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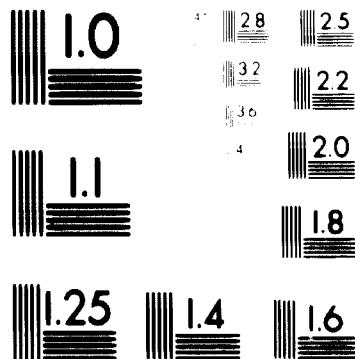
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BUDAPEST

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FINAL REPORT

On Repair and Maintenance of Industrial Equipment
in Republic of Indonesia

UNIDO Purchase Order No. 818 68-259.



2650

BUDAPEST, 1969.

TESCO
CONSULTING ENGINEERING CO.
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FINAL REPORT

**On Repair and Maintenance of Industrial Equipment
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UNIDO Purchase Order No. SIS 68-259.

Prepared by


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BUDAPEST, 1969.

Abstract

This report on one hand deals with the characteristic features of repair and maintenance of industrial equipment in the Republic of Indonesia and on other hand concludes in recommendations to improve the level and standard of their activities. The statements and conclusions of the Report are based on the direct experiences and observations of a team of two experts visiting near 30 different firms and enterprises all over Indonesia in one month, period.

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I. PREFACE

Preliminaries

The United Nations Industrial Development Organization /UNIDO/ intends to start a long-term campaign for the improvement of the repair and maintenance services of industrial equipment in developing countries.

With respect to the above theme UNIDO made a contract with TESCO Consulting Engineering Co. to carry out a survey of existing repair and maintenance services in the Republic of Indonesia and to prepare a report and recommendations for helping UNIDO.

- to formulate a long term working programme for the technical assistance to be rendered,
- to identify the crucial spots of industries where assistance would be urgently needed,
- to draw up a long term policy for assisting developing countries in the field of repair and maintenance.

Short description of field work

The field study under contract was carried out by a team of two experts - the signatories to this report. The team having been briefed by the UNIDO staff members concerned in Vienna arrived in Djakarta on 9.2.1969.

In the first few days the team accompanied by Mr. Delos called on the leaders of the Institute of Industrial Research and Training and other important officials regarding completion of the survey. During the visits the team informed the leaders concerned about the aims and limits of the field study and asked them to single out those characteristic samples of industries, enterprises and factories under their guidance where the team could collect necessary and reliable information to create a true picture of repair and maintenance

activities, and to identify the crucial fields and problems where immediate help would be necessary.

In the period between 10 and 13 February in close co-operation with the staff members of the above-mentioned Institute and especially with Mr. H. Ismail, the appointed consultant the team agreed on a preliminary program of visiting about 20 different factories and enterprises on Java in the district of Djakarta, Bandung, Semarang and Surabaya. However, that program of visits was extended later to Palembang and Padang in Sumatra /for detailed program and schedule of visits see Appendix A/.

From 13 February to 12 March the above program was carried out according to schedule.

Basic data of Final Report, their sources and values.

It can be stated that during the study the team succeeded, on the whole, in collecting the necessary basic information concerning repair and maintenance work in Indonesia, thanks to the kind help and understanding of the officials concerned, but the Authorities and firms were unable to provide the reliable and up-to-date data required for the quantitative and specific analysis stipulated in the team's contract. Therefore, to fill the gap the team has requested the Central Office of Statistics to furnish the basic information at their disposal concerning the detailed particulars of main industries and firms, their impact on national income and export, etc. With a deep understanding of the problems they have tried to do their best, but, with a few exceptions, owing to lack of previous survey and obsolete summaries of which the latest was dated 1964 they could not provide the necessary information.

Personal observations and experiences .

The Report is primarily in compliance with the briefing of UNIDO based on the team's personal impressions and

informations collected during the field study. Considering the short time at disposal it was out of question to get trustworthy and genuine written answers or to analyse the specific points of view of repair and maintenance on the spot. Therefore the gathered informations were in many cases supported only by the outlook of visited factories, their equipment and repair facilities, and by verbal explanations given by the leaders concerned. The subjectivity of partners, the contradictions in the answers, observations on the field and other informations were filtered by experts and only those data were for qualifying the picture on repair and maintenance, which had been supported by own practice and experience of the team members.

Written documents and data

Working out the report to verify the importance of main industries from aspect of national economy and to ponder the importance of the visited firms statistical reports and other authentic sources were used. These sources are enumerated in the bibliography.

It is regrettable but must be mentioned, that sometimes among the different sources have been significant deviations. In these cases only those data are used which directly or indirectly are supported by other official sources and correspond with the team's experience.

Method of evaluations and character of recommendations

Considering the relatively great number of existing industries, enterprises and factories, and the number of visited firms /see table 2/ the team's method, generalising the resume of observations of a few samples to the whole lot, may be accounted as a kind of sampling system. The fact that the chosen individual firms and industries cannot be accounted as accidental samples - because they were mainly selected on the base of wish of the authorities concerned and their importance and impact on national economy - it is counterbalanced by their share of relatively great number of labourers from the total and

by the observation that the important symptoms have been common in every visited enterprise. Consequently the observations mentioned in this report can be taken as characteristics of the repair and maintenance services in Indonesia and the conclusions, are based on a good average.

II. NATIONAL ECONOMY AND QUALIFICATION OF REPAIR AND MAINTENANCE

The observations and conclusions outlined below follow the sequence of items stipulated in the contract in paragraph III/1-4 of annex "A".

1. Important Industries including Transportation and Agriculture

a/ Structure Industry

The majority of industries is nationalized and at present it is working under the guidance of different Ministries and Authorities.

The main industries being subject of present survey are:

- Machine Industry
- Textile Industry
- Chemical Industry
- Food Industry
- Paper Industry
- Cement Industry

The majority of industries is located on Java and in certain extent on Sumatra islands. Near the total of industrial establishments are belonging to processing industries, but it is worth mentioning that a rather significant machine industry exists. Some of the machine industrial firms, considering the quality and quantity of machine tools, and labourers represent significant productive capacity. The relative weight of machine industry can be seen in Table 2 of appendix "B".

A short description of the visited factories and enterprises representing these industries can be found in appendix "D". Some other important, but not visited firms

given by the Central Office of Statistics are enumerated in Table 5.

In the opinion of authorities concerned there are no significant alterations allocated in the next future to improve the structure and to upgrade the production.

Transportation

According to the wish of Authorities the following transport facilities were surveyed:

- sea transport
- road transport
- air transport and
- railways.

Grading these branches from the point of view of territorial and industrial connection the most important is the sea and road transport. The railways have only local importance in Java and in Sumatra.

The majority of road transport park is private owned. A short description of the visited state owned firms representing the railway, sea and air transport can be found in appendix "D". The registered transport park is to be seen in Table 3.

Agriculture

With regards to the opinion of Authorities, the level of mechanization is very low, therefore the team's investigation was not extended to this field.

b/ Age of firms and other pertinent information

Industry

The average age of industrial firms may be estimated at more than 50 years. In the field of traditional industries such as Sugar, Feed, and Cement, firms 60-80 years old

occur. The Chemical and Textile Industry is more recent than the average.

The age of the important transport firms was not available.

The age or foundation date and some other data of the visited industrial and transportation firms can be seen in appendix "D". The name, location and foundation date of a few other factories considered important can be found in Table 5 of appendix "B".

c/ Importance and impact on national economy

The distribution of total employment according to the different sectors of the national economy can be seen in Table 1 of appendix "B".

The importance of the sectors surveyed and their relative share in national income in the average for 1960-64 were as follows: agriculture 55 %, industry 11 %, transport 3 %, mining 3 %. Consequently, it can be concluded that the most important sector is agriculture. The impact of industry and transport is of secondary importance. However, considering the role they should play in the economic life of a developing country they cannot be neglected.

As for mining, it is one of the most important sectors from the point of view of experts /see below under point d/.

d/ Importance in the field of exports

At present, of the various sectors only agriculture and mining /mineral products/ have export interests worth mentioning. /See Table 4 of appendix "B"./ Their shares in the total export are nearly 50-50 %.

e/ Type, age and condition of equipment in the various firms

Industry

Some detailed information regarding the equipment of the various firms can be found in appendix "D".

The equipment both for production and maintenance of the firms visited were delivered by different countries and consisted of different types. Dominant types were not identified. It may be stated that to a certain extent the suppliers of older firms were western countries and of younger ones, eastern countries.

The average age of industrial equipment may be estimated at 15-25 years.

The condition of equipment taking into account the time of delivery and working circumstances, is satisfactory, with a few exceptions.

Transportation

The transport park and the service equipment of the branches and firms visited were delivered by different firms and consisted of very different types. Dominant types were not identified. The exceptions are that the majority of passenger carriages of railways are of East German and Hungarian origin, and the aircraft with their service installations, have been supplied mainly by US and English factories.

The average age of rolling stock and service equipment can be estimated at 10-15 years for the railways and at 5-8 years for road transport. The data for estimating the average age of the merchant fleet were not available. The airplanes were mostly delivered in 1965.

The condition of transport park and service equipment of

railways and air transport, considering their average age and working climate is satisfactory.

The average condition of vehicles is below the acceptable limit. This statement concerns the merchant fleet too. Here it must be noted that the bad state of merchant ships is not the outcome of shortage in the capacity of shipyards but in the opinion of shipyard managements the result of consequently neglected docking.

2. Existing Repair and Maintenance Facilities

a/ In different firms according to sectors

Industry

It can be ascertained that most of the visited factories have their own maintenance units, with more or less equipped maintenance workshops. This unit consists of one chief, usually an engineer, and of workers. The unit has a separate spare-part store, /see Table 6 and Appendix D/. Unfortunately, this unit is below the minimum standard even for larger factories. Technicians are lacking between the leading engineer and the manual labourers for keeping records of the spare-part stock, drawings, machine manuals and filing cards. Under these conditions, even if it existed, the maintenance schedule could not be carried out.

On average, the number and composition of the machines in the workshops are adequate, but most of the machines are out-of-date and unsuitable for work of satisfactory quality.

Most factories have spare-parts stores, but in many cases these are limited to store premises only as there are no stocks owing to financial difficulties. Factories which have a spare-part stock with records kept and a storage system, are in many cases inadequate as regards the controlled storage system necessary for scheduled

maintenance. There are few of these /see Appendix D/, hence the estimated storage stocks which we prepared according to information received, do not always cover the actual demands because the necessary fast turning spare parts may not be on stock.

Generally, we consider a 6-12 months stock adequate.

Transportation

Most transport companies have their own maintenance firms.

The rail, aircraft and ship maintenance companies are acceptable, in fact, satisfactory, but the road transport companies have no maintenance unit of suitable capacity and standard. Therefore, 50 % of the vehicles are not operational, according to our estimates.

Here it should be mentioned that the repair and maintenance of heavy construction machinery especially outside Java is not properly solved.

b/ On regional or industrial level

There are no central repair workshops and spare parts stores on industrial or regional level even in the case of bigger enterprises having more than one factory. The exception is the Transportation sector where the capacity of shipyards, the railways repair shop and the central maintenance shop of aircrafts are sufficient.

c/ Availability of spare parts

For the time being the majority of spare parts requirement is covered by importation. There are some exceptions such as the majority of machine industry, the shipyards and the railways which are nearly self supporting. These firms produce their own need of spare parts besides some delicate items and normal commercial goods.

There are no extraordinary difficulties or restrictions concerning importation of spare parts. However to some extent the acute financing problem of the Indonesian economy and shortage of foreign currency limit the supply.

d/ Availability of spare parts manufacturing facilities

The machine industry capable of manufacturing spare parts in bigger quantity already exist but the utilization of this industry is low due to the above mentioned acute economic and financing problems of Indonesia and bad marketing. In most of the visited firms the idle capacity were near to 50 %.

The existing firms, considering the composition and quantity of machine tools represent significant productive capacity, however in some technological branches there are bottlenecks and quality problems, for example in the field of metal and ferrous castings, heat treatment, surface treatment, heat forming and in fine machining.

At present the factories in order to improve their utilization are starting to manufacture spare parts reasonably satisfactorily for other industries but in many cases they have difficulties due to the lack of standardization and high production costs. The buyers sometimes do not rely on the quality of local products and prefer importing.

e/ Availability of organized stores

As it was concluded above the majority of factories has its own spare parts store. The description and symptoms of these stores can be seen under point 2a.

It should be mentioned that there are no central spare parts stores organized on regional or industrial level. However in some branches especially in the textile and sugar industries the advantage of this solution would be obvious.

3. Prevailing conditions of repair and maintenance activities

a/ Standard of repair and maintenance

In general the standard of repair and maintenance activity is low. It may be stated that with the exception of the railway-rolling stock and aircraft where periodical supervision of equipment is a matter of vital importance and of brand new or lately rehabilitated industrial enterprises, where the management had been trained abroad there exists no satisfactorily carried out maintenance. One may consider this situation as not necessarily outcome of unsolved economic and financing problems, and in some extent the result of obsolete, worn out machinery which is not worth overhauling. It is mainly the result of not properly organized maintenance sections, spare parts supply, missing spare parts specifications and inventories. In the team's opinion the lack of "maintenance minded" management in the majority of visited firms and in some extent on industrial level is the basic reason of this inadequacy. From the points of view of different fields of industry the following sequence may be established:

For details see table 6 and appendix "D".

The sequence can be found on the next page.

b/ Industries or industrial equipment in which the problem of repair and maintenance is particularly acute.

It can be stated on the base of previous points that the problem of repair and maintenance is particularly acute on the field of:

Group	Denomination of Industry	Standard of repair and maintenance +
I.	Railways rolling stock	
	Aircraft	satisfactory
	Power plants	
	New Industrial Establishments	
II.	Paper Mills	
	Sugar Mills	
	Chemical Factories	
	Canning	adequate
	Cement Plants	
	A few metal working firms and shipyards as:	
	Pindad Army Factory	
	Dok Tandjung Priok	
III	Textile Industry	
	Road transport stock	
	Heavy construction machinery	unsatisfactory
	Merchant Fleet	

+ Here the data of Final Report of Mr. R. Korhonen, UNIDO expert on maintenance and inventory in Indonesia were taken into account too.

The base of classification was the following:

Group I

Production loss due to insufficient maintenance is low. The average idle time is below 10 % or other predesigned limit.

Group II

Production loss due to insufficient maintenance is low. The average idle time is below 15 %

Group III

Production loss is high. The average idle time is more than 15 %.

The average idle time in groups II and III was evaluated because the necessary statistics in the visited firms was available.

The idle time limits mentioned for Transport Firms were increased by 10 % each group.

- road transport park,
- heavy construction machinery,
- merchant fleet,
- textile industry⁺

Note: ⁺ excluding the new establishments.

c/ Factors affecting the adequacy of repair and maintenance facilities

As it has been outlined to some extent in previous paragraphs the following factors are affecting adequacy of repair and maintenance. The sequence outlined below - in the opinion of team - is identical with impact and significance of each symptom

- lack of maintenance minded management in the firms and to some extent on industrial level
- lack of properly organized and outfitted maintenance departments, spare parts inventories and well founded spare parts supply
- lack of Government or Private Institution and Coordinated Government policies dealing with repair and maintenance of industrial equipment
- lack of proper quality in locally produced spare parts
- shortage of qualified personnel in some special technological branches e.g. in casting, heat forming, welding, heat treatment and fine machining
- shortage of capacity in the above mentioned technological branches.

d/ Effect on maintenance and repair of lack of standardization and unnecessary variety of equipment

In compliance with paragraph II.1.e it must be stated that there were wide variations in the machine park in the firms visited. The variety in type and age is greater than can be accepted. This and the relatively many outdated types are the reason for a lot of difficulties in maintenance and repair work especially in organising

a supply of spare parts.

Moreover the above mentioned, the lack of standards both in the firms and on national level cannot be excluded from among major influences affecting repair and maintenance. However in the opinion of team the discussion and conclusion on this problem runs over the aims and limits of the present Report.

e/ Government organization or private institutions dealing with repair and maintenance

At present there is no Government organization or private institution to deal with the problem of repair and maintenance in the Republic of Indonesia. However, the advantages of this kind of institution were acknowledged by those concerned but as was discussed between the team and the leaders of the Institute for Industrial Research and Training only preliminary steps had been taken towards implementing this project owing to the lack of finance and experienced cadres.

f/ Government policy affecting repair and maintenance

According to the team's experiences the Government of the Indonesian Republic has already recognised the importance of a co-ordinated policy on repair and maintenance. This is proved by the fact that one of the major aims of the present Five Years Plan is the general rehabilitation of the national economy. However, here the team is obliged to point out that the leaders of the factories visited are looking for more practical help from the Government for solving their problems of repair and maintenance. Therefore, for improving the present situation it is necessary to work out a practical central government program dealing specially with the problems of repair and maintenance of industrial equipment in compliance with the recommendations outlined in paragraph III/5-7 and to coordinate it with the UNIDO Development Programme.

4. Personnel

a/ Availability of skilled personnel

Skilled workers

Both in production and maintenance the rate of skilled manpower compared to the total number of workers is generally about 40 %. That seems to be satisfactory, but one should consider that with few exceptions the apprentice training system is not known, and the skill of labourers based on experience rather than theoretical craftsmanship. This includes a working problem deviating from normal routine and the difficulties are multiplying.

Mid levelled executives

The number of technicians and high technicians in maintenance is below the necessary limit. Therefore no adequate number of mid-levelled executive is between engineer and worker.

Although the base of an adequate repair and maintenance organization consisting of responsible manager and more or less developed staff has been existing in the majority of visited firms, one of the main problem is the missing "maintenance minded" executives on managerial level. It is unfortunate that no course exists for improving the technical and managerial skill of the leaders in organizing repair and maintenance.

A list of personnel with experience on repair and maintenance met by the team during the visits is enclosed /see on table 7/.

b/ Availability of training facilities

Taking into account the dimensions of industry in Indonesia neither the capacity nor the territorial distribution of the existing Industrial Training Centres are

satisfactory. To the team's best knowledge on Java island three centres are in operation namely in Djakarta, at Bandung and Surabaya, but in other developing districts there are none.

In general the training centres deal with students finished secondary schools. The shops of Training Centre at Bandung moreover is used as a practical training facility for the Bandung Technical University.

In the training centres there are apprentice courses for the following trades: textile, machining /cutting/, motor mechanics and electricians.

The informations about technical secondary and high schools were not available. The Technical University at Bandung was not visited, but according to the gathered data no faculty for maintenance exists.

III Recommendations

The recommendations and program outlined below follow the sequence of items stipulated in the contract in paragraph III/5-6 of annex "A".

Under heading "Future Policy" the team is summing up the steps thought necessary for improving the present situation with priorities within each points if necessary and under heading "Suggested Programme of Implementation" indicates the prepared sequence of realization.

5. Future Policy

a/ Survey of maintenance and repair needs

It has to carry out:

- a detailed survey for the quantitative analysis of the total spare parts requirement and on the existing production capacity for the proper distribution of production among the machine working firms

- a detailed survey for establishing the most frequently used machine types in Textile and Sugar Industries, for finding out the possibility of rendering assistance by mother factories
- a detailed survey on service needs of road transport equipment and heavy construction machinery.

b/ Recommendations on upgrading of existing facilities

To improve the quality of locally made spare parts, to upgrade the production, to reduce the effect of bottlenecks and inequalities the team suggests the followings:

- setting up an up-to-date foundry for ferrous and non ferrous materials,
- extension of existing heat-treating, heat forming gear cutting surface treating, capacity /including grinding/.

The extensions must be carried out in accordance with the result of above mentioned surveys.

The suggested firms are: Pindad, PN. Barada and Indra factories.

To improve the standard of maintenance, experts are to be sent into each significant factory or enterprise mentioned on table 8 for helping the firm in organizing a programmed maintenance system. Helping the industries to solve the quality problems in some special technological branches such as ferrous- and nonferrous casting, heat treating, heatforming, welding, etc. experts are to be sent. The experts successively, calling on the significant factories concerned, in one or two weeks period could diagnose the defects and could give the necessary suggestions on the spot.

It is necessary to modernize and up-grade the capacity of the equipment of maintenance shops in the factories listed in Table 8, and described in appendix "D". The specifications for these activities shall be based on the experience

and written reports of the experts delegated for initiating the programmed maintenance in these factories.

c/ Recommendations on establishment of new facilities

To solve the repair and maintenance problem of the road transport and heavy construction machinery it is necessary to establish new repair centres and service stations according to the result of above mentioned survey.

With reference to the extent of different industries in Indonesia it is worth to set up on industrial level a maintenance Consulting Centre. The task of this Centre would be two-sided. The centre on one hand would assist the authorities concerned in drawing up short-, and long-term working programmes and policies in connection with repair and maintenance, and on the other hand it would help the factories in organizing programmed maintenance systems and reliable spare parts inventories and would help to coordinate spare parts requirement and possibilities of local manufacturing.

In the opinion of the team this centre can be established in Djakarta district either independently or as a subdivision of the Institute of Industrial Research and Training.

d/ Recommendations on improving existing stores and establishment of new ones.

To improve the existing stores and the composition of spare parts on stock in connection with organizing programmed maintenance mentioned, under point "b" and on "table 8", the experts work must be extended to this field too.

For the Textile and Sugar Industries central spare parts stores are to be established on regional level according to the results of previously outlined surveys.

e/ Required training

In compliance with paragraph II.4 it is necessary to organize:

- New in plant training facilities for technological branches of metal and ferrous casting, mechanics, welding heat treating and heatforming.

For this purpose the existing Training Centres are to be extended

- Short period vocational up-grading courses for mechanics, and mid-levelled executives in bigger firms /see notes on table 8/
- New Industrial Training Centre on Sumatra island similar to the existing ones. Proposed location is Palembang.

f/ Recommendation on the establishment of spare parts storage systems

For organizing the spare parts stores /see above under point "d"/ it is necessary that the experts start with initiating a maximum-minimum stock limit system where it is necessary.

The recommended new stores shall be organized on the basis of the minimum-maximum stock limit system.

g/ Recommendations on establishment of spare parts manufacturing facilities

The suggestion see above under point "C".

h/ Role that can be played by developing countries and mother factories

The help of developed countries should be useful:

- in replacing the out of date machine tools in the maintenance workshops mentioned appendix "D".
- in sending experts for surveys and organizing work outlined above

- in delivery of necessary equipment for the extension of technological branches and for establishing new training centre mentioned previously
- in establishing specialized service stations for road transport and heavy construction equipment.

6. Suggested Programme of Implementation

On the base of the previous paragraph the team suggests in the sequence of priorities the followings:

a/ Short term program for two years period:

- 1/ To send ten experts two by two successively to each factory listed on table 8, for a period of 2-5 months, for organizing and initiating the preventive maintenance and adequate spare parts store
- 2/ To send two experts for a period of one and a half year for assisting the Government in organizing the Maintenance Consulting Centre
- 3/ To send four experts successively to each factory noted on table 8, for a period of 2-5 months to improve the quality of products on the field of metal and ferrous casting, heat forming, welding and machining. Each expert must be a specialist at least one of the mentioned technological branches.
- 4/ To send teams to carry out
 - a detailed survey with suggestion on quantitative and production capacity analyses for spare parts /four experts for one year period/
 - a detailed survey with suggestions on service needs for road transportation and construction equipment /two experts for one year period/
 - a detailed survey and suggestion on improvement of merchant fleet maintenance /two experts for half a year period/

Note: the experts mentioned above should be international.

- b/ Long-term program for five years period or more according to the needs.
- 1/ To organize short period vocational courses for mechanics and mid-levelled executives continuously in the bigger factories
 - 2/ To organize high degree courses for management
 - 3/ To carry out the necessary extensions on Pindad, Indra and Barada factories, in casting and other special technological branches according to the result of survey
 - 4/ To carry out the extensions and modernization of repair and maintenance in the recommended factories.
 - 5/ To carry out the necessary extensions on the Industrial Training Centres in casting and other previously mentioned technological branches
 - 6/ To establish new Industrial Training centre in Palembang
 - 7/ To establish new service stations to road transportation and construction equipment according to the needs established by previous survey
 - 8/ To establish central regional spare parts stores for the Textile and Sugar Industries according to the needs established by previous survey.

7. Proposed schedule for short and long-term programs

Organizing preventive maintenance

Setting up maintenance consulting centre

To improve the quality

To carry out surveys:

- on quality and capacity of spares

- on service needs

- on merchant fleet docking

Organizing

- short period courses

- high degree courses

Carrying out extensions

- on existing factories

- on repair and maintenance sections

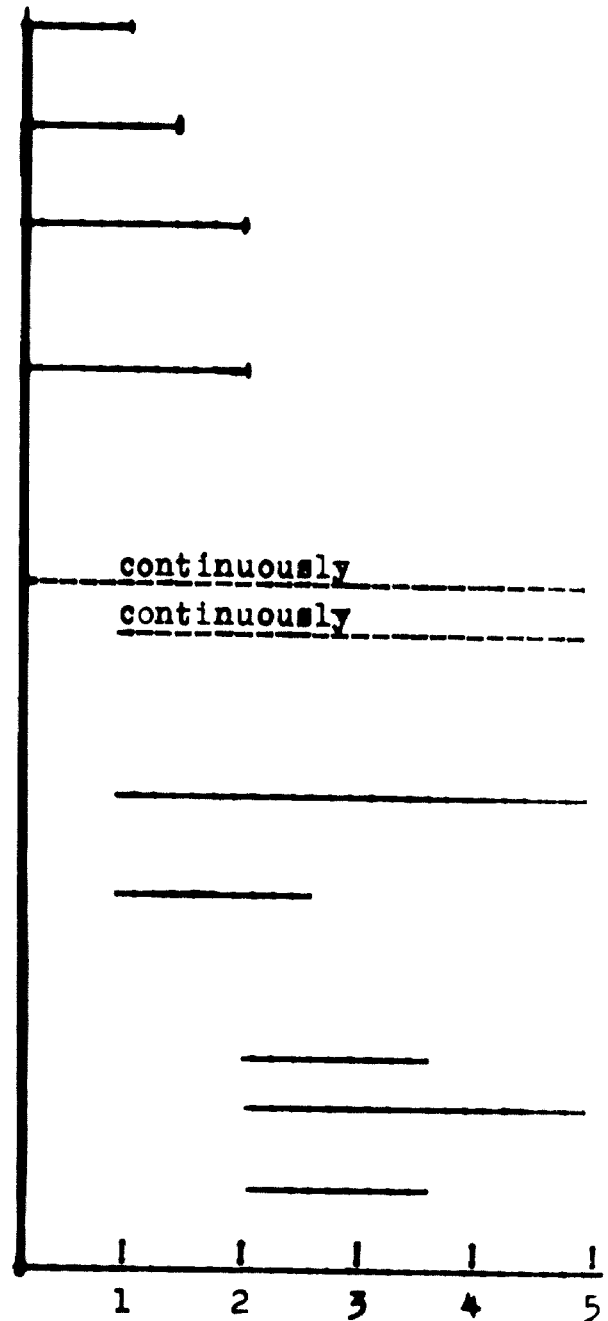
- on Industrial Training Centres

Establishing

- new Training Centre

- new Service Stations

- new regional spare parts stores



Appendix "A"

Appendix "A"

Scheduled Programme of Visits
in the Indonesian Republic
9 February - 14 March 1969

13-15	2	1969	<u>Djakarta</u>	
			Sabang Merauke	Metal-Working Industry
			PNKA Manggarai	Indonesian State Railways
			PN Dok. Tandjung Priok	Shipyard
17-21	2	1969	<u>Bandung</u>	
			P.T. Bandung Textile	Textile Industry
			Pindad Army Factory	-
			Textile I.T.I.	Textile Industry
			Central Industrial Laboratory	for total manufacturing Industry
			Industrial Train- ing Centre	for machine Industry
			Fabrik Mesin	Metal Working Industry
			Mentrust Canning	Food Industry
22	2	1969	<u>Djatiluhur</u>	
			Hydraulic Power Sta- tion	
			P.L.N.	
26	2	1969	<u>Semarang</u>	
			Kepala Unit VI. P.N.	
			Zatas	Origen Plant
			Projek Lamp Bulb Pidjar Lamp-Bulb Factory	Incandescent
27	2-2	3	1969	<u>Surabaya</u>
			P.N. Barata	Metal Working Industry
			P.N. Kryan Sugar	Food Industry
			P.N. Indra	Metal Working Industry
			P.N. Dok Surabaya	Shipyard
3-5	3	1969	<u>Djakarta</u>	
			Carya Ship Dock- yard	Shipyard

	P.L.N. Kalender	Electric Appliances
	P.N. Metrika	Electric Motors
7 3 1969	<u>Palembang</u>	
	P.N. Pupuk Striwidjaja Fertilizer Plant	
8 3 1969	<u>Padang</u>	
	P.N. Semen Padang	Cement Factory
10 3 1969	<u>Diakarta</u>	
	Garuda	Aircraft Repair and Maintenance

Appendix "B"

Tables 1 - 8

Table 1

**Distribution of Total Employment
in the National Economy
/1964/**

Field of Activity on Industrial Sector	% of total employment
Agriculture, Forestry and Fishing	65,37
Mining and Quarrying	0,42
Industry	6,31
Construction	1,49
Electr. Water and Gas Production	0,03
Trade and Commerce	10,89
Transportation and Communication	1,3
Services	12,51
Other	1,68
	<hr/>
	100,00

**Source: Economic Data for Investors in Indonesia
/Central Bank of Indonesia/**

Table 2

Manufacturing Industries
 Number of persons employed and number of
 establishments with more than 50 employees
 in 1964

Major groups of industries	No. of establishments	No. of persons employed	No. of establishments visited ^{xx}	No. of persons emp't. in visited establishments
Food manufacture	115	11 500	2	970
Tobacco	142	44 260		
Textiles	190	48 430	5	4800
Wearing apparel and made up textile goods	9	720		
Wood	10	940		
Furniture and fixtures	4	560		
Paper and products	6	1 400	3	2200
Printing	44	6 599		
Leather and products	14	2 100		
Rubber and products	38	7 930	1	
Chemicals and products	52	16 360	4	2150
Non-metallic mineral products	24	6 200	3	3500
^x Metal products except machines and transport equipment	39	6 260	7	4450
^x Manufacturing and repairing of machines exclusive electrical machines	20	3 030	4	2790
^x Manufacturing and repairing of electric machines and apparatus	11	1 860	3	221
Transport equipment	25	3 880	3	2100
Miscellaneous manufacturing	12	1 530		
Total	755	163 559	35	23181

^x Machine Industry

^{xx} Here the data of Final Report of Mr. R. Korhonen UNIDO expert on maintenance and inventory in Indonesia were taken into account too

XXI Does not include data on Pindad Army Factory

Source: Central Office of Statistics

Table 3

**Characteristic data of transport
equipments
/1965/**

Item	Unit	Remark
Motorized vehicles		
Passenger cars	units	127 853
Trucks	"	69 181
Buses	"	18 251
Merchant fleet		
Ocean Shipping	"	45 Total DWT 350 000
Inter Island Shipping	"	345 " DWT 403 215
Air Transport		
Aircrafts	"	33
Railroad Transportations		
Passengers	passenger km	5 894 246
Freight	ton km	791 603

Source: Central Office of Statistics and
Data for Investors in Indonesia

Note: The sources deviate from each other.
The given data are the higher values.

Table 4

**Export of Indonesia
in % of total value rounded off figures
/1967/**

Item	%
Living Animals and Animal Products	1
Agricultural products	49
Forestry products	2
Mineral products	44
Manufactured products and half manufactured products	4
Total export	100

Source: Central Office of Statistics

Table 5

**Important Industrial Firms
and Establishments**

	founded
Sugar Plants	
Djatirofo East Java	1963
Kebou Agung "	not available
Krebet Baru "	1919
Tasik Madu "	1925-30
Modjo Midle Java	not available
Cement Plants	
Pabrik Semen Padang Sumatra	1910
Pabrik Gresik Surabaya East Java	1957
Pabrik Semen Touasa Makasar	1968
Paper Establishment	
P.N. Blabah Mageloug Java	1961
Padalarang Padalaroung Java	1923
Letjes Prebolinggo Java	1939
Textil Establishment	
Bandung PT Bandung Java	1938
Busona Yosa Bandung Java	1933
Tjulatjap Tjulatjap Java	not available
Nebritex Surabaya Java	"
Chemical Establishment	
Unilever Surabaya Java	not available
P.N. Pupuk Sriwidjaja Palembang Sumatra	1963
Radje Farma Geberte Java	not available

Source: Central Office of Statistics

Table 6. Classification of Repair and Maintenance Services in the visited Enterprises

I t e m	Denomination of firms	No. of total emplo- yees	From the total		Maintenance Services		Character of maintenance			Standard of maintenance	
			No. of Eng.	Skilled workers as % of total emplo- yees	No. of Eng.	skilled workers as % of total mainte- nance	pre- ven- tive	ope- ra- tio- nal	emer- gen- cy	satis- facto- ry	accep- table
1	2	3	4	5	6	7	8	9	10	11	12
1.	PN Sahang Merauge	423	8	48	1	50		+			
2.	Pindad	6000	100	54	3	67		+			+
3.	Pabrik Mesni	180	1	13	-	50			+		+
4.	PN Barada	900	15	60	2	59		+			+
5.	PN Indra	685	13	62	3	87		+		+	
6.	PN Dok TG Priok	1270	65	71	3	85		+			+
7.	PN Dok Surabaya	1520	60	68	3	83		+			+
8.	Railway repair Station Manggarai	1665	16	65	2	75	+			+	
9.	Carya Shipyard	500	5	-	-	-			+		
10.	PT Textil	1100	9	5	1	76			+		
11.	Textil ITI/Central textil laboratory/	200	10	20	1	80			+		+
12.	Mantrust and CO. LTD Canning Factory	320	4	12	1	60		+		+	
13.	Kepala Unit VI, PN. Datas Oxigen Plant	56	2	25	1	80	+			+	
14.	Sugar Factory Kryan	650	4	50	2	62	+				+
15.	Fertilizer Plant Pupuk Sriwidja-ja	1500	20	53	3	83	+			+	
16.	Cement Padang PN.	1400	2	80	1	83		+			+
17.	PLN Kalender	150	1	66	-	100			+		
18.	PN. Metrika Electric motor repair and manufacturing shop	71	3	55	-	-		+			+

Maintenance Services in the visited Enterprises and Industries

Maintenance Services	Character of maintenance ^{1/}				Standard of maintenance ^{2/}			Separate maintenance shop		Spare part store		Imported spare part
	No. of workers as % of total maintenance	pre-ventive	operational	emergency	satisfactory	acceptable	unsatisfactory	exist	don't exist	exist	don't exist	% /estimated/
6	7	8	9	10	11	12	13	14	15	16	17	18
1	50		+				+	+			+	40
3	67		+			+		+		+		40
-	50			+		+			+	+		10
2	59		+			+		+			+	10
3	87		+		+			+		+		40
3	85		+			+		+		+		40
3	83		+			+		+		+		30
2	75	+			+			+		+		30
-	-			+			+		+		+	-
1	76			+			+	+			+	40
1	80			+		+		+		+		60
1	60		+		+			+		+		30
1	80	+			+			+		+		90
2	62	+				+		+		+		40
3	83	+			+			+		+		90
1	83		+			+		+		+		70
-	100			+			+		+	+		90
-	-		+			+		+			+	60

	7	8	9	10	11	12	13	14	15	16	17	18
--	---	---	---	----	----	----	----	----	----	----	----	----

3	80	+			+			+		+		90
3	83	+			+			+		+		90

			+			+			+			
are available	+			+			+		+			
			+			+			+			

} no summaries were available

as follow:

ried out according to programmes on the base of effective machine hours or other
 otically before a major deterioration is taken place in the condition of machine.

- two major overhaul few small repairs and supervisions.

anized, the necessary spares and replacements are at disposal for the scheduled

ic features are similar to the preventive maintenance, that is the maintenance
 he overhauls are not proceeding the deteriorozation of machine, but follow it. The
 e state of machine.

are accounted in this group too, where the schedules of preventive maintenance
 o carry out the schedules are not secured.

stricted to repair after breakdown. In most cases proper maintenance facilities
 . The production loss is very high.

SECTION 2

Table 7

**List of personnel with experience
met during the visits to factories**

Eng. Laini Muhibat	P.N. Pupuk Sriwidjaja
Eng. Didi Suwardi	- " -
Eng. H. Ismail	Industrial researche centre
Eng. Weersito	Kepala Unit.VI.PN.Zatas
Eng. Weersito, Samsi	P.N. Indra
Eng. Azwar Anas	Kepala Pusat Karya Pindad
Eng. R.M.S. Wibisono	P.N. Dol.Tandjung Prioh
Eng. K. Samadikun	Badan C. and. C. Klender
Eng. Irawan Sadiman	Departencen Perindustrian
Eng. Roeswan Reesli	P.N, Metrika
Eng. Pratis Sukatma Atmadja	P.T. Textile Bandung
Eng. Sudijo Sardjomo	P.T. Textile Bandung
Eng. Saleh Suporto	PNKA Mangarai

Table 8

Priorities of Factories

Since we saw only a part of the establishments, the sequence has to be consulted naturally with the local Authorities and their proposal has to be considered.

1. Pindad⁴
2. PN Indra^{1, 3}
3. PN Barada^{1, 2}
4. PT Textil Bandung^{1, 2, 3}
5. PN Dekk Surabaya³
6. PN Dekk TG Priok^{1, 3}
7. PN Sabang Merauke^{1, 2, 3}
8. PN Metrika⁴
9. Mantrust and Co⁴
10. Senen Padang¹
11. Sugar Factory Kryan³
12. PLN Kalender¹
13. Pabrik Mesmi^{1, 2}
14. Carya Shipyard¹

- Notes:
1. Factories where the programmed maintenance is to be initiated
 2. Factories where the spare parts store and policy are to be reorganized.
 3. Factories where the repair and maintenance shops are to be modernized
 4. Factories where the conditions are suitable for central spare parts manufacture after extension and modernization.

Appendix "C"

Appendix "C"

**List of Factories visited by Mr. Kerhonen
considered in this report**

INI - Indonesian National Industry and Bina Legan	Metal Industry	Djakarta
Patna Djaja	Paint Factory	Djakarta
Sidolin	Paint Factory	Djakarta
Intirub	Rubber Factory	Djakarta
Padalawang	Paper Mill	Bandung
Gresik	Cement Factory	Surabaja
Soda Waru	Soda Factory	Surabaja
Boma and Turangga	Machine Factory	Surabaja
Iglas	Glass Factory	Surabaja
Blabak	Paper Mill	Jogjakarta
Cambrie	Textile Factory	Jogjakarta
Gowa	Paper Mill	Makassar
Letjes	Paper Mill	Letjes
Patal Teapati	Spinning Mill	Denpasar

Appendix "A"

Appendix "B"

**BRIEF DESCRIPTION OF THE FACTORIES
VISITED BY THE TEAM**

The suggestions at the conclusion of this information list in sequence of importance the instructions which we consider necessary. Table B lists the sequence of importance between the factories.

1. PT Sabang Meranca

Djakarta; founded in 1900

General description

The factory is state owned. It manufactures construction steel and all kinds of pumps. The factory is outdated. It was last reconstructed in 1930. Its plate machining machines originate from 1930 or even earlier, and only some of the cutting machines in the machine park date from 1956-1960. Production is largely by hand. It has 423 employees, and 95 machines have to be maintained. The management of the factory is not maintenance minded.

Description of repair and maintenance

a/ Existing repair facilities maintenance organization and spare parts storage

The maintenance section of the factory is unorganized. An engineer is in charge of the maintenance workshop. The workshop staff is adequate, and the proportion of skilled workers is sufficient, but no spare-parts stock records are kept, drawings are not available, and the spare-parts store is inadequate. Repairs are according to an operational system, i.e. repairs are carried out when faults occur in the machine; old and outdated machines are idle because the replacement spares are manufactured singly since they cannot be obtained commercially. The lack of stock records and of drawings prevents suitable preparations. The machine park of the maintenance workshop is inadequate both as regards quality and numbers. Suitable spare parts store don't exist.

The workshop staff has 26 employees, including one engineer and 13 skilled workers.

The maintenance workshop has 6 machine tools. The estimated amount of imported spare parts is 60 % compared with the total consumption.

b/ Adequacy of maintenance and repair facilities

Maintenance activities are unsatisfactory.

c/ Recommendations for improvement

The maintenance workshop machine park needs new machines, programmed maintenance has to be organized and a spare-parts store established.

2. Pindad Army Factory

Bandung; founded in 1880

General description

The Army owns the factory.

Apart from its military work, it has a section for civilians' production; this mainly manufactures machine components and tools for different orders. The factory has a fairly modern machine park, gear cutting section suitable forge, iron and steel foundry and heattreating section.

The foundry is outdated, but with some investment it could be made up to standard. The factory is well organized, it has an excellent engineering and skilled working team. The total employees of the machining and engineering plant number 6000, and 2500 machines have to be maintained. Here must be noted that in certain technological branches as gear cutting, grinding and in general fine machining there are bottlenecks.

Description of repair and maintenance

a/ Existing repair facilities, maintenance organization and spare parts storage

Maintenance is well organized, mainly preventive. In certain cases due repairs are only carried out after faults have occurred in over-worked machines, it has been classified in Table 6 in the operational group.

Spare parts records are kept. The spare-parts store is well recorded and equipped, but no information was available as to the size of the stock and the annual use of the spare parts. The estimated imported spare parts amount to 40 % of the total consumption.

The maintenance staff of the civilian section is 60, including 3 engineers and 40 skilled workers.

b/ Adequacy of maintenance and repair facilities

Maintenance is satisfactory.

c/ Recommendation for improvement

Reconstruction of the foundry is necessary. Thus the factory would be most suitable as a central spare-parts manufacturing base. Naturally, for this purpose the mentioned technological branches have to extended in harmony.

3. Fabrik Masmi

Bandung; founded about 1950

General description

This is a privately owned small factory which manufactures all kinds of household mass products, i.e. household oil ranges and knapsack sprayers at present. The factory is well organized and used to capacity. The premanufacture of plate components is mechanized. The average age of the machines is 10 years. Twenty machines and the necessary auxiliary equipment have to be maintained.

It employs a total of 180 persons.

Description of repair and maintenance

a/ Existing repair facilities, maintenance organization and spare parts storage

The factory has no maintenance workshop of its own. A group of 16 persons, 8 of which are skilled workers, carry out maintenance. Machining is carried out in production workshops. Machine repair is only carried out if faults arise, and according to necessity, i.e. emergency maintenance, but the quality of the work is good. The spare-parts store is arranged well, but it has no suitable stock. The estimated imported spare parts amount to 10 % of the total used.

b/ Adequacy of maintenance and repair facilities

Although only emergency maintenance is carried out, at present no extensive machine idling has occurred as a result of the properties and age of the machines. Therefore, at present maintenance is acceptable.

c/ Recommendations for improvement

The introduction of programmed maintenance is suggested, and the supplementation of spare-parts on stock in the store.

PK Barada

Surabaya; founded in 1900

General description

The factory is state owned; it mainly manufactures construction steel, but also machine components. In fact it recently started the production of road rollers in medium series /Jugoslavia supplied the road roller section of the factory which is still being erected/. The factory has a large machine shop, a forge, iron and steel foundries. Most of the buildings and machines are out of date. The average duration of the machines is approx. 30 years. The factory employs 900 workers, and 350 machines have to be maintained. The management of the factory is not maintenance minded.

Description of repair and maintenance

a/ Existing repair facilities, maintenance organization and spare parts storage

It has a maintenance workshop of its own, but it has a very low standard. Productive plants manufacture cut components. Neither its organization nor the equipment is adequate.

The total maintenance staff is 22, including 2 engineers and 13 skilled workers. An operational method has been adopted, but since it lacks draftsmen, spare part inventories and its workshop capacity is small, the job cannot be carried out satisfactorily. /It should be noted that the full capacity of the factory is not utilized, as a result of lack of work. Idling of certain machines owing to repair, causes no stoppage in production, and so the management of the factory is not particularly interested in maintenance. The repair workshop has auxiliary machines only as the production unit manufactures the components./

It has a spare-part store, but it is badly organized, and it cannot be assessed how much reserve is available of the necessary spare parts. Therefore, in Table 6 this factory

is shown as not having a spare-parts store. According to verbal information, the spare-part stock is 6-months in value. The impert ratio is 10 %.

b/ Adequacy of maintenance and repair facilities

According to the above, maintenance is unsatisfactory.

c/ ^Recommendations for improvement

A complete re-organization of maintenance and spare-parts store, the establishment of a well-equipped maintenance workshop and reconstruction of the foundry are necessary.

5. PN Indra

Surabaya; founded in 1878

General description

The factory is state owned. It manufactures construction steel, different sizes of sludge pumps and machine components on order. It has a large cutting shop where the machines work efficiently, they are in good condition, although they are old and out of date. It also has a forge and foundry, but the latter is completely out of date. The factory employs 685 persons, and 153 machines have to be maintained.

Description of repair and maintenance

a/ Existing repair facilities, maintenance organization and spare parts storage

Maintenance is well organized and the good conditions of old machines proves this.

It has its own maintenance and component production workshops, with 8 basic machines. The maintenance staff numbers 40, including 3 engineers and 35 skilled workers. An operational method is used. It has a spare-part store with a 6-month supply and max.-min. supply records. Imported spare parts amount to 40 % of the total spares used.

b/ Adequacy of maintenance and repair facilities

Maintenance is satisfactory.

c/ Recommendations for improvement

It is necessary to exchange the machines and the equipment of the foundry. Thus, the factory would be suitable as a component producing base for East Java. Preventive maintenance has to be developed.

6. PH. Dek. TG Fricok

Djakarta; founded in 1891

General description

The factory is state owned. It is suitable for the repair of ships of 5-20 thousand tons. The factory is well organized; it has produced new ships in the past. It has machine and construction steel workshops, a forge and a foundry, and also 5-20 thousand ton docks, but its equipment is out of date. The average duration of the machines is above 30 years, nevertheless, they are efficient.

As a result of lack of orders, the utilization of the factory is very low. It should be noted that ship owners do not require regular docking and maintenance, and repairs are asked for as a last resort.

The factory employs 1270 persons.

Machines to be maintained number 120.

Description of repair and maintenance

a/ Existing repair facilities, maintenance organization and spare parts storage

It has its own maintenance workshop which is suitable for the manufacture of components. The maintenance workshop has 16 machine tools. The maintenance staff is 70, including 3 engineers and 60 skilled workers. An operational method is used. It has a well arranged spare part store, and the stock supply is 12 months. The inventories and records are kept in order. Import amounts to 40 % of the total spares consumption.

b/ Adequacy of maintenance and repair facilities

Maintenance is acceptable but owing to the frequent faults of the old machines, there is a constant delay.

✓ Recommendations for improvement

The factory has to be modernized, so that sea-going ships can be maintained efficiently. The same is valid for the machines of the maintenance workshop, and preventive maintenance has to be organized.

An X-ray apparatus is necessary, in order to test the welding seams.

7. PH. Dek Surabaya

Surabaya; founded in 1910

General description

The factory is state owned.

It mainly repairs ships, but new ships are also produced. It has machine and construction steel workshops, a forge and a foundry. In addition it has docks to accommodate ships of 5000-20000 tons. Its machine park is out of date, but it is in good condition. Most of the docks are new and their average duration is 10 years. The factory is suitable for the maintenance of sea-going ships.

The factory has a well equipped training workshop. Surprisingly, we saw no X-ray apparatus in a ship repair shop.

The factory employs 1170 persons and 90 machines and the necessary auxiliary equipment have to be maintained.

Description of repair and maintenance

a/ Existing repair facilities, maintenance organization and spare parts storage

The factory has its own maintenance workshop which manufactures components. The cutting shop has 14 machine tools.

Maintenance is well organized. The maintenance staff is 60, including 3 engineers and 50 skilled workers. Work is according to an operational system, but a preventive maintenance system is approached. Records of spare parts are kept, and regular checks are carried out. Unfortunately, the machines of the maintenance workshop are mostly out of date. The spare parts store is well organized, and max.-min. records are kept. A 6-month stock supply is available. Imported spare parts amount to 30 % of the total consumption.

b/ Adequacy of maintenance and repair facilities

Maintenance work is acceptable but the out-dated machines cause difficulties.

c/ Recommendations for improvement

The addition of modern machines in the maintenance workshop is necessary, and the purchase of an X-ray apparatus.

8. Railway Repair Station Mangarai

Djakarta; year of foundation not available

General description

The factory is owned by the State Railways.

Its job is the maintenance of railway engines and rolling stock. The station is well organized and carries out its work efficiently. It carries out preventive maintenance of the haulage and rolling stock of the railway; this involves periodical inspection, medium and general overhauls as a function of the kilometres completed. The standard of repair is satisfactory. The station employs 1665 persons; 6 Diesel engines, 12 motor trains and 500 waggons have to be maintained.

Description of repair and maintenance

a/ Existing repair facilities, maintenance organization and spare parts storage

It has its own maintenance workshop, but this has no machine shop. Productive workshops carry out cutting and machining.

The maintenance staff is 40, including 2 engineers and 30 skilled workers. For the equipment of the station an operational maintenance system is used. Records of spare parts are kept.

Its spare-part store is well organized, with a stock for 2 years; this is considered superfluous. Min.-max. records exist. The import ratio of spares for use is 30 %.

b/ Adequacy of maintenance and repair facilities

Maintenance is satisfactory both as regards the equipment and its own machines.

c/ Recommendations for improvement

No special recommendations are necessary.

9. Carya Shipyard

Djakarta; founded in 1952

General description

It is privately owned. Suitable for the production and repair of small ships. It is well equipped with new machines but it is practically at a standstill owing to lack of orders. Its max. personnel is 500 at complete production. 45 equipment have to be maintained. The management of the factory is not maintenance minded.

Description of repair and maintenance

a/ Existing repair facilities, maintenance organization and spare parts storage

It has no maintenance unit or spare-parts store of its own; only the most necessary repairs are carried out. The repairs are made by the productive works themselves.

b/ Adequacy of maintenance and repair facilities

Maintenance as such is non-existent.

c/ Recommendations for improvement

Primarily up-grading the utilization of the plant, and than organization of maintenance are necessary.

10. P.T. Textil

Bandung; founded in 1935

General description

It is the property of the Transport Workers Trades Union. Textiles and working overalls for railway workers are manufactured.

The average age of the machine equipment is 30 years; quite out of date, and production is uneconomic, so the factory has financial difficulties. The number of total employees is 1100. The following machines have to be maintained; 336 different weaving machines, 1100 spindles, 1 colour-printing machine and 87 sewing machines.

Description of repair and maintenance

a/ Existing repair facilities, maintenance organization and spare parts storage

It has its own maintenance unit, but its capacity is inadequate. In view of the completely outdated machine pool, only emergency repairs can be carried out.

The maintenance staff is 25, including one engineer and 20 skilled workers. The workshop has 6 machine tools.

It has no spare-part store worth mentioning owing to financial difficulties. 40 % of the spares consumption is imported.

b/ Adequacy of maintenance and repair facilities

Maintenance is at a very low standard as a result of the small capacity of the maintenance unit and of the machines

c/ Recommendations for improvement

Complete reconstruction of the machines and buildings of the factory is necessary, and commensurately, maintenance has to be organized.

11. Textil IRI/Laboratory/

Location; year of foundation: not available.

General description

This is a central state laboratory. Its jobs are the quality control of textiles, testing of new machine types and the training of specialists.

It has mechanical and chemical laboratories and manufacturing departments. The total number of employees is 200. Generally 800 spindles and a few weaving machines have to be maintained.

Description of repair and maintenance

a/ Existing repair facilities, maintenance organization and spare parts storage

It has its own maintenance workshop, employing 16 persons, including one engineer and 12 skilled workers. The maintenance workshop has 9 machine tools. Only emergency maintenance is carried out, but as the machines are tested for a short period, this is sufficient.

It has a well organized spare-parts store, with a 6-month stock supply. The ratio of imported spare parts is 60 %.

b/ Adequacy of maintenance and repair facilities

In view of the character of the plant, the standard of maintenance is acceptable.

c/ Recommendations for improvement

No special recommendations are necessary.

12. Martrust and Co. Ltd.

Canning Factory, Bandung; founded in 1907

General description

The factory visited is only one of the plants of the company. The number of employees is 320. Two main products are manufactured here: artificial rice which is quite new, only 2 years, and production is carried out with Italian machine-line; sardines or tinned meat is produced on three machine lines. The new unit of the factory is completely automatic, whereas only certain processes of canning are automatic. The above mentioned four machine lines and the necessary auxiliary equipment have to be maintained.

Description of repair and maintenance

a/ Existing repair facilities, maintenance organization and spare parts storage

It has its own maintenance unit, but general repairs are sub-contracted. The maintenance staff is 21, including one engineer and 12 skilled workers. An operational system is used. The maintenance workshop has 4 machine tools.

The spare-parts store is well organized, with a supply stock for 12 months.

b/ Adequacy of maintenance and repair facilities

The standard of maintenance is adequate.

c/ Recommendations for improvement

A central maintenance unit has to be established for all factories of the company.

**13. Insula Unit VI, P.I. Sateo Surma Plant
Semarang, founded in 1966**

General description

It is state owned.

**It is a modern well equipped factory which produces oxygen.
A total of 320 persons are employed and 3 machine units
have to be repaired.**

Description of repair and maintenance

**a/ Existing repair facilities, maintenance organization
and spare parts storage**

**It has a well equipped maintenance department. The maintenance
staff is 6, including one engineer and 4 skilled workers.
The maintenance workshop has 4 machine tools. Preventive
maintenance is carried out. It has a well organized spare
parts store with max.-min. supply recording.**

b/ Adequacy of maintenance and repair facilities

The standard of maintenance is satisfactory.

c/ Recommendations for improvement

No special recommendations are necessary.

**14. Sugar Factory Erya
Surabaya; founded in 1839**

General description

It is state owned. It produces raw sugar. It is a very old factory and most of the equipment dates from 1920-1930. The factory is out of date, but its equipment work efficiently. It employs 600 persons.

Description of repair and maintenance

a/ Existing repair facilities, maintenance organization and spare parts storage

Maintenance is well organized; it has its own unit. Maintenance is preventive but it is seasonable. At the end of the sugar season, most of the workers of the factory are employed for maintenance and necessary repairs. No loss of production occurs during production.

The maintenance staff numbers 400 at the beginning of the repair season. This figure includes 2 engineers and 250 skilled workers. The maintenance workshop has 25 machine tools, but most of these are out of date.

It has a well organized spare-part store, with a supply stock for a season /campaign/. The ratio of imported spare parts is 40 %.

b/ Adequacy of maintenance and repair facilities

Maintenance considering the circumstances is acceptable.

c/ Recommendations for improvement

The production and maintenance equipment have to be modernized.

**15. Fertilizer Plant P.N. Punt Srinidiana
Palembang; founded in 1966**

General description

The plant is state owned, and completely supplied by the USA. It produces chemical fertilizers and employs 1500 people. The plant is up-to-date and it is in a very good state.

Description of repair and maintenance

a/ Existing repair facilities, maintenance organization and spare parts storage

The plant has a well equipped maintenance department, with separate machine, construction steel and electric workshops. The maintenance staff total 300, including 3 engineers /which we consider too few/ and 250 skilled workers. Spare parts records are kept. Preventive maintenance is carried out. The quality of the work is faultless.

The maintenance workshop has 25 machine tools.

The spare parts store is well organized with min.-max. supply recording.

Stock supplies are for 2 years which can be considered as superfluous.

b/ Adequacy of maintenance and repair facilities

Maintenance is satisfactory

c/ Recommendations for improvement

No special recommendations are necessary.

16. Cement Padang

Padang; founded in 1910

General description

It is state owned, one of the plants of the Cement Association. It is well organized, but out of date. It has 4 kilns and activates one mine. Its great problem is that its experienced leaders leave Sumatra.

It is typical of the good management of the factory that it has a school for the workers where technical training is given and languages are taught. The factory employs 1400 persons. The management of the factory is against locally produced spare-parts.

Description of repair and maintenance

a/ Existing repair facilities, maintenance organization and spare-parts storage

Maintenance is well organized. It has its own maintenance department, but in certain branches, it lacks specialists, e.g. electrical mechanics. The maintenance staff numbers 85, including one engineer and 70 skilled workers. The maintenance workshop has 14 machine tools.

Work is according to the operational system.

It has a well organized spare-part store, with a supply stock for 12 months. Max.-min. supply records exist. The ratio of imported spare parts is near 70 %.

b/ Adequacy of maintenance and repair facilities

The physical possibilities of maintenance is acceptable but there are few leading technicians.

c/ Recommendations for improvement

Preventive maintenance has to be organized since 4 kilns afford the possibilities for this.

17. PLN. Kalender Machine and Electric Motor Repair
Workshop

Djakarta; founded in 1963

General description

It is state owned.

It is designed to satisfy the requirements of the electric company, but the plant is not completed, only its small screw and rivet manufacturing unit and the construction steel shop operate at present.

On completion, it will manufacture construction steel and repair electric motors. It has a modern electroplating plant, but it is not used. The management of the factory is not maintenance minded.

Japan supplied the factory. The total number of employees is 150, and 27 machines have to be maintained.

Description of repair and maintenance

a/ Existing repair facilities, maintenance organization and spare parts storage

It has no maintenance workshop of its own. The maintenance staff consists of 4 skilled workers.

Only emergency maintenance is carried out. It has a spare-parts store of medium standard /no recordings exist/ with a supply stock for 12 months. The ratio of imported spare parts is near 90 %.

b/ Adequacy of maintenance and repair facilities

The standard of maintenance is unacceptable.

c/ Recommendations for improvement

On completion of the factory, maintenance has to be re-organized and the establishment of a maintenance workshop is inevitable.

18. PN. Metrika Electric Motor Repair and Manufacturing Shop

Djakarta; founded in 1925

General description

The plant is a joint Indonesian and Dutch company. It is partly a commercial organization, and partly a service network, i.e. it has smaller plants in Bandung, Djakarta and Surabaja for the repair of electric motors and appliances, and it also manufactures electrical instruments.

At present the plant is not used sufficiently, owing to lack of orders, but it is suitable with some extensions as a central electric motor repair factory. Its total employees number 71, and 15 machines have to be maintained.

Description of repair and maintenance

a/ Existing repair facilities, maintenance organization and spare parts storage

It has its own maintenance department, but no machine shop, hence the productive workshop carries out the cutting work. Its maintenance staff consists of one engineer and 6 skilled workers. The operational method is used. The quality of the work is adequate.

It has a spare-part store without spare parts on stock owing to financial reasons.

The ratio of imported spare parts is 60 %.

b/ Adequacy of maintenance and repair facilities

The standard of maintenance is acceptable, but the lack of a spare-parts store is a fault.

c/ Recommendations for improvement

A well equipped central maintenance workshop has to be established for the various units.

19. Garuda Aircraft Repair Station

Djakarta; year of foundation not available

General description

It is the central repair station of the Garuda Airways Corporation. It is a very well equipped and organized station.

It has all the necessary workahops. Its team of skilled workers is excellent. Its equipment is suitable for the complete repair of internal-combustion engines. The engines of turbo or jet aircraft cannot be repaired, so these are repaired abroad. The station is at present being extended in order to enable it to carry out these repairs too.

The aircrafts are maintained according to international regulations. The station employs 780 people, and they maintain 90 machines.

Description of repair and maintenance

a/ Existing repair facilities, maintenance organization and spare parts storage

It has its own maintenance unit, but no machine shop. Otherwise, the maintenance of the factory equipment is also faultless. The maintenance staff is 103, including 3 engineers and 80 skilled workers. Preventive maintenance is carried out.

The spare-parts store is well organized, with a stock for 12 months. The recordings are kept excellently in order. The ratio of imported spare parts is near 90 %.

b/ Adequacy of maintenance and repair facilities.

Maintenance is satisfactory.

c/ Recommendations for improvement

No special recommendations are necessary.

20. P.L.N. Power Station
Djatiluhur; founded in 1963

General description

It is a hydraulic power station with a capacity of 125 MW. France has built it, with French and Italian equipment. The power station is modern and in faultless condition.

Description of repair and maintenance

a/ Existing repair facilities, maintenance organization and spare parts storage

The power station has a modern and well equipped maintenance department and workshops with separate machine, electrical, instrument, car and earth working machine repair shops. Its maintenance staff is 155, including 23 engineers and 100 skilled workers. Preventive methods are used. The quality of the work is good.

The cars and earth-working machines of the power station are repaired here. The maintenance workshop has 23 machine tools.

It has a well organized spare-parts store, with a 6-month supply stock. The spare parts recordings are up-to-date. The ratio of imported spare parts is 90 %.

b/ Adequacy of maintenance and repair facilities

Maintenance is satisfactory.

c/ Recommendations for improvement

The heavy earth-working machine repair shop here could be developed into a central heavy machine repair station for Java.

Apart from the factories listed under 1-20, we visited the following institutions, a short description of which is given below.

Central Industrial Laboratory

Bandung

A state laboratory established for the machine industry which is capable of performing all chemical and mechanical investigations and tests. In addition to the laboratories, it has well equipped machining and electrical workshops. Its experts are highly qualified. At present it has financial difficulties, and is unable to purchase new modern instruments.

Financial support is needed to purchase instruments.

Industrial Training Centre

Bandung

It is a modern teaching institution. It has well equipped textile, machining, cutting, motor, mechanical and electrical training workshops. Its use is manifold. It trains apprentices from young people who finished secondary schooling, postgraduate courses are run for workers and university students receive practical training. Its teaching capacity is approx. 400-500 persons annually.

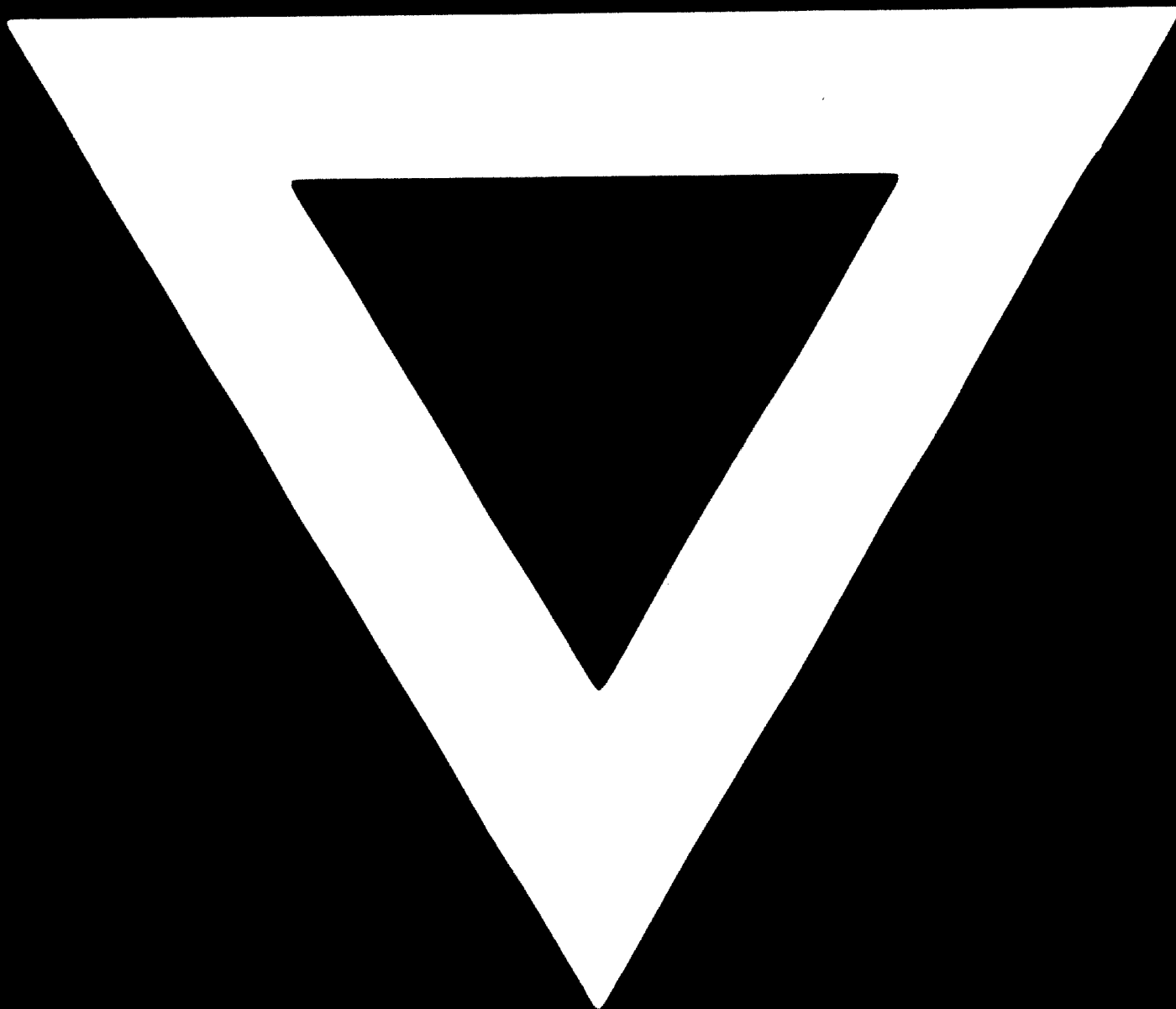
Appendix "F"

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