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ENGINEERING DESIGN AND
TOOL ENTERPRISE

FINAL REPORT

UNIDO CONTRACT No. 90 203
PROJECT DP ETH 83 / 024

MAY 1994


HMT (INTERNATIONAL) LIMITED
BANGALORE, INDIA.

**ENGINEERING DESIGN AND
TOOL ENTERPRISE**

FINAL REPORT

UNIDO CONTRACT NO. 90/203

PROJECT: DP/ETII/83/024

MAY 1994

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HMT (INTERNATIONAL) LTD.
BANGALORE, INDIA

ENGINEERING DESIGN AND TOOL ENTERPRISE

UNIDO CONTRACT NO. 90/203

PROJECT: DP/ETH/83/024

FINAL REPORT

Prepared by
A. BHASKARAN
Team Leader

MAY 1994


HMT (INTERNATIONAL) LTD.
BANGALORE, INDIA

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ACKNOWLEDGEMENTS

We acknowledge sincerely the spontaneous and excellent co-operation, guidance and involvement of the present General Manager Ato Gashaw Gebeyehu, the past General Manager & NPC Ato Mergaye Azeze, the Manager Engineering Ato Yeheyes Assefa, Manager Administration Ato Mulugeta Mekonnen and all Divisional Heads while carrying out the expert services at EDTE from March '91 to April '94.

The sincere and earnest approach, commendable interest, willingness to grasp new ideas, diligence and spontaneous acceptance by the technical staff have tremendously helped in achieving the outputs and objectives of the project.

We also acknowledge the co-operation and guidance we received from Dr. Peter Manoranjan UCD, Addis Ababa and Miss Claudia Linke. They have always spared readily their valuable time when ever approached.

We have received guidance and encouragement from back stopping office at UNIDO, Vienna from time to time. This we gratefully acknowledge.

During the entire duration of experts services, we have received excellent co-operation from the secretaries and administrative staff for the preparation of various technical documents and progress reports. Their timely assistance and excellent work is acknowledged.

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1. THE PROJECT

Project : Engineering Design and Tool Enterprise
Number : DP/ETH/83/024/D/1/37
Duration : 4 years
Primary function : Institution building
Sector : Industry
Sub-Sector : Establishment of manufacturing Industries
**Governmental
Implementing
Agency** : Ministry of Industry, Govt. of Ethiopia
Executing Agency : U N D P
Starting date : April '87
Govt. input : Birr 16,246,439
UNDP input : US \$ 6,437,705

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2. INTRODUCTION

2.1 EDTE (Engineering Design and Tool Enterprise) has been established at Addis Ababa by the Government of Ethiopia, Ministry of Industries with UNDP assistance.

The Project DP/ETH/83/024 has the following main objectives:

1. To develop national capability and facility in the areas of Equipment design and prototype making, Tool design and Tool manufacturing.
2. To develop capability and infrastructure for training of engineers and technicians of EDTE and enterprises from both private and government sectors in the country in all the fields mentioned above.

2.2 HMT (International) Limited, Bangalore, India was awarded a contract to provide 115 man-months of technical services through deputation of experts in the areas of Engineering design, Prototype workshop, Tool design, Tool manufacturing and Training and, in addition, 18 man-months of back stopping service from Home Office in Bangalore.

2.3 *This Report gives a comprehensive account of:*

- i. *Activities carried out by long and short-term experts to fulfill the objectives of the Project.*
- ii. *The achievements vis-a-vis the objectives of the Project.*
- iii. *A comprehensive programme for the phased development of the Enterprise.*

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3. MINUTES OF MEETING DATED 15.4.94 regarding completion of HMT(I) Experts Field Services at EDTE.

Ref: Project DP/ETH/83/024

Contract No.90/203 and Amendment No.1

Present: 1. General Manager, EDTE, Ato Gashaw Gebeyehu
2. HMT(I) Team Leader, Mr.A.Bhaskaran

Following points are agreed:

1. HMT(I) has deputed Experts as per enclosed Annexure (Assignment of Experts) and has satisfactorily completed 114 man-months of experts field services as shown in the annexure. (Refer Chapter No.13)
2. The date for deputation of Dy.Team Leader for review has to be mutually agreed between UNIDO, EDTE and HMT(I).
3. The experts deputed to the field have accomplished their task as stipulated in the contract to the entire satisfaction of EDTE management.
4. The home office back stopping service was helpful for the smooth execution of the field mission & has also supplied useful technical documents.
5. EDTE is satisfied that all the outputs as per the project documents are well established and also started delivering results.
6. HMT(I) back stopping office and the field experts have provided all the necessary technical documents, procedures and systems for the smooth continued good performance of the enterprise.
7. HMT(I) Team Leader has already submitted 5 copies each of Final Report (Draft Copy) for the perusal of General Manager, EDTE and the back stopping office of UNIDO in Vienna.
8. HMT(I) will submit its final report after the approval of draft report by EDTE & UNIDO.
9. Since all outputs are functioning satisfactorily HMT(I) requests EDTE to agree for the deputation of the Expert for review at the earliest.

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10. HMT(I) is honoured to put on record the excellent co-operation received from the EDTE management, the UCD at Addis Ababa and the back stopping office at UNIDO, Vienna, while carrying-out their contracted task.
11. The EDTE has affirmed that the evaluation mission of the Dy.Team Leader, Mr.V.L. Paramasivam shall be effected after 3 months. This is felt appropriate considering the existing situation and the previous understandings during the in-depth evaluation mission.

The mission shall begin in the month of July 1994.

Sd/-
General Manager
EDTE

Sd/-
Team Leader
HMT(I)

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4. REPORTS SUBMITTED BY HMT(I) EXPERTS' TEAM LEADER

SR.NO.	DESCRIPTION	NO.OF REPORTS	SUBMITTED TO
1.	Bi-monthly progress reports	16	EDTE, UNIDO & HMT (I)
2.	Interim reports	4	-do-
3.	Draft Final report	1	-do-
4.	Final report	1	-do-
5.	Terminal reports by:		
	- Senior Machine Shop Expert	1	EDTE/HMT (I)
	- Tool Design Expert	1	-d -
	- Tool Shop Expert	1	-do-

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5. TECHNICAL DOCUMENTS PROVIDED BY BACK STOPPING OFFICE AND PREPARED BY FIELD EXPERTS

Ser.No.	Description	No.of copies
1.	Theoretical Training Manuals	
1.1	Tool Maker - Jigs, Fixtures and Gauges	4
1.2	Tool Design Draftsperson - Advanced Tool Design Principles	4
1.3	Dies and Moulds - Fundamental design concepts	4
1.4	Dies and Moulds - Advanced design elements of dies and moulds and related toolings	4
1.5	Prototype manufacture - Volume - I	4
1.6	Prototype manufacture - Volume - II	4
1.7	Machine Design	4
2.	Practical Training Manuals	
2.1	Tool Design Draftspersons	4
2.2	Tool Maker - Jigs, fixtures and Gauges	4
2.3	Dies and Moulds I	4
2.4	Dies and Moulds II	4
2.5	Die Casting Dies and Moulds	1
2.6	Inspection & Quality Control	1
2.7	Assembly fitting	1
2.8	Industrial Hydraulics	1
3.	Procedural Manuals	
3.1	Equipment/Product design	1
3.2	Equipment Manufacture	1
3.3	Tool Design	1
3.4	Tool Project	1
3.5	Tool Manufacture	1
3.6	Training	1
4.	Quality Manuals	4
5.	Time and cost estimation manual	1
6.	HMT Standards, 44 Volumes	1 set

6. ACHIEVEMENT OF OBJECTIVES

6.1 PROJECT OUTPUTS

SR.NO.	DESCRIPTION OF OUTPUT	STATUS
1.	Engineering design unit	Established
2.	Prototype workshop	Established
3.	Training Unit for Engineering Design and Prototype Making	Established
4.	Tool Design Unit	Established
5.	Tool Shop	Established
6.	Training Unit for Tool Design and Tool Making	Established

6.1.1 Engineering Design Unit

A well equipped Engineering Design Division, with a Division Head, 6 Senior Design Engineers (all qualified Mechanical Engineers) and 3 Draftspersons with modern drafting facilities, large collection of reference books and standards (supplied by the sub-contractor) is established.

6 prototype designs are completed.

6.1.2 Prototype Workshop

The prototype workshop with a good Machine shop, Fabrication shop and Heat Treatment shop is established. The following staff viz., Workshop Head, Job Planner, Supervisor, Six mechanics and 3 other staff are trained to do their respective work satisfactorily. Complete production planning, monitoring, quality control and maintenance systems are introduced.

5 prototypes manufactured.

6.1.3 Training Unit for Engineering Design and Prototype making

Training expert conducted a study of the training needs of EDTE staff and that of local industries and identified training courses. The staff of the Engineering Design and Prototype Workshop trained on 'pedagogy' (Art of teaching) and preparation of training material. There is a common training co-ordinator. Facilities like well furnished class-rooms, conference hall, audio-visual (OHP, slide projector, video system etc.) of latest version is made available. For on-the-job training, facilities available in Design Office and Workshop will be used. With this, a good training unit is complete.

6.1.4 Tool Design Unit

A well equipped Tool Design Unit with a Division Head (now the General Manager), 5 Tool Design Engineers (3 of them specially trained in Tool Design in India), 3 Draftspersons with modern drafting facilities, a number of reference books and reference standards (prepared by the Design expert) is established. The gist of work done is:

- 66 Component drawings made (Products).
- 35 Tool designs made.
- 14 Tools manufactured and successfully tried.

6.1.5 Tool Shop

A Tool shop equipped with state of the art machinery, Heat treatment facilities, metrology is fully established. A Shop Head, Job Planner, Supervisor, 2 Tool Makers, 7 Machinists and 5 other staff are well trained to do their job. Production planning, scheduling and control, quality control and maintenance system established. Work carried out are:

- 11 Tools manufactured and successfully tried and working satisfactorily at client's works.
- 3 Tools reconditioned and working satisfactorily.

6.1.6 Training Unit for Tool Design and Tool Making

The Training expert conducted the programme "Training of Trainers". The staff of Tool Design and Tool Shop were trained on pedagogy and preparations of training material and training aids. There is an excellent common training facility.

The services of the trained staff of Tool Design and Tool Shop utilizing the facilities of Design Office and Tool Shop completes an excellent training unit for Tool Design and Tool Shop.

6.2. DEVELOPMENT OBJECTIVES

- 6.2.1 The national capability for designing and manufacturing of Equipments and Tools are achieved through on-the-job training, discussions and guidance at different stages of design and manufacture.
- 6.2.2 6 equipments and 35 tools have been designed. The Design Engineers have followed-up their design through manufacturing and testing in addition to understanding the fundamental design concepts and practical aspects of manufacturing and assembly during the design stage itself. The Design Engineers and Draftspersons have actively involved with the Experts while preparing the technical documents in their respective areas. Cross-functional job enrichment training also was imparted to all the staff. While preparing the training material after undergoing 'Pedagogy' training, the fundamental concepts are reestablished in their minds.
- 6.2.3 In the manufacturing side, 5 prototypes are manufactured, 4 of them assembled, 2 fully tested and ready for commercialization and one is under assembly. On the tool side, 14 tools are manufactured, tested and working satisfactorily at the customers works. In both prototype and Tool shops, the complete systems and procedures are established for economic production starting from receipt of manufacturing drawings to final trial and despatch/commercialization. "FOREIGN EXCHANGE SAVED IS FOREIGN EXCHANGE EARNED", if true, EDTE has already made an impact on foreign exchange savings to the country to an extent of 1 million birr and another 1 million birr worth orders are expected. This does not include the savings on account of production taken from these Tools and Equipments.
- 6.2.4 Thus an industrial sub-sector capable of designing and manufacturing machinery, equipments and tools is well established and on course of further development.

6.3 IMMEDIATE OBJECTIVES

6.3.1 The development of national capability for design and manufacture of equipments and tools, training of Engineers and Technicians.

i) Training of EDTE Staff:

Ser. No.	Description	Design Engr.	Prod. Engr.	Drafts person	Tech-nician	Total
1.	Engineering design	7	-	3	-	10
2.	Tool design	5	-	3	-	8
3.	Prototype workshop	-	3	-	6	9
4.	Tool shop	-	2	-	12	14
5.	Training Unit	-	1*	-	-	1
T O T A L		12	6	6	18	42

* Training Co-ordinator

36 Engineers and Technicians have undergone "Training of Trainers" (Pedagogy) programme. Training material on various subjects were also prepared by them.

Though only 2 Technicians (Grinders) from outside industries are so far trained in EDTE, the staff have matured into good trainers and can now confidently take-up training of Engineers and Technicians in the design and manufacture of equipments and tools.

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ii) Work experience:

Ser. No.	Shop/Item	No. of Items		
		Designed	Manufactured	Tested
1.	Prototype Workshop/ Equipments	6	5	2
2.	Tool Shop/Tools	35	14	14
TOTAL		41	19	16

In addition to the above equipments manufactured in the prototype workshop, the workshop has also manufactured components against specific customer orders, and taken-up manufacture of parts of the tools to assist the Tool Shop to meet their delivery schedules.

The tools manufactured and despatched by the Tool Shop include single and multi-cavity injection moulds, press tools and reconditioned tools.

In addition to 35 tools designed, 31 product drawings are also developed by Tool Design Division.

7. TRAINING ABROAD

7.1 FELLOWSHIP PROGRAMME

A total of 18 trainees went to New Zealand to get training in Design Engineering and Workshop Technology. 12 of these trained persons are in service of EDTE at present.

3 of these trainees also had specialized training in CITD in India.

7.2 STUDY TOURS

Manager and NPC had 2 study tours to New Zealand, India, Korea, China, etc. and paid visits to Machine Design Centres, Institutions, Factories, Government Offices, etc. to establish contacts and exchange views.

A team comprising of Manager Engineering, Tool Shop Head & Training Co-ordinator visited Trinidad and Tobago (5 weeks) to study the training programmes conducted by institutions similar to EDTE.

7.3 CAD/CAM WORKSHOP IN CZECHOSLOVAKIA

4 Engineers participated in the above programme sponsored by UNIDO.

7.4 POST GRADUATE STUDIES IN TOOL DESIGN

4 Engineers completed their post-graduate studies in CITD in India.

The above training, study tours and education has tremendously helped in achievement of objectives and outputs.

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8. OBJECTIVES OF THE PROJECT

8.1 DEVELOPMENT OBJECTIVES

The development objective of the project is mainly towards the establishment of an industrial sub-sector capable of designing and manufacturing of machinery, equipment, tools and other material inputs for supply to various sectors of the national economy and International market, creating a favourable impact on export earning.

8.2 IMMEDIATE OBJECTIVES

The immediate objectives of the project are:

- i) The establishment of the Engineering Design Centre (EDC) in order to develop designs and prototypes of machinery and equipment more suited to existing industries particularly for the gradual mechanization of agriculture and construction activities.
- ii) Development of national capability in the field of engineering and design of machinery and equipment through the training of national staff.
- iii) Development of designs for machinery and equipment which could be manufactured in the country and provide assistance to industries in manufacturing and product design.
- iv) Making prototypes of machinery and equipment and subsequently, preparation of domestic manufacturing, on commercial basis.
- v) Establishment of Tool Centre (TC) comprising of tool design and tool shop to assist existing and new factories in their efforts to achieve product diversification, better quality of product manufactured and more efficiency in the production process.
- vi) The development of capability in designing and producing on a regular and continuing basis the required tools, dies, jigs and fixtures and moulds of different kinds and for use in various industrial branches.
- vii) The training of national staff capable of designing and to produce required tools and dies, jigs & fixtures and moulds as well as the ability to train the personnel in industry so as to enable industry to carry-out progressively routine tasks.

**9. STATUS OF THE PROJECT AT THE TIME (MARCH 91)
HMT(I) STARTED THE FIELD SERVICES**

- 9.1 Building construction was almost complete but still not ready for erection of machines or occupation of offices. The project office was functioning at Addis Ababa while the Engineering Design and Tool Design activities were done at ASPF, Akaki, 20 km from Addis Ababa.
- 9.2 The machines and equipments received were lying in containers near the site but raw materials were lost in transit.
- 9.3 The project office had recruited all the key personnel for design workshop and management services.
- 9.4 The engineers and technicians trained in New Zealand and the two engineers trained in India had returned.
- 9.5 Based on list of feasible products for development identified by BWI-NZ, the EDTE design staff have conducted survey and identified few products and had started design activities.

10. ACTIVITIES CARRIED OUT BY LONG TERM AND SHORT TERM EXPERTS

10.1 DESIGN EXPERT AND TEAM LEADER

10.1.1 Period of deputation

27 man-months (March 91 to August 93. The period of absence of expert from field excluded).

10.1.2 Main tasks

- Continuous training of counterpart.
- In-house training of the Engineering Design Division staff and on-the-job training of design engineers from Industry.
- Preparation of Design Procedures and Activity Flow Diagrams and code of practices to be followed in EDC.
- Preparation of work programmes for the development of engineering design in EDC, in consultation with the Division Head and management.
- Carry-out continuous assessment of the staff and facilities of the Division and recommend appropriate measures to be taken in order to ensure its growth and development towards achieving self-sufficiency.
- Advise the EDTE Manager and National Project Director on general technical management and development and growth of EDTE.
- As the Team Leader of the Sub-Contractor, liaise between the other Sub-Contractor's Engineers and the EDTE staff - and thereby ensure smooth and well co-ordinated efforts.

10.1.3 Activities carried out

i) Continuous training of counterparts

- Assisted in preparation of job specifications, tests, interviews and selection of Design Engineers and Draftspersons.

- Designed guidelines for the preparation of layouts. Design Head, Design Engineers & Draftspersons were apprised of the same. All design layouts were redrawn as per the new procedure. Different alternatives of design, their merits and demerits were discussed at each stage of design and Designers were guided in respect of:
 - a) Producibility of components
 - b) Economy
 - c) Maintainability
 - d) Lubrication
 - e) Ease of assembly
 - f) Use of standard components
 - g) Adopting international standards etc.
- Guidance given regarding the achievable accuracies in different machining process.
- Proposed and formed design review committee, formulated design review procedures, and assisted Design Head in effectively conducting design reviews.
- Reverse engineering concepts explained, assisted Design Engineers to reverse engineer the equipment like 'bar cutter' and 'pallet truck'.

ii) **Technical Documents prepared and submitted**

- Procedure for development of new product
- Activity flow chart for development of a product
- Design office procedures and systems
- General design concepts in engineering design
- Formats for recording design activity
- Design reference sheets
- Design standards (44 volumes)
- Procedure for design review
- Drafting procedure
- Draft procedural manual for design of equipment, manufacture and testing of prototypes

iii) On the job training

The following Engineers & Draftspersons were given on-the-job training in designing and drafting.

Messrs:	
1. Yonas H/mariam	Div. Head
2. * Dr. Tamrat Tesfaye	Sr. Design Engineer
3. Abiy Abebe	"
4. * Hirpa Lemu	"
5. Dejene Zewdie	"
6. Daniel Zenebe	Design Engineer
7. Woudu Yedemie	"
8. Muzemil Mohammed	Draftsperson
9. * Getachew Sisay	"
10. Michael Moges	"

(* Since left the Organisation)

- On-the-job training was given while designing the following equipments:

1. Sheet bending roller
2. Oil expeller
3. Multi-crop thresher
4. Bar cutter
5. Centre lathe
6. Pallet truck

iv) Support programme

- From the beginning, participated in all staff meetings, assisted in formulating procedures for purchase of material, receipt, handling, storing and issue including inventory systems.
- Assisted the engineers in conducting the market study for identification of products for development at EDTE.
- Functions and responsibilities of various disciplines/ levels were drawn-out for EDTE reference.
- During the absence of Workshop Head/Workshop Expert, assisted the Design Head and Workshop personnel in carrying-out the work.
- Assisted the Design Head/Design Engineers in the preparation of subject outline for Engineering Design Training courses.
- 59 nos. of trade catalogues on various machine elements such as anti-friction bearings, power transmission belts, hydraulic cylinders and seals, electrical motors etc. given to Design Head for reference and use.

- Number of catalogues on agricultural machinery and equipments taken from India handed over to Design Head.
- Assisted to prepare and apply for the development grants from Science and Technology Commission and secured grants for three products.

v) **Co-ordination**

- Facilitated other experts to carry-out their work as per their job specifications and requirement of EDTE.
- All necessary services required from back-stopping-office was arranged in time.
- UNIDO & EDTE were provided complete information about progress, development and proposals through bi-monthly and interim reports of progress.
- Actively participated in the inaugural function of EDTE by delivering a talk and contributing papers and assisting in organizing related activities.

10.1.4 **Achievements of Objectives (EDC Design)**

- The development objectives and immediate objectives as envisaged in the project is fully met, mainly the following:
 - a) A well equipped Design office (Design unit) with reference books, standards, catalogues on all aspects of engineering design, manufacture and testing is established.
 - b) Methods and procedures are established starting from market survey to preparation of product profile, manufacture, testing and commercial production.
 - c) By training one Design Head, 6 Design Engineers and 3 Draftspersons who could complete 6 Design Projects and manufacture 5 out of them, the envisaged national capability for engineering design is created.

10.2 SENIOR MACHINE SHOP EXPERT

10.2.1 Period of deputation

22 man-months (From 15.8.91 to 1.4.94. The period of absence of the expert from field excluded).

10.2.2 Main Tasks

- Continuous training of counterpart.
- In-house training of the prototype workshop staff and assistance in training engineers and technicians from industry.
- Preparation of procedures for proper job planning, and efficient operation of the workshop; from receiving of customer's order upto completion of the final developed prototype ready for manufacturing.
- Preparation of work programmes for the operation and maintenance of prototype workshop, in consultation with concerned Division Heads and other experts.
- Carry out continuous assessment of the staff and facilities of the workshop and recommend appropriate measures to be taken to ensure the delivery of outputs as per the project document.
- Liaise with other Specialists and Division Heads on matters of mutual concern.

10.2.3 Activities carried out

Continuous training of the following counterparts:

i) Workshop Head

- Continuous guidance extended in day-to-day work. Adequate knowledge was imparted in areas of Production Technology, Heat Treatment, Process Planning, Production Planning, Monitoring Production Control, Pattern Making (Expendable Patterns) and Exposure to Foundry, Quality Management, Maintenance Systems, Good House Keeping, Productivity Improvement, Facility Planning, Batch Production and Testing of equipments. The Workshop Head can now independently manage the work.

ii) Job Planner

On-the-job training given in areas of General Planning, Production Planning, Process Planning, Material Planning, Time and Cost Estimation, preparation of manufacturing documents, co-ordination and review of manufacturing activities.

iii) Workshop Staff

Continuous guidance given for proper operation and maintenance of machines, appropriate job set-ups, selection of speed, feed, tools etc., Good house keeping, productivity improvement technique, heat treatment, process planning and aspects of quality control.

10.2.4 Procedures and Systems

A detailed procedural manual covering all activities starting from receipt of design documents to testing of prototypes have been prepared along with Workshop Head. Procedural manual for equipment manufacture includes:

- Material planning, indenting and issue
- Production planning, scheduling and control
- Maintenance of machines and equipment
- Quality control, etc.

10.2.5 Quality Assurance System

The quality control system introduced covers:

- Check lists for components and assembly
- Stage and final inspection of components
- Group and final assembly inspection
- Testing of prototypes
- Management of non-conformity

10.2.6 Costing System

Time and cost estimation manual introduced which includes standard hour and machine hour rate system, which in turn help estimation of standard cost. Booking of job-cards enabling calculation of actual cost.

10.2.7 Design review

Attended several design review meetings. Suggested several improvements; one suggestion was to manufacture 'Bar cutter' reducing the machining time by 40% to reduce the cost, to suit market requirements/make it competitive.

10.2.8 Other important activities

i) Organisation Chart

The Organisation Chart indicating all important functions and persons responsible.

ii) Seminars

On productivity improvement technique.

iii) Workshop

On waste elimination.

iv) Lectures

- On Heat Treatment
- On innovation and creativity in training, training of trainers
- Production planning

v) Training Manuals

- Inspection and quality control
- Assembly fitting
- Hydraulics
- Spark testing of steels

vi) Technical literatures/articles

- Grinding wheel selections
- Painting procedures
- Expendable patterns for single piece

vii) Manuals

- Quality manual
- Time and cost estimation manual
- Procedure manual for equipment manufacture

10.2.9 Achievements of Objectives

Prototype Workshop

- Prototype workshop is established with all machinery installed and working.
- The procedures for planning, manufacturing, maintenance are well established.
- The shop head, job planner; supervisor and operators are trained and confident to manage their work independently and effectively.
- The staff is also trained as trainers and can train engineers and technicians from outside industries.
- They can help transfer of technology for commercial production.
- Already 5 prototypes have been successfully built.

10.3. TOOL DESIGN EXPERT

10.3.1 Period of Deputation

33 man-months

(32 man-months of field mission and 1 man-month for review from 16th March 1991 to 14th April 1994 excluding the period of absence of the expert from the field.)

10.3.2 Main Tasks

- Continuous training of counterpart.
- In-house training of tool centre staff and assist in training of engineers from industry.
- Preparation of design procedures and activity flow diagrams and code of practice to be followed in Tool Centre
- Preparation of work programme for tool design in consultation with concerned Division Heads and other experts
- Carry out continuous assessment of the staff and facilities of the tool design office and recommend for appropriate measures to be taken to ensure the delivery of outputs as per the project document.
- Liaise with other Specialists and Division Heads on matters of mutual concern.

10.3.3 Activities carried out

i) Continuous training of counterparts

Continuous on-the-job training imparted to Division Head, Tool Design Engineers and Draftspersons, while

- Preparing product drawings for 66 components.
- Developing preliminary design concepts for 35 project orders received from clients.
- Conducting design reviews for 35 projects.
- Designing and preparing final part and assembly drawings for 25 projects.

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- Final checking and releasing for manufacture of 25 tooling projects.
- Manufacturing and successful trial of 14 projects (moulds, press tools, etc.)
- Conducting product identification survey in and around Addis Ababa and identifying 37 products which can be developed, produced and marketed by EDTE.
- Industrial visits to familiarise shop floor practices, machinery specifications and control systems.

ii) **Technical Documents**

- Tool design procedural manual

The Tool Design procedural manual exhaustively covers all activities starting from accepting the order to the release of drawing for manufacture viz.

- * Numbering system
- * Tolerance system
- * Drafting procedure
- * General rules for designing a mould
- * Mould design check list
- * Technical data sheets for press tools, moulds, die casting dies, blow moulds, etc.
- * Design review procedures and check lists for design review
- * Procedure for design alterations
- * Activity flow chart

- Procedure manual for Tooling project order, covering all operations starting from contracting an order through designing, manufacturing, try-out and hand over of the tools to the clients.

- Design reference standards

Press Tools	47 Nos.
Moulds	73 Nos.
General Engineering	60 Nos.

- Recommendation of materials for moulds, press tools, etc.

10.3.4 Support Programme

- Recommended suitable technical books for reference
- Selection of Design Engineers and Workshop Staff
- Requirement of materials
- Additional facilities, accessories, instruments for shop
- TOR for technical committee
- Prepared a guide book "Thermo-plastic, mould design, drafting, check list"
- Material selection guide for thermo-plastic materials
- Assisted HMT(I) back stopping office to prepare training manuals on:
 - * Moulds
 - * Press Tools
 - * Die casting Dies
 - * Jigs & fixtures
- Guided Design Engineers for preparing training material on moulds, press tools, jigs & fixtures, engineering drawing, etc.
- Guidance given for preparing proposal for a Tool Test facility at EDTE

10.3.5 Achievement of Objectives

The development objectives and immediate objectives as envisaged in the project is not only met but surpassed also. A brief summary is as follows:

- i) A well equipped tool design office, with number of reference books, standards and catalogues on all aspects of tool design, manufacture, testing, material used etc. is established. This includes materials prepared by expert and provided by HMT(I).
- ii) Systems and procedures are well established. Procedural manuals prepared by expert cover all operations starting from contracting an order to trials and hand over to customer.
- iii) Specialist Tool Design Engineers, trained abroad and by the experts can handle any tool design requirement. They have also received exposure to outside industries.

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- iv) The Design Engineers have attended 'Pedagogy' training, prepared training material for training Engineers & Draftspersons, under guidance of Tool Design and Training experts and are ready to train personnel from other industries.
- v) The Tool Design Engineers have been deployed to marketing due to their all round training in tool design preparation of estimates and participation in manufacturing and trials.
- vi) In all 66 product drawings are developed, 35 tool project files completed and 25 tool design documents released for manufacture at EDTE and 6 tools will be manufactured by clients. 14 tools completed and tried out. The Tool Centre has thus already contributed in a big way for diversification of user industries, foreign exchange savings and above all providing quality products to the consumers.

The foreign exchange savings have already exceeded 1 million without considering output from the tools.

10.3.6 RECOMMENDATIONS

Further recommendations to EDTE are as follows:

- i) Implement CAD facility.
- ii) Strengthen workshop equipment, metrology and production manpower.
- iii) Implement tool test facility and start production of own products.
- iv) Use the capability already developed for training of Engineers, Technicians and Tool Makers.
- v) Establish a reasonable captive training facility to avoid overloaded tool shop facilities.

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10.4 TOOL SHOP EXPERT

10.4.1 Period of Deputation

25 man-months (Aug.91 to March 94). The period of absence of the expert from the field excluded).

10.4.2 Main Tasks

- Continuous training of counterpart.
- In-house training of the tool shop staff and assist in training of engineers and technicians from industry.
- Preparation of procedures for proper job planning and efficient operation of the tool shop from receiving the customer order up to completion of the tool and delivery to customer.
- Preparation of work programme for the operation and maintenance of the tool shop in consultation with the Division Head.
- Carry-out continuous assessment of the staff and facilities of the tool shop and recommend for appropriate measures to be taken to ensure the delivery of outputs as per the project document.
- Liaise with other specialists and Division Heads on matters of mutual concern.

10.4.3 Activities carried out by the Expert

Continuous training of the counter-parts viz:

i) Shop Head

- Erection, commissioning and trials of machinery and equipments
- Daily, weekly and periodic maintenance of tool shop machines and equipments
- Good house keeping
- On-the-job training in manufacturing process, heat treatment, assembly and trials of press tools, moulds, etc.
- Hands on experience in production planning, monitoring and control
- Material planning and selection of raw materials and bought-outs
- Process planning, time estimation, job booking and performance assessment
- Design of electrodes for EDM, templates for copy turning
- Quality control

ii) Job Planner

- Production planning, scheduling and monitoring
- Process planning of tool components, assembly, time and cost estimation
- Job-time booking and assessment of actual performance and cost
- Machine scheduling
- Design of special electrodes, templates, etc.

iii) Tool Shop Staff

- The machinists were given continuous guidance in machine operation, tool selection, job setting, measurement, selection of proper cutting speed and feed, right sequence of operation, proper finishing allowances, etc.
- Tool makers were given guidance in planning and manufacturing of precision tool components, design of templates, electrodes, assembling, checking and trial of tools like moulds, press tool, etc.
- Heat treatment operator given training in all operations like stress relieving, hardening, tempering, case hardening, stabilizing, etc. with emphasis on defect prevention.
- Metrologist given guidance for inspection methods, systems and procedures for stage and final inspection of components and assemblies, performance tests, etc.

iv) Procedure manual for Tool Shop

The procedure manual gives details of system (formats) for:

- Quality control
- Efficient and cost effective system for manufacturing operations and management of workshop
- Performance evaluation
- Maintenance of machinery & equipments, etc.

10.4.4 Support Programme

- Visited potential clients
- Assisted marketing in product identification, preparation of estimates and quotations

- Conducted classes for the programme:
Training of Trainers,
Tool assembly, testing and trial,
Quality control, handling of process errors and
Customer service

10.4.5 Continuous assessment of Tool Shop staff and facilities

- i) Recommendations given from time to time for procurement of machines and equipment for balancing the capacity, improving efficiency, etc.
- ii) Recruitment and training of staff based on estimated load.

10.4.6 Achievement of Objectives

- A tool shop equipped with state-of-art technology like CNC machines, EDM, programmable heat treatment furnace, latest equipment for tool making etc. are fully operational.
- The systems, procedures and formats for operation and management of tool shop are written down and practiced.
- Tool Shop Head, Job Planner, 7 Machinists, 2 Tool Makers and one Heat Treatment Specialist are fully trained while manufacturing, trial and despatch of 14 tools (moulds single and multi-cavity, press tools and reconditioning of tools).
- The quality of these tools are well accepted by the clients and have helped them to diversify their production.
- Orders worth more than a million birr is pending which were hitherto imported. Thus the enterprise has already made a substantial impact on foreign exchange savings.

10.5 TRAINING EXPERT

10.5.1 Period of deputation

8 months in 4 missions of about 2 months each as follows:

Mission	From	To	Months	Days
I Mission	11.06.92	20.08.92	2	10
II Mission	14.01.93	13.03.93	2	00
III Mission	23.10.93	22.12.93	2	00
IV Mission	26.02.94	27.04.94	2	02
T O T A L			8	12

10.5.2 Main tasks

- Assess the training needs of the engineers and technicians of EDTE in consultation with the respective Sub-Contractors, Specialists and Division Heads and Management of EDTE and develop training programme for in-house on-the-job training as well as specialized training locally or abroad.
- Assess training needs of metal working industry in the public and private sectors vis-a-vis the training possibilities in EDTE, and develop a proposal for on-the-job training programme, short courses, seminars, workshops and conferences that would facilitate the promotion of immediate and development objectives of the project.
- Review the existing plans and facilities provided for training and recommend appropriate measures to be taken by the UNDP and government in order to achieve the project objectives.
- Liaise with others, long-term experts and Division Heads on matters of mutual concern.

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10.5.3 Activities carried out

i) Continuous training of counterpart

The training co-ordinator who is the counter-part has been trained for:

- Assessing training needs through survey, (interviews and questionnaires) for EDTE and outside industries.
- Organizing training sessions, seminars and conference by himself organizing such programmes.
- To plan and prepare training material through specialist.
- Training of trainers, first by undergoing pedagogy training and subsequently taking pedagogy classes.
- Identifying and developing internal faculty for training activity.
- Preparation of brochures, literature, etc. in connection with conducting training programmes for external agencies.

ii) Assessment of training needs of EDTE staff

After detailed discussion with field experts, division heads and supervisors, the training needs of EDTE staff have been identified and submitted in II field mission report (Jan- March 93) of Training Expert.

iii) Assessment of training needs of local, public and private sector industries

By circulating questionnaire to local industries the training requirement of engineers, technicians in various fields of industries identified which was submitted in the I field mission report (June to Aug.92)

iv) Proposals for on-the-job training in EDTE

During the II field mission after detailed deliberations in a meeting chaired by GM and attended by Division Heads and experts, the following courses were identified:

- On-the-job training - 6 courses
- Seminars, workshops - 13 topics

These recommendations have been included in the II mission report.

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v) Procedures and guidelines for preparation and execution of training programmes

Guidelines for preparation of procedure manual for the above prepared and given during III mission (Oct-Dec 93).

vi) Training in pedagogy

4 batches totalling 36 engineers and technicians were given training in Pedagogy (Science of training and preparation of training materials) during III and IV field missions.

vii) Job enrichment training

4 batches of job enrichment training programme conducted during the III mission.

viii) Supervisory Development Programmes

As EDTE felt the need to provide necessary management inputs, special programme was organized. 19 of its personnel were covered under this scheme.

ix) Guest lectures

Organized a guest lecture in "communication in training".

x) Proposal for Training Centre

A detailed technical proposal for establishing an advanced training centre with facility for training in tool making and other areas for providing hands-on-practical training and state-of-art technology was worked-out by the expert from Home Office between the II and III missions.

xi) Procedural manual prepared during IV mission.

10.5.4 Achievement of Objectives

i) Facility for Training

Well furnished conference hall and class-rooms with state-of-art training aids with a trained training co-ordinator is established. Library facility with a number of technical books, magazines and reference hand books makes the training facility complete.

ii) Training Unit for Engineering Design and Prototype Making

Design Division with all facilities for designing and drafting including technical books for reference is established. Similarly, the prototype workshop is well established. The staff of both EDC design and prototype workshop are trained in pedagogy and preparation of training materials. Though they have not taken-up training of engineers and technicians in the areas of engineering design and prototype manufacturing, EDC Division is fully ready and matured to undertake the task.

iii) Training Unit for Tool Design and Tool Making

Fully equipped with state-of-art machines and equipments for tool making and with tool designers qualified from Ethiopia and India and trained on-the-job at EDTE, the Tool Centre is fully geared up to train Tool Design Engineers, Draftspersons and Tool makers. All the staff are exposed to Pedagogy Training and preparations of training materials.

10.5.5 Recommendations for future developments

i) Captive Training Centre: Being an enterprise, the organisation is committed to self-sustaining. So the facility and capability, though available for training, they are most likely to be used for more remunerative production and supply of tools. Hence to establish a captive training centre, attached to EDTE, in line with the technical proposal submitted after the second field mission, will be essential for the skill development of the technical graduates from educational institutions.

ii) HRD Centre: The development of designs and batch/mass production needs tremendous entrepreneurship. All round training and development of individuals in addition to technical capability is essential. HRD Centre with one or two specialists and working in association with professional institutions and university is suggested. The topics to be covered should be:

- Industrial acts
- Financial institutions and sources of funds
- Feasibility analysis of projects
- Marketing (internal and export) etc. to name a few topics

An information centre also is to be attached to HRD. UNDP/Govt. assistance can be sought.

iii) The above proposals are in addition to the various short-term courses, seminars, workshops, etc. and long-term skill development programmes like tool making, tool design, engineering design and manufacturing, etc. proposed by the expert.

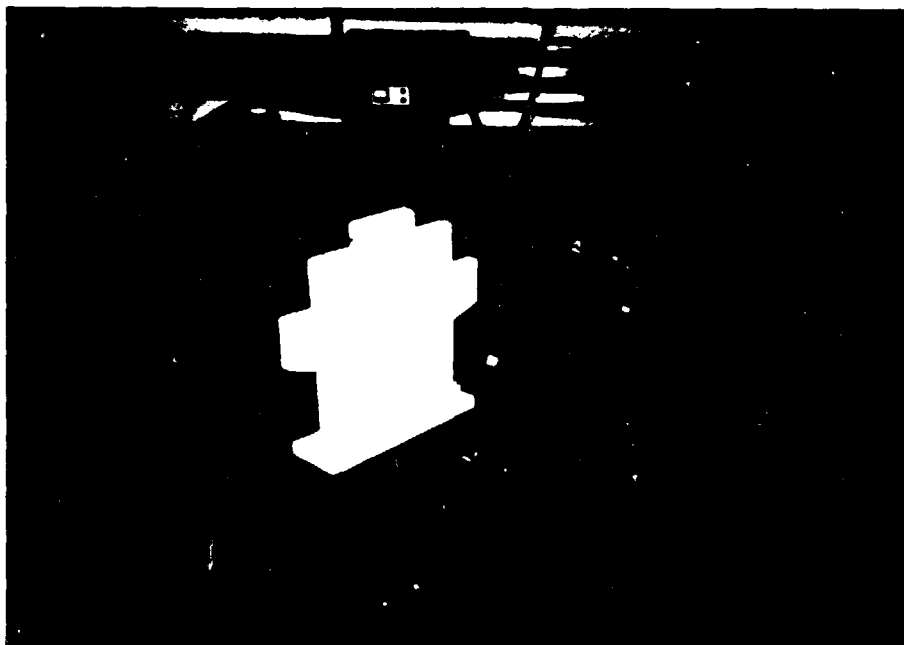
10.6 LOW COST EXPENDABLE PATTERNS FOR SINGLE PIECE CASTINGS

The method of making wooden or metallic patterns for castings, required generally in one number for the prototypes is highly expensive and time taking.

To offset this constraint, a very inexpensive method was tried for the first time in EDTE and even in Ethiopia.

The pattern which is a full replica of the casting with proper shrinkage allowance is fabricated from thermocole packing material cut to shape and size and finally assembled with glue. This is just kept in mould box and quick setting mould sand. When molten metal is poured, it replaces the pattern, which itself is evaporated. The complete process including the materials specification is written and given to EDTE.

Picture shows the pattern and the casting.



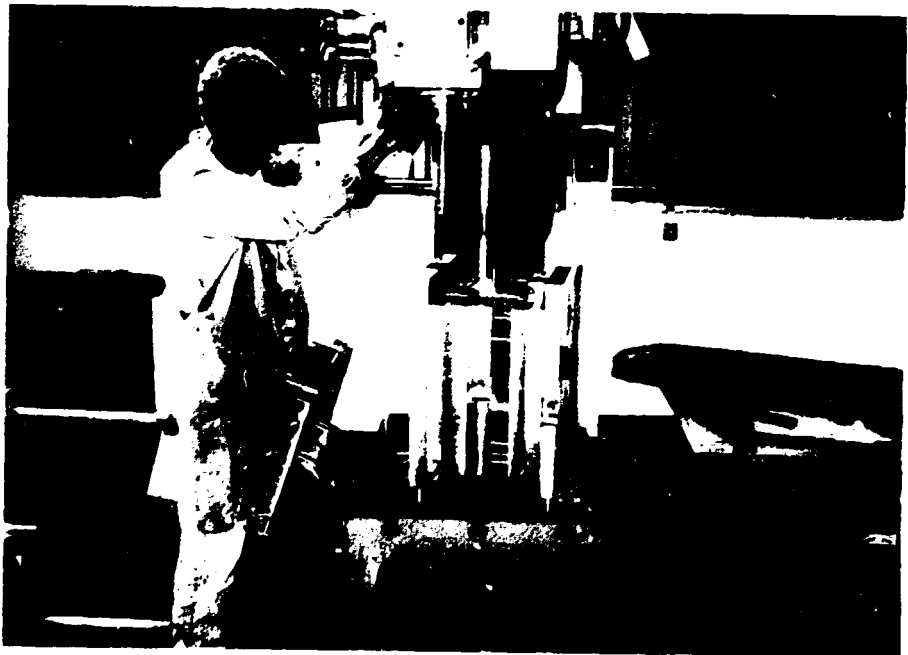
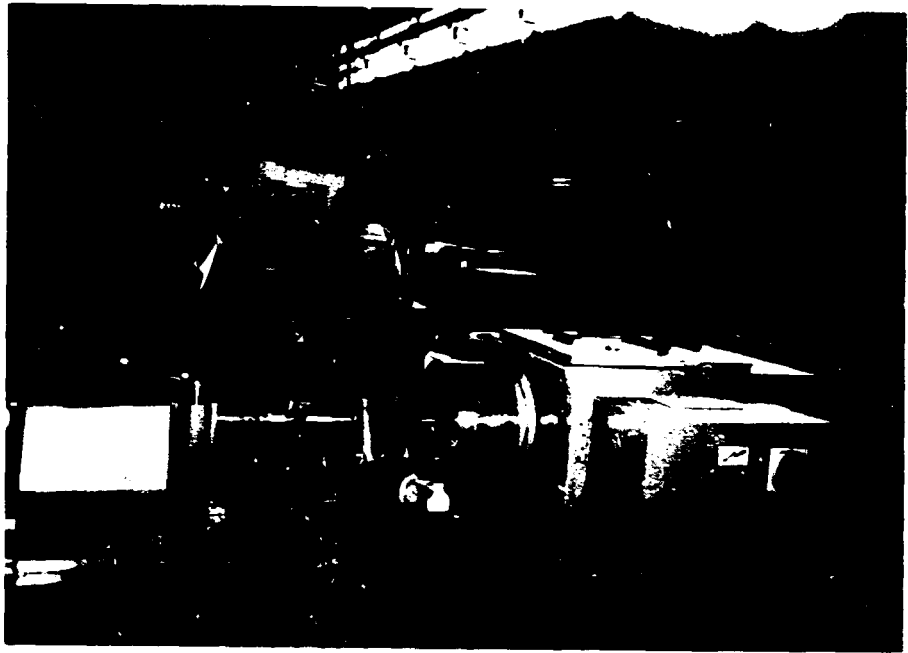
10.7 COST REDUCTION EXERCISE

When the prototype for Bar Cutter was developed and the actual cost of material and machining was estimated, it was felt that the market will not accept the item at that price.

Without affecting the design specifications, manufacturing process was reviewed and revised. This resulted in saving of 40% of machining time. This enabled the cost to be brought down to acceptable level.

The picture below shows the two models.

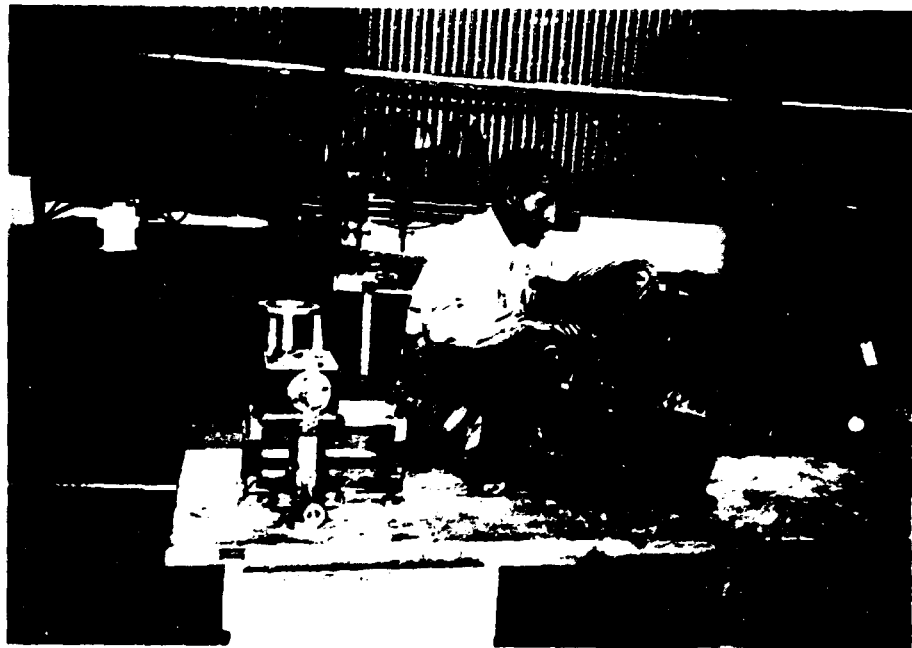




10.9 FINAL ASSEMBLY OF THRESHER



10.10 GROUP ASSEMBLY OF THRESHER

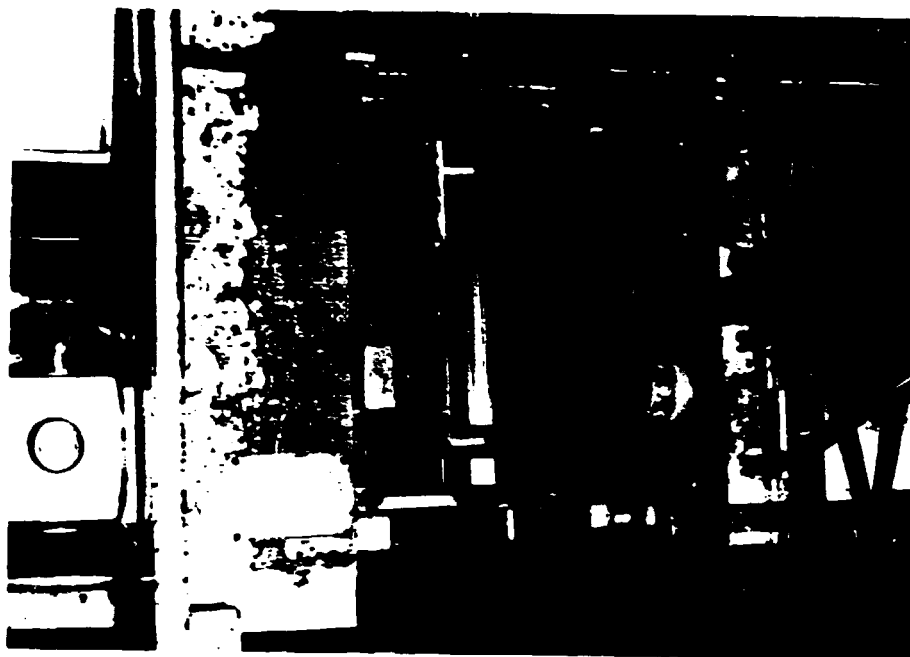


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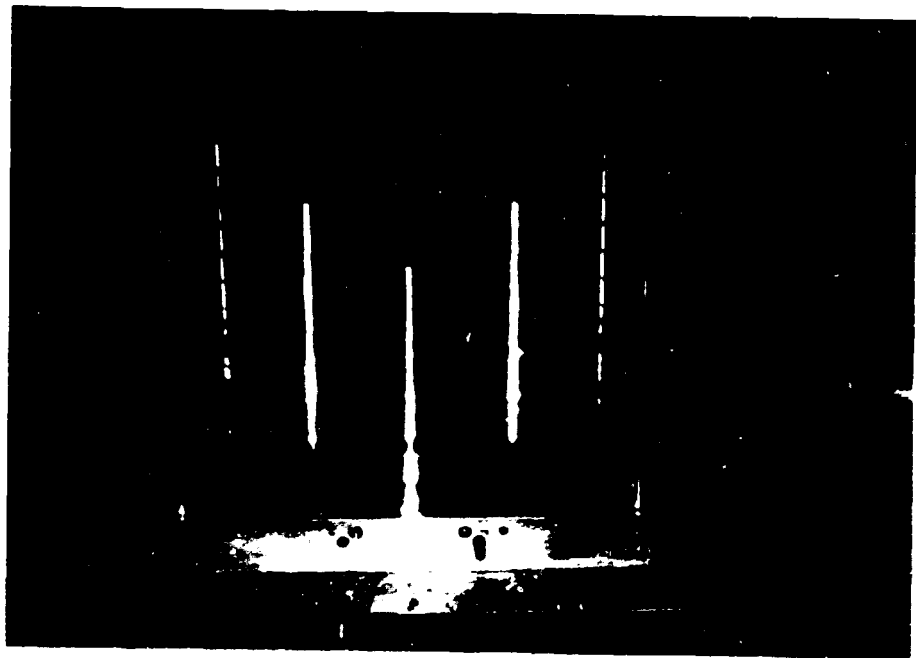
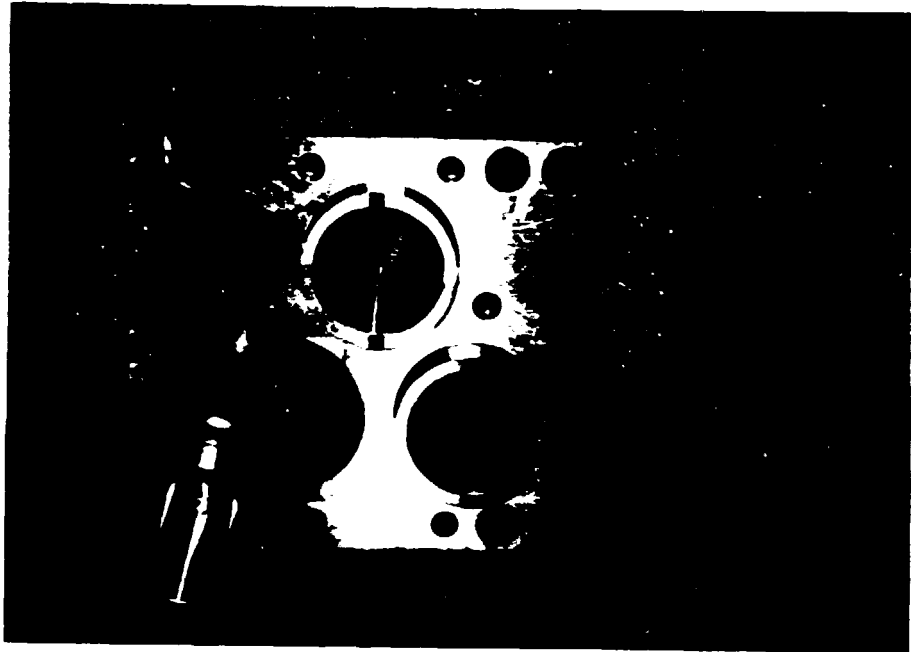
**10.11 4-CAVITY MOULD SUPPLIED BY EDTE UNDER OPERATION
AT ETHIOPLAST, ADDIS ABABA**



10.12 JUNCTION BOXES PRODUCED AT ETHIOPLAST



10.13 3-CAVITY MOULD FOR WATER CUP UNDER ASSEMBLY



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11. HOME OFFICE SERVICE

11.1 CONTRACTED MAN-MONTHS

Equivalent to 18 man-months, HMT(I) assigned two Senior Managers for this job through-out contract period.

11.2 ACTIVITIES CARRIED-OUT

- Arrangements for field experts (Passports, Visas, Tickets, Foreign exchange, Communication, etc.) and visit of families of the experts
- Co-ordination of the administrative and financial matters with the team leader and timely payment for experts
- Collection of data on training programmes from various training institutes in India viz: CMTI, FTI, Government Tool Rooms, ATI, etc.
- Collection of Technical information on agricultural machinery from Agricultural Ministries and Universities
- Arrangements for sending:
 - a) Technical publications
 - b) Standard sheets
 - c) Technical books
 - d) Design calculation reference sheets
- Prepared and sent to EDTE training manuals (4 copies each) both for theoretical and practical training in the areas of:
 - a) Tool design (Moulds, Dies, Press Tools, Jigs and Fixtures)
 - b) Tool manufacturing
 - c) Engineering design
 - d) Prototype manufacturing
- Preparation of copies of bimonthly and interim reports
- Arranged copies of HMT standards (about 2000 standard sheets - 44 volumes)

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- Assisted training expert for preparation of:
 - i) Technical proposal for a Training Centre for training of engineers and technicians with state-of-art facility for tool making
 - ii) Course outlines for 14 topics
- Arranged some bought out parts which were holding progress of prototype assembly
- Arranged samples of sickles for further development at EDTE.

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12. MARKETING AND CUSTOMER SERVICE

12.1 Independent Division for marketing and customer service was started at the recommendation of experts' team leader in early 1992 to perform functions such as market survey, customer service, sales promotion, sales execution, spare parts supply, etc.

The management has given due importance to this Division and has tried to strengthen it to match the growing requirements.

Existing Strength:

Division Head	- 1
Estimation Engineer	- 1
Sales Engineers	- 1+1*

* Temporarily posted.

12.2 There is a very urgent need to bring in government involvement to decide developmental plan for Engineering Design Centre and also identifying the Organization to take up for the production of the developed equipment. An integrated approach is essential to utilize the spare capacity available in other government factories and to develop Engineering Design Centre as a nodal agency for creating/acquiring new technology and proving the production process. Marketing has to play a key role in the entire set-up.

12.3 Tool Centre, as can be seen from the following table, is in an enviable position with regard to the number of enquiries. Only 15% of the enquiries are converted into orders. Some of the actions that can improve this situation is to improve productivity by planned effort, improve delivery and reduce cost. The spare capacity of EDC shop can be utilized for the time being. The excellent performance of the tools so far delivered to customers is the factor in favour of Tool Centre and should not be allowed to deteriorate.

12.4 Sales Performance *

Ser. No.	Description	Nos. (Value in Birr)			
		Cumulative			
		Sept. 93	Nov. 93	Jan. 94	Mar. 94
1.	Total enquiries recorded:-	165	173	219	255
	1.1 Injection Mould	112	115	138	165
	1.2 Blow Mould	10	11	25	27
	1.3 Vulcanizing Mould	2	2	3	3
	1.4 Press Tools	27	29	35	41
	1.5 Die casting dies	10	10	10	10
	1.6 Others	4	6	8	9
2.	Proposals submitted	44 (1,300,000)	54 (1,325,000)	73 (1,907,000)	90 (2,433,300)
3.	Orders received	20 (570,000)	22 (626,000)	33 (831,000)	44 (981,130)
4.	Orders executed	4 (53,000)	4 (53,000)	9 (169,000)	16 (333,350)

* As per information available from Marketing.

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13. ASSIGNMENT OF EXPERTS

Ser. No.	Title and Name of Experts	Contracted Man-months	Date of Entry	Break in Field Service						REMARKS
				From	To	M.	D.	Terminal Date	Field Service completed	
1.	Engineering Design Expert & Team Leader S. Basavarajaiah	27	29.3.91	8.6.91 3.7.92	17.7.91 22.7.92	1	10	31.8.93 - 20	27	
2.	Tool Design Expert Dy. Team Leader L. Paramasivam	32+1* *for review	16.3.94	8.6.91 9.4.92 24.4.93 8.12.93	17.7.91 29.4.92 16.5.93 16.2.94	1	10	14.4.94 (End of 32 months)	32	Date for review Mission to be selected between EDTE, UNIDO and HMT(I).
3.	Sr. Machine Shop Expert H. Govindaswamy A. Bhaskaran (Team Leader from 1.9.93)	22	15.8.91 14.1.93	10.5.92 14.7.93 9.3.93	13.1.93 23.8.93 11.3.93	8	04	1.4.94 10	22	** Official Leave
4.	Tool Shop Expert A.S. Royan	25		10.5.92 15.3.93	12.10.92 7.4.93	5	03	10.3.94 0 23 5 26	25	
				Date		Period				
				Mission	Start	Finish	M.	D.		
5.	Training Experts G.P. Prabhudev G.G. Sulkunte	8	I	11.6.92	20.8.92	2	10	8 1/2		
			II	14.1.93	13.3.93	2	00			
			III	23.10.92	22.10.93	2	00			
			IV	26.2.94	29.4.94	2	04			
		115				8	12	114 1/2		

14. RECRUITMENT OF NATIONAL STAFF

The following table gives details of man-power as recommended in Project Report, approved strength after review by NMWC/EDTE and the actual position at the end of each six months, starting from Dec. 1991.

Ser. No.	Division	Proposed strength as per Project Documents	Approved strength by NMWC & EDTE	Status				
				Dec. 91	June 92	Dec. 92	Jun. 93	March 94
1.	EDC Design	9	12	8	10	10	9	6
2.	EDC Workshop	13	13	3	3	3	12	11
3.	T.C. Design	4	13	8	10	11	10	8
4.	T.C. Workshop	13	24	7	9	14	19	18
5.	Training Unit	1	1	-	1	1	1	1
TOTAL		40	63	26	33	39	51	44

As per the recommendation of the Team Leader, a new Division viz. Marketing and Customer Service was formed.

The present strength of Marketing Division is 4.

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15. COMPREHENSIVE PLAN FOR PHASED DEVELOPMENT

15.1 ENGINEERING DESIGN

15.1.1 Man-power

Ser. No.	Description	Strength	
		As per Project recommendation	Existing as on 31.3.94
1.	Head, EDC Design	1	1
2.	Sr.Design Engineer	3	1
3.	Jr.Design Engineer	2	2
4.	Methods Engineer	1	-
5.	Draftsperson	2	2
T O T A L		9	6

15.1.2 Additional Man-power

As the 4 Senior Engineers trained by the Design Expert had already left the department, the Division is depleted of trained, experienced Design Engineers.

The following staff will have to be recruited immediately:

Senior Design Engineer - 2
Specialist Design Engineer
for hydraulics and pneumatic - 1

To offset future turnover of trained Engineers and Draftspersons, the following additional recruitment also will be necessary:

Juniór Design Engineer (Mechanical) - 4
-do- (Electrical) - 1
Draftsperson - 2

15.1.3 Training

At present, only one Senior Engineer trained by the Design Expert is available. Hence a few Engineers will have to be trained abroad, preferably in industries.

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15.1.4 Reverse Engineering

It may be noted that the products developed have market but commercialization of the equipments had not gone ahead. Batch production planned for some equipment did not materialize due to raw material and other constraints. Clients confidence is not yet built for immediate commercialization. Hence to overcome time constraints, market acceptability, cost factor, etc., it is advisable to go for reverse engineering.

Some products which appears viable are:

- Oil expellers (higher capacity than the one developed)
- Diesel engines
- Concrete mixers
- Bench drills
- Pedestal grinders
- Shaping machines
- Air compressors
- Hacksaw machines
- Tool resharpener machines

15.1.5 Government Support

To sustain the industrialisation policy of encouraging small and medium enterprises, fast development of capital goods sector is essential. Government support, particularly is required in the following areas:

- A definite product development and production plan and the necessary financial assistance and
- Facilitation of suitable technology transfer through bilateral agreements with other friendly countries. To start with General Purpose Machines like centre lathes, milling machines, drilling machines and grinding machines are proposed.

15.2 EDC WORKSHOP

15.2.1 Man-power

Ser. No.	Description	Strength	
		As per Project recommendation	Existing
1.	Head of workshop	1	1
2.	Job Planner	1	1
3.	Foreman	1	1*
4.	Senior Machinist	2	1
5.	Welder/Boiler maker	1	-
6.	Machinist	1	3
7.	Welder/Aid Welder	2	1
8.	Fitter/Aid Fitter	3	1
9.	Store Keeper	1	1
T O T A L		13	10

* Supervisor is in position and can be upgraded to Foreman

15.2.2 Additional Manpower

Senior Machinist (Grinder)	-	1
Aid Fitter	-	1
Assistant Job Planner	-	1
Supervisor (Assembly & Testing)	-	1

15.2.3 Utilization of Capacity and Capability

- Continue to off-load Tools/Components to EDC Workshop as they have proved their capability to produce tools as well
- Manufacture of parts/equipments as per specific needs of clients
- Batch production of established prototypes like Bar Cutter & Sheet bending roller
- Strengthening engineering design and develop prototypes through reverse engineering on TOP PRIORITY

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15.2.4 Additional facility

Though the prototype workshop is well equipped, the machining capability in the following areas is lacking:

- Planing
- Boring and Milling
- Gear cutting
- Gear grinding

The above facilities are required for development of prototypes proposed for reverse engineering. The above facilities will clear the constraints for developing higher technology products including machine tools.

15.2.5 Captive Production Facility

The demand for capital machinery is expected to be low in the near future. EDTE being new, clients will have hesitation to take-up commercial production of equipments developed by EDTE. Hence, to increase the pace of development, the equipments developed in EDTE will have to be produced in small batches of 5/10 in its own captive production facility. The details of the facilities required are as per Annexure-I.

15.2.6 Government Support

In the initial stages of development, total exposure of EDTE to the developed economy from outside countries will prove counter productive. Hence some incentives will be necessary, viz.:

- i) Allocation of foreign exchange at the standard rates,
- ii) Some duty privileges and subsidies for the machines and raw materials imported,
- iii) Easy credit facilities to the buyers of EDTE products,
- iv) Market support for the products identified by government and developed by EDTE.

15.3. TOOL DESIGN DIVISION

15.3.1 Man-power

Ser. No.	Description	Strength	
		As per Project recommendation	Existing
1.	Head, Tool Design	1	1
2.	Senior Design Engineer	2	1+3* Design Engineer
3.	Sr.Draftsperson	1	3
T O T A L		4	8

* The Division has specially qualified and trained Tool Design Engineers.

15.3.2 Additional facilities

The proposed CAD facility will reduce lead time required for tool design and improve its capability for meeting customers demands and gaining confidence of customers.

15.3.3 Test facilities

The proposed test facilities will enable Tool Centre

- i) to avoid tool trial at customer's works,
- ii) to develop own tools and products,
- iii) training of engineers and technicians will be complete and trainees will develop confidence to work independently

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15.4 TOOL SHOP

15.4.1 Man-power

Ser. No.	Description	Strength	
		As per Project recommendation	Existing
1.	Head, Tool Shop	1	1
2.	Job Planner	1	1
3.	Senior Machinist	4	4
4.	Senior Tool Makers	3	3
5.	Machinist	1	3
6.	Heat treatment specialist	1	1
7.	Maintenance Mechanic	1	1
8.	Welder	1	-
T O T A L		13	14

15.4.2 Additional Man-power

The market for the tools manufactured in tool shop is good and is growing. Hence to meet the requirement, two proposals are recommended.

- a) Recruitment of one Tool maker and 2 Machinists
- b) Use the idle capacity of the EDC Workshop

15.4.3 Additional Facilities

Tool making is a highly specialized area and at present there is no alternate source for users within the country. Due to new policies, big boost is expected for small and medium industries. With emphasis for foreign exchange savings demand for moulds, dies and press tools is bound to increase by many folds. It is therefore, advisable to remove manufacturing constraints and balance the resources for optimum utilization. Facilities as per Annexure-II is hence proposed. Recruitment of manpower should be matched to the expansion of facilities.

15.5 TRAINING DIVISION

15.5.1 Man-power

As per project document, only one training co-ordinator is planned and the person is already recruited.

Since training is proposed as a major revenue earning activity, an assistant training co-ordinator is recommended for recruitment to ensure continued follow-up and co-ordination of training activities, when training incharge will be busy with seminars, workshops, etc. and also during his absence.

15.5.2 Captive Training Centre

Though Engineering Design Centre and Tool Centre are fully geared to train outside trainees, the facilities available in these shops will be occupied with production activities and are not likely to be free for training.

A detailed technical proposal is given for a training centre by the training expert after the II mission. Though the proposal is for a training centre specialized for tool making, except for few special facilities, the training centre also have facilities to cover all general trades and also training of engineers.

In case EDTE finds it difficult to invest as covered in the proposal, it is recommended that EDTE implements the same in stages, according to the availability of funds and other resources. However, such a full-fledged Training Centre attached to EDTE is desirable.

15.5.3 Human Resources Development (HRD)

Along with technical capability, the capability to manage and supervise other resources are also to be developed. For example, managing of men, motivating and orienting them with the organisations' goals is one. Developing managerial capability in areas like material management, finance management, production & quality management, personnel management, etc. is the other. Conceptual skills for all the managers to enable them to integrate with the goals of the organisation is yet another area.

General management training is therefore an essential element of HRD. Entrepreneurship is one thing vital for all managers, whichever field they are working.

For an organisation like EDTE, aiming at development of technology, technology transfer, and encouraging commercial production of developed products, a very high entrepreneurship is called for. HRD hence assumes a big role in development of engineering enterprises in the country. HRD Division with one or two specialists and working in close collaboration with university and professional organisations is proposed. The work on establishing this Division needs immediate beginning as the development of such a Division need considerable time.

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15.6 STUDY TOURS

15.6.1 Visit to HMT by Senior Management Personnel of EDTE and Ministry of Industries:

The Engineering Design and Tool Enterprise, though just established is already showing promise of fast development. The young team is highly committed. To ensure that the pace of development is maintained, exposure to industries and organisations who have passed this stage in the recent past and sharing their experience is helpful.

HMT was established in 1953 in India in technical collaboration with M/s. Oerlikon of Switzerland for the manufacture of one single product viz. Centre Lathe, which is one of the basic machine tool. During the past 40 years, HMT has transformed itself into a multi-unit, multi-product company with diverse products, viz. Machine Tools, Watches, Tractors, Printing Machines, Dairy Machines, Precision Bearings, NC Systems, etc. The production facilities have both conventional and latest state of art CNC machines.

During this period of successful transformation, HMT had to accept a number of challenges and adjust itself to market demands with its new development policies, Marketing systems, Training of personnel, HRD policies, etc. The manufacturing facilities have also undergone qualitative changes.

There are a lot of things to learn and share, for Senior Managers of EDTE and the policy makers in the Ministry of Industries, Government of Ethiopia from organisations like HMT Ltd. for future development of EDTE.

It will therefore be in the fitness of things that study tours are undertaken by Senior Management Team of EDTE and personnel in the Ministry of Industries to organisations like HMT.

15.6.2 Since EDTE has established contacts with HMT(I) and HMT(I) is fully aware of its needs, it is also possible to take technical co-operation in specific areas. The study tour will help to identify such areas of co-operation.

FACILITIES REQUIRED FOR BATCH PRODUCTION

A. Building

The proposal is to build only the workshop. The offices of existing building can be used. Area of shop required will be approx. 15 m x 60 m. 3T overhead crane facility and compressed air supply are required.

B. Machinery

The following list of machines is for guidance and further details will have to be worked-out if decision is taken for implementation:

- Planing/plano-milling machine	1M x 4 M	1 No.
- Horizontal boring and milling m/c. table size	1M x 1M	1 No.
- Centre lathe	Dia.400 mm x 1000 mm c.d.	3 Nos.
- Vertical milling m/c. table size	400 x 1000 mm	1 No.
- Universal milling m/c. table size	300 x 1000 mm	1 No.
- Radial drill capacity	Dia.50 mm in steel	
- Precision universal cylindrical grinding machine	Dia.340 mm x 1500 mm c.d.	1 No.
- Precision surface grinding m/c. table size	300 x 1500 mm	1 No.
- Work bench with fitters tool kit		5 Nos.
- Precision surface plate	1M x 2 M	1 No.

Facility for fabrication, heat treatment, heavy-duty turning can be shared with prototype workshop. Castings and forgings can be bought-out.

ADDITIONAL FACILITIES RECOMMENDED

1. IMMEDIATE REQUIREMENT

1.1 Machinery

- Pantograph-Engraving machine with standard accessories
- Single lip cutter grinding machine

1.2 Accessories/equipments for existing machines

- Axis 'C' for CNC-EDM Die sinking
- Sine magnetic table for surface grinder
- Set of spring collets for cylindrical grinding machines
- Collet holder and draw bar for the above
- Spare quills for internal grinding spindle
- Spring collets for mounted wheels for the above
dia.3, dia.6
- Collet holder for the above

1.3 Inspection equipment for Metrology Laboratory

- Digital vernier caliper	0-300 mm	- 1 pc.
- Digital height master	0-600 mm	- 1 pc.
- Box angle plate	350x280x250 mm	- 1 pc.
- Precision vee blocks (Hardened and ground)	Dia 7-70 mm range	- 1 set
- Precision sine bar	150 mm	- 1 pc.
- Micro meter stand		- 1 pc.
- Concentricity tester,	100 mm Centre height	- 1 pc.
- Magnetic Vee block	Size 100x60x75 mm Accuracy 0.005 mm	- 1 pc.
- Illuminated magnifier	40 mm dia.	- 1 pc.

2. FUTURE REQUIREMENT

2.1 Machinery

- Precision surface grinding machine
Capacity grinding area - 200 x 500 mm
Angle and radius grinding attachment
Sine magnetic table
- Precision internal & external cylindrical grinding machine:
Distance between centres 800 mm
Centre height 130 mm
- Jig grinding machine
Working area 500 x 200 mm

2.2 Inspection Equipment

- | | | |
|--|-----------------------|----------|
| - Vernier caliper | 0 - 250 mm | - 5 Nos. |
| - Outside Micrometer | 0 - 25 mm | - 5 " |
| | 25 - 50 mm | - 2 " |
| | 50 - 75 mm | - 1 " |
| | 75 - 100 mm | - 1 " |
| - Depth micrometer | 0 - 200 mm | - 2 " |
| - Depth vernier | 0 - 300 mm | - 1 " |
| - Dial indicator | 0,02 mm, lever type | - 4 " |
| - Dial indicator | 0,02 mm, plunger type | - 3 " |
| - Vernier height gauge | 0 - 500 mm | - 1 " |
| - Bevel protractor | | - 2 " |
| - Slip gauges | | - 1 set |
| - Bore measuring gauges
(dial type) | | - 1 set |

