2-3 The Current Position of Production Equipment of Finished Products: Problems and Improvement Measures

(1) Conditions of wear on equipment and improvement measures

1) Outline

Deterioration and wearing of working equipment, metal molds and inspection equipment generally exists for all production processes such as casting, forging, machining, heat and surface treatment, etc. The influence of this state of affairs on the total productive efficiency and product quality is very large. The shops which were investigated for current wear on equipment and an outline of counter measures are shown in Table AI-2-3-1.

2) Working equipment

The working condition of individual equipment was investigated on the basis of the list provided from No.3 HI of the Breakdowns of working equipment. "Situation Checked by HI" of Tables AI-2-3-2 (1) to (15) organizes the details of the list. Figures for the condition of working equipment relating to agricultural machinery for the main shops gives the high rate of breakdown shown in the following table:

Summary of Machines to be Repaired/Replaced

Shop	No. of Machines Installed (I)	No. of Machines with Problem or Failure (F)	Rate of Trouble (F)/(I)x100, %
AME No.1	60	7	11.6
AME No.2	190	46	23.7
AME No.3	143	12	8.4
AME No.4	92	16	17.4
Press & Welding	43	10	23.3
Total, incl. of Others	967	154	15.9

A general survey of the breakdowns shows the following state of affairs:

1. There are considerable differences between the rates of occurrence of breakdown between the different shops.

2. Breakdown figures for the ordinary and turret lathes are particularly noticeable. The hexagonal heads of the turret lathe are worn and this results in reduced precision (ref. to Table AI-2-3-5).

3. There are a large number of machines which have stopped working and cannot be repaired due to electrical problems.

4. Defects due to oil leakage and defects arising in connection with oil pressure resulting from damage to the O-rings

5. Much of the equipment in the heat treatment and plating shop are out of order, and a large number of these have been left standing because of breakdowns of control mechanisms.

6. Some equipment has been inoperative for 7-10 years because of difficulties of obtaining repair components, and some have been out of order since operations began.

7. The life of the plating vat has finished and corrosion is advanced.

8. Many pieces of equipment had been stripped to supply components for similar machinery and only frames remained.

Analysis of the above; it is possible to classify equipment into 3 types:

1. Equipment for which obtaining repair components needs to be made easier.

2. Equipment such as the turret lathe which are comparatively difficult to repair.

3. Equipment which it would be preferable to replace.

Of these categories No.1 and No.2 were comparatively numerous. In these conditions it is necessary to proceed promptly with an overall repair operation as well as attending to individual repairs. Equipment which is deteriorated and requires replacement is listed in Tables AI-2-3-3 and AI-2-3-4 (1) to (4).

Further AME No.1 which is composed of equipment of which is shared as specialist production equipment for the electric generator and production equipment for the electric motor suffers from production problems due to the damage of central productive equipment such as wear to the universal facing head of the boring machine, and operating incapacity of the Balancing machine due to maladjustment of the IC, and burn damage to the adjustable resistor. The repair or replacement of these is absolutely essential.

Moreover, the electrical elements for the generator are currently produced by the one punch press method but taking into consideration the type of production equipment and production output introduction of notching press type equipment is advisable in order to reduce the number of repairs and replacements necessitated by damage to a number of the metal molds. Further there are 4 machines of West German make of this type presently installed, and No.3 HI has experience in their running. However of the 4 machines 3 are out of order due to breakdown, and the remaining one has precision defects. It is necessary to plan for provision of working equipment having an appropriate level of precision together with the necessary auxiliary parts.

3) Jigs and molds

A large number of the jigs used for machine processing which are in current use or stored are visibly worn. In particular, wear on the bushes for the jigs drill is deep and many of the bushes are loose. Although this is partly due to the lack of repair equipment, one cannot but see this as due to the neglect of managers. While speeding up the installation of new drill bush equipment as part of repair equipment for jig storage racks for these must be made and the storage maintenance of the jigs improved. Storage conditions for the metal molds for press use are even worse than those for the jigs. The number of metal molds, including those for both AME No.2 and the Press and Welding shops, is very large but if storage racks could be

provided and storage organized usable floor space could be increased and safety of handling improved. As one of the sets of supplemented metal molds used in complex processing was lost while being brought from Rangoon this series of metal molds cannot be used and the relevant components have to be imported. A counter measure to this problem is needed.

4) Gauges and measuring devices

A number of the micrometers in current use and storage were inspected in AMEs 2, 3 and 4. Of these, besides one which did not stand up to use because of loose screws, some had damaged ratchets components, having lost or loose clicks, so measurements were not possible in use. Repair or replacement of these is needed. Some of the stored micrometers used for measuring thickness of gear rings were defective. Nevertheless, the majority of micrometers were normal, but as several of these showed an error margin of 0.005-0.01mm to the accessory standard side, adjustment is necessary. A measurements room is found near the center of the group of No.3 HI shops (ref. to Fig.AI-2-2-1; Bldg. No.3-15). An examination of the measuring devices stored here revealed that most of the devices needed for measuring component dimensions were available. However, as some of the block gauges were affected with rust it is necessary to take measures for rust prevention of stored devices in general. Also there were a number of imported snap gauges in storage which remain out of use because it is not known which components these are used with, and it is necessary to ensure the effective use of these.

5) Maintenance of equipment

a) Maintenance system

The construction department is in charge of maintenance operations relating to buildings. The Electric and Services department is in charge of general maintenance of electricity, lighting, machinery, compressed air, etc. and has a staff of 91 but is without an operational base. This section is also responsible for fork lift repairs and is scheduled to be provided with one of the unused buildings as an operational base in the near future.

Trucks for external dispatches belong to the transportation

department which is also responsible for maintenance and repairs but there is only one table drilling press and one pit for rock piles.

In order to operate the facilities effectively it is necessary for the work force and those using the equipment to take an interest in maintenance. There is a weekly inspection chart attached to each machine in the AME No.4. Every week on Fridays the operators themselves check and fill in the 12 headings, and the shop manager signs the charts after confirming them. The shop manager said that this system was developed as the equipment of AME is comparatively new. Although such a system of recording checks done by operators of equipment is advisable for maintenance it has not been applied in any other shops. Maintenance would be effective if equipment were cared for with the same attention given by workers to their own bicycles. It is necessary for the Electric and Service department to gain the cooperation of the work force in progressing from the present repair on breakdown approach to a preventive maintenance system.

When repairs are done by the Electric and Service department a simple chronological record is made and kept of the machine name and the details of repair operations. Judging from these records a large number of the repairs were done by the limited number of engineers of the Electric and Services department, who have thereby made a vital contribution to the production activities of the factory. However, though one can examine the activities of the repair section, there are no clear records showing the past details of equipment. History cards for each piece of equipment are needed to make possible a preventative maintenance system. Exact details of repairs, maintenance records, and parts exchanged should be noted on the cards and these stored. The Administrative department of No.3 HI keeps detailed records of all personnel and the same thoroughness for equipment is needed.

b) Problems and improvement of maintenance

1. The list of machinery out of order and repair method for machines out of order touched on in the previous section 2) (ref. Tables AI-2-3-2 (1) to (15)) can be classified under the following 6 headings:

- Defective machinery to be replaced 36
- Out of order because spare parts can no longer be imported 2
- Waiting for arrival of imported spare parts 32
- Operative but in need of minor repairs 77
- Waiting for repair parts which can be locally manufactured 5
- Machine out of order and needs repair 2

The above headings were changed during the present report after consultation with No.3 HI. The list of defective equipment drawn up by No.3 HI does not include the boiler but the meter device is broken on this, and daily maintenance of the boiler poses problems. It is unclear what the state of the boiler body or the inside of water pipes is, and prompt counter measures are required. Further, the safety mechanism of the two hand operated press of AME No.2 is broken. Safety devices, including this, need to be checked generally. Re-evaluation of the No.3 HI breakdown list is advisable since there are machines listed for malfunctioning, and the exact part which is broken or defective is not given, and also there are parts which seem to require repair but which are not recorded.

Tables AI-2-3-2 (1)-(15) are lists of the number of processing machines owned of a similar type which suffer from frequent breakdowns. It involves category of malfunctioning (*2 in the list) and countermeasures (*3 in the list), by shop.

Table AI-2-3-3 indicates number of malfunctioned equipment by shop.

It is strange that the reject rates should differ so greatly from one shop to another. Whether the cause be the difference in number of operating years, the differences in maintenance checks, or differing standards for reject determination, or due to differences between personnel judgments of the breakdowns, needs to be clarified.

2. Results of the inspection show that breakdowns are numerous.

There is equipment which has been out of order since operations began, others which have been out of order for 7-10 years. HIC gives the long years of use as a general cause of the present high reject of breakdown of equipment, but in view of the number of agricultural machines produced in that period it would seem that other factors have played a large role. The following is a list of such possible factors:

a. Equipment originally used at No.1 HI in Rangoon which suffered damage during movement to Sinde on the completion of the shops of No.3 HI there (One number of press metal molds were lost).

b. Imported equipment was stored outside in their packing crates while awaiting the completion of the buildings of No.3 HI for a long period (apparently more than one year). Equipment damage due to rust occurred in some cases.

c. Over a period it was difficult to obtain lubricating and operating oil was difficult, and equipment operated without lubricating oil during this period was damaged (it would seem that this is the cause of inaccuracy in some of the hexagonal bases to the turret lathes). Further, it is said that water only was used as a cutting lubricant over a period during which it was difficult to obtain a water flux grinding lubricant for the grinder.

d. Because of the work systems of the maintenance department or production department and as sufficient daily inspections and maintenance operations are not carried out by the operators themselves prevention and early discovery of the occurrence of breakdowns did not take place.

It is necessary to re-consider the maintenance System of No.3 HI in general in order to prevent and reduce future occurrences of breakdowns, and preventative maintenance must be implemented.

3. When a breakdown of working equipment occurs it is serviced by the person responsible in the Electric and Service department and repaired using spare parts from the store. When spare parts are out of stock these are produced if possible. Inside the factory but as the Electric and Service department is without processing equipment it relies on the Production department to process equipment. When the equipment to process the part has a full processing load either this processing or repair processing must be delayed.

When a spare part is neither in the store of replacement parts and cannot be produced in the factory, the Electric and Service department sends a request to the Headquarters of HIC via the Planning department of No.3 HI. The Headquarters inquires about this with the manufacturer arranging the transfer of technology. At the same time, the Electric and service department requests spare parts taking into account the number and breakdown conditions for the same equipment as that needing repair. However for budgetary reasons a demand to the Main Office is limited to the strict minimum required. The equipment manufacturer confirms stock availability, inquires about pricing, and sends an estimate to the Headquarters of HIC. HIC in turn sends this to No.3 HI which presents it to the each department for confirmation that the part indicated is that required. After HIC receives the answer it sends an order. It takes at the earliest about four months from the time the order is made to the equipment manufacturers, on to shipping at Rangoon up to arrival of the order at No.3 HI before repairs can begin, and in long cases this takes more than one year, requiring on average some 7-8 months. In cases where there is not enough time for regular procedures to be followed since production would be adversely affected either the procedures are omitted or postponed while a telegram or telex for order of the parts is sent.

Supply parts are obtained by the above procedure from equipment manufacturers when they are available in stock but in cases of receiving an order for production of parts for machinery which was made more than 20 years ago has often been stopped a long time ago and the number of manufacturers who have stopped supplying spare parts increases. As can be seen under heading i) category 2 "Out of order because spare parts can no longer be imported for that model" in Tables AI-2-3-2 (1) to (15), equipment in such cases is completely taken off the production lines and simply becomes a nuisance.

There are also pieces of equipment which are put under category 3, "waiting for replacement parts", which actually could be included with those for which spare parts are unobtainable. Much of the equipment of No.3 HI is of old models and has been replaced by new equipment because of lack of spare parts even though perfectly operable otherwise. As this causes an increase of equipment expenditure and capital belongings and escalation of production costs it is necessary to install a repair shop having sufficient equipment as soon as possible and to implement an internal repairs system.

4. Working equipment of No.3 HI for production of agricultural machinery, including jigs for processing use and metal molds, has been supplied one by one since the start of the project in 1962. Consequently, there are many repairs which involve the replacement of spare parts since a large number of equipment is deteriorated. At present, simple repairs are the main counter measure at No.3 HI. Spare parts are manufactured using the equipment of lines in the production shops which results in a decline in operations.

   At present, there are a large number of breakdowns due to superannuated equipment and these can be expected to increase more and more. HIC plans to provide for repair equipment separate from working equipment for the production line. Further, when it undertakes a future rationalization and improvement of existing production lines it hopes to undertake improvement of production equipment to match with this. Also, repair and trial production of pressing jigs and sheet metal dies take place on the side of the lines of the No.3 HI AME Shop

No.3, beginning with the repair and new production of jigs for processing use and metal sheet patterns.

It also has a plan to move the work area to buildings distinct from those for the production shop and expand and improve these. Careful consideration of the functions, organization, working equipment, and location and timing for the installation must be made when these plans are realized (cf. Table AI-2-3-6).

(2) Bottlenecks of existing equipment and countermeasures

A number of bottlenecks were seen in the equipment and processes of the production areas of the agricultural machinery department of No.3 HI. It is strange that though production of agricultural machinery is below the capacity at the time of equipment planning for a number of machines a number of bottlenecks has occurred. The following is a list of possible reasons for these bottlenecks:

1) Due to breakdowns of equipment, among these are those caused by bottlenecks occurring when one machine is out of order and the operating number of the same machine is reduced. Then there are bottlenecks caused by an increased burden on following processes when accuracy of equipment is impaired and processing time thus longer. The bottleneck of the turret lather is an example of the former, when operations for Saudi Arabia occurred at the same time, while the bottleneck for the crankshaft grinder is an example of the latter type.

2) Temporary bottlenecks because the supply of crude materials for casting and forging production did not take place at the appropriate time. The engine crankshaft and camshaft are both midway in the machine processing of different lines, but the two parts are served by the same lines at the beginning and end processes. Therefore when the crude materials for these two parts are supplied at the same time this results in bottlenecks of these shared lines.

Problems of supply can be solved by consultations between the departments and process planning in No 3 HI. The problem of equipment breakdowns could be largely solved if the measures laid down in the previous section were realized. However the occurrence of bottlenecks is also due to the large increase of processing stages over the

original number anticipated in the original plan. Before increasing facilities it is necessary to examine a reduction of the present number of processes.

Despite a considerable hampering of accuracy the engine crank pin machining lathe is still used and repair will involve a considerable period of time, during which the machine must not be stopped for production reasons. It is therefore inevitable that another machine be introduced to allow repair of the two operating machines one at a time. Once these repairs have been completed it is necessary to set up separate lines by dividing those beginning and final processes now shared for the crankshaft and camshaft processing. Increased production must take place to prevent future bottlenecks arising from irregularities of crude materials supply.

Further standard bolts and nuts or their approximation are produced by a considerable number of grinding processes in No.3 HI. For these operations request for increase of turret lathes, etc. has been made but these would be better concentrated in No.1 HI.

In AME No.2 production of agricultural machinery parts using Bakelite molding equipment was attempted but because of problems of superannuated equipment and of technical know-how this failed. It would seem more profitable to move and store these to the shop where Bakelite mold processing is being put into operation.

Besides the above, there are bottlenecks due to processing problems with part of the equipment of the heat treatment shop. A list of the equipment required as counter measures to the bottlenecks is shown in Table AI-2-3-7, and a list of the equipment requiring supplement as a counter measure is shown in tables AI-2-3-8 (1) and (2).

Further, bottlenecks of the horizontal boring machine arise due to the long hours of operation required for the boring of the yoke on the production line of the AME No.1.

(3) Problems and improvement of present transportation facilities and material handling equipment

1) Outline

Facilities and equipment for material flow are surprisingly lacking in No.3 HI. Only part of the roller conveyer installed at the founding of the shop exists, and this is piled up damaged in a corner of the shop. Transportation vehicles and fork lifts for the area were hardly seen. A tiller used as a transport vehicle was seen but this could not turn in small circles the parts materials are simply placed in the center of the passageway. AME No.1 was producing its own iron wheel dump cart, AME No.2 was making racks using angles and iron plates and in AME No.3 a trailer for tiller use was used for in-shop transportation in AME No.3. Despite these actions however it does not seem that material handling and flow is given much thought. It is necessary that No.3 HI endeavor to reconsider and provide for equipment needed for material handling to maintain finished product quality and increase productivity. A list of the material handling equipment needed is shown in table AI-2-3-9.

2) Fork lift truck

The fork lift truck is useful for the transportation of parts, jigs, and metal molds in and outside of the shop buildings, but these were not seen in use much. Control and management of fork lifts belongs to the MPD (Material Planning Department) but it is said that it is uncertain how long a request for aid of fork lifts in moving heavy jigs will take to be answered. A large number of fork lifts seem to be out of order, and it is necessary that repairs be undertaken together with the introduction of necessary new machines. It is necessary to set up a system whereby each plant manager takes charge of a number of fork lifts which can be employed immediately as required.

At present, repair of fork lifts is done by the Electric and Service department, but it is necessary to decide which departments repair work should belong to at the time of installing a repair shop, and necessary repair equipment must be provided. Repair equipment and materials for the trucks of the Transportation Department are needed.

3) Conveyers

The roller conveyer for the engine frame line in AME No.3 is broken in several places and requires replacement. There are other lines lacking in roller conveyers and many areas which require installation of roller conveyers such as the cylinder head, crankshaft, and cam shaft lines.

As the roller conveyers used at present do not have sufficient strength against the shock of heavy objects it is necessary in future planning to take this into account when deciding on use.

A slat conveyer is used to connect the open furnace and press equipment for the 3 lines of mamootie forging equipment in the mamootie forge shop. As these are largely broken and out of order only a small section can be used, and the workmen carry materials themselves. Since temperature control of processed parts is important in forging operations these need to be quick. Also it is undesirable for workmen to carry the heavy objects at high temperatures for safety reasons, and a change of system is urgently needed. With the distances involved here it is not necessary to use a moving conveyer and since a chute system would be sufficient necessary adoptions should be made.

4) Transportation vehicles

In the present evaluation the lack of transportation vehicles for parts in each shop was evident. Excepting processing lines with conveyer equipment, it is at present desirable that parts and materials conveyance should be done with push carts and that the carriage to the following process be done with other carts.

Tillers and trailers are used for in and out shop transportation but these are not sufficient and their number should be increased. However the trailer type vehicle is not capable of short turns. If the agricultural engine and gear case of the tiller presently produced were used it would be possible for engineers to construct a compact transportation vehicle in the shop itself.

Steel and forging metal molds are placed for one span at the west end of the hand tools forging shop, and metal molds are carried to the vicinity of the overhead traveling crane and from there are moved by hand to the press equipment and attached. One proposed measure is to have an overhead crane covering the entire work area space. But this would be costly and laying of the metal mold suspended from the crane directly onto the press table very difficult. It is therefore advisable to have an upper surface of the supply heavy weight use pushcarts which can be adjusted to be at the same height as the press table surface in cases where the pushcarts are used for in shop transportation of the metal molds. The same method could be applied to the mamootie forge shop and to the heavy jigs used for machine processing in AMEs No.2, 3, and 4.

5) Cranes and hoists

There are 3 sawing machines for steel cutting in the AME No.2 which can cut steel material of 90 mm maximum diameter. As the shop has no hoist handling of the steel material is all done by manpower. This is quite dangerous and an operator who suffered damage to his fingers was seen. In order to move the entire steel material pool area here a hoist will be necessary. Considering the workload involved this could be done quite sufficiently using a hand driven chain block.

There is also a sawing machine in AME No.4 but the steel material it handles is smaller than that of AME No.2. It would be sufficient to install a monorail and a hand driven chain block located here. However, as the roller conveyer of the sawing machine of the work areas is too short and extension of the equipment is needed.

6) Handling of parts in the shop

Before and after processing parts are placed directly on the floor in the machine shop, and are left in piles. Some of the piles seem about to collapse parts are stacked so high.

Some parts were placed inside containers, but these were simply drum cans sliced up in many cases and the parts roughly thrown in. At least until the improvement measures for production process management, quality and safety listed under heading 4) have been carried out, the wood of the import crates and edge materials left

over from processed iron plates should be used to make storage racks and boxes for parts. Processed parts could be arranged and set out for easy confirmation of those finished and those in progress. This system would also improve process control, increase product quality and safety and ensure that scratches and damage were avoided.

(4) Problems and improvement of quality and efficiency of finished products

1) Occurrence of rejects

As the list provided by No.3 HI (Table A-2-3-10 (1), (2) indicates a part of this) does not distinguish between rejects of material and those of processing it was not possible to ascertain the occurrence rate of processing rejects. For example, for the engine cylinder head it is recorded that 843 of the 5,000 parts processed were failed as rejects,giving a high rate of 16.9% but it is not possible to judge how many of these were due to defective casting. Further, data shows considerable differences between reject rates for parts of similar processes but it is unclear whether this is due to operator differences or inspection methods.

However, the reject rate is generally not as high as expected. But since more than 5% of the 5,000 engines recorded were rejects and there are cases where 33 out of 119 products were rejects (27%) quality control is not satisfactory.

Results of this evaluation of the shops revealed that inspection of dimensions in the processing areas and inspection area were not very strict. Most parts are passed after a simple visual check unless some trouble arises such as an unprocessed part remaining on the cylinder liner or a cap to the large end of a connecting rod which will not assemble. On the test drive area of the engine assembly shop an engine is judged a reject when the engine will not start and not due to any defect in the efficiency of the engine. No records for occurrence of rejects in the assembly shop were available.

The shops which have problems concerning these flaws in product quality and additional equipment needed as counter measures are shown in Table AI-2-3-11.

2) Relation to proceeding and following processes

In forging and casting production difficulties of obtaining materials arise because of defects such as mold shift, deviation in thickness, and offset thickness of blanks caused by wearing of the forging and foundry molds. Greater strain is placed on processing equipment and tools because working has to be increased, and this produces breakdowns and damage, or results in occurrence of unprocessed parts and defects in the boring of the dead hole inspection. It is necessary to keep constantly in mind the questions of dimensional accuracy and material quality of the forging and foundry products and when a problem arises to contact the concerned production department immediately to request improvements and also ensure that these are carried out. Since the foundry shop and forging shop are both part of No.3 HI liaison meetings should be called at least once a month for consultations on quality control and delivery dates, and results of the meetings should be recorded.

The reduced levels of working equipment precision affects the processing of the cylinder head and connecting rod. Also because of the reduction in precision of the jig for the connecting rod processes have been altered and require a long time. Time required for the fitting of the valve sheet depends on the degree of concentricity of the valve hole and valve stem hole. If the fitting is defective engine efficiency is lowered because of gas leakage, etc. At present the concentricity degree is poor and fitting time takes twice standard time. Imprecision of other parts processes necessitates re finishing at assembly time, and so lengthens assembly time or results in a lowering of efficiency. Fundamentally, a mass production assembly line is possible only when a general level of quality has been reached, therefore a lowering of special processes is unacceptable. For this reason also is necessary to promptly improve equipment affected by bottlenecks due to precision problems.

3) Parts processing

a) According to data from No.3 HI the table of machining processes for the main parts of the agricultural machinery, and inspection standards were drawn up with the guidance of the technical expertise suppliers. However this was only seen in one location in the processing of the internal diameter of the large end of the connecting rod where each item was measured individually using a process diagram and an internal diameter measuring device, otherwise most of the work force seem indifferent to questions of the quality of processed parts and where they will be used and handling of materials and processed parts could not be described as good. Schematic drawings and processing dimensions should be made if only on paper or cardboard from the packing cases, and put on display at the operational areas concerned, and it is necessary for managers to make an effort, not necessarily rigorously formal to inform the work force of standards of processing and quality control.

In the AME inspection area 3 female inspectors check dimensions of small parts using micrometers. The inspection standards may be indicated orally but it is necessary to have a written indication of these since it is not clear what the inspection standards and results are.

b) The following gauges which were indicated in the inspection guide as necessary are in stock at present according to data on the provision of inspection gauges for agricultural machinery parts processed in No.3 HI.

Production Equipment	Engine	Tiller
Model	KND5B	KMB200
No. of processed parts inspected	44	80
No. of gauges necessary	193	192
No. of above in stock	57	25
No. lacking	136	167
Sufficiency rate	29.5%	13.0%

As can be seen from the above table the number of gauges lacking is very large and of these especially the bolt gauge and snap gauge. It seems that the insufficiency is due to loss or damage over the long period since operations began. Use of cylinder bore gauges and micrometers in the processing and inspection shops would seem to be in order to cover for the lack of these gauges. However, as the number of micrometers is small sufficient measurements cannot be made. So parts with small diameter holes are sent on unmeasured to the next process and are only treated as a problem if some hindrance is caused in the assembly process.

It is necessary to make a prompt check of which gauges of those lacking are important for maintaining quality control. Until HIC can set up a production system for its gauges these must be supplemented by imports. Further steps must be taken to rectify the present system where parts processing takes place without confirmation of quality control.

c) As stated above a measurements room is found in a building of No.3 HI provided with devices and facilities for measurements of dimension precision of the processed agricultural machinery parts. It is necessary to make prompt contact with the processing areas to set up a system for supervising quality control and to move the measurements room from its present distanced position to a part of AME No.2 or 3 where in close contact with processing the necessary measurements can be made.

Once the activities of the measurement room have been aligned with those of the processing areas and it acts to maintain the precision of processing then early introduction of a three dimensional measuring device to increase the accuracy and speed of measurements should be planned.

d) As prevention of rejects is one of the most effective means to increase productivity counter measures must be taken at once when rejects occur. Particularly with cases where the reject rate exceeds 5 or 10% as in the above damage occurs to productivity and when materials are imported this can result in disorder to the yearly production schedule. Swift counter measures are needed in such cases. In work areas where such high reject rates are shown it is probable that inspections at the start and in middle of processing do not take place as a matter of course or if there is such a rule then it is ignored. Before a part is taken to the inspector for final checking, rulings on the conduct of starting and in progress inspection are urgently necessary and should be made and a strict system of their recording should be set up to prevent occurrence of a high reject rate.

4) Assembly operations

a) No record of the occurrence of rejects or re-touching for assembly operations was provided. It is probable that all assembled finished products except for those which did not move were passed as operational and dispatched. However, it was not evident that sufficient inspections of each finished product of the agricultural machinery took place. In order to improve quality before and after the assembly and driving inspection someone should be put in charge to make a spot inspection to see if assembly parts have been forgotten or bolt nuts left untightened, and if so this should be reported to the workers and rectified while the defect is recorded in the inspection book. There is a danger with the present operating methods that errors in assembly or attachments will be overlooked.

As was the case for parts processing there are no signs posted up inside the assembly shop to indicate operational standards. It is necessary to indicate standards at key points to foster awareness of these among operators and ensure their practice.

b) As cleaning operations i.e. washing of the inside surface of the cylinder of the engine assembly line, do not take place in assembly shop No.1, the cylinders are assembled to the pistons or cylinder heads in a very soiled condition. There is a cleaning apparatus in the previous process but this is unused, and cleaning by operators with rags is also not performed. It is inevitable that the life of the finished engine will be short when such a vital part is assembled in such a condition. It is feared that other important parts such as the power tiller gear case is assembled in the same state though this could not be verified. It is necessary to improve the education of a sense of quality control among personnel from shop managers down.

For the assembly of engines many charging and assembling tools are used for bearings, bushes, plugs, etc. but these are used without any maintenance and are considerably worsened by wearing. This is not only a factor causing a reduction of engine efficiency and quality but is undesirable for safety reasons and should be promptly changed.

It is necessary to implement inspections after the assembly of engines to prevent oil leakages of finished products. Introduction of a leak test device is advisable since sinks and cracks must be identified in cast products.

c) The engines assembled in assembly shop No.1 are attached to a water pump in the outdoor test drive area and water in the water tank circulated and tested by eye to confirm the efficiency. This inspection is insufficient for testing engine efficiency and as this amounts to no more than a confirmation of operation only it is necessary to introduce devices which can actually test efficiency. It seems that the installation of an electric dynamometer for the test drive equipment was planned. However, this involved considerable expense and would be difficult to maintain so the test drive actually takes place using the rather old fashioned dynamometers of the prony break or water power meter. It is estimated that actually only 10 to 20% of the finished products are actually tested for efficiency with the electric dynamometer. On the basis of the results of the study on quality control, equipment for which evaluation of the necessity of supplement as a counter measure is listed in Table AI-2-3-12 (1) and (2).

5) Painting

The painting done to the finished products not only increases their commercial value it is essential in protecting from rust but the coat thickness is insufficient because low baking temperature of of painting done to agricultural machinery is insufficient.

The engine, tiller, and pumps manufactured in the assembly shop No.1 are cleaned, coated with paint, dried and seized by infrared rays, and completed by the final assembly process. But as the layout of the shops has been changed several times the work areas for the different processes are not only distanced one from the other, but in addition the drying furnace time is short and the temperature reached is not enough for a high grade coating of the cast parts in particular. As the assembly shop is at present extremely crowded it has been proposed that layout be re-organized as shown in (6)-2). When these changes take place it is desirable that painting quality of products be improved and the present coating equipment in assembly shop No.2 used only for painting of products destined for Saudi Arabia be repaired and its active use undertaken (cf. Table AI-2-3-12 (1)).

(5) State of power and attached equipment: problems and improvement

Steam from the boiler located near the center of No.3 HI is used for heating of liquids for the treatment liquid in the pre-treating equipment of the painting shop and for the plating liquid of the plating shop. This operates every day but for only a short time. The recording device to the boiler is broken and the needle device has been removed. Further it seems that the insertion of cleansing fluid into the boiler drum has not taken place and a considerable amount of scale has developed inside the can and pipes. This inhibits the efficiency of the rate of heat treatment and increases the chances of an unanticipated accident arising. The present superannuated boiler should be discontinued from use and either a package type boiler or electric heater provided for those points needing steam. This could be simply realized and if equipment were used only as necessary it would not be unprofitable in terms of fuel.

A separate inspection of air compressor equipment in No.3 HI was conducted: it is necessary to ensure the regular cleaning of the air cleaner at the air vent of the air compressor in the air compressor room for agricultural machinery and also to repair the air compressor in the mamootie foundry shop and ensure it is in working order.

(6) Problems and improvement of working space and equipment layout

1) Parts processing

The layout of equipment for each of the lines inside the shop of the agricultural machinery parts processing section does not seem to have any particular problem points.

However, various aspects of production have changed over the long period of operation and space has been taken up for the repairs of the production equipment and metal molds so that a part of the space originally for production lines has become cramped. It is necessary to ensure availability of space while setting out the future principles of layout for the entire shop.

1. Press and Welding Shop: the total number of press and welding machines is small but there is a large number of dies kept in storage and a large space is occupied so that the existing work space is extremely cramped. This leads to a poor operating rate and involves problems for safety. It is necessary to expand the roofed area and also organize storage methods for the metal jigs.

2. Plating shop No.1: space is cramped.

   The number of lots involved in flow operations according to the original production output was to have been small but the small amount of equipment was unable to realism a handling capacity for the large variety of product types and temporary stocking locations for materials and processed parts are needed at the side of processes.

   Deterioration of equipment in the same plating shop is so severe that replacement of the entire equipment is under consideration, and if undertaken it would be advisable that this occasion should be equally used as an opportunity to enlarge the entire shop.

3. At present in the machine processing shop the processing of parts destined for Saudi Arabia for the present year involves more than 1,200,000 process plans. These interfere with the processing of agricultural machinery, causing confusion in the various work areas. It appears that creation of separate independent work areas with equipment taken from the individual shops is being considered by HIC but the realization of this plan depends on the estimates of orders from next year onwards.

At present though there is no reason to hurry in changing the present layout the production of agricultural machinery tends to be small production of a large variety of products and if one examines current finished products these have the various particularities outlined below:

Engines:	Almost entirely made from castings and steel material
Pumps:	Constructed mostly using cast parts
Power tillers:	Besides castings and steel materials press and welding parts are numerous,and many of the accessories are press or welding parts.
Threshers:	Almost completely made from iron plates
Generators:	Constructed from large diameter pipes and steel materials, welding operations are frequent.

Consideration must be given in any future change of layout to the number and arrangement of equipment which will allow for the most efficient management possible taking into account the numbers of the various types of production equipment involved.

2) Assembly operations

Operations for the engine, thresher, tiller and pump take place in the same building of assembly shop No.1 and results in considerable confusion in the shop. The conveyer belt to the engine assembly is twisted, and the test run area is a roofed area outdoors. Also the

assembly area for the pump mixes into that for the engine, and the assembly area of the thresher seems to encroach and borrow that of the power tiller. The cleaning, painting and drying equipment for the engine and power tiller, are not only distanced from the assembling lines but far from each other. Finished parts are left lying about on the floor near to the mouth of the painting use drying furnaces located in two places. In contrast the space occupied by the drying furnace equipment in the No.2 Assembling Shop is very large and here small scale operations such as painting black of processed parts destined for Saudi Arabia, or assembly of spraying devices (sprayers and powder sprinklers) takes place and the shop seems half empty. A prompt and early re-consideration of the total layout of the assembly shop is needed. The layout of the assembly shop No.1 is cramped and confused in relation to the scale of present production, and it is necessary to implement an overall orderly layout to include the activities of assembly shop No.2.

On the occasion of reorganizing the layout of Assembly shop No.1 as the assembly shop for engines and pumps the conveyer lines should be planned on a straight line method and the arrangement of painting and cleaning equipment changed, so that the work areas are streamlined. At the same time the engine test run area should be moved indoors. In Assembly shop No.2 it is proposed that the sprinkler, power tiller and thresher assembly lines should be moved.

(7) Receipt, storage and issuance of raw materials and parts

1) Main store, materials store and intermediate store room

The inside of the main store and materials store are generally well organized. Cutting tools, ball bearings, belts, etc. are double locked in the store areas to prevent loss. The grinding stones are not piled on their sides and it appeared that the storage method had been changed for the better. However, holes in the roof of both the main store and materials store allows pigeons entry and these foul the goods in store, and the packing cases of the steel material and grinding stones were particularly bad. Measures to prevent soiling need to be taken.

Materials imported are stacked in their shipping cases three crates high (height of 5 m approx.) in the main store near the center of the

factory. In front of the store without roofing steel bar materials and other parts are stacked in their shipping crates. Import orders from HIC take place once a year and are based on figures of the production schedule. As the materials exported from the country of origin are often outdated and orders are small proposals to send several years supply at one shipment is sometimes considered because of domestic supply conditions of the exporting country. It is likely also that, as regards the plan to increase production at HIC, the quantity received in the store at one time will not decrease even if progress in the changeover to domestic production is made. The unpacking of imported parts immediately after receipt may be difficult to realize because of limited floor space in the store. But, activities to take out some of the materials from bottom of the three layers with a considerable number of workers and without crane are confused and dangerous. Besides not only is it impossible to keep a visual check on the goods in storage for rust, etc. the discovery of mistaken or missing parts among the delivered parts will only be occur just before assembly is about to begin. In such a case it is obvious that this will result in a hindrance to production even if telegraph, telephone and air communications with the supplying country are in order and sufficiently available. There have been actual precedents of this kind in the past. In order to avoid such inconveniences imported shipments received should be immediately unpacked after arrival and quantities and product quality confirmed. In order to make this possible it is necessary to evaluate the required space in the Main Warehouse and Storage Room, and the necessary items and quantities of storage and transportation facilities such as overhead cranes, fork lifts, pallets and parts boxes and make the necessary improvements.

Evidence of great activity of the carts used for conveyance of parts and materials in and out of the shop was not observed but each individual storeroom has a high number of personnel responsible for register administration. With such a large number of personnel the ordering of details of entries in the registers and collation of statistics involves a great deal of work and there is a danger of numerous mistakes arising. It is advisable to automate as far as possible this administrative work and mechanize the handwritten administration.

2) Stores in the factory

The store room on the west side of Assembly Shop No.1 has a large number of parts stored on racks but there are a large number of parts were seen which have been in storage for a long time which have rust. Entrance and exit of personnel, and the entry and exit of parts to and from the store are rigorously controlled but quality control is insufficient and several employees were engaged in removing rust, among these parts for which precision and degree of surface smoothness are vital were having rust removed with a file. There were materials which become completed rusted in one night due to the nature of the material and weather conditions, so that it is necessary to prevent rusting either by applying anti-rusting with a brush, by spray coating or by immersion in the anti rusting coatings.

Further, there is a considerable quantity of paints and thinners kept inside of the storeroom but the thinners are dangerous substances so storage in cans inside should be avoided, and these should either be stored in a special storehouse for dangerous substances or if kept inside the shops this should be in small quantities. It is necessary to introduce new iron doored rack closets with fire resistant specifications for storing of materials.

Also it is difficult to tell what material is stored where and in what condition and of course difficult to observe the rust conditions of parts because the storeroom is not only deep but the entrance is divided off with metal wire netting. Therefore when the layout of the work areas of the assembly shop is re-organized it would be recommendable to relocate material storage shelves closer to windows and production lines and confirm whether it is easy for operators to check the condition of parts. At the same time it would be possible to section the front side of the racks off from the assembly areas if this is necessary for management reasons by placing a metal wire net in front of the racks.

Imported hand tools are rigorously stored in the main Warehouse but when hand tools used at work areas are damaged or become worn and replacements are released from the warehouse it is very difficult for the actual production areas to have a clear idea of what type of machine tool and how many of this are stored. This results in some items remaining idle in storage, and of rushing off of orders for

parts in shortage until the following shipment arrives. A certain amount of spare parts should be stored in the Main Warehouse and the larger part of the hand tools be distributed proportionally for a specified period to the shops using these, and each shop take responsibility for storage and maintenance. If management were reformed in this way it would make the management of the main warehouse much simpler, and would permit efficient adjustments in use of tools since the stock situation of individual shops and of the tools would easy to observe.

3) Auxiliary materials and inventory taking

Imported raw materials and parts are supplied once a year but are sometimes in storage for more than one year if there are changes in production schedules. During that period storage management of the number of items is considered important but the aspect of quality of products stored tends to be overlooked. A system for supervision of the product quality of items in warehouse storage and first in first out methods should be established.

The adhesives, etc. included among the auxiliary materials imported have a limited shelf life and yet are kept in storage even though the usable period is long expired. This results in cases where the material is totally useless at time of employment. The same is true for paints. After this auxiliary materials having very short use periods were purchased and imported in several batches over a one year period. However, the stored items which had become unusable still remain in storage at present since they could not be thrown away for reasons relating to the store register entries. Such a state of affairs could easily result in hindrances to operations, and it is necessary to reform the system and employ methods of storage which allow for a clear understanding of the actual situation in addition to instituting an inventory of all shops once or twice annually. This should be conducted to allow for confirmation of the quantity of parts in progress and determination as to whether these are superior or reject. It is necessary by these procedures to clarify the stock effectively.

4) Handling of scraps

Aluminum alloys and Copper alloys, such as brass and bronze, etc. are imported. Moreover since domestic supplies of steel materials are limited these should be made use of as resources. However in the individual sections of No.3 HI there are piles of scrap arising from processing which are simply left lying about. In the various sections of AME No.2 and 3 empty drum cans are filled with the copper alloy cuttings and left. Some 100 tons of copper and aluminum alloy scrap had been collected and placed to the north west corner of AME No.3. And on the open land to the north west of the Mamootie finishing shop forging press punched material arising in the blanking processes was piled up in quantities considerably surpassing the amount of alloy scrap used in the foundry. In the half finished parts store room processing rejects dating back to the beginning of operations are gathered together and among these aluminum parts which could be re-used by No.4 HI are included.

Besides use of part of this scrap in the Foundry this scrap is sometimes recovered but active recovery activities are not undertaken. It is necessary to open up avenues for the re-use of this scrap domestically as a resource.

(8) Education and training of employees

1) Outline

Production activities for agricultural machinery, pumps, diesel generators, etc. are being carried out in No.3 HI and the working environment is certainly not worse provided than that of other shops. Rather the great distance from Rangoon involves many inconveniences. Despite these however, our admiration was gained by the vigorous efforts made to overcome working conditions and complete production levels especially among all the employees below superintendent level in No.3 HI. However the problems mentioned above in connection with the deterioration of present production equipment, together with the level of technical skill of operators mentioned below, and the inadequate understanding of shop management working together make the daily running of production activities far from smooth. In this respect by the provision of supporting guidance in the education and training of employees HIC can further and strengthen the pursuit of

economic rationalization of management. Thereby the reform and improvement of the comprehensive shop production and managerial methodology cannot be anticipated.

2) No.3 HI technical training school

Girls and boys graduates from Secondary School are regularly employed and are trained here for 2 years as factory workers for No.3 HI. The curriculum consists of a first year of classroom lectures followed by in factory training in the second year.

There is a shortage of practical instruction to enable trainees to get a sufficient grasp of the fundamentals concerning technical knowledge and skills. They are therefore sent to the Factory floor without sufficient understanding of the actual shop conditions and it is felt that the rate of improvement for levels of technology and skill actually achieved by this young fresh element of personnel resources is considered slow.

It is important to teach them the basics of the technical knowledge and skills they should acquire through actual practice in order to master the technical expertise needed to encounter the various technical problems facing workers of the No.3 HI. The present provision of lectures and factory floor training comprising the core of the educational training received the curriculum could be altered as follows to ensure that the training school functions as a practical facility.

1. Operating practice for basic handling of the working equipment

2. Practice in basic machine processing and finishing

3. Daily inspection of working equipment and practice in simple maintenance.

4. Product quality control and safety training, and basic factory ethic: organization, arrangement, cleaning, cleanliness, discipline

5. Technical knowledge of finished products, operations, disassembly, and assembly practice for the agricultural machinery produced in No.3 HI.

Equipment which should be used in the practice mentioned above are the drilling machine, lathe, miller, press, welder, then hand finishing operations (saw, file, scraper, etc.) and the sequence procedures relating to electricity, oil pressure, and air pressure. The equipment necessary for the above should be acquired for the Training School and allocation of superannuated equipment from No.3 HI is one effective way. For practice with agricultural machinery products made in No.3 HI should be appropriate.

A close direct contact with shops of No.3 HI on technical matters is important and after education and training in the training school first hand practice in the shop should take place.

3) The present shop work force

It is keenly hoped that the No.3 HI will endeavor to improve the skills of the work force and deepen their awareness of the production activities of the shop. At present the work force consists of those who operate the working equipment and process the parts, those who inspect and transport the parts, and those who assemble these to make the finished product. Some of the work force obviously felt that it was enough to try to realize the work load ordered by the shop manager for that day. But for the production activities of the shop it is necessary to endeavor not only to meet the production output and implement orders given but also to undertake a wider number of activities including pursuit of quality control of finished products, safety working, and an organized factory ethic (organization, arrangement, cleaning, cleanliness, and diligence). Improvements must be carried out through application of these principles in daily production.

The present insufficient level of awareness is a large obstacle to efforts to improve the production activity of the No.3 HI. Efforts to improve this level have not yet been fruitful. It is difficult to analyze and grasp the current technical level but perhaps systematization along the lines of a governmental system for authorization of technicians could be used. If applied, this would allow an analysis of the present situation and could be used to clarify targets for technical expertise through rankings (so a 3rd grade technician could advance to 2nd grade and then to 1st grade). Also active participa-

tion in the International Technical Olympics should be considered.

Further since the present normal production activities are mechanized there is not sufficient understanding of how the parts or finished products assembled are used in the respective agricultural machinery. It would be possible for a basic knowledge of finished parts to the agricultural machinery to be gained through practical training of disassembly and assembly as proposed for the Training School. Previously, a foreign technician was sent to No.3 HI to supervise the original assembly of the Power Thresher PT862. The technician gathered all the related operators and explained the specifications, construction, and functions of the parts in presence of the machine. This was favorably received by the operators, who moreover gained basic technical information and showed signs of a growing sense of quality control. The manufacturer carried out the assembly guidance very smoothly thanks to this method and it is hoped that appropriate training for all production lines will enable the Burmese themselves to raise and develop the level of technical competency.

4) Acquisition of repair expertise needed for superannuated production equipment in No.3 HI

In this present evaluation report a large number of superannuated equipment was noticed in the No.3 HI shop. It is clear that these need to be repaired and renovated urgently. Sufficient Japanese assistance is needed for this but the organized acquisition of the particular technology and expertise for repair by the Burmese themselves is the important question and must be achieved.

It is essential that basic technical expertise be promptly acquired by technicians of the equipment repair group and Electric and Service department who will be engaged in repair work. It is necessary to consider a training plan whereby Burmese technicians will be sent for mid to long term period (6 months to one year) to the original equipment manufacturers. For important equipment it is essential to undertake specialist training by the manufacturer, whether by a study tour of machine tool manufacturers, study of basic measures for compound re-assembly of defective machines or replacement of parts, countermeasures for electrical or mechanical tore parts for which production has stopped.

5) Factory management

In order to further planned production activity improvement of the managing skills of the middle managements (particularly shop managers) and office class managerial personnel is required.

a) The shop manager class is expected to develop the ability to instill a sense of quality control, technical know-how and his own management direction informing the finished products and parts of the shop work force and to create factory conditions which will promote this.

When inspecting the actual shops we confirmed that the equipment operators ran the machinery and were processing parts but no processing guidelines or diagrams were to be seen. Also measurements were tested with a micrometer but the basis of the tests was not clear. Also daily production schedules and production performance are not notified to the work force. It is necessary to introduce management which will make clear the correct standards and targets.

b) Supervision activities based on the actual conditions is essential. The shop managers must coolly examine the shop to observe the work of operators, flow of parts, and quality control and safety conditions. Any problems which are discovered must be systematically resolved. For example, if because of the uneven delivery of rough materials delivered to the forging and foundry shops processing time is lengthened and production delayed, the following process area should report this to the assembly shop where counter measures should be taken. Speedy counter measures through close contact between departments and shops is required, so that improvements at the latest for the following lot of production output can be undertaken if unevenness in the rough materials for the forging and foundry shops is reported.

c) In order to improve the factory management skills of shop and officer class managers setting up of I.E. training is particularly desirable. By introducing and employing this I.E. method changeover from the present ex post facto approach to a more scientific management style can be achieved, and the conditions and problems of the production areas analyzed. Further the need to set

operational and time guidelines adapted to Burmese standards will receive more attention as a consequence.

By acquisition of the processing, quality and cost management required as the next stage a more intensive style of management should develop and raising of the standards of managerial methodology should result through the acquisition of the above. Most urgently in need of implementation is the organized mastery by all personnel of the basic knowledge and expertise for quality control and processing control. It is essential that a firm foundation for management be laid and that improvement of management expertise in close contact with shop technology be realized as soon as possible to increase effective responsibility.

6) Relations with the technical advisory groups stationed by the four products manufacturers

A Japanese technical advisory group is permanently available at the agricultural machinery production project of No.3 HI.

Previously some 10 technicians, and at times up to 20, were stationed. At present one team leader is permanently stationed and specialist technicians are called in from Japan as needed for a short term. Though HIC has a keen interest to have technicians on location lack of foreign funds forbids this. On the manufacturers side in cases where the present assistance offered by the one employee is insufficient they are willing to send technical specialists for a short period as a free service.

The guidance given by the foreign technician includes instruction of Industrial Engineering method, shop management, processing control, small group activities, etc. This backup guidance is important to production, though actually not really part of the advisory function as such. This seems then due to the idea that progress will not be made in mastering of specialist technical expertise however many years guidance is continued unless a knowledge of basic managerial techniques is acquired first.

There has not been sufficient definition to the Japanese technicians of the problems faced on the Burmese side. Further, follow up activities for the results of the guidance have been insufficient.

It is necessary to tackle this along with the training and education of the manager class mentioned previously.

Table AI-2-3-1 SUMMARY OF NO.3 MI EQUIPMENT FAILURE AND COUNTERMEASURES

	Brdg. No.	Nomenclature	Products								Measures for Deterioration					
											Maintenance			Renewal		
			DE	PT	PH	MH	HT	Sp	Pu	Ge	Eq	JD	MI	Eq	MI	JD
1	3-05	AME Component Mfg Shop No.1								x	x					x
2	3-17	AME Component Mfg Shop No.2	x	x	x			x	x		x	x		x	x	x
3	3-18	Die Making and Repairing Shop	x	x	x	x	x			x	x	x				x
4	3-26	Hand Tool Finishing Shop					x				x	x				x
5	3-44	Wood Working Shop	x		x	x	x	x	x		x	x		x		x
6	3-03	AME Assembly Shop No.1	x	x	x				x		x	x			x	x
7	3-25	Hand Tool Forging Shop		x			x				x	x				x
8	3-31	Mamootie Forging Shop				x					x	x		x		x
9	3-12	AME Assembly Shop No.2						x	x					x		x
10	3-18	AME Component Mfg Shop No.3	x	x					x		x	x		x	x	x
11	3-47	AME Component Mfg Shop No.4	x	x					x		x	x			x	x
12	3-41	Press and Welding Shop	x	x	x			x			x	x		x	x	x
13	3-43	Saw Mill	x		x	x	x	x	x							x
14	3-30	Mamootie Finishing Shop				x					x					x
15	3-14	Plating Shop No.1	x	x			x	x				x		x		x
16	3-42	Combined Heat Treatment Shop	x	x			x		x	x	x	x		x		x
17	3-19	Material Planning Dept. Office & Main Store	x	x	x		x	x	x	x						
18	3-16	Material Store	x	x	x	x	x	x	x	x						x
19	3-50	Transit Store	x	x	x		x	x	x	x						
20	3-28	Store for Paint	x	x	x	x	x	x	x	x						
21	3-29	Manufactured Component Store	x	x	x	x	x	x	x	x						
22	3-51	Manufactured Products & Component Shop	x	x	x	x	x	x	x	x						
23	3-13	Boiler Room	x	x	x		x	x	x	x				x		
24	3-15	Inspection Room	x	x	x	x	x	x	x	x	x	x				x
25	3-04	Painting Shop														
26	3-11	Electric & Service Sec. under Technical Planning Dept.														
27	3-33	Technical Sec. under Technical Planning Dept.														
28	3-	Technical Training School														
29	3-	Agriculture Research & Development Farm														
30	3-	Motor & Transportation Section (M/T)														

Notes: DE: Diesel Engine PT: Power Tiller PH: Power Thresher MH: Mamootie Hoe HT: Hand Tools Sp: Sprayer
Pu: Pump Ge: Generator Eq: Equipment JD: Jigs and Dies MI: Measuring Instruments

Table AI-2-3-2(1) LIST OF DETERIORATED MACHINES/EQUIPMENT
- AME Component Shop No.1 -

No.	M/C Sr. No.	Mfg Year	M/C Model/Type	M/C Name	Company	Situation Checked by HIC*1	Trbl*2		*3	Action Needed at:
38.	50182		BT-8DR	Special Boring M/C	Toshiba	4	M	M		Milling head
78.	15205-0771	-	PP-XGC-55-SU(II)	Press M/C	AIDA	2	L	M		Oil pressure system
79.	15205-0769	-	PP-XGC-55-SU(II)	Press M/C	AIDA	2	L	M		Oil pressure system
125.	4309-13403	-	L.S	High Speed Lathe	Okuma	4	M	M		Main shaft gear
127.	4402-14122	-	L.S	High Speed Lathe	Okuma	4	M	M		Main shaft gear
128.	T44816	-	4AII.	Turret Lathe	Hitachi	4	M	M		Turret head
142.	27163	-	-	Circular Sawing M/C	-	3	L	M		Oil pressure equipment

Notes: *1 Situation checked by HI:
1 Machine is not good (to be replaced).
2 Machine is not running (spare parts are not available because of old type).
3 Machine is waiting for imported spare parts.
4 Machine is running (minor repair needed).
5 Machine is not running (spare parts can be locally manufactured).
6 Machine is not running (minor repair needed).

*2 Trouble:
M Mechanical
E Electrical
L Hydraulic
O Others

*3 Action needed:
M Maintenance
R Replacement

The above notes apply to Tables AI-2-3-2(2-1) to AI-2-3-2(15).

Table AI-2-3-2(2-1) LIST OF DETERIORATED MACHINES/EQUIPMENT
- AME Component Shop No.2 -

No.	M/C Sr. No.	Mfg Year	M/C Model/Type	M/C Name	Company	Situation Checked by HIC*1	Trbl*2	Action Needed *3	Action Needed at:
47.	4312-2754		GPB	Cylindrical Grinding M/C	Okuma	3	E	R	Sizing unit
76.	36433	3-1973	23 MD	Crank Pin Lathe	Nilgata		M	R	Chuck
89.	179 S.	1965		Key Way & Milling M/C	Yoshikawa Machinery Co. Ltd	3	L	M	Oil pump
90.	36530	Oct 1978	25 MD	Crank Pin Turning M/C	Nilgata Engineering Co. Ltd	4	M	M	Chuck
92.	4604-0537		LA	Automatic Copy Lathe	Okuma	4	M	R	Inferior accuracy
93.	4604-0536		LA	Automatic Copy Lathe	Okuma			R	
96.	T 35338		BA III	Turret Lathe	Hitachi Seiki	4	M	M	Turret head
97.	T 39333		BA III	Turret Lathe	Hitachi Seiki	4	M	M	Turret head
98.	T 37048		BA III	Turret Lathe	Hitachi Seiki	4	M	M	Turret head
99.	T 37042		BA III	Turret Lathe	Hitachi Seiki	4	M	M	Turret head
100.	2016	1971	1A-1	Turret Lathe	Hamai	4	M	M	Turret head
102.	2015	Feb:1971	1A-1	Turret Lathe	Hamai	4	M	M	Turret head
103.	1144	Aug-20-1968	1A-1	Turret Lathe	Hamai	4	M	M	Turret head
104.	T 38836		3A III	Turret Lathe	Hitachi Seiki	4	M	M	Turret head
105.	T 39005		3A III	Turret Lathe	Hitachi Seiki	4	M	M	Turret head
112.	174520	Aug 20 1968	1A-1	Turret Lathe	Hamai	4	E	M	Motor
113.	1142	Aug 20 1968	1A-1	Turret Lathe	Hamai	4	M	M	Turret head
114.	T 38252		3A III	Turret Lathe	Hitachi Seiki	4	M	M	Turret head
115.	T 37041		3A III	Turret Lathe	Hitachi Seiki	4	M	M	Turret head
116.	T 35337		3A III	Turret Lathe	Hitachi Seiki	4	M	M	Turret head
117.	T 35334		3A III	Turret Lathe	Hitachi Seiki	4	M	M	Turret head
120.	13200-0032		PS STG-100(2)	Straight Side Single Crank Press	Aida	3	O	M	Details N.A.
121.	15205-0765		PP-XGC-55 SU(I)	Hy-Flex Press	Aida	3	M	M	Spring & O-ring
128.	474	1943-9	S-20	Inclinable Press	Saka Kiko	3	M	M	Fly wheel
134.	15203-0428		PP-XGC-30SU(1)	30 ton Super Hy-Flex Press	Aida	3	E	M	Panel
-142.	6104		YIC-400	Automatic Copying M/C	Yoshikawa	3	E	R	
143.	4602-1848		LK	High Speed Lathe	Okuma	4	M	M	Turret head
144.	4310-1613		LK	High Speed Lathe	Okuma	4	M	M	Turret head
149.	73368		HOWA 650	Power & Precision Lathe	Howa Sangyo	4	M	M	Epron & main bearing
150.	4310-1612		LK	Power & Precision Lathe	Okuma	4	M	M	Turret head

Table A1-2-3-2(2-2) LIST OF DETERIORATED MACHINES/EQUIPMENT
- AME Component Shop No.2 (Cont'd) -

No.	M/C Sr. No.	Mfg Year	M/C Model/Type	M/C Name	Company	Situation Checked by HIC*1	Trbl*2	Action Needed *3	Action Needed at:
158.	T-44814		4A II	Turret Lathe	Hitachi Lathe M/C	4	M	M	Turret head
159.	T-44819		4A II	Turret Lathe	Okuma	4	M	M	Turret head
160.	T-44815		4A II	Turret Lathe	Okuma	4	M	M	Turret head
161.	T-44817		4A II	Turret Lathe	Okuma	4	M	M	Turret head
169.	4602-1847		L-K	High speed Lathe	Okuma	4	M	M	Turret head
170.	4310-1614		L-K	High speed Lathe	Okuma	4	M	M	Turret head
171.	4310-1620		L-K	High speed Lathe	Okuma	4	M	M	Turret head
172.	4309-13459		L-S	Precision High Speed Lathe	Okuma	3	M	M	Apron
178.	7047	1964-9	LS	High Speed Lathe	Okuma	3	M	M	Needle bearing
181.	4310-1619		LK	Precision High Speed Lathe	Okuma	4	M	M	Turret head
182.	4310-1621		LK	High Speed Lathe	Okuma	4	M	M	Turret head
183.	4310-1616		LK	High Speed Lathe	Hitachi Seiki	4	M	M	Turret head
184.	4602-1846		LK	High Speed Lathe	Hitachi Seiki	4	M	M	Turret head
186.	4310-1615		LK	High Speed Lathe	Okuma	3	M	R	Needle bearing
187.	713555-2		3 MV	Vertical Milling M/C	Hitachi Seiki	3	M/E	R	
188.	4603013		YUD 700	Upright Drilling M/C	Yoshida	3	M	R	Gear & shaft
189.	2019		LA 1	Turret Lathe	Hamai	3	M	R	Gear box

Table A1-2-3-2(3) LIST OF DETERIORATED MACHINES/EQUIPMENT
- AME Component Shop No.3 -

No.	M/C Sr. No.	Mfg Year	M/C Model/Type	M/C Name	Company	Situation Checked by HIC*1	Trbl*2	Action Needed *3	Action Needed at:
2.	4712025		YUD 700	Upright Drilling M/C	Yoshida M/C Tool	4	M	M	Gear
6.	T-45193		4A II	Ram Type Turret Lathe	Hitachi Seiki	4	M	R	Inferior accuracy
8.	4603-3043		LS-T	High Speed Turret Lathe	Okuma	4	M	R	Turret head
16.	11639	1971-9	CGK 25/50 DI	Cylindrical Grinding M/C	Okuma	1	E	R	Motor
49.	4311 3373		DRA J 1600	Radial Drilling M/C	Aichi Okuma Machinery	6	L	M	Clutch
58.	7AB911107	1964-9	7STT	Bench Type Tapping & Drilling M/C	Tokushukoki	3	M	R	Entire damage
95.	2127	MCH-73	1A-1	Precision High Speed Lathe	Hamai Japan M/C Tool	4	M	M	Turret head
105.	T 38253		3A III	Turret Lathe	Hitachi Seiki	4	M	M	Turret head
107.	T 37044		3A III	Turret Lathe	Hitachi Seiki	4	M	M	Turret head
108.	T 37043		3A III	Turret Lathe	Hitachi Seiki	4	M	M	Turret head
138.	73373		HOWA 650	Power & Precision Lathe	Howa Sangyo	4	M	M	Apron
140.	73370		HOWA 650	Power & Precision Lathe	Howa Sangyo	4	M	M	Feed device gear

Table AI-2-3-2(4) LIST OF DETERIORATED MACHINES/EQUIPMENT
- AME Component Shop No.4 -

No.	M/C Sr. No.	Mfg Year	M/C Model/Type	M/C Name	Company	Situation Checked by HIC*1	Trbl*2	Action Needed *3	at:
5.	8547	1978	3 ML-V	Vertical Milling M/C	Hitachi Seiki	4	M	M	Key
24.	T-33014	1964	3A III	Turret Lathe	Hitachi Seiki	4	M	M	Turret head
27.	T-37045	1964	3A III	Turret Lathe	Hitachi Seiki	4	M	M	Turret head
28.	TL(6)2128	1973	1A I	Turret Lathe	Hamai Japan	4	M	M	Turret head
30.	2020	Feb-1971	1A I	Turret Lathe	Niamat	4	M	M	Turret head
31.	T-37046	1964	3A III	Turret Lathe	Hitachi Seiki	4	M	M	Turret head
32.	5310-8053	-	LS	High Speed Lathe	Okuma	4	M	M	Feed device gear
40.	5310-8050	-	L.S	High Speed Lathe	Okuma	4	L	M	Profiling device
41.	2021	Feb-1971	1A-1	Turret Lathe	Hamai	4	M	M	Turret head
42.	2022	Feb-1971	1A-1	Turret Lathe	Hamai	4	M	M	Turret head
44.	4602-1849	-	LK	High Speed Lathe	Okuma	4	M	M	Tail stock
45.	15451	-	2 MF-V	Vertical Milling M/C	Hitachi Seiki	4	E	M	Feed device motor
46.	N-18699	-	2 MF-V	Vertical Milling M/C	Hitachi Seiki	4	E	M	Coolant pump
79.	4557	OCT-1974	KUBOTA	Special Purpose Boring M/C	Osaka M/C Tool	1	E	M	for H2
87.	12482	-	2 ML-V	Vertical Milling M/C	Hitachi Seiki	4	M	M	Lube oil
91.	4558	OCT,1974	KUBOTA	Special Purpose Boring	Osaka Machine	3	E	M	for H2

Table AI-2-3-2(5) LIST OF DETERIORATED MACHINES/EQUIPMENT
- Assembly Shop No.1 -

M/C No.	M/C Sr. No.	Mfg Year	M/C Model/Type	M/C Name	Company	Situation Checked by MIC*1	Trbl*2	Action Needed *3	Action Needed at:
14.	3-0258	1967	CT4RS-HI	Weld Timer	Osaka-Denki	4	O	M	Idle
26.	22587	1965	M.P.W	Projection Welder	Osaka-Denki	3	E	M	
28.	16859	1965	SL-AJ	Spot Welder	Osaka-Denki	3	E	M	

Table AI-2-3-2(6) LIST OF DETERIORATED MACHINES/EQUIPMENT
- Assembly Shop No.2 -

No.	M/C Sr. No.	Mfg Year	M/C Model/Type	M/C Name	Company	Situation Checked by HIC*1	Trbl*2	Action Needed *3	Action Needed at:
1.	-	1969	-	Cleaning Booth	-		0	R	Equipment not available
2.	-	-	-	Infrared Ray Drying Oven	-			R	Equipment not available
3.	-	-	-	Under Coating Booth	-		0	R	Equipment not available
4.	-	-	-	Top Coating Booth	-		0	R	Equipment not available
8.	-	-	-	Pretreatment Equipment	Meidensha	3	0	R	Pump bearing
10.	-	-	-	Dry Off Oven	-		0	R	
11.	-	-	-	Under Coating Booth	Mitsubishita	1	0	R	
12.	-	-	-	Drying Oven For Under Coat	-		0	R	
13.	-	-	-	Drying Oven For Top Coat	-		0	R	

Table AI-2-3-2(7) LIST OF DETERIORATED MACHINES/EQUIPMENT
- Mamootlo Forging Shop -

No.	M/C Sr. No.	Mfg Year	M/C Model/Type	M/C Name	Company	Situation Checked by HIC*1	Trbl*2	Action Needed *3	at:
11.	17691		LKM 1600	100 Tons Press M/C	Kurimoto		M	M	Bush
12.			RF-50	50 HP Forging Roll	Kurimoto	5			
13.	20504		S2-210	210 Tons Crankless Press M/C	Kurimoto	5	M	M	
15.	17635		LKM 1600	1600 Ton Forging Press	Kurimoto	4	M	M	
23.			TF-490	Rotary Furnace	Toyo Kogyo	5	O	M	Wheel
24.			Batch Type	Reheating Furnace	Nihon Industrial Furnaces Engineering	5	O	M	Refractory

Table AI-2-3-2(8) LIST OF DETERIORATED MACHINES/EQUIPMENT
- Hand Tools Forging Shop -

No.	M/C Sr. No.	Mfg Year	M/C Model/Type	M/C Name	Company	Situation Checked by HIC*1	Trbl*2	Action Needed *3	at:
5.	314101	1969	STB-2B	Shot Tumblast M/C	Shinto Kogyo	4	M	M	Exhaust system
6.	15207-0648	-	PP-XGC-75SU-PI	75 Tons Press	AIDA	4	M	M	Clutch
14.	15205-08487	-	PP-XG(-44SUSII)	55 Tons HY-Flex Press	AIDA	3	M	M	O-ring
21.	3256	-	NB	1/16 Ton Pneumatic Air Hammer	NITTAN	5	M	M	Piston ring

Table AI-2-3-2(9) LIST OF DETERIORATED MACHINES/EQUIPMENT
- Mamootie Finishing Shop -

No.	M/C Sr. No.	Mfg Year	M/C Model/Type	M/C Name	Company	Situation Checked by HIC*1	Trbl*2	Action Needed *3	at:
7.	26654	1969	A-3	Buffing M/C	C.Uyemura	3	E	M	Magnetic contactor
21.	(5442203)	1969	TDC-5	Dustube Collector	Shinto Kogyo	4	M	M	Ball bearing
22.	5442201	1969	TDC-5	Dustube Collector	Shinto Kogyo	4	M	M	Ball bearing

Table AI-2-3-2(10) LIST OF DETERIORATED MACHINES/EQUIPMENT
- Hand Tools Finishing Shop -

No.	M/C Sr. No.	Mfg Year	M/C Model/Type	M/C Name	Company	Situation Checked by HIC*1	Trbl*2	Action Needed *3	Action Needed at:
20.	3718	Jan 1970	NS 3	Slotting M/C	Nakabo Chuzo	3	E	M	Breaker
25.	26674	1969.9	A 3	Buffing M/C	Shikoku		M	M	Bearing
26.	26676	1969-9	A3	Buffing M/C	Shikoku		M	M	Bearing
27.	26675	1969.9	A3	Buffing M/C	Shikoku		M	M	Bearing
28.	26672	1969-9	A3	Buffing M/C	Shikoku		M	M	Bearing
29.	26665	1969-9	A3	Buffing M/C	Shikoku		M	M	Bearing
30.	26673	1969-9	A3	Buffing M/C	Shikoku		M	M	Bearing
42.5	908038		KCO-5-12-1000	Rectifier Chromium Plating	Sansha	3	E	M	Transformer

Table AI-2-3-2(11) LIST OF DETERIORATED MACHINES/EQUIPMENT
- Press and Welding Shop -

No.	M/C Sr. No.	Mfg Year	M/C Model/Type	M/C Name	Company	Situation Checked by HIC*1	Trbl*2	*3	Action Needed at:
2.	4602-1850		LK	High Speed Lathe	Okuma	4	M	M	Bearing & seal for Spindle
3.	23878	1972	SE-UV	Universal Seam Welding M/C	Daidon Osaka Denki	1	M/E	R	
5.	62-3412	1971	SL-AJ	Spot Weidor	Daiden Osaka	3	E	M	Ignition
	62-3412	1971	CT 4R	Weld Timer	Denki				
11.	52-0242	1974	SU-A	Rocker Arm Type Spot Welder M/C	Daidon Osaka Denki	1	M/E	R	Entire damage of frame
13.	52-0240	1974	SU-A	Rocker Arm Type Spot	Daiden Osaka	1	M/E	R	Entire damage of frame
	52-0241	1974-4	STC-42212-KI	Weld Timer	Denki				
17.	13205-1631		PC-5(2)	55 Ton Super Hy-flex Press	Nippon Setudanki	3	M/E	M	Solenoid valve o-ring
19.	53911	1978		Electric Furnace		3	E	M	Motor base heating coil
22.	15205-1647		PC-5-(2)	Super Hy-flex Press	Aida	3	M/E	M	Solenoid valve o-ring
34.	13200-0133	-	PS-10-2	Single Crank Press	Aida	1	M	R	O-ring, special skill req'd
35.	13200-0083	-	PS-10-2	Single Crank Press	Aida	1	M	R	O-ring, special skill req'd

Table A1-2-3-2(12) LIST OF DETERIORATED MACHINES/EQUIPMENT
- Die Making and Repairing Shop -

M/C No.	M/C Sr. No.	Mfg Year	M/C Model/Type	M/C Name	Company	Situation Checked by HIC*1	Trbl*2	Action Needed *3	Action Needed at:
29.	97030199	1971-7	DM 300	Electric Discharge M/C	Mitsubishi Electric	3	E	M	Register, special skill req'd

Table AI-2-3-2(13) LIST OF DETERIORATED MACHINES/EQUIPMENT
- Combine Heat Treatment Shop -

No.	M/C Sr. No.	Mfg Year	M/C Model/Type	M/C Name	Company	Situation Checked by HIC*1	Trbl*2	Action Needed *3	at:
8.				Time Control Box	Nissin Kanetsu	4	E	R	Timer
9.				Control Box (Air Pre-heating)	Nissin Kanetsu			R	
10.				Control Box (2nd Pre-heat & Austenizing)	Nissin Kanetsu	4	E	R	Voltmeter-ammeter
11.				Control Box For Hot Bath	Nissin Kanetsu	4	E	R	Voltmeter
12.				Step-Down Transformer	Nissin Kanetsu			R	
13.				Step-Down Transformer	Nissin Kanetsu			R	
14.				Step-Down Transformer	Nissin Kanetsu	1	E	R	Transformer
28.				Time Control Box	Nissin Kanetsu	1	E	R	Timer missing
29.				Control Box	Nissin Kanetsu	1	E	R	Parts not available
44.	7888		ASP	Drying Furnace	Fuji Koshi	1	E/O	R	
45.			HC	Heating Furnace	Fuji Koshi	1	E/O	R	
46.			D	No.1 Drawing Furnace	Fuji Koshi	1	E/O	R	
47.			TS	No.2 Drawing Furnace	Fuji Koshi	1	E/O	R	
50.				Transfer Mechanism (Hydraulic)	Fuji Koshi	1	E	R	
51.				Control Pannel	Fuji Koshi	1	E	R	
52.	T-3442			Cleaning Equipment	Fuji Koshi	1	O	M	Washing with trichloro-ethylene is needed.
89.	2031		F-10	Liquid Honing M/C	Fuji-Seiki	4	M	M	Impeller

Table AI-2-3-2(14-1) LIST OF DETERIORATED MACHINES/EQUIPMENT
- Plating Shop No.1 -

No.	M/C Sr. No.	Mfg Year	M/C Model/Type	M/C Name	Company	Situation Checked by HIC*1	Trbl*2	*3	Action Needed at:
1.	-	1969-3	-	Dryer	C.Uyemura			R	Deterioration
2.		1969-3	-	Dryer	C.Uyemura			R	Deterioration
3.	440207	-	-	Centrifugal Separator	Morisaki			R	Deterioration
4.	-	-	-	Hot Water Tank.	C.Uyemura			R	Deterioration
5.	-	-	-	Water Rinsing Tank.	C.Uyemura			R	Deterioration
6.	-	-	-	Zinc Plating Tank.	Sansha			R	Deterioration
8.	-	-	-	Water Tank.	C.Uyemura			R	Deterioration
9.	-	-	-	Zinc Plating Tank.	C.Uyemura			R	Deterioration
10.	-	1969-3	-	Electro Plating	C.Uyemura	1	0	R	Transformer & Register
11.	-	1969-3	-	Zinc Barrel Plating.	C.Uyemura			R	Deterioration
12.	-	1969-3	-	Zinc Barrel Plating.	C.Uyemura			R	Deterioration
13.	-	1969-3	-	Nickel Barrel Plating.	C.Uyemura			R	Deterioration
14.	-	1969-3	-	Barrel Polishing M/C	C.Uyemura	1	0	R	Deterioration
15.	-	-	-	Silicon Rectifier.	C.Uyemura			R	Deterioration
16.	902123	Feb-1969	WNC-3-12 500	Rectifier for Barrel Zinc.	C.Uyemura			R	Deterioration
17.	-	-	-	Alkali Degreasing Tank	C.Uyemura			R	Deterioration
18.	-	-	-	Water Tank.	C.Uyemura			R	Deterioration
19.	-	-	-	Water Rinsing Tank	-	1	0	R	Lined tank
20.	-	-	-	Water Rinsing Tank.	-	1	0	R	Lined tank
21.	-	-	-	Acid Pickling	-	1	0	R	Lined tank
22.	-	-	-	Water Tank.	-			R	Deterioration
23.	-	-	-	Neutralizing Tank	-	1	0	R	Deterioration
24.		-	-	Electrolytic Degreasing Tank.	-			R	Deterioration
25.		-	-	Water Tank.	-			R	Deterioration
26.		-	-	Neutralizing Tank.	-			R	Lined tank
27.	-	-	-	Water Rinsing Tank.	C.Uyemura			R	Deterioration
28.	-	-	-	Strike Copper Tank.	C.Uyemura			R	Deterioration
29.	-	-	-	Copper Plating Tank.	C.Uyemura			R	Deterioration
30.	-	-	-	Hot Water Rinsing Tank	C.Uyemura	1	0	R	Lined tank
32.		1963-3	-	Rectifier	Sansha			R	Deterioration
33.	-	-	-	Rectifier	Sansha			R	Deterioration
34.	902130	1969-Feb	KC05-15-1000	SCR Rectifier	Sansha			R	Deterioration
35.	-	-	-	Rack for Basket.	C.Uyemura			R	Deterioration
36.	902131	-	KC05-12-1000	SCR Rectifier.	Sansha			R	Deterioration
38.	-	-	-	Compressor.	Sango			R	Deterioration
39.	-	1969-3	A-3	Buffing M/C.	C.Uyemura			R	Deterioration
40.	-	1969-3	A-3	Buffing M/C.	C.Uyemura			R	Deterioration

Table AI-2-3-2(14-2) LIST OF DETERIORATED MACHINES/EQUIPMENT
- Plating Shop No.1 -

No.	M/C Sr. No.	Mfg Year	M/C Model/Type	M/C Name	Company	Situation Checked by HIC*1	Trbl*2	*3	Action Needed at:
41.	-	1969-3	A-3	Buffing M/C	C.Uyemura			R	Deterioration
42.	-	1969-3	A-3	Buffing M/C	C.Uyemura			R	Deterioration
43.	-	1969-3	A-3	Buffing M/C	C.Uyemura			R	Deterioration
44.	-	1969-3	-	Alkali Decreasing Tank	C.Uyemura			R	Deterioration
45.	-	1969-3	-	Water Rinsing Tank	C.Uyemura			R	Lined tank
46.	-	1969-3	-	Water Rinsing Tank	C.Uyemura	1	0	R	Lined tank
47.	-		-	H2SO4 Acid Pickling Tank	C.Uyemura	1	0	R	Lined tank
48.	-	1969-3	-	Water Rinsing Tank	C.Uyemura			R	Deterioration
49.	-	1969-3	-	Water Rinsing Tank	C.Uyemura			R	Deterioration
50.	-	1969-3	-	Water Rinsing Tank	C.Uyemura			R	Deterioration
51.	-	1969-3	-	HCL Acid Pickling Tank	C.Uyemura			R	Deterioration
52.	-	1969-3	-	Nickel Plating Tank	C.Uyemura			R	Deterioration
53.	302338	-	P30L.	Sansin Filter	Sanshin	6	0	R	Deterioration
54.	-	-	-	Water Rinsing Tank	C.Uyemura			R	Deterioration
55.	-	1965	S-P-R	Heat Exchanger				R	Deterioration
56.	-	-	-	Rack for Plating Jig	C.Uyemura			R	Deterioration
57.	-	-	-	Rack for Basket	C.Uyemura			R	Deterioration
58.	-	-	-	Chromium Plating Tank	C.Uyemura	1	0	R	Lined tank
59.	-	-	-	Water Tank	C.Uyemura			R	Deterioration
60.	-	-	-	Hard Chromium Plating Tank	C.Uyemura	1	0	R	Lined tank
61.	-	-	-	Water Rinsing Tank	C.Uyenura	1	0	R	Lined tank
62.	-	-	-	Water Rinsing Tank	C.Uyenura			R	Deterioration
63.	-	-	-	Dust Collector	C.Uyenura			R	Deterioration
64.	-	-	-	Oiling	Nihon Parkerizing			R	Deterioration
65.	-	-	-	Sealing	Nihon Parkerizing			R	Deterioration
66.	-	-	-	Water Rinsing	Nihon Parkerizing			R	Deterioration
67.	-	-	-	Phosphating Tank	Nihon Parkerizing			R	Deterioration
68.	-	-	-	Water Rinse	Nihon Parkerizing			R	Deterioration
69.	-	-	-	Neutralization	Nihon Parkerizing	1	0	R	Lined tank
70.	-	-	-	Water Rinse	Nihon Parkerizing			R	Deterioration
71.	-	-	-	Acid Pickling Tank	Nihon Parkerizing	1	0	R	Lined tank
72.	-	-	-	Water Rinse	Nihon Parkerizing			R	Deterioration
73.	-	-	-	Cleaning	Nihon Parkerizing			R	Deterioration
74.	H-509	1969-	WNC-S1	Cyanide Disposal	Sanshin	1	0	R	Deterioration
75.	H-518	1969-	WRC-1	Chromium Disposal	Sanshin	1	0	R	Deterioration
76.	-	-	-	Wastes Disposal				R	Deterioration
77.	1161	1969	BS-40	Boiler	Kawasaki		E/O	R	Pipe of panel
78.	-	1949-3	-	Soft Teling				R	Deterioration

Table AI-2-3-2(15) LIST OF DETERIORATED MACHINES/EQUIPMENT
- Wood Working Shop -

No.	M/C Sr. No.	Mfg Year	M/C Model/Type	M/C Name	Company	Situation Checked by HIC*1	Trbl*2	Action Needed *3	at:
1.	7244-7		ALB 1000	Copying Lathe	Kikukawa	1	M	R	Details N.A.
2.	7244-4		ALB 1000	Copying Lathe	Kikukawa	3	E	M	Lead screw
6.	710525	1971	BL-03	Bobbin Lathe	Thiyo	4	O	M	Details N.A.
7.	710524	1971	BL-03	Bobbin Lathe	Thiyo	4	O	M	Details N.A.
8.	710519	1971	WBL-300	Wood Boring Lathe	Thiyo	4	O	M	Details N.A.
12.	7244-7-2		ALB-1000	Copying Lathe	Kikukawa	4	O	M	Details N.A.
13.	7244-8		ALB-1000	Copying Lathe	Kikukawa	4	O	M	Details N.A.
14.	7244-5		ALB-1000	Copying Lathe	Kikukawa	3	M	M	Frame
16.	710523	1971	BL-05	Bobbin Lathe	Kikukawa Taiyo	4	O	M	Details N.A.
17.	710522	1971	BL-05	Bobbin Lathe	Kikukawa Taiyo	4	O	M	Details N.A.
27.	7219-2		PT-188	Three Side Planer Holder	Kikukawa Iroo Works	3	E	M	
46.	2298	1969	ET-402	End Tenoner M/C	IIDA-Kogyo	1	O	R	Entire damage
48.				Dust Collector		3	O	M	Impeller

Table AI-2-3-3 NO.3 HI STATUS OF EQUIPMENT DETERIORATION

Shop Name	Nos. Installed	Status of Deterioration		
		to be Replaced Shortly	Failured	in Normal Oper'n
AME Component Shop No.1*	60	-	7	53
AME Component Shop No.2	190	9	38	143
AME Component Shop No.3	143	4	8	131
AME Component Shop No.4	92	-	16	76
Assembly Shop No.1	30	-	3	27
Assembly Shop No.2	14	9	-	5
Mamootie Forging Shop	27	-	5	22
Hand Tool Forging Shop	28	-	5	23
Mamootie Finishing Shop	23	-	3	20
Hand Tool Finishing Shop	44	-	8	36
Press and Welding Shop	43	5	5	33
Die Making and Repairing Shop	30	-	1	29
Saw Mill	16	-	-	16
Combine Heat Treatment Shop	100	15	2	83
Plating Shop No.1	78	75	-	3
Wood Working Shop	49	2	11	36
Total	967	119	112	736

Note: * Numbers for agricultural machinery production only.

Table AI-2-3-4(1) LIST OF EQUIPMENT TO BE RENEWED

Shop Name	No.	Model	Machine Name	Company
Equipment				
AME Component Shop No.2	47	GPB	Cylindrical Grinder	Okuma
	92	LA	Automatic Copy Lathe	Okuma
	93	LA	Automatic Copy Lathe	Okuma
	142	YLC	Automatic Copying M/C	Yoshikawa
	186	LK	High Speed Lathe	Okuma
	187	3MV	Vertical Milling M/C	Hitachi Seiki
	188	YUD700	Upright Drilling M/C	Yosida
	189	1A1	Turret Lathe	Hamai
AME Component Shop No.3	6	4A-II	Ram Type Turret Lathe	Hitachi Seiki
	8	LS-T	High Speed Turret Lathe	Okuma
	16	(GK25/50DI)	Cylindrical Grinding M/C	Nippei
	58	7STT	Bench Type Tapping & Drilling M/C	Tokushukoki
			Fine Boring M/C for Cylinder Liner	Toyo
Assembly Shop No.2	1		Cleaning Bath	
	2		Infrared Ray Drying Oven	
	3		Under Coating Booth	
	4		Top Coating Booth	
	8		Pre-treatment Equipment	Meidensha
	10		Dry off Oven	
	11		Under Coating Booth	
	12		Drying Oven for Under Coat	
	13		Drying Oven for Top Coat	
Mamootie Forging Shop			Slat Conveyor	Kurimoto
Press and Welding Shop	3	SE-UV	Universal Seam Welding M/C	Osaka Denki
	11	SU-A	Rocker Arm Type Spot Welding M/C	Osaka Denki
	13	SU-A	Rocker Arm Type Spot Welding M/C with STC-42212KI Welder Timer	Osaka Denki
	34	PS-10-2	Single Crank Press	Aida
	35	PS-10-2	Single Crank Press	Aida

Table AI-2-3-4(2) LIST OF EQUIPMENT TO BE RENEWED

Shop Name	No.	Model	Machine Name	Company
Equipment				
Combine Heat Treatment Shop	Heat Treatment Equipment for Die of Mamootie			Nissin Kanetsu
	8		Timer Control Box	
	9		Control Box (Air Pre-heating)	
	10		Control Box (2nd Pre-heating & Austenizing)	
	11		Control Box for Hot Bath	
	12		Step-down Transformer	
	13		Step-down Transformer	
	14		Step-down Transformer	
	Heat Treatment Equipment for Die of Hand Tool			Nissin Kanetsu
	28		Time Control Box	
	29		Control Box	
	Automatic Heat Treatment Equipment, NACHI Solt Bath			Fujikoshi
	44	AEP	Drying Furnace	
	45	HC	Heating Furnace	
	46	D	No.1 Drawing Furnace	
	47	TS	No.2 Drawing Furnace	
	50		Transformer Mechanism (Hydraulic)	
	51		Control Pannel	
Wood Working Shop	1	ALB1000	Copy Milling M/C	Kikukawa
	46	ET402	End Tenoner M/C	Iidakogyo
Plating Shop No.1	1-76		Plating Equipment	Umemura & Others
	78			
	77	BS-40	Boiler	Kawasaki

Table AI-2-3-4(3) LIST OF EQUIPMENT TO BE RENEWED

Shop Name	No.	Model	Machine Name	Q'ty
Jigs and Press Dies				
AME Component Shop No.2			Machining Jig for Crank Shaft for Engine KND5B and KND7	1 Set
			Machining Jig for Cam Shaft for Engine KND5B and KND7	1 Set
			Pressing Dies and Welding Jigs for Engine parts KND5B and KND7	1 Set
AME Component Shop No.3			Machining Jigs for Cylinder head for Engine KND5B and KND7	1 Set
			Machining Jig for Cylinder Liner for Engine KND5B and KND7	1 Set
			Machining Jig for Cylinder Frame for Engine KND5B and KND7	1 Set
			Machining Jig for Connecting Rod for Engine KND5B and KND7	1 Set
			Machining Jig for Fly Wheel for Engine KND5B and KND7	1 Set
AME Component Shop No.3			Machining Jig for Side Cover for Engine, KND5B and KND7	1 Set
AME Component Shop No.4			Machining Jig for Gear for Engine, KND5B and KND7	1 Set
			Machining Jig for Gears for Power Tiller KMB200	1 Set
			Machining Jig for Main Gear Case for Power Tiller KMB200	1 Set
			Machining Jig for Central Gear Case for Power Tiller KMB200	1 Set
			Machining Jig for Auxillary Gear Case for Power Tiller KMB200	1 Set
Press and Welding Shop			Pressing Dies and Welding Jigs for Engine Parts for KND5B and KND7	1 Set
			Pressing Dies and Welding Jigs for Power Tiller Parts, KMB200	1 Set

Table AI-2-3-4(4) LIST OF EQUIPMENT TO BE RENEWED

Shop Name	No.	Model	Machine Name	Q'ty
Jigs and Press Dies				
Forging Shop			Forging Dies for Crankshaft for Engine, KND5B and KND7	1 Set
			Forging Diestor Cam Shaft for Engine KND5B and KND7	1 Set
			Forging Dies for Connecting Rod for Engine, KND5B and KND7	1 Set
			Forging Dies for Gears for Engine, KND5B and KND7	1 Set
			Forging Dies for Axle and Shafts for Power Tiller KMB200	1 Set
			Forging Dies for Gears for Power Tiller KMB200	1 Set
Measuring Instruments				
All AME Shop			Special Gauges and Inspection Instrument	a Part of 1 Lot
Inspection Room			Special Gauges and Inspection Instrument	a Part of 1 Lot

Table AI-2-3-5 RATE OF FAILURE OF MAJOR EQUIPMENT

Shop		AME2			AME3			AME4			Total		
Equipment	Type	No. Instl'd	No. Failure	Rate of Failure (%)	No. Instl'd	No. Failure	Rate of Failure (%)	No. Instl'd	No. Failure	Rate of Failure (%)	No. Instl'd	No. Failure	Rate of Failure (%)
Hitachi Seiki Turret Lathe	3A	14	10	71	8	3	38	8	3	38	30	16	53
Hitachi Seiki Turret Lathe	4A	5	4	80	5	1	20	6	0	0	16	5	31
Hamai Turret Lathe	1A	6	6	100	8	1	13	4	4	100	18	11	61
Okuma Mach. Lathe	LS,LK etc.	30	15	50	10	1	10	4	3	75	44	19	43
Total		55	35	64	31	6	19	22	10	45	108	51	47

Table AI-2-3-6 PROPOSED WORKS ASSIGNMENT FOR FACILITY IMPROVEMENT AND MAINTENANCE

Technical Classification			Remodelling & Renewal of Prod. Facilities				Maintenance of Existing Production					
			Production Engineering Shop			Die Making Shop	Auxiliary Machine Shop in No.3 HI, Sinde					
Stage of Investment			M			S	S					
Facilities/ Technical Features			Equipment: Multi-Purpose	Equipment: Single-Purpose	Jigs	Dies	Equipment	Spare Parts Control	Jigs	Dies	Fork Lift	Development and Trial Mfrg. of Agricultural Machines
			-Machine Tools -Press		-Jig for Machining -Jig for Assembling -Jig for Welding -Template and Model	-Dies for Forging -Dies for Press -Dies for Casting -Deicast Die	-Machine Tools -Press -Other Facilities -Others	-Machine Tools -Press -Other Facilities -Others	-Jig for Machining -Jig for Assembling -Jig for Welding	-Dies for Forging -Dies for Press -Dies for Casting	-Fork Lift	Make Trial Manufacturing of Component Parts for the Developed Products
Mix to be Assigned	No.1 HI		x		x	x						
	No.3 HI		x		x	x	x	x	x	x	x	
	No.4 HI		x		x	x						
Production Line	Agricultural Machinery (AM)		x		x	x	x	x	x	x	x	x
	Electric Products (EP)		x		x	x	x	x	x	x	x	
	Automobile (LV)		x		x	x				x		
Functions & Systems	Development and Design	New Products Manufacturing Technology		▲ (Partial)	x	x						
		Remodelling Technology	x	x	x	x						
		Maintenance Technology			x	x	x	x	x	x	x	
	Drawing	Specification	x	x	x	x						
		Ass'y Finish DWG	x	x	x	x						
		Complete Parts DWG	x	x	x	x						
		Sequence DWG	x	x	x	x						
		Maintenance Tools DWG					x		x	x		
	Production	The Total Component Parts		x	x	x						
		Specified Parts					x		x	x		x
		Assembly and Adjustment		x	x	x	x	x	x	x	x	
	Inspection	Facility Performance			x	x						
		Performance					x		x	x	x	
Specification of Plant Facility	Size of Workable Component Parts: L			x	x	x						
	: M			x	x	x	x		x	x		x
	: S			x	x	x	x		x	x	x	x

Table AI-2-3-7 LIST OF SHOPS TO BE DEBOTTLENECKED

	Bldg. No.	Nomenclature	Products								BCM*		
			DE	PT	PH	MH	HT	Sp	Pu	Ge	ME	HE	SE
1	3-05	AME Component Mfg Shop No.1								x			
2	3-17	AME Component Mfg Shop No.2	x	x	x			x	x		x		
3	3-18	Die Making and Repairing Shop	x	x	x	x	x			x			
4	3-26	Hand Tool Finishing Shop					x						
5	3-44	Wood Working Shop	x		x	x	x	x	x				
6	3-03	AME Assembly Shop No.1	x	x	x				x				
7	3-25	Hand Tool Forging Shop		x			x						
8	3-31	Mamootie Forging Shop				x							
9	3-12	AME Assembly Shop No.2						x	x				
10	3-18	AME Component Mfg Shop No.3	x	x					x		x		
11	3-47	AME Component Mfg Shop No.4	x	x					x				
12	3-41	Press and Welding Shop	x	x	x			x			x		
13	3-43	Saw Mill	x		x	x	x	x	x				
14	3-30	Mamootie Finishing Shop				x							
15	3-14	*Plating Shop No.1*	x	x			x	x					x
16	3-42	Combined Heat Treatment Shop	x	x			x		x	x		x	x
17	3-19	Material Planning Dept. Office & Main Store	x	x	x		x	x	x	x			
18	3-16	Material Store	x	x	x	x	x	x	x	x			
19	3-50	Transit Store	x	x	x		x	x	x	x			
20	3-28	Store for Paint	x	x	x	x	x	x	x	x			
21	3-29	Manufactured Component Store	x	x	x	x	x	x	x	x			
22	3-51	Manufactured Products & Component Shop	x	x	x	x	x	x	x	x			
23	3-13	Boiler Room	x	x	x		x	x	x	x			
24	3-15	Inspection Room	x	x	x	x	x	x	x	x			
25	3-04	Painting Shop											
26	3-11	Electric & Service Sec. under Technical Planning Dept.											
27	3-33	Technical Sec. under Technical Planning Dept.											
28	3-	Technical Training School											
29	3-	Agriculture Research & Development Farm											
30	3-	Motor & Transportation Section (M/T)											

Notes: * (BCM): Bottleneck Countermeasures
DE: Diesel Engine PT: Power Tiller PH: Power Thresher MH: Mamootie Hoe HT: Hand Tools
SP: Sprayer Pu: Pump Ge: Generator ME: Machining Equipment
HE: Heat Treatment Equipment ST: Surface Treatment Equipment

Table A1-2-3-8(1) LIST OF BOTTLENECKS AT NO.3 HI AME SHOPS

Shop.Name	Equipment	Qt'y	Requirements
AME Component Shop No.2	1) Multi-spindle Drill m/c	1 set	All the drilling works are being done by the vertical drill, forming the bottleneck to date. It is recommended to introduce a Multi-spindle Drilling Machine to rationalize works in drilling a lot of holes on items such as KND5B Main Bearing Case.
	2) Facing and Centering m/c	1 set	The machine is used for machining both crankshaft and cam shaft of engine. As the both works are performed at the same time, installation of another facing and centering machine is recommended to eliminate the bottleneck.
	3) Automatic Copying Lathe	2 sets	Same reason as above-said.
	4) Crank Pin Lathe	1 set	Accuracy of the both of the existing lathes has been considerably lowered. However, stopping of the operation for maintenance is not possible. Recommended measure is to procure an identical alternative machine and repair the existing machines one by one.
	5) Cylindrical Grinding m/c	2 sets	Machining of many items such as cam shaft, balancer shaft, cam idle gear, C10 shaft and S6 shaft is currently done using the two machines and has caused confusion in the work. To solve the problem a new machine specially installed for machining of cam shaft is required.
	6) Ram-type Turret Lathe	2 sets	This machine is to be added as machining of special bolts and nuts is a bottleneck of the line today. (Uses of 3AIII or STRONG 650 is also feasible.)
AME Component Shop No.3	1) Ram-type Turret Lathe	2 sets	Same reason as above-said. (Uses of 3AIII or STRONG 650 is also feasible.)
	2) Ram-type Turret Lathe	4 sets	Nine different type gear blanks are being machined with 3 lathes. The capacity of these existing lathes are not sufficient and forming a bottleneck. For performing machining conforming to the original technical requirement, installation of 4 sets of machine is necessary.
	3) High Speed Precision Lathe	4 sets	Machining of tappet, main bearing bush, main bearing case, rocker arm and others are being performed with 10 machines, i.e. 4 LSs and 6 STRONG 650s. Since the total capacity is not sufficient an additional installation of 4 machines is required.

Table AI-2-3-8(2) LIST OF BOTTLENECKS AT NO.3 HI AME SHOPS

Shop Name	Equipment	Qt'y	Requirements
AME Component Shop No.3 (cont'd)	4) Pulley Machining Equipment	1 set	4A-II Turret Lathe is used to make up capacity shortage of MONFORT pulley machine is the existing cylinder head machining line, and this is causing confusion in the works. It is recommended to establish an independent line with the new machine.
Press and Welding Shop	1) Arc Welding m/c	2 sets	Welding work is required for 80% of the forged parts. This welding work is done currently with 3 welding machines but the capacity is not sufficient. New installation of 4 welding machines is recommended.
	2) Pipe Bending m/c	1 set	Bending work of KMB200 30" steel wheel is being done with the bending machine located in AME Component Shop No.1. One set bending machine in this shop is necessary since there are problems in transportation, material handling and capacity of the said machine.
Combined Heat Treatment Shop	1) Shot Blasting Equipment	1 set	Currently scale removal works on large-sized parts such as crankshaft etc. are performed in Foundry Shop, where a large capacity is available. However, transportation for this work is being done with much difficulty and capacity allowance of existing blasting machine is short. For these reasons one set of the equipment is to be installed in this shop.
	2) Salt Bath Heat Treatment Equipment	1 set	The existing hardening equipment I-1, 4-1, 4-5, 4-8 and 4-13 through 16 is being used in high load and is not equipped with enough spare capacity. If this equipment breaks down then the entire production is shut-down. Therefore, an additional machine is required. A hand-operated type is acceptable.
Plating Shop No.1	1) Name Plate Photo Printing Facilities	1 set	The existing machine, domestically manufactured, is not suitable for production in a large quantity. Installation of one set machine with apparatus for making negative plates for aluminium name plate is recommended.

Table AI-2-3-9 LIST OF REQUIREMENTS FOR MATERIALS HANDLING EQUIPMENT

	Bldg. No.	Nomenclature	Products								Strengthening of Materials Transferring and Handling Equipment							
											Shop				Store etc.		Shop to Shop	
			DE	PT	PH	MH	HT	Sp	Pu	Ge	PL	JD	AS	MI	RC	TF	Rp	AP
1	3-05	AME Component Mfg Shop No.1								x	x	x	x	x				
2	3-17	AME Component Mfg Shop No.2	x	x	x			x	x		x	x	x	x				x
3	3-18	Die Making and Repairing Shop	x	x	x	x	x			x	x		x	x				x
4	3-26	Hand Tool Finishing Shop					x				x		x	x				x
5	3-44	Wood Working Shop	x		x	x	x	x	x		x			x				x
6	3-03	AME Assembly Shop No.1	x	x	x				x		x		x	x				x
7	3-25	Hand Tool Forging Shop		x			x				x	x	x					
8	3-31	Mamootie Forging Shop				x					x	x	x					x
9	3-12	AME Assembly Shop No.2						x	x		x		x	x				
10	3-18	AME Component Mfg Shop No.3	x	x					x		x	x	x	x				
11	3-47	AME Component Mfg Shop No.4	x	x					x		x	x	x	x				
12	3-41	Press and Welding Shop	x	x	x			x			x	x	x					x
13	3-43	Saw Mill	x		x	x	x	x	x									
14	3-30	Mamootie Finishing Shop				x					x							
15	3-14	Plating Shop No.1	x	x			x	x			x							x
16	3-42	Combined Heat Treatment Shop	x	x			x		x	x	x		x					x
17	3-19	Material Planning Dept. Office & Main Store	x	x	x		x	x	x	x					x	x	x	x
18	3-16	Material Store	x	x	x	x	x	x	x	x					x	x		
19	3-50	Transit Store	x	x	x		x	x	x	x					x	x		
20	3-28	Store for Paint	x	x	x	x	x	x	x	x					x	x		
21	3-29	Manufactured Component Store	x	x	x	x	x	x	x	x					x	x		
22	3-51	Manufactured Products & Component Shop	x	x	x	x	x	x	x	x					x	x		
23	3-13	Boiler Room	x	x	x		x	x	x	x								
24	3-15	Inspection Room	x	x	x	x	x	x	x	x				x				
25	3-04	Painting Shop													x			
26	3-11	Electric & Service Sec. under Technical Planning Dept.													x	x		
27	3-33	Technical Sec. under Technical Planning Dept.																
28	3-	Technical Training School													x	x		
29	3-	Agriculture Research & Development Farm																
30	3-	Motor & Transportation Section (M/T)													x	x		

Notes: DE: Diesel Engine PT: Power Tiller PH: Power Thresher MH: Mamootie Hoe HT: Hand Tools Sp: Sprayer
Pu: Pump Ge: Generator
PL: Material Handling in Production Line JD: Jigs and Dies Handling AS: Jigs and Dies Arrangement and Storage
MI: Measuring Instruments and Tools Arrangement and Storage RC: RM and CP Arrangement and Storage
TF: Transportation Facility Rp: Repair AP: Additional Procurement

Table A1-2-3-10(1) PART REJECT RATES, - KND5B ENGINE -

Name of Parts	Production		Rej.
	Good	Rej.	%
Cylinder Frame	5,000	500	10
Nut for Cylinder Head Bolt	20,000	246	1
Blind Cover for Lube Oil Pipe	5,000	1	0.2
Plug for Drain Pipe	5,000	263	5
Cylinder Liner	5,000	166	3
Gear Case Cover	5,000	500	10
Rear Cover	5,000	249	5
Oil Supply Ring	5,000	421	8
Main Bearing Bush	5,000	500	10
Cylinder Head	5,000	843	17
Intake & Exhaust Valve	10,000	310	3
Rocker Arm Box Cover	5,000	500	10
Silencer Flange	5,000	166	3
Air Cleaner Flange	5,000	342	7
Plus Wheel	5,000	500	10
Connection Rod Assembly	5,000	23	1
Cam Gear	5,000	152	3
Cam Shaft Bush (H/S)	5,000	258	5
Intake & Exhaust Tappet	10,000	683	7
Intake Rocker Arm	5,000	500	10
Exhaust Rocker Arm	5,000	500	10
Starting Gear Shaft	5,000	240	5
Cam Shaft Bush (P/S)	5,000	254	5
Pin for Starting Gear Shaft	5,000	26	1
Bush (A) for Starting Gear Shaft (F/S)	5,000	500	10
Supporter for Covernor Weight	5,000	46	1
Covernor Weight Pin	10,000	374	4
Covernor Spindle	5,000	103	2
Fork Lever Assembly	5,000	132	3
Rocker Arm Shaft	5,000	500	10
Piston Pin	5,000	267	5
Connecting Rod Bolt	10,000	1000	10
Joint Bolt	10,034	970	10

Table AI-2-3-10(2) PART REJECT RATES, - KND5B ENGINE -

Name of Parts	Production		Rej.
	Good	Rej.	%
Oil Pressure Indication Valve & Spindle	5,000	306	6
Water Hopper	5,000	9	1
V. Pulley (E/S)	5,000	500	10
Adjusting Rod	5,199	170	3
Hex. Bolt	25,000	1221	5
Hex. Nut	20,000	298	1
Hex. Bolt	1,000	308	3
Hex. Nut	20,000	1399	7
Plug	5,000	125	3
Hex. Nut	50,000	1519	3
Setting Nut for Silencer	5,000	334	7
Eye Bolt	5,042	40	1
Setting Pin	5,000	3	0.6
Oil Seal Cover	5,000	134	3
Piping Bolt	5,000	500	10
Lock Nut	10,000	274	3
Covernor Spindle	5,000	103	2

Table A1-2-3-11 LIST OF SHOPS STUDIED RE. QUALITY CONTROL AND REQUIREMENTS FOR ENSURING Q.C.

		Nomenclature	Products								Requirement for Ensuring Quality			
			DE	PT	PH	MH	HT	Sp	Pu	Ge	Mg	Pg	AO	MI
1	3-05	AME Component Mfg Shop No.1								x				x
2	3-17	AME Component Mfg Shop No.2	x	x	x			x	x					x
3	3-18	Die Making and Repairing Shop	x	x	x	x	x			x				x
4	3-26	Hand Tool Finishing Shop					x							x
5	3-44	Wood Working Shop	x		x	x	x	x	x					x
6	3-03	AME Assembly Shop No.1	x	x	x				x			x	x	x
7	3-25	Hand Tool Forging Shop		x			x							x
8	3-31	Mamootie Forging Shop				x								x
9	3-12	AME Assembly Shop No.2						x	x			x		x
10	3-18	AME Component Mfg Shop No.3	x	x					x		x			x
11	3-47	AME Component Mfg Shop No.4	x	x					x					x
12	3-41	Press and Welding Shop	x	x	x			x						x
13	3-43	Saw Mill	x		x	x	x	x	x					
14	3-30	Mamootie Finishing Shop				x								x
15	3-14	Plating Shop No.1	x	x			x	x						x
16	3-42	Combined Heat Treatment Shop	x	x			x		x	x				x
17	3-19	Material Planning Dept. Office & Main Store	x	x	x		x	x	x	x				
18	3-16	Material Store	x	x	x	x	x	x	x	x				x
19	3-50	Transit Store	x	x	x		x	x	x	x				
20	3-28	Store for Paint	x	x	x	x	x	x	x	x				
21	3-29	Manufactured Component Store	x	x	x	x	x	x	x	x				
22	3-51	Manufactured Products & Component Shop	x	x	x	x	x	x	x	x				
23	3-13	Boiler Room	x	x	x		x	x	x	x				
24	3-15	Inspection Room	x	x	x	x	x	x	x	x				x
25	3-04	Painting Shop												
26	3-11	Electric & Service Sec. under Technical Planning Dept.												
27	3-33	Technical Sec. under Technical Planning Dept.												
28	3-	Technical Training School												
29	3-	Agriculture Research & Development Farm												
30	3-	Motor & Transportation Section (M/T)												

Notes: DE: Diesel Engine PT: Power Tiller PH: Power Thresher MH: Mamootie Hoe HT: Hand Tools Sp: Sprayer
Pu: Pump Ge: Generator Mg: Machining Pg: Painting AO: Ass'y and Operation
MI: Measuring Instrument

Table AI-2-3-12(1) NO.3 HI AME ADDITIONAL INSTALLATIONS REQUIRED FOR ENSURING PRODUCTS QUALITY CONTROL

Facility	Shop Name	Equipment	Qt'y	Requirements
Machining Facility	AME Component Shop No.3	1) Turret-Head Drilling	1 Set	AII type Turret Lathe is being used for machining of models KND5B and KND7 diesel engine cylinder head valve port and valve stem hole. Since the lathe has been deteriorated and ensuring accuracy in the machining is difficult, the change of machining method is necessary.
		2) Equipment for Machining Connecting Rod, Bolt Hole	1 Set	Machining of bolt hole tightening diesel engine connecting rod big end and cap requires a high accuracy. The machining using the existing upright drilling machine and jig is depending on skill of the worker and accuracy of work in this way. Employing an index type borer is recommended to improve the quality of work.
Painting Facility	AME Assembly Shop No.1	1) Painting Equipment for Engine	1 Set	Painting of a product is important not only to enhance its value but also to prevent rust on it. In the existing painting system degreasing is not completely done and hardness of the coat is not sufficient. Therefore, the painting system is to be renewed when the ass'y line layout is remodeled.
	AME Assembly Shop No.2	2) Painting Equipment for Power Tiller Thresher and Reaper	1 Set	The painting facility in this shop is being used for painting pump parts only for Saudi Arabia to date. This equipment needs to be reconditioned and utilized as the shop layout is revised into painting shop of Power Tiller, Thresher and Reaper.
Assembly and Operation Facilities	AME Assembly Shop No.1	1) Testing Equipment for Diesel Engine	1 Lot	The individual engines after assembly are not being tested for the quality and performance. To make sure of testing these items, it is recommended to install newly 2 sets electric cradle dynamometers, 5 sets fan brakes and other measuring instruments required for the quality check.
		2) Leakage Checking Equipment for Diesel Engine	1 Lot	Testing oil leakage of engine after ass'y is required because many of component parts have been nationalized but especially in cast parts some blowholes and cracks are observed.
		3) Special Assembling Jig for Diesel Engine	1 Lot	Tools to insert or set bearings, bushes, plugs, etc. are being used but these are considerably abraded and degraded. This may cause inferior quality and performance of Engine, Power Tiller and Thresher and is not favorable to safety. Therefore, these tools are to be replaced soon.
		4) Special Assembling Jig for Power Tiller	1 Lot	
		5) Special Assembling Jig for Thresher	1 Lot	

Table AI-2-3-12(2) NO.3 HI AME ADDITIONAL INSTALLATIONS REQUIRED FOR ENSURING PRODUCTS QUALITY CONTROL

Facility	Shop Name	Equipment	Qt'y	Requirements
Measuring Instrument	AME Component Shop No.3	1) Special Gauges for Machining Parts for KND5B & KND7	a part of 1 Lot	To add special gauges due to deterioration of existing gauges.
	AME Component Shop No.4	2) Special Gauges for Machining Parts for Power Tiller	a part of 1 Lot	
	Inspection Room	1) Coordinate Measuring Machine	1 Set	To materialize high accuracy and speed in measuring at nationalization of crankcase, crankshaft and transmission case and other large-sized component parts manufacturing. The new instruments are to be utilized also by Auxiliary Machine Shop commonly.
		2) Roundness Measuring Instrument	1 Set	
		3) Surface Roughness Measuring Instrument	1 Set	
		4) Plating Tester	1 Set	To perform quality check of plated parts or painted parts.
		5) Salt Spray Tester	1 Set	
		6) Inspection & Measuring Instrument	1 Lot	To replenish shortage of the existing micrometer, vernier calipers, etc. and eliminate insufficiency in measurement of the products and parts.
	All AME Shops	1) Inspection & Measuring Instrument	1 Lot	