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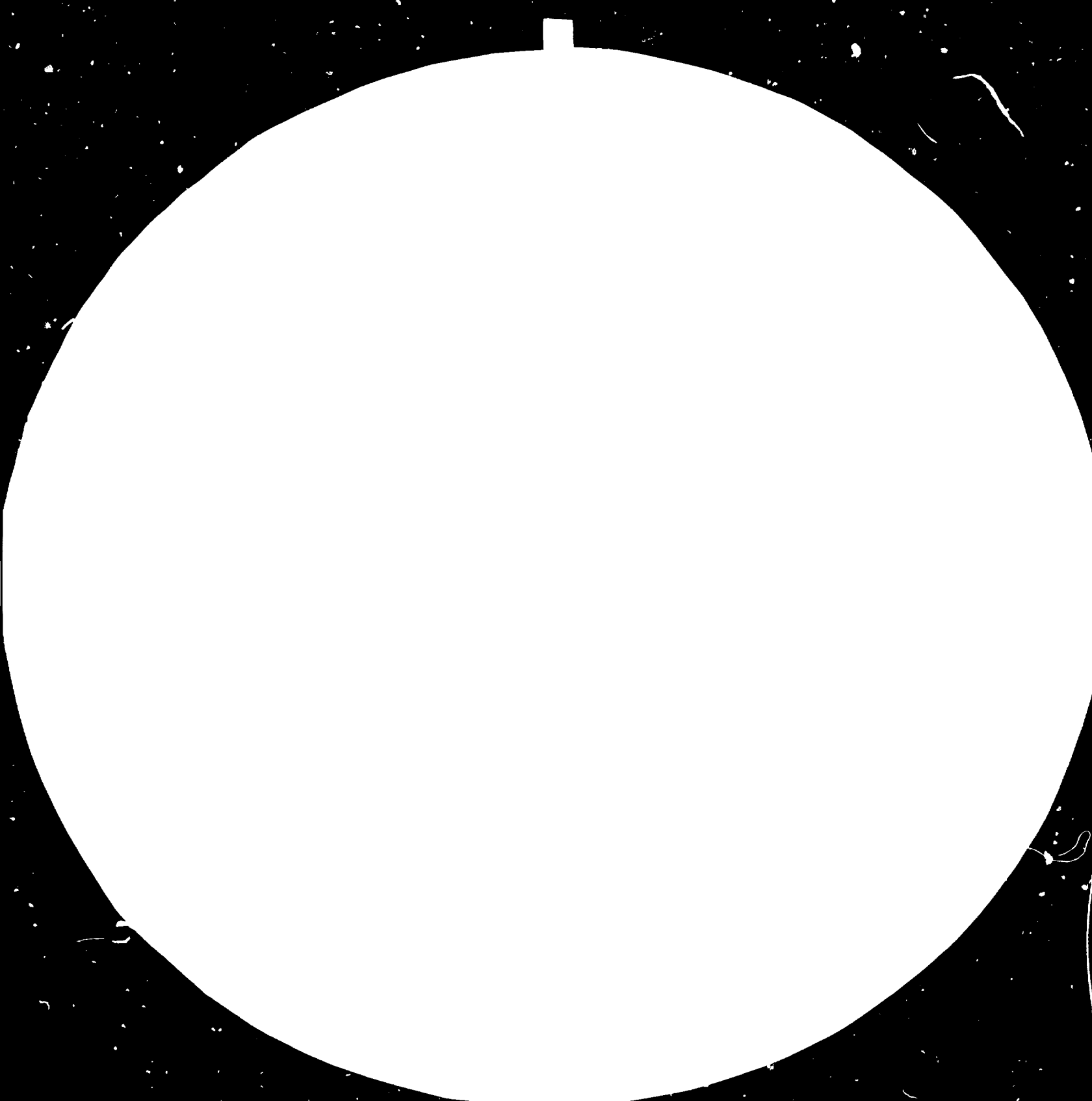

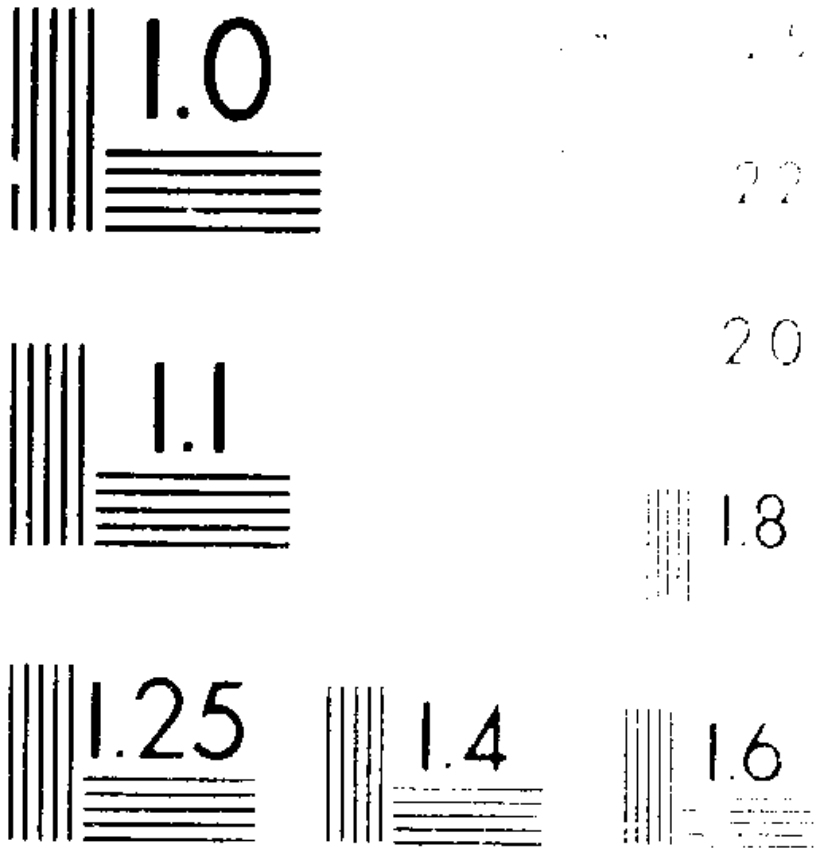
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NOVEMBER 1984

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NATIONAL QUALITY CONTROL AND TESTING CENTRE, ETHIOPIA

DP/ETH/79/003
CONTRACT NO. T 81/49

FINAL REPORT

PREPARED FOR UNIDO BY PZO POLYTECHNA PRAGUE, CONTRACTOR

BASED ON THE WORK OF MR. ANDREJ KURUC, M.Sc.,
CONTRACTOR'S TEAM LEADER

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CONTENTS

ABSTRACT

The aim of the Contract was to provide engineering and technical assistance to the Government of Ethiopia for the establishment of the National Quality Control and Testing Centre in Addis Ababa.

The Contractor has rendered the services to the Ethiopian Standards Institution as detailed in the UNIDO Terms of Reference dated 14 January 1981 and in the Contract No. T 81/49 between UNIDO and Polytechna.

To fulfil the terms of the Contract, the Contractor has made available a total of forty two (42) man-months of personnel services in the Project Area, and one man-month service at home according to the specification of the Contract. Additional one and half month (1,5) of services for ESI have been provided as a gift of the Government of the Czechoslovak Socialist Republic to Ethiopia by the extension of stay of Consultant on Equipment Maintenance and Servicing.

During the stay of Contractor's Team in the Project Area, the following facilities with the equipment available have been set up:

- mechanical and building materials testing laboratory
- chemical products testing laboratory
- electrical products testing laboratory
- textile and leather products testing laboratory
- agricultural and food products testing laboratory
- mechanical workshop.

The local staff has been trained on-the-job, procedures for testing materials, products and commodities have been suggested, consultancy services for the Ethiopian Industry have been rendered as well as cooperation in elaborating the Ethiopian Standards

INTRODUCTION

Industrial development of Ethiopia, as one of the most important factors in the country's economy calls for organizing of activities aimed at rationalizing and improving productivity and quality of products. Testing laboratories and ancillary facilities are an indispensable element in the application of a national quality control programme.

A necessary logical step to cover the above needs has been the establishment of Ethiopian Standards Institution in September 1970 and the establishment of a National Quality Control and Testing Centre under its auspices with support from UNDP/UNIDO, under the Project No. DP/ETH/79/003.

The new complex of buildings has been constructed by the Government and with UNDP support the respective laboratories have been established.

The task of providing the engineering and technical assistance to the Government by the establishment of the National Quality Control and Testing Centre was programmed in the Project Document on a subcontract basis. The subcontract was awarded to Polytechna, technical cooperation agency of Czechoslovakia. The official start of work on the Contract on behalf of Polytechna was made by the first field visit of the Contractor's Team Leader to Addis Ababa in May 1982, with the aim to investigate the situation and to estimate the possible date of Contractor's Team arrival. At that time only the rough construction of laboratories has been completed and practically no equipment was available. It was decided to wait for completion of buildings and arrival of the equipment. The preliminary report with the findings has been submitted to UNIDO along with the suggestions of additional necessary equipment and the list of chemicals. In April 1983 the whole Polytechna's Team was invited to start the work in the Project Area. However (and fortunately) only the Team Leader arrived to find, that only small progress in the completion of buildings has been done and a lot of equipment is still to be delivered. The situation report on status of construction has been prepared and Team Leader left for CSSR to wait for the completion of laboratories. Finally, in January 1984, following the invitation

of UNDP and CTA, Team Leader arrived in the Project Area again. In spite of the fact that there was still a lot to do in the laboratories and there was no electricity and water, it was decided to bring the Team, so that the greatest part of its work would be finished in the time of CTA departure in June 1984. So on February 2nd Contractor's Team arrived and stayed until July 17. The team Leader stayed until August 28 together with Consultant on Maintenance and Servicing, who's stay has been prolonged.

During the stay all the tasks of the Contract have been fulfilled to the maximum possible extent determined mainly by the availability or status of the respective instruments. The lack of some instruments or their parts made it impossible to fulfil the programme to the full extent, however, all the missing parts or missing important devices have been ordered and when possible, the Counterparts instructed on their use.

The problems associated with the Contractor's work were the minimum and inadequate number of counterpart staff (in spite of several requests from the part of CTA and Team Leader), continued delays in construction and furnishing of the laboratories and workshop including supply of electricity and water (up to now e.g. biochemical lab is not completed) and breakages, shortages and incompleteness of equipment.

In spite of the facts mentioned, the Contractor's team finished its work to the satisfaction and appreciation of ESI and UNDP Addis Ababa. However, as already proposed by CTA and UNDP Resident Representative, a serious consideration should be given to the second phase of this Project, possibly for inclusion already in the next country programme.

I. REPORT ABOUT ACTIVITIES

A. Information about services rendered

According to the Terms of Reference (dated 14 January 1981), the Contractor had to provide following consultancy services, totalling 42 man-months in the Project Area:

1) Team Leader, Consultant on Establishment and Furnishing of Testing Laboratories
2) Consultant on Quality Control and Testing of Building Materials
3) Consultant on Quality Control and Testing of Chemical Products
4) Consultant on Quality Control and Testing of Electrical Products
5) Consultant on Quality Control and Testing of Agricultural and Food Products
6) Consultant on Quality Control and Testing of Textile and Leather Products
7) Consultant on Equipment Maintenance and Servicing.

The Contractor has provided the personnel according to the Contract statement of total consultancy services approved by ESI and UNIDO as follows:

Name	Position Title	Duration of Assignment (man-months)	
		Project Area	Home
Mr.Andrej KURUC	Team Leader, Consultant 1)	9 x)	1
Mr.Jaroslav VESELY	QC Engineer, Consultant 2)	5,5	-
Mr.Ladislav BARNOKY	QC Engineer, Consultant 3)	5,5	-
Mr.Dusan GABRIS	QC Engineer, Consultant 4)	5,5	-
Mr.Jan HRONCEK	QC Engineer, Consultant 5)	5,5	-
Mr.Jaroslav ZBORIL	QC Engineer, Consultant 6)	5,5	-
Mr.Jiri SOBOLA	Equipment Maintenance, Consultant 7)	5,5	-
	Total (man-months)	42,0	1
	Extention Mr. Sobola	1,5	-

x) Note: 7,5 months in 1984

As mentioned in the Abstract and Introduction, the stay of Mr. Sobola has been extended for 1,5 months as the gift of Czechoslovak Government to Ethiopia (free of charge for any organization involved).

The replacement of personnel compared with original Contract Document has been done accordingly the request of Mr. Akberom Tedla, General Manager of Ethiopian Standards Institution. Change of duration of stay of the respective Consultants has been done after mutual agreement among Polytechna, ESI and UNIDO.

B. Activity in the Project Area

1) Consultant on Establishment and Furnishing of Testing Laboratories

1.1 The Consultant has been acting also as the Contractor's Team Leader, with duties specified in the Contract Document and fulfilled as follows (Paragraph Nos are according to the Contract):

2.04 Briefing and De-briefing of the Contractor's Team Leader at UNIDO Vienna:
The briefing before the first field visit had been done from 1982-04-19 to 04-22. The delay against the Contract had been caused by the constant delays in the construction of laboratories. The same for all the delays in a comparison with the data stated in the Contract, e.g. in Paragraph 2.06.

2.06 Commencement and Completion of the Contractor's Work in the Project Area:
The first field visit in Addis Ababa had been made from 1982--05-01 to 1982-05-20. The second visit (following the invitation to start the performance of the whole team) was from 1983-05-01 to 05-18. As it was found, that the status of construction did not allow to start the work of the team, Team Leader returned to Czechoslovakia at costs of UNDP. The final stay during which the Contract has been realized was from 1984-01-19 to 1984-08-28. The Team stayed in the Project Area from 1984-02-02 to 1984-07-17, with Mr. Sobola's stay extended to 1984-08-28.

2.07 Responsibilites of the Contractor's Team Leader:
During the work in the Project Area, the Team Leader has supervised, directed and coordinated the Contractor's specialists in the performance of their duties.

2.08 Relationship between the Contractor's Team Leader and the Resident Representative of the UNDP in the Project Area:
The Team Leader has maintained the close and continuing relationship with the office of UNDP in Addis Ababa; Resident Representative Dr. King, his Deputy Mr. Gernay and the officers dealing with the Project, namely Mrs. Marja Molenaar, Mr.Jorgen Lissner, Mr. Kadress Vencatachellum (SIDFA UNIDO), Mr. Arne Heinemann (JPO). Mr. King and his staff have paid several visits to the site and laboratories, following up the progress of construction as well as the progress of work of the Team.
The closest cooperation has been maintained with both CTA to the Project - Mr. Zdenek and Dr. Stephens as well as with the board and staff of ESI - Mr. Akberom Tedla, General Manager, Mr. Yohannes Afework, Head of Technical Services and the group of Counterparts.

2.09.a) Preliminary Report had been submitted to UNIDO in three copies in June 1982.
b) Draft Final Report is represented by this material.
c) Final Report will be submitted after receiving the comments on the draft final report.

1.2 The main duties of the Team Leader in his function as the Consultant on Establishment and Furnishing of Testing Laboratories were:

1. Organizing and furnishing the laboratories for Quality Control and Testing on the basis of standards in the following product areas:
   - mechanical and building materials
   - chemical products and primary materials
   - agricultural and food products
   - electrical products
   - textile and leather products.
2. Training of local staff in the furnishing and installation of Quality Control Laboratories.

3. Assistance and advice in the establishment, organization and operation of quality control department in industrial enterprises.
4. Ensurance of the proper functioning of all laboratory equipment prior to it becoming operational.
5. Advice on the installation of equipment for mechanical, physical, electrical and chemical testing and advice on its proper maintenance.
6. Advice and participation in providing technical consultancy services to industry particularly in the areas including materials testing, quality control, selection, installation and testing of equipment.

1.3 The Comprehensive Report about Activity

1.3.1 The First Field Visit

The first field visit has been scheduled by UNIDO Headquarters for May 1982, to get the exact information about the status of the construction of the laboratories and the Project itself. As already mentioned, there was only rough construction completed and practically no equipment delivered. Furthermore the shortage of financial funds demended some savings on the equipment part. The proposal for cancelling some duplicated devices has been elaborated, saving about 144 000 US Dollars. At a request of General Manager of ESI, the Project Document of National Metrology Program has been revised and adjustments have been proposed.

The Preliminary Report has been submitted to UNIDO, stating the findings. At a request of ESI and CTA, the list of the most important parts and devices for each of respective laboratories has been prepared and submitted to UNIDO and to CTA to be ordered.

The additional visits concerning the Project to UNIDO Vienna have been realized in October and December 1982 aiming to specify more exactly the equipment and requirements on laboratories.

1.3.2 The Second Field Visit

Having been invited by CTA and UNDP Addis Ababa to start the work in the Project area to the full extent, the Team Leader arrived in Addis Ababa on 1983-05-01 again, with the arrival of the whole

Team scheduled two weeks later, However, the status of completion ofconstruction and equipment available did not allowed the work to be started. The Inter Office Memo has been issued by the Team Leader, specifying the most necessary works to be done before star ting the work of the Team. UNDP Office Addis Ababa has provided air tickets for the return trip, with the beginning of final work expected on 1983-08-01.

1.3.3 Activity during the Main Stay in Addis Ababa

Against the expectations, the start of work was postponed again, to begin with the arrival of the Team Leader on 1984-01-19 and the Team on 1984-02-02-

In spite of the fact that the construction of the Centre was not completed, it was decided to start with the work of the whole Team in February. The Team arrived on schedule and immediately started to work.

The Consultant on establishment and furnishing and simultaneously the Team Leader has from the very beginning organized and took part himself in unpacking and inventoring the equipment. According to his instructions the instruments for all laboratories have been checked and installed. The designed layouts of the Building Materials Testing Laboratory and Mechanical Workshop have been redesigned to improve the handling of materials to be tested and worked. Another suggestions for organizing the rooms for humidity tests of Building Materials and Electrical Products have been submitted. The additional water installation in laboratory benches of Biochemical Laboratory has been designed and finally installed, by the Team. Simultaneously, the staff of ESI has been on-the-job trained in the furnishing and installation of Quality Control Laboratories, the functions and use of instruments have been explained and the importance of assuring the measuring conditions and the calibration has been explained.

During the installation and checking of instruments, the detailed inventory was made and the Progress Report with specifications of all spare parts, damaged missing and broken parts in its Annex has been submitted to UNIDO. The instruments found defective were either immediately repaired or the damaged parts specified, required and

after delivery replaced, putting the device into operation.

The Consultant took part in the Quality Control Workshop organized by Dr. Stephens, CTA, for the representatives of Ethiopian Industry, which has been taking place from April 23 to April 29 in Addis Ababa. From May 2 to May 10 followed visits to chosen factories and closing discussions from May 16 to May 18.

During the workshop and factory visits as well as by closing discussions the assistance and advice in the establishment, organization and operation of Quality Control Departments in industrial enterprises have been provided and highly appreciated by the participants. The consultancy services to industry have been rendered when required, concerning materials testing, selection, installation and testing of equipment. The importance of keeping and controlling the technological procedures for quality improvement has been stressed out. The close relationship between Quality Control and Metrology has been permanently explained and the importance of the calibration and verification of measuring instruments has been pointed out.

Besides of installing the equipment and putting it into operation, the ability of the respective laboratories to perform the quality control tests has been studied. As the result, the set of the most important testing instruments for electrical laboratory has been required for ordering through UNIDO. The original Project Document did not foresee the equipment of this laboratory by testing instruments, it was furnished exclusively by the measuring instruments. The similar situation has been found in the biochemical laboratory which was not equipped for most important microbiological tests. Again the request for ordering the necessary equipment and nutrient media has been passed to UNIDO. A lot of auxiliary instruments was designed to be manufactured in the mechanical workshop after it being equipped by the items necessary for its activity. Some of them, not available on the local market were requested from UNIDO, but the amount of approx. 15 000,- US dollars was spent locally from the local funds.

1.3.4 The Results Achieved

With regard to the Job Description, the results of the Consultant's work are as follows:

1. The laboratories for Quality Control and Testing on the basis of standards of:
   - mechanical and building materials
   - chemical products and primary materials
   - agricultural products and food products
   - electrical products
   - textile and leather products

   have been furnished, equipment installed and checked, organizational charts and Job Descriptions of staff worked out. The same in the Mechanical Workshop.
2. The staff have been trained on-the-job on the respective instruments and on the furnishing and installation of QC laboratories.
3. Assistance and advice to the industrial enterprises has been given during the Workshop on QC.
4. The proper functioning of all laboratory equipment was ensured when not damaged or no vital parts were missing.
5. The advice on installation of instruments in all the laboratories has been given together with the instructions on its maintenance.
6. Technical consultancy services to industry have been provided at a request (e.g. Awash Power Engineering, Mulu International Trading, Addis Tyre, Anbassa Shoe Factory etc.)

The correspondance related to work of the Team Leader and the Team has been channelled through CTA and after his departure directly to UNIDO after consultation at ESI and the UNDP office.

The Consultant has worked under supervision of CTA Dr. Stephens and in close cooperation with him.

The work of the Consultant has been intertwined with the work of the Team and therefore it is possible to find the detailed information in the following parts concerning the work of other Consultants.

1.3.5 Out of Project Activities

The Consultant has been asked to perform also some actions not directly connected with the present Project as follows:

- The lecture about the principles, importance and advantages of the System International of Measuring Units has been given to the members of ESI Technical Committee at a request of General Manager of ESI.
- The workshop on using and programming of programmable calculators HP-97, TI-59 for Counterparts has been conducted from August 13 to August 22-
- The working visit to Asmara University has been realized from June 22 to June 27 with an approval of UNDP and ESI at a request of Asmara University, resulting in repair and check-up of approx. 150 000 US Dollars of equipment.
- The elaboration of the new list of equipment for the National metrology programme has been realized at a request of CTA, GM ESI and office of UNDP. The justification of the equipment has been provided for UNDP as well as written remarks to the importance of metrology for the developing countries, especially in relation to the Quality Control.
- Following the proposition of the UNDP office, the Team Leader took part in the workshop organized by UNIDO on Design and Evaluation of Development Projects from March 19 to March 23.

2) Consultant on Quality Control and Testing of Building Materials

2.1 The Consultant has worked under the direct supervision of the Team Leader, and under the general supervision of the CTA. He worked in close cooperation with the Counterparts assigned by ESI. Unfortunately, the whole program has been followed only by one Counterpart - Mrs. Semegne Girma, occasionally by Mr. Alemayehu Belete. By the initial installation helped also Mr. Futurzeab Asgedom.

2.2 The main duties of the Consultant, according to his Job Description were:

1. To prepare a comprehensive plan and programme for the quality control and physical and mechanical laboratory tests and chemical analysis of mechanical and building materials, such as:
   - Structural Steel
   - Cement and Cement Products
   - Timber and Timber Products
   - Mechanical Fastener.
2. To train local staff in performing quality control testing and analysis of mechanical and building materials on the basis of standards and standardising documents.
3. To develop a unified methodology for conducting laboratory tests, carrying out technical and chemical analysis and quality control.
4. To advise and participate in the installation of equipment for mechanical and physical testing and advise on its proper maintenance.
5. To advise on and participate in providing technical consultancy services to industry particularly in the areas including materials testing, quality control, selection, installation and testing of equipment.
6. To participate in the elaboration of national standards related to mechanical, physical and chemical testing and co-operate in developing quality control systems with industry.

7. To train counterpart personnel on-the-job in the performance of the above duties and advise on an appropriate programme for fellowship training abroad.

2.3 The Comprehensive Report About Activity

The primary task to be fulfilled after starting the activity in the Project Area was unpacking, completing, inventoring and checking-up the equipment.

With regard to the needs of optimal organization of testing in the laboratory, the original layout of equipment has been changed. The layout proposed in the Project Document did not allow the handling of relatively roomy products to the tested and also the dividing the laboratory into characteristic groups of testing was not provided (e.g. cement, timber, pipes etc.). The new layout demanded adaptation of original installation of electricity and construction of the new anchorage for some instruments. This task has been very successfully solved by the teamwork of Consultants for Establishment and Furnishing, Maintenance and Servicing, Electrial Testing and Building Materials Testing Consultant himself.

According to the Comprehensive Plan of Testing prepared by the Consultant, the majority of tests has been trained. However, some tests have not been trained to the full extent, due to the lack of chemicals (not ordered and at the moment not available) and due to the damaged or missing parts of devices. (Pipe Testing Machine, Le Chatelier Flasks and Moulds, Rigdens Apparatus). Some instruments needed the manufacture of accessories (High Autoclave, Cube Molds etc.). In those cases, the training has been performed as the given conditions allowed.

The Consultant has drawn several drawings of building's and laboratories adaptations for the ensurance of the work of the laboratory.

2.3.1 Installation and Status of Equipment, Training on-the-job.

The installation of the equipment delivered, its status and the information about the acquaintance of the local staff with the operation, maintenance and tests are as follows:

1. Hydraulically Operated Universal Testing Machine
   P.O.No. 15-1-N1387
   Fundamental Parts were partly damaged, but repaired during the stay. Staff fully trained on operation, maintenance and tests.
2. Impact Testing Machine
   P.O.No. 15-1-N1387
   Delivered in good order, staff trained, acquainted with operation, maintenance and tests.
3. Hardness Testing Machine
   P.O.No. 15-1-N1387
   Delivered in good order, staff trained, acquainted with operation, maintenance and tests.
4. Compression Machine
   P.O.No. 15-1-N1226
   Delivered damaged. The spare parts have been specified and the machine has been repaired. The staff has been trained, acquainted with operation, maintenance and tests.
5. Furnace
   P.O.No. 15-1-N0948
   Delivered in good order, staff trained, acquainted with operation and maintenance.
6. Vibro Consistometer
   P.O.No. 15-1-N1033
   Delivered in good order, staff trained, acquainted with operation, maintenance and tests.
7. Air Entrainment Meter
   P.O.No. 15-1-N0578
   Delivered in good order, staff trained, acquainted with operation, maintenance and tests.
8. Mixer
   P.O.No. 15-1-N1146
   Delivered in good order, staff trained, acquainted with operation, maintenance and tests.

9. Weighing Machine (50kg/20g)
   15-1-N0722
   Delivered in good order, staff trained, acquainted with operation, maintenance.
10. Weighing Machine (25kg/1g)
   P.O.No. 15-1-N0722
   Delivered in good order, staff trained, acquainted with operation and maintenance.
11. Top Pan Balance (Model SM 1600 from Sauter)
   P.O.No. 15-1-N0707
   Delivered in good order, staff trained, acquainted with operation and maintenance.
12. Test Sieves
   P.O.No. 15-1-N0578
   Delivered complete, staff acquainted with operation and maintenance.
13. Sieve Shaker
   P.O.No. 15-1-N0948
   Delivered in good order, staff acquainted with operation, maintenance and tests.
14. Vibrating Table
   P.O.No. 15-1-N0948
   Fundamental parts were complete, staff was acquainted with operation and maintenance.
15. Curing Tank
   P.O.No. 15-1-N0578
   Delivered in good order, staff trained, acquainted with operation,, maintenance.
16. Moisture Conditioning Oven
   P.O.No. 15-1-N1223
   Transferred to the biochemical lab
17. Los Angeles Abrasion Machine
   P.O.No. 15-1-N0961
   Delivered in good order, staff trained, acquainted with operation, maintenance and tests.

18. Rigdens Apparatus
    P.O.No. 15-1-N0578
    Delivered not complete, parts have been ordered, but not arrived during the stay, Staff was acquainted with operation, maintenance and tests only theoretically.
19. Vicat Apparatus
    P.O.No. 15-1-N0578
    Delivered complete, staff trained, acquainted with operation, maintenance and tests.
20. Le Chatellier Water Bath and Mould
    P.O.No. 15-1-N0948
    Delivered not complete, parts have been ordered, but not arrived during the stay. Staff was acquainted with operation, maintenance and tests.
21. Heat of Hydration Apparatus
    P.O.No. 15-2-N0572
    Delivered in good order, the information on use, maintenance and tests only theoretical, as no chemicals available.
22. Penetrometer
    P.O.No. 15-1-N1146
    Delivered not complete, parts have been ordered, but not arrived during the stay. Staff was acquainted with operation, maintenance and tests only theoretically.
23. Ductilometer
    P.O.No. 15-1-N1239
    Delivered without specimens, therefore only theoretical information on operation, maintenance and tests.
24. Loss on Heating Oven
    P.O.No. 15-1-N1237
    Delivered without thermometer, therefore only theoretical information on operation and tests.
25. Cleveland Flash Cup Apparatus
    P.O.No. 15-1-N1387
    Transferred to the biochemical lab.
26. Sieving Extractor
    P.O.No. 15-1-N1237
    Delivered without specimens, therefore only theoretical information on operation, maintenance and tests.

27. Bench Mounted Mixer
    P.O.No. 15-1-N1146
    Delivered in good order, staff acquainted with operation and maintenance.
28. Pipe Testing Machine
    P.O.No. 15-1-N1226
    Delivered not complete, claim for lost parts pending, staff not trained at all.
29. Flow Table
    P.O.No. 15-1-N1237
    Delivered in good order, staff trained, acquainted with operation, maintenance and tests.
30. Abrasion Machine
    P.O.No. 15-1-N1348
    Instead of Abrasion Machine for testing of terrazzo tiles, the machine for testing of PVC materials has been delivered - the use for Textile and Leather Laboratory possible.
    The staff has not been trained.
31. Jolting Apparatus
    P.O.No. 15-1-N0948
    Delivered complete, staff acquainted with operation and maintenance.
32. Mortar Mixer
    P.O.No. 15-1-N0948
    Delivered complete, staff acquainted with operation and maintenance.
33. Drying Oven
    P.O.No. 15-1-N1387
    Delivered not complete. Missing parts ordered, staff acquainted with operation and maintenance.
34. High Pressure Autoclave
    P.O.No. 15-2-N0600
    Delivered not complete, staff acquainted only theoretically.
35. Flexure Tension Machine
    P.O.No. 15-2-N0600
    Delivered complete, staff trained, acquainted with operation, maintenance and tests

The remaining items (No.38,39,41-46 of CTA list are accessories

installed with their respective main instruments.

2.4 The Results Achieved and Their Utilization

The achieved results could be divided into following groups:

1. All delivered items of laboratory equipment have been assembled and completed, cleaned, installed and the Flow Charts of the proper maintenance elaborated.
2. All the items have been rechecked, missing or damaged parts ordered and if delivered, replaced.
3. The local staff has been acquainted and trained in performance of quality control testing and analyses of mechanical and building materials on the basis of Ethiopian Standards and standardizing documents. The on-the-job training of the above duties and advice on an appropriate programme for fellowships abroad have been provided.
4. Comprehensive plan and programme for the quality control and physical and mechanical laboratory tests and chemical analyses of mechanical and building materials have been prepared.
5. Methodologies for conducting laboratory tests have been developed, unified and completed by proposals of supplements to the national standards.
6. It has been advised on and participated in providing technical consultancy services to industry, particularly in areas concerning materials testing, quality control, selection, installation and testing of equipment during the Workshop on Quality Control organized by the CT4. The additional advice and training on-the-job were realized during following factories visits.
7. The list of suggestions for improvement of the economy of the tests to be performed and the laboratory work itself has been elaborated.
8. The suggestions to the organization of the laboratory and to the Job Descriptions have been made.

The results of the work have been already partly utilized du-

ring his stay, the full utilization is planned in future, supposing the recommendations of the Team (see the relevant chapter) will be realized.

Visits to the factories have brought results immediately (see the list of submitted documents where the findings of visits the factory production, the status of quality control, main problems and the recommendations are described. The real tests for customers of Ethiopian Industry have been started during the stay and that way the activity of ESI in the field of Quality Control has been opened.

3. Consultant on Quality Control and Testing of Chemical Products

3.1 The Consultant has worked under the direct supervision of the Team Leader, and under the general supervision of the CTA. He worked in close cooperation with the sole Counterpart assigned to him - Mr. Aklile Berhane.

3.2 The main duties of the consultant, according to his Job Description were:

1. To prepare a comprehensive plan and programme for the chemical analyses of the Quality Control and Testing Centre.
2. To perform all kinds of quality control and laboratory analyses of chemical products and primary materials such as:
   - Plastics
   - Petroleum Products
   - Surface Agents.
3. To establish and put into action systems and on-the-job training of local staff in performing quality control and analyses of chemical products on the basis of standards and other methods of testing.
4. To ensure the accuracy and the proper functioning of all testing instruments intended for chemical analysis.

3.3 The Comprehensive Report About Activity

Similar to the rest of laboratories the work started with unpacking and inventoring the instruments. Unfortunately, most

of them was already unpacked earlier and not returned to their original boxes, which did not facilitate the identification of the parts and completing of accessories.

After unpacking and assembling the devices, they have been checked for mechanical damages and after electrical power installation (April 2) the electrical circuits have been checked. The missing parts have been ordered including spare parts and accessories for improving the performance of devices in quality control testing.

Most of delivered devices represent the common laboratory equipment. The installation has been complicated by the fact, that the laboratories were not completed, there was no water running and till April 2 no electricity. Another problem was the lack of chemicals. In spite of the fact that Polytechna's Team elaborated the list of chemicals already in May 1983 and submitted it for ordering procedure to UNIDO Headquarters and to CTA. The chemicals did not arrive until the end of the stay of the Team Leader in Addis Ababa.

Major parts of Consultant's working capacity have been devoted to spectrophotometers and chromatographs completing, testing and operating. Usually for understanding and application of any of these devices in quality control testing, the operator needs 6-9 months learning time. In this case, only one Counterpart was assigned for all the devices and only 3 months were available for training on all devices. The lack of chemicals (already mentioned) we tried to overcome by borrowing some chemicals from Addis Ababa University. The Counterpart has been acquainted also with the electronical, optical and mechanical parts of devices and the principles of their operation.

One of the most important parts of Consultants activity were testing programs. To prepare them, the thorough study of Ethiopian Standards was made with regard to their compatibility and traceability to ISO standards and other recognized international standards. The suggested testing program is based on Ethiopian Standards and covers the testing of Plastics, Petroleum Products and Surface Agents. The selected standards and short description of testing methods have been elaborated in the form of Inter Office Memo toESI.

The advice on establishment and operating the laboratories

for quality control in industry has been given during the Workshop on Quality Control and subsequent visits of factories.

3.3.1 Installation and Status of Equipment. Training on-the-job.

The Consultant has worked in close cooperation with the Consultant on Agricultural and Food Products Testing. The equipment installed in the laboratory is to be found in two parts of the original list of equipment as suggested by CTA. We consider in this case as of advantage to refer to numbers of instruments as they are in the list mentioned.

Chemical Products:

1. Automatic Adiabatic Bomb Calorimeter.
   P.O.No. 15-1-N1320
   Delivered without oxygen cylinder. Spare parts ordered but not delivered. The operation explained to the Counterpart, the practical determinations not realized (reasons above).
2. Muffle Furnace
   P.O.No. 15-1-N1223
   Delivered complete, staff acquainted with operation and maintenance.

13. Water Still
   P.O,No. 15-1-N1027
   Delivered complete, prepared for the installation on the wall, counterpart acquainted with operation and maintenance. Not usable for preparation of water for analytical purposes.

14, 15 Analytical Balances
   P.O.No. 15-1-N0705
   Delivered in good order, staff trained in operation and weighing procedure.

16, 17 Top Pan Balances
   P.O.No. 15-1-N0705
   The same as above.

20. Glassware and other Lab. items
   P.O.No. 15-1-N1325
   Delivered glassware is absolutely insufficient for the work of laboratories concerned. The additional items are to be ordered, some parts reordered because of incompatibility.

23. Gas Analyser
    P.O.No. 15-1-N1236
    Delivered with all main parts broken. Spare parts ordered and installed. Apparatus is ready for use, but chemicals are missing.
24. Automatic Melting, Boiling and Drop Point Apparatus
    P.O.No. 12-2-N0600
    Delivered with spare parts, assembled and ready for use. Counterpart informed about operation.
25. Moisture Balance
    P.O.No. 15-1-N1238
    Delivered in good order, set up and counterpart acquainted with operation.
29. Viscometer Bath
    P.O,No. 15-1-N1224
    Delivered without viscometers, therefore not usable. Viscometers ordered according to specification of Team Leader. Counterpart instructed on use and maintenance.
30. Atomic Absorption Spectrophotometer
    P.O.No. 15-1-N1011
    The pressure cylinders not delivered. The compressor supplied delivers only minimum air flow 4,5 l/min. Counterpart trained on operation and calibration with borrowed cylinders. The calibration curves for Cu and Fe prepared and applied for determinations in edible oils.
31. Visible Spectrophotometer
    P.O.No. 15-1-N0962
    Delivered complete, prepared for use, counterpart familiar with operation.
32. Ultraviolet Spectrophotometer
    P.O.No. 15-1-N1225
    Delivered with defect in electrical circuitry - repaired. The staff is trained and familiar with operation and tests to be performed. The additional spare parts have been ordered.
33. Infrared Spectrophotometer
    P.O.No. 15-1-N1225
    Delivered without vacuum pump for solid sample finalizing. Staff trained and able to operate the instrument.

34. Gas Chromatograph
    P.O.No. 15-1-N1225
    Delivered in good order, but additional set of columns has to be ordered. Until now, no cylinder for Nitrogen. Device prepared for operation, staff trained, able to operate by himself after delivery of Nitrogen cylinder.
35. Liquid Chromatograph
    P.O.No. 15-1-N1225
    Delivered with mechanically defective columns which after 2-3 hours operation get clogged by column support material. Staff acquainted with operation, maintenance and tests.
36. pH - meter
    P.O.No. 15-1-N1134
    The missing parts ordered, delivered and put to operation. Counterpart acquainted with operation, theory of measurement and maintenance.
37. Hydrogen Generator with Accessories
    P.O.No. 15-3-D1162
    Delivered without spare parts - ordered. Installed and operated by Counterpart.

Petroleum Products:

2. Determination of Sulphur Content
   P.O.No. 15-1-N1341
   Delivered with some broken parts, ordered. Staff instructed theoretically on operation.
3. Determination of Vapour Pressure
   P.O.No. 15-1-N1123
   Delivered without bath, with only one pressure gauge for the maximum range. Staff acquainted with operation, as bath could be Viscometer bath used. The additional pressure gauges are suggested for ordering.
4. Determination of Existent Gum in Fuels
   P.O.No. 15-1-N1223
   Delivered without thermistors - ordered. Air compressor not delivered, specification for ordering prepared. Operation discussed with staff.

5. Determination of Corrosiveness of Copper
   P.O.No. 15-3-N0331
   Delivered without spare parts - ordered and delivered. The instrument is installed and staff acquainted with operation.
6. Oxidation Stability Test
   P.O.No. 15-1-N1223
   The test bomb delivered without bath and pressure gauge. The specifications for bath and pressure gauge suggested and staff instructed on replacement.
7. Determination of Flash Point
   P.O.No. 15-1-N1134
   The motor for stirre is missing, reordered. Staff instructed about operation.
9. Determination of Kinematic Viscosity
   P.O.No. 15-1-N1223
   Delivered the bath only. Viscometers ordered, in the meantime, the will be used for other purposes.
10. Determination of Carbon Residue
    P.O.No. 15-1-N1032
    Delivered complete, staff acquainted with operation and tests. Temperature regulators will be used also for other devices.
11. Determination of Penetration
    P.O.No. 15-1-N1223
    Delivered complete, staff acquainted with operation and tests.
12. Saybolt Viscometer
    P.O.No. 15-1-N1387
    Staff acquainted with operation, maintenance and tests.
13. Colour Comparator
    P.O.No. 15-1-N1027
    Delivered with defective optical part, repaired, and staff acquainted with operation and tests.
14. Cloud and Pour Point Bath
    P.O.No. 15-1-N1027
    Delivered not complete, missing parts ordered, but as they are no more produced, not available. Instrument not usable.

15. Abel Apparatus
    P.O.No. 15-1-N1223
    Delivered in good order, not put into operation as no asbestos plates available. Staff instructed theoretically.
16. Smoke Point Lamp
    P.O.No. 15-1-N1160
    Prepared for operation, staff instructed.

3.4 The Results Achieved and their Utilization

The achieved results could be evaluated from the following points of view:

1. The Consultant has installed, checked and prepared for operation 34 different instruments. The instruments represent good technical basis for improving the quality control of chemical products.
2. The additional devices for use in the laboratory have been specified and after delivery, the technical basis will be significantly enlarged.
3. The Counterpart has been acquainted with operation and testing with all not defective items.
4. The testing programs based on Ethiopian Standards were elaborated for Plastics, Petroleum products and Surface Agents.
5. It has been advised on and participated in providing technical consultancy services to industry.
6. The suggestions to the organization of the laboratory and to the Job Descriptions have been made.

The results have been utilized during the stay of Consultant (e.g. tests of edible oils, petroleum products etc. for industrial customers).

4) Consultant on Quality Control and Testing of Electrical Products

4.1 The Consultant has worked under the direct supervision of the Team Leader and under the general supervision of the UTA. He worked in close cooperation with the Counterpart Messai Girma. Later during the stay, two additional Counterparts were attending the program.

4.2 The main duties of the Consultant, according to his Job Description, were:

1. To prepare a comprehensive plan and programme of the quality control and physical and electrical laboratory tests of electrical and electronic products.
2. To train local staff on-the-job in performing quality control and testing of electrical products, especially on safety and reliability, and environmental testing, on the basis of national and international standards and prescriptions.
3. To develop measuring methods for laboratory routine tests of mass production of electrical items.
4. To advise and participate in the installation of equipment for electrical and physical testing and advise on its proper maintenance and calibration.
5. To advise on and participate in providing technical consultancy services to industry and trade organizations, particularly in the areas including materials testing, quality control selection, installation and testing of equipment.
6. To participate, whenever necessary, in collaboration with other experts in the elaboration of national standards and to cooperate in developping quality testing with industry.
7. To participate in investigations of special research products if required by the Centre's programme.

4.3 The Comprehensive Report about Activity

The activity of the Consultant started with installation of delivered devices and instruments. It was found that some accessories and manuals were missing, which were specified and ordered through UNIDO Headquarters.

Soon after unpacking and installation of the laboratory equipment it has been discovered that there have not been ordered, or even suggested to be ordered suitable testing apparatuses, instruments and power supplies for the laboratory. The items delivered until now are either only measuring instruments or testing instruments not to be used in the next future (not considering the unability of operation because of missing parts). Instruments useless at present are:

- No.4 - DC Micro Voltameter (in fact, the instrument delivered is milivoltmeter) it is not necessary for any of tests to be carried out in the next future. It is possible to use it for some temperature measurements if the thermocouples are available.

- No. 11 - Transformer Ratio Tester, because no tests of any transformers are to be carried out in the next future.

- No. 13 - High Voltage Testing Unit, because it is a special instrument for testing of electrical strength of transformer oils and similar insulating liquids and foils which are not to be tested in the next future.

- No. 17,18,19,20 - Generators, because these are special instruments for testing of telecommunication devices and appliances which are not to be tested in the next future.

The functional checking of the equipment was (as in the rest of laboratories) delayed by late power supply to laboratory.

Not sufficiently equipped laboratory by testing devices did not make possible to perform any practical tests of products. The staff was trained only theoretically how to test the most important products according to the available drafts of Ethiopian Standards or IEC Standards. However, the staff has been trained in operation and maintenance of all completely delivered devices and instruments. They obtained a lot of practical experience in electroinstallation work and in repairing and

maintenance of different devices, instruments and machines.

Measuring methods were not developed as they are sufficientlly described in the draft Ethiopian Standards or IEC Standards for most important products to be tested at first. Measuring and testing methods which are to be developed must be adapted for the respective testing devices and instruments, which were not available at present.

The comprehensive plan and programme for the most important electrical products have been elaborated. They contain all the required tests, their importance, used standards describing the testing methods, necessary equipment. Easy to survey Flow Charts have been elaborated and hung on the wall of the laboratory. As already mentioned, no testing instruments are at present available. The most important (13 pieces) have been suggested to be bought through UNIDO. Another 34 items have been suggested to be manufactured in ESI Workshop. The technical drawings have been submitted to Workshop.

Electrical Laboratory itself is underdesigned. It consists of one laboratory room which is absolutely insufficient for performing of all the tests. Furthermore, the tests for humidity and moisture must be carried out in a separate room. The proposal on the adaptation of the Curing Room for these purposes has been elaborated, as well as requirements of adaptations of the laboratory itself.

The Consultant closely cooperated with the Standards Department. The advice to amendments of draft standards and the elaboration of the new ones where necessary has been provided.

As the rest of Consultants, during the workshop on Quality Control, provided the Consultant technical consultancy services, followed by the practical advices during the factories visits. Recommendations for avoiding many scraps and waste concerned the proper measurement of machine parameters, proper adjustment of machines, testing the products during and after manufacture.

4.3.1 Installation and Status of Equipment, Training on-the-job.
Following devices have been delivered and installed:

1. Universal Test Instrument for Electrical Dom.Appl.
   P.O.No. 15-1-N1160
   Delivered with German manual only. English manual ordered.
   The change of single phase socket was necessary. Staff acquainted with operation and maintenance.
2. DC Micro Ammeter
   P.O.No. 15-1-N1160
   Delivered complete, staff acquainted with operation and maintenance.
3. Multimeter
   P.O.No. 15-1-N1160
   Delivered with discharged batteries, spare ones have been ordered and received. Staff familiar with operation.
4. DC Micro Voltammeter
   P.O.No. 15-1-N1235
   Delivered without line transformer, will be purchased locally. Staff acquainted with operation.
5. Clip on Voltammeter
   P.O.No. 15-1-N1160
   Delivered complete, staff familiar with operation.
6. Clip on Wattmeter
   P.O.No. 15-1-N1160
   As previous item.
7. Clip on Power Factor Meter
   P.O.No. 15-1-N1131
   As previous item.
8. Insulation Tester with Magneto Generator
   P.O.No. 15-1-N1160
   As previous item.
9. Insulation Tester for Battery Operation
   P.O.No. 15-1-N1235
10. Power Measuring Set
    P.O.No. 15-1-N1160
    Delivered only with German manual. English manual ordered and received. Staff familiar with operation.

11. Transformer Ratio Tester
    P.O.No. 15-1-N1226
    Delivered complete, staff acquainted with operation and maintenance.
12. R.L.C. Measuring Bridge
    P.O.No. 15-1-N1160
    Delivered with German manual only, English manual ordered. Staff familiar with operation.
13. High Voltage Testing Unit
    P.O.No. 15-1-N1131
    Delivered with small defect in the Voltage measurement at the range x0,25, repaired, staff acquainted with operation and maintenance.
14. Digital Timer
    P.O.No. 15-1-N1235
    Delivered complete, staff acquainted with operation.
15. Lightmeter
    P.O.No. 15-1-N1028
    As previous item.
16. AC/DC Breakdown, Leakage and Ionization Tester
    P.O.No. 15-1-N1028
    Delivered without high and low voltage probe. Ordered and delivered. Staff acquainted with operation and maintenance.
17. Calibration Generator
    P.O.No. 15-1-N1234
    Delivered without power mainframe, therefore useless. Missing part ordered, but not yet delivered. Staff not trained.
18. Time Mark Generator
    P.O.No. 15-1-N1234
    As previous item
19. Signal Generator SG 503
    P.O.No. 15-1-N1042
    as previous item
20. Signal Generator SG 504
    P.O.No. 15-3-D1095
    As previous item

21. Dual Beam Oscilloscope
    P.O.No. 15-1-N1042
    Delivered without plug,in units, therefore useless. Two plug-in units ordered, but not yet delivered. Staff not trained.
22. DC stabilized Power Supply
    P.O.No. 15-1-N1160
    Delivered complete, staff acquainted with operation.
23. Drying Oven
    P.O.No. 15-1-N1027
    After initial installation in chemical lab, transferred to electrical lab for tests "resistance to heat". Delivered without manual, but staff acquainted with operation and maintenance.

4.3.2 Additional work for the Centre

It was found out at the beginning of establishment of laboratories, that a lot of additional electrical work is to be done in all the laboratories of ESI. Without it, many devices, equipment and machines could not be put into operation. The Consultant has performed following works:

1. Because of wrong specifications of power supply for machines in Workshop, five electromotors and two transformers of the Surface Grinder and the Bridgeport Milling Machine had to be reconnected. Further five electromotors were checked.
2. As each of delivered instruments was not provided with plug, more than 110 single phase plugs had to be installed. Five 3-phase plugs were installed in the workshop and textile laboratory.
3. Each of the single and three phase sockets in the electrical textile and building laboratory was checked and if necessary repaired because of poor quality of electrical installation made by constructing agency EBCA.
4. Milling Machine Bridgport, Surface Grinder and Universal Testing Machine. Los Angeles Abrasion Machine were fixly joined to the 3-phase mains. Sieving Extractor was joined to the power using a special plug.

5. Control Boards in the electrical and building laboratory had to be partly reconnected including the exchange of phases sequence. The Control Board in the workshop had to be completely reconnected because of lack of the space for new circuit. breakers, wrong sequence of phases and connections made against safety regulations.
6. Total of 11 new sockets has been installed in bulding, textile and electrical laboratory.
7. Five single and two three phase extentional cables were manufactured for the laboratories. Two adaptors from 3-pin to 2-pin plug were manufactured.
8. Each of electrically operated item of equipment was functionally checked and put into operation.
9. Repairs of devices and machines were carried out as follows:
   - Universal Testing Machine: Repair of the control system for threaded column, control system of the differential valve including the feedback, control panel for hydraulic clamps, zeroing circuits of the lowest range. Zeroing circuits of other ranges and measuring circuits of all ranges were adjusted.
   - Los Angeles Abrasion Machine: Repair of the Control Panel.
   - Balances in the building laboratory: Repair of the aretation, linearity and adjustment of the base and full range.
   - Compression Machine Farnell: Repair of the Control Panel damaged during the transport.
   - Universal Strength Tester: Repair of the contacts of switches in the Control Unit and repair and adjustment of the printer.
   - Double Wheel Coarse Grinder: Exchange of the electrical connections including the new cable installation and grounding of the grinder.
   - Light Colour Fastness Meter: Repair of the defective lamp contact.
   - Truck T2-148: Repair of the electopneumatic valve.
10. According to the new layout of machines in the workshop and Building labcratcires, the necessary new Electrical Installation Plans were drawn and relized in accordance with safety regulations.

11. The following work on the electrical installation has been carried out:
    - Installation of the new cables into the concrete floor for joining the Milling Machine, Metal Cutting Bandsaw and Surface Grinder to the power.
    - Installation of two new circuit breakers into the Control Board, interchange of circuit breakers No. 9-10 and 14-15. The Control Board has been completely reworked.
    - Three new junction boxes were installed for the lathe, new 3-phase sockets and for the Furnace.
    - Installation of total 10 three-phase sockets on the wall, floor and universal shelves.
12. The new delivered transformer for the Lift Truck Battery Changer has been checked-up and discovered, that it is not suitable for the local voltage conditions. The respective Inter Office Memo has been issued.

4.3.3 Out of Project Activity

The Consultant took part in the working visit of Asmara University and in repair and adjustment of devices as already mentioned in 1.3.5. He cooperated also in the revision of the Project document for the National Metrology Programme made by the Team Leader.

4.4 The results Achieved and their Utilization

The results of the Consultant's work are as follows:

1. Each of the delivered instruments and devices (23 items) has been assembled, functionally checked, missing parts and manuals ordered.
2. The local staff has been acquainted and trained in operation and maintenance of all completely delivered equipment.
3. A lot of reparatory and installatory work has been done in all the laboratories as described in 4.3.2.
4. Testing Programme and Flow Charts for it have been elaborated for the most important electrical products to te tested.

5. The list of 34 testing instruments to be manufactured in the workshop and the technical drawings and descriptions have been submitted.
6. The Proposal for Curing Rooms adaptations has been made and submitted for the realization.
7. The suggestions for organization of the laboratory and for Job Descriptions of the staff have been made.
8. The advice and recommendations to Ethiopian Industry have been provided.
9. Additional equipment and necessary adaptations of the laboratory have been suggested and submitted to ESI.

Some of the results of the Consultant's stay have been already utilized, as e.g. practical use of measuring instruments for the purposes of other laboratories, electro installatory works, advice to industry.

In the future, the tests according to the presented Programmes for testing will be realized, supposing the suggestions for equipment and adaptations will be completed.

5) Consultant on Quality Control and Testing of Agricultural and Food Products

5.1 The Consultant has worked under the direct supervision of the Team Leader and under the general supervision of the CTA. He worked in close cooperation with the Counterpart Mr. Robel Watro, Mrs. Fattlework and after coming back from fellowship study abroad Mr. Tamiru Geno.

5.2 The main duties of the Consultant, according to his Job Description were:

1. To perpare a comprehensive plan and programme of the quality control for both the laboratories and field testing and aralyses of agricultural and food products such as:
   - Coffee and coffee products
   - Hides and skins
   - Oilseeds and pulses
   - Meat and meat products
   - Fruits and vegetables
2. To train local staff on-the-job in performing quality control and laboratory as well as field tests and analysis of agricultural and food products on the basis of standards and prescriptions.
3. To develop measuring methods for laboratory and field routine tests of agricultural and food products.
4. To advise on and participate in the installation of testing and measuring equipment and on their proper maintenance and calibration.
5. To advise on and participate in providing technical consultancy services to industry and trade organizations.
6. To participate, whenever necessary, in collaboration with other experts in the elaboration of national standards.
7. To participate in investigations of special research projects required by the Centre's programme.
8. To participate in analysing some of the drawbacks in the implementation of the national standards.

5.3 The Comprehensive Report about Activity

The laboratory in which the Consultant should work was not prepared for the work in the time of his arrival in the Field Area. The laboratory benches were not suitable for the biochemical work. The laboratories were without electrical power, without gas and without water taps for connection of laboratory equipment.

During the unpacking it was discovered that the glassware delivered is not compatible, i.e. it is impossible to connect some pieces together. Some apparatuses were assembled in spite of this fact.

The proposal for the adaptation of benches in the lab has been elaborated, but it took too much time to get the necessary parts as sinks, taps and outlets to be installed. The work of the Consultant in the laboratory was at that time practically impossible. After having specified the broken and spare parts for ordering procedure, the Consultant started his activity in providing the consultancy services to Ethiopian industry. With regard to the equipment available, the areas covered were divided into three main groups:

1. Edible oil industry
   Beverage industry
   Sugar industry
   Meat industry
   Flour mills industry
   Dairy industry
2. Canned goods
   Bakeries
   Poultry industry
   Water supply industry
   Fermentation industry
3. Coffee and coffee products
   Pulses
   Fruits and vegetables

The first group represents the main portion of work to be realized in ESI in the next future and the laboratory is

relatively good prepared for all the tests concerned. The two remaining groups will request equipment mainly for the microbiological tests, which at the time being is not available and therefore the tests not to perform. The equipment nad nutrient media for microbiological purposes have been proposed for ordering.

Another problem is connected with the glassware which is not suitable because of incompatibility and wrong sizes. The list of glassware is being prepared and it will be submitted to UNIDO Headquarters for ordering.

With regard to the facts mentioned, the counterpart has been trained in the preparation of testing solutions and performing the tests as:

- Density of edible oil
- Moisture in edible oil
- Saponification value
- Unsaponifiable matter
- Free acidity
- The content of oil in oilseeds
- Proteins in oilseeds
- The Nitrogen in fertilizers
- The content of alcohol in drinks
- The free acidity in drinks
- Esters in drinks
- Determination of reducin sugar

These determinations are classical and they give the Counterpart the basis for testing of all products with the necessary chemicals available.

The Consultant together with Counterparts visited several factories with the aim to help in improving the quality of their production as wall as the efficiency. The Counterpart has been instructed in finding the sources of poor quality production by checking the technology of processes by calculations of yields, consumed energy, reliability of each process, the time necessary for performing the process.

The short explanation on sensory analysis has been given to the Counterparts, according to the ISO methods.

The workshop on sensory analysis has been prepared, but of the time difficulties not realized.

The importance of checking the exploitation of all products and byproducts during the production for assuring the optimum quality has been explained.

For the beverage industry, the simple method for determination of quality of used spirit has been developed, and is already in use. The practical results of Consultants two weeks stay in beverage industry were improved yield of alcohol from molasses, removing foam from fermenting molasses by an agent prepared by the Consultant, selection of yeast from brewery yeast and winery yeasts. In the Liquor factory, the quality of different beverages has been improved.

The visit to Ethiopian tanneries brought the improvement in deliming process and gelating production.

In the Sugar factories, the proposal of the new standard of molasses has been elaborated according to the needs of factories using molasses as a raw material for the production.

In the meat factories the advice has been given on blood recovery, exploitation of bones as fodder and glue or gelatin production.

During the installation of apparatuses, the missing parts have been specified and ordered.

A total of 18 national standards have been investigated and the respective ammendments and changes have been proposed.

5.3.1 Installation and Status of Equipment, Training on-the-job

The following items of equipment were installed:

3. Centrifuge
   P.O.No. 15-1-N1160
   Delivered without head, reordered, but not yer received.
   Staff not instructed.
6. Incubator
   P.O.No. 15-1-N1223
   Delivered complete, staff acqainted with operation, maintenance and use.

7. Kjeldahl Equipment
   P.O.No. 15-1-N1223
   Delivered without support rings, ordered, not yet received. Staff acquainted with operation and maintenance.
8. Oven
   P.O.No. 15-1-N1027
   Delivered in good order, staff acquainted with operation and maintenance.
10. Refrigerator
   P.O.No. 15-3-N0285
   Delivered complete, staff familiar with.
12. Flask Shaker
   P.O.No. 15-1-N1027
   Delivered in good order, staff familiar with.
18. Microscope
   P.O.No. 15-1-N1223
   Delivered in good order, staff acquainted with operation and maintenance.
19. Stereoscopic Microscope
   P.O.No. 15-3-N0286
   Delivered in good order. Spare parts ordered, not yet received. Staff trained.
22. Freeze Drying Apparatus
   P.O.No. 15-1-N1236
   Delivered without connectors, until their arrival not usable. Staff not trained.
11. Deep Freezer
   P.O.No. 15-1-N1341
   Delivered in good order, staff trained

As for glassware, see information on Chemical expert's activity and this Consultant's Comprehensive Report.

5.3.2 The Factories visited

The Consultant visited during his stay and provided the appreciated advice to the following factories:

Addis Ababa:

1. Dele Edible Oil Factory
2. United Oil Mills and Soap Factory
3. Teramaj Edible Oil Factory
4. Akaki Edible Oil Factory
5. Mesrak Edible Oil Factory
6. National Distilleries
7. Liquor Factory
8. S.G. Brewery
9. Abay Mesk Soft Drinks Factory
10. Anbesa Flour Mills
11. Ethio-plastic Factory
12. Tobacco Factory
13. Ethio-Japan Synthetic Factory
14. Shoa Sugar Estate
15. Abattoir's Meat Factory

Mojo:

16. Mojo Tannery

Nazereth:

17. Nazrawi Kiba Nuge Oil Factory

Wonji:

18. Wonji Sugar Estate

The Consultant stayed in the National Distilleries for 15 days and in Wonji Sugar Estate 5 days to held to solve their Quality Control and production problems. His advice has been highly appreciated by the representatives of the factories.

5.3.3 Participation in the Elaboration of Standards

The Consultant participated in the elaboration of following Ethiopian Standards:

1. ES.B.M3.100 - Natural Wines, Specification
2. ES.B.M3.101 - Natural Wines, Additives and Contaminants, Specification
3. ES.B.M3.102 - Vermouths and Appetizers, Specification
4. ES.B.M3.001 - Beer, Specification
5. ES.B.M2.001 - Fermented Malt Beverages, Specification
6. ES.B.M4.001 - Non-alcoholic Beverages and Concentrated Carbonates Soft Drinks
7. ES.B.M4.002 - Citrus Squash
8. ES.B.M4.003 - Citrus Beverages
9. ES.B.M4.004 - Preserved Concentrates - Orange Juice
10. ES.B.M4.005 - Natural Citrus Juice
11. ES.B.45.001 - Canned Fruits and Vegetables Preserved by Heat Processing, General Requirements
12. ES.B.36.303 - Fresh Fruits and Vegetables, Packing
13. ES.B.M3.203 - Gin, Specification
14. ES.B.M3.204 - Ouzo, Specification
15. ES.B.M3.205 - Brandies, Specification
16. ES.B.M3.206 - Cognac, Specification
17. ES.B.M3.207 - Whisky, Specification
18. ES.B.M3.208 - Fernet, Specification

5.4 The Results Achieved and Their Utilization

In spite of the fact, that the laboratory suffered from delays in completing the construction (in fact it is not completed until now), the Consultant fulfilled his stay as follows:

1. After installing the instruments available and specifying the missing parts, the plan and programme for the tests based on Ethiopian Standards has been prepared and submitted to ESI.
   The Counterparts have been trained in performing the most important tests in quality control of agricultural and food products.
2. The additional devices for performing the microbiological tests has been developed and submitted to Counterparts.
3. The methodology for performing the laboratory and field tests has been developed and submitted to Counterparts
4. Wide and detailed consultancy services have been provided for Ethiopian industry, resulting in improvement of quality and efficiency of production.
5. The Consultant participated in elaboration of 18 ES.
6. The list of chemical glassware to be ordered has been elaborated.

The most important part of the results which has been immediately utilized are advices to industry. The methodology of tests and the training in performing the quality control itself depend to the great extent on the delivery of suggested equipment and chemicals. The lack of chemicals, similar as in the case of Chemical Products expert influenced negatively the work of expert, and the quality of training of Counterparts, which could be done mostly only theoretically.

6) Consultant on Quality Control and Testing of Textile and Leather Products

6.1 The Consultant has worked under the direct wupervision of the Team Leader and under the general supervision of the CTA. He worked in close cooperation with the Counterpart Mr. Ezra Terefe.

6.2 The main duties of the Consultant, according to his Job Description were:

1. To prepare the comprehensive plan and programme for the quality control and physical, mechanical and chemical laboratory tests and analyses of textile and leather products such as:
   - Textile fibres, yarns, fabrics and leather products
   - Qualitative and quantitative analysis of textile and leather materials etc.
2. To train local staff in performing quality control testing and analysis of textile and leather raw materials and products on the basis of standards and standardizing documents.
3. To develop a unified methodology for conducting laboratory tests, carrying out physical and chemical analysis and quality control.
4. To advise and participate in the installation of testing and measuring instruments and advise on its proper maintenance and calibration.
5. To advise on and participate in providing technical consultancy services to industry.
6. To participate in the elaboration of national standards related to mechanical, physical and chemical testing and cooperate in developing quality control systems with industry.
7. To train counterpart personnel on-the-job in the performance of the above duties, and to advise on an appropriate programme for fellowship training abroad.

6.3 The Comprehensive Report about Activity

After arrival of the Consultant to ESI, the installation of water and electricity in the laboratory has not been completed. The activity itself could be started only after unpacking of all the instruments, their cleaning, completion and transporting them to their respective working places. This activity took a reasonable amount of time. The situation was complicated also by problems with getting of cleaning agents, lubricants and even the materials to be tested.

From the original project document, several instruments have been cancelled in spite of their necessity for the laboratory. Also the original layout of laboratory did not considered the dimensions of instruments and other relevant demands (as e.g. the constant water supply) for some of them. The new layout of instruments in the laboratory has been provided as well as the design of 7 special benches and tables to accomodate some of them.

To perform the tests internationally prescribed (included also in Ethiopian Standards) the following designs have been made:
- the drawings for necessary accessories of laboratory (e.g. drawings for special cutting knives for samples preparation, drawing of special clamps for Universal Strength Tester etc.)
- the design of testing device for waterproofness of fabrics, included the testing method. The device itself has been manufactured in workshop by the Consultant on maintenance and servicing
- the templates for sample preparation (testing of fabrics) have been designed and manufactured in the workshop.

The Consultant elaborated the programme for testing of textile and leather products, such as: Fibre, yarn, thread, fabric, leather.

The practical tests of quality of fabrics for overrals and tents have been even made before the completion of laboratory.

The suggestions to the organization and the Job Descriptions of the staff of laboratory have been made.

C.3.1 Installation and Status of Equipment, Training on-the-job. The following items of equipment were installed:

2. Yarn Hairness Meter
   P.O.No. 15-2-N0583
   Delivered in good order, staff acquainted with operation, maintenance and tests.
4. Fineness and Maturity Tester
   P.O.No. 15-2-N0583
   As the previous item
5. Rubbing Colour Fastness Tester
   P.O.No. 15-2-N0600
   As the previous item
6. Cyclic Bending Tester
   P.O.No. 15-2-N0591
   Delivered damaged. Repaired, staff acquainted with operation, maintenance and tests.
7. Yarn Friction Tester
   P.O.No. 15-2-N0591
   Delivered in good order, staff acquainted with operation, maintenance and tests.
9. Comb Sorter
   P.O.No. 15-2-N0583
   As the previous item
10. Nep Conting Templates
    P.O.No. 15-2-N0600
    As the previous item
11. Crimp Tester
    P.O.No. 15-2-N0583
    As the previous item
12. Stiffness Tester
    P.O.No. 15-2-N0583
    As the previous item

14. Fibre Length Machine
    P.O.No. 15-2-N0584
    Delivered with the 5 mm scale instead of 2 mm scale, reordered but not yet arrived. The staff acquainted with operation, maintenance and tests.
16. Moisture Testing Oven
    P.O.No. 15-2-N0584
    Delivered complete, staff acquainted with operation, maintenance and tests.
17. Moisture Monitor
    P.O.No. 15-2-N0600
    As the previous item
18. Roving Reel
    P.O.No. 15-2-N0584
    As the previous item
19. Yarn Examining Machine
    P.O.No. 15-2-N0584
    As the previous item
20. Twist Tester
    P.O.No. 15-2-N0584
    As the previous item
22. Universal Strength Tester
    P.O.No. 15-2-N0584
    Delivery considerably delayed. Finally delivered considerably damaged. Provisionally repaired, claim with insurance pending. Staff acquainted with operation and maintenance, as well as with tests.
23. Fastran Count Balance
    P.O.No. 15-2-N0591
    Delivered in good order, staff acquainted with operation, maintenance and tests.
25. Wash Wheel
    P.O.No. 15-2-N0584
    As the previous item

26. Light Fastness Tester
    P.O.No. 15-2-NO584
    Delivered partly damaged, repaired, staff acquainted with operation, maintenance and tests.
27. Colour Matching Cabinet
    P.O.No. 15-2-NO584
    Delivered in good order, staff acquainted with operation, maintenance and tests.
28. Wrap Reel
    P.O.No. 15-2-NO584
    As the previous item
31. Balance
    P.O.No. 15-2-NO592
    As the previous item
32. Thermohygrograph
    P.O.No. 15-2-NO591
    As the previous item
33. Air Permeability Tester
    P.O.No. 15-2-NO583
    As the previous item
34. Thickness Gauge
    P.O.No. 15-2-NO583
    As the previous item
35. Pilling Tester
    P.O.No. 15-2-NO584
    As the previous item
36. Finish Rub Fastness Tester
    P.O.No. 15-2-NO590
    As the previous item
37. Lastmeter
    P.O.No. 15-2-NO590
    As the previous item
38. Swag Tester
    P.O.No. 15-1-N1490
    Cancelled
44. Upper Leather Flexing Machine
    P.O.No. 15-2-NO590
    As the item 27

46. Leather Shrinkage Temperature Determination
    P.O.No. 15-2-N0590
    Delivered damaged. Repaired, staff instructed,and acquainted with operation, maintenance and tests.
48. Soling Materials Abrasion Machine
    P.O.No. 15-2-N0590
    Delivered in good order, staff acquainted with operation, maintenance and tests.
49. Bottom Leather Grain Crack Tester
    P.O.No. 15-2-N0590
    As the previous item.

6.4 The Results Achieved and their Utilization

The results of the Consultants work are as follows:

1. Each of the delivered instruments has been unpacked, cleaned-up, assembled (if necessary repaired), checked-up, adjusted and now ready to operation.
2. The Counterpart has been acquainted with operation, maintenance and tests to be made with the respective instruments, based on standards, manuals and experience of the Consultant. The Counterpart has been provided with advice concerning his training abroad.
3. The comprehensive plan of laboratory tests to be performed has been prepared, including testing methods for tests of leather, waterproofness of tents, microscopical determination of fibre composition etc. The local conditions and importance of tests with regard to the needs of Ethiopian industry have been taken into account.
4. During the workshop on quality control and by subsequent visits to the factories, the advice to industry relating quality control and improvement has been given
5. The suggestions for organization of work in the laboratory have been elaborated.

The results of Consultants work may be evaluated on the basis of the practical tests made during his stay for customers of Ethiopian industry, and on the basis of consultancy services provided They were immediately utilized.

7) Consultant on Equipment Maintenance and Servicing

7.1 The Consultant has worked under the direct supervision of the Team Leader and under the general supervision of the CTA. He worked in close cooperation with the Counterpart Mr. Teclehaimanot, occasionally Mr. Alemayehu Belete attended the activity.

7.2 The Consultant was expected to:

1. Prepare working instructions and time schedules for periodical equipment and maintenance and servicing.
2. Prepare forms on failure rate and failure characteristics of equipment for statistical data processing and economic evaluation.
3. Advise on designing testing, measuring and research equipment constructed for the use of ESI
4. Advise on requisitioning of new equipment using statistically processed data on equipment in use.
5. Advise on evaluating out-of-date equipment
6. Advise on the installation, calibration and maintenance of equipment.

7.3 The Comprehensive Report about Activity

The situation in the field of Maintenance and Servicing in the time of Consultants arrival was complicated. Some basic machines and technologies were not available (e.g. column drill, rod metal cut off, tinsmith technologies, acetylen and arc welding sets, double wheel grinder, compressor, universal tool room sharpener). From woodworking technologies there were no machines available. In addition to it, there were no milling cutters, no drillbits, no bolts, nuts, screws, nails, no raw materials etc. The floor plan of workshop has not met the basic requirements for the respective workplaces and therefore it had to be overworked.

In the field of mechanical tests the basic equipment was almost satisfactory, but for determination of material properties

metallographical techniques and metal analysis procedures should be employed.

The Consultant tried his best to improve the actual situation.

7.3.1 Installation and Status of Equipment, Training on-the-job.

The activity of the Consultant has been aimed from the very beginning to unpacking, discovering the accessories, checking of equipment in accordance with manuals and packing lists. Extra attention has been paid to more complicated machines which arrived partly defective. The detailed description of his activities by installation and repairs of the respective instruments is as follows:

1. Universal Testing Machine:
   Deepening and enlarging of holes for anchoring, installation by means of forklift, assembling and levelling, repair of failure of the hydraulic differential valve to reach specifical test force, repair of driving system of threaded columns, repair of recording device, instruction of Counterparts.
2. Farnell Compression Machine:
   Specification of damaged components, reinstallation of hydraulic system, repair after spare parts arrival, instruction of staff.
3. Pipe Testing Machine:
   Specification of shortlanded parts, assembling of supporting frame.
4. Impact Testing Machine:
   Deepening and enlarging of anchoring holes, installation and levelling, specification of damaged parts, instruction of Counterparts, sampling and preparation of samples.
5. Hardness Tester:
   Repair of loading mechanism, repair of control system, practical test training.
6. Milling Machine:
   Installation and levelling, training of Counterpart in techno-

logical counts, milling technologies, operation with vertical and horizontal dividing head, maintenance and servicing, production of parts and test samples according to requirements.

7. Metal Cutting Band Saw:
   Installation, specification of cutting technologies within ESI and order of cutting blades, detailed training in blade path and tension adjustment, welding, annealing and grinding of blades, practical straight, angular and curve cutting, maintenance and servicing.
8. Surface Grinder:
   Installation, levelling, specification of missing parts and spare parts for two years operation, assembling and filling of hydraulic system, training of Counterpart in safe operation of machine, checking, clamping and balancing of grinding wheels, technology of coarse and fine grinding, grinding wheel dressing.
9. Heat Treatment Furnace:
   Investigation of damages caused by reckless handling during the transport, detailed specification of damaged parts.
10. Truck Tatra T2-148
    Comprehensive control after arrival from Assab, repair of hydraulic crane, detailed instruction of driver about control, operation, function, maintenance and servicing of the truck.

7.3.2 Services for Other Laboratories

In addition to installation of complicated testing apparatuses mentioned above, following services have been provided.

In the Building Laboratory:

Flexure Tension Machine - Weight shifting mechanism and limit switch breaker adjusted to the proper operation.

Miscellaneous accessories as rest plates, wall outlets supporters, covers etc. have been manufactured.

In the Textile and Leather Laboratory:

Thickness Gauge - assembled and put into operation.

Cyclic Bending Machine - repair of clamping devices and lifting levers damaged during the transport.

Universal Strength Tester - damaged during the transport, repair of Variator, manufacture of broken parts, assembling and putting into operation, instruction about operation, maintenance and servicing.
Templates - 11 pieces of templates for sampling of fabrics have been produced.
Abrasion Test Machine - maintenance and instruction on use has been made.
Chemical Laboratory:
Design of water supply for two already mounted benches with six new sinks and new pipeline with 12 taps, specification of material, realization of adaptation.
Change of installed taps in Petroleum Laboratory for more suitable ones.
Assembling of stands for fitting the complicated glass assembly.
Services for Audiovisual Aids:
Briefing on assembling, operation, maintenance and servicing of 16 mm sound projector Elmo, theoretical principles and practical use of photographic equipment, proper use and cleaning of slide projector Kodak Carousel, repair of this projector damaged by reckless handling.

7.3.3 Practical Training in the Workshop

The training has been limited by the equipment available. All machine technologies have been trained, namely: seam and corner welding, material cutting, drilling, drillbit sharpening, thread cutting and basic locksmith and tinsmith techniques.

7.3.4 The Products Manufactured

Apart from items already mentioned, following items have been produced:

- Stand for lever shears (cutting, welding)
- Universal Store Shelf (for storing rods and sheets)
- Aids (shims) for levelling the machines
- Stand for coarse grinder
- Pipelines for electric cables

- Barrel supporters
- Clamping devices for milling machine and column drill
- Test samples for hardness and impact test
- Supporting horses
- Rigid safety covers for sockets etc.

7.4 The Results Achieved and their Utilization

1. The Flow Chart of the maintenance of equipment in the Building Laboratory has been prepared. Maintenance of the workshop machines is detailly prescribed by producer on the labels on the respective machines.
2. Three weeks workshop dealing with applications of the statistical methods in the field of quality control has been held in ESI. All the Counterparts attended this workshop.
3. The Consultant has advised on designing of testing and measuring instruments, the overview of manufactured ones see above.
4. The Consultant advised and suggested to order the missing parts and the new testing and measuring devices.
5. Evaluation of out-of-date equipment was not met as the whole equipment is up-to-date.
6. The Consultant took part and advised in installation of equipment in practically all laboratories (see above).

All the results of the Consultants work have been utilized immediately.

7.5 Extension of the Consultant's Stay

At the request of the Board of Ethiopian Standards Institution the stay of Consultant on Maintenance and Servicing has been prolonged for 6 weeks as the gift of the Government of Czechoslovak Socialist Republic to Ethiopia. During the prolonged stay the Consultant realized following activities:

7.5.1 Installation and Repair of Machines

1. Precision Lathe - unpacking and inventoring according the packing list, installation, putting into operation, on-the-job training of the Counterpart in all technologies.
2. Acetylen-Oxygen Welding Apparatus - assembly, training of the Counterpart in sheet welding, corner and seam welding, oxygen cutting up to 70 mm.
3. Compression Machine Farnell - repair after defect caused by mishandling by Counterparts.

7.5.2 Production in Workshop

1. Test samples for Impact and Izod test
2. Trolley for heavy 3-phase transformer
3. Fine grinded plates for steel molds
4. Stand for double wheel grinder
5. Movable stand for Heat Treatment Furnace
6. Boards with lampholders (according to IEC Standard 64) for testing of 200 bulbs
7. Frames for proper positioning of boards with built-in power supply
8. Circular sawing machine with rising and tilting cutting blade
9. Concentric heavy plates for Compression Machine, to test cubes and hollow blocks from 50x50 to 300x400 mm.
10. Insulating Boards with battery holders (according to ES.H.H8.002)
11. Cubic Photometric Integrator (according to ES.H.D8.004)
12. Stand for Cubic Integrator
13. Test Corner (according to IEC 335-1)
14. Modification of Milling Machine for attachment with ISO cross key-hole milling cutters
15. Set of weights up to 10 kg (according to IEC 335-1)
16. 45 m shelves under workshop benches

7.5.3 Detailed Drawings and Sketches

1. The drawings for all the previous items
2. Apparatus for checking the cord anchorage (according to IEC 320)
3. Flexing Apparatus (according to IEC 254), design of moving trolley and transmission.

7.5.4 Other Activities

1. Specification of materials and parts for production of 34 testing apparatuses as required by electrical laboratory.
2. Conception and design and production of apparatuses for Building Laboratory as mentioned above.
3. Specification of measuring devices and machines to be ordered by UNIDO.

C. RECOMMENDATIONS

1 Recommendations to UNIDO / UNDP

1.1 To consider carefully the implementation of the next stage of this Project with the aim to put into operation the rest of equipment (not delivered until now), to train local staff on-the-job, to deepen the relationship between ESI and industry and to build-up the legal background of the Quality Control.

1.2 To follow-up and support the delivery of remaining instruments especially in the case of the Workshop, Electrical, Chemical and Leather Laboratories.

1.3 To implement as soon as possible the National Metrology Programme. Because the equipment in the National Quality Control and Testing Centre are not able of self-calibration, they can be calibrated only according to metrological procedures and equipment.

2. Recommendations to Ethiopian Government

2.1 To establish the legal background of Quality Control on the basis of the Act, enabling the Ethiopian Standards Institution to fulfil its role as the only authority responsible for Quality Control decisions in the country.

2.2 To ensure the obligatory and compulsory submission of manufactured and imported products to ESI for evaluation.

2.3 To ensure the sufficient testing of the semiproducts and the final products during and after the production process in industry.

3 Recommendations to Ethiopian Standard Institution

3.1 To enlarge the staff of National Quality Control and Testing Centre according to the suggestions presented by the Team as the present status is absolutely insufficient and does not allow to fulfil the tasks of ESI to the full extent.

3.2 To ensure the specialization of the staff and to enable the necessary fellowship trainings abroad.

3.3 To continue in the production of testing equipment in the workshop according to the suggestions and drawings made by the Team.

3.4 To carry out the necessary rooms adaptations as suggested by the Team (e.g. Curing Rooms adaptations, Electrical Lab adaptation).

3.5 To elaborate missing Ethiopian Standards (e.g. the standard for testing of electrical household appliances)

3.6 To supplement existing Ethiopian Standards according to the remarks of Consultants

3.7 To speed-up the implementation and publishing of existing draft standards as the valid compulsory standards

3.8 To consider the testing of water used for technological processes, as the quality of many products directly depends on its quality.

3.9 To complete the furnishing of the workshop and laboratories with furnishing and equipment according to the Team's suggestions.

E N C L O S U R E S

1. List of Inter Office Memos Submitted

1.01 Essential Items for Completion of Laboratory Buildings
1.02 Completion of Laboratory Buildings
1.03 Preparation for Start-up of Consultants Work Programme
1.04 Progress Report - Status of Equipment
1.05 Technical Report for Meeting with Counterparts
1.06 List of Main Equipment of BML in accordance with ES
1.07 Technical Report on Visit in Addis Ababa Cement Factory
1.08 Technical Report on Visit in Warka Furniture Factory
1.09 Technical Report on Visit in Ceramical Brick Factory
1.10 Methodology for Laboratory Tests of Aggregates
1.11 -"- of Reinforcement Steel
1.12 Comprehensive Plan and Programme for QC of Cement
1.13 -"- of Aggregates
1.14 -"- of Concrete
1.15 -"- of Asbestos Cement
1.16 -"- of Clay Bricks
1.17 -"- of Concrete Blocks
1.18 -"- of Steel Sheets
1.19 -"- of Natural Stones
1.20 -"- of Standard Sand
1.21 -"- of Timber
1.22 -"- of Reinforcement Steel
1.23 -"- of Quicklime
1.24 -"- of PVC Pipes
1.25 -"- of Ceramics
1.26 Specification of Equipment, Appliances and Facilities
1.27 List of Lubricating Material
1.28 List of Chemicals for Tests in accordance with ES
1.29 Handling Instructions for Using of Chemical Materials
1.30 List of Products and Test to be Provided with Present Eq.
1.31 Ensurance of Testing in accordance with ES
1.32 Test Report, Test Results and Forms for Test of Aggregates, and Reinforcement Steel

1.33 Pattern of the Test Report of Piece Samples and Cement
1.34 Test Results, Forms: Asbestos Cement - Flat Sheets
1.35 -"- Asbestos Cement - Pipes
1.36 -"- Solid Clay Bricks
1.37 -"- Hollow Concrete Blocks
1.38 -"- Galvanized Plain Steel
1.39 -"- Portland Cement
1.40 -"- Corrugated Steel Sheets
1.41 Flow Chart of the Maintenance of Equipment
1.42 Specification of Accessories to be made in Workshop
1.43 List of Additional Equipment for Offices and BM Laboratory
1.44 Supplement to the Ethiopian Testing Standards
1.45 Proposal for Ordering the Equipment for Chemical Lab
1.46 Specification for Ordering the Plug-in Units for Oscillosc.
1.47 Proposal on the Adaptation of the Curing Rooms
1.48 Tables of Testing Programme for Electrical Products
1.49 Testing Equipment for Electrical Products Testing Lab
1.50 Additional Equipment and Room Adaptation of Electr.Lab
1.51 List and Drawings of Instruments to be made in Workshop
1.52 List of Electroinstallation Works
1.53 Technical Report from Ethioplastic
1.54 Testing Programme for ESI, Electrical Laboratory
1.55 New 3-phase Transformer for Battery Charger
1.56 Missing Parts in the Biochemical Laboratory
1.57 Chemicals for Microbiology Laboratory
1.58 Laboratory Sinks
1.59 Necessity of Laboratory Sinks
1.60 Technical Report on Edible Oils Factories
1.61 -"- on Soft Drinks Factories
1.62 Fermentation Technology and Sensory Analysis
1.63 Workshop on Fermentation Technology and Sensory Analysis
1.64 Tentative Schedule and List of Participants of the Workshop
1.65 Testing Programme for Food and Agricultural Products
1.66 Basic Solutions, Methods for Preparations
1.67 Technical Report on Distilleries and Liquor Factories
1.68 Technical Report on Meat Factories

1.69 Proposal on Microbiological and Enzymological Dpt.
1.70 Test Programme for Textile and Leather Lab
1.71 The Basic Tests in Textile and Leather Lab
1.72 List of Methodics for -"-
1.73 The Results of Factory Visits (11 Textile and Leather Fact.)
1.74 Operation Data Sheets
1.75 Basic Technical Data for Product Testing in T.L Lab
1.76 Specification of Missing Machines for Workshop
1.77 Specification of Parts and Tools to be bought on Local Mar.
1.78 Specification of Raw Materials on Local Market
1.79 Solution of Storage of Raw Materials
1.80 Solution of New Power and Gas Supply for Workshop
1.81 Technical Report from Metal and Tool Factory
1.82 Specification for Metallographic Lab
1.83 -"- Surface Finish Evaluation
1.84 -"- Metal Analysis
1.85 -"- Dark Room
1.86 -"- of Cutting Blades for Band Saw
1.87 -"- of Spare Grinding Wheels
1.88 -"- of Equipment for Tool Grinding
1.89 -"- -"- for Tinsmith Technologies
1.90 -"- -"- for Woodworking
1.91 -"- -"- for Measuring
1.92 -"- of Missing Cutting Tools
1.93 -"- of Raw Materials
1.94 -"- of Bolts and Nuts
1.95 -"- of Rivets, Nails and Woodscrews
1.96 -"- of Equipment in Designing Office
1.97 -"- -"- for Cutting off Rod Materials
1.98 The Organization and Job Description for the Staff
1.99 The Equipment for Biochemical Lab and Workshop (UNIDO)
1.100 The New List of Equipment for National Metrology Prog.
1.101 The Justification of Equipment for NMP
1.102 The Importance of Metrology with Regard to QC
1.103 The Suggestions for Ordering of Outstanding Equipment

2. List of Technical Drawings and Sketches

2.01 Adaptation of the Cement Testing Room
2.02 Adaptation of the Curing Rooms
2.03 Draft of Recovery of Technical Water for the Chemical and Building Laboratory
2.04 Draft of the Shed for Specimens to be Tested in Building Lab
2.05 Drawings of 34 Testing Instruments to be Manufactured
2.06 Electrical Installation Plan of Workshop
2.07 Drawings for 9 new Benches for Textile Lab
2.08 New Floor Plan of the Workshop
2.09 Rod and Sheet Raw Material Store
2.10 Base for Anvil
2.11 Stand for Lever Shears
2.12 Stand for Double Wheel Coarse Grinder
2.13 Stand for Cut-off Grinder with Adjustable Supporters
2.14 Modification of Benches in Chemical Lab
2.15 Pipe Lines for Cables and Compressed Air Supply
2.16 Storage System and Containers for Tools, Spare Parts etc.
2.17 Stand and Lid for Curing Tank
2.18 Accurate Steel Molds for Concrete Test Cubes
2.19 Stand for Barrels