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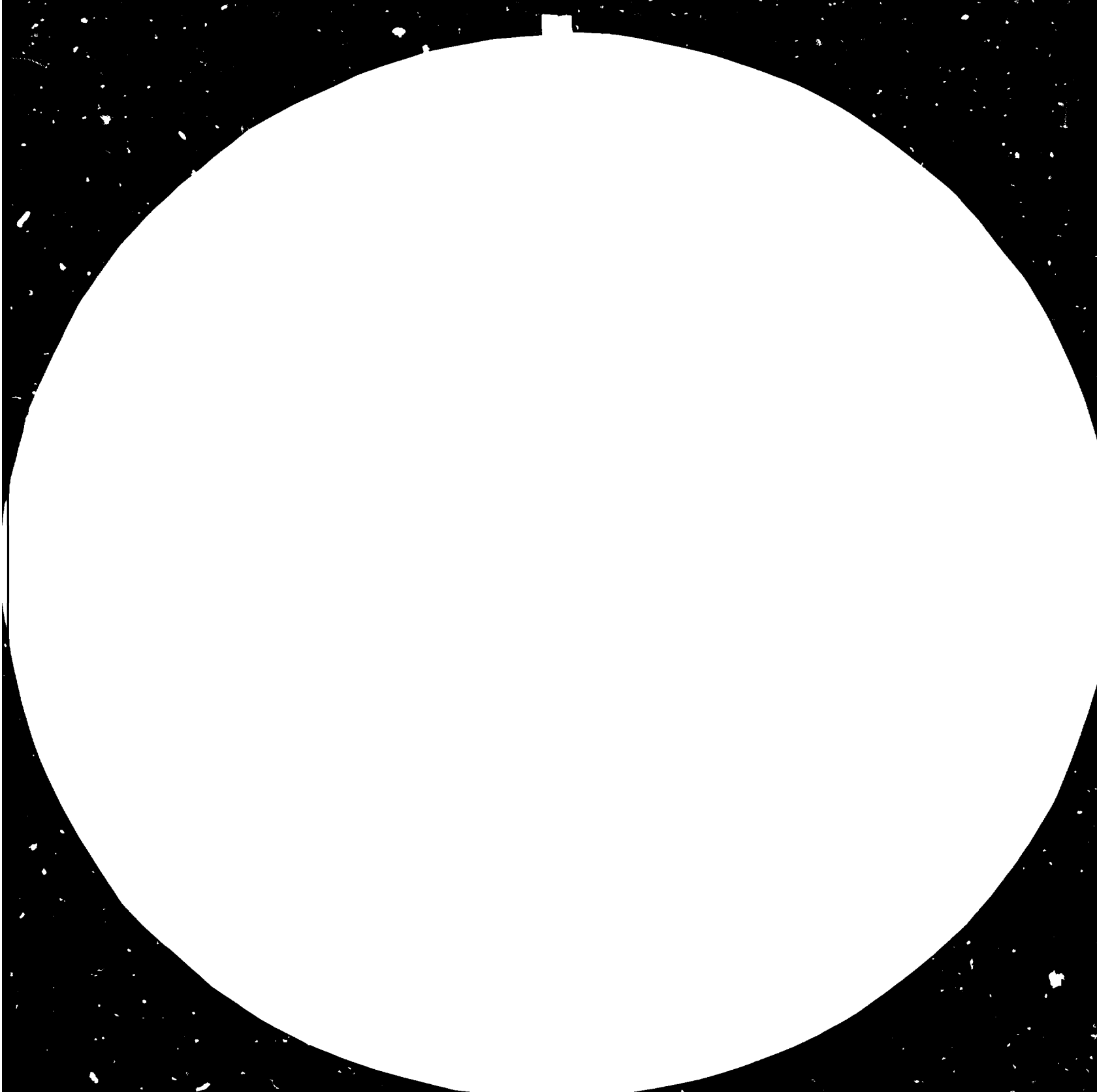
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INDUSTRIAL TRAINING AND DEVELOPMENT CENTRE
(ITDC)

TURKEY.

SURVEY AND TRAINING PROGRAMME
IN
MAINTENANCE PLANNING IN PROCESS INDUSTRIES

DP/TUR/77/024/11-03/EEE

TERMINAL REPORT PREPARED

BY

JÜRGEN STEFFENS
MAINTENANCE CONSULTANT

Expert of the ITDC in collaboration with the United Nations Industrial Development Organization acting as Executing Agency for the United Nations Development.

This report has not been cleared with the United Nations Industrial Development Organization which does not therefore necessarily share the views expressed.

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INTRODUCTION

The aim with the project was to study the maintenance situation in one selected plant in order to make recommendations. Also based on the recommendations short concluding seminars should be conducted and thereby introduce current development in the field of planned maintenance.

In addition to the above also a one week general seminar was to be prepared and conducted where by necessary documents have been prepared.

The above activities have been carried out and in addition to that short seminars, conferences were held.

Below is a short description of the various activities.

The field study was carried out during one week at the MKEK steelplant in Kirikkale. During the study personnel from management, production and maintenance were interviewed. Also the present organization, routines and systems were studied. As a result of the above a detailed report has been prepared. In this report the present situation at the plant is described and based upon this, together with analysis of received information, data etc. recommendations were made. This report was presented to the company during a one day session. (A copy of the report is shown in appendix 2).

In connection with the preparation of the report, handouts and seminar notes for a three days seminar for maintenance personnel at MKEK in Kirikkale were prepared. The seminar was held after presentation of the report. During this seminar the problems discovered during the field study as well as general

maintenance aspects were discussed.

The preparations of the one-week general seminar was carried out in two steps. The first step was to learn about the general maintenance situation in various companies.

Based on the above, in the second step, lecture notes, handouts and overheads for the seminar were prepared.

In the first step of the preparations three companies were visited. During these visits short maintenance sessions were held where after maintenance procedures, routines and systems were studied. Also specific problems have been discussed.

In the second step of the preparation ,seminar material based on the above experience was prepared.

In addition to the above, during the time of preparation, a lecture at the Middle East University and a conference for top management in Kırıkkale was held.

The general maintenance seminar was held in Ankara during the last week of the mission and attended by 30 participants.

By a request the mission was extended with four days which was used to conduct a three days seminar for PETKİM in İzmir.

ACTIVITY REPORT

In the following all activities carried out during the mission are listed. Detailed descriptions are shown in appendices.

- 2.3.1983 : Arrival in Ankara (Evening)
- 3.3.1983 : Briefing at UNIDO
Introduction to ITDC
- 4-53.1983 : Planning of activities together with counterpart
at ITDC.
The tentative activity plan is shown in Appendix 1.
- 7-11.3.1983 : Maintenance survey at MKEK Steel Plant in Kirikkale.
- 12-21.3.1983 : Preparation of report for MKEK, Kirikkale and
preparation of seminar.
- 22.3.1983 : Presentation of report to management at MKEK. A copy
of the report is shown in Appendix 2.
- 23-25.3.1983 : Seminar on maintenance planning for MKEK maintenance
personnel.
The content of the seminar is shown in Appendix 3.
The list of participants is shown in Appendix 4.
The summary of the seminar evaluation is shown in
Appendix 5.
- 38.3.-1.4.1983 : Visits at Turyağ, Viking, Meteş.
- 4-15.4.1983 : Preparation of maintenance planning seminar.
A list of prepared lecture notes and overheads is
shown in Appendix 6.
During this time also the following activities
more done :
- 11.4.1983 : Lecture at the Middle East Technical
University about modern maintenance methods.
- 14.4.1983 : Conference on maintenance for top management
in MKEK, Kirikkale. An outline of the
content is shown in Appendix 7 and a list
of participants is shown in Appendix 8.

- 18-22.4.1983 : Seminar on maintenance in Ankara.
The content of seminar is shown in Appendix 9.
The list of participants is shown in Appendix 10.
The summary of the seminar evaluation is shown in Appendix 11.
- 25-27.4.1983 : Seminar on maintenance for maintenance personnel at PETKİM, İzmir.
The content of seminar is shown in Appendix 12
The list of participants is shown in Appendix 13
The summary of the seminar evaluation is shown in Appendix 14.
- 28.4.1983 : Departure for Vienna.

FINDINGS AND RECOMMENDATIONS

General

Experience gained during field studies, visits and seminars indicates problems in the various fields of maintenance. A summary of the above gives:

- Maintenance is very often considered to be costly. Understanding for maintenance problems in relation to production is missing. Overall cost factors for maintenance are not observed.
- Maintenance routines and systems are not applied properly and thereby hinders effective maintenance performance.
- Modern techniques, especially for condition monitoring, are not applied, resulting in increased maintenance costs and lower availability,
- Personnel in maintenance need to be trained in applying modern maintenance methods and routines .

Based on the above, the following recommendations can be made

- Short seminars for management and maintenance management should be carried out in order to create an understanding for need of improvements in the field of maintenance.
- One to two week seminars for maintenance engineers, technicians and foremen should be carried out in the field of
 - o Preventive maintenance
 - o Preparation and planning of maintenance work
 - o Organization and routines in maintenance

Overhead and seminar notes for information to the management and preventive maintenance have been established during this mission

and can be used for further training programmes.

ITDC involvement in training seminars

As stated above material for part of the training programmes is established. Although lack of practical experience and detailed knowledge hinders performance of future programmes without assistance.

Since there is a demand and need for future programmes the following can be recommended:

- short seminars for management and maintenance managers to be conducted by ITDC personnel without assistance.
- If ITDC is going to arrange maintenance seminars in the future it must be ensured that the ITDC personnel gain more practical experience. A combination of consultancy in order to find the problems, followed by problem solving training and by follow-up activities is recommended. The above give the opportunity for ITDC to learn about practical problems while at the same time gained experience is applied.

APPENDIX 1

MAINTENANCE PLANNING

TENTATIVE ACTIVITY PLAN. 7.2 to 26.4.83

7.3 - 11.3.83 Maintenance survey at M.K.E.K. steel plant
in Kirikkale

14.3- 18.3.83 Preparation of report and seminar at ITDC

21.3- 25.3.83 Presentation of report.

Detailed discussion on report

3 days maintenance seminar, Kirikkale.

28.3-1.4.83 Visits at:

- Metas steelplant

- Turyağ

- Viking paper mill

4.4-15.4.83 Planning and preparation of seminar:

- Handouts

- Lecture notes

- Overhead. etc.

Session on maintenance in ITDC and university

(one day)

18.4.-22.4 Maintenance seminar, Ankara

25-27.4 Maintenance seminar, Izmir.

APPENDIX 2

PROJECT REPORT
ON THE MAINTENANCE SYSTEM OF
M.K.E.K. KIRIKKALE STEEL PLANT

PREPARED BY
JÜRGEN K.F. STEFFENS
MAINTENANCE CONSULTANT

MARCH 1983
KIRIKKALE

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1. INTRODUCTION

This report is based on a survey at site during 7th to 11th of March 1983.

The survey was carried out by Maintenance Engineer J.Steffens (UNIDO) and T.Cengizhan Pamir (SFCEP) on behalf of UNIDO and SEGEM.

The aim with this survey was to find :

- The present organization, routines and procedures applied in maintenance
- Problems in the performance of maintenance.

Information about the above have been gathered through interviews with personnel from maintenance, production and other relevant sections and through detailed studies of forms and procedures used in the company. The result of the interviews and studies is described in one chapter of this report called "Present Situation".

The above facts were subject to an evaluation with the aim to find solution of problems which have been detected. The result of this evaluation is described in chapter "COMMENTS AND RECOMMENDATIONS".

Apart from the above the report also has guided us in the preparation of a maintenance seminar to be held in Kirikkale during 23.3 to 25.3 1983.

2. SUMMARY

This description contains a brief description of the report.

The main problems in maintenance and related functions which have been detected during evaluation are the following:

1. The maintenance organization is decentralized and transfer of personnel is difficult due to regulations. This results in longer repair time and insufficient utilization of maintenance personnel.
2. Mechanical maintenance consist of too many section which are impossible to handle for one head of department
3. Preventive maintenance, preparation and planning of repairs and fellow up of repairs is not carried out up to date resulting in breakdown maintenance performance.
4. Present and suggested routines and forms are complicated and involves much personnel and thereby hinders quick performance.
5. Lack of qualified personnel hinders proper and quick repairs.
6. Insufficient co-operation between production and maintenance results in unutilized time for repairs.

The above described main problems are based on an evaluation of the present situation described in this report in chapter "PRESENT SITUATION".

Details about the above and other problems are described in this report in chapter "COMMENTS AND RECOMMENDATIONS".

In order to improve the situation the following recommendations are made:

1. Division of the present mechanical maintenance department into a department for mechanical maintenance and department for civil engineering . In doing this mechanical maintenance as well as civil engineering can concentrate on their respective tasks.
2. Forming of a central workforce to be utilized in all sections where additional resources are required. This will help to decrease the repair time and qualified personnel is utilized better.
3. Implementation of a preventive maintenance system and establishment of routines for preparation and planning. This will increase the amount of planned repairs and result in a decreased amount of breakdowns. Also this will improve the co-operation between production and maintenance.
4. Simplification of present and suggested routines and forms which will result in a quick and reliable information flow and delays due to procedures are avoided. At the same time all required information for planning and analysis is channeled to the relevant section.
5. Start of training activities in order to improve the qualification of personnel.

Details about the above and other recommendations are described in the following.

3. PRESENT SITUATION

This chapter describes the present situation of maintenance organization, routines and systems as well as routines for other related sections within the company. The facts given in this description have been collected during interviews with related personnel and by collecting samples of forms, routine descriptions etc.

The aim with this description is to establish a base on which recommendations can be made.

Due to the short duration of the survey only the principle descriptions of routines systems etc. are given.

3.1. GENERAL

The MKEK steelplant produces mainly high quality alloyed steel. Its production consists of four production units and equipment:

Steel mill

Three arc furnaces with accessories

Black rolling mill

A 700 Ø black rolling mill with accessories

Profile rolling mill

A 550 ϕ , 440 ϕ , 280 ϕ universal profile rolling mill
with accessories.

Forging mill

3000 t press

1500 t press

CMF continuous forging machine

Several smaller forging machines and presses

Heating and heat treatment furnaces

The total production is 50 000 t/year.

The total number of employees is 1200.

3,2. ORGANIZATION

The structure of the main organization in the company
is shown in the below organization chart.

The maintenance department is divided into mechanical and electrical maintenance as shown below.

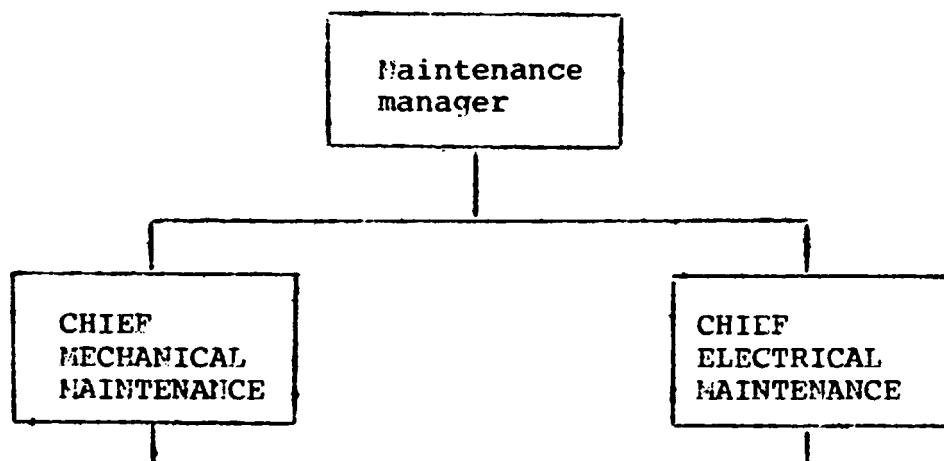


Fig. 2- Present Organization of the Maint.Dep.in the Steel Mill.

A chart for each of the main maintenance departments and a short descriptions of the responsibilities and the number of staff is given in the following.

3.2.1. MECHANICAL MAINTENANCE

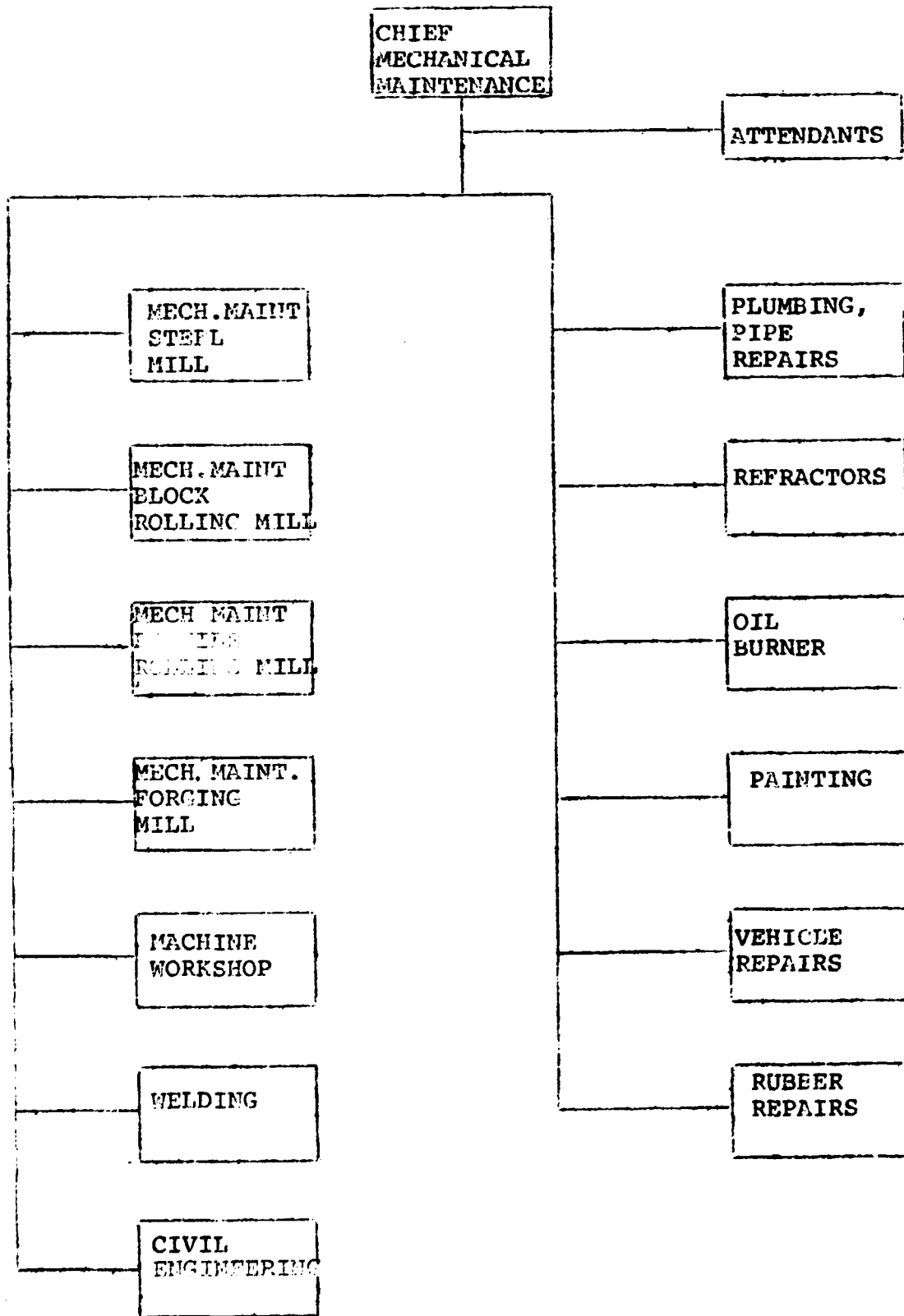


FIG.3- Present Organization of the Sections Directly Related to the Mechanical Maintenance Chief Engineer.

A. MECHANICAL MAINTENANCE STEEL MILL

Responsible for all mechanical repairs, overhauls, lubrication and preventive maintenance of equipment in the steel mill.

Staff: 1 engineer

1 foreman

19 workers

3 shift is applied and each shift consist of
2 workers

B. MECHANICAL MAINTENANCE BLOCK ROLLING MILL

Responsible for all mechanical repairs, overhauls, lubrication and preventive maintenance of equipment in the block rolling mill.

Staff: 1 foreman

8 workers

2 shift is applied and each shift consist of
2 workers

C. MECHANICAL MAINTENANCE PROFILE ROLLING MILL

Responsible for all mechanical repairs, overhauls, lubrication and preventive maintenance of equipment in the profile rolling mill.

Staff: 1 foreman

11 workers

2 shift is applied and each shift consist of
2 workers.

D. MECHANICAL MAINTENANCE FORGING MILL

Responsible for all mechanical repairs, overhauls, lubrication and preventive maintenance of equipment in the forging mill. In addition to the above there is a compressor unit which is responsible for maintenance and operation of compressors in the forging mill.

Staff forging mill: 1 engineer
1 foreman
10 workers

Staff compressor
unit 4 workers

2 shift is applied and each shift consist of 1 worker

E. MACHINE WORKSHOP

Responsible for manufacturing of spare parts and production of consumables by request from respectively section. The section is also responsible for maintenance of own machines

Staff: 1 technician
1 foreman
20 workers
2 repairmen

F. WELDING

Responsible for welding activities throughout the plant by request from respectively section.

Staff: 1 foreman
39 welder

G. CIVIL ENGINEERING

Responsible for internal civil engineering work requested by the various departments. Since most jobs are carried out with hired personnel the responsibility is mainly of administrative nature. Only minor jobs can be done by own personnel.

Staff: 1 technician
1 foreman
2 workers

At present there are 36 workers hired.

H. PLUMBING AND PIPE REPAIRS

Responsible for repairs of pipes and pipe systems and for assembly of new pipe systems by request from the various departments. The section consist of there groups.

- General plumbing
- Steam pipes maintenance
- Water pipes maintenance

Staff:

General plumbing 1 technician
 1 foreman
 14 workers

Steam pipe
maintenance 1 foreman
 5 workers

Water pipe
maintenace 1 foreman
 10 workers

I. REFRACTOR

Responsible for refraction of furnaces

Staff: 1 technician
1 foreman
22 workers

J. OIL BURNER

Responsible for maintenance of oil burners throughout the plant.

Staff 1 foreman
3 workers

K. PAINTING

Responsible for painting works throughout the plant.

Staff 1 foreman
3 painters

L. VEHICLES REPAIR

Responsible for maintenance of vehicles belonging to the company.

Staff 1 foreman
4 workers

M. RUBBER REPAIRS

This section consist of two groups. One has the responsibility for repairs on rubber equipment e.g

belts etc. throughout the plant. The other is responsible for glass work eg. replacement of window panes etc.

staff: 1 foreman
5 workers

In all the mechanical maintenance department consist of:

1 chief engineer mechanical maintenance
2 engineers
4 technicians
15 foremen
181 workers
2 attendants
205

3.2.2. ELECTRICAL MAINTENANCE

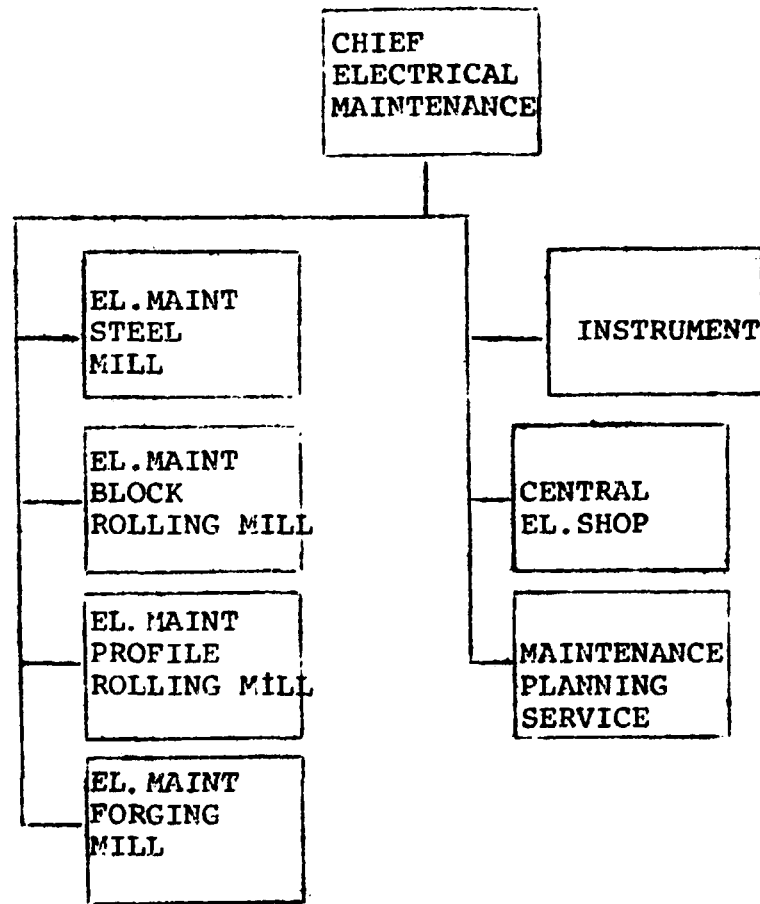


Fig. 4- Present Organization of the Sections Directly Related to the Electrical Maintenance Chief Engineer.

A. ELECTRICAL MAINTENANCE FOR PRODUCTION UNITS:

- STEEL MILL
- BLOCK ROLLING MILL
- PROFILE ROLLING MILL
- FORGING MILL

Responsible for all electrical repairs, overhauls preventive maintenance of equipment in the respective section. The sections are also responsible for lubrication of electrical motors.

Staff:

- Steel mill: 1 engineer
 1 technician
 1 foreman
 10 workers

3-shift is applied and each shift consist of 2 workers

- Block rolling mill: 1 technician
 1 foreman
 6 workers

2 shift is applied and each shift consist of 2 workers.

- Profile rolling mill: 1 engineer *
 1 technician*
 1 foreman
 5 workers

2-shift is applied and each shift consist of 2 workers

- Forging mill: 1 engineer
 1 technician
 1 foreman
 6 workers

*Are also responsible el.maintenance in the forging mill

2 shift is applied and each shift consist of 1 worker.

B. INSTRUMENT

Responsible for repairs, adjustments and calibration of instruments throughout the plant.

Staff: 1 engineer*
1 technician*
1 foreman

C. CENTRAL EL. WORKSHOP

Responsible for repair of general electrical equipment.

Staff: 1 foreman
2 workers

D. MAINTENANCE PLANNING SERVICE

This section has been established recently and is not yet full in function.

The main activities to be carried out by this section are:

- establishment of electrical and mechanical preventive maintenance guides for equipment throughout the plant.
- carry out preventive maintenance actions according to established guides.
- establishment of lubrication charts for equipment throughout the plant. (except electrical motors).
- carry out labrication according to established charts

* Are also responsible for el. maintenance in the forging mill.

- establishment of machine cards
- planning of weekly and monthly repairs
- record keeping of performed repairs

All activities to be carried out by this section are in detail described in "WRITTEN PRACTICE OF MKEK FOR MAINTENANCE AND REPAIRS. DEC. 1977 "

Staff: 1 mech. engineer
1 mech. technician
1 el. technician
2 workers (el.)
6 mech. workers
6 lubricators

In all the electrical maintenance department consist of:

1 chief engineer electrical maintenance
3 engineers
4 technicians
6 foremen
43 workers

57

The total number of employees in the maintenance department is 263.

3.3. MAINTENANCE ROUTINES AND SYSTEMS

In the following the presently applied routine systems for maintenance are described briefly. In general all routines and systems described are valid for all maintenance sections and therefore not detailed for each section.

3.3.1. ROUTINES FOR JOB REQUESTS

The following flow chart shows the flow of information when jobs are requested. The numbers refer to description given in the following.

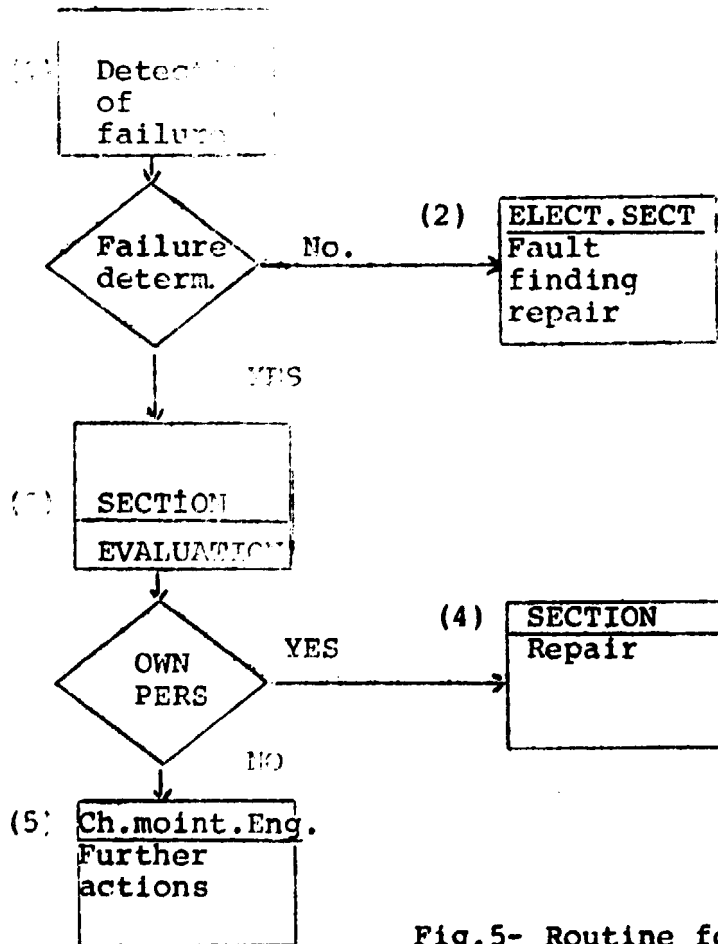


Fig.5- Routine for Job Requests

- (1) Most of the failures are of breakdown nature and are detected by production personnel. If the nature of the necessary repair can be determined by the production personnel the failure will be reported verbally to the respectively section. On other cases it will be reported verbally to the electrical section for further actions.
- (2) Failure for which the necessary repair could not be determined are subject to fault finding and repair by the electrical section if found to be of electrical nature. In other cases information about nature of the repair will be given to the production personnel for reporting to the respectively section.
- (3) A failure directly reported to the respectively section is subject to an evaluation whereby it will be determined if the necessary repair can be done immediately and by own personnel.
- (4) If the above is the case the repair is done.
- (5) In other cases the information will be given to the respectively chief maintenance engineer for further actions.

3.3.2. WORK-ORDER ROUTINES

The above routine is maintained at present but a new routine including a written job request is proposed and is in the process of implementation. Details about

the new routines can be found in "WRITTEN PRACTICE OF
MKKK FOR MAINTENANCE AND REPAIRS. DEC.1977"

3.3.3. PREPARATION AND PLANNING OF REPAIRS

At present no special routine for preparation and planning of reported repairs are applied. The personnel which is to do a repair is informed about the job. Spare parts, drawings etc. are supplied when the need arises.

Repairs which are to be carried out during the annual stopover are prepared which means that the necessary spare parts will be ordered to be purchased or to be manufactured. A record of these repairs is established about 15 days before the actual start of the stopover. When establishing this records also repair demands from production sections are asked for. The final list is sent to the chief maintenance section engineer and to the maintenance manager for approval. There after the repairs will be planned in co-operation between the respectively sections in the production unit.

3.3.4. FOLLOW-UP OF REPAIRS

Since a written work order is not used follow up of repairs cannot be done. However, both maintenance and some production sections are keeping separate records about downtime due to maintenance. These records state the amount of downtime in the various production equipment and are only used for "back-up" when discussion about downtime arises.

3.3.5. PREVENTIVE MAINTENANCE

Up to now systematic preventive maintenance routines are not established. The only preventive maintenance actions which have been carried out is cleaning which is done by operators and lubrication which is done by maintenance personnel. These actions have been carried without any documentation.

Note:

As mentioned before a new section has been established with the aim to implement preventive maintenance routines. Details about these routines can be found in "WRITTEN PRACTICE OF MKEK FOR MAINTENANCE AND REPAIRS.DEC.1977"

3.3.6. ROUTINES FOR SPARE PART SUPPLY

Four different routines for spare parts supply are maintained:

- spare parts drawn from local stores
- spare parts to be manufactured by the machine shop
- spare parts issued from the central store
- spare parts to be purchased.

The different routines are described below.

A. SPARE PARTS DRAWN FROM LOCAL STORES

Every maintenance section has its own small store and spares can be taken from this store without any written documentation. There are no records about items and quantity of items in the store. Refilling of the store

is done with corresponding routines as described below.

B. SPARE PARTS TO BE MANUFACTURED IN THE MACHINE SHOP

Spare parts to be manufactured in the machine shop can be ordered in two ways depending on the urgency.

If a spare part is urgently needed in a section sample, sketch or drawing is sent to the machine shop together with an oral request.

If the spare part is not urgently need the information is given to the respectively chief maintenance engineer. Who will write a request to the machine shop. No special form for this request is used.

In both case material to manufacture the part is provided by the requesting section.

C. SPARE PARTS ISSUED FROM THE CENTRAL STORE(STORE NO.1)

In this case a requisition is used. An example of a requisition is shown in app.1. The flow of the requisition is shown in the below flow chart. Given number are referring to a description.

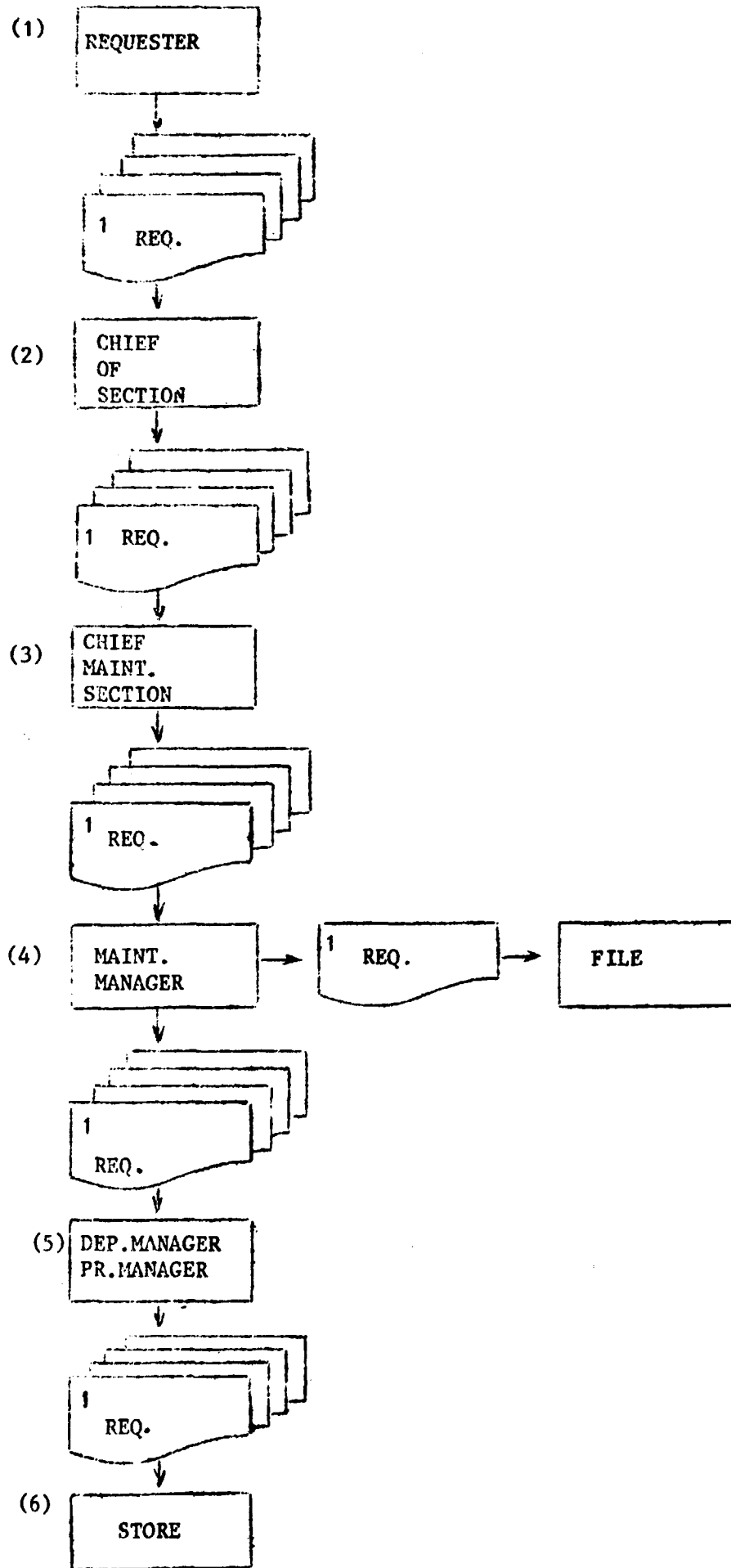


FIG. 6- Requisition Flow Chart

- (1) The requester fills the requisition form in fourfold. Information about the spare parts required can only be obtained from the store.
- (2) The set of requisitions is given to the respectively chief of section for approval.
- (3) Thereafter the set of requisitions is given to the chief of maintenance section for approval.
- (4) Thereafter the set of requisition is given to the maintenance manager for authorization. One copy is kept in an own file.
- (5) The three copies are sent to the deputy manager or production manager for further outhorization.
- (6) Thereafter the remaining copies are given to the store for issuing.
When issuing the quantity is noted whereafter one copy is filed in the store and the remaining two copies are sent to the finance section for accounting.

The above routine is the official way but in case of urgency only, parts of the routine is applied and the requested part is issued from the store whereafter the remaining prodecure with the requisition is carried out.

D. SPARE PARTS TO BE PURCHASED.

The routines for this procedure are shown in the below flow chart.

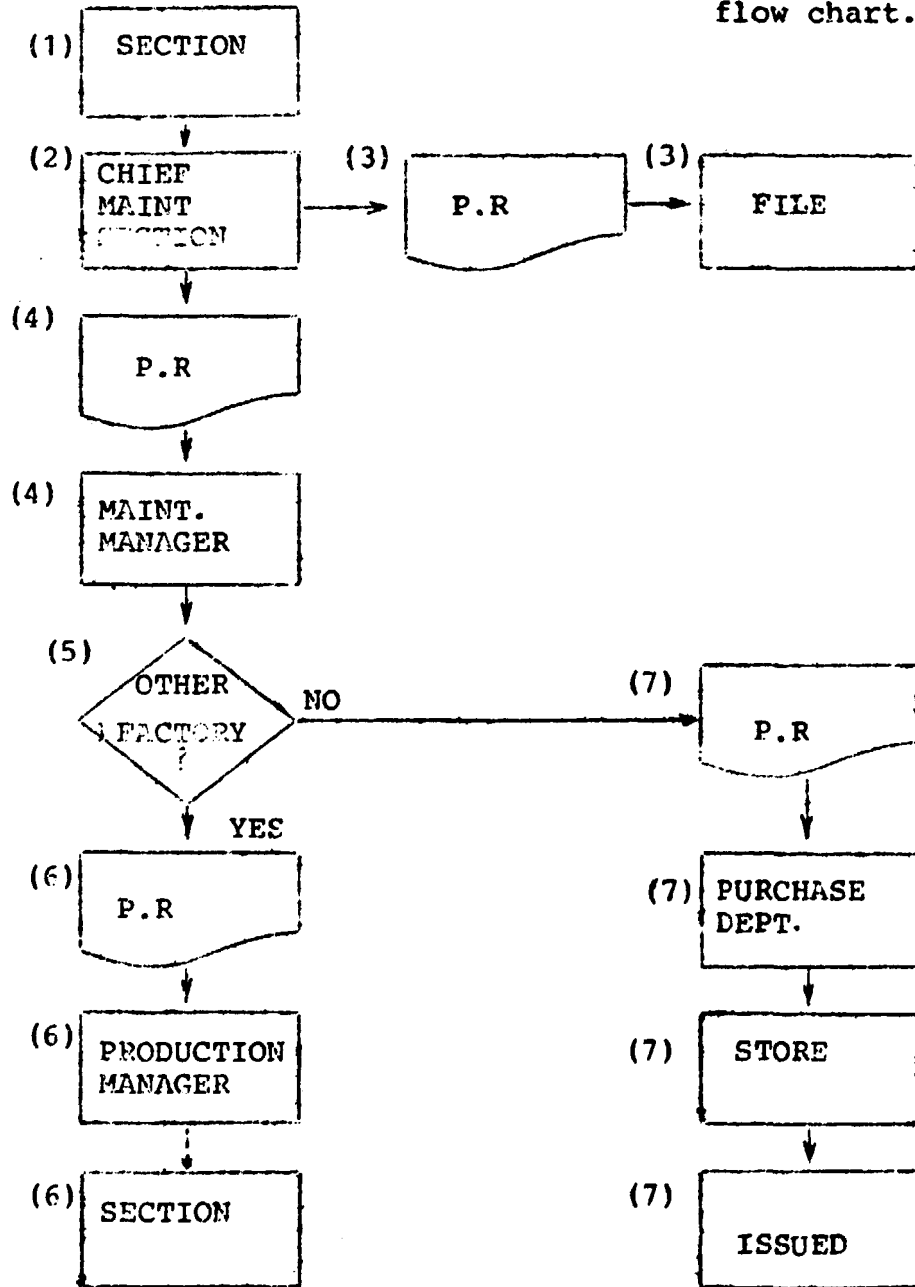


FIG. 7- Routine for the Spare Parts to be Purchased

- (1) The section which requires a spare part informs the chief of the maintenance section orally.
- (2) If approval is given the chief of maintenance section will write a purchase request. There is no special form for this purchase request.
- (3) One copy of the purchase request will remain at the requesters office
- (4) The original of the purchase request will be sent to the maintenance manager.
- (5) The maintenance manager will find out if the requested item is available or can be manufactured in an other MKEK plant.
- (6) If this is the case the purchase request will be sent to the relevant production manager who will see to it that the item is sent to the requesting section.
- (7) If the item is not available in an other MKEK plant or cannot be manufactured there either the purchase request is sent to the purchase department which will see to it that requested items are purchased and send to the central store. From there the items can be issued by means of a requisition.

3.4. OTHER STATEMENTS RELATED TO MAINTENANCE

3.4.1. WORKSHOP AND WORKSHOP FACILITIES

Most the described maintenance sections have a small local workshop and an office at their disposal. The facilities within the workshop are said to be sufficient. In the machine workshop several machines of different types are at disposal and can be used for manufacturing of spare parts.

Also in connection with the local workshop there is a small local store for common spare parts.

3.4.2. DOCUMENTATION

There are archives in every local workshop which contain copies of drawings, manuals etc. These archives are said to be sufficient for most of the fairly new machines. The original of these drawings are kept in a central archive and copies can easily be obtained.

By request also new drawings or sketches can be made by personnel from the central archive.

Also a routine for revising drawings is established.

3.4.3. DOWNTIME DUE TO MAINTENANCE

As mentioned before there are no proper records about the downtime due to maintenance. However, the records

kept by both production and maintenance indicates that a high rate of breakdowns are occurring. Also the annual stopover is very often exceeded.

The reason for the above is said to be

- lack of spares
- number of personnel is too low
- low personnel qualifications

In all this gives that the total downtime is considered to be high and should be reduced.

3.4.4. UTILIZATION OF PRODUCTION STOPS

In most of the production units there are normal stops like change of dies, rollers etc. In most cases these stops are not known in the maintenance sections and can therefore not be utilized for repairs to be done. It has been confirmed from the production planning department that this information is available in advance and can easily be given to the relevant maintenance section.

Also the production and production planning section stated that time for necessary repairs is given during change of shift if properly planned. At present this time is said not to be utilized.

3.4.5. WORKLOAD IN THE VARIOUS MAINTENANCE SECTIONS

In all the workload in the various sections is said to be very high. This is especially valid for mechanical maintenance in the forging mill and in the machine shop.

An exchange of personnel to section where a heavy workload exist is seldom done due to regulations and due to employment conditions.

3.4.6. NATURE OF JOBS DONE BY MAINTENANCE

As stated before most of the reported jobs are of breakdown nature. The duration of jobs vary from section to section. An estimation gives the following:

Jobs with a duration of less than 2 hours

A. Mechanical maintenance:

- Block rolling mill	60%
- Profile rolling mill	60%
- Steel mill	80%
- Forging	30%

Only 10-20% of the above jobs can be carried out by one maintenance worker.

B. Electrical maintenance:

About 70% of all electrical repairs have a duration of less than 1 hour. (Applies to all sections)

95% of the above jobs can be carried by one electrical repairman.

3.4.7. QUALIFICATION AND SPECIALIZATION OF MAINTENANCE PERSONNEL

At an average it is said that about 30% of the present manpower are qualified. Especially in the field of

hydraulics the lack of experienced personnel is said to hinder quick fault-finding and proper repairs. At present most fault-finding and repair on hydraulics is done in cooperation between electricians and mechanical repairmen.

Also lack of ability to read drawings hinders in some cases quick and proper repairs.

3.4.8. COOPERATION BETWEEN MAINTENANCE AND PRODUCTION

During our discussions with production personnel many topics where improvements are said to be possible have been pointed out.

Example of these topics are:

- quality of repairs
- waiting time for repairs
- availability of personnel for repairs
- reporting of performed repairs
- daily caretaking of machines
- maintenance organization

Although these topics have been discussed with maintenance, solutions for improvements have not been found.

1. COMMENTS AND RECOMMENDATIONS

4.1. PREVENTIVE MAINTENANCE (PM)

As described in the present situation preventive maintenance is in the process of implementation . Before giving any comments about the suggested system and making any recommendations it must be explained what PM is aiming at, what activities are to be included and which information is necessary to achieve proper planning.

4.1.1. GENERAL ABOUT PREVENTIVE MAINTENANCE

Preventive maintenance is a term for all programmed maintenance carried out with the aim of preventing failures from arising or of discovering failures before they result in further damage or trouble on both machines and products.

Typical preventive maintenance actions are:

- lubrication
- cleaning, housekeeping
- inspections, condition monitoring
- calibrations, adjustments
- programmed repairs
- programmed overhauls
- programmed replacements.

The aim of a preventive maintenance (PM) System is to plan and control all PM- activities so that they will be carried out at the right time with the right method and by the right personnel.

A system in some form is essential because it is impossible

without a system to ask anyone to remember when, where and how a lubrication or an inspection should be fulfilled. The system should allow to plan those PM- activities which may be performed during operation e.g. inspections, measurements of temperatures, leakage checks, lubrication etc. in some form. Also the system should be able to plan those PM-activities which need special planning because the activity cannot be done during operation but needs a shutting down of the machine e.g. change of oil, accuracy tests etc.

The system also should be supplemented with instructions for PM activities, describing briefly to an experienced person and in more details to a less experienced person how to carry out the PM- activity.

As the PM system is closely connected to production equipment, it must be changed when production equipment is modified, added or discarded. The system should also allow changes because of collected experience such as more suitable methods, change of intervals etc.

4.1.2.COMMENTS ON THE PRESENT PM SYSTEM

The present PM system is based on a "PREVENTIVE MAINTENANCE-PERIODICAL INSPECTION CARD" which is shown in appendix 2 and a "PERIODICAL LUBRICATION CARD" which is shown in appendix 3.

With the above general description of PM in mind the following comments on the above can be made:

1. The description of the points to be inspected must be very brief since there is not sufficient space.

2. The number of activities to be described is limited.
3. There is no reference to instruction numbers in which the job is described in detail.
4. Both electrical and mechanical activities are mixed which means in practice that "inspectors " from both categories must either co-operate or do the activities separately at different time.
5. Both activities which have to be done while the machine is in operation and activities which have to be done while the machine is stopped are mixed. This means for instance that an inspector comes to a machine for an inspection to be done during a stop but cannot perform it because the machine is in operation!
6. In the "PERIODICAL CUBRICATION CHART" also hourly and daily activities are described which means that somebody has to go to the relevant machines which is difficult from the planning point of view.
7. In the "PERIODICAL LUERICATION CHART" the viscosity of the lubricant is stated. This is not necessary since the type of oil will have a given viscosity. The quantity of bubricant for each lubrication point is not stated.
8. Also on the "PERIODICAL LUBRICATION CHART" the manufacturer, model etc. are stated. These satementes have no influence on the performance of the lubrication.
9. The planning of all activities is not described.

Due to the above comments a proper performance and wanted results are difficult to achieve and we therefore suggest the following adjustments.

4.1.3. EXPLANATIONS AND RECOMMENDATIONS ON PM

As stated above only in the lubrication chart hourly and daily PM activities are described. Required hourly or daily mechanical activities are neglected.

On the other hand the performance of these activities is difficult from the planning point of view.

We therefore suggest that the hourly and daily activities are to be extracted from the lubrication chart and together with established mechanical hourly or daily activities be transferred to a separate card called "OPERATORS MAINTENANCE INSTRUCTIONS"

A. OPERATORS MAINTENANCE INSTRUCTIONS

The content of this card should consist of all activities to be done hourly or daily. When preparing the above card a description of the activity must be given and also the interval and aids to be used. If it is necessary to identify the various points also a sketch should be attached. When establishing the card the following activities should be included.

Lubrication

Describe every activity:

- points to be lubricated
- method of lubrication
- quality and quantity of lubricant.
- time when activity has to be done e.g.
before start, during operation, every second hour etc.

Don't forget to describe the preparatory activities i.e

...ing of grease nipple before applying grease gun etc.

Cleaning

- points or parts to be cleaned
- method of cleaning
- time when activity has to be done

Checks

- points or parts to be checked
- method of checking i.e. listening, feeling,
- limits of clearance, temperatures etc.

Also when describing the above activities the safety regulations should be noticed.

The above card should be established for every equipment or part of equipment, plastic covered and be attached to the equipment or given to the operator.

The description should be established in co-operation with production personnel. Also when introducing the card to the operator he should be instructed how to carry out the various actions and it must be ensured that required aids are made available.

By introducing the above cards the following advantages can be achieved.

- The hourly or daily activities will be performed at the right time. This is impossible when maintenance workers are used unless a maintenance worker is assigned to the equipment
- Failures can be detected at an early stage
- The operator is motivated to take better care of "his" machine which also results in less breakdowns due to mishandling of machines.

PREVENTIVE MAINTENANCE SYSTEM

All PM actions which are not described on the "OPERATORS MAINTENANCE PROCEDURES" should be described on a "PREVENTIVE MAINTENANCE GUIDE". This is the main document for the PM system. It contains all activities to be carried out by maintenance personnel e.g. mechanical, electrical and lubricators. Further more the document is used for planning of all PM activities and for the performance of the activities. The following information is required.

For each equipment:

- Name of machine or equipment or of parts of equipment.
- Machine or equipment number.

For each activity:

The subject for the PM activities. This can be expressed by either giving the name of the component or part on which the PM activity is to be done e.g cooling system, gear box etc. or by giving the type of activity to be performed eg. overhaul, accuracy test etc.

- A brief description of the activity to be carried out consisting of:
 - : description of method
 - : limits for clearance, backlash, temperatures etc.
 - : name of instruments and aids to be used
 - : quality and quantity of lubricants needed.
- Number referring to a detailed description of the activity (if necessary)
- Category who is to do the activity eg. Mechanical, electrical, lubricator.
- The operating condition during which the activity has to be done eg. stop or operation.
- The interval between the activities expressed in weeks.

- Time needed to perform the activity.
With the above information it is possible to plan all activities. When doing the planning the following should be taken in to consideration.
- All activities to be done during operation must be planned separately for each category.
- The above activities must be planned in a logical sequence in order to avoid unnecessary loss of time due to complicated walk ways.
- Activities must be planned so that an equal workload per week can be achieved,
- Activities to be done during a stop must be planned for all categories together and in cooperation with the production planning so that during a single stop all relevant activities can be carried out.

The planning of the activities results in a number of activities to be done each week. This constitutes a "Work-package" and should be given to the performing personnel/section. Below some guideline for performance of the jobs are given .

- detected failures which could be repaired without stopping the machine (other than change of tool, shift etc.) should be done immediately if the job is supposed not to exceed about 30 minutes and if required tools are available.
- all other detected failures should be reported or recorded on a work-order for preparation and planning and later performance.

Detailed descriptions about how to fill in the forms and how to plan is described in "DESCRIPTION OF A MANUAL PREVENTIVE MAINTENANCE SYSTEM J. Steffens 1981-10-22"

As mentioned above the PM system should be supplemented with instructions. This is valid when activities cannot be described in detail on the PM-guide or to make sure that activities are carried out properly. There are several types of instructions:

- Instructions for condition monitoring on frequent occurring components. This instruction should be established once for each component and referred to whenever this component occurs in the machine or equipment.
- Detailed instructions which describes the job sequence in detail and where also needed tools, aids and spare are described.
- Instructions for tests or measurements which contains detailed descriptions about tests and measurements to be carried out and also provide spaces for notes about measurement results.

By establishing and implementing the above PM system the following advantages can be achieved.

- the amount of planned jobs will increase considerably.
- normal production stops are used to maintain equipment.
- failures are detected before they result in further damage which also reduces the spare part consumption.
- Reduced breakdowns and a minimized downtime due to maintenance.

Details about the organization for performance of PM activities will be given later in this report.

2. ROTINES FOR JOB REQUESTS, PLANNING AND RECORDING

The above routines are described in the manual "WRITTEN

PRACTICE OF MKEK FOR MAINTENANCE AND REPAIRS". Our comments on these routines, forms etc are given below followed of our recommendations and explanations,

4.2.1. COMMENTS ON THE JOB REQUEST FORM AND JOB REQUEST ROUTINE.

A. Comments on the layout of the job request form: An example of the job request is shown in app 4.

1. The space to describe the name of machine and part or component to be repaired is not sufficient.
2. Is it necessary to describe the type and model of the machine. Maintenance has its own record where these facts are stated.
3. Is it necessary to describe the type of production which is done in the machine? For most machines this is a known fact.
4. Somewhere it should be stated who has detected the failure or who knows more about the failure or failure symptom (if not clear). If this is stated, maintenance can contact this person in order to learn more about the failure.
5. It is not stated who has to fill in the request number. Is there a numbering system for each unit or is the number printed on the form?
6. The space for description of job, failure or failure symptom is very small.
7. The space for job report (description of job which has been carried out) and replaced parts is not sufficient.

8. The meaning with the work-order number is not clear.
Is this the same number as the request number? If so, why repeat it.

Apart from the above comments there are other subjects to be commented on. This is done in connection with the below given comments on the routines to be applied.

B. COMMENTS ON ROUTINES FOR JOB REQUESTS

1. In the routine description it is stated that the job request routine does not apply for minor jobs. In this case it must be stated what a minor job is.
2. In case of emergency the job will be started immediately whereafter the routine will be carried out. Since most of the jobs coming from the production sections are of emergency nature the routine will not be applied as intended.
3. Is it necessary that so many sections must approve the repair? (Up to date no approval is needed) For normal repairs this should be avoided since the procedure takes too long time and is of little value.
4. The job request for performed jobs are recorded in a book "Record book for repair requisitions (see app. 5) in the sequence they are received. In this way it is difficult to find all jobs done on one machine. It might be more useful to record the jobs per machine number.
5. In the above record book the following headings are found:
 - Date of arrival of request.
 - Job order no.
 - Date for completing the preparatory activities.
 - Time allowed for the job.

According to the flow of the request the jobs are recorded when performed and except for the job order number this information cannot be found on the job request.

6. The job requests for performed jobs are also recorded in "Maintenance cost determination form" (app 6). In this form the costs, unit price, total costs are asked for. From where does maintenance get this information? These facts are not known in the maintenance section.

Is it necessary to fill in the above facts, and send it to the finance section? The finance section has already received the used requisitions.

4.2.2. COMMENTS ON FORM "REPAIR PROGRAMME FOR A 3 MONTH PERIOD"

See appendix 7.

The procedure for planning of preventive maintenance has already been mentioned before. This form could be used for the above procedure.

4.2.3. COMMENTS ON FORM "PLAN FOR WEEKLY WORKLOAD"

See appendix 8.

Jobs from the above form will be transferred weekly to this form and thus containing weekly PM jobs.

The use of this form is doubtful if a PM system has been approved by the maintenance management and since the PM system originates work-orders for these jobs.

4.2.4. COMMENTS ON FORM "PERIODICAL INSPECTIONS FOR BUILDINGS"

See appendix 9.

This form can be used if buildings are not included in the PM system.

4.2.5. COMMENTS ON FORM "PERIODICAL INSPECTIONS FOR CRANES"

See appendix 10.

If cranes are not included in the PM system this form could be used.

4.2.6. COMMENTS ON FORM "WEEKLY WORK REPORT"

See appendix 11.

The use of this form seems doubtful.

4.2.7. COMMENTS ON "REVISION CARD"

See appendix 12.

If all revision jobs are recorded on a job request, most of the information requested in this form can be found there. If additional information is needed a simpler form could be used.

4.2.8. COMMENTS ON "REVISION PROGRAMME"

See appendix 13.

No comments.

4.2.9. COMMENTS ON "MACHINE CARD"

See appendix 14.

No comments.

4.2.10. COMMENTS ON "WORK REPORT FOR MACHINES"

See appendix 15.

No comments if properly applied.

4.2.11. COMMENTS ON "LUBRICATION CHART"

See appendix 16.

Routines for the use of this form is included in PM system.

4.2.12. GENERAL COMMENTS ON MANUAL

"WRITTEN PRACTICE OF MKEK FOR MAINTENANCE AND REPAIRS"

The routines described in this manual are not very clearly stated. During our discussions about the routines we got several different statements which resulted in confusions. If these routines are applied, detailed descriptions should be established.

Also this description is based on an organization which is not yet implemented. This organization includes one section for maintenance and one section for repairs . These definitions are not quite clear to use since maintenance also involves repairs.

4.3. EXPLANATIONS AND RECOMMENDATIONS ON ROUTINES

In addition to the weak points which are given in the comments above we feel that the described routines consist of too many forms and involves too many persons. This makes the routines slow and creates waiting time for signatures and approvals etc. We fear that easy ways will be found to avoid this slow procedures resulting in a collapsed system. Therefore our suggestion is to simplify the routines.

In the following an outline of a simplified system is given.

4.3.1. WORK ORDER FLOW

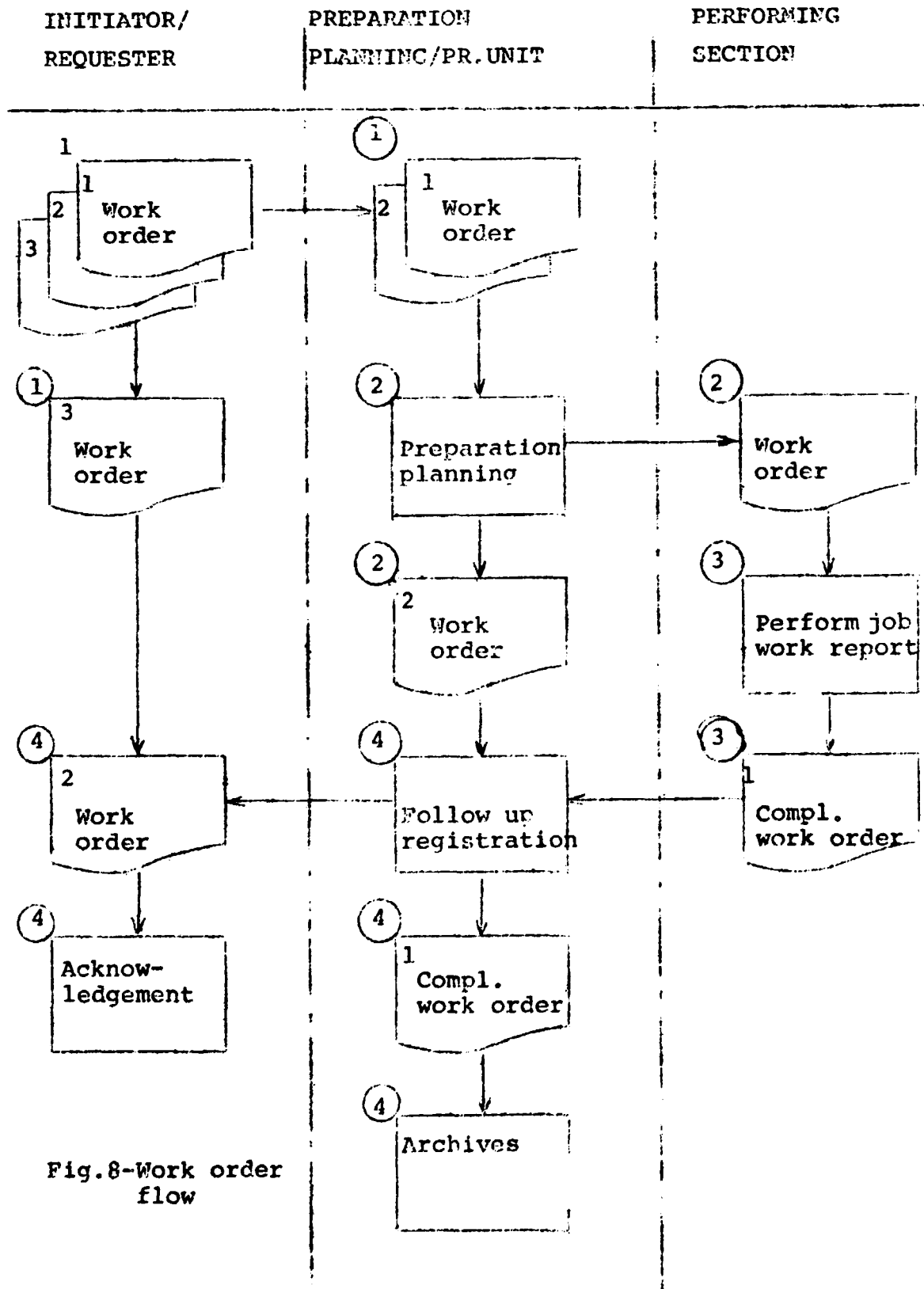


Fig. 8-Work order flow

- (1) Work orders must be completed in triplicate, (The number of the work order sheet is marked on the flowchart). Sheets 1 and 2 are given to the maintenance "preparation and planning" section. Sheet 3 remains at the initiator/requester.

- (2) Received work orders are prepared and planned according to routines described in "Preparation and planning". After preparation and planning, work order sheet 1 is sent to the department/section that is to do the work. Work order sheet 2 remains in the preparation and planning department for follow-up purposes.

- (3) When the job has been performed, a work report is recorded on the work order, and the work order is sent back to preparation and planning for follow up and registration.

- (4) When work order (sheet 1) is received it has to be checked for a complete work report. The duplicate (work order sheet 2) is sent to initiator requester for acknowledgement. Work order sheet 1, with the work report, is subject to the follow-up and registration procedure described under "follow-up, registration"; where after the work order is filed.

In the routine described above all work-orders are sent to a preparation and planning function. The organizational point of view will be described later in this report. In addition to the routines it should be mentioned that the initiator/requester can be any authorized person which also should include PM inspectors.

A work - order should be written for all jobs except for minor adjustments. In case of emergency job description can be given orally to the preparation and planning section.

Below a flow chart for simplified fountines within the preparation and planning section is shown.

- (1) As described in the work order flow sheet 1 and 2 of the work order are sent to the preparation and planning section.
- (2) The preparation and planning section has to state whether the job is:
 - modifacation which requires drawings etc.
 - a job to be done during overhaul
 - other major jobs which involves long stop time, high costs for spares etc. or outside contractors.
- (3) In this case work-order sheet 2 will be sent to the chief engineer for maintenance together with a written request or explanation. Work order sheet 1 remains in the preparation and planning section
- (4) In other cases the work order remains in the preparation and planning section and is subject to preparation and planing activities.
- (5) Work order sheet 2 together with the written request or explanation will be subject for futher actions:
 - drawings to be made
 - approval for longer stops
 - approval of revision jobs
 - hire of contractors

The above activities will be carried out and work order

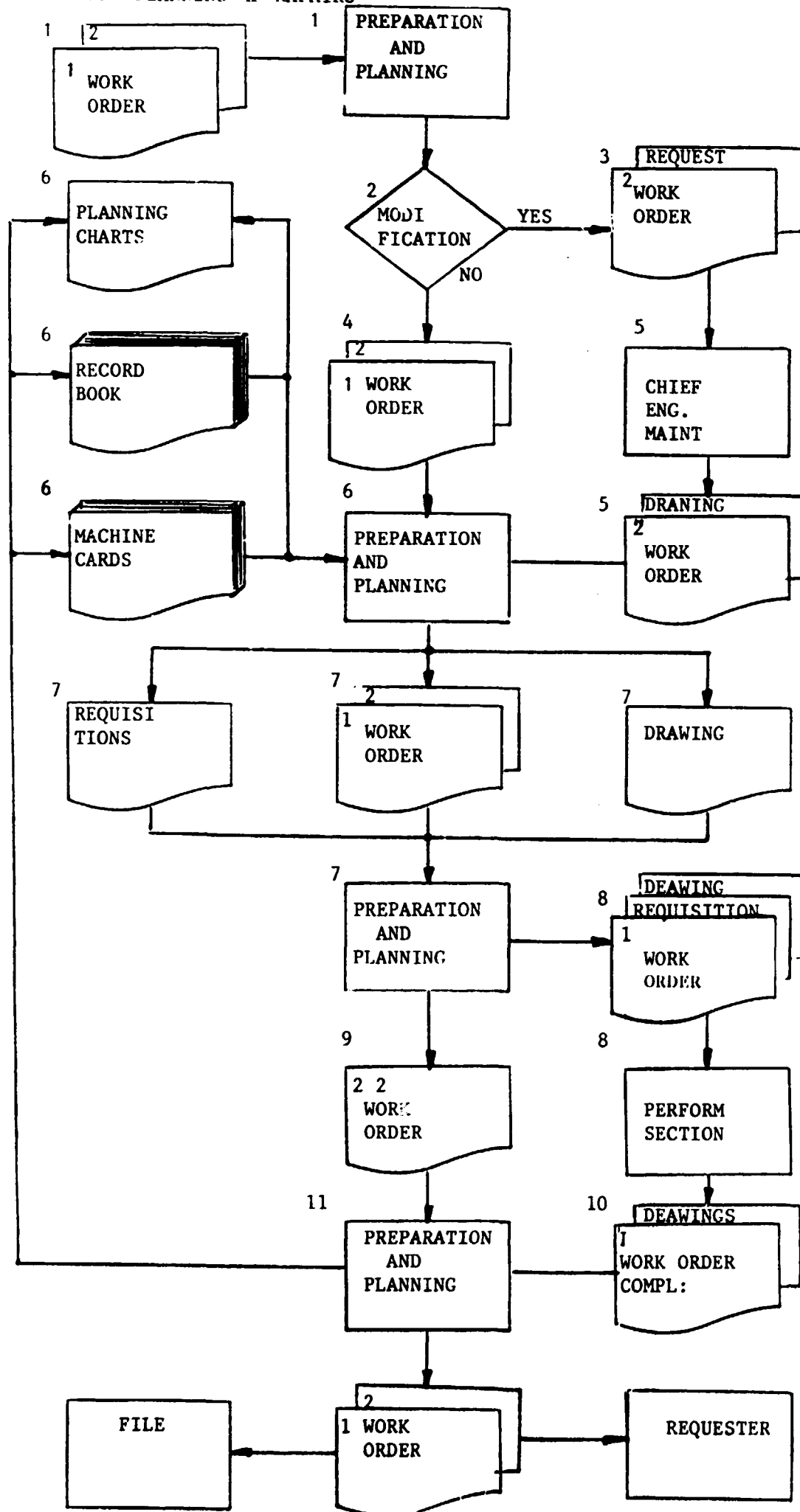


FIG. 9- Routines for preparation and planning

sheet 2 with required drawings or sketches will be sent back to the preparation and planning section.

- (6) With the above in hand preparation and planning activities are done.

Preparation:

- What is to be done
- How should it be done
- Which aids and tools are required
- Which drawings and sketches are needed
- Which spare parts and materials are needed

Planning:

- Estimation of time needed
- Number of personnel required
- Maintenance sections involved
- Starting point for repair

The above will be recorded on the work order and on planning charts. Record books and machine cards are used as information sources for the above.

If necessary a visit to the workplace could be made.

- (7) As a result of the above activities work order (sheet 1 and 2) are prepared requisitions are written and required drawings, sketches or instructions are assembled.
- (8) Workorder(sheet 1) together with the above documents are given to the performing section for performance.
- (9) Work order (sheet 2) remains in the preparation and planning section for follow up purposes.

(10) When the job is performed the work order (sheet 1) including work report together with drawings, sketches, instructions etc are given to the preparation and planning section,

(11) The received completed work order will be subject to follow up and recording. Where after work order sheet 1 is filed and sheet 2 is sent to the requester for acknowledgement.

Note! In order to obtain all information about a job also the requisitions including recorded costs must be sent to the planning and preparation section. (see Requisition routine).

The preparation and planning officer will then be able to provide the finance section with all information required.

4.4. REQUISITION ROUTINES

4.4.1. COMMENTS ON REQUISITION FLOW

1. Spares drawn from the local store are not recorded.
2. The requisition procedure for parts to be issued from the central store seems complicated and time wasting. Is it necessary that so many persons have to approve?
3. Maintenance sections do not receive a copy of the requisition where costs for issued parts have been recorded. This makes a follow up of costs per machine or job impossible.

Considering the above comments the following recommendations are made.

1. Simplify the requisition routine for parts to be issued from the store. This can be done by giving limited authority to maintenance engineers or technicians in the sections.
2. A requisition should be written for all spares and material drawn from the local store.
3. A work order should be established for all parts to be manufactured in the machine shop.
4. A copy of issued parts, furnished with the costs, should be sent to the requester.

In doing this it will be ensured that all costs can be recorded and appropriate information can be gathered for follow up purposes both in the maintenance sections and in the finance section.

4.5. ORGANIZATION

4.5.1. COMMENTS

A. Below only comments on the present organization are given.

1. The chief of mechanical maintenance is head of 13 sections. In a maintenance organization this is far too much to be handled by one person.
2. Good utilization of skilled personnel is difficult since maintenance sections are established for each production unit and personnel can hardly be utilized in other sections.
3. Specialization is hard to achieve.

B. Considering the comments given about do we recommend the following?

1. To divide the present mechanical maintenance department into a mechanical department and a civil engineering department.

This would result in the following main maintenance organization.

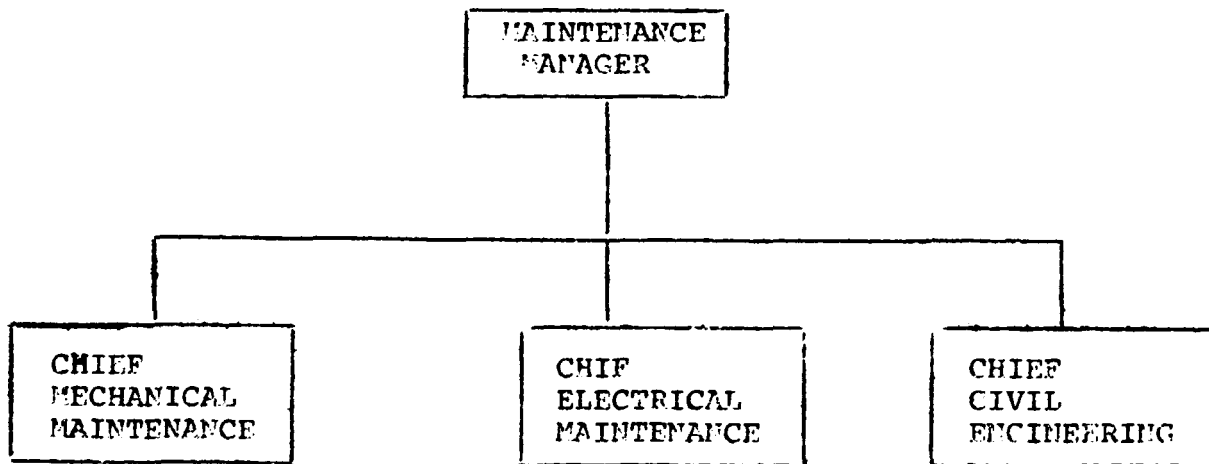


Fig. 10 Main maintenance organization structure.

The advantages with the above suggestion is that:

- Mechanical maintenance is reduced to an acceptable level of sections which are only dealing with mechanical maintenance and can therefore concentrate on their task.
- The civil engineering department can concentrate on handling all activities related to civil engineering.

With the above organization in mind the mechanical maintenance can be formed as follows:

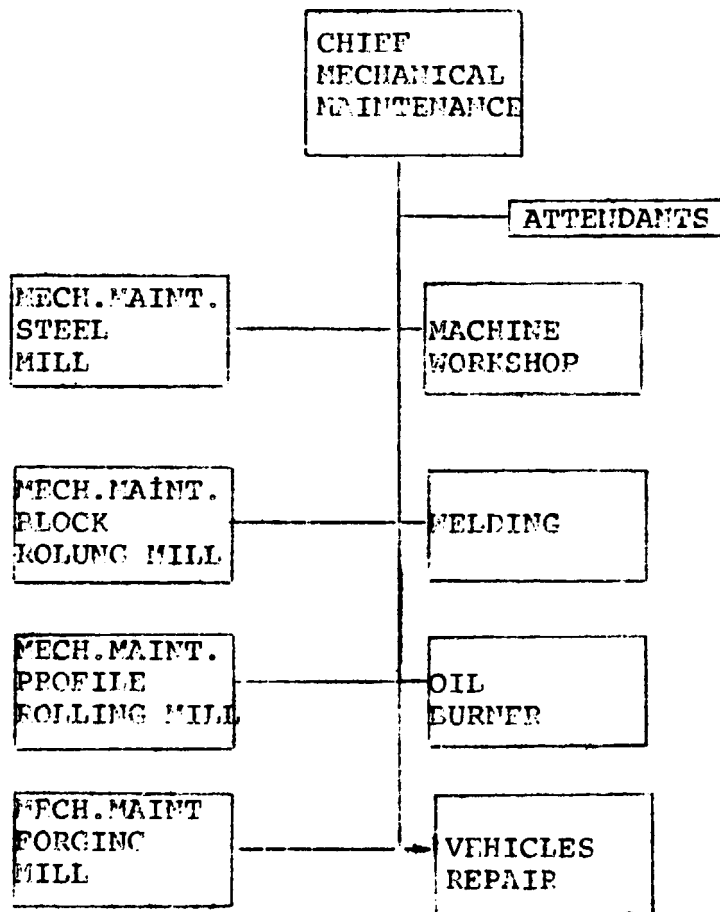


Fig.11-Mechanical maintenance structure

2. The remaining sections civil engineering, plumbing and pipe repairs, refractors, painting and rubber repairs can be organized under the civil engineering department in the same way.

C. Regarding the organization of the mechanical maintenance sections the following recommendations are made:

1. In the sections steel mill, block rolling mill, profile rolling mill, forging mill, machine workshop and welding a function of preparation and planning of maintenance repairs is to be established.
2. A number of workers (20-25%) from steel mill, block rolling mill, profile mill and forging mill are to be transferred and formed into a central workforce preferably stationed in the machine shop and supervised by an own foreman.

D. With respect to the above the responsibilities for the sections is described briefly below,

- Mechanical maintenance steel mill.
- " block rolling mill
- " profile rolling mill
- " forging mill

Responsible for all mechanical repairs requested by production personnel and as a result of PM inspections and overhauls.

In addition to that the preparation and planning officer is responsible for preparation and planning of all requested repairs in accordance with the outlines given in chapter 4.3.

Machine workshop:

Responsible for manufacturing spare parts and production consumables.

Responsible for preparation and planning of own activities.

Responsible for repairs in the various production units by request from the chief engineer for mechanical maintenance.

Welding:

Responsible for welding activities throughout the plant upon request (work-order) from respectively section.

Responsible for preparation and planning of own activities.

E. Electrical department.

No changes in organization in general are suggested.

However, the responsibilities for the maintenance planning service changes and is described below.

Maintenance planning service:

Responsible for establishing and updating "OPERATORS INSTRUCTION CARD".

Responsible for establishment and updating of a PM system for all mechanical and electrical equipment and to carry out inspections and lubrication in accordance with the above.

Responsible for initiation of work order as a result of inspections carried out.

F. If the above organization is implemented and suggested routines for work-order, PM, requisition and preparation and planning are applied the following advantages can be achieved:

1. The establishment of the central repair group results in:
 - personnel from this group can be sent to production units where an overload of maintenance personnel exists. There by waiting time for repairs and repair time can be reduced.
 - better utilization of personnel.
 - permits flexibility when planning the annual overhaul.
2. By establishing preparation and planning functions it will be ensured that:

-- Preparation and planning activities allows repairs to be done at the right time and as fast as possible.

- the preparation and planning officer is supposed to have daily contact with production or production planning which will result in better utilization of normal stop time and co-operation between production and maintenance.

3. By introducing the simple routines a quick information flow is achieved and all required information can be recorded and analysed properly.

G. General comments about organization.

In the above organization chart it is stated that the "Maintenance planning service" remains under the leadership of the chief electrical engineer. If this proves not to be successful it might be considered to establish a separate "Preparation and planning" department on equal level to mechanical, electrical and civil engineering. In this case all preparation and planning officers can be connected to this section and also the PM personnel.

4.5.2. OTHER COMMENTS AND RECOMMENDATIONS RELATED TO MAINTENANCE

A. BUDGET

A budget for maintenance is established but maintenance has little influence on this. Budget responsibility given to maintenance can result in better motivation and forces maintenance to evaluate and analyse most of their doing.

B. MAINTENANCE OF HYDRAULICS

To avoid long fault finding time and to be able to do reliable repairs fault finding schedules and instructions should be

prepared. If this shows not to improve the situation the establishment of a special group for maintenance on hydraulics might be considered.

C. STORAGE OF SPARES

Both in local stores and in the central stores items like bearings could be seen stored without protection and exposed to atmospheric reaction. This should be avoided and the store keepers should be told the proper ways to store these parts.

D. USE OF INSTRUMENTS AND AIDS

To achieve more reliable results when performing P₁ inspection instruments and aids for condition monitoring should be used.

E. TRAINING

Lack of qualified personnel in repair techniques reading of drawings and flow charts hinders proper and quick repairs. Regular training should be started immediately. To solve this problem it might be considered to establish a training and repair centre in cooperation with other companies in Kirikkale belonging to MKEK.

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NOT :													14
I S T E Y E N		Veriniz. (Yetkili Md.)		Veren		Alan		Muhasebe					
Mas. Y. Amiri		İnşaat Md. (Md.)											

B Ambar muhasebesine

NOT : 7 No. lı hüccye ana grup, tali grup ve pozisyon numaraları yazılacak.

O - M/JF-04-012

PERYÖDİK YAĞLAMA KARTI

Sistem No.	Yağlanacak yer sayısı	Yağlama tarzı	Yağlanacak makina kısımları	Yağlama periyodu	Yağın tarifi			Düşünceler
					Viskozite	Cinsi	M.K.E. No.	

Yağlama periyodları :

- S : Saatte bir
- G : Günde bir
8 saatlik çalışma için
- H : Haftada bir
- O : 2 haftada bir
- A : Ayda bir
- Ü : Üç ayda bir
- L : Altı ayda bir
- Y : Yılda bir

Dikkat :

Bütün merkezi yağlama sistemleri için, yağlama şeması eklenir. Yağlanacak noktalar iyi işaretlenmelidir.

D. No.	Talimatın ait olduğu tezgâhların adı :		
İmal eden :	Model :		
Hidrolik şema :	Kontrol :	Tarih :	
Basınçlı hava şeması :	Onay :	Tanzim eden :	
M. K. E. K. Fb.		Sayfa No. :	Top. Say. :

M. K. E. K. Fb. M.İ.		ONARIM TALEP VE İŞ EMRİ FORMU			Tarih/...../ 197 Talep No :	
Tezgâhın, tesisin, takımın, binanın ve diğerlerinin	ADI	Arıza oluşumunun				
	Tipi Modeli Demirbaş No.	Tarih		Saat - dak.		
	Atl. sı veya Masraf yeri No.					
	YAPTIĞI İŞ	Yapıla- cak iş	Onarım İmalât			
Arızanın veya talebin oluşunu nedenlerine ilişkin açıklamalar.						
İşin ivedilik durumu	Normal	Acil	Çok acil	Tesisin vardiya durumu	1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/>	
Bakım Onarım Kısım Müdürlüğüne Hizmetin görülmesinin gereğini arz ve rica ederim. Kısım Müdürü		 Kısım Md. lüğüne Gereğini arz ederim. Başmühendisi	 Başmüh. lüğüne Gereğini arz ederim. Servis Şefi	
Arıza veya talep hakkında düşünceler						
Yapılan işlemler (Değiştirilen parçalar dahil yazılacaktır).				İş Emri		
				No.	Tarihi	
ONARIM İMALAT Süresi	Saat/Dak.	Onarım tezgâh Tesisinin imalâta girdiği	Tarih/...../197... Saat/Dak.	Tezgâhı tesisi takım teslim aldım/...../ 197... Atl. Şefi		
..... ONARIM BAŞMÜHENDİSLİĞİNE Gereğini rica ederim. Bakım Onarım Kısım Müdürü (İmza)			 ONARIM SERVİS ŞEFİĞİNE Gereğini rica ederim. Onarım Başmühendisi (İmza)		

) Aylık Onarım Programı

T E R M İ N

AYI

7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

BAKIM BAŞ MÜHENDİSİ

SECTION 3

M. K. E. K.

BİNALAR İÇİN PERİYODİK

Muayencisi :

Adı, Soyadı :

Tarih : İnce

Bina adı :

BAKIM FORMU

D. No. :

Önceki muayene tarihi :

Muayene edilen kısım herhangi bir aksaklık göstermiyorsa «Kullanılabilir» sütununa (V) işareti konur. Aksaklık var ise «İhtiyatla kullanılabilir» sütununa A, B, C veya D harflerinden biri yazılır. Aksaklığın sebebi diğer sütunlarda (X) işaretiyle belirtilir. Notlar arka sayfaya yazılır.

A — Kullanılabilir, bakım yapılmalı.

C — Fena durumda, öncelikle onarılmalı.

B — Müsait bir zaman bulunca onarılmalı.

D — Çok fena durumda, derhal onarılmalı.

		Kullanılmaz Kullanılabilir	İhtiyatla kullanılabilir Emin değil - Titreşim var Kırılmış - Parçalanmış Bozuk - Açınmış Sızma - Rutubet problemi Deformasyon - Çöküntü Çalışma binaya uygun değil. Yerleşirme binaya uy. değil. Çirkin görünümlü-boyama ger. Koku problemi			Kullanılmaz Kullanılabilir	İhtiyatla kullanılabilir Emin değil - Titreşim var Kırılmış - Parçalanmış Bozuk - Açınmış Sızma - Rutubet problemi Deformasyon - Çöküntü Çalışma binaya uygun değil. Yerleşirme binaya uy. değil. Çirkin görünümlü-boyama ger. Koku problemi
	DIŞ YAPI			51	İçme suyu		
1	Temeller			52	Sihhi tesisat elemanları		
2	Duvarlar			53	Rezervuar ve duş		
3	Eşik - İento			54	Lavobalar ve musluklar		
4	Pencereler			55			
5	Kapılar			56	Aydınlatma tesisatı		
6	Kirişler			57	Ampuller, anahtarlar		
7	Kolonlar			58	Elektrik girişi		
8	Platform			59	Elektrik dağıtım sis.		
9	Merdiven			60	Elektrik bağlantıları		
10	El merdiveni			61			
11	Korkuluk			62	Isıtma sistemi		
12	Diğer yapı elemanları			63			
13				64	Havalandırma sistemi		
14				65	Klima		
15				66			
16	Çatı			67	Tanklar-su		
17	Saçak			68	Tanklar-yağ		
18	Korkuluk-parmaklık			69	Tanklar-diğer		
19	Gölgelik			70			
20	Oluklar			71			
21	Yağmur borusu			72			
22	Paratöner				Emüiy. Yangın. K.		
23	Aydınlık penceresi			73	Söndürme suyu vanal.		
24	Bacalar			74	Kimyasal söndürme S.		
25	Baca deliği			75	Söndürme tüpleri		
26	Levhalar			76	Alarm tertibatı		
27	Diğer çatı elemanları			77	Su hortumları		
28				78	Alev sütteleleri		
29				79	İlk yardım dolabı		
30				80	Acil çıkış yerleri		
	İÇ YAPI			81	Diğerleri		
31	Temeller			82			
32	Duvarlar			83			
33				84			
34	Pencereler			85			
35	Kapılar			86			
36	Tavanlar			87			
37	Kirişler			88			
38	Kolonlar				ARSALAR		
39	Döşemeler			89	Kaldırımlar		
40	Korkuluk			90	Yollar		
41	Platformlar			91	Park yerleri		
42	Merdiven			92	Çitler, kapılar		
43	El merdiveni			93	Levhalar		
44	Trabzan			94	Genel görünüş		
45	Diğer yapı elemanları			95			
	TESİSAT			96			
46	Su boruları				Diğer Kısımlar		
47	Buhar boruları			97			
48	Basınçlı hava boruları			98			
49				99			
50	Boru izolasyonları			100			

M. K. E. K.

VINÇLER İÇİN PERİYODİK MUAYENE RAPORU

Fabrikası

İmal eden :

Mod./Fb. No :

D. No. :

Masraf yeri :

MEKANİK KISIMLAR

ARABA	DURUM			KÖPRÜ	DURUM		
	İyi	Orta	Değişecek		İyi	Orta	Değişecek
Araba tekerlekleri				Köprü tekerlekleri			
» tekerlek milleri				Köprü tekerlek milleri			
» tekerlek mil bilyaları				Köprü tekerlek bilyaları			
» tahrik dişlisi				Tahrik dişleri			
» tahrik pinyonu				Tahrik pinyonları			
» motor dişlisi				Uzun mil bilyaları			
» motor pinyonu				Uzun mil kavramaları			
» dişli milleri bilyaları				Köprü motoru dişlisi			
» akım kollektörü				Köprü motoru dişli milleri			
				Köprü motoru dişli bilyası			
Kaldırma motoru pinyonu	Esas			Köprü motoru pinyonu			
	Yar.			Köprü freni balataları			
Kaldırma motor dişlisi				Köprü freni pabuçları			
Ara dişli				Köprü freni tüpleri			
Ara pinyonu				Köprü freni kolları			
Dişli milleri bilyaları				Ana akım kollektörü			
Kasnak dişlisi				Tamponlar			
Kasnak dişlisi pinyonu				Ray bağlantıları			
Kasnak dişli mil bilyaları				Takozlar			
Mekanik yük freni							
Mekanik yük fren balatası							
Üst denk makarası							
Üst denk makara bilyaları							
Alt blok makarası							
Alt blok makara bilyaları							
Alt blok sevk bilyası							
Kaldırma kablosu							
Motorlu fren pabuçları							
Motorlu fren balataları							

ELEKTRİKLİ KISIMLAR

KISIMLAR	ESAS KANCA			YARDIMCI KANCA			ARABA TAHRİK			KÖPRÜ TAHRİK		
	DURUM			DURUM			DURUM			DURUM		
	İyi	Orta	Değişecek	İyi	Orta	Değişecek	İyi	Orta	Değişecek	İyi	Orta	Değişecek
Motor												
Motor mili ve bilyaları												
Motor bobinleri												
Motor fırça tutucular ve fırçalar												
Motor komitatoru												
Kontrollar												
Kontrol kontaktları ve bıçakları												
Kontrol fırça tutucuları												
Kontrol fırçaları												
Kontrol yayı												
Dirençler												
Son anahtarı												
Son anahtarı kontaktörü												
Elektrikli fren bobini												
Tabla												
Kablolar												
Gergi izalatorleri												
Karşı kablo												

Muayene tarihi :/...../ 197

Muayeneyi yapan :

M. K. E. K.

Masraf yeri No :

..... Fabrikası

İş emri No. :

REVİZYON KARTI

Tezgâh veya tesisin adı :

Tarih :

Markası-Modeli :

Kart sıra No. su :

Demirbaş No. :

Revizyon periyodu :

Bulunduğu yer :

Başlama zamanı	Bitiş zamanı	Revizyonda çalışan ekiplerin		
		Adı ve Soyadı	Pozisyonu	Fb. No.
Değiştirilen yedek parçalar				
Revizyonda tespit edilen arızalar		Revizyonda yapılan işlemler		
Sonuç ve düşünceler :				
Onarım Başmühendisi		Bakım Başmühendisi	Bak. Onr. Ks. Müdürü	
(İmza)		(İmza)	(İmza)	

O-M/F-08--010

19... Yılı

Reviz

T E

AYI

SECTION 2

Revizyon Programı

T E R M İ N

AYI

BAKIM ONARIM KISIM MÜDÜRÜ

SECTION 3

Plan

Uygulama

İ Ş Ç İ L İ K S A A T I

AYI

Mak. Tanı.

Tesisatçı

İşletici

Aparatçı

Kaynakçı

Takımcı

Hidrolikçi

Elektrikçi

Düvarcı

Marangoz

Diğerler

ONARIM KISIM MÜDÜRÜ

ONAY
FABRİKA MÜDÜRÜ

SECTION 4

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

Tasnif No.		Cinsi :	İmal eden firma :
		Tipi :	Modeli/Fb. No.sı :
			İmal senesi :
			Satın alındığı tarih :
			Mübayaa fiyatı :
Tezgahın teknik evsafı			
Tezgahın alabileceği iş			
Sürünler arası mesafesi : Gayitlarda		mm ; Gayitlar altında :	mm
Bağlama masası il. gayitlar arasındaki mesafe :			mm
Bağlama masası	Yüksekliğine ayar kabiliyeti :		mm. ye kadar
Bağlama sathı :			mm
Bağlama plakası : Kalınlık	mm ; delik O / <input type="checkbox"/>		mm
Bağlama kanalları : Adet		Şekil :	
Ölçüleri :		Vida ø :	mm
Hamil	Bağlama muylusu : Delik ø	mm ; Derinliği :	mm
Hareket siası enaz/ençok	/	mm ; İtici yolu :	mm
Hamilinin hareket sayısı :			dakikada
Bastırıcı	Bağlama sathı :		mm
Bağlama kanalları : Adet		Şekil :	
Ölçüleri :		Pul ø :	mm
İş bağlama masasından mesafesi ençok :			mm
Hareket siası :			mm
			Tezgahın
			Ağırlığı :
			Yüksekliği :
			Kapladığı yer :
			Hassasiyeti :
			Kullanma talimatı, katalog ^{var} / _{yok} No.

-80-

Agıp.14

20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1

Elektrik motoru				Tarih	Fabrikanı	Masraf yeri	Demirbaş No.
n = _____ (1/dak) Kw							
Tezgahın bususi tertibatı, ilaveleri ve yedekleri				Kıymet Değişiklikleri			
Kalıp bilezikleri : Yükseklik mm				Mahiyeti	Değişiklik tarihi	İlave kıymeti	Düşünülen kıymet
Ø : Dış mm ; İç mm							
İşverme tertibatı :							
Emniyet tertibatı :							
Tezgahın çalışma karakteristikleri							
Takati	Kesme basıncı Kg.	Çekme basıncı Kg.	Nihai basınç Kg.				
Tezgahı çalıştıran işçi sayısı :							
Bilhassa yapabileceği işler				Düşünceler			

Tezgâh-Tesis Çalışma Raporu

Yılı : _____

Fb. _____

Şubesi : _____	Adı : _____		Demirbaş No. _____																																	
Masraf yeri : _____	İmal eden ve model : _____																																			
AYLAR	G Ü N L E R																															TOPLAM (saat)				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Dolu	Boş			
OCAK					Tk																															
ŞUBAT																																				
MART																																				
NISAN																																				
MAYIS																																				
HAZİRAN																																				
TEMMUZ																																				
AĞUSTOS																																				
EYLÜL																																				
EKİM																																				
KASIM																																				
ARALIK																																				

YILINDA			BOŞ KALAN SAATLERİN DÖKÜMÜ						
Çalışacağı Saat	Çalışılan Saat	Boş kalan Saat	İçti gelmedi	İş gelmedi	Sipariş yok	Ayar bozuk	Takım noksan	Bakım onarım	Tesisatta arıza
SEMBOLLER			<p>G = İçti gelmedi</p> <p>Tk = Takım noksan</p> <p>İş = İş gelmedi</p> <p>Tg = Tezgâhta bakım onarım</p> <p>Ts = Tesisatta arıza</p> <p>Ay = Ayar bozuk</p> <p>Sp = Sipariş yok</p>						
<p>Örnek : $\frac{Tg}{4}$: Tezgâhta onarım yapıldığından 4 saat çalışılmadı.</p>									

O-M/E - 08 - 019

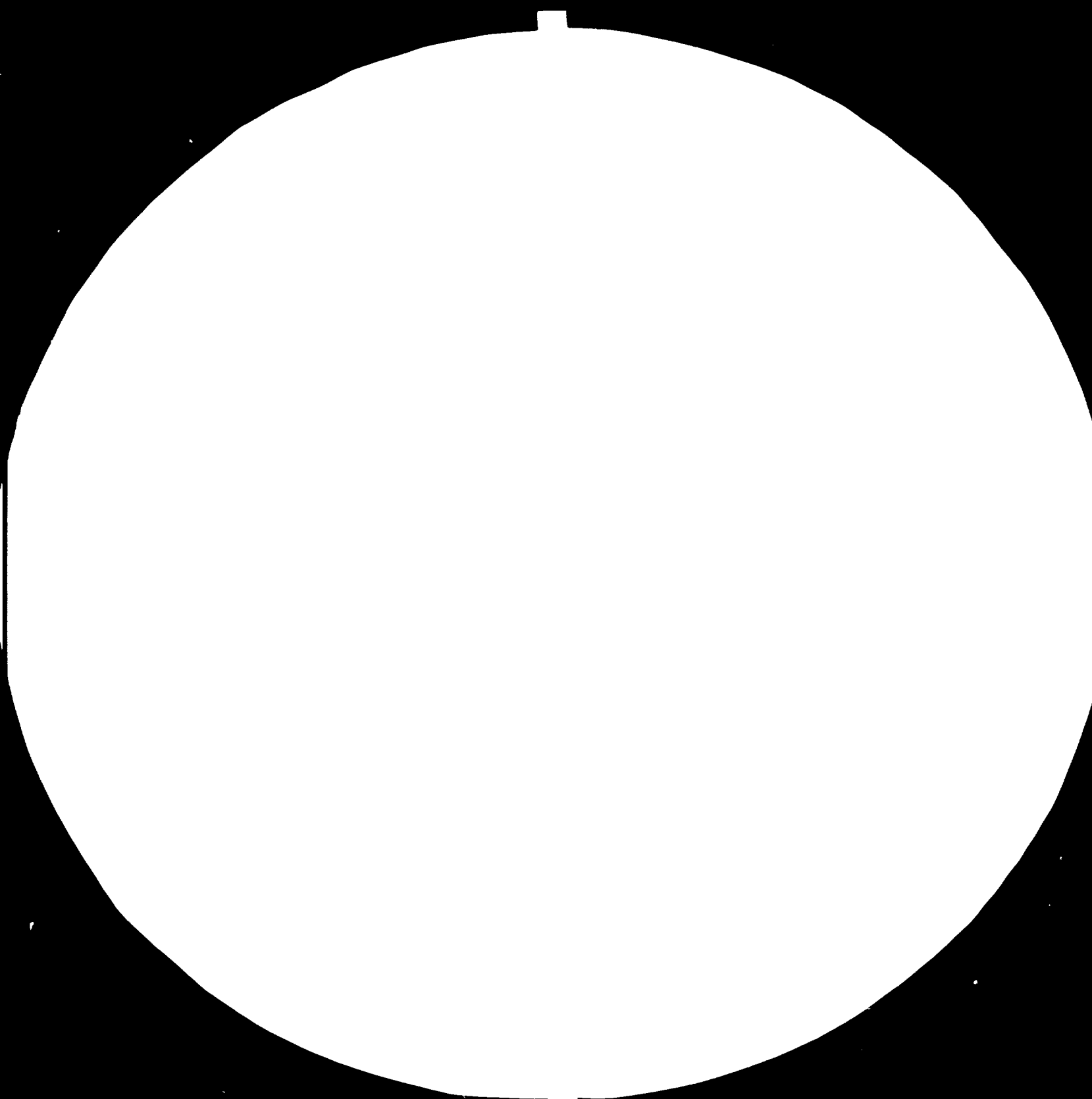
Dolduran

İmalât kısmı

İmalât planlama kısmı

Bakım onarım kısmı

83.11.09
AD.85.03





2.8



3.2



3.6



Microcopy Resolution Test Chart (ANSI/ISO #2)

Resolution Test Chart (ANSI/ISO #2) is available from the following sources:

Bakım

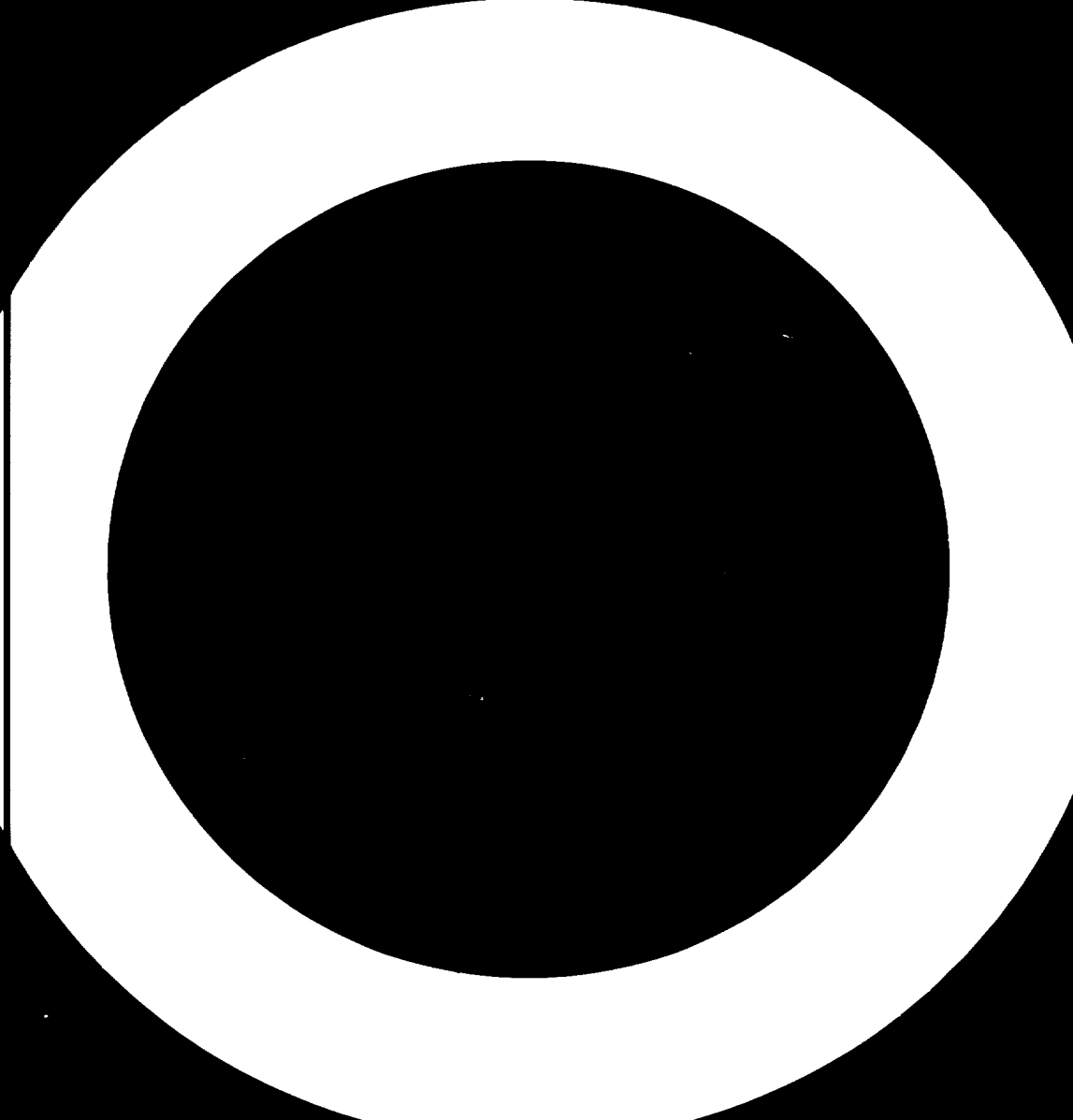
Yağlama

D Ü Ş Ü N C E L E R

8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

ONAY
Fb. Md.

SECTION 4



APPENDIX 3

SEMINAR ON MAINTENANCE PLANNING

Kırıkkale 23-25.3.1983

FIRST DAY

Production and maintenance
Availability of production equipment
Various maintenance procedures
Failure analysis
The maintenance system

SECOND DAY

Preventive and corrective maintenance
Preventive maintenance
Condition monitoring
Condition monitoring techniques
Examples on condition monitoring

THIRD DAY

Preventive maintenance system in general
Daily caretaking
Description of a preventive maintenance system
Implementation of preventive maintenance
Organizational viewpoints

APPENDIX 4

LIST OF PARTICIPANTS (MAINTENANCE SEMINAR, KIRIKKALE, MARCH 1983)

<u>NAME</u>	<u>PROFESSION</u>	<u>PROF EXP. (Yr.)</u>	<u>ORGANIZATION</u>
1.Satılmış BAYCAN	Electr.Eng.	17	MKEK Steel Plant
2.Haydar GÜNDÜZ	Mech.Eng.	8	MKEK Steel Plant
3.H.İbrahim GEREM	Mech.Eng.	5	MKEK Steel Plant
4.Mustafa ÜNAL	Mech.Eng.	4	MKEK Steel Plant
5.Hasan BÜKEN	Electr.Tech.	-	MKEK Steel Plant
6.Cemil KOÇAK	Mech.Tech.	3	MKEK Steel Plant
7.Esat YILMAZER	Mech.Eng.	6	MKEK Steel Plant
8.Turgut ÖZGEN	Mech.Eng.	8	MKEK Weapon and Rifle Fac.
9.Ismail YILDIZ	Electr.Eng.	10	MKEK Steel Pipe Drawing Plant
10.Ethem SAYINER	Mech.Eng.	7	" " "
11.Adem CANATAN	Mech.Eng.	8	" " "
12.Süleyman BULUT	Mech.Eng.	3	" " "
13.Güneş HIÇYILMAZ	Electr.Tech.	21	" " "
14.M.Ali EKER	Electr.Tech.	15	" " "
15.Recep ERGENÇOĞLU	Mech.Tech..	18	" " "
16.Nihat GÜRBÜZ	Tech.	10	" " "
17.Nevzat DELLAL	Electr.Tech.	20	MKEK Elect.Mach.Plant
18.Dursun BOZKURT	Mech.Eng.	7	MKEK Missile Plant
19.Murat ÖZTÜRK	Mech.Eng.	10	MKEK Gas Mask Plant
20.Ali ONAT	Mech.Eng.	13	MKEK Explosives Plant, Elmadağ
21.Galip AKGÜL	Mech.Eng.	10	" " "
22.Atabay ÜNAL	Mech.Eng.	10	MKEK Explosives Plant, Kırıkkale
23.Naim DOĞAN	Electr.Tech.	21	" " "

(cont.)

APPENDIX 4 (Continued)

<u>NAME</u>	<u>PROFESSION</u>	<u>PROF EXP. (Yrd.)</u>	<u>ORGANIZATION</u>
24.Mustafa AKAR	Mech.Eng.	7	MKEK Textile Mach. Plant
25.Mustafa AYDIN	Mech.Eng.	6	MKEK Gazi Cartridge Plant
26.Ahmet SAYIN	Mech.Tech.	23	MKEK Ammunition Plant
27.Özkan GÖKBULUT	Electr.Tech.	26	MKEK Ammunition Plant
28.Haydar GÜMÜŞBAŞ	Mech.Tech.	4	MKEK Ammunition Plant
29.Bayram GÜÇLÜ	Mech.Eng.	10	MKEK Civil Eng.Mach. Plant
30.Zerrin ATA	Chem.Eng.	10	MKEK,Inv.Planning Branch
31.Çetin ERGİN	Mech.Tech.	9	" "
32.Raci YALÇIN	Tech.	5	MKEK,Mach.Ind.Plant
33.Doğan TÜRKMEN	Mech.Eng.	6	MKEK Wooden Products Plant
34.Mustafa YALÇIN	Electr.Eng.	9	MKEK Heavy Ind.Equip. Plant
35.Ahmet ARSLAN	Mech.Tech.	20	MKEK Gun and Automative Plant
36.Ahmet ORUÇ	Mech.Eng.	10	MKEK Brass Plant
37.Abdullah ERKİLETLİOĞLU	Mech.Eng.	7	MKEK Brass Plant
38.Hasan KÖSOĞLU	Mech.Eng.	5	MKEK Brass Plant
39.Mustafa DEDEBALI	Mech.Tech.	3	MKEK Brass Plant
40.Arif YAT	Civil Eng.	12	MKEK Regional Branch, Kirakkale
41.Mehmet ÇETİN		12	MKEK Gazi Cartridge Plant

APPENDIX 5

MAINTENANCE SEMINAR IN KIRIKKALE
(23 rd - 25 th March,1983)

EVALUATION OF THE PROGRAM :

	<u>Grade out of</u> <u>"5"</u>		<u>Weight</u> <u>Factor</u>	<u>Overall</u>
1.The sufficiency of the duration of program in relation to its contents.	3.22	x	0.08	0.26
2.Matching of the subjects handled to the brochure	4.87	x	0.14	0.66
3.Contribution to the knowledge	4.5	x	0.25	1.13
4.General organization	4.45	x	0.12	0.53
5.Balance of theory and practice	4.43	x	0.14	0.44
6.T.Group, Case Study,etc.	4.35	x	0.16	<u>0.70</u>
				3.72 out of "4.25".

EVALUATION OF THE EXPERT = 0.73 out of "0.75".

OVERALL EVALUATION OF THE PROGRAM = 3.72 + 0.73 = 4.45
out of "5".

The number of participants was 41

APPENDIX 6

LIST OF ESTABLISHED SEMINAR NOTES

<u>NOTE NO</u>	<u>TOPIC</u>	<u>NO PAGES</u>
1	Production and maintenance	1
2	Objectives of maintenance	1
3	Availability	1
4	Maintenance procedures	1
5	Types of maintenance	1
6	Maintenance windows	1
7	Production-maintenance planning	1
8	Failure analysis	3
9	The maintenance system	2
10	The forgotten profit	1
11	General about condition monitoring	2
12	Condition monitoring procedures	2
13	Practical viewpoints for determination of PM actions	2
14	General about PM	3
15	Planned and unplanned maintenance	2
16	Corrective and preventive maintenance	2
17	Direct and indirect preventive maintenance	2
18	Individual life time	2
19	Failure development	2
20	Examples on semi-objective condition monitoring	4
21	Description of a PM system	36
22	Exercise on V-belts	1
23	Exercise on coupling	1
24	Maintenance procedure model	1
25	Indirect and direct maintenance costs	1
26		
27	Exercise on fan and pump	3
28	PM-system-daily caretaking	2
29	Daily caretaking	9

(Cont.)

APPENDIX 6 (Continued)

30	Exercise steam box	2
31	Maintenance costs	2
32	Implementation of PM	2
33	Maintenance economy	1
34	Life cycle cost	2
35	Summary of maintenance needs	1
		<hr/>
		100

In addition to the above about 50 overhead pictures have been prepared.

APPENDIX 7

CONFERENCE ON MAINTENANCE FOR TOP MANAGEMENT

KIRIKKALE April 14 th 1983

- The role of maintenance in the production system
- Economical aspects of maintenance performance
- Conclusions and discussions
- An overview over various maintenance procedures and their connection to other related functions in the production system
- Future aspects of maintenance
- Maintenance training aspects
- Use of modern maintenance techniques and their influence on the overall economy.

APPENDIX 8

LIST OF PARTICIPANTS DURING THE TOP MANAGEMENT CONFERENCE
(KIRIKKALE):

<u>NAME, SURNAME</u>	<u>OCCUPATION</u>
1.Yilmaz ALTAN	Manager, Gun and Outomotiv Ind.Plant
2.Frol CUMUSLU	Manager, Steel Pipe Plant
3.Kemal SEYFEN	Manager, Brass Plant
4.Nehmet MEHMETOGLU	Manager, Weapon and Rifle Plant
5.Emin BALFAYA	Manager, Elec.Mach.Plant
6.Nehmet Tahir CUBUK	Manager, Scrap Plant
7.Ihsan AYTEKIN	Manager, Soc.Fac.
8.Tuncer HIZLI	Dp.Ing., Gun and Outomotiv Ind. Plant
9.Yavuz YUCEL	Dp.Ing., Steel Pipe Plant
10.Muzaffer Unver	Dp.Ing., Elec.Mach.Plant
11.Turker YETIK	Dp.Ing., Weapon and Rifle Plant
12.Orhan KOCANLI	Dp.Ing., Ammunition Plant
13.Ibrahim HALBANT	Dp.Ing., Explosives Plant
14.Remzi CEHRELI	Dp.Ing., Steel Plant
15.Fecai SAPIKAYA	Dp.Ing., Soc.Fac.
16.Bekir CELIK	Tech.Insp., General Directory, IREK

APPENDIX 9

MAINTENANCE SEMINAR

Ankara 18.4 - 24.4 1983

FIRST DAY

Objectives of maintenance

Availability

Maintenance procedures

Direct and indirect maintenance costs

Downtime analysis

SECOND DAY

Preventive and corrective maintenance

Condition monitoring

Examples on condition monitoring

Failure development

Instruments and aids for condition monitoring

THIRD DAY

Cost reduction due to condition monitoring

Determination of maintenance- daily caretaking

Daily caretaking in practise

Description of a PM system

FOURTH DAY

Description of a PM system

Group work on PM system

FIFT DAY

Discussion of group work

Implementation of PM

Organizational viewpoints for PM

Preparation and planning of repairs

APPENDIX 10

LIST OF PARTICIPANTS (MAINTENANCE SEMINAR, ANKARA, APRIL 1983)

<u>NAME</u>	<u>PROFESSION</u>	<u>PROF. EXP. (Yr.)</u>	<u>ORGANIZATION</u>
1.R.Eşref ŞATANA	Mech.Eng.	5	NITROGEN Company, Ank.
2.M.Hikmet OCAKLI	Mech.Eng.	8	Karabük Iron and Steel Works
3.Mehmet EROL	Electr.Eng.	9	" " "
4.Hüseyin AŞIK	Mech.Eng.	11	ÇINKUR A.Ş., Kayseri
5.Turgut GÖZÜBÜYÜK	Mech.Eng.	8	ÇINKUR A.Ş., Kayseri
6.İsmet MISIRLI	Mech.Eng.	15	PETKİM, Yarımca
7.Şeref YANAR	Tech.	9	ETİBANK Mech. Supply Branch.
8.Adnan SÜER	Mech.Eng.	7	" " "
9.Selçuk DURUBAL	Mech.Eng.	3	" " "
10.Mevlut ERGÜN	Mech Eng.	10	ETİBANK Perlit Plant, Izmir
11.Şakir ORAKÇI	Mech.Eng.	8	ETİBANK Kalemanit Plant Bigadiç
12.Metin KÖSELOÇLU	Mining Eng.	10	E Mine, Bursa
13.Osman GÖK	Mech.Eng.	7	F am Mine, Bursa
14.Hüseyin BEKTAŞ	Mech.Eng.	7	E. Borax Plant, Kırka
15.Orhan ÖZEN	Mech.Eng.	5	E. Copper Plant, Ergani
16.Osman MÜKZİROĞLU	Mech.Eng.	3	E. Copper Plant, Ergani
17.İbrahim ENDEŞ	Mech Eng.	5	E. Ferrkrom Plant, Elazığ
18.Mehmet BOSTAN	Mech.Eng.	4	E. Sulphuric Acid Plant, Bandırma
19.Celalettin ATAMAN	Mech.Eng.	4	E. Borax Plant, Bandırma
20.Yılmaz SAĞLAM	Mech.Eng.	3	E. Aluminium Plant, Seydişehir
21.Semih AYHAN	Chem.Eng.	4	" "

(Cont.)

APPENDIX 10 (Cont.)

<u>NAME</u>	<u>PROFESSION</u>	<u>PROF. EXP. (Yr.)</u>	<u>ORGANIZATION</u>
22. Haşim ÜÇÖZ	Electr. Eng.	1	E. Aluminium Plant, Seydişehir
23. Remzi KARABULUT	Elec. Tech.	21	" "
24. Nafiz MERCAN	Elec. Eng.	7	" "
25. Hüseyin ÜNLÜ	Mech. Eng.	8	E. Boksit Plant, Milas
26. Hüseyin KARAGÖZ	Mech. Eng.	11	E. Barit Plant, Beyşehir
27. K. Ahmet DOĞRU	Mech. Eng.	10	E. Barit Plant, Beyşehir
28. Celal SFYİDOĞLU	Mech. Eng.	9	E. Southeast Phosphate Hq.
29. Dursun ÖZEN			E. Southeast Phosphate Hq.

APPENDIX 11

MAINTENANCE SEMINAR IN ANKARA

(18 th - 22 nd April, 1983)

EVALUATION OF THE PROGRAM :

	<u>Grade out of</u> <u>"5"</u>		<u>Weight</u> <u>Factor</u>	<u>Overall</u>
1.The sufficiency of the duration of program in relation to its contents.	4.07	x	0.08	0.33
2.Matching of the subjects handled to the brochure	4.62	x	0.14	0.65
3.Contribution to the knowledge	4.59	x	0.25	1.15
4.General organization	4.69	x	0.12	0.56
5.Balance of theory and practice	4.17	x	0.10	0.42
6.T.Group, Case Study, etc.	4.59	x	0.16	<u>0.73</u>
				3.84 out of "4.25".

EVALUATION OF THE EXPERT = 0.70 out of "0.75".

OVERALL EVALUATION OF THE PROGRAM = 3.84 + 0.70 = 4.54
out of "5"

APPENDIX 12

SEMINAR ON MAINTENANCE

Izmir 25-27/4/1983

FIRST DAY

Production and maintenance
Objectives of maintenance
Availability
Direct and indirect maintenance costs
Preventive and corrective maintenance

SECOND DAY

Condition monitoring
Failure development
Examples on condition monitoring
Instruments and aids for condition monitoring
Daily caretaking

THIRD DAY

Overview over a PM system
Implementation of PM
Organizational viewpoints for PM
Preparation and planning
Work order and recording routines.

APPENDIX 13

LIST OF PARTICIPANTS (MAINTENANCE SEMINAR, İZMİR, APRIL 1983)

<u>NAME</u>	<u>PROFESSION</u>	<u>PROF. EXP. (Yr.)</u>	<u>ORGANIZATION</u>
1.Tuncer ÜLKÜ	Mech.Eng.	25	PETKİM Petrochemical Complex,Aliağa,İZMİR
2.Mustafa MANİSALI	Mech.Eng.	8	" "
3.M.Halil KAMAY	Pr.Cont.Eng.	4	" "
4.Vedat MONKUL	Chem.Eng.	5	" "
5.Mustafa KARAKAYA	Mech.Eng.	11	" "
6.Rasim ÇALHAN	Electr.Eng.	6	" "
7.Alparslan ARIKAN	Mech.Eng.	4	" "
8.Süleyman AKBIYIKOĞLU	Mech.Eng.	13	" "
9.Erden AKBAŞ	Mech.Eng.	4	" "
10.Ahmet SAĞLAM	Mech.Eng.	8	" "
11.Uğur ARIĞTEKİN	Enstr.Eng.	10	" "
12.Ali KUYUCU	Electr.Eng.	9	" "
13.Salih MUTLU	Electr.Eng.	7	" "
14.Işık BĞAN	Mech.Eng.	6	" "
15.Adil AYDIN	Mech.Eng.	10	" "
16.Necmettin ÇETİNKÖPRÜLÜ	Mech.Eng.	5	" "
17.K. Sinan TÜZÜN	Mech.Eng.	4	" "
18.H.Hüseyin KOLUAÇIK	Mech.Eng.	5	" "
19.Ali DOĞAN	Mech.Eng.	10	PETKİM Petrochemical Complex,Aliağa,İZMİR
20.Osman TUTUM	Mech.Eng.	13	" "
21.Hüseyin PINAR	Mech.Eng.	7	" "
22.Alev BEZİRCİ	Mech.Eng.	4	" "
23.Yalçın YUNTUCU	Mech.Eng.	12	PETKİM,Yarımca Complex
24.Necdet ÖZDEMİR	Enst.Eng.	7	PETKİM,Yarımca Complex
25.Atilla ÜLER	Electr.Eng.	6	PETKİM,Yarımca Complex

APPENDIX 14

MAINTENANCE SEMINAR IN IZMIR
(25 th - 27 th April, 1983)

EVALUATION OF THE PROGRAM :

	<u>Grade out of</u> <u>"5"</u>		<u>Weight</u> <u>Factor</u>	<u>Overall</u>
1.The sufficiency of the duration of program in relation to its contents.	4.04	x	0.08	0.32
2.Matching of the subjects handled to the brochure	4.58	x	0.14	0.64
3.Contribution to the knowledge	4.33	x	0.25	1.08
4.General organization	4.71	x	0.12	0.57
5.Balance of theory and practice	4.46	x	0.10	0.45
6.T.Group, Case Study,etc.	4.39	x	0.16	<u>0.70</u>
				3.76
				out of "4.25".

EVALUATION OF THE EXPERT = 0.73 out of "0.75".

OVERALL EVALUATION OF THE PROGRAM = $3.76 + 0.73 = 4.49$
out of "5".

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
(UNIDO)

JOB DESCRIPTION

DP/TUR/77-024/11-03/EEE

- POST TITLE : : Expert in Maintenance Planning - Process Industries.
- DURATION : Two months
- DATE REQUIRED : October 1982, Earlier if possible.
- DUTY STATION : ITDC Ankara, with travel to Kocaeli, Istanbul, Antalya and other places.
- PURPOSE OF PROJECT : To upgrade the knowledge of maintenance engineers in process plants in Turkey in modern maintenance planning systems and thereby improve operating systems.
- DUTIES : The expert, together with counterparts from Industrial Training and Development Center (ITDC) will investigate the maintenance and repair systems of selected host organizations on site. Depending on the findings the expert will make his recommendations and introduce current developments of maintenance planning systems through a series of short concluding seminars in each of the plants. The mission will finish with a one week course which is expected to cover:
1. Description and purpose of the maintenance planning systems.
 2. Economic and engineering aspects of maintenance.
 3. Managerial and organizational aspects of maintenance.
 4. Resources required for the development and implementation of maintenance planning.
 5. Basic principles and applicability of proposed new methodologies for maintenance planning.

The expert is expected to supply ITDC with necessary documents and training aids.

The expert should document the findings, recommendations and other program material as a booklet which will be handled to ITDC for use as a reference literature.

The expert will also be expected to prepare a final report, setting out the findings of the mission and his recommendations to the Government on further action which might be taken.

QUALIFICATIONS: Expert should have extensive experience in maintenance planning systems in one or more of the following process industries:

1. Fertilizer
2. Iron and Steel
3. Chemical Industries
4. Metallurgical
5. Glass works etc.

Training experience is also required.

LANGUAGE : English

BACKGROUND INFORMATION : Industrial Training and Development Center (ITDC) is a joint project of Turkish Government and United Nations rendering training and consulting services to the Turkish industry. The aim of ITDC, at the highest level, is to upgrade the skills and capabilities of professionals employed in the industry, hence to contribute to the national economy.

A growing number of organizations have requested that ITDC provide training courses in maintenance planning. Most of these requests come from process industries. Maintenance Planning is of critical importance to Turkish industry and no courses in this subject are currently available in Turkey.

ITDC has therefore decided to enter this field with a series of short in-plant seminars and a final one-week course on maintenance planning in process industries. Prospective host organizations for such in plant seminars include:

- Azot Sanayii T.A.Ş.
- Iskenderun Iron and Steel Works
- Çinkur Zinc and Lead Works
- Iğsaş Fertilizer Plant
- Çukurova Chemical Industries
- MMEK Battery Plant
- Işabahçe Glass Works
- Metaş Iron and Steel Works

A limited number of the above organisations will be chosen for visits and short seminars. Selection will be made on the basis of the industrial background of the expert.

