Chapter 4 QUALITY CONTROL

4-1 Current Organization and Problems

4-1-1 Organization

The quality control organization at the head office is Quality Control Section subordinate to Planning Department. Refer to Figure AII-4-1-1.

The each plant has its own Inspection and Quality Control Section under the control of the Planning Department of the plant, and the example of No.1 HI is shown in Figure AII-4-1-2. The organization and arrangement regarding the matter is practically the same also in other plants.

The personnel breakdown by hierarchy of the Inspection and Quality Section of the plants No.1 HI, No.3 HI, No.4 HI and the comparison of the said personnel with the total number of employees of the plant are shown in Table AII-4-1-1.

It must be borne in mind, however, that the inspectors related to the manufacture of electric products are not included in Table AII-4-1-1 and are directly under the control of the production process line belonging to the each plant instead.

Inasmuch as personnel involved in the inspection of electric products is not included in the list of personnel of the Inspection and Quality Control Section, the number of persons involved in this category of work is presumed to be slightly larger than the number of persons mentioned in Table AII-4-1-1, accounting for 5%-8% of the total personnel of the plant. The percentage of inspection and quality control personnel of No.3 HI is particularly large because there are more inspectors in the foundry than in other workplaces.

It may safely be said that the work force being committed to the inspection duties is disproportionately large for an enterprise as HIC engaged in the mass production of standard type goods. In Japan the apparent number of persons engaged exclusively in inspection and quality control duties shown in the organization chart of the workplace is very small because spontaneous inspection is included in the routine duties of workers of ordinary production lines and furthermore the inspection and measurement of mass-production goods is in advanced state of automation.

4-1-2 Methods of Inspection and Quality Control

(1) Functions of the Organization in Charge of Inspection

Most of the personnel of the Inspection and Quality Control Section of the plant is dispersed and a very modest staff is under direct control of the Chief of Section. Figure AII-4-1-3 shows the state of things at No.4 HI.

As their responsibility, the inspection and quality control personnel measure dimensions of the parts and check or test assembled products in the manufacturing flow through production lines. In other words, they play the role of direct inspection personnel. Once a month the list containing the inspection record is submitted to the Chief of the Inspection and Quality Control Section.

Figure AII-4-1-4 shows the mechanism how this system works.

Figure AII-4-1-5 shows the finishing inspection flow of light vehicles.

Check of the parts in the midway through the machining and assembly processes are left to the spontaneous inspection of the workers, and in general no inspection record is registered in this connection.

The major responsibilities of the chief of Inspection and Quality Control Section is to coordinate the number of inspectors to be assigned to each production lines as well as to edit inspection record data and compile statistics on such data.

(2) Problems Related to the Activities of the Organization in Charge and the Method of Inspection

1) Workers responsible for the production line are lacking in motivation to improve the quality of products because inspection is left complepletely to inspectors. On the other hand, the inspectors merely remove the faulty items or mark them for subsequent diversion to the repair line, and take no action to remove the causes of the problems. Both parties are merely doing what they are being said to do, and no initiative is being taken to improve the quality.

2) Inasmuch as the Chief of the Inspection and Quality Control Section does not have perfect control of the characteristics of the production lines, no problem related to quality control is brought forward, no initiative is taken to improve the state of things, and what the chief of section is doing is merely to function as an office which sends the work force to their workplaces and tabulates the inspection records.

3) The inspectors are not given much directions from the Chief of the Inspection and Quality Control Section who is their superior, and furthermore the supervisor of the production line where they are stationed is not their superior. Under the circumstances there is no satisfactory communication between the parties concerned for executing the activities of the organization and furthermore the responsibilities are not clearly defined.

4) Since there is practically no record of the spontaneous inspection carried out by the workers of the production line, there is no means to know up to which point the quality control is working.

4-1-3 Inspection and Test Equipment

Such equipment as gauges, measuring instruments, test facilities and the like are timeworn, and most of them are improper for use due to damages or discalibrated and being used as they are. Details of these aspects are reported in the diagnosis of the production line of each product described in APPENDIX I.

People seem to have given up improving the situation because any request in this connection is declined in view of the shortage of necessary foreign currency.

In some extreme cases the test and measurement processes are omitted at all because their implementation is impracticable. Some examples are mentioned in the followings.

- Since the galvanometer for measurement of the initial characteristics in the final inspection of incandescent lamp in No.1 HI is broken, this test is not being carried out at all in the last 2 or 3 years. Under the circumstances there is risk of producing incandescent lamps with short service life.

- The two Horse-Power Calculators to test the engines for light vehicles at No.4 HI are broken. Such being the case the engines are being delivered without checking the output performance.

- The following equipment for final tests of light vehicles at No.4 HI are broken and therefore tests using them are impracticable.

  . Head light tester (convergence adjusting equipment)
  . Meter of the brake tester
  . Speed meter tester (air lift failure)

There are many other cases of failures, but they are omitted here because details are mentioned in the diagnosis of each production line reported in ANNEX I.

As things now stand there is no organization able to calibrate measuring instruments in HIC nor in the government offices of Burma.

4-1-4 State of Availability of Standards and Manuals

Such aspects as the functions and performance of the products, accuracy of the machined components, etc., have reportedly been inherited from Japanese manufacturers of the 4 projects that took charge of the manufacturing technique aid. There are some sections in which draiwngs and work manuals are stuck on the walls at the machining site of standard articles.

It must be remembered, however, that such important aspects as the work standards as well as points and aspects requiring special attention to secure the quality and prevent the faulty manufacturing and assembling products are not clearly known. There are manuals but they are kept in the files of such superior personnel as chief of section and foremen, and their contents are not known by workers, and furthermore no effective results are expected because directions and instructions are being given verbally. The unavailability of copy machines in the plants are making things worse.

At the plating shop of No.1 HI, notice boards indicate the duration of the treatment time and the intensity of the plating current of each plating bath. Such display of instructions is effective. Personnel of the shop workers by display of instruction posters can understand at a sight the work methods and the cautions referring to the work. It is advisable to introduce this method in HIC because it can be implemented with ease when there is any encouragement or motivation.

4-1-5 Filing System

Records, data, statistical documents, reports and the like about quality control must be kept in such a way to be accessible whenever and whoever required.

Data and documents must be controlled in such a way to use them as means to identify the causes of troubles and to find out ways to improve the situation.

In the head office and in the plant offices of HIC data and documents referring not only to quality control but also to other matters were not being properly sorted out and stored. Such being the case, finding the required data and documents and bibliography depends on the memory and on

the intuition of the person in charge of its storage, and as things now stand it is impossible to make any attempt of shared use.

Furthermore, there is practically no criteria for systematic control, classification and numbering.

Documents and drawings tend to be kept locked in the files of the managers in fear of being soiled or lost because they can not be copied due to the unavailability of copier machines in the plants.

4-1-6 System to Prevent the Recurrence of Faults

HIC has a feedback system on defects. Under this system, if defects develop in manufacturing processes for causes other than on the relevant production line, i.e., causes found in raw material of attributed to the preceding stage. Quality Control Section will take necessary remedial action to prevent recurrence of such defects in consultation with all the parties concerned. Refer to Figure AII-4-1-6.

However, no documents proving that this system is fully functioning were found.

The quantities of parts that are found defective and rejected are recorded and reported in the form of monthly and annual statistics. Refer to Figure AII-4-1-7.

However, no recommendations for improvement are fed back to the party responsible for defects because no statistics of defects by cause are available. Shops which detect defects will not trace their causes to other shops. Inspection and Quality Control Section makes no attempt to trace their causes, and leaves the problem without any action for improvement.

Because percentage defective is high at the casting shop of No.3 HI, statistics of defects by cause are now being taken under the guidance of a Japanese resident.

4-1-7 Servicing System

The system to cope with complaints from the user, that occur when the product is delivered, used and put into practical operation, is not satisfactorily organized. In general, the period of guarantee with repair free of charge has 1-year duration. The Sales Department of the head office takes charge of the supply of parts for repair. Local organizations in charge of servicing are located in Rangoon and in Mandalay.

There is a vehicle service station at No.1 HI. It was verified, that the said service station is mainly in charge of the repairs of vehicles possessed by HIC.

As things now stand there is no data tracing the quality of the products after their delivery.

The only exception, in which quality data are available, consists of distribution transformers manufactured by No.5 HI that are totally delivered to the Electric Power Corporation. Transformers that are burned are sent back to No.5 HI for repair, and the causes of the burning are recorded. Refer to Table AII-4-1-2.

Table AII-4-1-1 THE NUMBER OF PERSONNEL IN CHARGE OF INSPECTION AND QUALITY CONTROL IN EACH PLANT

Hierarchy / Plant	Total number of employees of the plant	Breakdown of the personnel of the Inspection and Quality Control Section					
		Chief of section and engineer	Foreman	Skilled worker	Semi-skilled worker	Un-skilled worker	Total
No.1 HI	3,107	1	4	44	45	14	108
No.3 HI	2,507	85	16	22	34	13	170
No.4 HI	1,737	7	6	46	15	1	75

Table AII-4-1-2 RECORD OF THE REPAIR OF TRANSFORMERS AT NO.5 HI

List of burnt down Transformer

Sr: No.	Class	Trans: Sr:No.	Department	Cause of Failure	Remarks.
1.	11KV,300 KVA	0036	Technical service corporation	Burnt down due to thunder	Received on (3-12-81)
2.	11KV,100 KVA	0032	M.O.C	Water coming inside and burnt	" (19-2-82)
3.	6.6KV,300 KVA	0035	Rice Bran Mill , Rangoon	Burnt down(One turn short circuit)	" (22-12-82)
4.	6.6KV,300 KVA	0022	Live Stock development and- marketing corporation	Burnt down(")	" (24-1-83)
5.	6.6KV,300 KVA	0043	No. 2 D.I	Burnt down(")&	" (11-4-83)
6.	6.6KV,300 KVA	0032	No. 6 M.I	Oil Leakage	" (19-5-83)
7.	6.6KV,300 KVA &	0061	University Press	Water coming indide and burnt (One turn short circuit)	" (15-8-83)
8.	6.6KV,300 KVA	0034	E & S Rangoon.	Burnt down(One turn short circuit)	" (10-8-84)
9.	11 KV ,100 KVA	0081	Jute Bailing Factory	Burnt down.	" (29-8-84)
10.	11 KV ,100 KVA	0096	Agriculture Corporation	Not work properly	" (18-10-85)
11.	6.6KV,300 KVA	0016	Dagon Areated water and Ice Factory , Rangoon.	Burnt down(One turn short circuit)	" (20-11-85)
12.	6.6KV,300 KVA	0037	The Corrogated Cupboard - Factory, syriam Rangoon.	Burnt due to the contact of - coil weighting board and core- (One turn short circuit)	" (10-3-86)
13.	6KV, 300KVA	0031	M.I.C , Rangoon.	Burnt due to the contact of - coil weighting board and core (One turn short circuit)	Received on (18-12-86)
14.	6.6KV, 300KVA	0063	People Police Force , Rangoon	Turn Short(One turn short circuit)	" (9-12-86)
15.	6.6KV, 100KVA	0040	No.11, Intellegence Unit	Water enter inside & burnt	" (15-9-87)

Source: HIC (No.5 HI)

Figure AII-4-1-1 ORGANIZATION IN CHARGE OF QUALITY CONTROL IN THE HIC HEAD OFFICE

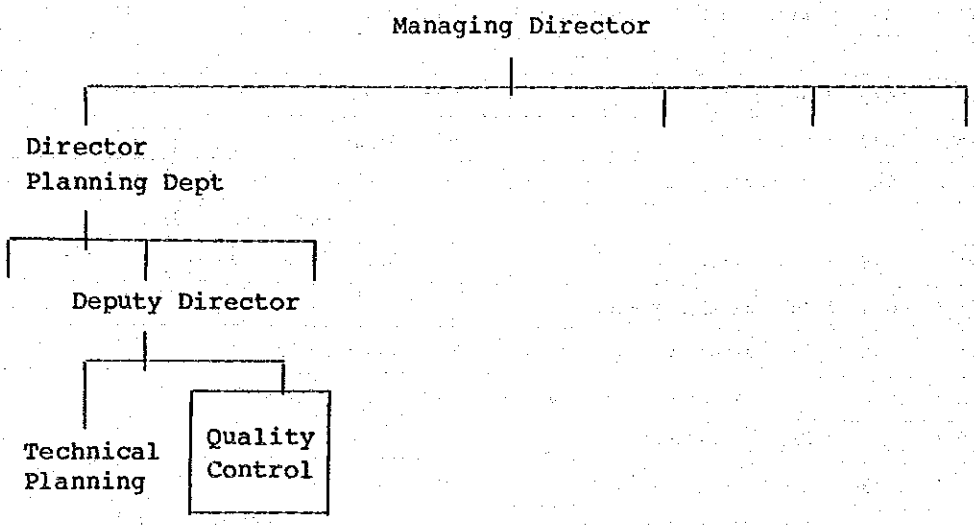


Figure AII-4-1-2 ORGANIZATION IN CHARGE OF QUALITY CONTROL IN NO.1 HI

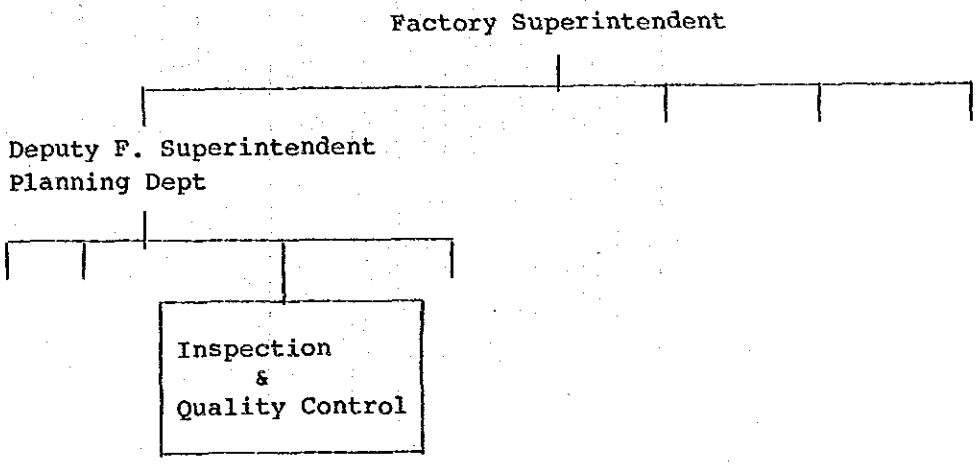
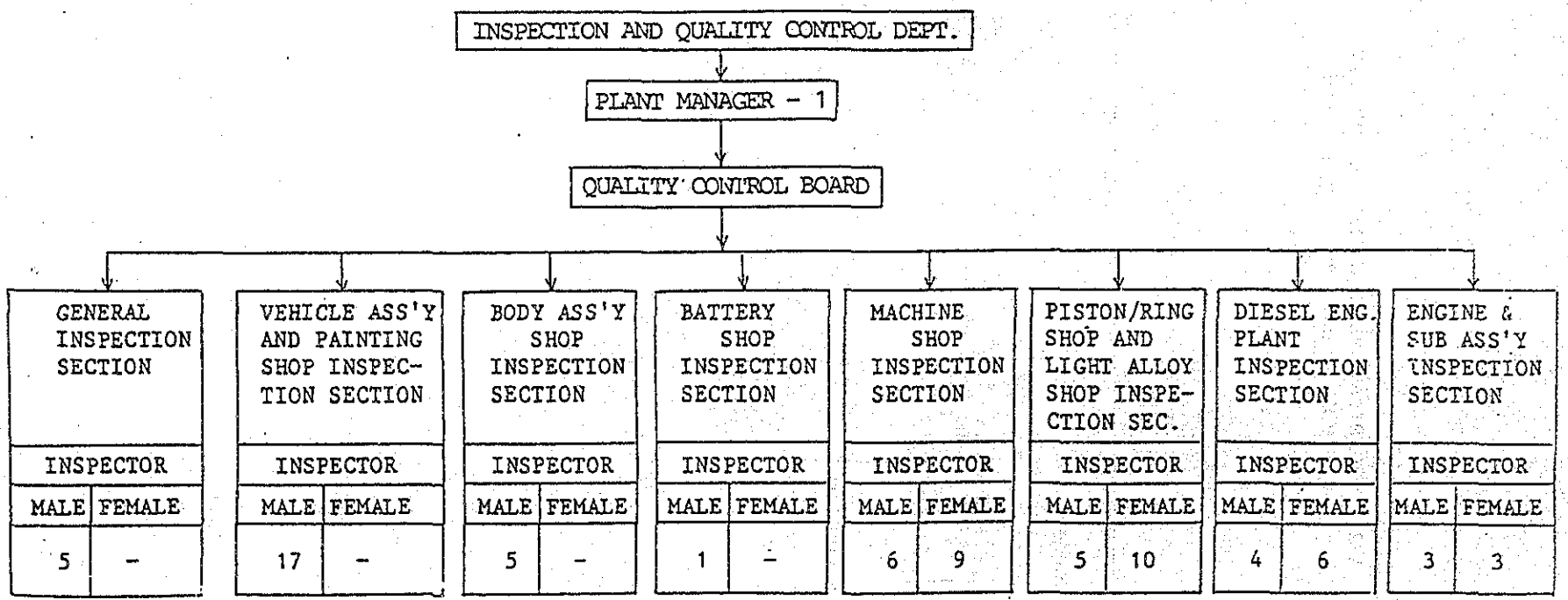


Figure AII-4-1-3 THE DISTRIBUTION OF PERSONNEL OF THE INSPECTION & QUALITY CONTROL SECTION IN NO.4 HI

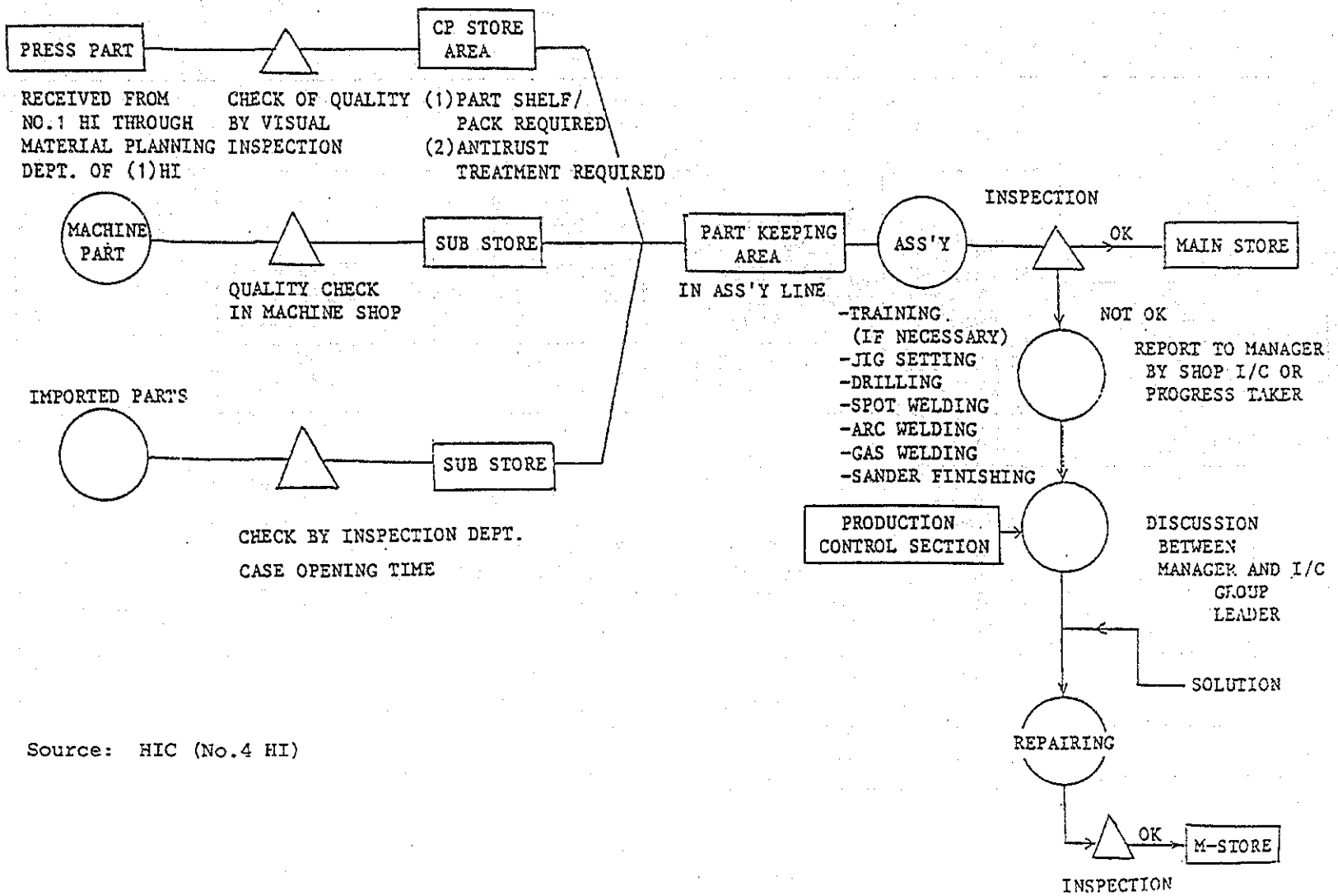


GENERAL INSPECTION SECTION		VEHICLE ASS'Y AND PAINTING SHOP INSPECTION SECTION		BODY ASS'Y SHOP INSPECTION SECTION		BATTERY SHOP INSPECTION SECTION		MACHINE SHOP INSPECTION SECTION		PISTON/RING SHOP AND LIGHT ALLOY SHOP INSPECTION SEC.		DIESEL ENG. PLANT INSPECTION SECTION		ENGINE & SUB ASS'Y INSPECTION SECTION	
INSPECTOR		INSPECTOR		INSPECTOR		INSPECTOR		INSPECTOR		INSPECTOR		INSPECTOR		INSPECTOR	
MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
5	-	17	-	5	-	1	-	6	9	5	10	4	6	3	3

MALE	FEMALE	TOTAL
47	28	75

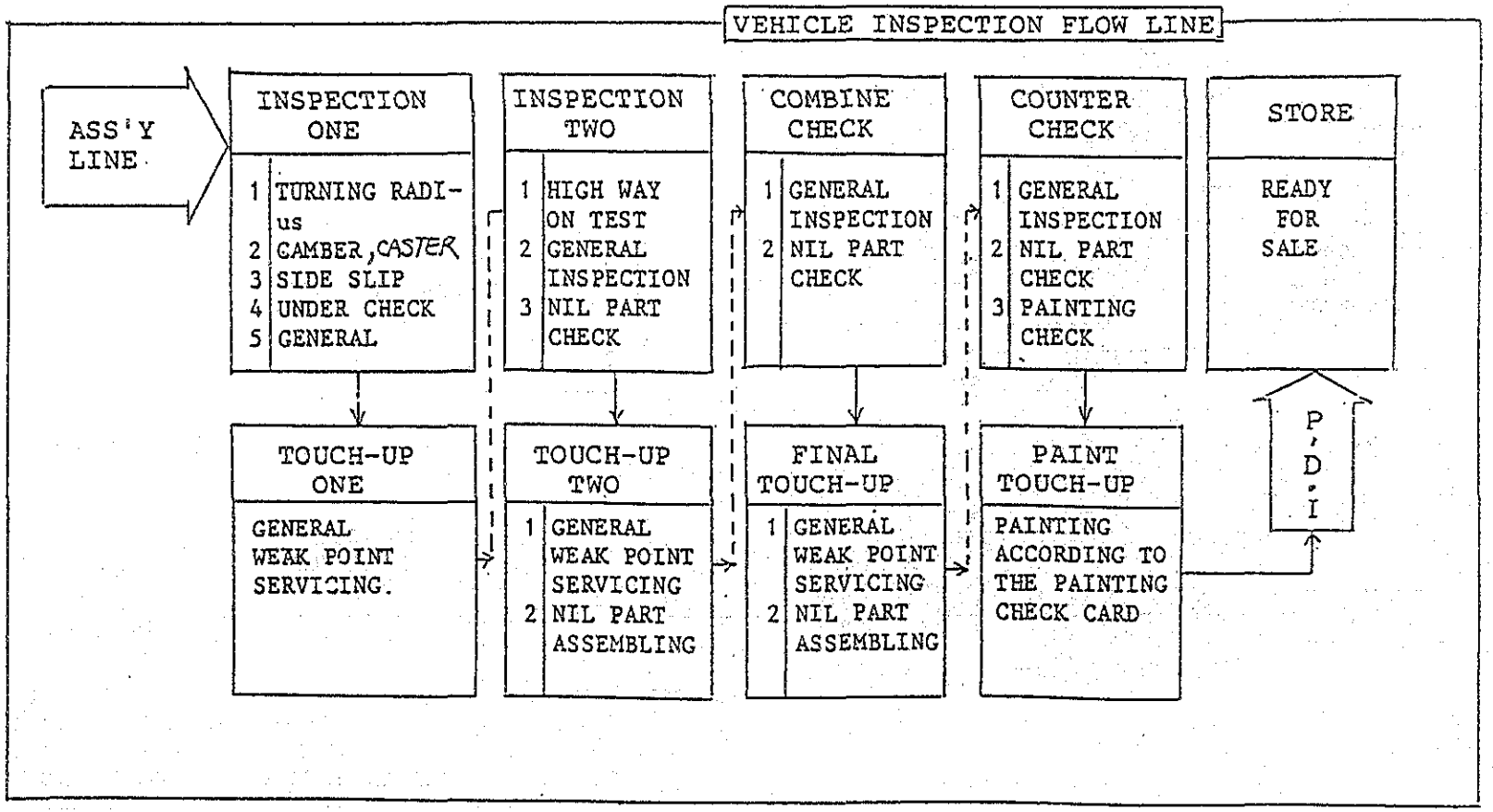
Source: HIC (No.4 HI)

Figure AII-4-1-4 FLOW DIAGRAM OF COMPONENT PARTS AND REPORT OF QUALITY, BODY ASS'Y SHOP, IN NO.4 HI



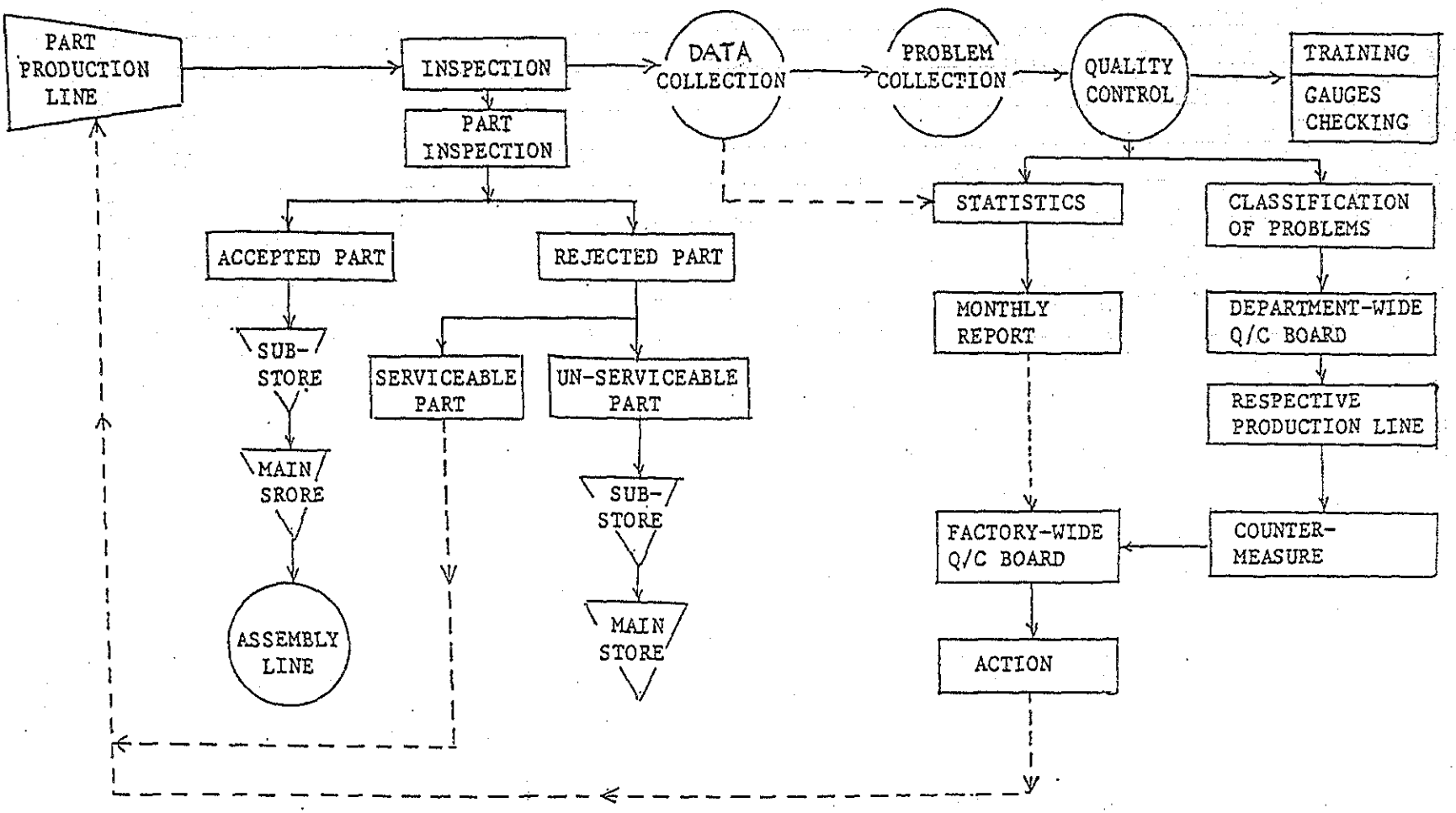
Source: HIC (No.4 HI)

Figure AII-4-1-5 LIGHT VEHICLE FINISHING INSPECTION FLOW IN NO.4 HI



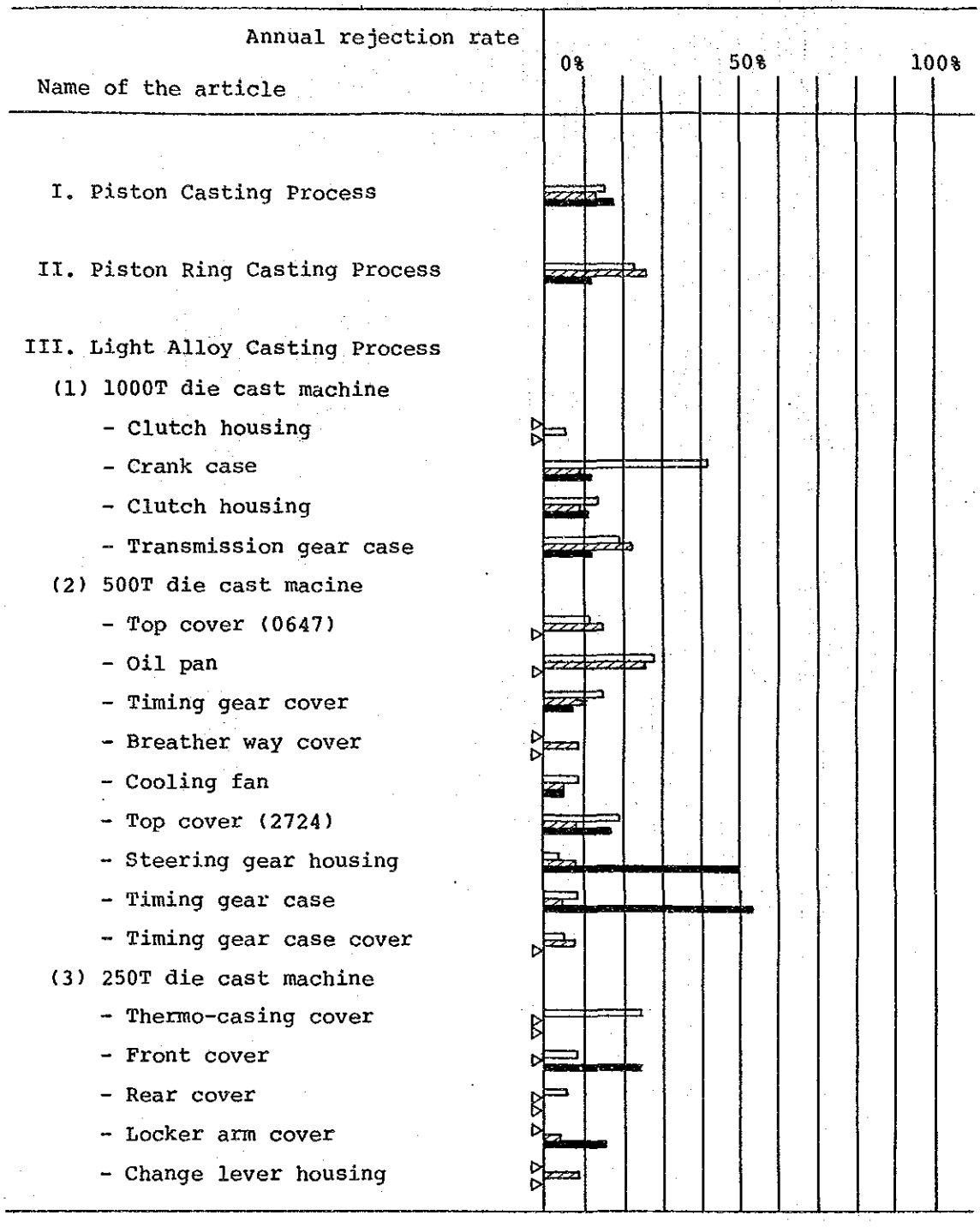
Source: HIC (No.4 HI)

Figure AII-4-1-6 FLOW OF THE INSPECTION AND QUALITY CONTROL IN NO.4 HI

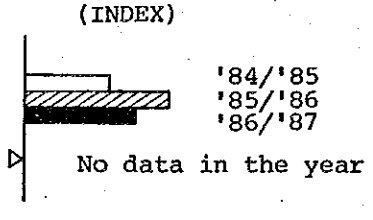


Source: HIC (No.4 HI)

Figure AII-4-1-7 EXAMPLE OF ANNUAL REJECTION RATE



Source: Rate of inferior products in light alloy foundry shop (yearly) (No.4 HI)



4-2 Quality Control in the Manufacturing Process

4-2-1 Factors Influencing the Quality

As can be seen from the results of the diagnosis of the manufacturing process of the various products reported in APPENDIX I, the rate of occurrence of faulty products is high. The problem is caused by the following factors.

1) Improper execution of the production schedule due to improper delivery timing of the materials to the machining and assembly processes.

2) Time worn and unavailability of production facilities, jigs, moulds, and the like.

3) Low quality of the raw materials, particularly the domestic ones.

4) Improper work method (including not only the direct work but also the transportation and storage)

5) Less skill of the workers

6) Lack of consciousness regarding the quality among the management personnel.

Furthermore, these factors may combine to causes of defect. This may sometimes make it impossible to determine the cause of defects. Meanwhile, the attitude that "some sacrifice in quality of products may be permissible so long as this has no significant effect on their performance or functions" is liable to prevail by giving top priority to securing of production volume.

This is partly because Burma is a seller's market with no competitors for HIC's products. However, such attitude toward the product quality will leave the problem of competitiveness for the future when HIC tries to export their products.

As a specific example, steel products and parts imported by spending foreign currency are left exposed outdoors for a long period with the result that these materials rust or sustain damage. As the first step, such fundamental point needs to be improved.

4-2-2 Raw Materials and Parts

(1) Castings

The rejection rate of ordinary cast iron and ductile cast iron was almost 20%. This is a result of substantial improvement under the guidance of Japanese residents for the 4 projects. The said rejection rate needs to be further improved to below 5%.

Analysis of the composition of the materials and strength test by means of test pieces are being carried out in the laboratory of No.3 HI and the obtained results are being reported to the parties concerned. It must be remembered, however, that a few days are required until the results of the analyses and tests become available. Such being the case, it is indispensable to establish an appropriate method making it possible to obtain the results without delay through sampling from the molten metal, so as to refelct the data on the manufacturing process for the sake of upgrading the yield.

There are many castings whose dimensional accuracy (including uneven wall thickness and other problems) is not within the standard tolerances, and they are creating problems in the next machining stage.

Many factors such as the raw materials (domestic pig iron and the like), casting facilities, casting moulds, casting sand, technical skill of the casting worker, etc., exert influence on the quality of the castings. Such being the case, it is indispensable to take such measures as establishing standards and procedures susceptible of scientific control, strengthening the measuring control, etc., in such a way to attain the most effective results with least pain.

(2) Forgings

The rejection rate of forgings is variable from 0% through 20%, averaging approximately 5%. Steps to improve the situation must be taken by paying particular attention to such items as connecting rods, gear transfer drive, spline shaft, etc., that have high rejection rate.

The totality of the raw materials used to manufacture parts of the 4 projects are imported.

The forgings have poor dimensional accuracy in the same way as in the case of castings, and this is causing serious problems in the machining at the next stage. As things not stand no countermeasure has been taken to identify the causes and prevent the recurrence of the problem.

Accuracy control of metallic moulds is still not sufficient. Measures to realize the centralization of the facilities for machining and repair of metallic moulds in general including other kinds of moulds (metallic moulds for press, etc.) besides those ones for forging as well as the relevant engineering system must be taken without fail.

(3) Glass Materials

Attempts were made at No.1 HI to manufacture incandescent lamps by using bulbs supplied by the Ceramic Industry Corporation that is under the control of another governmental office, but the initiative has failed because the rejection rate mounted to 40% through 50% without any perspective of improvement, and as a consequence the plant was forced to use imported materials once again. Improper material and poor dimensional accuracy are the causes of the high rejection rate of domestic articles, and the obtained bulb breaks with ease.

Joint efforts must be made in cooperation with the Ceramic Industry Corporation with the object of solving the said problems, so as to secure the stable supply of locally made glass bulbs and tubes of satisfactory quality for both incandescent lamps and fluorescent lamps in the near future.

(4) Materials of Seats of Vehicles

This kind of materials consist of cushion materials and seat cover materials. Instead of questioning the quality of the materials, the driver's seated level becomes too higher when seating on the driver's seat of the vehicle because the cushion material is being placed without adjusting its thickness. This problem can be solved by properly adjusting the thickness of the cushion material procured domestically.

(5) Pressed Products

In some cases the press can not be used due to unsatisfactory dimensional accuracy of the metallic mould caused by wearing, broken metallic mould, etc., and the parts are being made by means of vibro shear or by manual bending. These parts bring about serious problems during the assembly process, resulting into additional work due to subsequent repair and products with bad appearance.

On the other hand, the all thin steel plates that are the raw for press-working are imported but these materials are being left outdoors for long time after arrival of the factory. As a consequence these steel plates are rusted and the rusted steel plates are press-worked because it is troublesome to remove the rust and this exerts noxious influence on the quality of the coating work carried out at subsequent stages of the manufacturing process. This point has been pointed out at most plants.

Most of the press-worked parts are being manufactured at No.1 HI, but they are rusted or deformed during their transportation to the other plants. Such being the case, at least anti-corrosion coating must be carried out at No.1 HI, and furthermore proper measures must be taken in connection with the storage and the delivery package.

(6) Machined Parts

Japanese manufacturers that took charge of the 4 projects prepared manuals on the occasion of the introdution of the machining facilities, and the machining accuracy is in conformity with these manuals. It must be remembered, however, that the machining facilities and equipment are being used without any improvement to cope with such problems wearing and deterioration due to aging in view of the unavailability of parts and components for replacement. Such being the case, rectification by manual work is indispensable to secure the required machining accuracy.

The same thing is occurring also with measuring instruments and gauges, and as a consequence no accuracy can be expected in connection with the inspection. Such being the case, there is no choice but regarding the attitude as acceptable as long as no immediate problems

from the functional standpoint are observed after assembly of the parts and components in question.

Putting the machining process itself aside, such facts as putting workpieces under the machining or machined directly on the floor and piling up the workpieces with the machined faces in direct contact with each other are observed at all plants. This is a serious problem regarding the working manner because it causes damages on machined surfaces requiring special attention related to the accuracy.

Furthermore, proper protective measures must be taken to prevent dust and chips getting on the machined surfaces and into the machined workpieces.

(7) Gears and Special-Purpose Machined Parts

The same problems as those ones mentioned in (6) above occur also in connection with these parts. For example, in some cases the accuracy of the gears relies on manual measurements because of the inexistence of calibration instruments to control the accuracy of special-purpose gauges or the inexistence of the gauge itself. Such being the case, it is indispensable to establish a control center in charge in order to centralized control of an in-house manufacture of gauges and dies.

(8) Finishing Work

Finishing work is being carried out manually and relies on the perception of the worker in some cases, and the problem must be solved through the equipment of proper cutting tools, jigs, gauges and the like.

For example, such the removal of burrs after machining gears as the finishing work of metal surface of crankshafts are being carried out manually with sandpaper to comply with tolerance. If the facilities and tools for machining be in proper operating conditions within the required limits of accuracy, these troublesome manual finishing work could be eliminated in most of the cases.

(9) Heat Treatment and Surface Hardening

The steps of work of the manufacturing process and the subsequent inspection are being carried out in conformity with the manuals written under the orientation of Japanese manufacturers of the 4 projects. Anyway, there are many difficulties regarding the repair of failures and adjustments required as a consequence of the aged deterioration of the equipment. Under the circumstances it is necessary to define clearly the foundations of the quality assurance, besides the control of the accuracy of the instruments used to measure the hardness on the sampling inspection and other relevant characteristics through the execution.

(10) Plating

The process itself is being controlled but there is practically no record of the relevant data and information. Evaluation of the quality is omitted here, because data regarding the durability of the plating when the products are put into practical use are not available.

(11) Coating

Bad quality of the coating stands out throughout all plants.

Radical revision is required from the standpoints of the workplace, facilities, tools, paint, work method and other relevant aspects.

Such problems as uneven coating, bubbling, peeling off and rust before the delivery of the product, etc., are observed through superficial observation.

Such environmental problems as equipment of the painting shop not available for use due to functional failure or painting work carried out at conventional open spaces due to no specific painting shop, etc., are also observed.

Rust is being eliminated very roughly by hand work due to the shortage of proper tools.

The types of paint to be used are not being properly selected. For example, paint for hot drying is being used in natural drying applica-

tions (light vehicles).

There are also problems to be reviewed such as the aged deterioration of the spray guns for painting, improper storage method of the paint and improper coating method.

Painting work standards and inspection standards are not properly equipped.

4-2-3 Assembly Process and Finished Products

It is presumed that no problem will occur in connection with the quality when properly machined parts are properly assembled.

Practically no quality problem is occurring in such cases as electric products that consist mostly of imported parts and components and articles of which assembly is not complicated and furthermore does not depend on other plants or workplaces for their manufacture.

(1) Welding Assembly Process

Generally, the technical level of arc welding is not sufficient. Welding work is rather rough and unevenness and blow holes are found in welds.

Both light vehicles and heavy vehicles use many welds to assemble the vehicles body frame. The weld between the tubular material and the driving shaft is particuarly important in the propeller shaft of light vehicles. Models of the sub-assemblies are placed at the doorway of the building wings of the each plant, but the welds of these models have neat finish. Inasmuch as the welds of vehicles are subject to repeated stress and shocks, there is risk of concentration of stress when the welds are not smoothly finished and this may result into cracks, break of the base material of the structure and other serious disasters. Such being the case, improper welding is a serious treat to long-term reliability and safety. Finish on the welding work for tanks of tank trucks is not satisfactory, either. In view of such situation, measures should be taken such as assignment of special skilled workers to the manufacture of pressure tanks. Among leading workers and shop managers at plants, there are many who have received

technical training abroad. It is strongly recommended that the use of expertise and technical skills they have acquired through such abroad training is the best for improvement.

(2) Assembly Process of Machined Parts

Engine units, pumps, generator sets, etc. which are produced simply by assembling machined components and parts have no particular present quality problems. It must be remembered, however, that many parts and components soiled with dust are assembled without cleaning them, or they are kept with neither any protection nor covers against infiltration of dust and foreign objects.

(3) Overall Assembly Process

Insufficient inspection and check are being made at assembly process of light vehicles and heavy vehicles concerning whether proper parts are being used, and such details as tightening of bolts, nuts and the like are being overlocked, and furthermore there is no inspection record. In the worst case reported by a Japanese expert engaged in the manufacture of TE21 trucks, 5 to 10 small-sized parts came off and furthermore 10 to 20 places with loose bolts and nuts were found after merely 100 kilometers of land transportation.

It is advisable that the Inspection Section provides the norms and standards, in cooperation with the assembly shop, to prepare the check list, to carry out spontaneous inspection by foreman and to confirm the contents of the inspection record.

(4) Final Inspection and Test

Such problems as impracticability of the tests after completion of the assembly due to failure of part of the test equipment, impracticability of the measurement due to the damage of measuring instruments, insufficient precision due to the aged deterioration of the equipment, etc., have been mentioned as a result of the individual diagnosis of the various products.

4-3 Quality of Export Products

HIC has experience of export of simple castings such as parts of pumps to Saudi Arabia. Anyway, HIC desires to export Diesel engines, now used in vehicles such as trucks and buses, for applications such as marine use, generators for land use and the like.

The following problems are mentioned in connection with the export competitiveness of complete units being manufactured at the present time.

- Old fashioned design model
- Weak competitiveness in terms of cost
- Low quality level regarding functions and appearance

It must be remembered that quality control activities have not only the primary effect of improving the quality of the products, but are also accompanied with such side effects as reducing the production cost, improving the working environment and improving the marketing method. In other words, these activities are presumed to contribute to improve the quality of the behavior of the human being.

Exports are not necessarily restricted to complete units. Such as spare parts and raw materials may also be included in exports. Thus, continued efforts to improve the quality and reduce the cost of domestically manufactured castings bring about intended results.

As for overall products that pass through such processes as machining, assembly, tests, etc. it may safely be said that as long as the current business management type of HIC is concerned they regrettably have less export competitiveness.

As a starter, design and production engineers of HIC are advised to assess the competitiveness of their products in quality, production cost and delivery by importing samples of foreign products equivalent to those of their own which they plan to export and comparing the quality of these foreign products with their capability upon use, disassembly, measurement and test. And steps should be taken to solve each specific problem by defining the targets and setting up execution plans.

4-4 Relation between Quality Control and Production Cost

In the current production cost control system of HIC such items as losses in the production cost due to the occurrence of faulty products, additional cost due to work stepping back to previous stages, losses accompanying indemnification and repair services after the delivery of the products, are not clearly classified and counted as reported in CHAPTER 6. It must be remembered, however, that from the theoretical standpoint quality deterioration and the cost to prevent it are bringing about additional cost including foreign currency.

In Japan ordinary failure cost, indemnification cost and quality control cost are discriminated from each other. Targets to cut down the next budget are determined based on the past record and efforts of various kinds are provided to minimize those costs. Any positive result attained in this connection is reflected on the evaluation of the production section. The scope of responsibility is defined for each section and improvements are made every year through comprehensive efforts.

No initiative of this kind is being taken in HIC, and furthermore there is no systematic organization in this connection. The number of defective units is counted, but it is not taken into account as loss of production cost. Another point which is not taken into account is stepping back to previous stages of the production process for the sake of repair of defective items. The said items are regarded as costs indispensable for the sake of production, and are included in the form of lump sum in the ordinary production cost. Such being the case, there is no way to define the target to cut down this kind of cost.

To worsen the situation, production goods prone to be defective are supplied by including in advance a surplus margin of 10% in the production plan, and a rejection rate of 10% in the production line is regarded as acceptable. Furthermore, when the rejection rate is far below 10% the approved goods in excess are stocked beside the production line as savings to cope with rejection rates surpassing 10% in the subsequent lots. Cheating of this kind is being carried out openly to keep the official rejection rate within 10%.

Inasmuch as tricks of this kind are being carried out tacitly at every place of every plant, the officially announced rejection rates do no

reflect the true state of things, and people are more interested in balancing the books regarding the quantity of approved items than identifying the cases of the rejections by establishing targets to cut down the rejection rates.

This corrupt practice is presumably attributable the self-protection instinct of the management personnel because from the standpoint of the individual responsibility it is "bad" to record high rejection rate and it is indispensable to secure the required quantity of approved goods at any rate. It is indispensable to break this vicious circle immediately to grasp honestly the actual state of things, to make efforts to identify the causes of the problems and to manufacture products of good quality.

It is also necessary to find means to convert losses, failurs and stepping-back into costs so as to obtain statistical data by phenomenon and by cause of the loss and to take the applicable countermeasures beginning from causes bringing about the largest costs.

4-5 Improvements to be Made in the Quality Control

4-5-1 Clarification and Establishment of the Policy

Successful implementation of quality control depends upon the policy adopted in this connection. In the first place it is indispensable to define clearly the position of the quality control within the context of the managing polity in HIC, and then it is necessary to develop and to define the quality level and the course of the control activities.

The term "Quality Control" means to pursue the rationalization of the action of the human being to eliminate any overworking waste and unevenness through constant improvement and upgrading efforts. It involves not only enthusiasm but also scientific techniques.

Instead of looking for defective items, it consists of attaining the goals defined in advance by intertwining such factors as design/production schedule/procurement of materials/production equipment/processing technology/motivation to encourage the initiative of the workers/after service, etc., that contribute to easily improve the quality into the production process and of elevating still more the level of the goal.

There is no panacea to realize successful quality control because it is a complicated and difficult problem involving many factors as mentioned in Section 4-2-1 but on the other hand the repetition of a long series of efforts brings about overall effects mentioned below from the standpoint of management.

1) Improvement of quality and reduction of rejection rate
2) Improvement of productivity
3) Reduction of cost
4) Reliability of delivery time
5) Realization of comfortable and safe workplace with firm motivation for the workers through improvement of the working environment
6) More trust from the customers
7) Upgrading of the morale of the workers of the various hierarchical categories

Executives of HIC should take the initiative to define the concrete policy and the vision of the priority measures to be taken by section, by plant

and by production line during the current year, during the next year, during the next 5 years ahead, during the 10 next years, etc., and to concentrate their efforts to implement the measures and to realize the goals and targets.

These targets and goals, also, should take into consideration not only the production volumes but also the quality level. Furthermore, the concrete measures must be provided so that the targets and goals can not be merely called.

4-5-2 Changes in the Control Organization and in the Quality Control Duties

Routine jobs of inspectors to test and record the result of inspection and measurement should be intertwined with the organization of the production line. If possible, no distinction should be made between inspectors and manufacturing workers with their responsibility. It is desirable that the workers check the products they are working with and record the relevant data. It is desirable to induce the workers to decide the approval/rejection of the workpieces by themselves and to take the measures the improvement through the initiative of the individual workers or their group.

Inasmuch as the production line is the section with most familiarity with the characteristics of the process, equipment and work method involved in the production, it is only natural that the production line take charge of the efforts and actions for improvement.

Such being the case, the Inspection and Quality Control Section of the plant should stop sending inspectors to the various production lines.

As a matter of fact, inspection duties are being built into the production line of electric products at the plants of HIC, and fairly good results are being attained through this spontaneous inspection system.

On the other hand, the Quality Control Section should be given the role of staff section of the plant and should take charge of the control activities in the strict sense of the word. It should provide the production line with guidance and supporting regarding such aspects as preparation of stan-

dards and manuals, statistical tabulation and analysis of data, etc., through a small staff of engineers. Furthermore, it should take charge also of the coordination duties required to promote measures to prevent the recurrence of faults and defects.

The Quality Control Section of the Head Office should take charge of planning duties of various kinds required to establish the quality control system in HIC as a whole. In this connection it should study techniques of various kinds so as to provide the Quality Control Sections of the various plants with proper orientation and to support the programs for training and education of executives of the head office and the plants of HIC.

The sections of the head office and the plants, including the Production Planning Section, that are engaged in quality control activities must take special care not to become irresponsible sections that merely propose plans and slogans and assume an attitude of total indifference to the results.

4-5-3 Establishment of the Quality Assurance System

Quality assurance is one of the mainstays for the enterprise to fulfill its social responsibility. Providing guarantee for the product during the period of 12 months after its delivery to the user is by no means sufficient. It is indispensable to demonstrate that proper control to prevent the occurrence of any trouble is being implemented within the context of a series of production activities.

In order to establish the system it is indispensable to make the Quality Control System Manual and to submit all related parties to training programs in conformity with the said manual so as to make its contents widely known to everybody before starting the activities. The manual should comprise approximately the following items.

1) Control of the standards, criteria and steps of procedure
2) Clear definition of the executive organizations in charge of quality control
3) Control of the design and production technologies
4) Control of bibliography and files including drawings, documents, forms
5) Control of the procurement of materials, parts and works done by sub contractors

6) Control of the each process
7) Control of the storage and retrieval of tests and inspections, records and certificates
8) Control of the measuring instruments and test equipment
9) Control to prevent the recurrence of defects
10) Auditing and monitoring system

Personnel of the Quality Control Section alone is not sufficient to cope with the creation of the standards, criteria and procedures. Furthermore samples-available from abroad are useful as reference but their application with no modification at all is impracticable. It is indispensable to create methods to fit the needs of each section of HIC. These systems should be self-created at the lines, under the leadership of the chief of the line, its staff and its foremen, and by taking into consideration the view of skilled workers. The fact that the system was created by themselves is a motivation for them to implement it. When rules are imposed from outside they are often neglected or disregarded merely as empty slogans so save appearance as happened before.

4-5-4 Implementation of Companywide Organized Activities

The total quality control (TQC) system and the QC circle activities, that play important roles within the context of the TQC, are attaining conspicuous results in Japan. They are results of the application of statistical quality control methods developed in the United States of America in the form of small group activities with motivation matching the conditions of Japan. This method is being applied also in South Korea and in Taiwan, and it is attracting the attention of other countries interested in its introduction.

Some executives of HIC are interested in the matter, and its introduction has been proposed by resident Japanese technical experts of the 4 projects, but the situation does not seem to be sufficient mature to accept the system. There is, however, initiative to do with small groups in workers of No.3 HI and No.4 HI, and posters drawn by them have been put on notice boards of the workplace. Initiatives of this kind can foster QC circles in HIC.

Initiative of top management of HIC is most important to implement TQC because initiative of bottom-to-up type is not sufficient for its success-

ful implementation. It must begin with such approaches as study sessions and introductory courses under the orientation of experts in order to get familiarized with the matter. Training of the managers of the plants is also necessary. When introducing the system it is recommendable to commence by selecting one or two model workplaces at each plant to implement the system on trial basis and to evaluate the process by people concerned.

Anyway, the shortage of foreign currency is presumed to be the obstacle against management. However, a systematic planning of business management is to order the priority in order to the most effective use of the financial resources and to improve the most important ones which are able to expect the most effective results. The ideas required to realize the improvements are obtained by both collective and individual wisdom of the employees. The goal and targets are determined by the employees, instead of being imposed from top management and executives. This is the aim of the TQC system.

The implementation of TQC does not require any major investment. It is presumed to be especially suited for Burma, which is characterized by warm-hearted people full of solidarity.

We recommend the staff of the Quality Control Section of the head office of HIC and some specific executives form a project team to examine the viability of the introduction of TQC and submit the conclusion to the managing director of HIC.

4-5-5 Introduction of Statistical Techniques

Frankly speaking, quality control being implemented at HIC consists merely of picking up defective items and repairing them. Statistics consists of merely tabulating data referring to defective items and calculating the rejection rate, and no initiative is being taken to analyze the phenomena, to identify the causes of the problem and to ponder on possible countermeasures. The fundamental misunderstanding which consists of regarding inspection as quality control seems to be deeply rooted. As a matter of fact there are so many questions to be solved that people are not aware of the seriousness of the situation or they do not know what to do and how to do on the question.

The very same thing happens also with the control of the facilities and equipment.

In the first place it is necessary to identify what is the most important problem and the influence of which solution exerts on the situation as a whole. Then, the first step should be taken by focusing on the problem to bring about the most effective results, followed by sound and steady efforts to attain continuous improvements. In other words, the quality control should be implemented in such a way to build quality into the very manufacturing process so as to keep the quality within the objective.

The conventional system which consists of merely putting up slogans or tightening the norm and monitoring has quite the opposite effect. Such being the case, it is desirable to attempt a solution to the problem by means of logic and scientific methods that consist of measuring the causes of failure and their effects in terms of numerical values or sums of money (cost). It is the Statistical Quality Control that has been implemented quite successfully in such countries as the United States of America and Japan, taking measures to cut down the extent of the negative influence of the problems, evaluating the attained results, and taking the next step to cope with the problem. In other words, it is recommendable to develop the P (Plan), D (Do), C (Check), A (Action) cycle. Figure AII-4-5-1 is the diagram of the factors which shows the relation between the cause and the effects of the defect.

Such being the case, it is indispensable for the middle-class managers to receive a training program of basis of "Statistical Quality Control" on such key points as data collection method, data classification method, methods to convert the data into histograms, Parato charts and other statistical materials visible to one's eyes, etc. The middle-class managers play the important role of teaching the matter to their workers and collecting useful idea from them. The workers are usually fully familiarized with the process and the related equipment and facilities. Their managers propose problems and teach elementary knowledge of statistical quality control. When specialized knowledge related to other fields are required, the respective experts are provided to obtain the support. These knowledge should be intertwined with the TQC activities. The ideal situation is to devise useful idea regarding to jigs, special tools and the likes at the workplace and within the context of these TQC activities.

Figure AII-4-5-2 is the Parato Chart for classification of the losses by causes.

- Pick up the probable causes of the defects and the sum of lost by each defect (Kt ... if possible it is desirable to consider also the sum of lost in foreign currency corresponding to import portion) and record them in individual forms.
- Gather the obtained data during a given period (e.g. 6 months or 1 year) and tabulate them in the form of the graph shown above.
- Inasmuch as the causes A and B are the worst two, aim at reducing them by a half during the next period.
- The process which consists of evaluating the state of things by means of numerical values and eliminating the causes of defects one by one is called "Statistical Quality Control".
- It must be remembered that attempting to eliminated many causes at once is impracticable. Such being the case, it is recommendable to begin by attacking the cause with the most important influence in the last.

4-5-6 Implementation of Quality Control Training by Hierarchy

Generally speaking, such institutional measures as merely establishing systems and tightening the control are not sufficient to realize the diffusion of quality control throughout the corporation. It is indispensable to promote along with proper education and training programs. Such being the case, it is necessary to implant the trainers (instructors) consisting of personnel of the corporation in order to educate the general concepts of the quality control in the mind of the executive personnel responsible for the promotion of quality control as well as the personnel in charge of the practical affairs of the quality control. The circle of the training/education program is expanded under the leadership of the said trainers (instructors).

Example of the curriculum to be adopted in this connection is mentioned in the followings for the sake of reference.

(1) Curriculum of Trainers in Charge of education/training of Personnel Responsible for the Promotion of Quality Control (Personnel Responsible for the Promotion of Quality Control Consists of Executives of the HIC Head Office, Plant Superintendents, People of Plant Manager Class, Chief of the Quality Control Section and Its Staff)

1) Introduction, promotion, development and establishment of TQC
2) Organization, operation and education of TQC
3) Way to promote the improvement of TQC
4) Quality assurance and reliability

(2) Curriculum for Trainers in Charge of education/training of Personnel in Charge of the Practical Affairs of Quality Control (Personnel in Charge of the Practical Affairs of Quality Control includes People Ranging from the Plant Managers to Foremen, as Well as the Chief of the Quality Control Section and Its Staff)

1) Statistical line of reasoning
2) QC paraphernalia
3) QC circle activities
4) Ways to promote improvements in the quality control

Sending HIC's staffs to overseas countries or inviting foreign expert lecturers to HIC are the possible alternatives for the sake of formation of

these trainers (instructors).

The most important thing in this connection is the "chain-reaction" in which the staffs submitted to training/education programs under the leadership of these trainers (instructors) propagate their knowledge to other people under their control in such a way that everybody become perfectly familiarized with the philosophy of quality control.

4-5-7 Maintenance and Control of Inspection and Measuring Instruments and Test Facilities

It goes without saying that these facilities and equipment must be submitted to periodic inspection and maintenance. Furthermore, their accuracy must be calibrated and checked once or twice a year by using reference standards and instruments.

Many of the various measuring instruments, equipment, gauges and the like possessed by the production plants present symptoms of aged deterioration, with some of them idle because any repair is impracticable. Under the circumstances, some products are delivered without the required measurement and inspection.

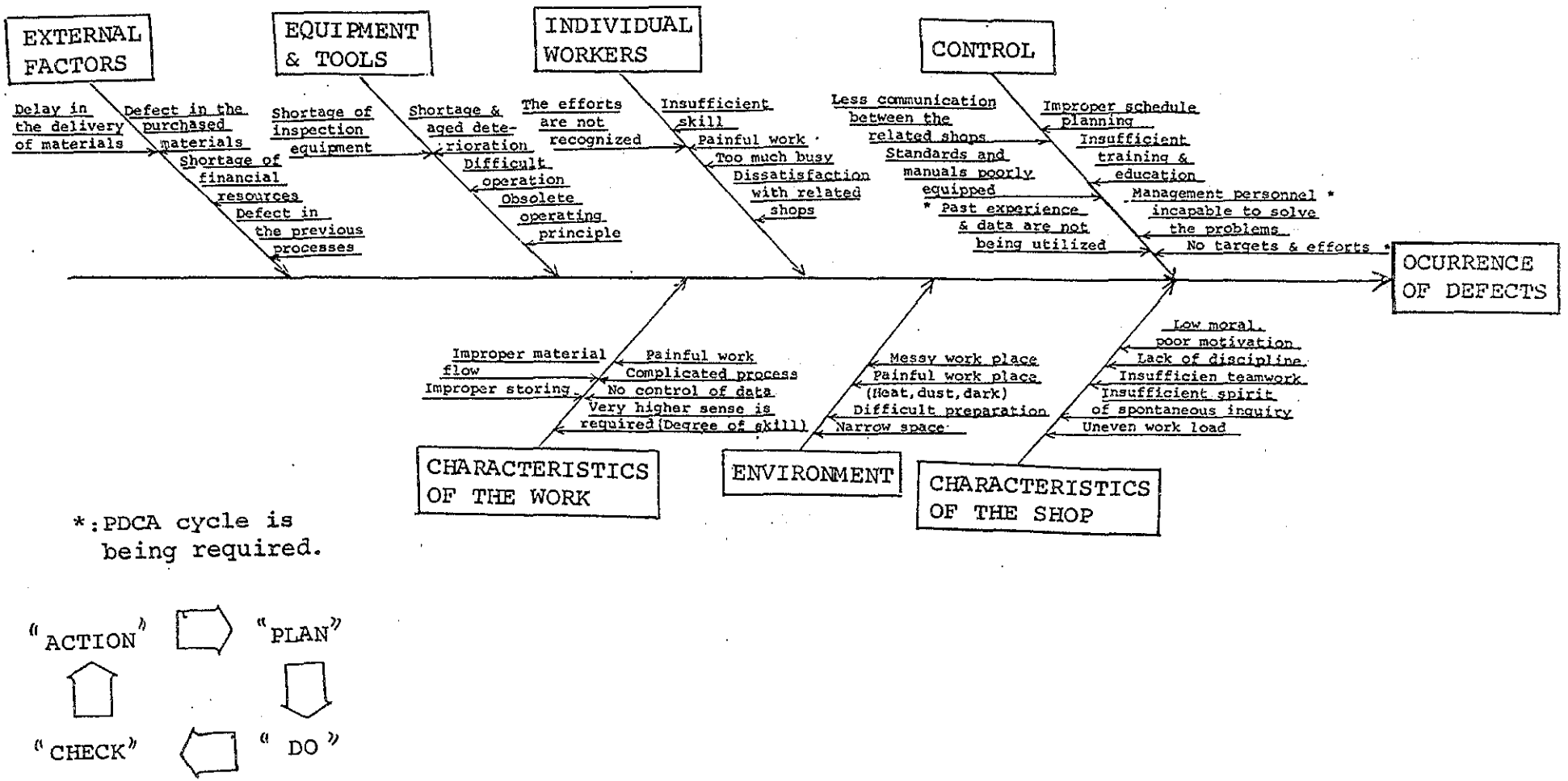
There is no institution in Burma properly qualified to calibrate and certify these measuring instruments. Furthermore, the official system required in this connection has not been established yet.

If the current state of things should evolve unchanged, gradual deterioration goes on in the quality of the manufactured products, with eventual risk of noxious influence on the performance of the products.

The installation of the calibration center for measuring and inspection equipment is scheduled as an important item of the modernization plan of HIC.

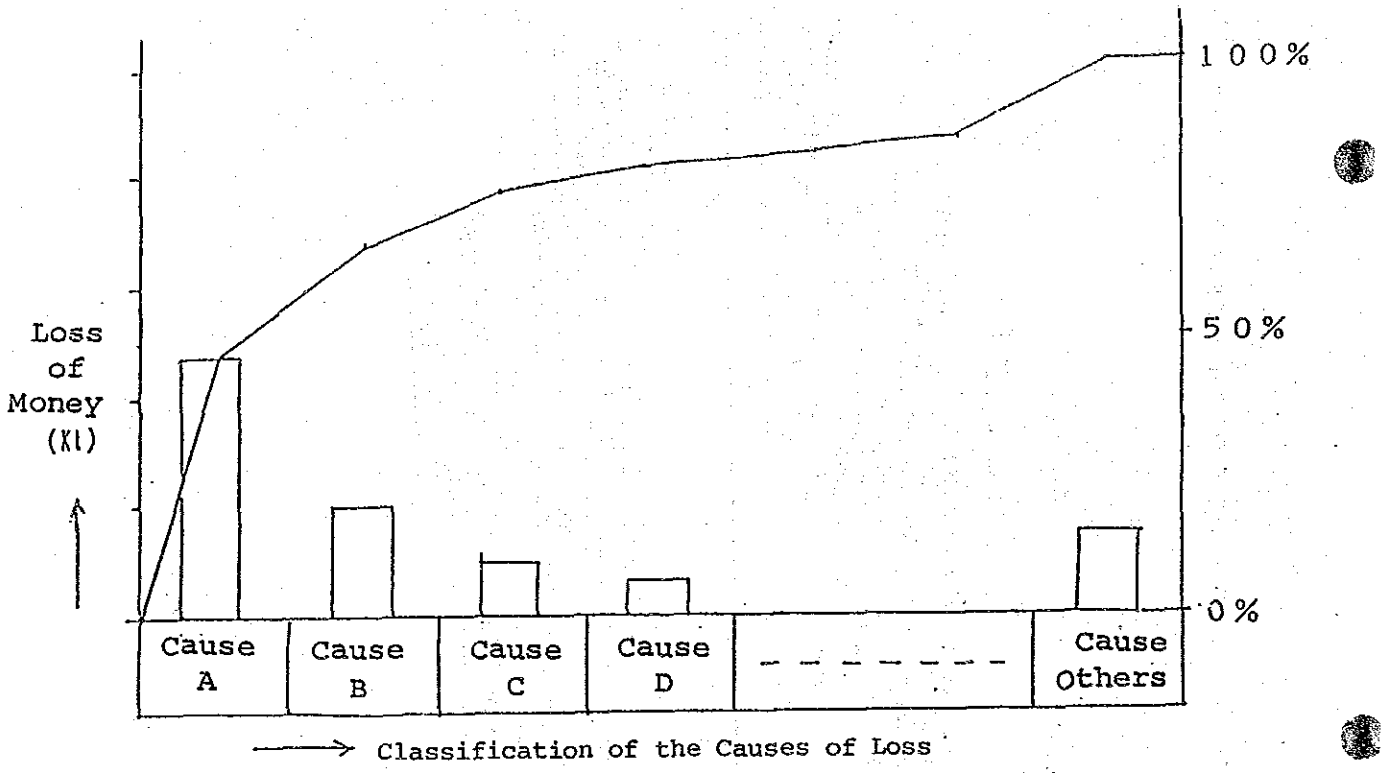
Besides the establishment of the said center it is indispensable to establish a system for compulsory verification of measuring instruments in HIC. Furthermore, it is necessary to take measures to form experts in the field within HIC in order to operate the center to instruct proper utilization these instruments and facilities by the people of production sections and to promote their diffusion.

Figure AII-4-5-1 CHART OF THE CHARACTERISTIC FACTORS OF THE CAUSES OF DEFECTS



*: PDCA cycle is being required.

Figure AII-4-5-2 PARATO CHART FOR CLASSIFICATION OF THE LOSSES BY CAUSE



Chapter 5 PRODUCT IMPROVEMENT AND DEVELOPMENT SYSTEM

5-1 Current Position and Problem

5-1-1 Oganization and Functions

As to development of products, the Design Department of the Planning Department of the head office is in charge of the matter.

The Design Department is staffed with 133 persons and the breakdown of the duties of its personnel is shown in the followings.

- Manager	1 person
- Engineering staff	26 persons
- Administration staff	5 persons
- Foremen of draftmen	28 persons
- Skilled draftmen	36 persons
- Semi-skilled draftmen	30 persons
- Assistant workers	7 persons
TOTAL STAFF	133 persons

Furthermore, the breakdown of the engineering staff by field of speciality is shown in the followings.

- Mechanical engineering	21 persons
- Electrical engineering	3 persons
- Civil engineering	2 persons
TOTAL ENGINEERING STAFF	26 persons

The said personnel is taking charge of the following duties.

1) Office-Administration
2) Priting & Recording Section
3) Laboratory and Microfilm Section
4) Product Design Section
5) Press Tools & Cutting Tools Design Section
6) Jigs, Fixture & Gauges Design Section
7) New Products Development Section
8) Architectural Design Section
9) Civil Design Section

In this table the sections 4) through 9) are effectively the technical sections.

The section 4) is in charge of the technical aspects of products being manufactured at each HIC, and the domestic production of the parts is being studied in this section.

The sections 5) and 6) are in charge of the production and machining aspects.

The section 7) is literally in charge of the development of new products.

The sections 8) and 9) are in charge of the design of the civil and architectural facilities of HIC well as the foundations and other relevant aspects.

Inasmuch as the number of college-graduate technical personnel of the Design Department mounts to barely 26 persons (11 senior engineers and 15 junior engineers), the design sections 4) through 9) cannot afford to have full-time staff and in most of the cases each engineer plays various functions at the same time. In particular, since there are barely 3 electrical engineers, 2 civil engineers and no architect at all, engineers of other fields take charge of the relevant duties and in the worst case the job is being taken charge by foremen of draftsmen.

From the standpoint of the organization of the plants, there are some plants that have a design group within its planning department, but in reality these groups are poorly staffed with engineers in charge of design. For example No.1 HI has no engineer at all, No.3 HI has 1 engineer, No.4 HI has no engineer and No.5 HI has 2 engineers.

In addition to the said engineers there are several draftsmen in these design groups but in reality they are practically idle from the standpoint of the design function.

Every year HIC recruits approximately 30 persons in average graduated from engineering colleges, but of that total barely 1 or 2 are assigned to the design department of the head office. Securing young engineers in charge of design is an important problem to be solved hereafter.

In reality the design department of the head office is covering a wide variety of fields ranging from the research field and technical survey

field to the production technology functions of HIC as a whole. It may safely be said that it is being overstrained from the standpoints of both organization and staffing.

ITEMS DEVELOPED AND MANUFACTURED BY HIC
FROM THE DESIGN STAGE OF THE FINAL PRODUCTION STAGE
BY MAKING USE OF AUTONOMOUS TECHNOLOGY

Source: Information Sheet of the head office of HIC dated 2nd February 1988

A. Agricultural Machinery Sector

1) 2" self priming pump
2) 3" self priming pump
3) Manned rice transplanter
4) Motor driven 4" pumps (2 types)
5) Trailer for power tiller
6) Six types of trailers to be coupled to 50 HP tractor
7) Several types of tilling implements

B. Transportation sector

1) Long base cross country vehicle (4x4)
2) Station wagon (4x4)
3) Estate wagon (4x4)
4) Estate wagon (4x2)
5) Standard body for 6.5 t truck
6) 1200 gallon water douser
7) Passenger body for 2000 cc light truck
8) Ambulance body for 2000 cc light truck
9) 140 HP 65 passenger single end control sub propelled rail bus trailer
10) 80 passenger rail bus trailer
11) Logging truck

C. Machine Tools and General Engineering Sector

(Machine Tools)

1) Gang drilling machine
2) Abrasive cutoff machine
3) Lead core press machine
4) Briquettor for fuel sticks
5) Pedestal grinder

6) Bench type grinder
7) Compression moulding machine
8) Wrapping machine

(For Jute Cardboard Plant)
9) Single row cylinder moulded machine
10) Double row cylinder moulded machine
11) Calender machine
12) Jute cutter machine
13) Jute blower machine
14) Containers and equipment for jute board plant

(For Oil Field Equipment)
15) Sucker rod beam pumping unit (Small size)
16) Spare parts for oil field equipment

(For Electrolytic Copper Refining Pilot Plant)
17) Rotary furnace 1.5 t
18) Centrifuge

(Others)
19) Water treatment plants for industrial use

D. Electrical Machinery Sector

1) A new series of electric motors up to 7.5 kW
2) Lighting fixtures
3) Several types of micro-hydro turbines, crossflow and Pelton turbines of the range 4 kW to 150 kW
4) SSB Transceiver 5 W
5) SSB Transceiver 20 W

Another area of activity is in developing local manufactured parts which previously are purchased from abroad. In such cases, tooling development are carried out to fit in existing processes and facilities.

Some instances are
a) Development of how mould dies for local manufacture of electric bulbs.
b) Development of ductile castings for crankshaft of small diesel

engines which are previously purchased as forgings.

c) Development of forging dies for heavy vehicle parts.

d) Development of energy saving devices.

Future aspects of development will be based on available facilities and know-how, with the aim to increase local manufacture, better quality and productivity and the use of indigenous materials.

Besides the aforementioned items trial design for autonomous development of the following products is under way in the Design Department of the head office.

- 6" high head pump
- 6" low head pump
- 600 kVA transformer (transformer up to 300 kVA capacity are being manufactured at the present time with technical assistance of Matsushita.)
- Fork lift making use of 50 HP tractor engine being manufactured with technical aid of Czechoslovakia.

5-1-2 Collection and Sorting of Technical Information

Within the context of design standards and manuals, the compilation of the "Mechanical Engineering Data Book" is under way but it has not been finished yet. The contents of the parts of the said data book whose compilation has already been finished consists of such numerical tables, mathematical and engineering formulae, characteristics and test methods of materials, standards of screws and machining methods related to the foundations of the production technology.

Under the circumstances, the improvement of parts and the development of new products can hardly be carried out by making use of indigenous technology.

The availability of handbooks and reference bibliography seems to be quite limited.

Technical publications and other documents from overseas are virtually unavailable in view of the shortage of foreign currency.

Furthermore, data and information referring to the performance, functions and prices of materials and parts available on foreign markets become useless when outdated, but there is no means to obtain the most recent information.

5-1-3 Domestic Production of Parts

Table AII-5-1-1 lists the names of the parts HIC wants to switch to domestic production. Some items of the equipment to be installed with the purpose of realizing domestic production are explained within the context of the investment plan for modernization of HIC by referring to parts contained in the said list.

(1) Domestic Production of Parts Related to Products of the 4 Projects

Approval of the various manufacturers (licensers) involved in the 4 projects is required in order to switch to domestic production of parts related to products of the said projects in view of the licensing conditions. It must be remembered, however, that Japanese manufacturers (licensers) don't have internal production of part of the raw materials, shaped materials and parts, and are relying on items purchased from the ordinary market instead. Such being the case, technical orientation from the manufacturers (licensers) is not necessarily available when attempting domestic production of such items.

The most recent information is being required in connection with the following parts.

- Manufacture of bulbs of incandescent lamps
- Electric products for vehicles
- Manufacture of bearings
- Alloy iron materials and shaped materials

(2) Domestic Production of Raw Materials and Shaped Materials

The causes why the supply of these items is relying on imports are the difficulty of domestic procurement, unavailability of items with sufficient quality, too high machining level, etc. If the manufacture of parts is merely superposed over the current production process the

confusion simply increased as long as the coordination with the production plan, the quality control and the maintenance and control of the facilities remain unchanged at the current level, and the result will a complete failure. Such being the case, HIC is being required to prepare a rationally organized system and a sound forecast of the future evolution of the things before making any attempt to realize domestic products of raw materials and shaped materials.

When using domestic raw materials and shaped materials HIC will be required actions regarding the quality and the control of the term of delivery to their suppliers. If HIC should assume a passive attitude as it used to do until now it is almost sure that the plan would fail. The process would be further confused as a result.

For example, the articles supplied by the Ceramic Industry Corporation, which is taking charge of the domestic production of bulbs of incandescent lamps, had problems regarding the quality of the materials and the dimensional accuracy, and almost a half of the incandescent lamps making use of these materials were rejected, and as a result it was unavoidable to use imported bulbs once again.

5-1-4 Model Change and Design Change

Table AII-5-1-2 shows the contents of the model change and design change HIC is looking for.

As important fact common to all products of the 4 projects is that all models are old fashioned and as things now stand the various manufacturers (licensers) are not making these models any more, and both production and sales consist exclusively of new models. Needless to say that the new models have rationalized production cost and improved performance and functions. Such being the case, it is perfectly understandable that HIC wants to switch to these new models.

The following problems must be taken into consideration in this connection, however.

1) The production does not build up necessarily at once when new models are introduced. There is a phase during which there is mixture of both old and new models, and as a consequence there is risk of confusion in the production process during some time.

2) New equipment will be required to manufacture parts of the new models investment. Investment in moulds, jigs, tools, gauges and the like will be required to manufacture the new products.

3) Some quantity of parts and components for maintenance and repair of the old models will be required, and an inventory sufficient to cope with approximately 10 years of servicing will be required even when the production of the old models is stopped.

Table AII-5-1-1 POTENTIAL COMPONENTS TO BE CONVERTED TO LOCAL SUPPLY FROM IMPORT

Products	Component Parts
I. Vehicles	
1. 6.5 Ton Truck	- Side Frame, Disc Wheel, Radiator, Rear Axle Housing - Rear Axle Shaft, Final Gear, Gear for Engine, Inlet and Exhaust Valve, Nozzle Holder, Knuckle Arm, King Pin - Injection Pump, Inlet and Exhaust Manifold - Cylinder Liner, Piston Pin, Water Pump - U Bolts, Wheel Nut, Stud Bolt - Rubber Parts Engine Mounting, Bumper-Spring, Weather Strip, Floor Mat
2. 33 Passenger Bus	- Frame, Body Parts (i.e., Side Construction, Roof Construction, Front Construction, Rear Construction, Door Panel, etc.), Disc Wheel, Radiator, Rear Axle Housing - Rear Axle Shaft, Final Gear, Gear for Engine, Inlet and Exhaust Valve, Nozzle Holder, Knuckle Arm, King Pin - Injection Pump, Inlet and Exhaust Manifold - Cylinder Liner, Piston Pin, Water Pump - U-Bolt, Wheel Nut, Stud Bolt, Tapping Screw - Engine Mounting, Bumper-Spring, Weather Sprip, Inside Rubber Lining
3. X-2000 (Modified Version) Cross Country Vehicle	- Rear Axle Housing, Radiator, Disc Wheel, Side Frame - Rear Axle Shaft, Inlet and Exhaust Valve - Engine Mounting, Stopper, Weather Strip, Floor Mat
4. T-2000 2 Ton Truck	- Rear Axle Housing, Side Frame, Disc Wheel, Radiator, Side Panel, Cabin - Rear Axle shaft, Inlet and Exhaust Valve, Front Axle - Cam Shaft, Inlet and Exhaust Manifold, Oil Sump - Transmission, Final Gear, Propeller Shaft

Products	Component Parts
5. 600cc Vehicle	- Rear Axle Housing - Inlet and Exhaust Valve - Engine Mounting, Stopper, Floor Mat
II. Agricultural Machinery	
1. Tresher	- Side Frame
2. KND5B Engine	- Injection Pump, Nozzle Holder, Inlet and Exhaust Valve - Air Cleaner
3. KND7 Engine	- Injection Pump, Nozzle Holder, Inlet and Exhaust Valve - Air Cleaner
4. Power Tiller	- Disc Wheel, Gear Case Cover, Bolt Guard
III. Electrical Appliances and Products	
1. Distribution Transformer	- Fasteners Terminal Retaining Ring, Solderless Connecting Sleeve, Radiator Panel
2. Storage Battery	- Cap
3. Fluorescent Lamp	- Tube
4. Watt Hour Meter	- Glass Cover, Digital Counter

Source: Information Sheet of the head office of HIC

Table AII-5-1-2 MATERIALS/PARTS/PRODUCTS URGENTLY REQUIRING A CHANGE OF DEVELOPMENT OF MODEL/DESIGN FOR PRODUCTIVITY IMPROVEMENT AND MATERIAL COST PRODUCTION

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

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

Source: HIC Document Dated February 15, 1988

5-2 Course of Improvement

5-2-1 Organization and Functions

The most important factor to be taken into consideration in connection with the development of products is proper staffing of the engineering personnel, and for the time being two measures must be taken to cope with the shortage of design engineers.

1) To select design and development engineers out of the engineering college graduate staff and administrative personnel assigned to the production floors of the plants by examining their aptitude.

2) To select foremen and other people of the drafting staff with aptitude for design and development and to promote them to quasi-engineering posts after intensive training courses.

Furthermore, of the occupational functions mentioned above it is recommendable to unify the design sections (press mould, cutting tool, jig, tool and gauge) that ought to be directly connected with the production floors of the plant in the form of the production technology center (provisional name) so as to establish the design required for the sake of production.

The architectural design section and the civil engineering design section should be unified as design section of the head office, and on the other hand the product design section and the new products development section should be unified for the time being to for the sake of reinforcing the engineering staff while sharing the design and development duties.

As for the development of new products, it is desirable to establish an independent development center in the head office by unifying such functions as technical survey, planning, test, development design, etc.

5-2-2 Collection and Sorting of Technical Information

Inasmuch as HIC is the key industry of the country, independent financial resources in hard currency should be provided at each section for the sake of information gathering, and specialized personnel should be assigned at each section to obtain the most recent information from all over the world, to supply the said information so as to make them available for the development engineers.

In particular, when making preparations to develop new products it is indispensable to know what kind of product in on the market of other countries, the functional design of these products, the techniques used for the sake of basic design, the performance level of the product, data on the market price to examine the economical efficiency, etc. Such being the case it is necessary to create a group in charge of the coordination of information within the development section so as to make these information available for anybody.

5-2-3 Domestic Production of Parts

(1) Domestic Production of Parts of Products of the 4 Projects

There are two ways to obtain technical orientation required for the sake of domestic manufacture of parts related to products of the 4 projects. One is via manufacturers (licensers) and the other is signing technical orientation contracts with suppliers of raw materials, shaped materials and purchased items used to make the said parts. Furthermore, it is also necessary to install a development center at the head office to carry out basic tests as needed.

(2) Domestic Production of Raw Materials and Shaped Materials

Teamwork and mutual cooperation between the various fields of the basic industries of Burma will be required to solve the problems occurring when using domestic raw materials and shaped materials. For example the following measures will be required for HIC be supplied with material for electric lamps with satisfactory quality made by the Ceramic Industry Corporation, which is under the control of a different government office.

1) Specifications referring to the quality of the matrial and the limits of dimensional accuracy of imported glass for electric lamps should be presented in the first place and after that the problems related to the manufacture of the material should be identified.

2) The implementation of such measures introduction of manufacturing technique from foreign country and dispatch of Japanese technical experts should be asked to the supplier. Depending on the case HIC would better take the initiative about the said measures.

3) As for the mould (refer to Section 5-1-1 a) above) to make incandescent lamps, whose development is being planned at the design department of the HIC head office, it should be built HIC and supplied to the manufacturer.

5-2-4 Model Change and Design Change

As be seen in Section 5-1-4, there are various problems that must be pondered from the technical and economic standpoints. Inasmuch as switching to new models will be unavoidable sooner or later, it is necessary to carry out simulations on the profitability by formulating hypothetical plans and by taking into consideration the plant and equipment, the human resources, the materials, the machining methods and other relevant factors.

A project team with participation of experts of the various sections of HIC should be organized for the sake of the said planning work. For the time being the design department of the head office should assume the leadership, but the development center should be established in the future to take charge of model change, design change and other related works.

Needless to say that the support of manufacturers (licensers) of the 4 projects will be required in this connection.

Chapter 6 COST CONTROL

HIC is a national enterprise with a self supporting accounting system which was founded in accordance with the " Guideline for Operation on Commercial Lines to be used by all State Economic Organization in the various Ministries " which was decided in May of 1975.

6-1 Method for Calculating Costs

Cost calculations in the case of the introduction of new products is with the standard calculation method employing the standard cost set on the basis of a time and motion study. In the case of mass production these are done by product and by assembly line. However, there are exceptions for example in the case of the fluorescent lamp the unit used was the entire shop. Further, in the case of order production an actual cost method is carried out based on the costs occurring at the time of production and the quantity of raw materials consumed.

Costs are formed of the direct and indirect raw materials costs, direct and indirect labor costs and depreciation costs.

1. Direct raw materials costs are based on the calculated unit price which is decided on the basis of the employed amount as reported from the shop and the unit price purchased beforehand and calculated at the Head Office.

2. Direct labor costs are calculated for each shop on the basis of the salary levels set by the government and the number of work hours put in at the shop.

3. Depreciation costs are calculated for the acquisition costs using the fixed sum method.

4. Costs are calculated on the basis of the various cost ratios for the direct costs for raw materials.

5. Indirect raw material costs ,indirect labor costs and utility costs are carried out with the distribution method on the basis of production output objectives in principle.

Further, loss of materials is calculated on the basis of the spoilage unit price with regard to direct raw materials costs. Moreover, the various costs are distributed according to the various cost ratios set beforehand for the different groups of parts produced internally in the HIC.

6-2 Particularities of the Breakdown of Costs of Finished Products of HIC

The breakdown for the costs of 1987 are shown by individual product in the tables AII-6-2-1(1) to AII-6-2-1(6). Unit prices are given in local currency (kyats).

More than half of the costs for the various finished products are for imported raw material costs, tax (import duty and excise tax), and depreciation. Depreciation is large because scheduled production is small compared to production capacity. On the other hand labor costs and costs for domestic raw materials are very small in the composition of costs. In this way costs are largely composed of factors beyond the control of the HIC itself and for the present there is small room for a reduction in costs through cost control.

6-3 Future Tendencies of Cost Control

Hereafter, if there is an expansion in the scheduled production output, it will become necessary to increase the operating rates of equipment, and for this it will be important to undertake the effective activation of working equipment. In such an event the decision as to which machinery should be apportioned to the production of which product will be a problem. Further, the necessity to consider the optimum allocation of resources will arise due to the rise in labor costs and raw material costs etc. Moreover, in the case of exports competition with the finished products of other countries will arise, cost control will be essential in order to assure reductions.

Since the actual costs are not easily manifested by the present cost calculation methods these are not appropriate for cost control. Re-consideration of this point will be necessary in the future.

Table AII-6-2-1(1) PRODUCTION COST OF HIC PRODUCTS
(1982/83 AND 1987/88)

(Unit: Kyat)

	Description	D/C Bt 82	D/C Bt 87	FL 82	FL 87	IL 82	IL 87	WHM 82	WHM 87	L.Fix 82	L.Fix 87
1.	Im CP + RM Cost	1.01	1.36	8.71	5.76	2.327	1.85	168.64	288.98	85.62	119.90
1-1	F.O.B Price	0.94	1.24	8.07	5.33	2.155	1.72	156.15	267.58	79.28	111.01
1-2	Freight	0.07	0.12	0.64	0.43	0.172	0.13	12.49	21.40	6.34	8.89
1-3	Insurance										
2.	Local CP + RM Cost	-	0.08	-	14.85	-	2.49	0.40	7.65	10.47	28.33
3.	Depreciation										
3-1	Facil. or Fixed Assets	0.015	0.02	0.696	0.696	0.067	0.067	25.78	28.18	4.02	4.02
3-2	Variable Cost										
4.	Utility Cost	0.018	0.02	0.108	0.108	0.027	0.027	19.17	19.17	0.76	0.76
5.	Im Duty or Im License Fee	0.330	0.47	5.53	2.04	1.54	0.74	56.18	109.91	40.17	35.33
6.	Unloading Cost	0.012	0.02	0.12	0.07	0.02	0.02	2.19	3.76	1.11	1.56
7.	Labor Cost	0.023	0.06	0.143	0.15	0.043	0.15	19.20	19.20	6.14	6.14
	Direct Labor										
	Indirect Labor										
8.	Design Fees, etc.	-	-	-	-	-	-	2.50	2.50	3.80	3.80
9.	Overhead	0.013	0.01	0.157	0.157	0.028	0.028	8.79	11.18	2.05	3.35
10.	Adm. Cost&Sales Expenses	0.009	0.03	0.104	0.129	0.011	0.126	2.42	2.42	1.52	1.67
	Fixed Cost										
	Variable Cost										
11.	Make-up/Profit	-	0.01		0.10	0.140	0.02	10.00	10.00	10.35	10.28
12.	Excise Tax	0.71	1.04	4.62	7.22	1.18	1.66	94.58	150.89	49.79	64.56
	Total	2.15	3.12	20.048	31.28	5.103	7.178	409.85	653.84	215.80	279.70
13.	Sales Price	2.15		20.05		5.10		409.85		215.80	

Notes: 1. Name of products indicated by abbreviation of the full names listed in the attached explanatory note
2. "82": 1982/83 fiscal year
"87": 1987/88 fiscal year

Source: HIC

Table AII-6-2-1(2) PRODUCTION COST OF HIC PRODUCTS
(1982/83 AND 1987/88)

(Unit: Kyat)

	Description	El M 82	El M 87	Trans 82	Trans 87	El Acc 82	El Acc 87	El Fan 82	El Fan 87	P-Up 82	P-Up 87
1.	Im CP + RM Cost	298.16	358.52	60533.18	72192.28	0.84	1.65	253.99	367.32	18669.40	25643.33
1-1	F.O.B Price	276.08	331.97	56049.24	66844.70	0.78	1.53	235.18	340.11	16972.18	23485.48
1-2	Freight	22.08	26.55	4483.94	5347.58	0.06	0.12	18.81	27.21	1697.22	2157.85
1-3	Insurance										
2.	Local CP + RM Cost	251.99	255.87	-	-	0.05	0.05	-	249.93	290.80	2213.00
3.	Depreciation										
3-1	Facil. or Fixed Assets	32.83	36.79	16718.25	17650.95	0.343	0.343	37.27	37.27	4568.45	9440.20
3-2	Variable Cost										
4.	Utility Cost	7.47	7.47	750.00	750.00	0.017	0.017	23.16	23.16	1937.34	1937.34
5.	Im Duty or Im License Fee	112.73	129.07	29833.47	31565.51	0.49	0.87	103.98	183.30	8382.13	6351.78
6.	Unloading Cost	3.88	4.66	786.94	938.50	0.04	0.02	12.70	4.77	242.70	333.36
7.	Labor Cost	14.40	14.40	2913.60	2913.60	0.107	0.107	31.80	63.65	1207.98	1989.95
7-1	Direct Labor										
7-2	Indirect Labor										
8.	Design Fees or etc.	7:00	7.00	-	-	0.03	0.03	-	-	429.79	429.79
9.	Overhead	36.80	36.80	19043.57	19043.57	0.381	0.381	170.79	103.75	1024.70	489.13
10.	Adm. Cost&Sales Expenses	10.86	10.86	1068.32	1068.32	0.05	0.05	25.06	30.07	522.23	574.45
10-1	Fixed Cost										
10-2	Variable Cost										
11.	Make-up/Profit	77.27	77.27	13106.46	13106.46	0.23	0.23	73.25	49.13	1841.40	988.05
12.	Excise Tax	170.66	187.74	43426.16	47768.76	0.77	1.15	439.20	667.40	11735.08	15117.12
	Total	1024.05	1126.45	188179.95	206997.95	3.348	4.898	1171.20	1779.75	50852.00	65507.50
13.	Sales Price	1024.05		188179.95		3.35		1171.20		50852.00	

Notes: 1. Name of products indicated by abbreviation of the full names listed in the attached explanatory note
2. "82": 1982/83 fiscal year
"87": 1987/88 fiscal year

Source: HIC

Table AII-6-2-1(3) PRODUCTION COST OF HIC PRODUCTS
(1982/83 AND 1987/88)

(Unit: Kyat)

	Description	LV 82	LV 87	2T T 82	2T T 87	1/4T 82	1/4T 87	1/2T 82	1/2T 87	1/2TS 82	1/2TS 87
1.	Im CP + RM Cost	19610.57	25643.33	35398.41	57309.66	41477.53	55500.54	53137.53	64356.52	58451.05	71127.60
1-1	F.O.B Price	17827.79	23485.48	32180.37	47238.44	37706.85	49906.08	48306.85	57869.36	53137.32	63957.92
1-2	Freight	1782.78	2157.85	3218.04	10071.22	3770.68	5594.46	4830.68	6487.16	5313.73	7169.68
1-3	Insurance										
2.	Local CP + RM Cost	520.40	2592.95	230.50	1876.05	365.50	7244.97	365.50	8001.17	365.50	8465.02
3.	Depreciation										
3-1	Facil. or Fixed Assets	4945.31	5021.47	9760.47	21320.64	9017.77	22680.85	9017.77	25946.55	9017.77	31649.68
3-2	Variable Cost										
4.	Utility Cost	1939.28	1939.28	1939.28	1939.28	1943.16	1943.16	1943.16	1943.16	1943.16	1943.16
5.	Im Duty or Im License Fee	8478.23	6351.78	18312.81	27669.28	19215.97	18146.24	21547.97	22245.86	23702.71	25458.01
6.	Unloading Cost	254.94	333.36	460.18	745.02	539.21	721.50	690.79	836.63	759.86	924.66
7.	Labor Cost	1884.98	1884.98	2432.19	3000.00	2138.97	3557.25	2138.97	4039.75	2138.97	6039.75
7-1	Direct Labor										
7-2	Indirect Labor										
8.	Design Fees or etc.	430.22	430.22	490.00	490.00	540.00	540.00	540.00	540.00	540.00	540.00
9.	Overhead	2177.54	453.43	5071.50	1149.80	3818.18	1113.40	4553.56	1289.15	5870.49	1471.54
10.	Adm. Cost&Sales Expenses	1146.01	1146.01	573.00	630.30	914.65	1006.12	914.65	1006.12	914.65	1006.12
10-1	Fixed Cost										
10-2	Variable Cost										
11.	Make-up/Profit	1072.52	915.94	4053.13	2322.60	3625.31	2249.08	4742.48	2604.00	5185.18	2972.51
12.	Excise Tax	25476.00	28027.65	23616.53	35535.77	25078.75	34410.94	29877.62	39842.70	32666.66	45479.40
	Total	67936.00	74740.40	102338.00	153988.40	108675.00	149114.05	129470.00	172651.70	141556.00	197077.45
13.	Sales Price	67936.00		102338.00		108675.00		129470.00		141556.00	

Notes: 1. Name of products indicated by abbreviation of the full names listed in the attached explanatory note
2. "82": 1982/83 fiscal year
"87": 1987/88 fiscal year

Source: HIC

Table AII-6-2-1(4) PRODUCTION COST OF HIC PRODUCTS
(1982/83 AND 1987/88)

(Unit: Kyat)

	Description	6.5TDT 82	6.5TDT 87	6TLT 82	6TLT 87	DT 82	DT 87	OT 82	OT 87	WB 82	WB 87
1.	Im CP + RM Cost	87145.73	101933.74	83588.90	93687.90	115640.77	134177.85	133676.75	157621.28	85933.55	107066.06
1-1	F.O.B Price	79223.39	92667.04	75989.90	85170.82	105127.97	121979.87	121524.32	143292.07	78121.40	97332.78
1-2	Freight	7922.34	9266.70	7599.00	8517.08	10512.80	12197.98	12152.43	14329.21	7812.15	9733.28
1-3	Insurance										
2.	Local CP + RM Cost	1543.16	20023.09	300.00	17859.50	-	17206.09	-	17111.97	-	17111.97
3.	Depreciation										
3-1	Facil. or Fixed Assets	9788.71	19498.45	8304.70	19143.50	8375.20	20311.33	9192.02	21215.15	9972.88	19930.50
3-2	Variable Cost										
4.	Utility Cost	360.00	360.00	320.00	320.00	250.00	250.00	280.00	280.00	440.00	440.00
5.	Im Duty or Im License Fee	42387.96	39410.75	41155.92	37755.39	57138.79	55223.15	67732.25	70165.35	41434.16	40441.05
6.	Unloading Cost	1132.88	1325.15	1086.66	1217.96	1503.29	1744.31	1737.79	2049.07	1117.14	1391.87
7.	Labor Cost	1670.00	1931.10	1580.00	1895.95	1900.00	1966.20	2000.00	2106.65	2000.00	2106.65
7-1	Direct Labor										
7-2	Indirect Labor										
8.	Design Fees or etc.	375.00	375.00	300.00	300.00	250.00	250.00	300.00	300.00	450.00	450.00
9.	Overhead	2408.23	1859.13	1026.31	1732.15	3714.86	2318.82	2342.09	2716.03	7116.77	1900.15
10.	Adm. Cost&Sales Expenses	960.00	1056.00	940.00	1034.00	685.00	753.50	685.00	735.50	980.00	1078.00
10-1	Fixed Cost										
10-2	Variable Cost										
11.	Make-up/Profit	6807.56	3755.44	3374.43	3498.90	5535.14	4684.00	6031.00	5486.40	6784.82	3838.35
12.	Excise Tax	46373.77	57458.35	42593.08	53533.60	58497.95	71665.58	67193.10	83941.60	46868.68	58726.40
	Total	200953.00	248986.20	184570.00	231978.85	253491.00	310550.85	291170.00	363747.00	203098.00	254481.00
13.	Sales Price	200953.00		184570.00		253491.00		291170.00		203098.00	

Notes: 1. Name of products indicated by abbreviation of the full names listed in the attached explanatory note
2. "82": 1982/83 fiscal year
"87": 1987/88 fiscal year

Source: HIC

Table AII-6-2-1(5) PRODUCTION COST OF HIC PRODUCTS
(1982/83 AND 1987/88)

(Unit: Kyat)

	Description	FFT 82	FFT 87	25Bus 82	25Bus 87	33Bus 87	WPSS 82	WPSS 87	WPSK 82	WPSK 87
1.	Im CP + RM Cost	343292.79	509012.32	115935.97	162454.25	341982.82	1601.85	1840.15	2218.66	2522.77
1-1	F.O.B Price	312084.35	462738.48	105396.33	147685.68	284985.68	1483.20	1703.84	2054.31	2335.89
1-2	Freight	31208.44	46273.84	10539.64	14768.57	56997.14	118.65	136.31	164.35	186.85
1-3	Insurance									
2.	Local CP + RM Cost	-	17111.97	850.00	9511.64	20112.14	300.00	181.50	392.12	444.11
3.	Depreciation									
3-1	Facil. or Fixed Assets	21612.33	31988.85	9755.00	20129.00	35774.37	237.88	266.32	260.62	223.44
3-2	Variable Cost									
4.	Utility Cost	440.00	440.00	450.00	450.00	450.00	27.90	27.90	32.85	32.85
5.	Im Duty or Im License Fee	-	-	67869.16	66539.24	177875.00	250.45	392.42	492.55	562.94
6.	Unloading Cost	4462.81	6617.10	2000.00	2111.91	4445.77	17.53	23.92	28.84	32.79
7.	Labor Cost	2000.00	2106.60	2000.00	1755.55	1755.55	34.44	34.44	62.40	62.40
7-1	Direct Labor									
7-2	Indirect Labor									
8.	Design Fees or etc.	450.00	450.00	400.00	400.00	400.00	-	-	-	-
9.	Overhead	3731.98	5688.06	4536.03	2644.31	17552.82	77.15	77.15	78.65	78.65
10.	Adm. Cost&Sales Expenses	980.00	1078.00	940.00	1081.00	1081.00	11.24	11.24	16.86	16.86
10-1	Fixed Cost									
10-2	Variable Cost									
11.	Make-up/Profit	6845.09	11489.85	4100.00	5341.55	21050.03	71.80	71.80	100.65	100.65
12.	Excise Tax	-	-	62650.84	81725.55	186743.85	526.06	585.36	1105.25	1223.24
	Total	383815.00	585982.75	271487.00	354144.00	809223.35	3156.38	3512.20	4789.45	5300.70
13.	Sales Price	383815.00		271487.00						

Notes: 1. Name of products indicated by abbreviation of the full names listed in the attached explanatory note
2. "82": 1982/83 fiscal year
"87": 1987/88 fiscal year

Source: HIC

Table AII-6-2-1(6) PRODUCTION COST OF HIC PRODUCTS
(1982/83 AND 1987/88)

(Unit: Kyat)

	Description	PT 82	PT 87	Thr 82	Thr 87	PG 82	PG 87	2000E 82	2000E 87	2000T 82	2000T 87
1.	Im CP + RM Cost	7958.30	8509.89	674.73	2344.37	5768.47	6059.75	7085.03	12296.02	-	5954.25
1-1	F.O.B Price	7368.81	7879.52	624.74	2170.71	5341.17	5610.88	6440.94	11178.20	-	5412.96
1-2	Freight	589.49	630.37	49.99	173.66	427.30	448.87	644.09	1117.82	-	541.29
1-3	Insurance										
2.	Local CP + RM Cost	-	457.00	2.88	2.88	-	1009.72	-	1688.18	-	210.00
3.	Depreciation										
3-1	Facil. or Fixed Assets	119.08	119.08	181.03	368.58	278.50	278.50	-	11507.10	-	5753.55
3-2	Variable Cost										
4.	Utility Cost	59.87	59.87	26.04	26.04	72.12	72.12	-	971.58	-	485.80
5.	Im Duty or Im License Fee	1674.45	1703.00	43.73	232.79	1317.01	868.81	3949.89	4674.28	-	1746.00
6.	Unloading Cost	103.38	110.57	13.73	30.47	74.99	78.78	425.10	159.84	-	77.40
7.	Labor Cost	67.09	67.09	42.24	42.24	86.78	86.78	407.55	1778.65	-	889.30
7-1	Direct Labor										
7-2	Indirect Labor										
8.	Design Fees or etc.	-	-	-	-	-	-	-	270.00	-	135.00
9.	Overhead	-	-	50.44	153.58	280.06	280.06	5706.23	1692.50	-	775.45
10.	Adm. Cost&Sales Expenses	58.50	58.50	24.13	24.13	80.80	80.80	271.70	500.30	-	250.15
10-1	Fixed Cost										
10-2	Variable Cost										
11.	Make-up/Profit	-	-	52.95	161.25	568.81	568.81	-	1776.92	-	813.85
12.	Excise Tax	2008.13	2217.00	222.38	677.27	2558.26	2815.22	2125.50	11194.63	-	5127.25
	Total	12048.80	13302.00	1334.28	4063.60	11085.80	12199.35	19971.00	48510.00	-	22218.00
13.	Sales Price										

Notes: 1. Name of products indicated by abbreviation of the full names listed in the attached explanatory note
2. "82": 1982/83 fiscal year
"87": 1987/88 fiscal year

Source: HIC

Explanatory note to Table AII-6-1-1(1) to Table AII-6-1-1(6).

Abbreviation	Name of Products	Abbreviation	Name of Products
D/C Bt	Dry Cell Batteries UM-1	6.5 TDT	TE-21AZ 6.5ton Diesel Truck
FL	Flusrescent Lamp 40W 4FT	6 TLT	TE-21TLB 6ton Logging Truck
IL	Incandescent Lamp 60W	DT	TE-21 Dump Truck
WHM	Watt Hour Meter TE-1	OT	TE-21 Oil Tanker
L.Fix	Lighting Fixture	WB	TE-21 Water Bouser
El M	Electric Motor	FFT	TE-21 fire Fighting Engine
Trans	Transformer	25 Bus	25 Passenger Bus
El Acc	Electric Accessories	33 Bus	33 Passenger Bus
El Fan	Electric Fan	WPSS	Water Pump SCYC
P-Up	B-600 Pick-Up	WPSK	Water Pump KND-5B
LV	B-600 Light Van	PT	Power Tiller KMB-200
2T T	T-2000 2ton Light Truck	Thr	Thresher ATA-45
1/4 T	T-2000 1/4ton Cross Country	PG	Portable Generator
1/2 T	X-2000 1/2ton Cross Country	2000E	X-2000 Engine
1/2 TS	X-2000 1/2ton Station Wagon	2000T	X-2000 Transmission

Chapter 7 PERSONNEL MANAGEMENT

Introduction of management and control systems of various kinds including production control and systematic operation of these systems is indispensable to realize efficient and smooth production activities.

Inasmuch as the human being (i.e., the employees) are the persons who will handle and operate these systems, such factors as realizing proper allocation of the right man at the right place and elevating the morale of the workers will exert decisive influence on the production activities.

The implementation of education/training programs and the assurance of safety and proper work environment are essential for the sake of maintaining high morale of the workers. Such being the case, the management of personnel of HIC will be examined from the said standpoints.

7-1 Education and Training

7-1-1 Current Situation of Education and Training

The education/training programs of HIC as a whole are planned and executed at its head office, but part of the technical training programs is executed at the various plants.

The education/training programs are divided in two categories, clerical personnel and technical workers. The education/training program for clerical personnel comprises 3 levels, executives, management personnel and ordinary personnel. The education/training activities taken charge by HIC consists mainly of on the job training, which is carried out besides off the job training which consists of dispatching training to domestic institutions and to Japan and other foreign countries. (Table AII-7-1-1, AII-7-1-2)

Example of curriculum of domestic training/education institution is shown in Table AII-7-1-3. On the other hand, example of acquisition of technical knowledge through dispatch to overseas is shown in Table AII-7-1-4.

The training/education program for technical personnel consists of 3 levels that cover newcomers consisting of newly recruited workers graduated from

junior high school, personnel with previous work experience at other workplaces, and foremen. The education/training program course of sending them to technical training centers and on the job training carried out at the workplace.

Technical training to newly recruited workers graduated from junior high school is carried out during 2 years at the technical training schools existing in the various plants. The personnel submitted to this kind of training mounts to 100 persons including female workers. The organization of the technical training center is shown in Table AII-7-1-5. A sum equivalent to ¥1,800 through ¥2,000 per month is paid during the training program, and approximately ¥1,200 is discounted to cover dormitory and other costs.

The contents of the course consists of (1) Theoretical classes and (2) Practice, with the first year consisting mainly of theory and the second year mainly of practice. (Table AII-7-1-6)

The curriculum of the theoretical course comprises basic knowledge common to the various occupations (i.e., mathematics, physics, mechanics, etc.) as well as such specialized knowledge as welding, plating, heat treatment, etc.

The practice has the object of acquiring practical knowledge about forging, heat treatment, mechanics, welding, inspection, etc., and is carried out under the supervision of instructors. On the other hand, technical training of workers with experience at other workplaces consists mainly of on the job training.

Every year HIC is recruiting approximately 120 persons graduated from the Industrial Training Center - Sinde (I.T.C.).

I.T.C. has training courses with 3-year duration for male and female trainees selected after an admission examination in which only one out of several applicants is approved. Each year the center admits 130 trainees that are divided into 8 specialized courses (Table AII-7-1-7).

The curriculum is divided into theoretical classes and practice (Table AII-7-1-8), and intensive training is provided through full-day training courses.

The graduated trainees are admitted at HIC as skilled technical workers.

The facilities and teaching materials used for the sake of training are fairly equipped (Table AII-7-1-9), but the obtainment of the materials used as teaching materials is not necessarily smooth.

The layout of I.T.C. is shown in Figure AII-7-1-1.

7-1-2 Problems of Education and Training

The education and training of employees begins with the orientation when they are admitted. After that it is desirable to carry out education and training programs according to the required levels of technique and skill or according to the degree of responsibility of managerial positions and supervisory positions, for the capacity of the employees to be given full play on each occasion and in each occupation. Table AII-7-1-10 shows desirable education and training system.

The education/training programs of HIC have the characteristics mentioned in the previous section, but their contents are not necessarily satisfactory in connection with the following aspects.

- Improvement of the managerial capability of the administrative personnel
- Improvement of the supervisory capability of the supervisors
- Teaching of managerial techniques to administrative personnel, supervisors and middle-class workers
- Improvement of the technical capability of middle-class workers of the technical field
- Improvement of the technical skill of technical workers
- Motivation to encourage each worker to participate enthusiastically in the production activities

The following problems are becoming apparent because satisfactory training/education is not being carried out connection with the aforementioned points.

1) Administrative personnel must be perfectly familiarized with their duties when taking charge of managerial positions. In reality, however, they do not succeed at causing workers to observe the work regulations and to tackle their jobs with enthusiasm because they are not sufficiently familiarized with such basic matters as control of the

workers and assignment of tasks, communication with and motivation of the subordinates, etc. Under the circumstances the workers do not feel encouraged to propose improvements related to the work and to take the initiative to improve the technique and the level of skill.

2) Problems of various kinds are occurring in connection with the quality, cost, terms of delivery, and other aspects because employees ranging from middle-class employees to management personnel are not giving full play to administrative techniques.

3) Foremen are not able to give full play to the capability and the motivation of the workers because they are not necessarily familiarized with basic knowledge of supervisory duties.

4) Engineers are not given chances to upgrade their technical knowledge after their admission and as a consequence they do not have the technical qualification required for the sake of development of products and improvement of the production techniques.

5) Workers of the technical field consist of junior high school graduates, Industrial Traiing Center - Sinde graduates and personnel with work experience at other workplaces but they are not given chance to upgrade their technical skill after the training given after their admission. Such being the case their skill level becomes stagnant and their area of work is not enlarged.

The situation brings about low motivation to work and job hopping in the worst case, and is one of the major causes of the shortage of skilled workers.

6) Stimulation of the motivation to work is not being given much attention in the personnel affairs of HIC.

There is no difference between individual salaries, and furthermore the yield, efficiency and other relevant factors are not reflected in the evaluation of the personnel.

Furthermore, there is no official commendation for proposition of improvement, meritorious deed, long-time continuous service and the like. These measures are indispensable to create the feeling of iden-

tification with the workplace and the consciousness of participation in the production activities.

The problems of the education/training programs of HIC are mentioned in the followings.

1) Administrative personnel and middle-class workers are being sent to educational institutions located outside the corporation in most of the cases, but the steps to realize practical application of the knowledge learned at the said institutions are not sufficient. Such being the case, the learned contents are not given full play at the workplace and as a consequence the obtianed results are not satisfactory.

2) There are cases of reshuffling of personnel right after training aborad, and as a consequence the knowledge learned overseas are not given full play at the workplace.

   Furthermore, extension of the learned knowledge to other persons is rare, ending up as an exclusive asset of the person dispatched overseas, and as a consequence it is not given full play at the workplace.

3) Inasmuch as the head office takes charge of the education/training programs including those ones referring to the technical skill of the workers, these programs do not reflect such characteristics as products, types of occupation, equipment, environment, staffing and the like of each individual plant and as a consequence the effectiveness of the training is somewhat questionable.

4) The technical training centers in the plants are attaching too much importance to the theoretical aspects. The training programs are not bringing about effective results due to the shortage of training materials, equipment and machinery. Furthermore, textbooks are available only for instructor and are not distributed to the trainees. As a consequence the classes are given via blackboard but the efficiency is low and the preparation and review are not sufficient.

7-1-3 Improvements to be Made in Education and Training

As mentioned before the morale of the workers exerts decisive influence on the productivity. And it may safely be said that education/training exerts decisive influence on the morale.

Such being the case, the following measures are proposed in connection with the education/training programs of HIC.

1. Improvement of the managerial capability
2. Learning of administrative techniques
3 Improvement of the supervisory capability
4. Improvement of the technical skill
5. Improvement of the technical level of the middle-class workers

(1) Improvement of the Managerial Capability

The function of the administrative personnel is to make shift with the work and the human resources to operate the workplace and the organization as a whole in the best way so as to realize the expected results and business showings.

Inasmuch as the duty of the administrative personnel consists of "controlling the work" and "controlling human resources", the contents of the training/education program to upgrade the managerial capability must cover the following aspects.

1) Foundations of managerial work
2) Control of the work
3) Improvement of the work
4) Understanding of the action of the human being

(2) Learning of Administrative Techniques

Administrative and supervisory personnel must have control of the flow of the parts and components, aspects related to the quality and aspects related to the safety, and they must take prompt improvement action when there is any problem.

Such being the case, administrative and supervisory personnel must be perfectly familiarized with the objects of the administrative duties,

the administrative techniques and the merits of the introduction of the techniques.

The following production control courses should be provided for administrative and supervisory personnel as well as middle-class workers (both clerical and technical workers).

- Courses related to the human being:
  Labour control, safety control
- Courses related to materials:
  Control of the inventory, control of the purchase, control of outside manufacture
- Courses related to plant and equipment:
  Control of plant and equipment, control of jigs and tools, control of the maintenance
- Courses related to methods:
  Control of techniques, control of design, control of transportation
- Courses related to financial resources:
  Control of the finances
- Courses related to the assurance of the quality of the products:
  Quality control
- Courses related to the observance of the terms of delivery:
  Schedule control
- Courses related to the production cost:
  Cost control

(3) Improvement of the Supervisory Capability

Foremen are personnel belonging to the front of the administrative and supervisory system that play a function of primordial importance to link the plant floor organization with the kernel of the business administration. Such being the case, it is indispensable to define clearly the scope of responsibility and authority of the foremen, to consolidate his position as a person in charge of supervisory duties and to create training programs aimed at improving the productivity.

1) The basic and ideal stand of the supervisory personnel
2) Effective way to carry out the work

3) Job control
4) Safety and hygiene control
5) Training of subordinates
6) Control of duties
7) Human relations

(4) Training to Improve the Technical Skill

Training courses to improve the technical skill are considered by dividing then into 2 categories, (1) courses for junior high school graduates and (2) courses for middle-class technical workers.

1) Training Course for Junior High-School Graduates

Junior high school graduates are admitted regularly every year and are submitted to 2 years of technical training at the Technical Training School.

Since basic matters related to technical knowledge and technical skill are not sufficiently learned, however, the following curriculum will be added to the current training contents.

a) Practice of basic handling and operation of equipment and machinery.
b) Basic machining and finishing practice.
c) Routine inspection and maintenance practice of mechanical facilities
d) Quality of products, safety education and cleaning/inspection.
e) Basic knowledge on products being manufactured at the plant.

The following equipment and machinery should be equipped exclusively for training purpose for the sake of more effective results.

Boring machine, lathe, milling machine, press, welding machine, grinder, sequences related to hand finishing work electric, hydraulic, pneumatic and other related systems.

Timeworn machinery and/or idle facilities of the plants should be used for the said purposes.

2) Improvement of the Technical Skill of Middle-Class Workers

After the technical training on the occasion of the admission, the improvement of the level of technical skill of the workers is left to on the job training activities. In view of the shortage of middle- and upper-class technical workers in HIC as a whole, urgent measures must be taken to promote the formation of the said categories of workers.

The training programs have the purpose of upgrading the level of technical skill of the workers, familiarizing them with the plant control techniques and implanting them the consciousness of their roles.

As a general rule improvement of the technical skill level will be realized mainly through on the job training, but the technical skill level will be divided in ranks for both the instructor side and the side being taught to define clearly the targets to be attained.

The contents of the training/education program on plant control are mentioned in the followings.

a) Safety and hygiene control
b) Production control
c) Quality control
d) Cleaning and inspection
e) Problem-solving methods
f) Basic knowledge on products being manufactured at the plant

Training outside the workplace will cover such technical items as metallic materials, cleaning techniques, repair techniques and the like common to the various kinds of equipment and occupations of the plant, besides practice on the operation, disassembly and assembly of products being manufactured at the plant.

(5) Improvement of the Technical Skill Level of Middle-Class Employees

Technical capability is an important factor besides control/supervision capability, and technical skill. In particular, technical capability is especially required in the fields of production techniques and product development.

Such being the case, people graduated from the I.T.C. (Industrial Training Center) and employees of the technical field with 3 through 6 years of service should be submitted to training to upgrade the technical capability.

Training Curriculum

- Mathematics (differential and integral calculus)
- Metallic materials
- Electricity
- Physics
- Thermodynamics
- Mechanics
- Fluid dynamics
- Foreign languages
- Physical education

Table AII-7-1-1 DISPATCH TO DOMESTIC TRAINING AND EDUCATION INSTITUTIONS (EXAMPLE)

a) The Central Institute of Public Services
b) The Central Institute of Political Science
c) Vocational Training Centre
d) Trade Department Training School 1. Export Management and Export Promotion Course 2. Export Management Course 3. Export Procedure Course 4. Course on Foreign Procurement Method and Procedure
e) Senior Management Course at the Institute of Economics

Source: HIC

Table AII-7-1-2 YEARLY TRAINING STATEMENT OF HEAVY INDUSTRIES CORPORATION'S PERSONNEL IN ABROAD (1973 through 1988)

Sr. No.	Calendar Year	JAPAN	F.R.G.	C.S.S.R	U.S.S.R	ITALY	NETHERLAND	AUSTRIA	AUSTRALIA	TURKEY	POLAND	NORWAY	SWEDEN	SWITZER-LAND	PHILIPPINE	U.S.A.	MALAYSIA	INDIA	CHINA	SRI LANKA	THAILAND	SINGAPORE	SOUTH KOREA	TOTAL
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
1.	1973	1(U)																						1
2.	1974		4(FRG)																					4
3.	1975	2(C)														1(U)								3
4.	1976	1(C)																						1
5.	1977	6(C)	4(FRG)		2(U)				2(C)		1(U)				1(IR) 1(WB)		1(NL+H)							18
6.	1978	2(C) 2(KT)	6(FRG)	1(U) 3(KHV)			1(NL)	1(U)			1(U)				1(U)			1(C)						19
7.	1979	2(C) 1(MT)	18(FRG)					1(U)			2(U)						1(M+NL) 1(FRG)	2(C)				1(C)		29
8.	1980	7(C)	9(FRG) 1(BB)		1(U)			1(U)	1(C)				1(U+SIDA)			1(USA)		2(C) 1(UO)				1(C)		26
9.	1981	1(U) 7(C) 2(MT)		1(U)	3(U)		1(NL)					1(KB)						2(C)		1(U+SIDA)				19
10.	1982	4(C) 5(HN) 5(MT) 7(TK) 5(KT)	4(FRG)	2(U)										2(O)				1(C)						35
11.	1983	5(C) 6(HN) 6(MT) 5(TK) 6(KT)	5(FRG) 3(FW)	1(U)	1(U)	1(I)												1(C)					1(SK+B)	41
12.	1984	7(C) 6(HN) 10(MT) 10(TK) 8(KT)	1(FRG)	10(TEX)	1(U)					1(U)			1(S)			1(ADB)	1(M+J)				1(FRG)			58
13.	1985	1(U) 8(C)		1(U) 10(TEX) 11(OMP)	1(U)	1(I)		1(U)		1(U)							1(M+J) 1(M)		2(U)					39
14.	1986	1(U) 5(C)	2(FRG)	1(U) 4(TEX) 11(OMP)	1(U)	1(I)		1(U)		1(U)							1(M)	3(C)	1(U)			1(UNDP+ITU) 1(C)		35
15.	1987	6(C)	1(FRG)	2(U) 1(TEX)			1(NL)											4(C) 6(ID)	2(U)			4(C)		27
16.	1988	2(C)																						2
	Total	152	58	59	10	3	3	5	3	3	4	1	2	2	3	3	7	23	5	1	1	8	1	357

Remarks

ADB : Asia Development Bank
B : Belgium
BB : Bruno Bachmann Co.
C : Colombo Plan
FRG : Federal Republic of Germany
FW : Fritz Werner Export GmbH
HN : Hino
I : Italy
ID : India
IR : International Rice Research Institute
ITU : International Telecommunication Union
J : Japan
KB : M/S Kongsberg Co.
KT : Kubota
M : Malaysia
MKV : Motokov
MT : Matsushita
NL : Netherland
O : Oerlikon
OMP : Omnipol
S : Sweden
SIDA : Swedish International Development Agency
SK : South Korea
TEX : Technoexport
TK : Toyokogyo
U : UNIDO
UNDP : United Nations Development Programme
UO : UNESCO
USA : United States of America
WB : World Bank

Source: Yearly Training Statement of Heavy Industries Corporation's Personnel in Abroad (HIC)

Table AII-7-1-3 EXAMPLE OF CURRICULUM OF DOMESTIC TRAINING/EDUCATION INSTITUTE

Sr. No.	Intake Qualification	Duration	Main Curriculum
1.	Officer (under 45 years of age)	4 1/2 months	- Political Science - Physical Training - Basic Civil Law - Economic Policy - Basic Accounting - Basic Agriculture - Basic Livestock Breeding - Basic Cooperatives - Basic Narcotic Law - Basic Criminal Law - Personnel Management - Office Work Procedure
2.	Supervisor (320 scale level)	4 1/2 months	- ditto -
3.	Clerk (185 scale)	5 1/2 months	- Physical Training - Political Science - Typing - Letter Writing - Office Work Procedure

Note: The Central Institute of Public Services (This Institute is under the management of the Public Services Selection Board, the Council of State. The above training courses are conducted yearly for training of officers, supervisors and clerical staff.)

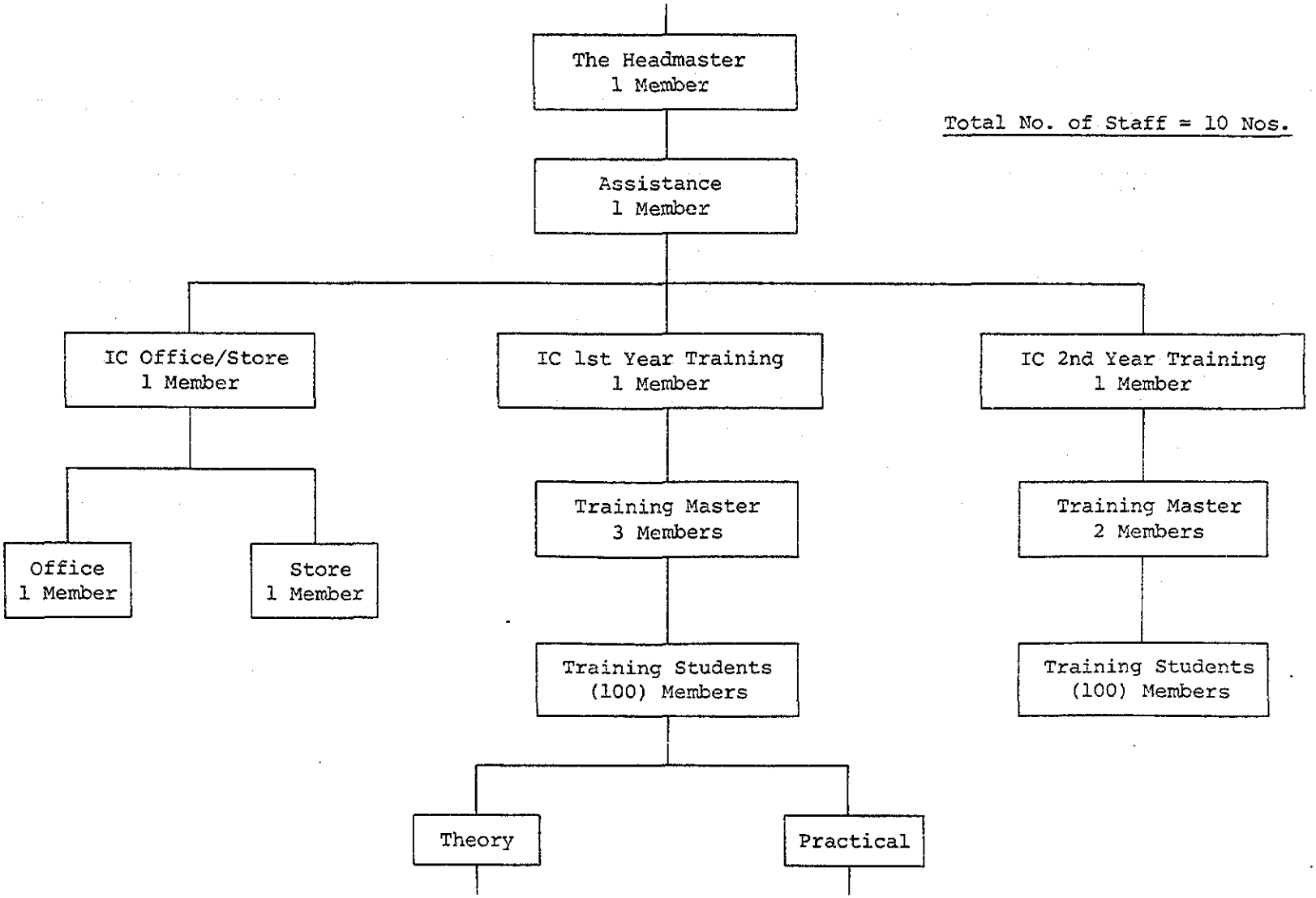
Source: (HIC)

Table AII-7-1-4 EXAMPLE OF TECHNICAL COURSES ABROAD FOR HIC'S STAFFS

1.	Group Training Course in Properties and Testing of Steel Products
2.	Group Training Course in Metal Finishing
3.	Group Training Course in Welding Technology
4.	Group Training Course in Highly Skilled Machinist
5.	Group Training Course in Colour Television Engineering (I)
6.	Group Training Course in Plastic Technology
7.	Group Training Course in Industrial Standardization, and Quality Control
8.	Group Training Course in Consultancy Services for the Promotion of Small Industries
9.	Group Training Course in Foundry Engineering
10.	Group Training Course in Electrical Steel Making Engineering
11.	Group Training Course in Tooling and Production Facilities Practical Engineering
12.	Group Training Course in Farm Machinery Design
13.	Group Training Course in Heat Treatment Technology
14.	Group Training Course in Vocational Training Instructor (Machinery Trade)
15.	Air Conditioning and Refrigeration Mechanics
16.	Electrical Fitting and Installation
17.	Electronics Servicing (Digital Equipment)
18.	Electronics Servicing (Video Equipment)
19.	Precision Machining
20.	Mechanical Engineering Drawing and Design
21.	Printed Circuit Board/Electronic Teaching Aid Design and Fabrication
22.	Post Graduate Course on Tool, Die and Mould Design
23.	Post Diploma Course on Tool, Design
24.	Post Graduate Course in Tool Design and Manufacturing
25.	Tool and Die Making

Source: Name of Technical Course (HIC)

Table AII-7-1-5 ORGANIZATION OF THE TECHNICAL TRAINING CENTER



Source: Technical Training School Organization Chart (No.4 HI)

Table AII-7-1-6 EXAMPLE OF CURRICULUM OF THE TECHNICAL TRAINING CENTER

Theory

(1)	Algebra + Geometry	(6)	Electrical
(2)	Lograthium + Trigonometry	(7)	Chemistry
(3)	Machinery + Technical Math + Measuring Instrument	(8)	Drawing
		(9)	Heat Treatment
		(10)	Welding
		(11)	Plating
(4)	Hand Tools, Machine Tools and Prevention	(12)	Metallurgy
		(13)	Automobiles
(5)	Physics		

Practical

(1)	Making by Vice and Hand Tools	In Technical Training School
(2)	Hand Forging	
(3)	Carpenter	
(4)	Sheet Metal	In No.4 HI Shop
(5)	Welding	
(6)	Machinery	
(7)	Heat Treatment	
(8)	Inspection	

Source: Technical Training School Organization Chart (No.4 HI)

Table AII-7-1-7 TECHNICAL COURSES OF THE ITC

		Nos. of Trainee/Year
o Maintenance and repair of machines, plant services, structural steel work, sheet metal work, pipe installation	MACHINERY FITTER	20
o Operation of lathe machines, shaping machines, milling machines, grinding machines etc. assembly and maintenance	MACHINE TOOL OPERATOR	20
o Production of press tools, forging tools, jigs and fixtures as well as maintenance and repair of such items	TOOL AND DIE MAKER	10
o Maintenance and repair of cars, trucks and stationary combustion engines including diesel and electrical systems	MOTOR VEHICLE MECHANICS	20
o Fault analysis and repair of all types of electric motors, generators, transformers, etc.	ELECTRICAL MACHINE MAKER	20
o Installation and maintenance of electric power supply systems for domestic and industrial use	ELECTRICAL FITTER	20
o Design and production of pattern and core boxes for foundries repair of patterns	PATTERN MAKER	10
o Making of detail and assembly drawings for all applications in mechanical engineering. Detail design	MECHANICAL DRAUGHTSMAN	10
	Total Intake per Year	130

Source: ITC (Industrial Training Center - Sinde (No.3 HI))

Table AII-7-1-8 TRAINING SCHEDULE OF THE ITC

	Nos. of Trainee/ Year	Month 0 – 6 – 12 – 18 – 24
Machinery Fitters	20	Basic Training | Machine Tools Operation | Sheet Metal, Pipe Fitting Welding, Forging, Heat Treatment | Basic Electrical Engineering | Productive Repair and Manufacturing Projects | Basic Automotive Engineering
Machine Tool Operators	20	Basic Training | Machine Tools Operation | Sheet Metal Forging Welding Heat Treatment | Productive Projects
Tool and Die Makers	10	Basic Training | Sheet Metal Welding Forging Heat Treatment | Machine Tools Operation | Productive Tool and Die Making Projects
Motor Vehicle Mechanics	20	Basic Training | Introduction to Automotive Engineering | Sheet Metal Forging Welding Heat Treatment | Productive Maintenance and Repair of Motor Vehicles
Electrical Machine Makers	20	Basic Training | Sheet Metal Welding Forging | Basic Circuitry, Electrical Measuring | Productive Repair & Manufacture of Electrical Machine | Lathe Work | Productive Work | Motor Control Circuitry
Electrical Fitters	20	Basic Training | Sheet Metal Welding Forging | Basic Circuitry, Electrical Measuring | Domestic and Industrial Installation | Productive Repair | Refrigeration El. m/cs
Pattern Makers	10	Basic Training | Introduction to Wood Work | Basic Pattern Making | Foundry Practice | Productive Pattern Production | Tech. Drawing Pattern Design | Productive Pattern Production
Mechanical Draughtsman	10	Basic Drawing | Basic Training | Mechanical Engineering Drawing | Workshop Practice | Productive Mechanical Engineering Drawing and Basic Design

Remark: The third year of training is spent with in factory practical training supplemented by two blocks of theory lectures of the ITC.

Source: Industrial Training Center - Sinde (No.3 HI)

Table AII-7-1-9(1) LIST OF TRAINING AIDS IN THE INDUSTRIAL TRAINING CENTRE

Sr. No.	Nomenclature	Q'ty
1.	Hydraulic workshop crane No.2136000	1
2.	Engriving machine bench type model UGB-S machine No.780220	1
3.	Hydraulic high capacity hacksaw machine type super 215 PU No.5784471	1
4.	Hydraulic high capacity hacksaw machine type super 325	1
5.	Lever shearing machine model 5 S/10R	2
6.	Lever shearing machine model 5 S/8R	2
7.	Shearing machine model 2/4/400	1
8.	Curve-cutting plate shear model 35/1	1
9.	Drilling machine type SB 23 3 phase, AC 220/380V, No.241400026-28	3
10.	Bench drilling machine type TBZ 14 3 phase, AC 220/380V	9
11.	Electric precision coloum-type drilling machine type B 35 VS, machine No.526655 motor No.160686	1
12.	Metal cutting and filing machine model LSM 4	1
13.	Grinding machine DS 07/200 No.117058-64	
14.	Steel grinding machine DS 12/ST 0.8/1.0 HP 1450/2900 RPM, 380V, 50Hz (RIMA)	1
15.	Steel grinding machine DS 12/ST 0.8/1.0 PS 1450/2900 RPM, 380V, 50Hz	1
16.	Coloum screw press type SP 16/410 (AGEO)	1
17.	Mandrel presses type DP 3000 (AGEO)	2
18.	Mechanical heavy duty shaping machine model 375 in standard design	1
19.	Mechanical heavy duty shaping machine model 450 in standard design	1

(Continued)

Source: Industrial Training Center - Sinde (No.3 HI)

Table AII-7-1-9(2)

Sr. No.	Nomenclature	Q'ty
20.	High precision centre lathe for tool room and production model CONDOR VS-1	19
21.	Precision plain-style tool makers lathe model MDU 260	2
22.	Universal tool room milling and boring machine MH 400, serial No. 40171	1
23.	External cylindrical grinding machine model RFH 500	1
24.	SI universal tool and cutter grinder	1
25.	Universal milling machine of combined horizontal and vertical construction model 62:Q machine No.2600517 - 54	4
26.	Production centre lathes model commodor - 2	4
27.	Food-operated spot welding machine type-PFU 35 No.670.1140	1
28.	Winding machine for hand drive without plates No.014	9
29.	Winding machine complete No.018, 019, 028 (UNIVERSAL)	3
30.	Arnature winding machine AWR with working table	1
31.	Industrial-plant type ITHU 650 x 500 x 750mm 220/280V, 50Hz, tropical-isoliert model 100.7800.22	1
32.	Flooding and impreganting apparatus for stators TRANKFIX I, Gr 8. 800mmø	1
33.	Stator warmer model AZ with gas-burner and tool complete	1
34.	Flexible shaft machine R. Manmoth MD 10	1
35.	High precision centre lathe for tool room and production model CONDOR VS. 1	1
36.	Drilling machine 3 phase, AC 220/380V, 50 cycl. SB 23 No.24140190-193	4
37.	Bench drilling machine 3 phase, AC 220/380V, 50C	3
38.	Coloum screw press type SP 10/255 with base to match and with arresting device (AGEO) No.12746	1
39.	Lever shearing machine model 45S/10R	1

(Continued)

Table AII-7-1-9(3)

Sr. No.	Nomenclature	Q'ty
40.	Lever shearing machine model 5S/8R	2
41.	Shearing machine model 2/4/400	1
42.	Lever shearing machine model 5/13R	1
43.	Hydraulic workshop press 16 MP	1
44.	Brake lining grinding machine model 3211	1
45.	Car washing pump model VN 6 220/380V, 50 cps, 3 phase	1
46.	Manual flame cutting machine	1
	Arc welding transformer	3
	Welding rectifiers, other welding cutting equipment	2
47.	Engine lathe D23 x 1500 model No.3009.97	1
48.	Grinding machine DS 07/200 0.7 HP 2900 RPM, 220/380V, 50Hz pedestal model No.088094/95	2
49.	Grinding machine DS 15/300 2HP 1450 RPM, pedestal model No.098034/35	2
50.	Grinding machine DS 40/400 4HP 1450 RPM, 50Hz, pedestal model No.078019	1
51.	Double smith heart S 950/4	2
52.	Smoke extractor type A-2 Equipment for double smith heart	2
53.	Hydraulic high capacity hacksaw machine type super machine No.1278 4716, 1278 4717	2
54.	Surface grinding machine complete with supplies supplies type LB 300	1
55.	Hardness tester HT 2000 No.9178	1
56.	Air compressor model HL 760-4500 EV and spraying equipment	1
57.	Small air compressor model DKS 180-50	2
58.	Inert-gas shielded arc welding machine	1

(Continued)

Table AII-7-1-9(4)

Sr. No.	Nomenclature	Q'ty
59.	Technoscope complete incl. installation vertical	1
60.	Sandblasting cabin SP 60 complete	1
61.	Hand lever guillotine with open throat, heavy pattern No.505, model TSG machine No.	1
62.	Swaging, wiring, jennying and closing machine hand operated fabricated DIN standards 55211	1
63.	No.412 model UBSH size 80/1.75 capacity 80 x 315 x 1.75 machine No.79 412 007	
64.	Slip bending roller with gearing hand operated No.103 model RL, size 12/2.5 capacity 1270 x 2.5mm	1
65.	Universal folding machine hand operated, without beading attachment No.206 model AL size 12/3 capacity 1270 x 3mm, machine No.7926 010	1
66.	Wheel blancing machine type GEODYNA 22 CON 220/380V, 50Hz, 3 phase	1
67.	Valve refacer VKDR 1 220V No.9869	1
68.	Chamber furnace KS 120, 380V, 3/N, 50Hz serial No.7900688	1
69.	Tempering furnace K750/1, 220V AC, 50Hz serial No.7900230	1
70.	Combined circular slot mortising and drilling machine model KL machine No.79/233	1
71.	Spindle shaper with titting spindle model SFM/3 machine No.79/352	1
72.	Feeding attachment type HOLZ HER No.1117	1
73.	Combined surface and thickness planner model HCH 63, No.79/1567	1
74.	Planner knife sharpner model HMS machine No.M/125	1
75.	Precision horizontal surface grinding machine model hanseat 5 No.11822	1
76.	Assorted drills	

(Continued)

Table AII-7-1-9(5)

Sr. No.	Nomenclature	Q'ty
77.	Milling cutter and other machine tools	
78.	Universal counter sink set	5
79.	Assorted tools	
80.	Tungsten carbide grinder model HS/A-3	1
81.	Automatic saw sharpening machine model JL II 50/5C	1
82.	Circular saw setting apparatus	1
83.	Narrow band saw setting machine model F399	1
84.	Hand apparatus lever type shearing machine model A 2/50	1
85.	Lap grinder model SM 60	1
86.	Band saw brazing machine model B/3	1
87.	Assorted files	
88.	Assorted tools	
89.	Assorted tools holder	
90.	Measuring instrument	
91.	Machine equipment	
92.	Forging Vise	
93.	Anvil base	4
94.	Ring level horn	1
95.	Assorted tools for electrical USE	
96.	Assorted tools	
97.	Tinmen's work block	
98.	Assorted tools	
99.	Welding table	
100.	Tool sets	

(Continued)

Table AII-7-1-9(6)

Sr. No.	Nomenclature	Q'ty
101.	Assorted tools	
102.	Assorted tools	
103.	Assorted tool	
104.	Tools cabinet	
105.	Injection pump	1
106.	Welding equipment	
107.	Spare parts for air compressor	
108.	Spare parts for engraving machine	
109.	Assorted tools	
110.	Assorted tools	
111.	Pattern making equipment	
112.	Stores boxes	
113.	4 post car lift H 435	2
114.	Optical wheel aligner P 800/AZ	1
115.	Lifting equipment H16/H14	2
116.	2 post car lift H 225	1
117.	High pressure cleaner with standard equipment	1
118.	Cylinder battery for 2 x 3 oxygen cylinders	1
119.	Centre pressure reducing valve	1
120.	Oxygen time complete set	1
121.	Acetylene generators	2
122.	Acetylene line complete set	1
123.	Combined workplace distributors	9
124.	Gas economizer for acetylene/oxygen with pilot flame	6
125.	Gas hose and other welding equipment	1

(Continued)

Table AII-7-1-9(7)

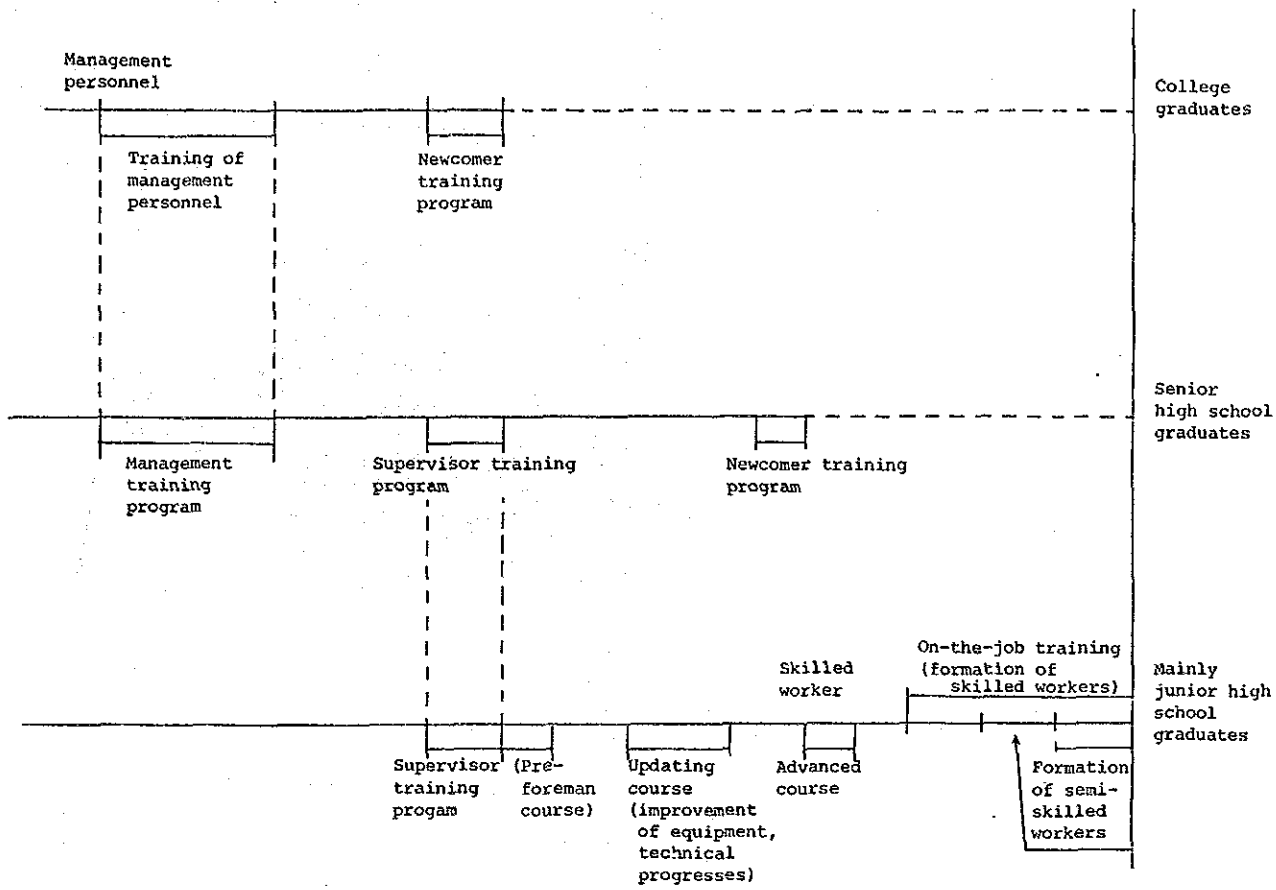
Sr. No.	Nomenclature	Q'ty
126.	Universal tilting belt sander model KED U	1
127.	Battery charger 1789 331	1
128.	Wood turning lathe with hand feed	1
129.	Passet engine No.0491000 15 H	1
130.	Movable chip suction device SPANEX MOBIL type 14 electrics 380V, three phase current, 50 cycles colour green	1
131.	Table bandsawing machine electrics 380V three phase current 50 cycles colour green	1
132.	CIRCULAR SAW type 620 FELLBACH tiltable saw blade electric 380V, 3 phase current, 50 cycles colour green	1
133.	Grind RTS-SL compl. with supplies	1
134.	Hand plane	1
135.	Hand disk saw AU 65-S	1
136.	Hand band sander AU 65-S	1
137.	Plate grind WST	1
138.	Special precision circular saw type 1612 SP	1
139.	Injection - pump test banch	1
140.	Pressure - vacuum tester	1
141.	Mini - tester	2
142.	Spark - plug adaptor	1
143.	Mobile stand	1
144.	Winding machine "FORTSCHRITT KLEIN" No.042	1
145.	Mechanical heavy duty shaping machine model 375 in standard design	1
146.	Universal milling machine of combined. Horizontal and vertical construction type UF 6/2	2
147.	Coil winding machine EWA complete	1

(Continued)

Table AII-7-1-9(8)

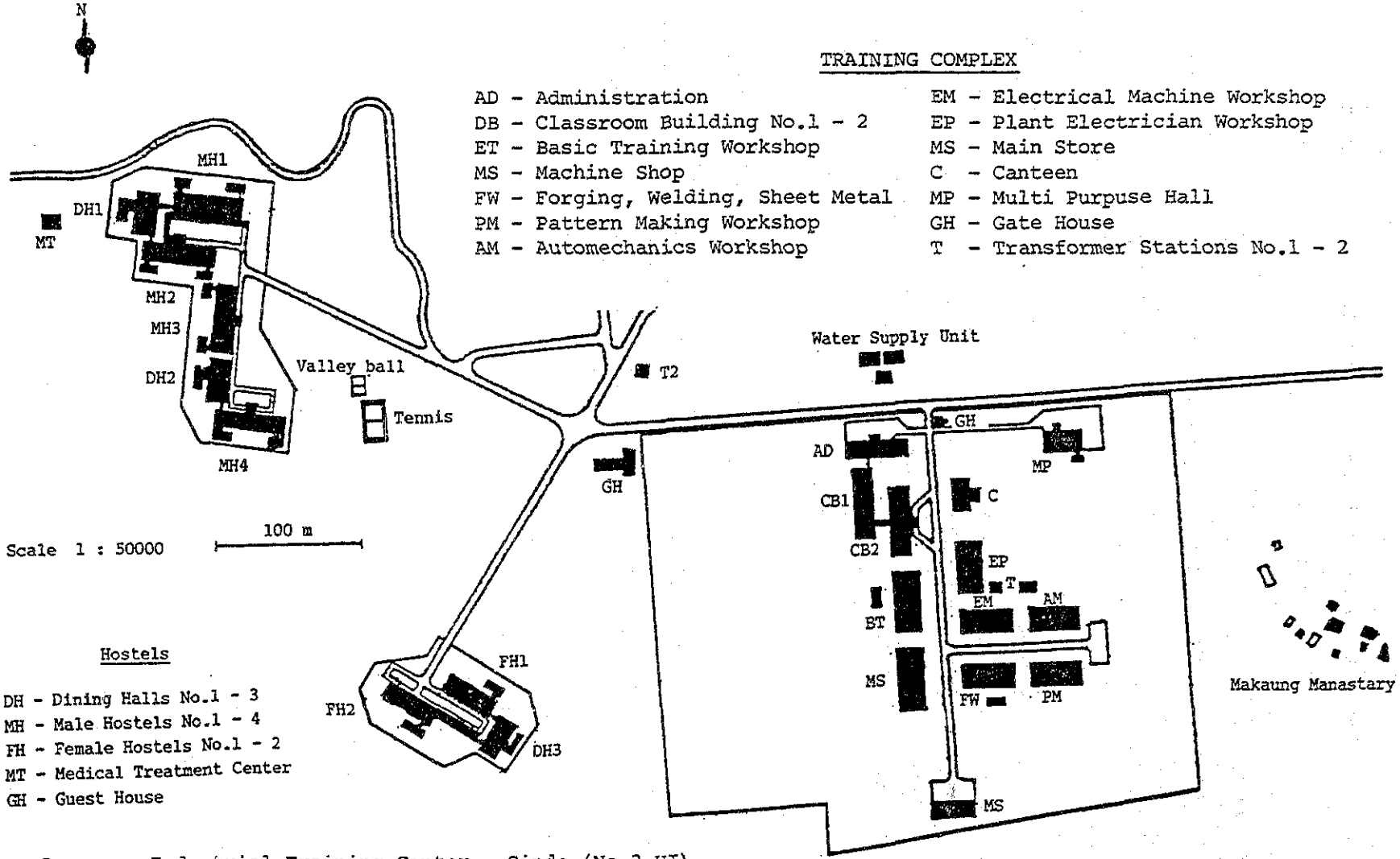
Sr. No.	Nomenclature	Q'ty
148.	Fiederfix slitting machine complete	1
149.	Pattern makers band saw BZU 400 machine No.32, 33	2
150.	Universal bench pattern miller and riuter FZO machine No.2197, 2199	2
151.	Disc sanding machine SZ 2 machine No.521	1
152.	Portable disc sanding machine SZ PICCOLO	2
153.	Bobbin sander OZS machine No.171	1
154.	Tool grinding machine WKZ machine No.306	1
155.	Ignition tester	1
156.	Reader for Micro film	1
157.	Cylinder lock	10
158.	Electric motor	
159.	Spare parts for saw sharpener	
160.	Spare parts for circular saw machine	
161.	Spare parts for drilling machine	
162.	Spare parts for circular saw machine	
163.	Assorted hand tools	
164.	Lathe machine DZUE 1000 M/C No.151152	2
165.	Machine spare parts	
166.	Assorted machine tool	
167.	Die holder	
168.	Spare parts chip suction device	
169.	Shaping machine spare parts	
170.	Tools for die shop	
171.	Assorted tool	
172.	Assorted tool	

Table AII-7-1-10 DESIRABLE EDUCATION/TRAINING SYSTEM



Source: Education/Training (JPN)

Figure AII-7-1-1 INDUSTRIAL TRAINING CENTER, SINDE - LAYOUT PLAN



Source: Industrial Training Center - Sinde (No.3 HI)

7-2 Safety Control and Environment Control

7-2-1 Current Position of Safety Control and Environment Control

The control sections of the various plants have coordinating functions related to the safety control and environment control of HIC.

There is no unified safety control standards applicable to HIC as a whole, and the matter is being handled individually by each plant or each section with approval of the control sections.

The maintenance and improvement of the safety and the environment at the workplace is being taken charge by administrative and supervisory personnel, but there is no unified philosophy applicable to the plant as a whole controlling the study groups and communication groups engaged in the maintenance and promotion of the safety and environment.

Furthermore, such data as safety and hygiene statistics and other control materials are not available.

7-2-2 Problems of Safety Control and Environment Control

Executive, managerial, supervisory personnel and employees in general do not have sufficient consciousness of the importance of the safety having priority over everything else. For example, everybody know the necessity of wearing protective goggles, but in reality there are many persons working without protective goggles due to their insufficient quantity, and this is a problem to be solved urgently by the managerial side.

Examples of safety problems are shown in the Figures AII-7-2-1 to AII-7-2-4.

From the standpoint of the work environment there are problems related to the method of storage and control of inflammables. Large quantities of A-type fuel oil, Diesel oil, lubricating oil, and cutting oil are stored at the same place and in some cases they are left at the vicinity of fire.

Furthermore, facilities for disposal of waste oil, chemicals for plating and the like are not properly equipped and in addition there are also problems related to the maintenance of the facilities.

The ventilation at the painting shop is insufficient and the smell is very bad. There is much dust at the forging shop and fettling shop and there is no dust collector. At some places the existing dust collectors are not operating properly, causing problems from the safety and sanitary standpoints. Absenteeism is seen as a consequence of the illness, and this is exerting influence on the production.

Toxic materials are being used but their storage and delivery are not being properly controlled.

There is frequent corrosion of plating tanks and the containers to receive the overflowing solution have small capacity.

7-2-3 Improvements to be Made in Safety Control and Environment Control

Safety and sanitary control are obviously indispensable from the standpoints of humanitarian, economic and public reasons and they must be handled with top priority in connection with the control and supervision of the workplace.

Such being the case, safety and sanitary control must be an activity directly connected with the routine supervisory duty of the foremen, under the guidance and control of the staff and line personnel and based on the interest and enthusiasm of the executives.

Safety and sanitary control standards should be formulated by forming organizations in charge of the matter in HIC as a whole, in the various plants and in the various sections, with participation of experts from outside. These standards must be enforced all-out so as to implant the safety-consciousness in everybody's mind.

The level of safety-consciousness should be elevated through such measures as safety/sanitary education, safety/sanitary circle activities at the workplace, periodic inspection of the workplace by the managerial and supervisory staff as well as personnel in charge of the matter, and meetings to prevent accidents.

Safety/sanitary education programs must cover all employees.

The contents of the safety/sanitary education programs must comprise the following matters.

a) Fundamentals of safety/sanitary control
b) Safety control
c) Sanitary control

As for workplace environment control, systems in charge of the matter should be established in HIC as a whole and in each plant in the same way as in the case of safety/sanitary control. Furthermore, standards should be established also in connection with the handling of dangerous substances and toxic substances.

By the way, matters requiring urgent planning and implementation found as a result of the diagnosis carried out this time are mentioned in the followings.

1) All-out enforcement of the use of safety and protective apparatuses
2) All-out use of work clothes and safety shoes
3) Preparation and all-out enforcement of the standards for handling of heavy weight objects
4) Equipment of shelves to prevent drop of objects
5) Cleaning, house-keeping and assurance of safe passage-ways
6) Equipment of facilities for exhaustion of dust and smell
7) Preparation and all-out enforcement of standards to control dangerous and toxic substances
8) Repair of plating tanks
9) Measurement and improvement of the lighting conditions of the offices and plants
10) Tree-planting in the plants and measures to prevent forest fire (measures to prevent fire spreading)

Figure AII-7-2-1

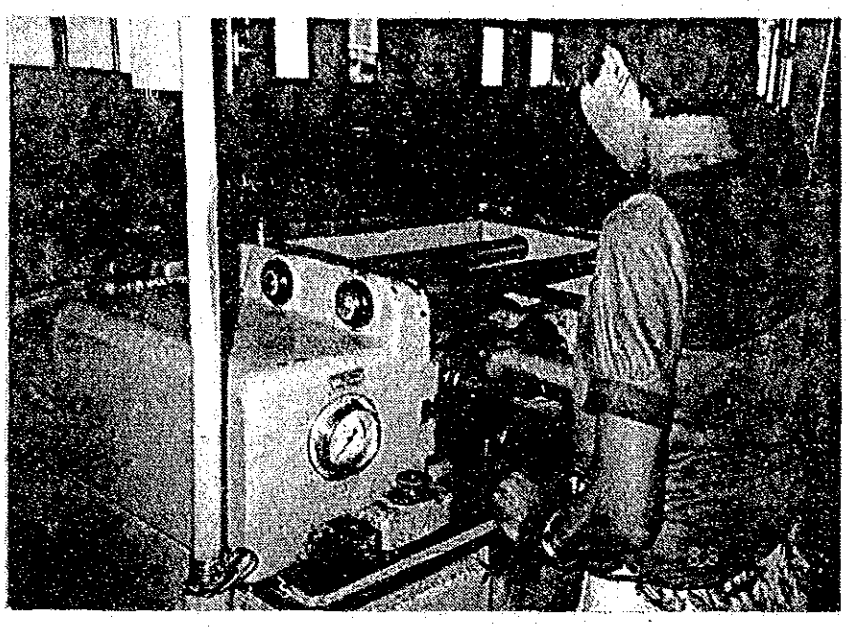


Figure AII-7-2-1 shows workers are putting the hand inside rotary machines during the machining work being carried out at the bolt/nut shop, and this is very dangerous.

Figure AII-7-2-2

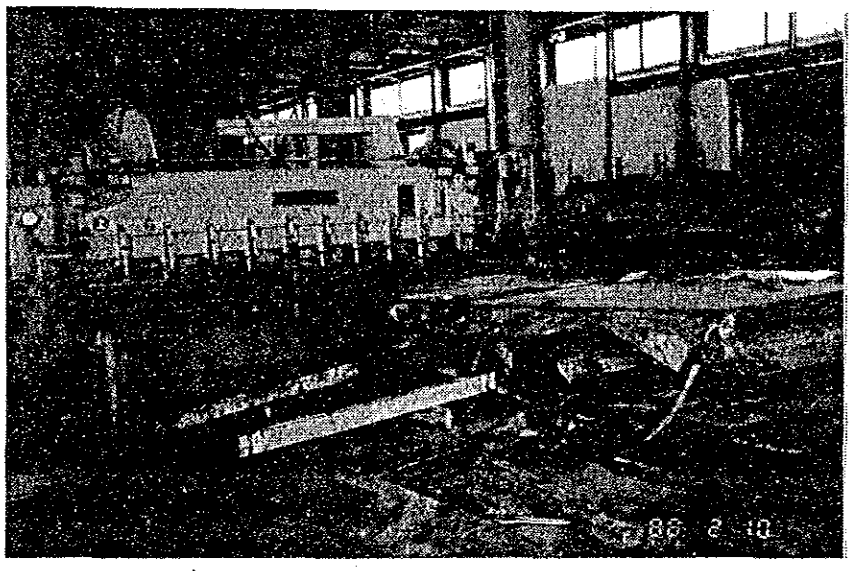


Figure AII-7-2-2 shows the periphery of the shearing machine. There is no distinction between work area and storage area. Furthermore, scrap and raw materials are being put together with each other, with no distinction between them.

Figure AII-7-2-3

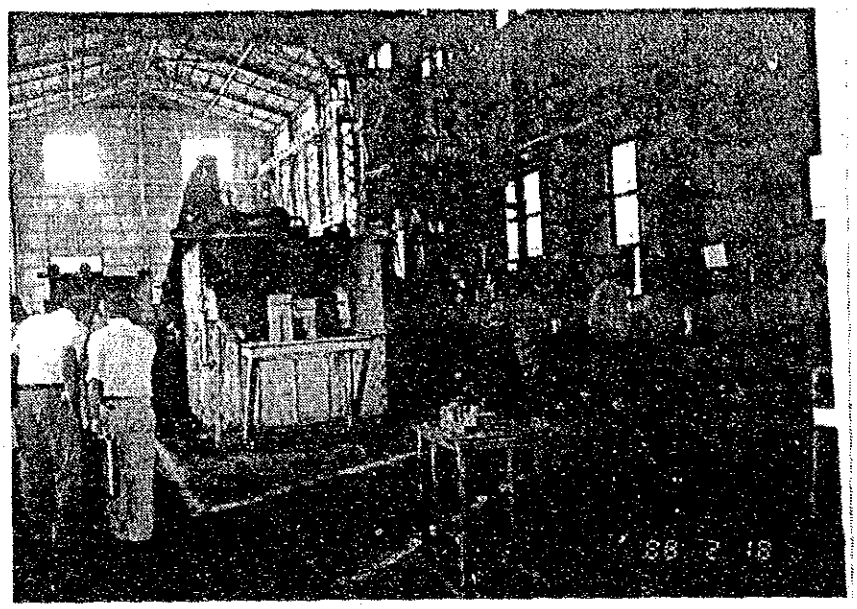


Figure AII-7-2-3 shows the furnace at the center and the worker is at the right side, and as can be seen he is stripped to the waist. Furthermore, he is working with rubber sandals. This is very dangerous from the safety standpoint.

Figure AII-7-2-4

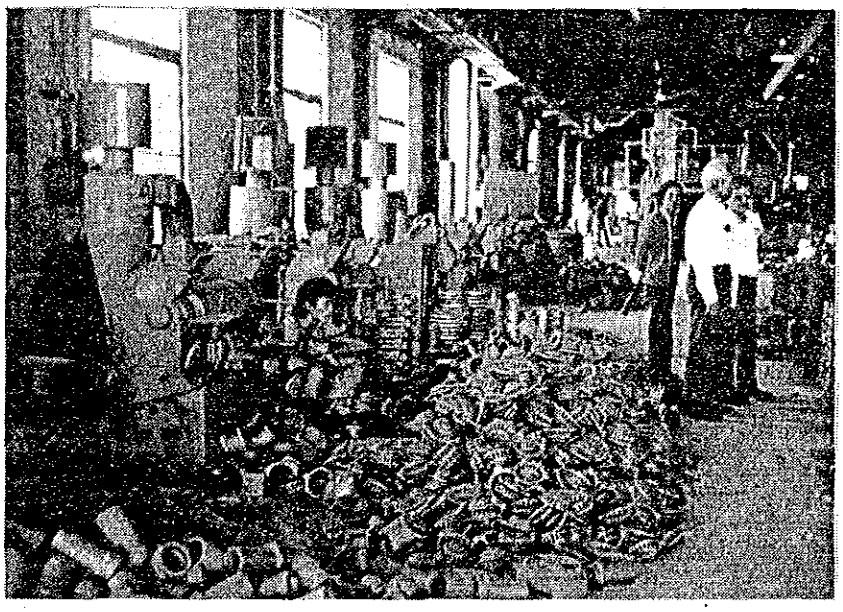


Figure AII-7-2-4 shows the finishing shop. Parts waiting for machining are overflowing around the machine and are obstructing the passageways. This is a problem from the standpoint of the work and furthermore it is impossible to secure safe passageway.