-
4.	Manufacture Store	2	-	-	-	-	-
5.	Production Dept(No.3)	-	-	-	-	-	-
6.	Finance	-	1	-	-	-	-
7.	Production Dept(No.4)	1	-	-	-	-	-
8.	Construction	1	-	-	-	-	-
	Total	8	5	3	2	2	1
	Good	6	5	3	2	1	1
	Unserviciable	2	-	-	-	1	-

Source: Document provided by No.3 HI

Table AII-3-4-1(4) ELECTRONIC CALCULATORS POSSESSED BY NO.4 HI

Sr No.	Description	Model	Specification	Qty
1.	Electric Calculator	JE-26334	Panasonic, Size 6" 12 Digits	4 Nos

Source: Document 4.89 provided by No.4 HI

Table AII-3-4-1(5) OFFICE EQUIPMENT OF NO.5 HI

S = Serviceable

R = Repairable

U = Unserviceable

Sr. No.	Description of Equipment	Made in	Model	Size of Capacity	Registration No.	Date Condition				Remarks
						Received	S	R	U	
1	2	3	4	5	6	7	8	9	10	11
1.	Olympia international type riter	GERMANY		18"	B-7-5228380	10.6.83	V			English
2.	Electric type writer	GERMANY	SGK-65	18"	47-0517018	15.5.84	V			"
3.	Type writer ADLER	T.A.Organization GERMANY		18"	30401574	1981	V			"
4.	Portable-type writer(CONSUL)	CHECHO-SLOVAKIA		10"/8"	0222-171709	15.6.81	V			"
5.	Type writer	T.A. Vertriang	GAHRTELE GERMANY	10 8"	A301-03005 (Form-2)	10.9.82	V			"
6.	Type writer(OLYMPIA)	GERMANY	BG-3N	15"/18"	7-4153848	19.5.79	V			Burmese
7.	Type writer(OLYMPIA)	GERMANY		24"/18"	B-7-5227679	10.6.83	V			"
8.	Duplicating machine gastemer	ENGLAND	GASTENER	1520	1.61A-2713	8.7.83	V			
9.	Hectograph(ORMIG)	GERMANY			F-229330	15.5.84	V			
10.	Copying press(CANNON)	JAPAN			30129505	15.5.84	V			Spare required
11.	White printing machine	GERMANY	E8. TE Automatic 5005			3.3.81	V			Spare required
12.	Electric calculator Panasonic	Matsushita	JE/2601		000397	7.4.82			V	
13.	Drawing Board	GERMANY					V			

Source: Document 5.5 provided by No.5 HI

3-5 Utilization of Computers

3-5-1 Current Position of the Utilization of Computers

The utilization of personal computers, both in technical field and clerical work field is very active at the computer room of the HIC head office.

The specifications of the existing computer hardware are shown in Table AII-3-5-1.

Of the existing computer equipment the TURBO-XT model is made in Singapore, the DYNAMICS-TURBO model is made in Taiwan and the other models are made in Japan. The equipment currently in use are all 16-bit business personal computers.

The operating staff is organized by about 10 persons including a few operators who have received training in foreign countries and are capable of developing programs in BASIC language. Besides the manager there are 3 more persons able to generate programs of their own, totaling a staff of 4 programmers. The other operators are working under the supervision of more experienced people and studying by themselves.

It was learned that 15 persons in total are being trained in 4-month courses (mainly operators) and 2-year courses (mainly system and software personnel) according to the plan of human resources for computerization. There are plans to increase the computer staff by approximately 5 persons per year.

The programs in practical use or under development are shown in Table AII-3-5-2(1)∿(3). They are applications of the following semipackaged programs that facilitate instant software utilization.

- Lotus - 1, 2, 3
- IBM BASICA
- Multiplan
- d-Base-III

These programs are being applied exclusively for uses of independent type, and there is no case of relational network type application.

Cases of practical application consist mostly of handling tabulation work carried out on the workplace by bringing the relevant data into the com-

puter room, and on-line operation with the computer installed on the floor of the workplace is not available yet.

HIC has no plans to substantially expand both hardware and software at once. Instead, they intend to follow the policy of promoting application of software to be developed through steady efforts at the level of personal computers.

The manager clarified that the plan for future development is outlined was the followings.

- Installation of personal computers in the various plants during the next year aiming at training and familiarization with this kind of equipment.
- Opening of the computer course in the Training Center located in Sinde during the next year.
- Realization of mutual connection between computers (LAN: Local Area Network) within approximately 2 years
- Future introduction of CAD (Computer Aided Design).

3-5-2 Problems of HIC

(1) Problem of the Corporate Environment Related to the Construction of the System

Broadly speaking jobs susceptible of application of computers are classified in business type jobs and technical type jobs. Anyway, the most important problem to be considered before introducing the computer itself is to verify whether the information of the job in question is properly standardized and whether the flow and the classification of the information in question is properly systematized.

In other words, it is the most important that the control system by manual work be established and that an environment at the workplace exist in which decisions once made faithfully followed.

(2) Problems Related to the Availability of Foreign Currency

The modernization plan formulated by HIC requires the financial resources mentioned in the following.

Medium-term modernization plan:	
Office automation for improvement of planning, design, stock control and management process	¥300 million
Long-term modernization plan:	
Upgrading of office equipment	¥200 million
TOTAL	¥500 million

The breakdown of the aforementioned sum is shown in the following table.

BUDGET OF THE OA PLAN PROPOSED BY HIC

- Technical services:	¥10 million
- Machinery & equipment:	¥490 million
TOTAL	¥500 million

Breakdown

1)	Drawing boards and instrument	1 lot
2)	Auto drafting machine	1 "
3)	Computer work station	1 "
4)	Personal Computer	1 "
5)	Software	1 "
6)	Word processor	1 "
7)	Plain paper copier	1 "
8)	Desk top printing facilities	1 "
9)	Microfilm equipment	1 "
10)	Document filing and retrieving facilities	1 "
11)	Technical Literatures (such as JIS, ISO, Hand books, etc.)	1 "
12)	Ancillary equipment	1 "

As can be seen, the budget consists mainly of hardware, and furthermore the total sum is too little as computer investment because the plan comprises other office equipment besides computers.

HIC's policy is to use personal computers for computer hardware for the moment, and no medium- or large-size machines of office computer level are included in their present plan. It is also considered advisable not to contemplate introduction of such higher level, more sophisticated machines because no technical capability is available to maintain and control these machines in terms of either hardware or software.

In connection with the selection of hardware models and development of home-made software it is recommendable to pick up qualified personnel out of the HIC staff and to send them for training courses abroad.

(3) Problems Related to the Organization and the Development of Human Resources

1) Maintenance and Control of Hardware

Trial manufacture of personal computers is being attempted at the computer room of the head office by importing modules.

It is indispensable to posses internal service functions comprising such duties as maintenance, control and repair because there is no computer service network in Burma and furthermore the diffusion of computers in other industries and in government offices is just beginning.

2) Training of Software Personnel

- As mentioned in Section 3-5-1 of this document, HIC have programmer training but these programs have not yet accomplished the intended results.

- Cultivation of system engineers depend on improvement of contents of job objectives to which the computer system will be applied. However, the improvement measures described in (1) above have not been implemented yet in the organizations involved.

- The formation of keyboard operators has to be indispensable.

3) Application of Computer Systems to Jobs of Technical Type

The most important problem is the technical level at which computer systems are to be introduced for the sake of design work.

In the first place it is indispensable to establish the basic design method of equipment.

If approach to CAD (computer aided design) is made, design standards and design patterns should be available so that drawings can be produced by combining modules. Also, to prepare lists and tables for purchase of materials, the related data base should be provided so that data are accumulated. For these functions, it is necessary to improve the level of activities performed by Design and other related departments as well as to train qualified personnel.

3-5-3 Proposals for Future Plans

The schematics of the ideal concept referring to the utilization of computers, drawn by taking into consideration the far future, is shown in Figure AII-3-5-1.

The portions of the figure bearing the mark "*1" indicate the stages that are being partially attempted and being put into practical use at the computer room of the head office.

In this connection it is recommended to take the following measures by taking into consideration the current state of things and the future development matching the peculiarities of both HIC and Burma.

(1) Development of Hardware

Along with 1 or 2 simple programs which have already been tried for practical use at the head office, 1 or 2 units of personal computer should be installed at each plant and training should be started for familiarization and operation according to HIC's plan.

The model of personal computer to be installed should be selected by taking into consideration the suitability to form LAN (Local Area

Network) in the future and the possibility of interconnecting with office computer and other kinds of host computer. In this connection it is recommendable to use personal computer of business type which can be used as work station. It is important that compatibility with the personal computer and with the host computer must be taken into consideration when selecting the software.

(2) Development of Software

Standardization and systematization of the duty in question must precede computerization.

A. Utilization of Computer in Technical Field

1) Design of the principal particulars of a transformer surpassing 300 KVA is being tried as a test case of computer application for design purposes. The same line of reasoning should be applied to other types of equipment involving relatively short computing steps such as self priming pump.

2) The approach to CAD (computer aided design) should begin with relatively simple drawings of such simple products as low tension panels.

CAD software should be purchased from abroad. Mastering CAD is indispensable before attempting an approach to CAM (computer aided manufacturing). It is considered effective to plan future application of CAD/CAM to the construction of metallic moulds at HIC.

3) First, an attempt should be made to systematize the filing and retrieval of original drawings to control technical information. As next step, such systematization should be promoted for the filing and retrieval of documents, literature, and other materials.

B. Utilization of Computer in Business Field

As a short-term measures (covering a period of 1 to 3 years), an attempt for computerization should be started with applications that are easy to operate and will bring about effective results. (Some of the following applications mentioned below have already been started on a trial basis.)

- Personnel control:
  Personal history, tabulation of work hours and idle hours, wage calculation.
- Accounting:
  Receipts and disbursements of cash
- Office control:
  Storage and retrieval of documents and bibliography
- Procurement control:
  Tabulation of purchased materials by products, control of terms of delivery
- Stock control:
  Recording of warehousing and delivery of actual articles

1) Before implementing these types of computer application, it is necessary to clearly define in advance the flow of information, what to obtain at output and how such output to be utilized.

2) Various existing coding systems should be revised and re-established to facilitate processing by computer (these coding systems include codes of employees, workplace, equipment, products, parts and units, file classification and others). A cross-reference system should also be established to provide cross-references for old and new codes, if applicable.

3) Furthermore, input and output formats should be designed to match the forms used in current manual processing systems.

4) The targets established in medium- and long-term plans require substantial corporate efforts and technical resources.

   The items bearing no "*1" mark in Figure AII-3-5-1 pertain to these particular targets.

5) As an important fact, when business systems are computerized, introduction in original form of computer systems working satisfactorily in advanced countries would not bring about expected good results. Instead, it is important that HIC select a system to be introduced and further modify it according to their particular operating conditions.

Table AII-3-5-1 COMPUTERS POSSESSED BY THE HEAD OFFICE OF HIC

SR. NO.	BRAND & MODEL	LIST OF COMPUTERS: SPECIFICATION	SUPPLIER	Q'TY	REMARKS
1	NATIONAL (JR-100)	PERSONAL COMPUTER 32 KB ON BOARD CASSETTE STORAGE 45 KEYS(KEY BOARD) 12 INCHES MONOCHROME JR-P01 PRINTER	MATSUSHITA	3 SETS	
2	PANASONIC	PERSONAL COMPUTER 256 KB ON BOARD 8 INCHES DUAL DRIVE 95 KEYS(KEY BOARD) 12 INCHES MONOCHROME MOMONITOR	MATSUSHITA	1 SET	
3	TURBO-XT	PERSONAL COMPUTER 640 KB ON BOARD 8 1/4 DUAL DRIVE 98 KEYS(KEY BOARD) 14 INCHES COLOR MONITOR FT -7000 PRINTER	KINSHO	1 SET	
4	TURBO-XT	PERSONAL COMPUTER 640 KB ON BOARD 8 1/4 DUAL DRIVE 98 KEYS(KEY BOARD) 14 INCHES COLOR MONITOR FT -7000 PRINTER	KINSHO	2 SET	
5	HEATHKIT	PERSONAL COMPUTER 320 KB ON BOARD 5 1/4 DUAL DRIVE 84 KEYS(KEY BOARD) 14 INCHES COLOR MONITOR EPSON FX-100 PRINTER	FTRIZ WANER	1 SET	
6	NEC SYSTEM 20	BUSINESS MICRO COMPUTER 256 KB ON BOARD 8 INCHES DUAL DRIVE 109 KEYS(KEY BOARD) 12 INCHES MONOCHROME MONITOR 35 CPS PRINTER	SUMITOMO	1 SET	
7	TURBO-XT	PERSONAL COMPUTER 640 KB ON BOARD 5 1/4 DUAL DRIVE 98 KEYS(KEY BOARD) 12 INCHES MONOCHROME MONITOR FT -7000 PRINTER	KINSHO	2 SETS	
8	TURBO-XT	PERSONAL COMPUTER 640 KB ON BOARD 5 1/4 DUAL DRIVE 98 KEYS(KEY BOARD) 12 INCHES MONOCHROME MONITOR FT -7000 PRINTER	KINSHO	1 SET	UNDER EXPERIMENTAL MANUFACTURING
9	DYNAMICS-TURBO	PERSONAL COMPUTER 640 KB ON BOARD 5 1/4 DUAL DRIVE 104 KEYS (KEY BOARD) 14 INCHES COLOR DISPLAY FT-7000 PRINTER	FISHERIES CORPORATION	2 SETS	
10	DYNAMICS-TURBO	PERSONAL COMPUTER 640 KB ON BOARD 5 1/4 DUAL DRIVE 20 MB HARD DISK 104 KEYS (KEY BOARD) 14 INCHES COLOR DISPLAY	FISHERIES CORPORATION	1 SET	
			Total	15 sets	

Source: Document provided by the HIC Head Office

Table AII-3-5-2(1)

LIST OF SOFTWARE APPLIED IN HEAVY INDUSTRIES CORPORATION

(Source: Document provided by the HIC Head Office)

(A). LOTUS APPLICATION.

1. Workshop Equipment and Tooling. (INTRA)
2. Production and Delivery Situation of THura Transceiver Sets Accessories. (Third Lot - 280 Sets).
3. THURA Transceiver (204-00-000).
4. Forging and Casting Planning.
5. Bicycle Main Chart.
6. A.M.E Group.
   (Calculation For Raw Material Consumption Rate.
   Component Parts Consumption Rate.
   Auxiliary Material Consumption Rate.
   Stock Balance Quantity.
   Purchased Quantity.
   a. Pump (Model: SC 4C).
   b. Pump (Model: SVO 102KB).
   c. Engine (Model: KND 5B).
   d. Engine (Model: KND 7).
   e. Power Tiller (Model: KMB 200).
   f. Generator (Model: BSK 120).
   g. Generator (Model: BSK 140).
7. Service Station Report.
8. 13 CL Summary. (A.M.E)
9. Tyre, Tube, Flat & Bladder.
   a. Tyre Calculation.
      For Tyre 21 Item.
      Tube 20 Item.
      Flat 5 Item.
      Bladder 21 Item.
   b. Raw Material Consumption Rate. (Code List)
      Calculation For Require Weight & Amount.
      Balance Weight & Amount.
      Net Weight & Amount.
   c. Summary Raw Material Consumption Rate.
      Total Generation Form & Balance Stock percentage
   d. Invoice Report Form.
      On detail Raw Material Name & Req Qty, Unit Price & Amount.
   e. Local Raw Material Consumption Rate.
      Calculation For Require Weight & Amount.
      Balance Weight & Amount.
      Net Weight & Amount.
   f. The Costing Value For Raw Material.
   g. The Costing Value For Local Raw Material.
10. Monthly Report.
    a. For No.(1) Heavy Industry.
       No.(2) Heavy Industry.
       No.(3) Heavy Industry.
       No.(4) Heavy Industry.
       No.(5) Heavy Industry.
       No.(6) Heavy Industry.

b. Standard Generation Report Form.
Calculation For Target Quantity & Amount.
Opening Stock Quantity & Amount.
Monthly Production Qty & Amount.
Accumulated Production.
Monthly Sale Qty & Amount.
Closing Stock Balance Qty & Amount.
c. Summary Generation Report Form.
Sub Total & Grand Total By Industry Wise.
d. In Data Store Form.
Monthly Production & Sale By Industry Wise.
e. In Closing Stock Balance.
Extract From Standard Report Form.

11. Heavy Vehicles.
a. Raw Material Consumption Rate.
b. Auxiliary Material Consumption Rate.
12. Machine Tools.
a. Raw Material Consumption Rate.
13. Electric Hot Plate.
a. Raw Material Consumption Rate & Invoice Report Form.
14. Tyre Sanction.
Tyre Sanctionable Qty Form.
15. Export Situation.
Export Situation Report Form to Minister's Office.
16. Forging and Casting Planning.

(B). IBM BASICA APPLICATION.

1. Components Fitted On Main PCB.
(THURA HF SSB Transceiver Set).
2. CP/RM For HF SSB Transceiver Manpack 5 Watts.
3. Evaluation of Cost Per SSB Set. (Main Unit)
4. CP/RM For Ancillary Equipment For HF SSB Transceiver Manpack.
5. Material Situation For HF SSB Transceiver Manpack.
6. Electronic Active Passive Components For HF SSB Transceiver Manpack From INTRA Singapore nd Centurian U.K
7. Transformer Design
8. Pumping Unit Gear Box Design.
9. Net Reducer Torque Calculation.
10. Transformer Main Chart and Raw Material List.
11. Indexing. (XVA 44L)
12. E.C.C (Demand Quantity & Approved Quantity in Yearly.)
For State Organ Of Power & (20) Ministries
a. By Ministry, Corporation, Department Wise Generation Report.
b. By HIC Product Group, Product Name Wise Generation Report.
c. The Product Total Generation Report.
d. Approved List For Vehicles in Yearly.
13. General Sale & Issue Situation.
a. List of Order No./Date, Order Quantity From Corporation.
By Product Wise.
b. List of Issue No./Date, Issue Quantity From Corporation.
By Product Wise.
c. Calculation For Stock Balance Quantity.
By Product Wise.

14. Code No. & Name.
    a. Corporation, Department Name & Relational Code No. for State Organ of Power & (20) Ministries.
    b. Product Name, Model No. & Relational Code No. for All Products in Heavy Industries Corporation.
15. Tyre Situation.
    a. Tyre Order Monthly Situation.
    b. Tyre Order Accumulated Situation.
    c. Tyre Order, Sanction, Balance Accumulated Situation.
16. Welding Electrode Situation.
    a. Welding Electrode Order Monthly Situation.
    b. Welding Electrode Order, Sanction, Balance Accumulated Situation
17. Press Fast Situation.
18. D.H.I Employee Payroll
19. Inventory (V Belt & Ball Bearing)

(C). MULTIPLAN APPLICATION.

1. Transformer Raw Materials, Component Parts, Spare Parts Purchase Plan And Price Calculation.
2. Electric Fan (130 YO)
   Raw Material Consumption Rate & Invoice Report Form.
3. Raw Material Consumption Rate & Invoice Report Form.

(D). DBASE III APPLICATION.

1. M.O.C Spares Stock Situation System.
2. Fuel Injunction Pump. (PV 4B 8F 115G 1444)
   a. Part List Generation Report Form.
      By Data Management & Record Collection.
   b. Material Schedule Report Form.
      By Data Management & Record Collection.
3. Nozzle Holder. (VN 805453 B 1064)
   a. Part List Generation Report Form.
      By Data Management & Record Collection.
   b. Material Schedule Report Form.
      By Data Management & Record Collection.
4. Nozzle Complete.
   Part List Generation Report Form.
      By Data Management & Record Collection.
5. Heavy Vehicles. (For Raw Material)
   a. Closing Stock Balance in Store Department.
      By Data Management.
   b. Total Stock Balance Calculation.
      By Same Material Wise & Deimension Wise.
6. Heavy Vehicles. (For Auxiliary Material)
   a. Closing Stock Balance in Store Department.
      By Data Management.
   b. Total Stock Balance Calculation.
      By Same Material Wise & Dimension Wise.

Figure AII-3-5-1 CONCEPT OF THE INFORMATION SYSTEM FOR BUSINESS ADMINISTRATION