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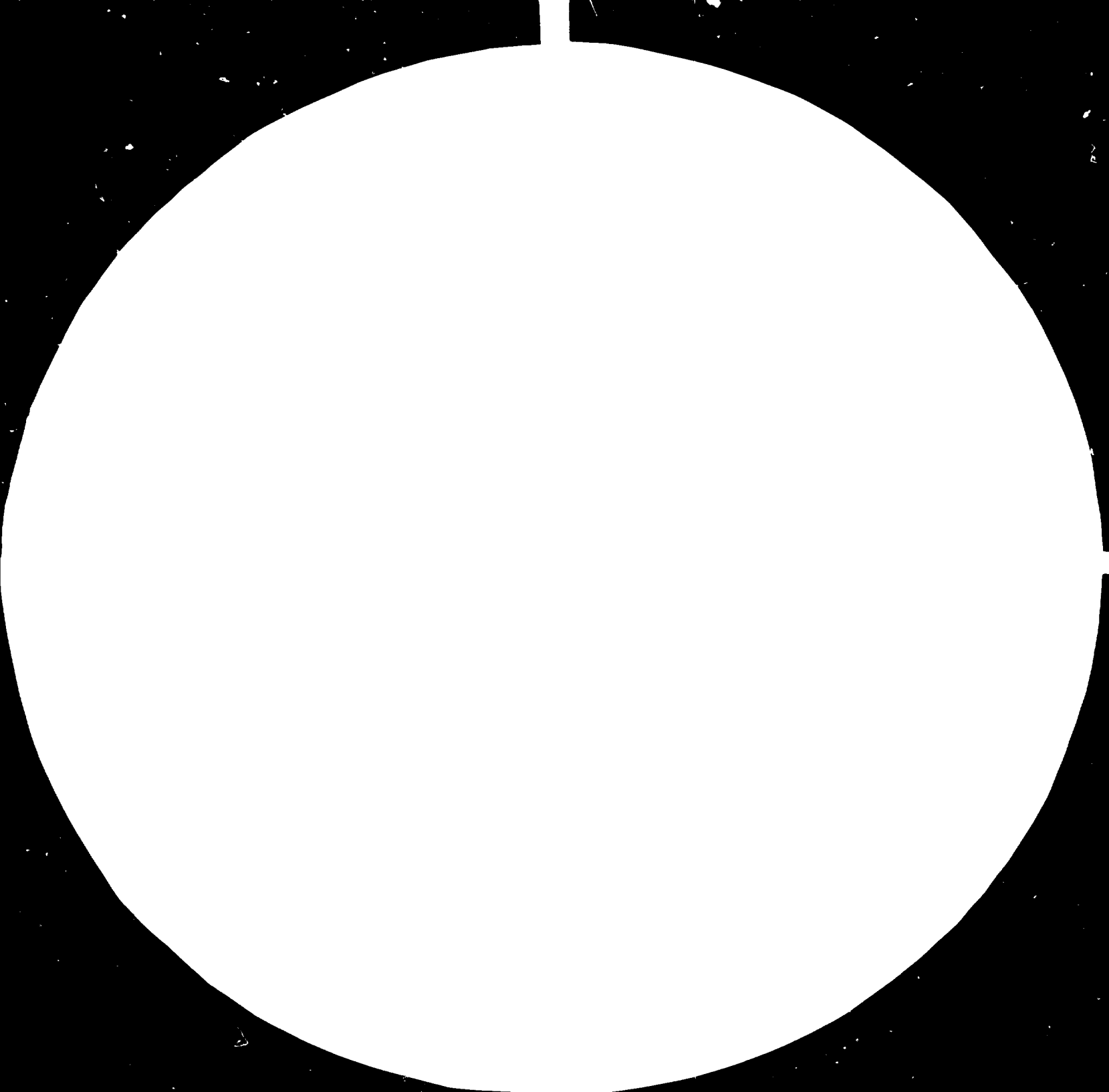

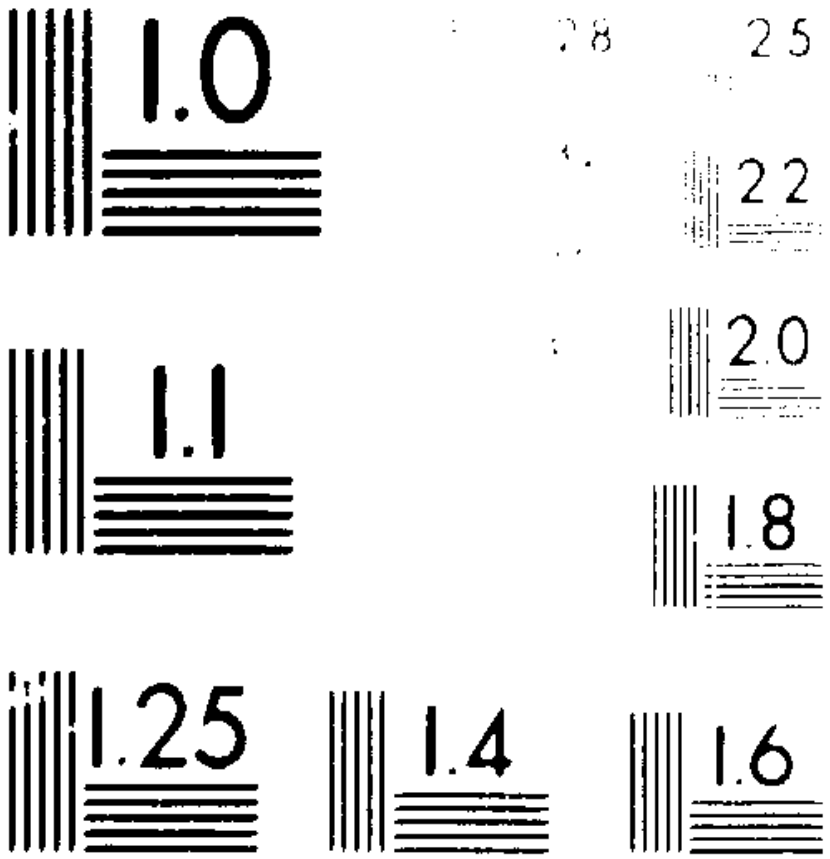
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INDUSTRIAL TRAINING AND DEVELOPMENT CENTRE

(ITDC)

ANKARA/TURKEY

MAINTENANCE PLANNING

DP/TUR/77/024/11-03/C3/31.5 A

FINAL REPORT

PREPARED BY

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MAINTENANCE CONSULTANT

NOVEMBER 1983

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

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1. INTRODUCTION

The aim with this project was to upgrade the knowledge and skills of maintenance engineers, who are occupied in manufacturing and process plants, in the following subjects:

- Planning of maintenance activities
- Preventive and corrective maintenance procedures
- Condition based maintenance and condition monitoring techniques
- Preparation and planning of repairs

Thus, the participants will have a clear view of how to describe and plan preventive maintenance (PM) activities and will be aware of the difficulties which may be encountered during the implementation phase of preventive maintenance.

The expert and his counterpart from the Industrial Training and Development Centre (ITDC) will prepare and implement a training programme in the following three phases:

Phase 1. To conduct an on-site survey at a selected plant in order to determine:

- main topics to be covered during the training programme
- plant equipment on which cases will be prepared for the training programme.

Following this survey a training programme will be planned and outlines for handouts, aids, instruments, etc. needed during the training programme will be determined.

Phase 2. During this phase the expert is expected to carry out the following activities:

- preparation of lecture notes, handouts, overheads and other necessary documents.
- gathering the instruments and aids to be used during the training programme.

This phase of the programme, which was estimated to take two weeks was carried out in the home country of the expert. Notes, handouts and other necessary documents were sent to ITDC before September 1st, 1983 for tanslation and printing.

Phase 3. During this phase the maintenance training progamme including in plant training was conducted in view of of the identified training need for the participants in the initial phase.

2. ACTIVITY REPORT

PHASE 1.

During this phase of the project the selected plant, ETIBANK's ALUMINIUM PLANT in SEYDISEHIR was visited for three days. The following activities have been carried out:

- Visit to all production sections in the plant in order to learn about the type of production, machinery, etc.
- Discussion of maintenance problems, routines and organization in each maintenance department.
- Selection of suitable machines to be used for groupworks during the training programme.
- Dicussion of practical arrangements for the seminar

The maintenance problems discussed, together with general maintenance aspects were used as a base for the preparation of the detailed training programme which is shown in appendix 1.

Also when preparing the detailed programme special attention has been given to the groupworks in order to ensure that both participants and the host plant will benifit to a large extend.

The seminar was planned to be conducted during October 31th - November 11th in Etibanks lecture rooms in Seydisehir. In order to provide the participants with appropriate seminar notes nine existing seminar notes must be revised and twelve new seminar notes must be established.

This work together, with the gathering of instruments and aids for practical training will be done during phase 2 of the project.

A brief day-to-day report about activities, carried out by the expert during the first phase is given below.

17.7.1983	Expert's departure from home country
18.7.1983	Arrival Ankara Discussion about programme at ITDC
19.7.1983	UNDP office Travel to Seydisehir
20.7.1983 to 22.7.1983	Site survey at ETIBANK Aluminium plant
25.7.1983 to 29.7.1983	Establishment of detailed seminar programme and practical arrengements.
30.7.1983	Travel to Vienna

1.8.1983 Debriefing at UNIDO, Vienna.

PHASE 2.

Durind this phase the lecture notes as stated in phase 1 were prepared and sent to ITDC for translation, printing and production of overheads.

In addition to the above 86 manufacturers of instruments and aids for condition monitoring and repairs were informed about the programme and were asked to contribute with broschures, descriptions and samples.
As a result of this, the expert was able to bring the following instruments and aids for practical demonstrations:

- Shock pulse meter for condition monitoring of ball and roller bearings.

- Electronic stetoscope

- Vibrameter

- Tachometer

- Ultrasonic leakage detector

- Temperature tapes

- Temperature crayons

- Slide set for brush plating

- Slide set for vibration monitoring

- Slide set for thermovision

Also as a result a company, representing maintenance welding techniques participated in the programme, giving theoretical and practical demonstrations.

In addition to the above a stroboscope was purchased for ITDC as training material.

The maintenance expert was also able to bring a microcomputer including printer for practical demonstrations of a computerized system for preventive maintenance.

PHASE 3.

During this phase the actual training programme was conducted. In addition to the planned 2-weeks programme a 4-days seminar at PETKIM, IZMIR was requested and conducted.
The progamme, conducted in Seydisehir was done in accordance to the seminar outlines shown in appendix 1. As an additional topic 1 1/2 days were spent on maintennance welding.

An outline of the seminar conducted at PETKIM, IZMIR is shown in appendix 2.

The number of participants in Seydisehir was 31. A list of participants is shown in appendix 3.

The number of participants in Izmir was about 25. A list of participants was not available but can be requsted from ITDC.

The evaluation of both programmes was not available but can be requested from ITDC.

Below follows a brief day-to-day report about the activities carried out by the expert during the third phase:

29.10.1983 Experts departure from home country and arrival in Ankara.

30.10.1983 Travel to Seydisehir.

31.10.1983 to 11.11.1983 Maintenance seminar at Etibank, Seydisehir.

11.11.1983 Travel to Ankara.

13.11.1983 Travel to Izmir.

14.11.1983 to 17.11.1983 Maintenance seminar at Petkim, Izmir.

17.11.1983 Travel to Ankara.

18.11.1983 Work at ITDC.

20.11.1983 Travel to Vienna.

21.11.1983 Debriefing at UNIDC, Vienna.

3 RECOMMENDATIONS

PREFACE

As can be seen from the programme outline (app 1) most of the lectures were done by the expert. This depends on the following:

- There is only one engineer at ITDC assigned to maintenance as part of his duties. This gives that there is too little time for proper preparation of lectures in maintenance programmes.

- The engineer assigned to maintenances has only very limited practical experience in the field of maintenance and can therefore not conduct lectures were practical topics are involved.

During the training programmes the following observation was made:

- Instruments and aids, presented during the programme and demonstrated in-situ, were subject to very great interest and many participants requested more information.

During discussions with the participants the following viewpoints were expressed frequently:

- The training programme is very benificial but more personnel in "my" company must be trained before an implementation can start.

- It is difficult to implement the ideas given in the programme depending on the established bureaucracy and the management's attitude toward maintenance. A common request was that also the management should be trained or informed.

- It will be difficult to purchase the demonstrated instruments (which were found very useful), since the management is not informed about the advantages.

- The training programmes should be based more on existing problems in the companies.

- The time for the programme is too short.

RECOMMENDATIONS

In view of the above and due to the fact that there seems to be no qualified lectures in the field of maintenance in Turkey the following recommendations can be made:

A More personnel at ITDC should be employed assigned to maintenance.

This of course, depends on the policy of ITDC. Since there seems to be an enormous demand for training in maintenance the above suggestion should be considered.

B The personnel must be given the opportunity to gain practical experience.

The above can be achieved by conducting a "Problem Oriented Training" project as outlined in appendix 4.

In doing such a project the instructors at ITDC will have the opportunity to:

- to be trained to find maintenance problems
- be involved in training, based on actual problems
- participate in the implementation and thereby gain practical experience

Further advantages with such a project are:

- complete training material will be established together with maintenance personnel in the selected companies
- maintenance personnel at the selected companies will be trained at the same time and can, if found qualified, participate as guest lecturers in future ITDC training programmes.
- The selected companies can be used as "case studies" in future training programmes.

A problem oriented training project furthermore complies with the viewpoints (see preface) expressed by the participants in previous programmes.

A first problem oriented training programme should be conducted with the help of an external maintenance expert whereafter future programmes can be conducted by ITDC personnel and in co-operation with personnel from the in the above programme included companies.

C Inform managers and decision makers about the advantages of proper performed maintenance.

As expressed by participants, many managers and decision makers are not aware of the advantages to perform proper maintenance or to allow maintenance to use proper instruments and aids. A way to improve this is to arrange a conference as outlined in appendix 5.

Such a conference should aim at to convince managers and decision makers both in industries and in the ministry of industry and technology about the importance and the economical benefit to perform proper maintenance. This will help the maintenance personnel, trained by ITDC to be able to implement their knowledge gained during the training programmes.

The conference should consist of a one-day conference for per-

sonnel from the ministry of industry and technology, personnel from the ministry of finance or other ministries involved in approving purchase of spare and material from foreign countries and managers from industrial enterprices in Turkey, followed by two days with short seminars on various maintenance techniques for maintenance managers.
These two days with short seminars and exhibition are aiming at to show maintenance personnel available instruments, aids and service and to give an overview about the advantages. Various manufacturers of instruments and aids for maintenance should be invited for an exhibition of their products and also for short seminars.

MAINTENANCE PLANINIG PROGRAMME

COURSE OUTLINE

(October 31 st - November 11 th 1983)

DAY	TOPIC	NOTE	LECTURER
1	-Opening ceremony	-	J. STEFFENS
	-Objectives of maintenance	2 +	"
	-Maintenance and production	1	"
	-Availability	3 +	"
	-Maintenance procedures	4 +	"
	-Economy	33 +	"
	-Direct and indirect maintenance cost	25 +	"
	-Group work: Economy and direct and indirect maintenance costs for a described case	new	J. STEFFENS C. PAMİR
	-The maintenance system	9	J. STEFFENS
2	-Corrective and preventive maintenance	5.10.6	J. STEFFENS
	-Planned and unplanned maintenance	15	"
	-General about preventive mainten.(PM)	new	"
	-Various types of PM	17	"
	-Condition monitoring	11	"
	-Condition monitoring procedures	12	"
	-Cost reduction due to condition monitoring	31 +	"
	-Individual life time	18	"
	-Plant visit	-	-
3	-Failure development	19	"
	-Types of condition monitoring	new	"
	-Examples on condition monitoring	20 +	
	-Group work: Example on how to apply condition monitoring to a given case	new	J. STAFFENS C. PAMİR
	-Instruments and aids for condition monitoring		
4	-PM - system - daily caretaking	28 +	J. STEFFENS
	-Daily caretaking	29	C. PAMİR
	-Maintenance procedure model	24	C. PAMİR
	-Group work: Practical application of maintenance procedure model on selected machines. Use of instruments.	new	J. STEFFENS C. PAMİR

DAY	TOPIC	NOTE	LECTURER
5	-Discussion of group work	-	
	-Description of a manual PM system	21	C. PAMİR
	-Practical viewpoints for determination of PM activities	13	J. STEFFENS
	-Group work: Establishment of PM for selected machines. Use of instruments.	-	J. STEFFENS C. PAMİR
6	-Group work continued		
	-Discussion of group work		
	-Description and demonstration of a computerized PM system		J. STEFFENS
7	-Denonstration and practical exercises on a computerized PM system		C. PAMİR
	-Implementation of PM	32	J. STEFFENS
	-Organizational viewpoints for PM	new	"
	-Group work: Evaluation of the existing PM organization in the selected plant sections		J. STEFFENS C. PAMİR
	Establishment of recommendations		
8	-Maintenance windows	6,7	J. STEFFENS
	-Analysis of repairs	8 +	"
	-Preparation and planning of repairs	new	"
	-Work order system	new	"
	-Follow-up and evaluation of repairs	new	"
	-Description and demonstration of a computerized work order system(optional)		"
9	-Maintenance organization	new	J. STEFFENS
	-Future aspects of maintanance	new	"
	-Life cycle costs	34	"
	-Group work: Evaluation of existing organization and routines for preparation and planning of repairs, work order system, follow-up and evaluation of repairs		J. STEFFENS C. PAMİR
	Establishment of recommendations		
10	-Discussion of group work		
	-General viewpoints about corrective maintanance	new	J. STEFFENS "
	-Methods for corrective maintenance		
	-Discussions		
	-Closing ceremony		

MAINTENANCE PLANNING SEMINAR

COURSE OUTLINE

November 14th - November 17th

PETKIM, IZMIR

Day	Topic
Monday 14.11.83	Objectives of maintenance Maintenance and production Availability Maintenance procedures Maintenance costs Planned and unplanned maintenance Preventive maintenance Condition monitoring
Tuesday 15.11.83	Instruments and aids for condition monitoring Description of a PM system Maintenance procedure model Corrective maintenance methods
Wednesday 16.11.83	Corrective maintenance methods (cont.) Groupwork on preventive maintenance Demonstration and practical exercises on a computerrized preventive maintenance system Implementation of PM
Thursday 17.11.83	Organizational viewpoints for PM Preparation and planning of maintenance work Work order system Discussions

PARTICIPANTS IN MAINTENANCE SEMINAR IN TURKEY OCT.29 th - NOV.11 th PAGE 1
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ABBAS CENTEZ MAKINA MUHENDISI	AZOT SANAYI T.A.S. GEMLIK
ABDULLAH KOYUNCU MAKINA MUHENDISI	ETIBANK ALUMINYUM TESISLERI DÖKUM MD.LUGU SEYDISEHIR KONYA
ALI GOKOGLU MAKINA MUHENDISI	ETIBANK ALUMINYUM TESISLERI ALUMINA FAB. SEYDISEHIR KONYA
ARIF TAS MAKINA MUHENDISI	ETIBANK KIRKA BORAKS ISLETMESI MUESSESESI SEYITGAZI/ESKISEHIR TURKEY
AYHAN AKIN MAKINA MUHENDISI	ETIBANK ALUMINYUM TESISLERI ALUMINYUM MD.LUGU SEYDISEHIR KONYA
AZIZ KARAPINAR MAKINA MUHENDISI	ETIBANK ULUDAG VOLFRAM ISLETMESI CEKIRGE/BURSA TURKEY
BASRETTIN YILDIZ MAKINA MUHENDISI	AZOT SANAYI AMONYAK TESISLERI KUTAHYA TURKEY
CEMAL TOKAY ESER MAKINA MUHENDISI	ETIBANK ERGANI BAKIR ISLETMESI MADEN/ELAZIG TURKEY
EMIN UNAL MAKINA MUHENDISI	SEKER FABRIKASI KONYA
ERGUN PARLAKULAS MAK.BAS.MUH.	ETIBANK KIRKA BORAKS ISLETME MUDURLUGU SEYITGAZI-ESKISEHIR TURKEY
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HALUK YILDIZ MAKINA MUHENDISI	KARA DENIZ BAKIR ISLETMELERI A.S. SAMSUN
HILMI MUSLU MAKINA MUHENDISI	ETIBANK ALUMINYUM TESISLERI INS.ISLT.VE BAK.MD. SEYDISEHIR KONYA
HUSEYIN GERCEK ELEKTRIK MUHENDISI	ETIBANK ALUMINYUM TESISLERI SEYDISEHIR KONYA
IBRAHIM UZ MAKINA Y. MUHENDISI	ETIBANK ALUMINYUM TESISLERI STOK KONT.MD.LUGU SEYDISEHIR KONYA
ISMAIL MORAL MAKINA MUHENDISI	AZOT FABRIKALARI SAMSUN
ISMAIL YAYLALI MAKINA MUHENDISI	ETIBANK A.T.BOKSIT ISLETMESI MUDURLUGU SEYDISEHIR KONYA
IZZET ARSLAN MAKINA MUHENDISI	ETIBANK ALUMINYUM TESISLERI SEYDISEHIR KONYA
MEHMET KAYA MAKINA MUHENDISI	SEKA AKDENIZ MUESSESESI TASUCU SILIFKE
MEHMET SAK MAKINA MUHENDISI	ETIBANK ALUMINYUM TESISLERI MAK.TECH.FB. SEYDISEHIR KONYA
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MUSTAFA KIRIMHAN MAKINA MUHENDISI	ILGIN SEKER FABRIKASI ILGIN-KONYA TURKEY

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NEJDET KURNAZ MAKINA MUHENDISI	AZOT SANAYI T.A.S. ISLETMELER MD.LUGU SAMSUN
NEZIR GUNES MAKINA TEKNIKERI	ETIBANK ERGANI BAKIR ISLETMESI MADEN ELAZIG
SEFER MEHMET SUER MAKINA MUHENDISI	ETIBANK ERGANI BAKIR ISLETMESI MADEN ELAZIG
SUAYIP KAVAS ELEKTRIK MUHENDISI	AZOT SANAYI T.A.S. GEMLIK
YASAR CORUH MAKINA MUHENDISI	ETIBANK ALUMINYUM TESISLERI HADDEHANE MD.LUGU SEYDISEHIR KONYA

PROBLEM ORIENTED TRAINING IN MAINTENANCE

PROJECT OUTLINE

1. Selection of companies.
   Three medium sized companies (total maintenance staff less than 50) with similar typ of production should be selected. The companies should not be located too far from each other. Preferrably also the companies should be in full production and in need of better maintenance.
   This work can be done by personnel from ITDC.

2. Maintenance survey in selected companies. This part consists of of three steps:

   Step 1.

   Existing maintenance organisation, routines, systems etc. will be studied and maintenance problems will be "spotted".

   Step 2.

   The survey findings will be discussed and outlines for activities to be carried out will be prepared.

   Step 3.

   The outlines will be presented to the company management for commitment.

   This work must be a co-operation between a maintenance expert, ITDC personnel assigned to maintenance and respectively plant maintenance personnel.
   The duration of the above activities is estimated to 1 1/2 weeks/company.

3. Preparation and presentation of report. As a result of the discussion of the outlines with respectively company management a report will be prepared.

   The report includes:

   - A brief description of the present situation in maintenance.

   - Findings

   - Outlines of activities to be carried out

   - Training required

   - Tentative schedules for training and implementation

   The above report will be prepared and presented in each company by personnel from ITDC in co-operation with respectively plant maintenance personnel.

4. Training programme I

The actual training consists of several steps:

- Training in general principles for maintenance. This part consists of an information to management and maintnance personnel followed by more detailed training in maintenance concepts for maintenance personnel.

  The duration of this part is estimated to four days.

- Detailed training on the first topic in accordance with the findings from the survey.

  The duration is estimated to one week.

- Group work consisting of establishment of routines, systems, forms etc. in order to solve the actual problem in each company. Also during this time an implementation schedule will be prepared.
  The groups consist of personnel from each company accompanied by an instructor from ITDC.
  Part of the group work will be carried out in the company. Write-up and discussion will be done in the lecture room.

  The group work including discussions and write-up is estimated to a duration of one week.

- Each group works will be presented to other groups and the recommended solutions will be discussed.

  The duration of this part is estimated to 3-4 days.

- The management from each company will be invited and the group work will be presented by personnel from the company. Necessary corrections will be made. The schedule for implementation will be discussed. The aim with this operation is to commit the management to the implementation.

  The duration of this part is estimated to 2-3 days.

During the whole training period the maintenance expert will do the lecturing and assist ITDC and company personnel in their work.

5. Implementation of the suggestions established during the group works and approved by the management. This work will be done by personnel from ITDC assigned to the company.

   The duration of this part is given in the implementation schedule.

6. Preparation of report on achievements done by ITDC personnel in co-operation with company personnel.
   This work can be done during the implementation period.

7. Follow-up of implementation by expert and start of next training programme (if necessary). During the follow-up necessary corrections will be made. The training programme

will follow the same procedure as described above.

8. Final report on the achievement of the completed programme to be worked out by ITDC personnel in co-operation with personnel in the company.

Remark: The final report should consist of descriptions of achievements and a description of the complete "maintenance system" in the different companies including examples of forms, descriptions of organization, routines etc. This material can be utilized as a handbook for maintenance in the company and as a base for future training programmes in ITDC.

OUTLINE FOR CONFERENCE ON MAINTENANCE

Day 1.

- Introduction

Lectures on the following topics:

- The influence of maintenance on national and industrial economy

- The concept of maintenance

- The idea of maintenance centres

- Modern maintenance management in an Turkish industry

- ITDC involvement in maintenance training

- Panel discussion

For personnel from ministry of industry, ministry of finance general managers and maintenance managers.

Day 2 and 3.

Exhibition of instruments, aids and service available for maintenance and short seminars on maintenance topics i.e.:

- Computerized maintenance systems

- Maintenance and its various activities

- Presentation of special techniques:

  : maintenance welding
  : various repair methods
  : instruments and aids for condition monitoring
  : recondtioning techniques
  : condition monitoring techniques

The participants will be given the opportunity to discuss their problems with the representatives from manufactures.

For maintenance managers and interested personnel from the ministry of industry and finance.