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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
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TECHNICAL SUPPORT FOR KIE ASSISTED MICRO-BUSINESSES AND KIE'S EXTENSION SERVICES - NYANZA PROVINCE

DP/KEN/87/009

KENYA

Terminal Report *

Prepared for the Government of Kenya
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of V. Cumarasamy,
Small-Scale Business Advisor/Project Coordinator

Backstopping officer: Z. Taluy
Institutional Infrastructure Branch

United Nations Industrial Development Organization
Vienna

* This document has not been edited.

CONTENTS

1. SUMMARY

The immediate objective of the project was to improve the capacity of Kenya Industrial Estates Ltd. to:

- provide effective extension services, design and implement a supervision and monitoring system and meet the training needs of its clients in Nyanza Province.

  * Two UNIDO experts were assigned to KIE's Regional Manager, Nyanza Province and stationed at the Regional Office, Kisumu from August 1988.

  * Initial delay and constraints were experienced in the implementation of the project.

  * All three outputs set to implement the immediate objective of the project, were however carried out during the project period.

  * The project design was found to be adequate and the overall performance of the project proved to be satisfactory.

  * The concept of "National Extension Service Officers" was included in the project for implementation as a Pilot Extension Service activity. Satisfactory performance by the five officers recruited by UNIDO proved the concept effective and the sustainability of UNDP/UNIDO assistance, relating to KIE's extension service capability was established.

  * UNDP/UNIDO funding is available to KIE to continue the work of the 5 extension service officers upto end of September 1991. Replication of this Extension Service activity in other KIE's regions in the country is under consideration by KIE's Management.

  * An articulated entrepreneurial training programme was implemented, to upgrade industry specific skills and build indigenous capability in Nyanza Province primarily and other KIE's regions. Training curricula and methods were adapted to actual needs, which facilitated the acquisition of necessary entrepreneurial technical and managerial skills by KIE's clients.

  * With the funding of a third party "Sponsor" DANIDA - (Danish Embassy in Kenya) KIE's trainees produced ten tricycles for physically handicapped crippled persons. The trainees were assisted to adopt a business

orientation, as a prelude to developing this activity into a sustainable enterprise.

* A Women entrepreneur's Seminar was held to emphasise to KIE's Management the importance of particular support to this group.

* UNIDO equipment and vehicles in Nyanza Province were entrusted to the custory of KIE's Regional Manager, Kisumu in continuation of the project to end September 1991.

* Discussions were held with KIE's Management to facilitate smooth transfer of UNIDO appointed National Extension Service officers and UNIDO purchased equipment and vehicles to the KIE.

2. ACKNOWLEDGEMENTS

During a term of nearly three years in Nyanza Province, the UNILO team received the fullest cooperation and assistance of all KIE's clients and staff, and Organizations which collaborated in the entreprenurial training courses conducted to upgrade skills of KIE's clients.

The project team wishes to express its sincere appreciation to the following Organizations and associated staff:

- The head office management of KIE - Nairobi
- The Regional and RIDC staff of KIE - Nyanza Province
- Kisumu Industrial Training Centre - Kisumu
- The Ramogi Institute of Advanced Technology - Kisumu
- The Kiambu Institute of Technology - Kiambu Nairobi

The funding given by a third party "sponsor" DANIDA and its Project Coordinator in Kisumu enabled KIE's trainees to produce ten tricycles for the physically handicapped children of Joyland School - Kisumu. This gesture is acknowledged with appreciation.

The project team is most grateful and earnestly acknowledge the contribution of the Managing Director, KIE Ltd. and the Regional Manager, KIE Kisumu.

3. INTRODUCTION

This report covers activities of UNDP/UNIDO Technical Support for Small Industrial/Micro Enterprises assisted by the Kenya Industrial Estates Ltd. in Nyanza province under project KEN/87/009.

The project became operational in August 1988 when UNIDO's two experts based in KIE's Regional Office Eldoret under Project KEN/84/001 moved to Kisumu Regional Office which was covering the five KIE stations of Nyanza Province which comprised the area of operation of the proposed project.

The concept of a pilot programme to provide direct extension services support to the KIE's clients and strengthen entrepreneurial training through skill upgrading courses was the rationale of this project.

The two UNIDO Experts consisted of a Small Business Advisor and a Production Engineer. The Small Business Advisor covered also the duties of the Chief Technical Advisor/Project Co-ordinator. As advised by the UNIDO Country Director in Nairobi and on a mutually agreed basis, the production Engineer supervised and implemented the extension services activities while the CTA covered the Entrepreneur Training Programme.

The KIE's set up in the Nyanza Province was under the Regional Manager who was stationed in Kisumu. The total administrative area comprised five KIE stations. Four of them being Rural Industrial Development Centres covering a district each and run by a KIE Centre Manager. The Regional office at Kisumu covers the 5th district, in addition to being in overall charge of the activities of the KIE in Nyanza Province. The total project team thus comprised of the two UNIDO experts, the KIE Regional Manager and the KIE officials in the region under his immediate supervision and the five nationally recruited extension officers appointed by UNIDO.

This report is an overall presentation. Documentations produced on the training activities are attached to this report. Additional material in the form of files pertaining to KIE's client trainees have been handed over to the Regional Office of KIE, Kisumu.

The Production Engineer's report covering the activities and implementation of the extension services supervision and monitoring is submitted as Volume II.

The first Tripartite Review was held in February 1990. The delay in the appointment of the five National Extension Service Officers which constrained implementation of the extension services output was discussed at this meeting and it was decided that the project

be extended. At the same time the Review Meeting also agreed that computerised monitoring of the extension service be incorporated into the activities of the project. The budget revision which followed made the required provision for this additional support.

Technical and Managerial extension services to the KIE's clients through regular visits and counselling services on the scale envisaged in the project commenced in April 1990 when the five National Extension Officers assumed duties at their respective stations in the Province. These officers were selected by the KIE in February and appointed by UNIDO on contract for 20 months, expiring on 30th April 1991.

The second Tripartite Review Meeting took place in February 1991. The situation relating to the expiring of contacts of the UNIDO internationally recruited staff, expiring on 30th April 1991, nationally recruited staff on 30th April 1991 and implementation of the computerised monitoring system yet remaining to be commenced, was taken note of by the meeting.

The KIE's Management has indicated to UNIDO its intention to install the computer programme before the contract of the five UNIDO Extension Officers expires on 30th September 1991 and for this purpose requested UNIDO to make available follow-up services of the UNIDO experts - Production Engineer who had been supervising the extension services activities for an appropriate period.

Prior to the departure of the two international experts, arrangements regarding the funding of the activities of the five Extension Service Officers, supervision of their work, reporting system, custody of UNIDO Project Equipment/Vehicles and other connected administrative matters have been discussed with KIE's Management.

Annexure 1 gives details of UNIDO project equipment/vehicles entrusted to the custody of the Regional Manager, KIE, Kisumu.

4. PROJECT BACKGROUND AND OBJECTIVES

Background

There has been long stading co-operation between UNDP/UNIDO and the Kenya Industrial Estates Ltd., starting from 1978. Three projects, namely; KEN/77/066, KEN/81/017 and KEN/84/011 had already been implemented. Technical assistance in the form of experts and equipment in the magnitude of about US$ 2.0 million was made available to KIE, towards these projects during the period 1978-1988.

The assistance to KIE covered the following areas:

1. Financial management and designing workshops and infrastructure for Industrial Estates and supervision of their construction. This activity was operated from the KIE's head office at Nairobi.

2. Assistance to small-scale and rural entrepreneurs to set and operate their industries. Operation of this project was at a regional level carried out at the Eldoret Industrial Estate, and Rural Centres and Industrial Promotion Areas in the Eldoret Region.

3. Focus on implementation of projects identified in the previous programme in Eldoret Region, and training KIE's clients and entrepreneurs and staff.

Justification of the Current Project - KEN/87/009

This was based on the need to re-inforce two principal activities of the KIE namely:

Extension Services to KIE's Clients:

KIE's inability to maintain regular contracts with its clients and deal expeditiously with enquiries of potential clients in the rural areas, (particularly outside the immediate location of regional centres where industrial estates exist) became evident. KIE was expected to provide improved services to its clients, establish an efficient supervision and monitoring system.

Training of KIE's Clients/Staff:

The need to organise and provide further skill upgrading training to KIE's clients in order to improve technical and managerial performance of their projects was recognised as an essential component of KIE's services. Additionally, appropriate formal training courses to KIE's staff was also observed as an area which required special emphasis.

Hence, an extension service oriented project designed to take care of these two aspects was proposed and it was agreed that the project be established in Nyanza Province. This was proposed in the initial Terms of Reference provided by KIE.

While being a continuation of UNDP/UNIDO Technical assistance to KIE, UNIDO took note of other programmes formulated by the Government of Kenya. The on-going GTZ programme to finance KIE's informal sector projects (Micro Enterprises) was of immediate relevance and this context justified the target beneficiaries of the programme, namely KIE's loanees both in the small-scale

organised sector (Formal Sector) and micro enterprises in the Informal Sector of Nyanza Province.

Another aspect which has to be mentioned is that the project provided for recruitment of five Kenyan personnel to act as Extension Service Officers within Nyanza Province. The purpose of this was to develop the extension services under the project as a pilot scheme for possible replication by KIE on a phased basis, ultimately to be implemented as a national activity.

Project Objectives

With the primary function of institution building, the objectives of the project as indicated in the project document were:

Development Objective:

"Increased economic growth and employment through the development of viable small-scale industries in the urban and rural areas including the formal & informal sector".

Immediate Objective:

"To improve the capacity of Kenya Industries Estates Ltd. (KIE) to:

a) Provide effective extension services to formal and informal small-scale industries in Nyanza Province.

b) Design and implement a supervision and monitoring system for small-scale industry and micro businesses in Nyanza Province in order to develop their entrepreneurship and increase their productivity, and

c) Meet the training needs of its clients".

5. ACTIVITIES CARRIED OUT AND OUTPUTS PRODUCED

The activities carried out and outputs achieved in the Nyanza Region during the project period are summarised below:

Output I - Extension Services

- Regular visits were made to formal sector KIE's clients and they were assisted to improve their technical and managerial performance. Direct extension services were provided to 122 operating and 32 under implementation KIE projects in the formal sector.

- Consultancy services were provided to prospective KIE's clients in the formal sector resulting in 73 interested parties receiving assistance in the preparation of their applications, choice of product lines, scale of operations etc. and in presentation of their applications to KIE.

- Five nationally recruited Extension Service Officers were given on-the-job training to provide the extension services. Participation by these officers in the preparation of an overall work plan of the services to be provided to the region as a whole, as well as individual work plans to suit the needs of the respective districts to which each of the five officers were attached, was the basic position from which on-the-job training was developed and conducted.

- Regular contact with KIE's clients established improved KIE/ client relationship.

- Communication between the region's five District Officers and KIE's head office improved resulting in speedier and more effective action on management decisions. Field action on rehabilitation of projects, improved loan re-payments are some of the cases in point.

- Reports were submitted by each of the five national Extension Service Officers at the review of their work held in Nairobi in December 1990. Though the reports reflected experiences of field activity for a comparatively short period of nine months (April 1990 - December 1990), KIE's head office, Senior Management evaluated performance as satisfactory development of a pilot activity, to be considered replication in KIE's other regions.

Output II - Supervision and Monitoring

- This was carried out as an integrated activity of extension services. Data collected by the extension service officers on all the projects visited by them were analysed manually.

- Installation of a computerised monitoring system required sequence of actions, namely:

  Needs Assessment
  Hardware Specification, and
  Software Development.

Provision for implementation of this output were made on the basis of discussions of the First Tripartite Review Meeting held in 1990. Action to finalise needs assessment and hardware specifications/ purchase were pending as on 30th April 1991 when the contracts of the two UNIDO experts expired. Funding for the return of the UNIDO expert - Production Engineer, for two months to assist in the installation of the computerised system and training of the officers was subsequently approved in July 1991 and the expert commenced his assignment in August 1991.

Output III - Training

This output covered training of KIE's clients and staff.

- A total number of 329 participants from KIE's formal sector and Micro business enterprises in the informal sector, consisting of owners/employees of the projects attended training courses as follows:

Number of Courses:		17
Type:	- Needs Assessment	4
	- Industry Specific Skill Upgrading Training	12
	- Women Entrepreneurs Seminar	1
Course Days		115

- Sequence of training activities as adopted to develop and implement the training courses were - Needs Assessment, Designing of Courses, Development of Training Materials, Delivery of Programme and Evaluation.

- Details of training activities, including estimated costs were discussed with KIE's Management before submission to UNIDO for approval. Prior to arrival of UNIDO Country Director in Nairobi, approvals were obtained directly from Vienna.

- Skill upgrading was the key objective of the Industry Specific Training Courses conducted. Industrial activities covered at the courses were:

  Light Engineering (Welding General, Fitters General and Automotive Mechanism)

  Carpentry and Joinery

  Bread Making/confectionary

  Tailoring/Dress Making

  Shoe Making and Repair/Designing and Pattern Making

  Technical Drawing related to Mechanical Applications

  Production of Fibre Concrete Roofing Tiles

  Production of Tri-Cycles for Physically Handicapped Persons

  Machinery Maintenance for Posho Mills (Small-Scale Maize Grinding Units).

  Note:

  Annexures 2 - 7 provide copies of training materials used as follows:

  Annexure 2: Scheme of Work

  Light Enginering, Carpentry, Tailoring and Bread Making Industries.

  Annexure 3: Skill Upgrading

  Shoe Making, Repair and Footwear Designing; Mocassin Shoe Construction/Pattern Making.

  Annexure 4: Skill Upgrading - Reference Handout

  Technical Drawing related to Mechanical Applications.

  Annexure 5: Skill Upgrading

  Production of Fibre Concrete Roofing Tiles.

  Annexure 6: Skill Upgrading - Production Manual

  Production of Tri-Cycles for Crippled Persons.

Annexure 7: Skill Upgrading

Machinery Maintenance, Posho Mills (Small-Scale Grinding Units).

Annexure 8: Women Entrepreneurs Seminar

Over 50 KIE's promoted women entrepreneurs attended a seminar which was conducted to highlight to the KIE's Management the importance of the particular attention necessary to promote and develop industries owned/managed by KIE's women clients.

The programe of the seminar and the invitation to the participants are in annexure 8. It is submitted to give an indication of the UNIDO support which was extended to women entrepreneurs during the project period.

- The facilities and expertise of training institutions in Kisumu itself were utilised in the first instance to conduct the training courses. Assistance of institutions outside the project area was included when necessary.

  The collaborating organisations were:

  * Kisumu Industrial Training Centre - Kisumu
  * The Ramogi Institute of Advanced Technology - Kisumu
  * The Kiambu Institute of Science & Technology - Kiambu
  * Kenya Industrial Training Institute - Nakuru
  * Intermediate Technology Development Group - Nairobi

- KIE's clients from outside the area of operation of the project participated in the training courses conducted on Shoe Making, Bread Making, Confectionery and Production of Roofing Tiles, which included trainees from KIE's regions all over Kenya.

- Each trainee was given complete sets of course material for their follow-up reading and refernece. Class room lectures and instructions were supplemented by practical demonstrations. Active Participation by trainees and their satisfaction in the improved and additional skills which they acquired were some of the highlight of the Entrepreneur Training Programme conducted under the project. Ability of the National Resource persons to assist trainees as and when necessary with translations and explanation in the local language ensured full particpation by each of the trainees.

KIE's Staff

The KIE's staff from the project area participated fully in all the training courses along with the UNIDO Team. Their development as Resource Persons who would be able to take over and continue the training programme promoted by UNIDO was the prime concern of the UNIDO Team, and every effort was made in this direction.

Additionally, the project also provided for training abroad through individual fellowship. Five fellowships were granted and the training was successfully completed by the following staff categories:

* 2 Regional Managers
* 1 Centre Manager
* 1 Project Assistant
* 1 Divisional Manager

The Centre Manager and one of the Regional Managers were from Nyanza Region - the area of operation of this project.

6. ACHIEVEMENTS OF IMMEDIATE OBJECTIVES OF UTILISATION AND PROJECT RESULTS

The immediate objectives of the project related to:

- provision of extension services
- implementing a supervision and monitoring system
- meeting the training needs of KIE's clients and staff.

The extent of achievement of these objectives varied with the effective implementation period available to the Team under each of them.

Objective I

Activities for all the project period comprised participation and involvement of the UNIDO Team to the best extent possible in the overall KIE/Client interaction in the Nyanza Region as a whole. However, intensive work during nine months (August 1990 - April 1991) by the five National Extension Officers stationed one in each of the five districts, enabled the Team to achieve satisfactory development of the pilot programme proposed under the project and to present to the KIE's Management the scope and usefulness of its replication in other KIE's regions.

Objective II

Up to the end of the term (30 April 1991) of the two UNIDO experts, data collection and analysis was carried out manually. Installation of a computerised system was the principal means by which the scope of monitoring was to be established. The system however, was pending installation as on 30th April 1991. The direction and sope of this activity was demonstrated through the collection of field records and an analysis by the extension officers which was done manually.

Objective III

Activities to implement this objective was carried out with the assistance of the KIE's staff in the region from the beginning of 1989 - the earlier five months being devoted to participating in the KIE's programme which had already been drawn up by the KIE's Management for the Region (August - December 1988).

Details of the activities/courses which were implemented have been indicated in the preceding chapter. Particular reference is made to the introduction of training on technical drawing related to mechanical applications and concerted activities on the production of tricycles for handicapped persons leading to Delivery of Ten Tricycles Produced by the Trainees. The Micro enterprises (KIE's informal sector clients) demonstrated their capability to absorb technical skills and also exhibited their entrepreneurial talent.

In both of these courses (Technical Drawing and Tricycle Production) as in all the others, the objectives and course content were developed in consultation with the concerned prospective trainees. This approach contributed to the achievements under this objective.

Enabling the KIE to follow-up the training on the basis of files submitted to KIE Kisumu on the respective client/trainee involvement and participation, and the manner in which future training courses may be identified and implemented for KIE's clients are further aspects of the achievement of this objective.

Development of the KIE's staff members as resource persons and the acquisition of additional knowledge and experience through training abroad are aspects relating to the achievement of this objective.

UTILISATION OF PROJECT RESULTS

The results of UNIDO Team's assignment to the KIE's regional set up in Nyanza Province through the work that it carried out may be stated to include:

- Emergence of entrepreneurial interest in KIE's activities in the region.

- Recognition by KIE's clients of the capability and potential of KIE to support its clients through direct extension services and training.

- Improved KIE/client relationship.

- Demonstrated capability of the informal sector to benefit from the entrepreneurial training courses conducted.

- Over 300 clients/participants involvement in the Entrepreneur Training Programme and 152 of them directly upgrading their skills.

- Follow up of the collaboration established with public and private sector industrial training institutions, to enhance facilities and resources which could be used by KIE to train its clients.

- Opportunity provided to over 50 KIE's promoted women entrepreneurs to meet with KIE's Management at a seminar and discuss the promotional support required for them.

- Enabling KIE to sustain extension services work in the Nyanza region through the five national extension service officers who have been trained for that purpose.

7. CONCLUSIONS

The delay which was experienced in the fielding of National Extension Service Officers and the supply of equipment affected full scale operations of the project. The extension officers did not have the full twenty months of on-the-job training as envisaged in the project. Additionally supply of computer equipment did not materialise even at the expiry of the contracts of the UNIDO experts.

The outputs of the Project would have been more satisfactory if the Extension Service Officers and equipment were available to the UNIDO Team for the total twenty months period envisaged.

The assessment made by the KIE of the performance of the Extension Service Officers, however, established the sustainability of KIE's extension services within Nyanza Province.

Basically the Extension Service Programme as planned and implemented, integrated with KIE's operators at all levels. In principle and as a policy measure, this pilot activity in Nyanza Province was accepted by KIE as suitable for replication in other KIE's regions.

Further financial support from UNDP/UNIDO to replicate the extension services was brought up by senior staff of KIE. This implied KIE's continuing reliance on Donors. The Managing Director, KIE however, emphasised the need for KIE to gear itself to developing its own capability and resources for the purpose.

In the area of entrepreneur training, the involvement of KIE's staff, the response and participation of KIE's clients contributed to ensure the impact of the projects training programme. The industry specific training courses proved to be an effective means of upgrading and tranfering skills.

The need to pay specific attention to the continuation of the entrepreneur training programme for KIE's clients was recognised. The entire training activity was documented for KIE's reference; in order to facilitate and ensure follow-up, history sheets in respect of all trainees were left behind with the regional office, Kisumu.

Business opportunities and successful entrepreneurship need to be actively promoted in Nyanza Province.

The results of intervention were visible in the interest shown by indigenous population at the seminars held in the different KIE's stations of Nyanza Province at which the UNIDO Team participated.

8. RECOMMENDATIONS

In the light of what has been implemented and what remains to be done, the following recommendatins are made:

1. **Installation of Computerised System**

   That the computerised system be installed and KIE's staff trained on its operation.

2. **Transfer of UNIDO Property in Kisumu, to KIE**

That in view of KIE's expressed decision to continue the project at the conclusion of UNIDO's commitment on 30th September 1991, the equipment and vehicles which were left in the custody of the Regional Manager, KIE Kisumu be transferred to the KIE. In this regard it may be noted that KIE is not in a position to replace UNIDO equipment and vehicles with its own.

3. **Transfer of Five National Extension Service Officers to KIE**

That with a view to adding to the KIE's capabilities the benefit of the experience and know how acquired by the extension officers, the concerned officers be absorbed into the permanent employment of the KIE.

4. **Follow-up of Entrepreneur Training Programme**

That:

a) the efforts made by UNIDO project to establish contact and collaborate with industrial training institutions in the public and private sectors be pursued by the KIE.

b) follow-up of trainees on an individual/project basis be actively pursued, the basic action plan for this has been left behind for KIE Kisumu by the project.

c) the pioneering activity - Production of Tricycles for handicapped persons be actively pursued by KIE to develop the scope of this activity for KIE's clients. In this regard it is suggested that:

i) KIE explore the range of rehabilitation equipment for physically handicapped persons which could be produced by the trainees who had already proved their skills, and by more KIE's clients from other regions who could be trained;

ii) greater marketing awareness be promoted;

iii) the media be used to promote the KIE's role on this activity;

iv) third party "sponsors" be located and the production of tricycles should be developed as a sustainable enterprise.

Note:

The feasibility and scope for production of rehabilitation equipment is assumed on the self confidence shown by the KIE's client trainees and their proven capabilities.

Copies of two publications have been left behind to KIE for their follow-up study and action.

U.N.D.P./U.N.I.D.O Project DP/KEN/87/009
Technical support for
K.I.E's Micro Businesses and
Extension Services in Nyanza Province

ANNEXURE No. 1

(6 Pages)

UNITED NATIONS INDUSTRIAL
DEVELOPMENT ORGANISATION
(U.N.I.D.O.)

KENYA INDUSTRIAL ESTATES LTD
P. O. BOX 1360
KISUMU.
KENYA.
TELEPHONE: 40320

Reference:

Date:

UNIDO OFFICE EQUIPMENT LEFT IN THE CUSTODY OF THE KIE REGIONAL MANAGER KISUMU FOR CONTINUATION OF THE UNIDO PROJECT KEN/87/009 IN THE REGION.

THE EQUIPMENT REMAINS THE PROPERTY OF UNIDO UNTIL DECISION IS MADE ON TRANSFER

Presently used in Kisumu Station

Description	Quantity Received	Date of Receipt	Remarks
1. Fax Machine Model 7100 Serial No. 7111081	1	10/7/90	
2. Xerox Photocopier Serial No. 101740 NP 115 Model - 5014	1	22/8/90	Delivery Note No. 1949
3. Gestetner Duplicating machine Model No. 4130 Serial No. 2A/16290	1	29/6/90	Delivery Note No. 2079
4. IBM Typewriter Model No. 6784 Serial No. 11/0133203	1	6/9/90	Delivery Note No. 1949
5. IBM Typewriter Model - 6784 Serial No. 11/133308	1	6/9/90	Delivery Note No. 1949 Dated 4/6/90
6. IBM Typewriter Model - 6784 Serial No. 11/0133215	1	5/9/90	Delivery Note No. 1949 Dated 4/6/90

Kisumu Continues.

Description	Quantity Received	Date of Receipt	Remarks
7. Steel Carbinet	1	8/10/90	
8. Steel Cabinet	1	8/10/90	
9. Overhead Projector Porta Vista Serial No. 1124	1		
10. Projector Screen Porta Vista with stand	1		
UNIDO VEHICLE - KISUMU Description - - Chasis No. NMD 21.430191 - Engine No. Z24361974 W - Registration No.40UN 207K	1		

Certified correct

30/4/91

Regional Manager
Kenya Industrial Estates Ltd. - Kisumu

U.N.D.P./U.N.I.D.O. Project DP/KEN/87/009
Technical support for
K.I.E's Micro Businesses and
Extension Services in Nyanza Province

UNITED NATIONS INDUSTRIAL
DEVELOPMENT ORGANISATION
(U.N.I.D.O.)

KENYA INDUSTRIAL ESTATES LTD.
P. O. BOX 1360
KISUMU.
KENYA.
TELEPHONE: 40320

Reference:

Date:

U. N. I. D. O.

SIAYA R.I.D.C.

Description	Quantity Received	Date of Receipt	Remarks
1. Photo copier XEROX Serial No. Model No. 5014	1		
2. Gestetner Duplicating Machine Serial No. Model No.	1		D/N. No. 1091 dated 23/8/90
UNIDO VEHICLE - SIAYA RIDC Description - Chasis No. NMD 21-430202 - Engine No. Z 24-362625W - Registration No. 40 UN 209 K	1		

Certified correct

Regional Manager
Kenya Industrial Estates Ltd.

30/4/91

U.N.D.P./U.N.I.D.O. Project DP/KEN/87/009
Technical support for
K.I.E's Micro Businesses and
Extension Services in Nyanza Province

UNITED NATIONS INDUSTRIAL
DEVELOPMENT ORGANISATION
(U.N.I.D.O.)

KENYA INDUSTRIAL ESTATES LTD.
P. O. BOX 1360
KISUMU.
KENYA.
TELEPHONE: 40320

Reference:

Date:

U. N. I. D. O.

KISII R.I.D.C.

Description	Quantity Received	Date of Receipt	Remarks
1. IBM Typewriter Serial No. 11-0133245 Model No. 6784	1	6/9/90	Delivery Note No. 1949 Dated 23/8/90
2. Photo Copier XEROX Model 5014 Serial No. 788733	1	1/3/91	
UNIDO VEHICLE - KISII R.I.D.C. Chasis No. NMD 21-430207 Registration No. 40UN 210K Engine No. Z 24 363203 W	1		

Certified correct

Regional Manager
Kenya Industrial Estates Ltd.

U.N.D.P./U.N.I.D.O. Project DP/KEN/87/009
Technical support for
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UNITED NATIONS INDUSTRIAL
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(U.N.I.D.O.)

KENYA INDUSTRIAL ESTATES LTD.
P. O. BOX 1360
KISUMU.
KENYA.
TELEPHONE: 40320

Reference:

Date:

U.N.I.D.O.

KEROKA R.I.D.C.

Description	Quantity Received	Date of Receipt	Remarks
1. Gestetner Duplicating Machine Serial No. - 2A/16311 Model No. 4130/MC	1	24/8/90	Delivery Note No. 1090 Dated 23/8/90
2. Photo Copier Canon NP Model No. NP 115 Serial No. - 101740	1		Delivery Note No. Dated 13/2/91
UNIDO VEHICLE - KEROKA RIDC (NYAMIRA DISTRICT)			
Description - Chasis No. NMD 21-430209 - Engine No. Z 24363012/W - Registration No. 40 UN	1		

Certified correct

Regional Manager

30/4/91

Kenya Industrial Estates Ltd. - Kisum

U.N.D.P./U.N.I.D.O. Project DP/KEN/87/009
Technical support for
K.I.E's Micro Businesses and
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UNITED NATIONS INDUSTRIAL
DEVELOPMENT ORGANISATION
(U.N.I.D.O.)

KENYA INDUSTRIAL ESTATES LTD.
P. O. BOX 1360
KISUMU.
KENYA.
TELEPHONE: 40320

Reference:

Date:

R.I.D.C. HOMA BAY

Description:	Quantity Received	Date of Receipt	Remarks
1. IBM Typewriter Serial No. 0133243 Model No. 6784	1	24/11/90	Delivery Note No.1949 Dated 23/8/90
2. Photocopier XEROX Model No.-Xerox 5014 Serial No. 211 7886333	1	24/8/90	Delivery Note No. 1090 Dated 23/8/90
UNIDO VEHICLE - HOMA BAY RIDC/S. NYANZA Description - Chasis No. NMD 21430197 - Registration No. 40UN 208K - Engine No. Z 24362291 W	1		ime

Certified correct

Regional Manager

30/4/91

Kenya Industrial Estates Ltd. - Kisum

ANNEXURE 2

SCHEME OF WORK

LIGHT ENGINEERING, CARPENTRY,

TAILORING AND BREAD MAKING INDUSTRIES

DP/KEN/87/009

P R E F A C E

UNDP/UNIDO PROJECT - DP/KEN/87/009 for Technical support to the Kenya Industrial Estates Limited is currently assisting K.I.E. Clients in the Nyanza Province, Kenya.

Technical Training needs of small industries and micro-enterprises (informal sector activities) promoted by K.I.E. were assessed in participation with the clients. This document contains specific topics and lesson points of the propossed training programme which is an endeavour to improve skills and working efficiency of:-

Fitters General, Welders, Tinsmiths, Automotive Mechanics Carpenters/Joiners, Tailors/Dress makers and Bakers.

The document has been developed in collaboration with the following Institutions which are providing the training in their respective workshops.

Kisumu Industrial Training Centre - Kisumu
Ramogi Institute of Advanced Technology - Kisumu
Kiambu Institute of Science and Technology - Kiambu.

PROJECT DP/KEN/87/009

In-Service Training 1989 - (July - December)

PROGRAMME

	LOCATION OF COURSE AND ACTIVITY	DISTRICT COVERED	EVENING/DAY	DATES
1.	AT KISUMU INDUSTRIAL TRAINING CENTRE KISUMU			
	Skill Upgrading Courses - Fitters (General)	Kisumu District	Evening	31st July to 19th August
	- Carpenters/Joiners - Welders	Kisumu District	"	4th to 23rd September
	- Tinsmiths	Kisumu District	"	25th Sept., to 4th Oct.,
2.	AT KIAMBU INSTITUTE OF SCIENCE AND TECHNOLOGY NAIROBI Baking Technology	Kisumu, Siaya, Kisii (Keroka) Homa-Bay Districts	Day (Residential)	28th August 8th September
3.	AT RAMOGI INSTITUTE OF ADVANCE TECHNOLOGY KISUMU Skill Upgrading course for Tailors/Dress makers	Kisumu, Siaya Districts	Day (Residential)	27th November 1st December
4.	AT KISUMU INDUSTRIAL TRAINING CENTRE KISUMU Skill Upgrading Courses - Fitters General - Carpeters/Joiners - Welders - Automobile Mechanics - Tinsmiths	Siaya, Kisii (Keroka) Homa - Bay Districts	Day Residential)	28th November to 9th December

C O N T E N T S PAGE

PROJECT DP/KEN/87/009 - NYANZA PROVINCE - KENYA

IN-SERVICE TRAINING 1989

KIE/UNIDO TECHNICAL TRAINING - SKILL UPGRADING PROGRAMME

VENUE: KISUMU INDUSTRIAL TRAINING CENTRE

SKILL AREA: FITTER GENERAL

ACTIVITIES: STEEL FABRICATION i.e. STEEL DOORS, WINDOWS
BICYCLE PARTS

DURATION: 60 HOURS

MAIN TOPIC	LESSON POINTS	AVAILABLE AT THE INSTITUTE MATERIAL	EQUIPMENTS AND SPECIAL TOOLS	NO OF HOURS
FITTER GENERAL TOOLS (INTRUCTION)	THEORY -Introduction to bench fitters -Detailed explanation of the purpose and the correct application of each tool. -Explanation of important features of each tool i.e. angle of the cutting tip, shape etc. -Tool material for every tool and reason for that material. -Any other feature of the tools. -Calipers (inside) outside and odd leg) -Safety precaution regarding the use of every tool used by the fitter.	-Handouts and charts	i) Files of oll kinds ii) Cold chisel iii) Hacksaw frame iv) Blade v) Hammer vi) Try squre vii) Centre punch viii) Ruler ix) scriber x) scraper xi) Punches xii) file card	2 hours
MEASURING GIVEN MEASUREMENTS	THEORY -Defination of the term 'measuring' -Distinction between measuring and gauging -Measuring tools	-Charts and hand outs	150mm steel rule 300mm steel rule	2 hours

MAIN TOPIC	LESSON POINTS	AVAILABLE AT THE INSTITUTE MATERIAL	EQUIPMENT AND SPECIAL TOOLS	NO. OF HOURS
CONT. MEASURING AND MARKING OUT GIVEN MEASUREMENTS	-Measuring instruments -Correct way of reading - a steel rule. -Scales of the rule -Unints of measurement. -Application of the steel tape. -Accuracy of the rule and steel tape. -A vernier caliper as a more accurate means of measurement. -Scale of the vernier caliper -Reading the vernier -Accuracy of the instrument. -The vernier height gauge. -Application of the instrument.		-Steel tape -Vernier -Vernier height gauge.	
	-Reference (DOTLIM) EDGES		-Steel rules -Steel tapes.	
MARKING OUT	THEORY -Marking out by using: i) Steel rule ii) Steel tape iii) Vernier height gauge. -Importance of marking (surface) table. -Application of the marking in connection with vernier height gauge. -Surface gauge and its application. -Use of calipers in marking out progress.	Handouts -Charts	-Vernier height gauge -Calipers -Surface gauge -Marking table.	2 hours

MAIN TOPIC	LESSON POINTS	AVAILABLE AT THE INSTITUTE MATERIAL	EQUIPMENT AND SPECIAL TOOLS	NO OF HOURS
DRILLING MACHINE TYPES AND PURPOSES	THEORY -Purpose of the machine. -Types of the machine i.e. i) Bench type ii) Piller type iii) Portable drilling machine. iv) Radial arm drilling machine. -Application of each type in comparison with the other. -Drill bits, type and material of drill sleeves and drift.	-Handouts	i) Drilling m/c in workshop. ii) Portable machine. iii) Parallel shank drill bit. iv) Tapered shank drill v) Drill sleeve vi) Drift. vii) Drill angle gauge.	2 hours
	-Drilling process i.e. relation between the hole diameter with the machine spindle speed in r.p.m. -Feed as the distance moved in per revolution of the spindle. -Drill bit lip angle and importance of equal lip length.	"	"	2 hours
GRINDING MACHINE TYPES AND PURPOSES	THEORY -Purpose of the machine -Types of the machine (i.e.) i) Bench type ii) Floor type iii) Angle grinder or portable grinding machine. -Grinding stones (wheels) types -Elementary theory on the wheel structure -Physical checks on the wheel as a daily service. -Grinding as an operation -Safety precautions during grinding. -Emphasis on the use of goggles, when grinding. -Use coolant when grinding tools.	Handouts and charts. -Charts	-Grinding machine in the workshop. -Grinding wheels. -Goggles and faceshield	2 hours

MAIN TOPIC	LESSON POINTS	AVAILABLE AT THE INSTITUTE MATERIAL	EQUIPMENT AND SPECIAL TOOLS	NO OF HOURS
F.T.G. METAL CUTTING & FILING (Drilling)	-Cutting metal with hacksaw -Correct application of hacksaw blade. -Filing two detums flat and square -Marking out from the detum edges as per drawing. -Cutting filing to size and shape -Further exercise on filing flat and square. -Selection of correct spindle speeds. -Fixing of the drill into the chuck -Setting work on machine table. -Drilling the hole to required accuracy	WORKING DRAWING	HAND TOOLS e.g. Files Hacksaw -Drilling machine Drill bits	6 hours
REAMING	PRACTICAL -Reaming as way of improving the surface of the hole. -Direction of reaming -Types of reamers -Selection of reamers -Safety precaution when drilling and reaming.		-Reaming -REamers	6 hours
TAPPING	PRACTICAL -Relation between tap size and drill size. -Reading of standard tapping table. -Correct method of tapping. -Use of lubricating oil when tapping.	WORKING DRAWING	- Taps -Tapwrench	2 hours

MAIN TOPIC	LESSON POINTS	AVAILABLE AT THE INSTITUTE: MATERIAL	EQUIPMENT AND SPECIAL TOOLS	NO OF HOURS
GRINDING	THEORY -Purpose -Tools that require -grinding such as:- i) Scriber ii) Centre punch iii) Chisels. iv) Cutting tools -Tool angles e.g. for the common bench tools as above. -Need for cooling when grinding the tools/ -Mention of hardening as a heat treatment that takes place when a ground tool is cooled	Charts & Handouts		2 hours
GRINDING	PRACTICAL -Grinding of common hand tools to correct angle. -holding of the tools on the tool rest of the grinding machine (correct method) -Cooling as grinding progresses. -Emphasis on the adherance to relevant safety precautions e.g. Use of protective goggles. -Sharpening of drill bits.		-Chisels -Scribers -Centre punch. -Safety goggles. -Drill angle gauge.	2 hours
ASSEMBLY FITTING	PROJECT WORK An exercise involving -Metal cutting -Filing -Drilling -reaming -Tapping -Chiseling.	-Mild steel bar 10x100mm 12x100mm		30 hours
			TOTAL	60 HOURS

PROJECT DP/KEN/87/009 - NYANZA PROVINCE - KENYA

IN-SERVICE TRAINING 1989

KIE/UNIDO TECHNICAL TRAINING - SKILL UPGRADING PROGRAMME

VENUE: KISUMU INDUSTRIAL TRAINING CENTRE

SKILL AREA: CARPENTRY AND JOINERY

ACTIVITIES: JOINERY, CARPENTRY, CABINET MAKING, WOOD MACHINIST

DURATION: 60 HOURS

MAIN TOPIC	LESSON POINTS	AVAILABLE AT THE INSTITUTE MATERIAL	EQUIPMENT AND SPECIAL TOOLS	NO OF HOURS
TECHNICAL DRAWINGS AND ITS APPLICATION	CIRCLES -Diameter -Cord -Segment -Quadrants -MOULDINGS: Ovolo Ogee Caveto etc	Drawing paper size A2 H pencil H pencil Errasor	Geometrical instruments	1 hour
	ORTHOGRAPIC PROJECTION -First angle -Third angle		Scale rule	
	SECTIONS: -Vertical -Horizontal	"		
	ISOMETRIC AND OBLIQUE PROJECTIONS	"		5 hours
WOOD-WORKING MACHINES Familiarisation and practice	THEORY -Dimension, rip and cross cut saws. -Band saws -Surface planer -Chain and chisel -Morticing machine -Selection blades -Molenting cutters -Operations involved -Wood turning lathe			5 hours

MAIN TOPIC	LESSON POINTS	AVAILABLE AT THE INSTITUTE MATERIAL	EQUIPMENT AND SPECIAL TOOLS	NO OF HOURS
USE AND CARE OF POWER HAND TOOLS	THEORY -Portable power tools -Drills -Planers -Saws -Sanders -Jig saws SAFETY-EMPHASISE the need to exercise great care when handling the above tools.			3 hours
ADVANCED JOINTS CONSTRUCTION	PRACTICAL -Setting out and lengthening joints. -Scraft joints -Hammer headed joints.	Timber		1 hour
WINDOW CONSTRUCTION	THEORY -Casement -Sash -Stiles -Transom -Mullion -Sill -Glazing bar -Head -Jamb - DESIGN AND CONSTRUCTION -Selection of timbers -Norminal sizes -Selection of shapes of timber -Joints used -Anti capillary grooves -Weatherings -Throatings -Drip grooves -Condensation grooves -Machine and manual preparation of timber.			3 hours

MAIN TOPIC	LESSON POINTS	AVAILABLE AT THE INSTITUTE MATERIAL	EQUIPMENT AND SPECIAL TOOLS	NO OF HOURS
WINDOW CONSTRUCTION	PRACTICAL Making a casement window with a fanlight	Timber Glue Butt hinges screws.	Machines Hand tools	5 hours
MARKING OF A JOINERY STAIR WITH LANDING	Setting out and CONSTRUCTION of a standard timber STAIRCASE as likely to be used in a domestic building	Timber Glue Nails Screws Sand paper.		5 hours
DOORS CONSTRUCTION	PRACTICAL Flush doors -Solid core - Skeleton core	Timber Plywood P.V.A. glue.		5 hours
FORMWORK CONSTRUCTION	Construction of formwork to insitu concrete staircase	-Plywood -Timber -Nails -Mould oil or white wash.		4 hours
	Construction of formwork to columns, beams and floor.			4 hours
ROOF CONSTRUCTION	THEORY Design and construction Setting out of roof bevels i.e. rafter, hip rafter, Jack rafter, purlin	-Drawing paper -B pencil -Errasor	Drawing instruments	1 hour
	PRACTICAL Construction of a model roof with a hipped, gable end and a valley.	-Timber -Plywood	Common hand tools	3 hours

MAIN TOPIC	LESSON POINTS	AVAILABLE AT THE INSTITUTE MATERIAL	EQUIPMENT AND SPECIAL TOOLS	NO OF HOURS
DOMESTIC FURNITURE	-Base units Wall units -Cupboards -Drawers -Table/Chairs -Built in cupboard and ward robes -Fixing veneers to prepared surfaces -Fixing of appropriate hardwares	Timber -P.V.A. glue -Contract adhesive -Formica -Butt hinges -Piano hinges -Cupboard locks -Tower bolts -Screws -Nails	Machines Hand tools	15 hours
			TOTAL	60 HRS

PROJECT DP/KEN/87/009 - NYANZA PROVINCE - KENYA

IN-SERVICE TRAINING 1989

KIE/UNIDO TECHNICAL TRAINING - SKILL UPGRADING PROGRAMME

VENUE: KISUMU INDUSTRIAL TRAINING CENTRE

SKILL AREA: WELDER GENERAL

ACTIVITIES: STEEL WINDOWS, DOORS, METAL BOXES, STEEL FURNITURE BICYCLESTANDS, CARRIERS, HYBS E.T.C.

DURATION: 60 HOURS

MAIN TOPIC	LESSON POINTS	AVAILABLE AT THE INSTITUTE		NO OF HOURS
		MATERIAL	EQUIPMENT AND SPECIAL TOOLS	
STRAIGHT BEADS	-Marking out -Straightening -Removal of burr -Current setting -Striking the arc. -Running the beads. -Electrode slope. -Chipping off slag. -Cooling workpiece -Removal of spatter	M/S plate or flat bar 6x100x300 mm. Electrodes Rutile Ø3.25mm and Ø4.0mm	-Welding Transformer -Hammer, anvil, steel rule or tape measure -Scriber wire brush -Chipping hammer -Hand shield -Hacksaw, file.	4 hours
SQUARE BUTT JOINT-FLAT POSITION	PRACTICAL -Joint preparation -Removal of rust burr. -Straightening the pieces -Tack welding -Welding procedures -Current setting -Arc length -Electrode angle -Removal of slag, and spatters.	-M/steel sheet 3x200x300mm 2 pieces. -Electrode Ø3.25mm and Ø2.25 mm.	-Welding Transformer, Hammer, anvil steel rule or tape measure, scriber, guillotin shears hand shield, and file, chipping hammer and wire brush.	4 hours
OUTSIDE CORNER JOINT-FLAT POSITION.	"	M/s flat bar 6x50x300mm 4 pieces each. Electrode rutile Ø3.25mm	Welding transformer, Hammer, square, anvil, tape measure or steel rule, hand shield scriber chipping hammer wire brush.	3 hours

MAIN TOPIC	LESSON POINTS	AVAILABLE AT THE INSTITUTE		NO OF HOURS
		MATERIAL	EQUIPMENT AND SPECIAL TOOLS	
FILLET WELD-VERTICAL DOWN/VERTICAL UP.	"	M/s flat bar 10x100x300mm = 1 pcs 10x50x300mm = 2 pcs Electrode Rutile Ø3.25mm and Ø4.0mm	"	3 hours
FILLET WELD FLAT POSITION	-Cutting workpieces -Straightening the pieces. -Removal of burr and rust. -Tuckwelding -Welding procedure -Starting and terminating the arc.	-Milasteel -Flat bar or plate 6x100x300 mm 1 pc. 6x50x300mm 2 pcs. Electrodes Rutile Ø3.25mm and 4.0mm.	-Welding transformer, -Hammer, anvil, steel rule, or tape measure scriber, Wirebrush, Chipping hammer Hand shield, Hack-saw and file	3 hours
LAP JOINT HORIZONTAL POSITION	"	Mild steel flat bar 6x50x300mm 3 pieces. Electrodes Rutile Ø3.25mm	"	3 hours
FILLET WELD HORIZONTAL POSITION	"	-1 piece 6x200x500mm plate 2 pieces pipe 2"x100mm 1 piece T-iron 1½ ins. 1 piece U-iron 2 ins.	"	3 hours
STRAIGHT BEADS	"	M/S PLATE 3mmx100mm x250mm Filler rod Ø2.6 or 2mm	"	3 hours

MAIN TOPIC	LESSON POINTS	AVAILABLE AT THE INSTITUTE MATERIAL	EQUIPMENT AND SPECIAL TOOLS	NO OF
OUTSIDE CORNER JOINT-FLAT POSITION WITHOUT FILLET WIR	-Preparatory work -Positioning the Plates -Adjusting the flame -Starting the molten pool -Using the correct motion -Testing the beads of completed weld.	-M/s steel sheet 1.5x250x40 mm	-Complete Oxy-acetylene Welding equipment goggles, wire brush, scribes bench sheets Spark eighter Hammer, anvil, Square, longs or pliers.	3 hours
BUTT JOINT (BUTT WELDING)	"	M/s sheet 1.5x100x250 mm Filler rod Ø2.0mm	"	3 hours
LAP JOINT LAP WELDING FILLET WELD	PRACTICAL -Joint preparation -Positioning the plates. -Adjusting the flame -Adding filler rod to the puddle. -Controlling the puddle. -Beads uniformity -Checking weld. smoothness. -Testing the weld beads.	-M/s sheet 4mmx50x200 mm - 2 pcs -Filler rod Ø2.0-2.6mm	-Complete gas welding Equipment goggles, Spark-lighter long or pliers Hammer, scriber shears, anvil	5 hours
PROJECT WORK	Making of typical exercise relevant to the client's product.	-To be provided.	Available at Centre.	6 hours

MAIN TOPIC	LESSON POINTS	AVAILABLE AT THE INSTITUTE MATERIAL	EQUIPMENT AND SPECIAL TOOLS	NO OF HOURS
BRAZING LAP joints. BRAZING FILLET JOINTS	PRACTICAL - Joint preparation -Cleaning the bevelled edges -Positioning the plates. -Adjustment t -Adjusting the flame -Heating end of bronze rod Heating end of plates. -Melting, flux into joint. -Placing rod into flame -Controlling width of beads. -Testing the brazed joint.	-M/s sheet 2x100x250mm Bronze rod Ø1.6 and Ø2.0mm Brazing flux	Complete Oxy-acetylene Welding equipment (set) goggles, scriber, bench shears, long or pliers Hammer, spark lighter.	6 hours
BRAZING CAST IRON	"	Broken pieces of cast iron Bronze rod Ø2mm Brazing flux.	"	3 hours
SAFETY (ARC WELDING)	THEORY -General safety -Safe use of welding -welding equipment. -Personal safety -Hazard to sight -Electric shock -Ventilation -Special welding -conditions. -Weather conditions -Repairing tanks and vessels which contain flammable materials.	-Charts, chalkboard handouts	-Welding skills and practice by WEEKS The science and practice of welding by DAVIS ITB Books	2 hours
METAL ARC WELDING	THEORY -Fusion welding -Power and voltage -Current and volatage control -Methods of striking Selection of current Defects in Butt and fillet welds.	"	"	2 hours

MAIN TOPIC	LESSON POINTS	AVAILABLE AT THE INSTITUTE MATERIAL	EQUIPMENT AND SPECIAL TOOLS	NO OF HOURS
BRAZING PROCESSES	THEORY -Definition -Advantages -Fluxes -Basic procedure and safety.	-Chalkboard -Handouts -Wall charts	Basic fundamentals of Oxy-acetylene welding by RONALD J. BAIRD	2 hours
OXY-ACETYLENE WELDING)GAS WELDING)	THEORY -Safety in welding -Gases used in welding -Welding torches -Welding torchtips -Operation of welding equipment -Welding flame -Welding symbols.	"	"	2 hours
			TOTAL	60 hours

PROJECT DP/KEN/87/009 - NYANZA PROVINCE - KENYA

IN-SERVICE TRAINING 1989

KIE/UNIDO TECHNICAL TRAINING - SKILL UPGRADING PROGRAMME

VENUE: KISUMU INDUSTRIAL TRAINING CENTRE

SKILL AREA: TINSMITH

ACTIVITIES: WATER TANK PALES, GUTTERS, DOWN PIPES KARAYAS, JIKOS. E.T.C.

DURATION: 60 HOURS

MAIN TOPIC	LESSON POINTS	AVAILABLE AT THE INSTITUTE MATERIAL	AVAILABLE AT THE INSTITUTE EQUIPMENT AND SPECIAL TOOLS	NO OF HOURS
1. TECHNICAL DRAWING AND APPLICATION	DEVELOPMENT OF GEOMETRICAL SHAPES SUCH AS: (i) Water tank (ii) Pails (iii) Boxes (iv) Down pipes etc	DRAWING PAPER SIZE A2 -"H" pencils -Erasor	GEOMENTRICAL INSTRUMENT -Pair of scissors -Packet of marking pens	10 hours
TINSMITH RIVETING	THEORY -Types of rivets ie shape of rivet heads. -Application of each type. -Selection of rivet size. -Relation between rivet dia and the hole to be drilled. -Rivet material and their application. -Relation between rivet dia and the thickness of plate -Spacing of rivets. -Riveting tools and their application.	-Samples of different rivets (i) snap head. (ii) Counter sunk head. iii) Flat head. iv) Pan head v) Pop rivet. -Relation between rivet.	-Different reveting tools including poping tools	
RIVETING	PRACTICAL -Considering of rivet diameter in relation with the plate thickness -Marking of hole positions on the plate.	i) Adequate number of rivets.	-Riveting tools. -Drills	

MAIN TOPIC	LESSON POINT	AVAILABLE AT THE INSTITUTE: MATERIAL	AVAILABLE AT THE INSTITUTE: EQUIPMENT AND SPECIAL TOOLS	NO OF HOURS
Cont.	PRACTICAL -Drilling of the holes with the correct size of drill. -Correct procedure of carrying out riveting exercise -Emphasis on correct use of tools to form correct rivet head. -Typical exercise/ project relevant to the clients products i.e. making a neat and strong jiko by riveting only.	ii) M/s plate of the desired thick-	-Hammers -Scissors -Shearing m/c.	15 hours
SOLDERING	THEORY -Soldering as compared to other methods of making joints. -Different kinds of solder . i) Soft solder (ii) Hard solder. -Composition of these categories of solder. -Application of these solders i.e. (i) Electricians solder ii) Tinmans solder iii) Plumbers solder -Melting temperatures -Soldering flux and purpose. -Different kinds of soldering flux. -Advantages of each flux over the other. -Other mechanical methods cleaning the surface before soldering. -Consideration of grades of G.I. sheet.	i) Soldering fluxes of different kinds. ii) Solders of different composition. iii) Relevant charts outs.	Hand file	2 hours

MAIN TOPIC	LESSON POINT	AVAILABLE AT THE INSTITUTE		NO OF HOURS
		MATERIAL	EQUIPMENT AND SPECIAL TOOLS	
SOLDERING JOINTS	**THEORY** -Methods of soldering -Soldering tools and methods of heating -Types of soldered joints (i) Flush butt joint (ii) Lap joint. (iii) Flush lap joint iv) Grooved joint -Comparison of the strengths of these joints. -Seating as a method of soldering. -Advantage of "Sweated" joint as compared to other soldered joints. -Hand soldering. -Silver soldering -Soft silver solders -Brazing as compared to soldering. -Temperature of brasing -Types of brazed joint.	i) Soldering bits. ii) Relevant charts.	Grooving tools Hammers (soft & steel)	2 hours
	PRACTICAL -Consideration of the joint to be made. -Preparing of the surface to be soldered and making a flush butt joint. -Starting the heating equipment and heating the soldering iron to the correct temperation. -Determination of the correct temperature through visual observation of the colour of the iron. i) Soldering to produce a neat and strong lap joint.	-G.I. sheet -Soldering flux	Below lamp or open fire.	

TOTAL 60 hours

Cont.

MAIN TOPIC	LESSON POINTS	AVAILABLE AT THE INSTITUTION		NO OF HOURS
		MATERIAL	EQUIPMENT AND SPECIAL TOOLS	
SOLDERING	PRACTICAL ii) Soldering to produce a neat strong lap joint. (iii) Flush lap joint. -Preparation of the material to allow for flush lap joint. -Soldering to produce the joint neat and strong.			
(iv) Grooved joint.	-Prepare the material -making proper grooved joint using grooving tool. -Soldering the grooved joint to produce neat and strong joint.	-G.I. -Flux -Solders	Scissors -Soldering iron -Grooving tool. -Heating equipment. -Hammers (Soft & Steel) e.t.c.	14 hours
PROJECT WORK	-Making of typical exercise relevant to the products of the clients e.g. i) Pale ii) Down pipe iii) Metal box	TO BE PROVIDED -G.I. sheet -Solders -Flux	AVAILABLE -Grooving tool -Scissors -Scribers -Ruler -Dividers -Soft hammer -Steel hammer. -Soldering iron	17 hours
			TOTAL	60 hours

PROJECT DP/KEN/87/009 - NYANZA PROVINCE - KENYA

IN-SERVICE TRAINING 1989

KIE/UNIDO TECHNICAL TRAINING - SKILL UPGRADING PROGRAMME

VENUE: KISUMU INDUSTRIAL TRAINING CENTRE

SKILL AREA - AUTOMOTIVE ENGINEERING

ACTIVITIES: MAINTENANCE, REPAIRS AND SERVICE OF PETROL AND DIESEL AUTOMOBILES

DURATION: 60HOURS

	MAIN TOPIC	LESSON POINTS	AVAILABLE AT THE INSTITUTE		NO OF HOURS
			MATERIAL	EQUIPMENT AND SPECIAL TOOLS	
1.	Petrol ENGINE overhaul, assembly and test	THEORY Main parts and working principles -Cycle of operations -Engine components -Valve and ignition timing. -Combustion chambers -Multi-cylinder engines.		Complete petrol engine	3 hours
		PRACTICAL -Examination of different types of engines. -Valve lapping -Piston and crankshaft measurement -Cylinder bore measurement -Bearing clearance	Petrol Grinding paste Engine oil.	-Micrometers -Dial gauge -Torque wrench -Valve lappers -Plastic gauge	8 hours
2.	The fuel SYSTEM for petrol engine.	THEORY -Fuel supply system -The functions of a carburettor -Starting from cold -Air cleaners -Inlet manifolds -Fuel pumps.		-Carburettor -Fuel pump	
		- PRACTICAL Dismantling, overhauling and assembling petrol pumps and carburettors.	Petrol	Hand tools	2 hours

	MAIN TOPIC	LESSON POINTS	AVAILABLE AT THE INSTITUTE		NO OF HOURS
			MATERIAL	EQUIPMENT AND SPECIAL TOOLS	
6.	Clutches Dismantling testing, assembly and adjustment	THEORY -The purpose of the clutch -Single plate clutch -Multi-plate clutch -Pressure plate.		Clutch plate and pressure plate.	1 hour
		PRACTICAL Dismantling, examination and assembly of a single dry plate friction clutch	-Petrol -Sand paper	Hand tools	2 hours
7.	Gearboxes Dismantling inspection assembly and test.	THEORY -The purpose of the gearbox -Sliding mesh gearbox. -Constant mesh gearbox -Synchromesh gearbox -Over drive.		Gearboxes	2 hours
		PRACTICAL -Dismantling, examination and assembly of various types of gearboxes	Petrol Oil gearbox	Hand tools	4 hours
8.	Rear axles Dismantling Inspection, assembly and test.	THEORY -Final drive gears -The differential -Axle construction -Live and dead axle.		Rear axle	1 hour
		PRACTICAL -Dismantling, examination and assembly of convectional rear axle.	-Petrol -Rear axle oil.	Hand tools	4 hours

	MAIN TOPIC	LESSON POINTS	AVAILABLE AT THE INSTITUTE		NO OF HOURS
			MATERIAL	EQUIPMENT AND SPECIAL TOOLS	
2.		PRACTICAL -Cleaning air cleaner.			
3.	The cooling system for petrol/ Diesel engine.	THEORY -The function of the cooling system -Water cooling and air cooling system -Water pumps -Radiators.		-Water pump -Radiator	2 hours
		PRACTICAL -Testing pressurized cooling system. -Testing radiators -Testing radiator pressure cap.		-Radiator and pressure cap tester.	2 hours.
4.	Engine lubrication system petrol/ Diesel	THEORY -Properties of lubricants. -The lubrication system. -Oil pumps and filters.		-Oil pump -Oil filter	2 hours.
		PRACTICAL -Dismantling, inspecting, assembling and testing an oil pump. -Servicing oil filters	-Petrol	Oil pump	2 hours
5.	Diesel engines, overhaul assembly and test	THEORY -Cycle of operation -Combustion chambers -Injection pumps -Injectors -Governors.		Injection pump	2 hours
		PRACTICAL -Dismantling, inspection, assembly and running adjustments of diesel engine	-Petrol -Kerosene -engine oil	-Micrometers -cylinder gauge. -Torque wrench	7 hours

	MAIN TOPIC	LESSON POINTS	AVAILABLE AT THE INSTITUTE: MATERIAL	AVAILABLE AT THE INSTITUTE: EQUIPMENT AND SPECIAL TOOLS	NO OF HOURS
9.	Steering system Dismantling inspection, assembly and test.	THEORY -Steering components -Camber, castor and king pin inclination.		Camber, castor gauges	2 hours
		PRACTICAL -Dismantling, examination and assembly of various types of steering gears. -Checking wheel alignment, camber Castor and KPI.	Petrol Rear axle oil.	Camber castor KPI gauge.	2 hours
10.	Brakes Overhauling inspection, assembly, adjustment and test.	THEORY -Overhauling, examination of braking system.	-Brake fluid		4 hours
		PRACTICAL -Simple braking system -Mechanical brakes -Hydraulic brakes -Vacuum servo operated.		Brake models	2 hours
11.	Basic Electrical wiring and trouble sketching exercise	THEORY -General layout -Basic electrical parts.		Electrical parts	2 hours
		PRACTICAL Examination of vehicle electrical components.		Alternators Starter motor	4 hours
				TOTAL	60 HOURS

PROJECT DP/KEN/87/009 - NYANZA PROVINCE - KENYA

IN-SERVICE TRAINING 1989

KIE/UNIDO TECHNICAL TRAINING - SKILL UPGRADING PROGRAMME

VENUE: RAMOGI INSTITUTE OF ADVANCE TECHNOLOGY

SKILL AREA : TAILORING/DRESSMAKING

ACTIVITIES: DESIGNING, GARMENT MAKING, PATTERN DRAFTING AND EQUIPMENT MAINTENANCE

DURATION: 60 HOURS

SUBJECT	MAIN TOPIC	PROVIDED AS MATERIALS	AT PAGE 27 MACHINES/TOOLS	NO OF HRS
EQUIPMENT MAINTENANCE	THOERY Part of standard manual and electric sewing machines	Instruct-ional manual blackboard chalk paper pen ruler coloured pencils.	Standard sewing machine Manual and electrical	1hr.
INTRODUCTION TO THE ELEMENTARY CONCEPT OF ac AND dc SUPPLY SAFETY PRECAUTIONS	" Instructional manual of sewing machine	Blackboard		1hr.
	PRACTICAL Cleaning oiling of the standard sewing machine and zig-zag sewing machine. Knee lifter position Important spots for oiling.	Sewing machine oil.	Standard sewing machines brush and one screw driver wide, small 1 screw driver small. Waste materials.	1 hr.

SUBJECT	MAIN TOPIC	PROVIDED AS AT PAGE 27 MATERIALS	MACHINE/TOOLS	NO OF hrs
	Cleaning and oiling Overlock Needle setting straight zig-zag Threading of machines	Overlock Zig-zag machine needles for overlock and zig-zag machine pins Sewing machine oil.	Overlock (Baby lock) Zig-zag sewing machine. 1 brush 1 tweezer	1 hr.
DESIGN	4 ELEMENTS: COLOUR TEXTURE STRUCTURAL LINE DETAIL Introduction-meaning of each of them.	Coloured Blackboard chalk. Pencil + rubber Coloured pencils. Plain paper.	Blackboard	2½ hrs.
	-The effect of fabric texture -Matching of accessory colour to garment colour	Fabric samples Combined printed tarted with plain materials for belt, scarfs	Blackboard	2½ hrs.
GARMENT MAKING DETAIL MAKING	Threading of the machine Control of tension seans Normal Topstiched French Flat folded Self finished. Bias bound Piped Slot S. 1 Slot S. 2	Thread,white Tailor's chalk set square calico ginger (coloured calico for bias binding (Green)	Standard sewing machine. iron boxes scissors thimble Tape measure Pins.	21 hrs.

SUBJECT	MAIN TOPIC	PROVIDED AS AT PAGE 27 MATERIALS	MACHINE/TOOLS	NO. OF HOURS
	EDGE-PIPING SMALL FINISHING - -Roundings corners with cording. -Facing to W.S. -Facing to R.S. (Topstiched) corner V-shape.	Thread, white Tailors chalk Set square Calico Ginger (coloured calico)	Standard sewing machine Iron boxes Scissors Thimble 2 hand sewing needles Tapemeasure Pins.	4 HRS
	BUTTON HOLES: HANDWORKED: Bartack rounding BOUND BUTTON HOLE	Material Tailor's chalk Thread Interfacing Material	Beewax Punch pliers/ sewing machine Scissors Iron box 2 hand sewing needles Tape measure	1½HRS
GARMENT MARKING DETAIL MAKING	POCKETS: -IN SEAM POCKET Separate. -IN SEAM POCKET Extend. facing -PATH POCKET -Round shaped -Corner with pleat. -SINGLE PIPED POCKET - 2 methods -DOUBLE PIPED POCKET - 2 methods	-Pocket patterns -Materials Pocket lining -Interfacing Thread	Sewing machine Iron box Tailor's chalk Set square Tape measure 2 hand sewing needles Scissors Pins - pincushion	2 HRS 2 HRS 2 HRS
GARMENT MAKING	THEORY SEAMS: Where to use which kind of seam	-Paper -Pencil, rubber coloured pencils -ruler	-Blackboard -Blackboard chalk	1 HR

SUBJECT	MAIN TOPIC	PROVIDED AS AT PAGE 27 MATERIAL	MACHINE/TOOLS	NO OF HOURS
	EDGE FINISHING CORNERS CURVES	Paper Pencil, rubber Coloured pencils Ruler.	-Blackboard Blackboard chalk	1 HR
	MAKING CUTTING PRESSING	Thread Material	Ruler Set square Hand sewing needles Scissors Tailor's chalk Tracing wheel paper.	1½ HR
GARMENT -FULL GARMENT	PRACTICAL To the choice of the candidate -Joining together of garment parts -Collar & cuft inserting	Material Interfacing Lining Pocket lining	Sewing machines Iron boxes Ironing board-sleeve board Tailor's ham Tape measure big french curve Pins - pincushion Scissors/ Tailor's chalk	10 HRS
PATTERN DRAFTING	HOW TO TAKE MEASUREMENTS BASIC SKIRT BLOCK Developing to flared skirt panel skirt Skirt with pleat INDUSTRIAL PROJECT DEVELOPED BY TRAINEES	1 Roll of brown paper Plain papers 1/4 scales Set square-ruler Tracing wheel pencils, rubber Sallo tape Office glue	Tape measure Blackboard Blackboard ruler " set square " chalk	1 HR 1 HR 2 HRS 1 HR TO BE EXTENDED AS NECESSARY
			TOTAL	60 HRS

EQUIPMENT, TOOLS AND MATERIAL

1. TRAINEES TO BRING	2. RIAT TO PROVIDE	3. SPONSER TO PROVIDE
CUTTING SHEARS tape Measure THIMBLE (Middle finger)	WORKSHOP: Sewing Machines Ironing boxes Cutting tables Chairs TOOLS: SET SQUARES TRACING WHEELS BLACKBOARD RULER " SET SQUARE CONSUMABLE: ELECTRICITY SEWING MACHINE OIL.	STATIONERY 5m interfacing 10m training material CALICO 10 NO treads cotton, white middle. 30m material, plain 10 No threads, matching the c of f. 15 No. threads for special machines 10 No tailor's chalk white. 1 roll of brown paper. 2 boxes of pins Hand sewing needles Machine needles 10 No Cardboard sheets.

PROJECT DP/KEN/87/009 - NYANZA PROVINCE - KENYA

IN-SERVICE TRAINING 1989

KIE/UNIDO - SKILL DEVELOPMENT AND UPGRADING

VENUE: KIAMBU INSTITUTE OF SCIENCE AND TECHNOLOGY

SKILL AREA: BAKING TECHNOLOGY

ACTIVITIES: BAKING AND MANAGING A BAKERY ENTERPRISE

DURATION: 2 WEEKS

TOPICS TO BE COVERED

BAKING TECHNOLOGY

1. BAKING PRINCIPLES

- 1.1 Straight dough method
- 1.2 Sponge and dough method
- 1.3. Kenya sponge and dough method
- 1.4 The fermentation process
- 1.5 Scaling and weights
- 1.6 Proofing time and dough handling
- 1.7 The baking process.

2. RECIPES

- 2.1 Buns
  - 2.1.1 Buns, straight dough
  - 2.1.2 Buns, sponge and dough
- 2.2 Brown bread
- 2.3 White bread
  - 2.3.1 Ordinary white bread
  - 2.3.2 Oven bottom
  - 2.3.3 Plaited bread
- 2.4 Powder earated goods
  - 2.4.1 Rock cakes
  - 2.4.2 Rasp-berry buns
  - 2.4.3 Victoria scones
- 2.5 Cake
  - 2.5.1 Cake, general
  - 2.5.2 Cake, cheaper
  - 2.5.3 Causes, faults
- 2.6 Puff pastry
  - 2.6.1 French method
  - 2.6.2 Meatpies
  - 2.6.3 Jam turnovers
  - 2.6.4 Fault, causes

3. SIMPLE CALCULATIONS

   3.1 Bread recipes
   3.2 Confectionery recipes
   3.3 Ovens

4. BREADTINS

5. CHARACTERISTICS OF GOOD BREAD

   5.1 Bread faults

OTHERS

Standard baking procedures
Product diversification
Product planning and factory lay-out
Internal controls
Distribution
Maintenance
Any other according to the individual needs.

ANNEXURE 3

SKILL UPGRADING
SHOE MAKING, REPAIR
AND FOOTWEAR DESIGNING

DP/KEN/87/009

PREFACE

UNDP/UNIDO Project KEN/87/009 was designed to provide Technical Support for Small Industries/Micro Enterprises assisted by the Kenya Industrial Estates Ltd. in Nyanza Province.

One of the objectives of the project being to meet the training needs of the K.I.E. Clients, the UNIDO Team in Kisumu along with the K.I.E. Regional Staff developed and conducted skill upgrading Technical Courses covering several of the activities promoted by K.I.E. in the Nyanza Province.

Training courses to upgrade skills of K.I.E. Clients engaged in shoe making and repair programme. Since suitable workshop facilities and expertise were not available within Nyanza Province for the purpose, arrangements were made with the Kenya Industrial Training Institute (KITI) a Kenya Government owned Institution at Nakuru, about 200 km. from Kisumu to undertake the training.

Taking note that KIE clients engaged in this activity are mainly from the Informal Sector carrying out their industry in the traditional method, and observing the level of technology applied by them, the training was directed to:-

a) Impart theory and practical technical knowledge to help gain appreciation of the scope for modernisation of the industry, when it is supported by appropriate training to upgrade skills.

b) Emphasise the importance of designing and pattern making in manufacturing of new shoes.

c) Improve the quality of repair services.

Trainees provided by KIE's Nakuru Office were included and on request an employee from Jayland Special School for Criples in Kisumu was given special training in the repair of surgical leather footwear for use by the inmates of the school.

An additional, if not special feature of this programme was the participation of a Woman Entrepreneur, owner/manager actively engaged in making and repairing shoes in a project promoted by KIE in Kisii District of Nyanza Province.

The training topics covered in the two residential courses - each of two weeks duration held at KITI Nakuru, and one follow up course at Kisumu for three days are presented in this document along with'Hand Out' reflecting the intensive training on'Mocassin Shoe' construction/ pattern making which was given at the follow up course in Kisumu.

UNDP/UNIDO PROJECT

DP/KEN/87/009

KENYA

TRAINING COURSES FOR K.I.E. CLIENTS

SKILL UPGRADING

SHOE MAKING, REPAIR AND FOOTWEAR DESIGNING

INTENSIVE TRAINING

MOCASSIN SHOE CONSTRUCTION/PATTERN MAKING

MARCH AND AUGUST, 1990

TRAINING TOPICS COVERED

Shoe Repair

Sequence of operations

Footwear Designing

Sequence of operations

Pattern Making

Marking the last

The Insole Pattern

Out Sole Pattern

The slotted Forme

Mean Forme

Mens Shoe Standard and Sections

Oxford Shoe Sections

Derby Shoe Sections

Monk Shoe Sections

Chukka Boot - Standard and Sections

Ankle Boot - Standard and Sections

Ladies High Leg Boot Standard and Sections

Pattern Making

(Mocassin Shoe Construction) Hand out attached

Notes on Sewing Machine Operations

List of Shoe Making Tools

Maintenance of Records/Book keeping with practical application to shoe making/repair services.

KIE/UNIDO ENTERPRENEUR TRAINING 1990.

NYANZA REGION.

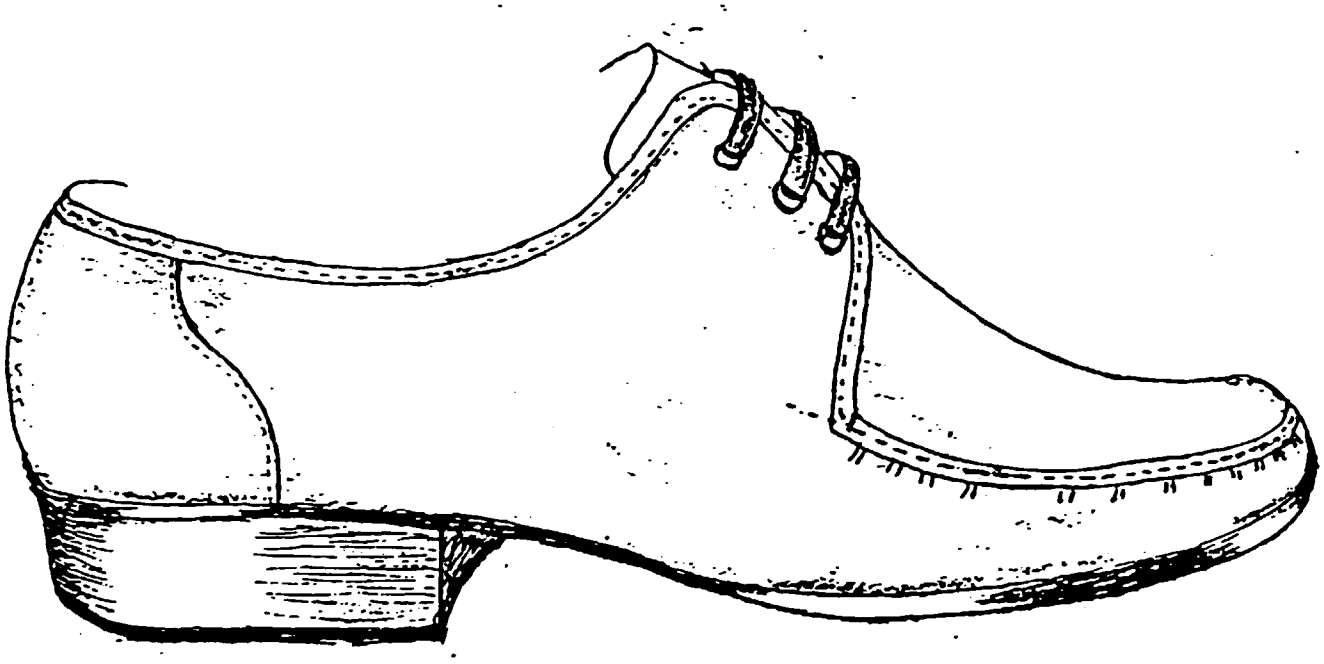
SKILL UP-GRADING COURSE IN SHOEMAKING I REPA

FOLLOW-UP AT KISUMU - AUGUST 1990.

MOCCASIN SHOE CONSTRUCTION.

PATTERN MAKING.

MOCCASIN SHOE



The most waterproof type of shoe construction

Light in weight.

Easy to manufacture.

Cheap to produce.

Always in fashion.

BY JONATHAN D. MBIARI
TRAINING INSTRUCTOR

FESTUS KINYUA
INSTRUCTOR.

KIE / UNIDO ENTERPRENEUR TRAINING 1990.

NYANZA REGION

SKILL UP-GRADING COURSE IN SHOEMAKING & REPAIR

FOLLOW-UP AT KISUMU - AUGUST 1990.

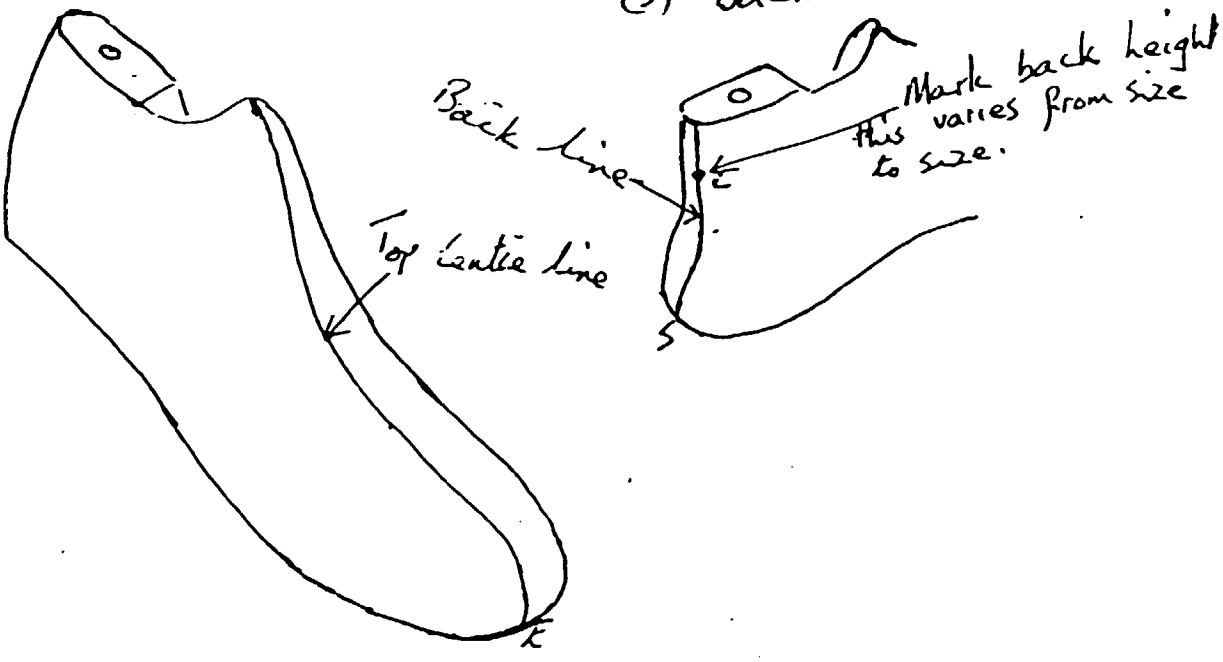
MOCCASIN SHOE CONSTRUCTION

PATTERN MAKING.

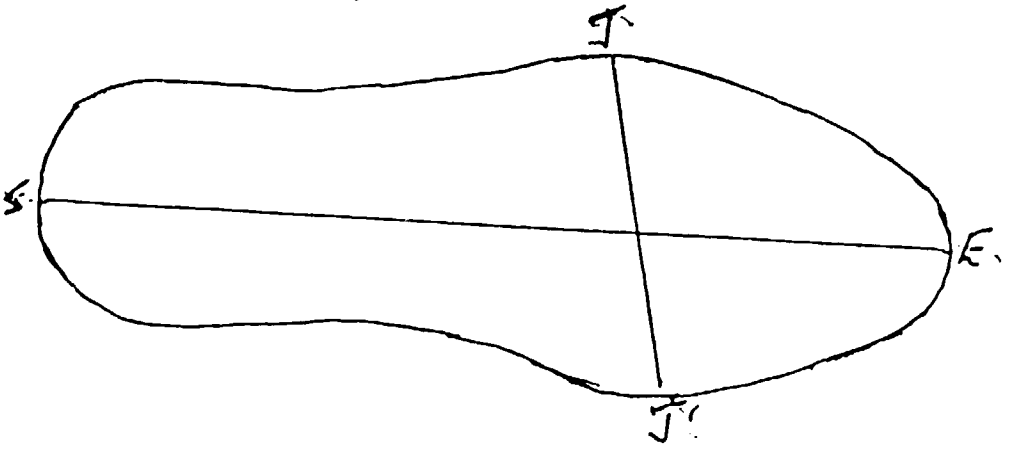
1. LAST MARKING

(a) Top Centre line.

(b) Back line.

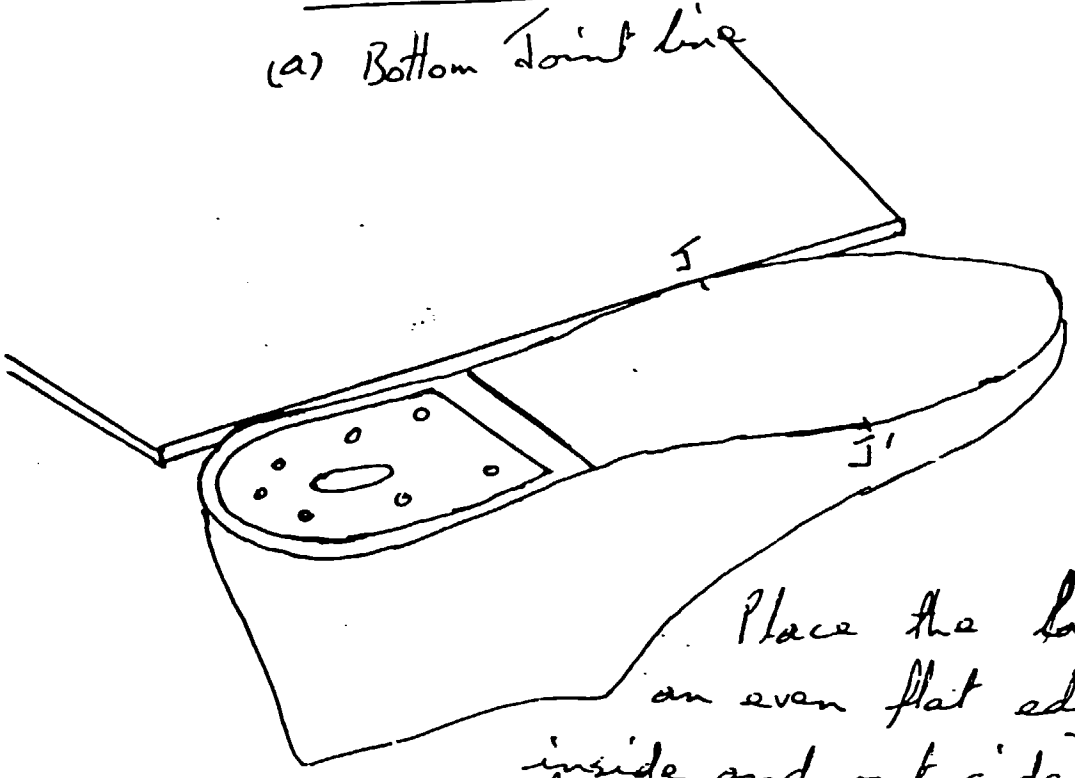


(c) Bottom Marking



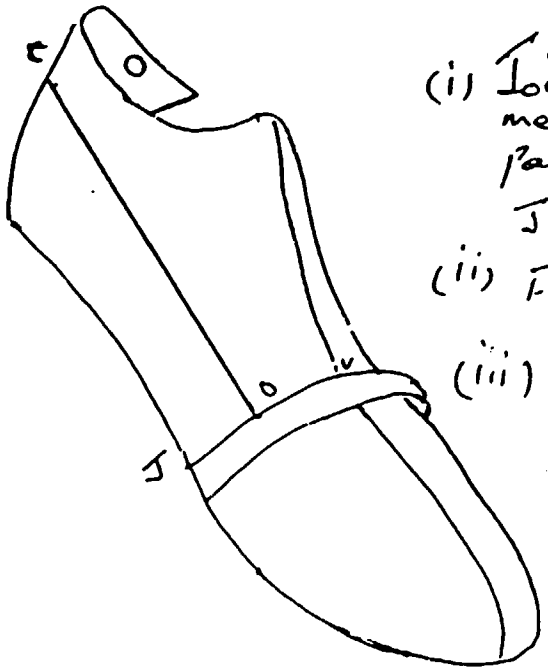
2. Joint line

(a) Bottom Joint line



Place the last against an even flat edge of both inside and out side edge of the last and mark the two points J and J' that touch the flat edg

(b) Top Joint line

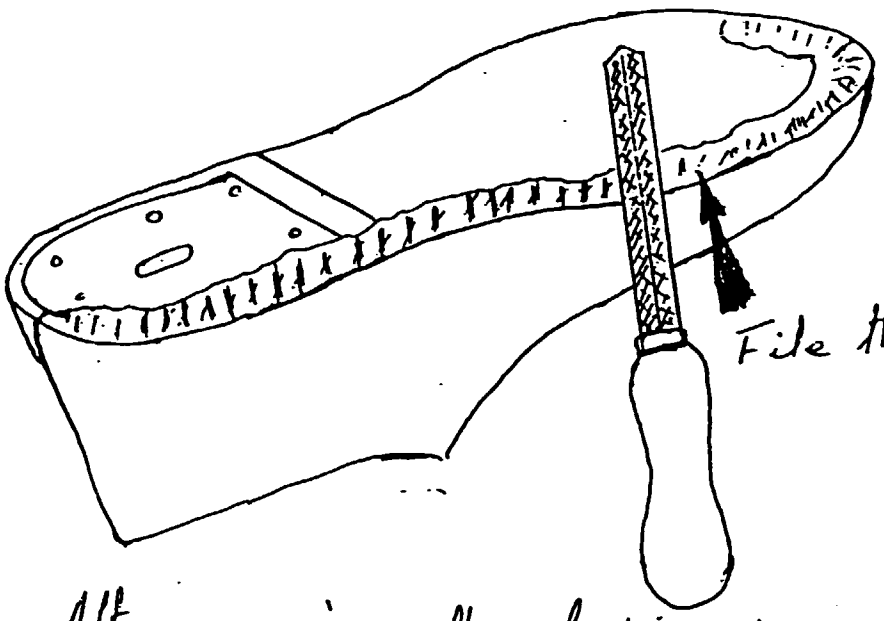


(i) Join the two points by means of a straight strip of Paper and draw the line JV.

(ii) Find the point O = ½ JV.

(iii) Join CO.

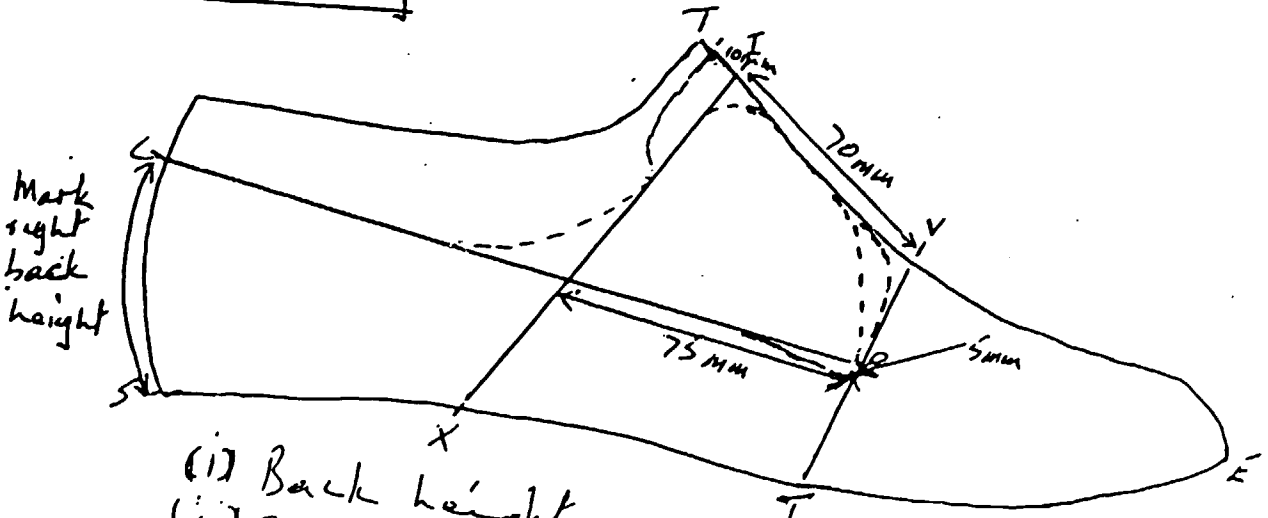
3. Last Blocking.



File this way only.

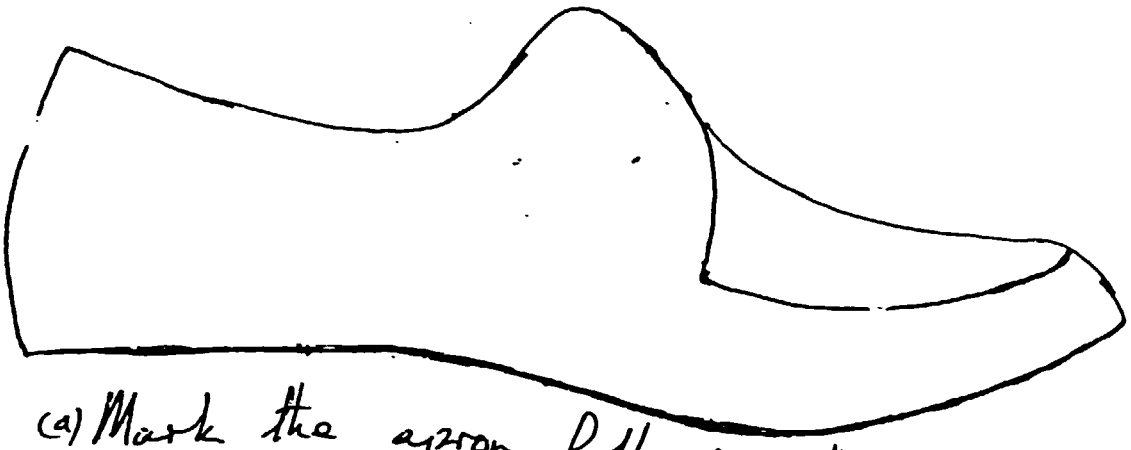
After covering the last with a masking tape remove the excess material of the tape on the bottom edge of the last using a file with a forward filling movements.

4. Quarter Marking.



(i) Back height SC.
(ii) Quarter Tondline JV.
(iii) Quarter Waist line XI.

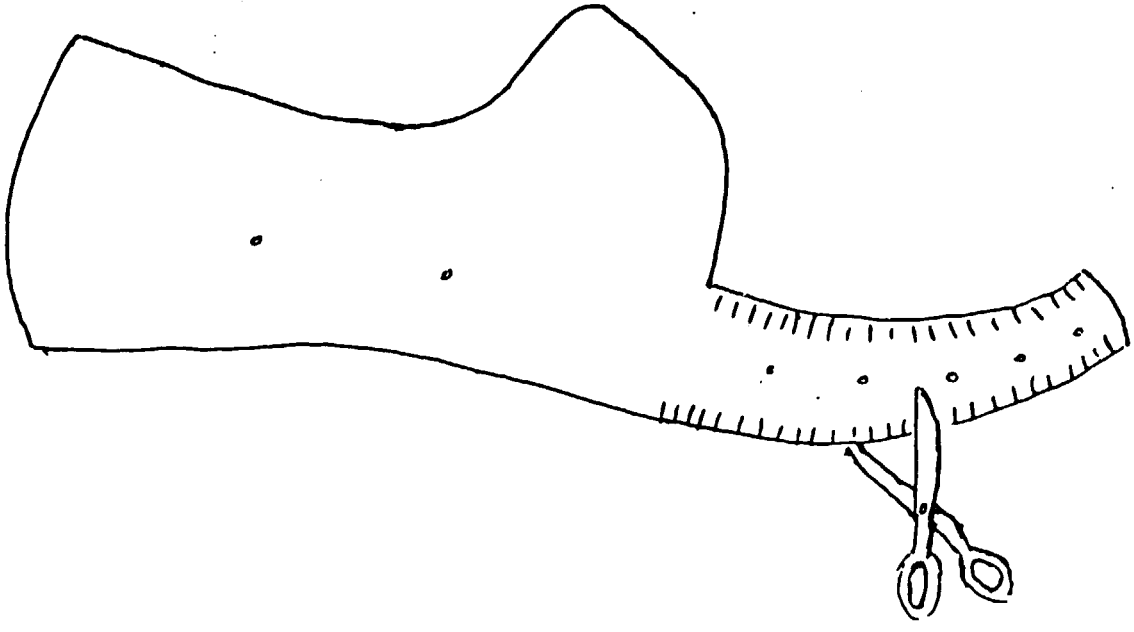
5 Apron Marking



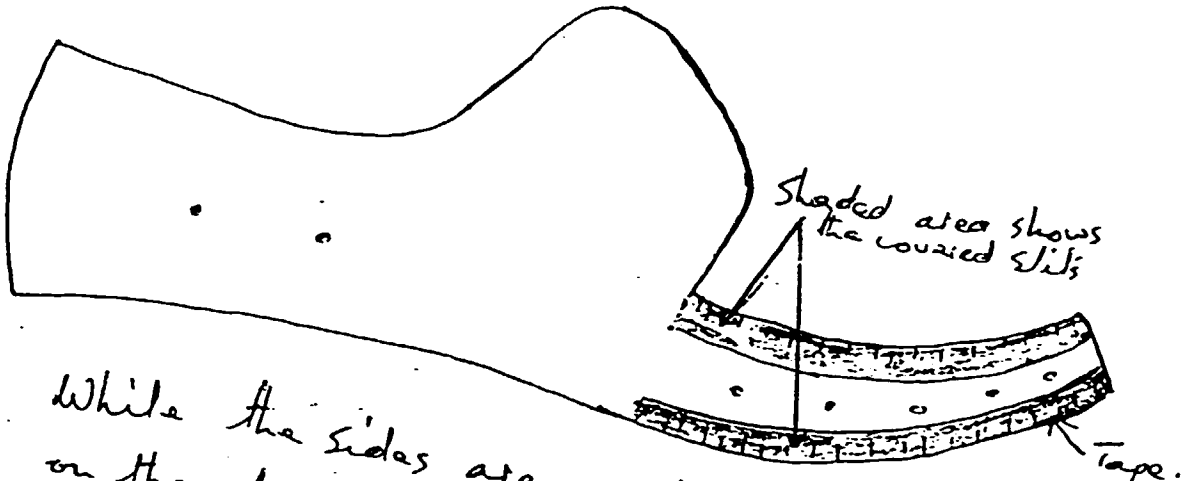
(a) Mark the apron following the last contours on the at the top fore part.
(b) Cut the blocking tape sections.

6. Pattern Sections

(a) Remove blocking tape sections and stick the on manila paper and cut.
(b) Restick the side sections using small tacks and slit the pattern with scissors.



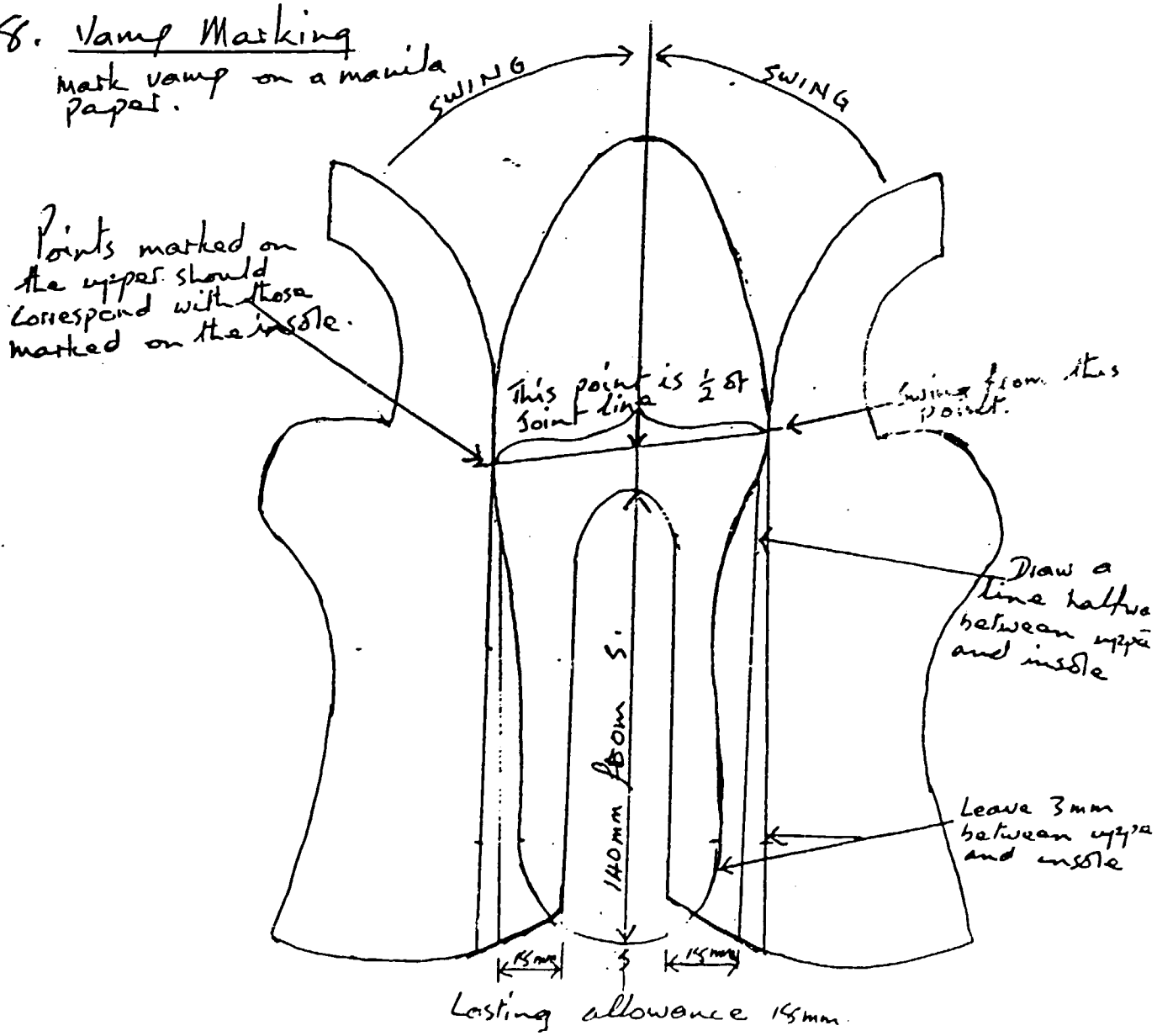
7. Folding the sides



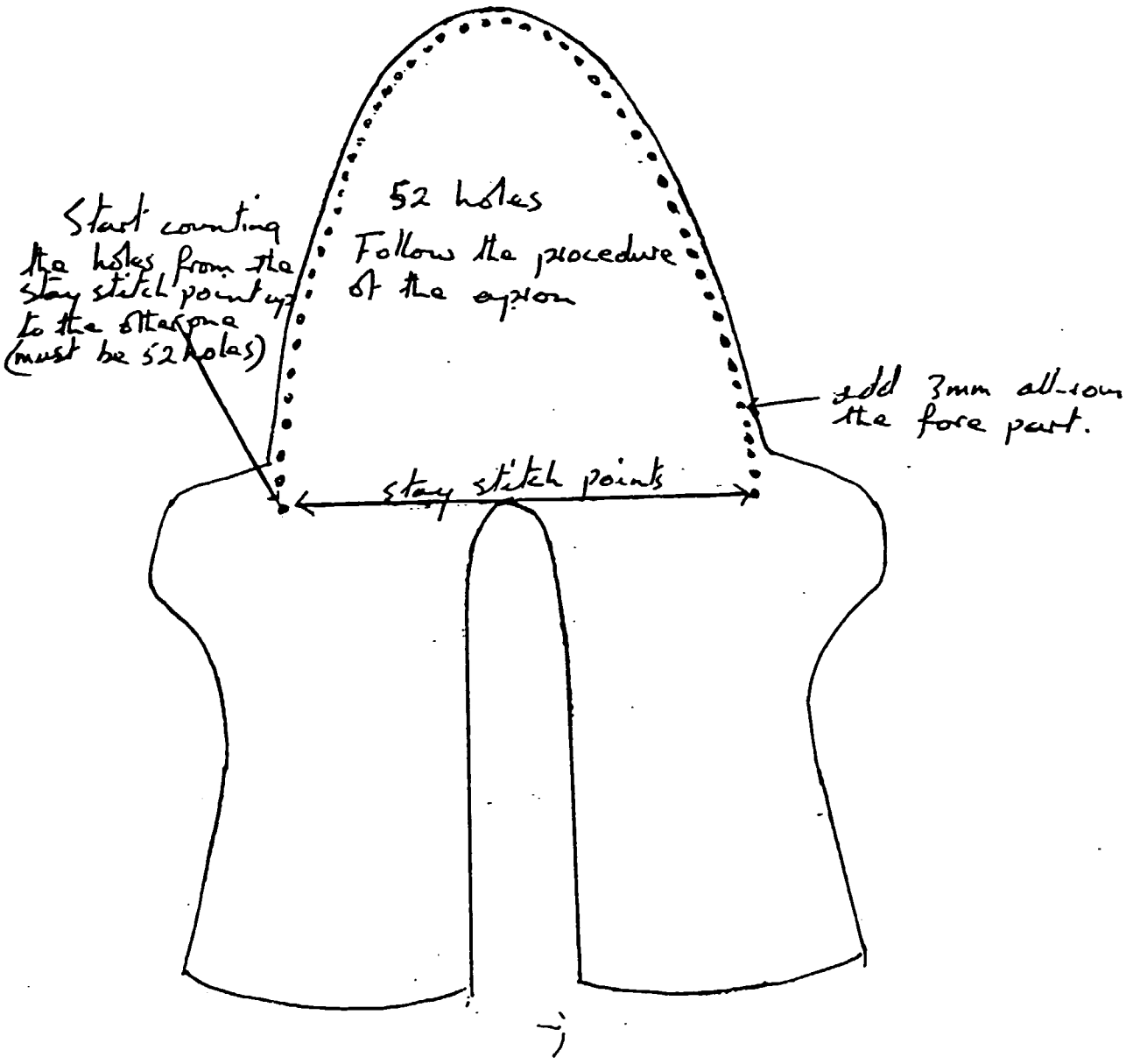
While the sides are on the last press them on the last to lay flat on the last and cover with a tape.

8. Vamp Marking

Mark vamp on a manila paper.



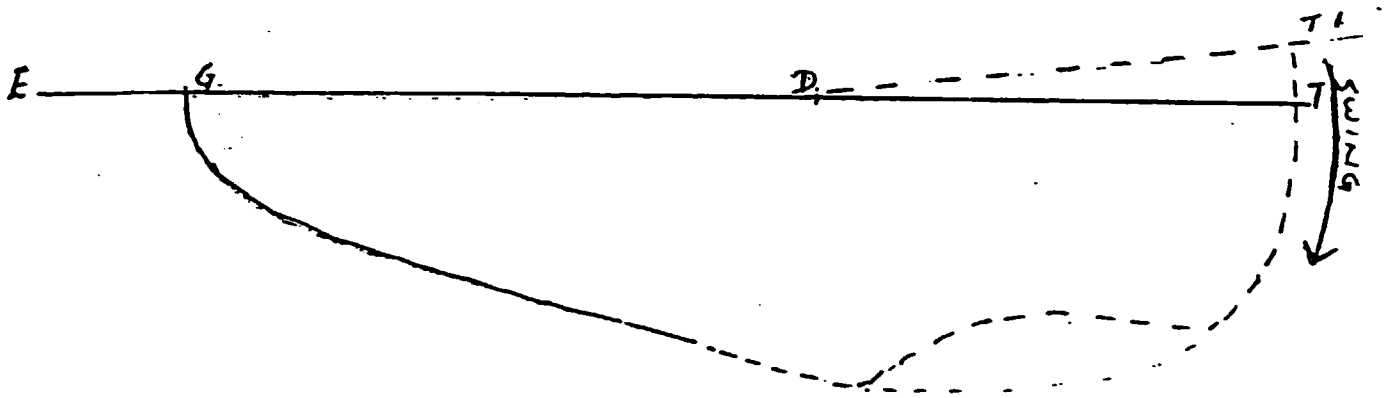
9. Vamp holes.


52 holes
Follow the procedure of the apron
Start counting the holes from the stay stitch point up to the other one (must be 52 holes)
add 3mm all-round the fore part.
stay stitch points

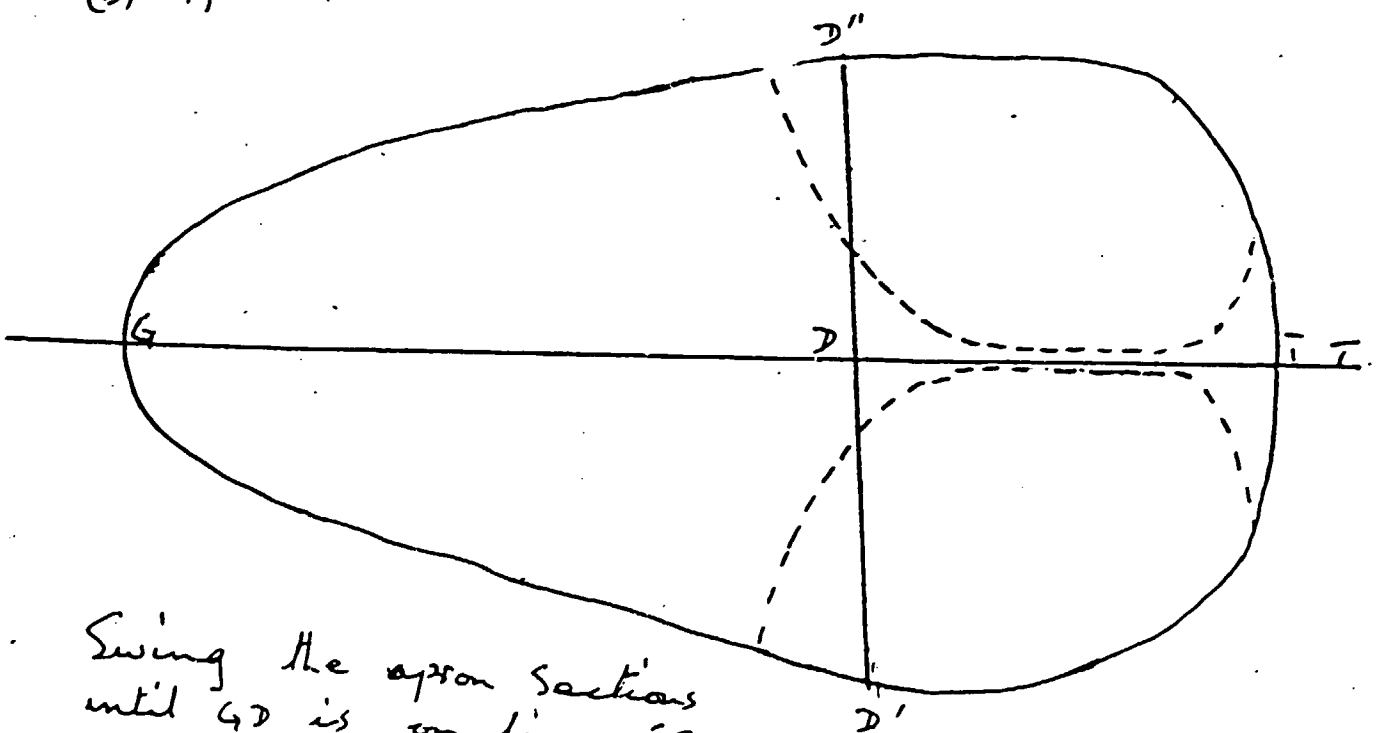
Apron Making

(a) Apron marking

The pattern should be swung a bit at a time always keeping the line GDT' parallel to the line ET.

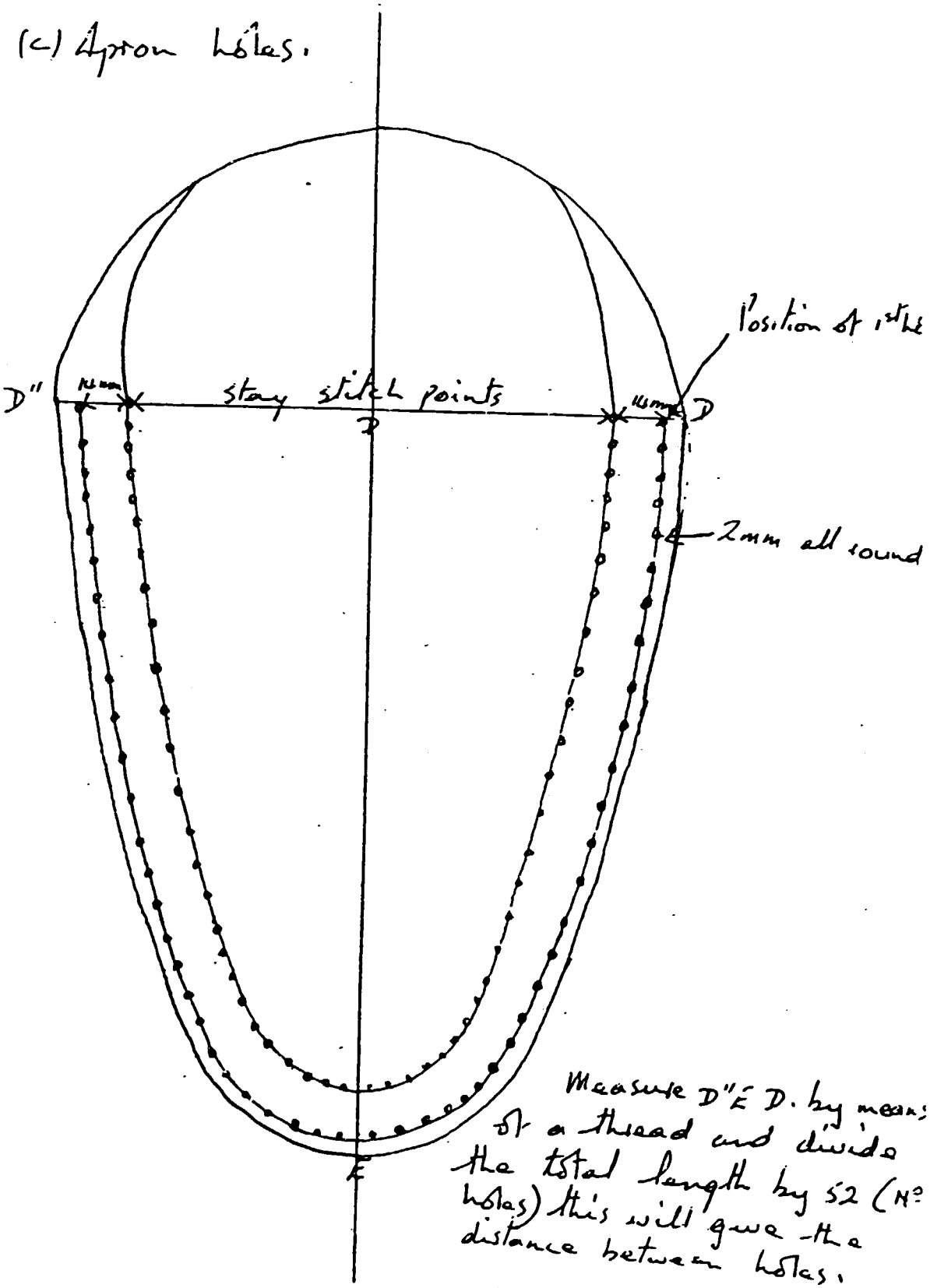


(b) Apron Pattern



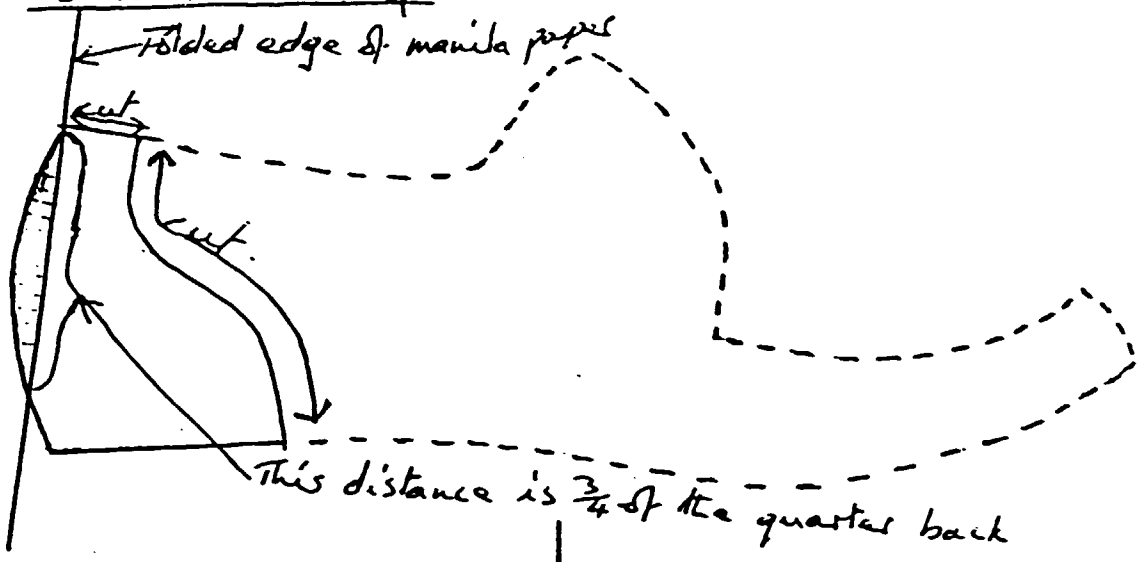
Swing the apron sections until GD is on line ET. Do this for both inside and outside sections

10 (c) Apron holes.

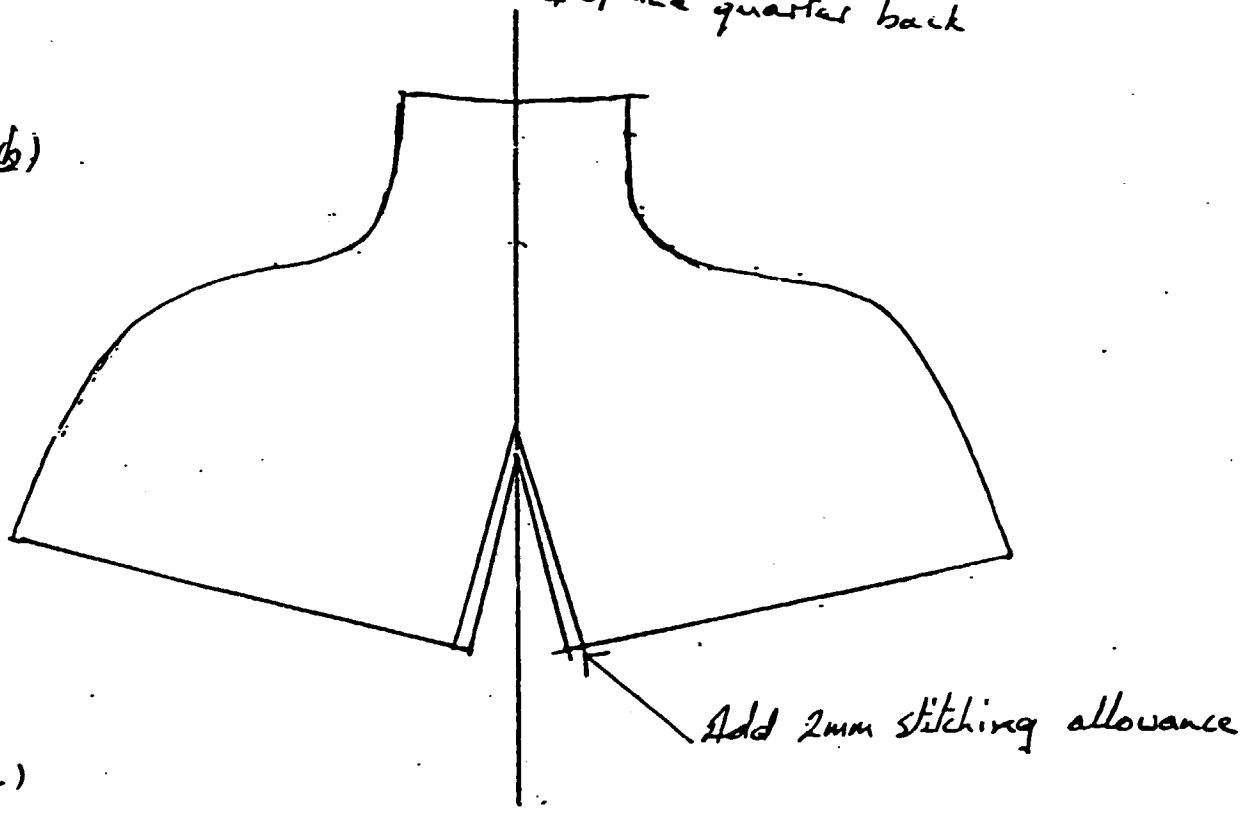


Measure D"E D. by means of a thread and divide the total length by 52 (No holes) this will give the distance between holes.

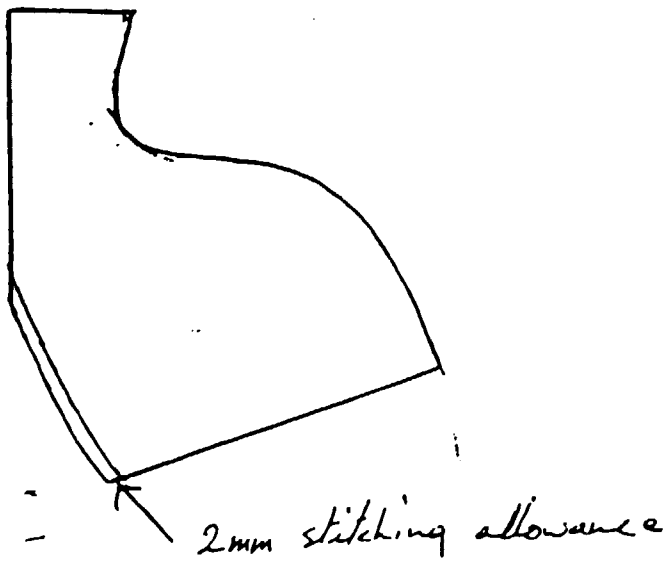
11. (a) Counter marking



11. (b)



11. (c)



ANNEXURE 4

REFERENCE HANDOUT

TECHNICAL DRAWING RELATED TO

MECHANICAL APPLICATIONS

DP/KEN/87/009

KIE/UNIDO

UNDP/UNIDO PROJECT

DP/KEN/87/009

KENYA

TRAINING COURSE ON TECHNICAL DRAWING

RELATED TO MECHANICAL APPLICATION

FOR

KIE CLIENTS

SEPTEMBER TO NOVEMBER, 1990

C O N T E N T S

PREFACE

UNDP/UNIDO Project DP/KEN/87/009 for Technical support to the Kenya Industrial Estates Ltd has, as one of its immediate objectives the provision of facilities to meet the training needs of KIE clients in the Nyanza Province of Kenya

During 1989/90, a number of technical training courses have been developed and conducted towards achieving this objective. These included industry specific courses designed to improve skills and working effeciency in a wide range of activiteis in the small industry and micro-enterprise sectors promoted by KIE.

In August, 1990 a technical course to provide basic knowledge and skills in reading and interpreting Technical Drawings related to mechanical application was developed in consultation with the prospective trainees. 72 hours of training was imparted to 6 clients by teaching staff of the Kisumu Industrial Training Centre (KITC). The course was spread over 12 days in 3 months from September to November, 1990

This document is primarily meant to serve as a "Reference Handout" to the trainees who attended the course. It is hoped that the facility of this reference to the topics and teaching methods adopted will be an incentive to the KIE client/trainee to apply the training they received, to benefit both themselves and the consumer

Introduction:

Throughout the ages, people have found Communication with each other to be essential to their development. The means they have used have progressed from signs, speech and drawings which explain the problem at hand. All these have served to convey ideas, information and instructions from one person to another.

In present day industry, the principal means of Communication is Engineering drawing (Technical drawing), which is the international language of Engineering. This is a system of Communication in which ideas are expressed exactly, information is coveyed completely without any ambiguity and even the most complicated shapes are specifically described. The system is 'governed' by the international Conventions of Engineering as published by the British Standards Institution BS 308 - "Engineering drawing practice". The Standard enables the draughtsman to understand clearly the designer's ideas and instructions and the Craftsman(fundi) to interpret precisely an engineering drawing for manufacturing or assembly purposes.

Engineering drawing is a two-dimensional visual representation of a three-dimensional object. Such a drawing must be clear, concise and accurate so as to convey as required, the:-

(a) information about the shapes and sizes of components,

(b) material requirements

(c) instructions about the methods of manufacture.

All informations must be complete and specified once only.

DRAWING EQUIPMENT

It is advisable to poses good quality drawing instruments and learn to use and maintain them properly. The following is a list of the drawing equipment that are commonly used:-

1. The drawing board must be kept clean and smooth, care should be taken not to damage the edge of the board

   - The drawing paper should be fixed to the drawing board with clips or adhesive tape but never with drawing pins as they damage the board and the paper.

2. The T-square is used only for horizontal lines and should be held tightly against the edge of the board when in use. The working edge of the T-square is normally bevelled and care should be taken not to damage it.

3. Set Squares: These are of 45^{o} and $60^{o}/30^{o}$ or an adjustable set square with bevel edges. They should always be maintained clean so as to avoid making the drawing paper dirty. They are used in conjunction with T-square to draw vertical lines and lines at the angles of their edges i.e. 45^{o}, 60^{o}, 30^{o} or any other angle when the adjustable type is used.

4. Pencils:- These are normally of the H, and 2H grades

The H grade is used for thick line work e.g. visible outlines while 2H grade is generally used for:-

i. thin line work

ii. dimensions

iii. centre lines

iv. hidden details

HB grade is also available and is used for (i) lettering, (ii) numerals, (iii) sketching.

Pencil can be sharpened in one of the following manner:-
(i) pencil sharpened to a cone point,

fig.(a)i

(ii) Chisel point, below are two views of a pencil sharpened to a chisel point,

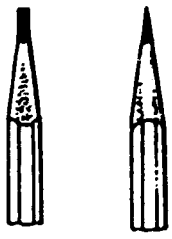


fig.(a)ii

(iii) Pencil sharpened in one place on the inside,

fig. (a) iii

(iv) pencil sharpened in one plane on the outside,

fig.(a) iv

5. Compasses: There are several types of compasses but the spring-bow type with a shoulder pin is preferable, compass pencil leads should be of the the same grade as the drawing peincil used. They should be sharpened in one plane only i.e. on the inside for small compasses on the outside for large compasses Fig (a) and (b) illustrates.

6. The eraser:- Should be a soft white pencil rubber, to ensure that the drawing paper surface will not be damaged,

7. Scales or rulers should be marked accurately in divisions of 1mm or preferably, 0.5mm over the full length,

8. Clean duster or handkerchief is useful for keeping drawing equipment clean. Hands must always be kept clean and dry.

9. French Curve is very useful for drawing curves other than circular curves.

10. Sharpener:- a good quality sharpener such as new razor blade is necessary for re-sharpening of pencil leads. A sandpaper block or a small smoothfile is also used for sharpening leads.

FREE -HAND SKETCHING

The importance of free hand sketching is often under-estimated. The ability to sketch quickly, accurately and in good proportion is essential to engineering Communication.

A free hand sketch is a drawing in which all proportions and lengths are judged by the eye and all lines are drawn without the use of drawing instruments. The only equipment used are pencil, eraser and paper.

Ability to Sketch: is a skill which is acquired through learning initially to draw free hand:-

(i) Vertical lines

(ii) Horizontal lines

(iii) Squares

(iv) Circles, ellipses and cunes

To sketch a straight line:

1. Mark the end points of the required line
2. Sketch a light trial line using several short strokes, with the eye fixed on the point towards which the straight line is being drawn.
3. Finally press the pencil (HB) down to get a uniform bold straight line.

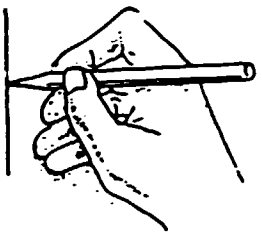


fig. (b)i.

To Sketch a Circle

1. Sketch Centre lines and the enclosing construction square, then sketch the diagonals.
   - Step off distances from the Centre equal to the radius.
2. Position your hand within the Circle and pivoted at the wrist - then sketch the trial circle consisting of eight short arcs.
3. Finally, press the pencil down to get uniform bold lines - erase all construction lines as required.

fig. (b)ii. Three stages in sketching a Circle.

NOTE: Circles may also be drawn by rotating the paper with the left hand about one of the fingers of the right hand acting as a pivot, FIG. (c) iii below illustrates this method.

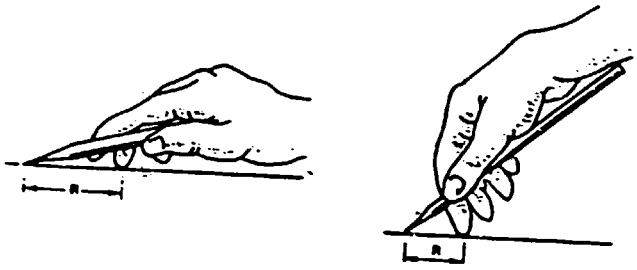


fig. (c) iii.

Sketching of Solid Objects:

Solid objects e.g. tools, machine parts e.t.c. can be sketched in two ways:-

1. as a two dimensional Sketch
2. as a three dimensional Sketch

Two dimensional Sketch: This is a Sketch showing only one face of the object giving only its length/width and depth (height)
Figures (f) i - ii, show two dimensional sketch of the same workshop tools and equipment.

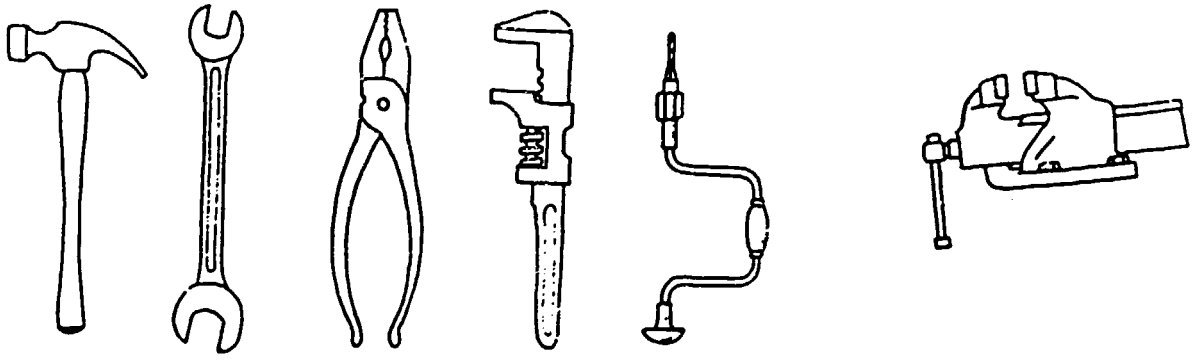


Fig. (f) i

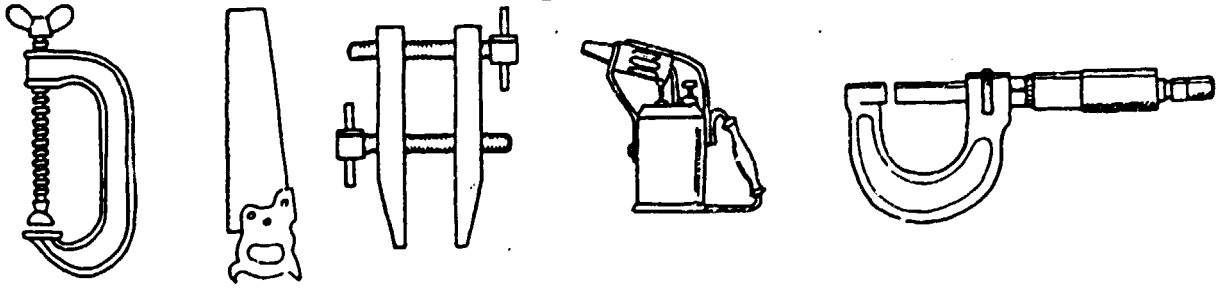


Fig. (f) ii

When sketching such items, particular attention should be paid to the density of line, good from or shape and relative proportionality of parts of the item being sketched.

Three dimensional sketch:

This is a sketch which covers the three fundamental dimensions of an object i.e. length, width and depth (height). When properly done, the sketch will show the real picture of the item. This kind of sketch is usually made in isometric projection or in Oblique projection.

Making a three dimensional sketch in isometric projection.

This is often, quickly achieved by first making a light construction framework of either rectangular box or a cube or Cone e.t.c. The choice of such frame work depends on the shape or form to be sketched. Fig. (b) illustrates how an isometric projection of rectangular box can be used as a guide frame when sketching workshop spanner and stepped blocks shown. Note that some parts of the box edges will be used to represent the outlines of the object being sketched.

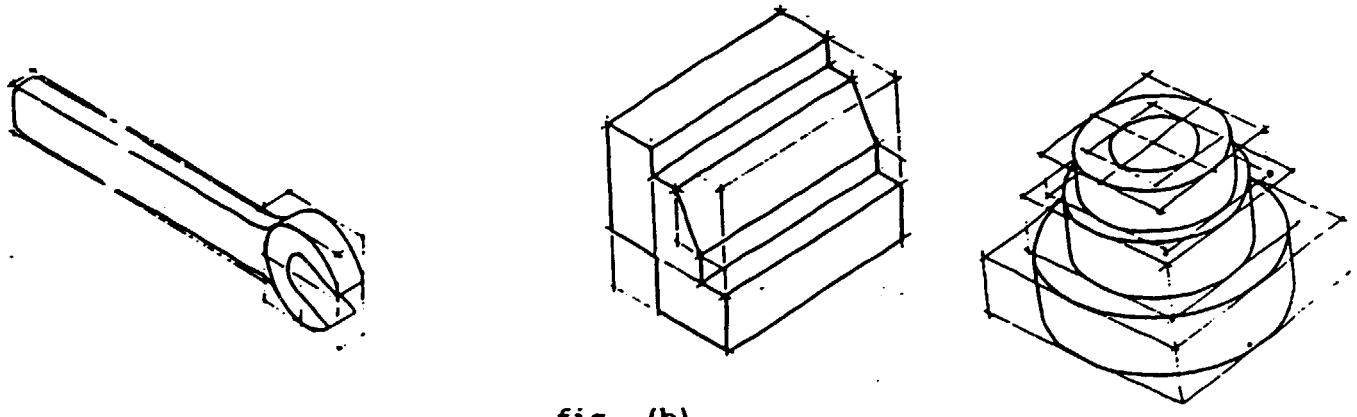


fig. (b) .

Sketching a Circle or a curve - isometrically

- Sketch an enclosing "isometric square" i.e. a rhombus, with its sides equal to the diameter of the circle under construction
- Sketch bisecting lines and, at the intersection points, sketch short tangential arcs.
- Finish the ellipses with a uniform bold line.
  (Fig.(b)i. illustrates the procedure.)

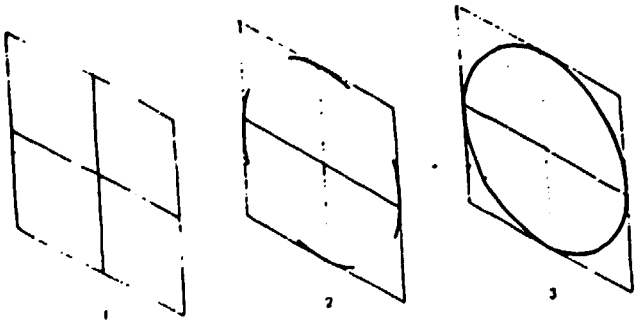


fig.(b)i.

The knowledge of this skill will help a great deal in illustrating holes through a given pieces as shown in(fig.c)i. or drawing round edges as shown in (fig.c)ii.

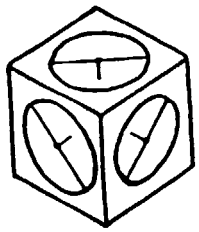


fig.c(i)

Further examples are shown in (fig.j)ii below.

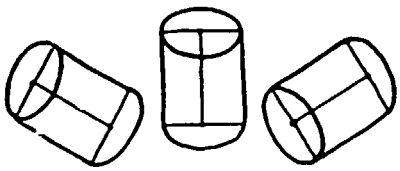
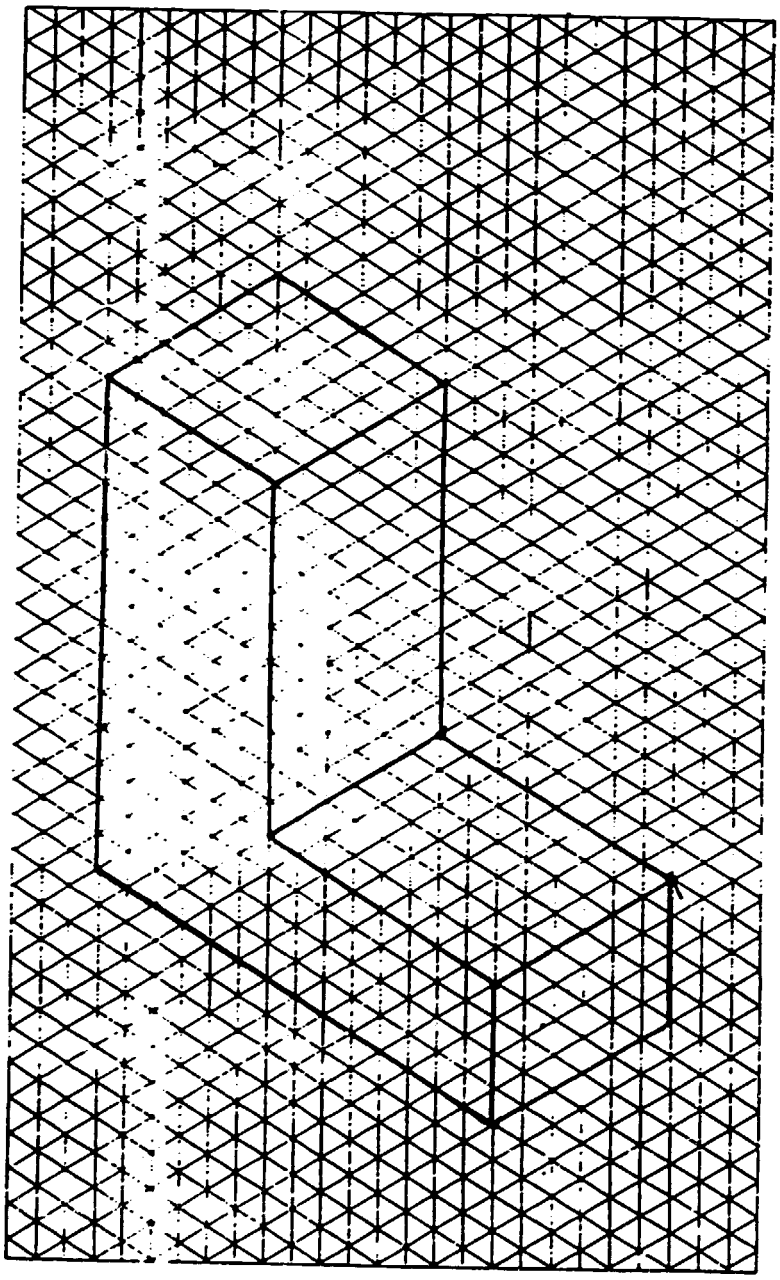


fig. c(ii)

Guided sketching:-

Sketching can be made much simpler and more proportional when isometric grid or oblique grid papers are used. The edges of the object being sketched are drawn along the grid lines. For the proportionality of the sketch, the edge of one small square is taken to represent a certain dimension of the object e.g. 5mm.

Fig.d(i) shows an example of how the grid paper is used.



Isometric grid for guided sketching

Fig d(i)

ORTHOGRAPHIC PROJECTION

This is a method of producing a number of separate two-dimensional inter-related views which are mutually at right-angles to each other.

Orthographic projection may also be explained as a multi-view projection. This projection enables us to fully describe even the most Complex shape. However the method dows not create an immediate three dimensional visual picture of the object as the case is with pictorial projection e.g. isometric or oblique projection.

There are two forms of orthographic projection namely:-

i. first angle projection
ii. third angle projection

First angle projection:

In first angle projection, the object is positioned in the space between the planes of projection as shown in fig.e(i)

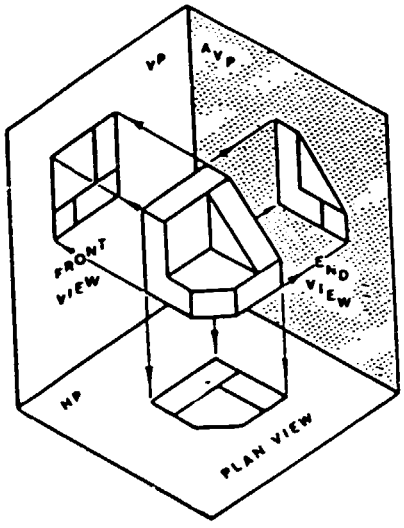


fig.e (i)

A view of the object is projected by drawing parallel projecting lines from the object to the vertical principal plane (VP). This view on VP is called a front view. A similarly projected view, on the horizontal principal plane (HP) is called a plan view

For the complete description of the object, an additional plane, called the auxiliary vertical plane (AVP), is used at 90^{0} to the principal planes. The view projected on to this plane is called an <u>end view</u>. Fig.e(i) above illustrates the positions of all these three views.
Fig.e (ii) -- (iv) shows examples of Orthographic first angle projection.

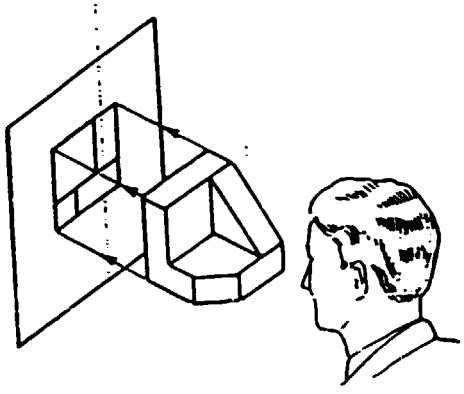


fig. e (ii)

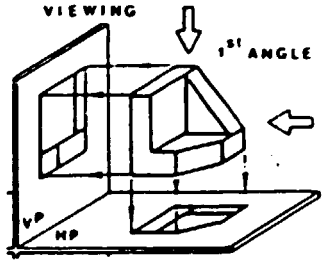
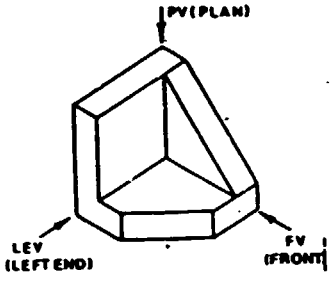
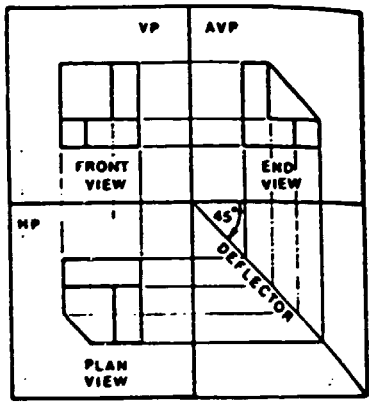


fig.e (iii)

Fig.e (iv)


PV(PLAN)
LEV
(LEFT END)
FV
(FRONT)


VP
AVP
FRONT
VIEW
END
VIEW
HP
45°
DEFLECTOR
PLAN
VIEW

Third angle projection.

While in both first and third-angle projection the views are identical, the positioning of views in third-angle projection is different from that of first angle. In third-angle, the view under consideration is drawn on the same side occupied by the person looking at the object. In otherwords, the projection lines are drawn towards him and not as in 1st angle projection. Fig.f(i) below illustrates this concept.

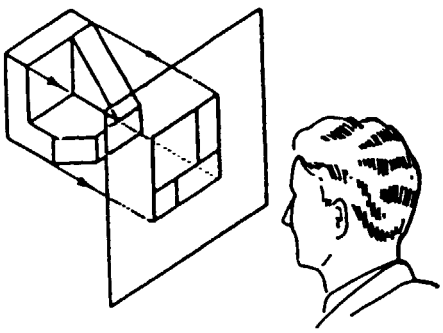
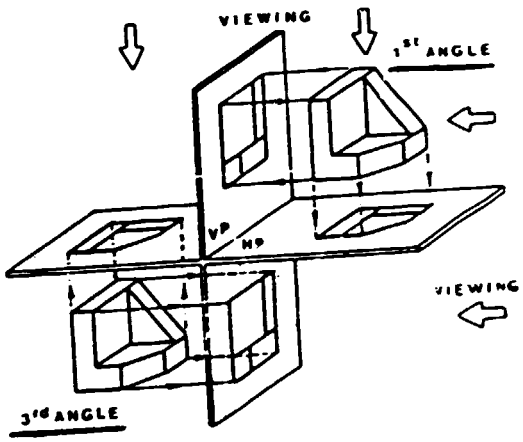
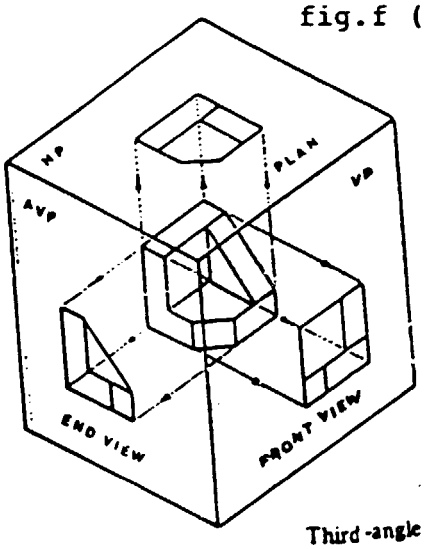


fig.f (i)



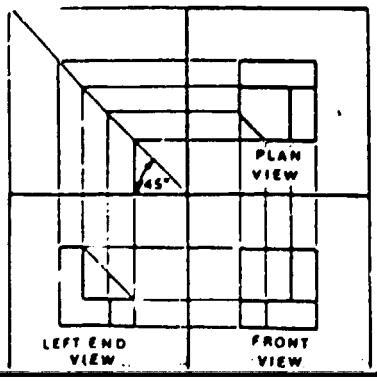
Principle of orthographic projection



Third-angle projection – 'glass-box' method

fig.f (ii).

Note: - The plan view is drawn above the front elevation
- The left end view is drawn on the left hand side
- The right hand view is drawn on the right hand side.



SCALES AND SCALE-DRAWING

Need often arises to make drawings of very large engineering components or buildings. Such drawings cannot easily fit on our standard sizes of drawing paper i.e. A3, A2, or A1 (A1 being the largest size of a standard paper.) Such drawings should therefore be made in selected proportion to a uniform scale. The dimensions will thus be decreased in the same proportion. Similarly, tiny objects can also be drawn to increased proportions.

A scale can therefore be thought of as a rule contracted or stretched as necessary. A photograph of a 300mm rule printed so that it appears 150mm long could be used for making drawings half full size.

The following are some scales often used:-

i. full-size:- 1:1

ii. smaller than full size - 1:2, 1:5, 1:10, 1:20, 1:50, 1:100

iii. larger than full size:- 2:1, 5:1, 10:1, 20:1, 50:1, 100:1

While standard scale rules are available in the market, you can also quickly and accurately make a scale. The simplest scale is a Straight line scale and it can be constructed as follow:-

- Determine the maximum dimension of the object to be drawn
- Decide on the scale to be used i.e. 1:5
- Devide this maximum dimension by 5
- Draw this straight line whose length equals $\frac{\text{max.dim.}}{5}$ e.g. = 250mm.
- Divide this line into ten equal parts
- Divide the first division into a number of parts that enables you to obtain the samallest fraction you required.
- Number the scales as shown below
- Note the position of the '0'. The divisions in the first part enables you to measure lengths in ones or tens.

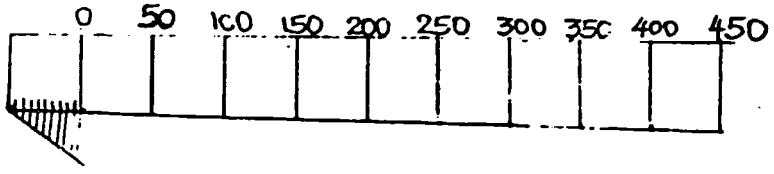


fig.f (iii)

Diagonal Scale: Difficulty often arises in dividing the first division into 10 equal parts to be able to measure into units of one millimetre. To ease such difficulties, a diagonal scale is constructed and the construction of such a scale is as follows:-

- First, draw a plain scale
- Draw a perpendicular at the left-hand end of the scale, the length of this perpendicular is not fixed.
- Divide this perpendicular and the first division into a number of equal parts so that the multiple of the divisions equals the denominator of the smallest fraction required.

Example:- To show millimetres, the first division on the plain scale could be divided into 2 parts and the perpendicular line into 5 parts or vise visa.

i.e. 2x5 = 10 (the denominator of the smallest fraction.

i. e.g. $\frac{1}{10}$ x 1cm = $\frac{1}{10}$ x 10mm

= 1mm.

The divisions of the perpendicular are drawn as horizontal lines accross the scale as shown.

- Measurement in 'tens' i.e.50mm is taken from position '0' but any additional measurement in 'ones' is obtained by considering the intersection of the diagonal and the corresponding horizontal line. The figure (f.(iv) below shows is a diagonal scale with a reading of 57mm (50+7mm) marked by two dots.

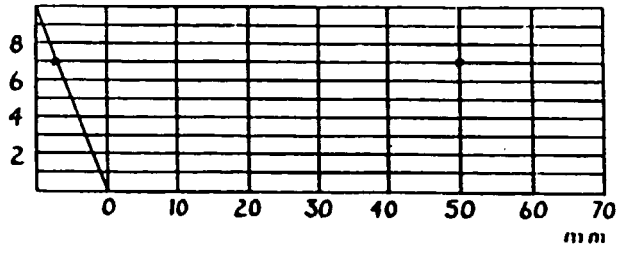


fig.f (iv)

THE GEOMETRY OF INTERPENETRATION AND SURFACE DEVELOPMENT

INTERPENETRATION:- More often in industry some parts require to interpenetrate into the others. Such parts as the shape may be, may interpenetrate at 90° or at angles other than 90°. No matter at what angle such parts may interpenetrate, the most important thing is determine, through geometrical construction, the line or curve of interpenetration between the two parts.

PROCEDURE FOR DETERMINING THE LINE OR CURVE OF INTERPENETRATION

Consider two pipes interpenetrating as shown in fig.f(v).

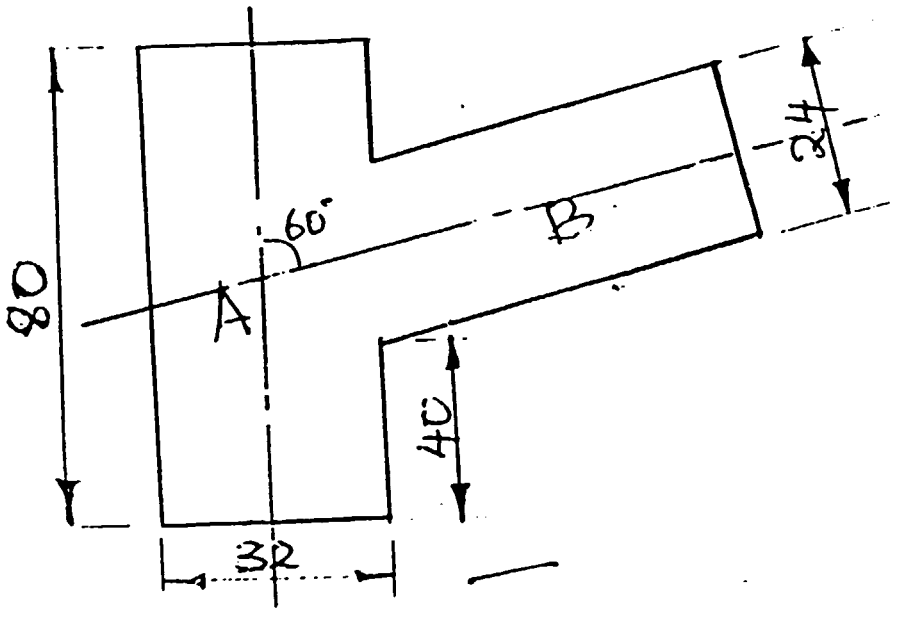


fig.f (v)

Step 1. Copy the given elevation on a drawing paper or on a metal sheet.

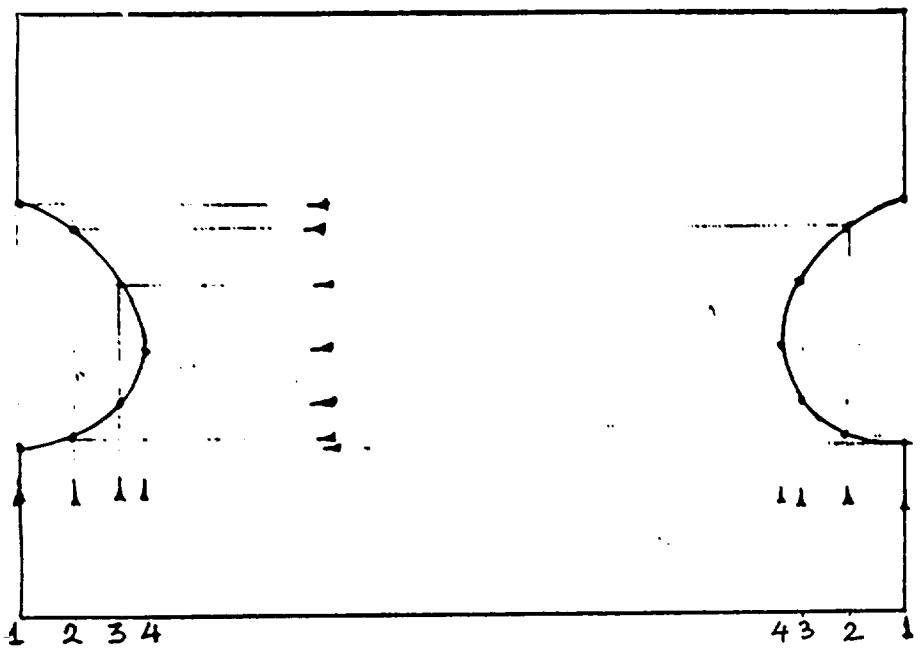
2. Project the plan below the elevation

3. Draw the end elevation of pipe B both along with the front elevation and the plan as shown in fig.f(vi) below.

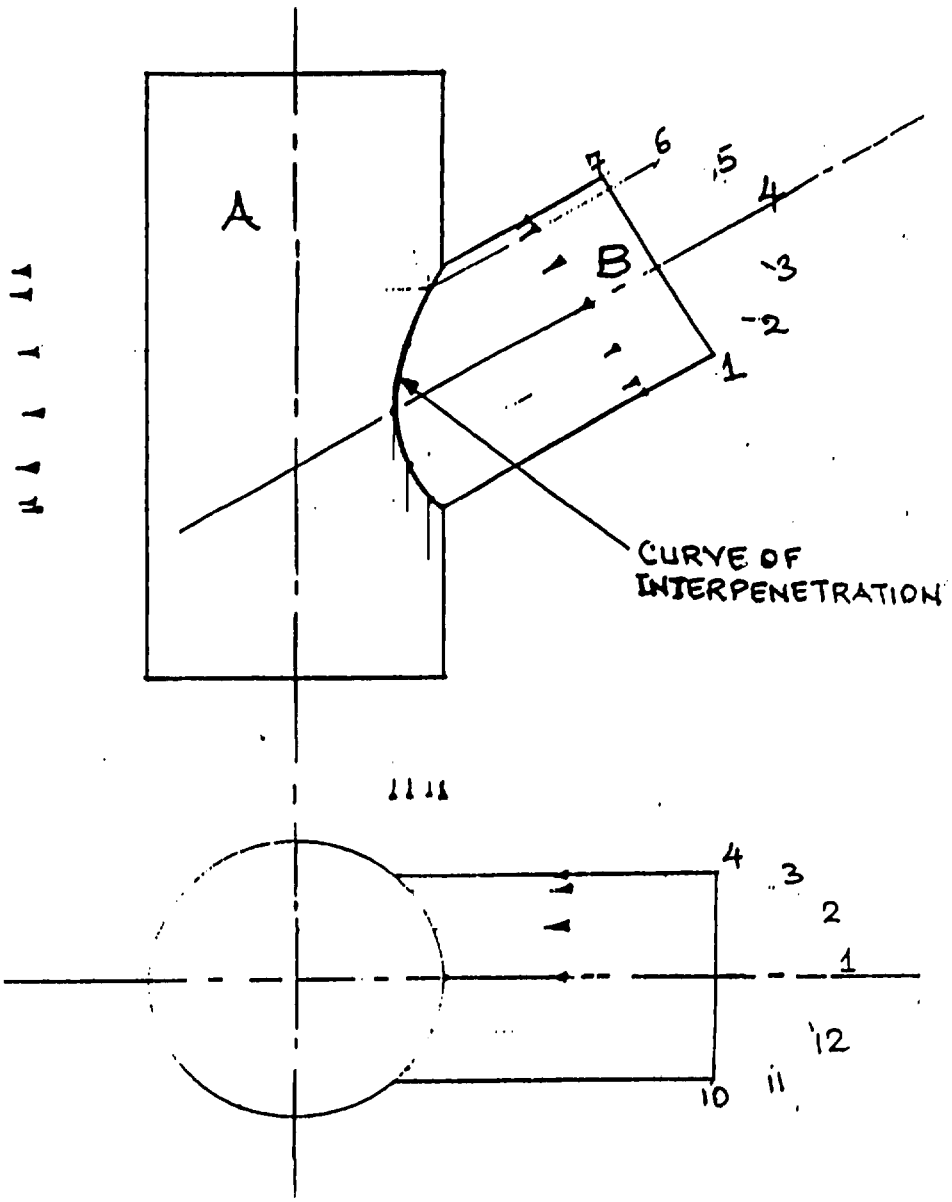
4. Divide this end elevation into a number of equal parts and number the parts accordingly.

5. Draw lines through this parts to touch the plan and the front Elevation as shown.

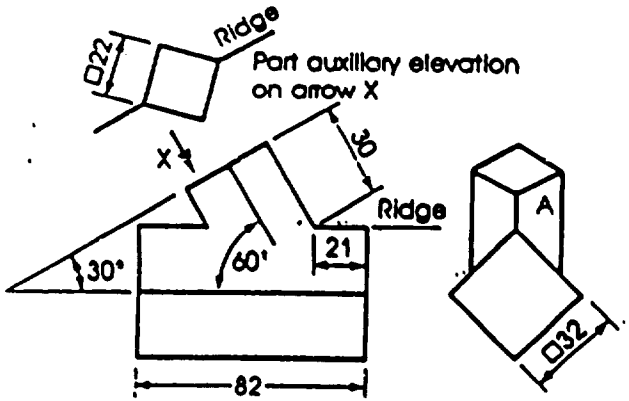
6. The intersection of two corresponding lines plot a point. Such points are then plotted as here shown and a line drawn through them is the curve or line of interpenetration.

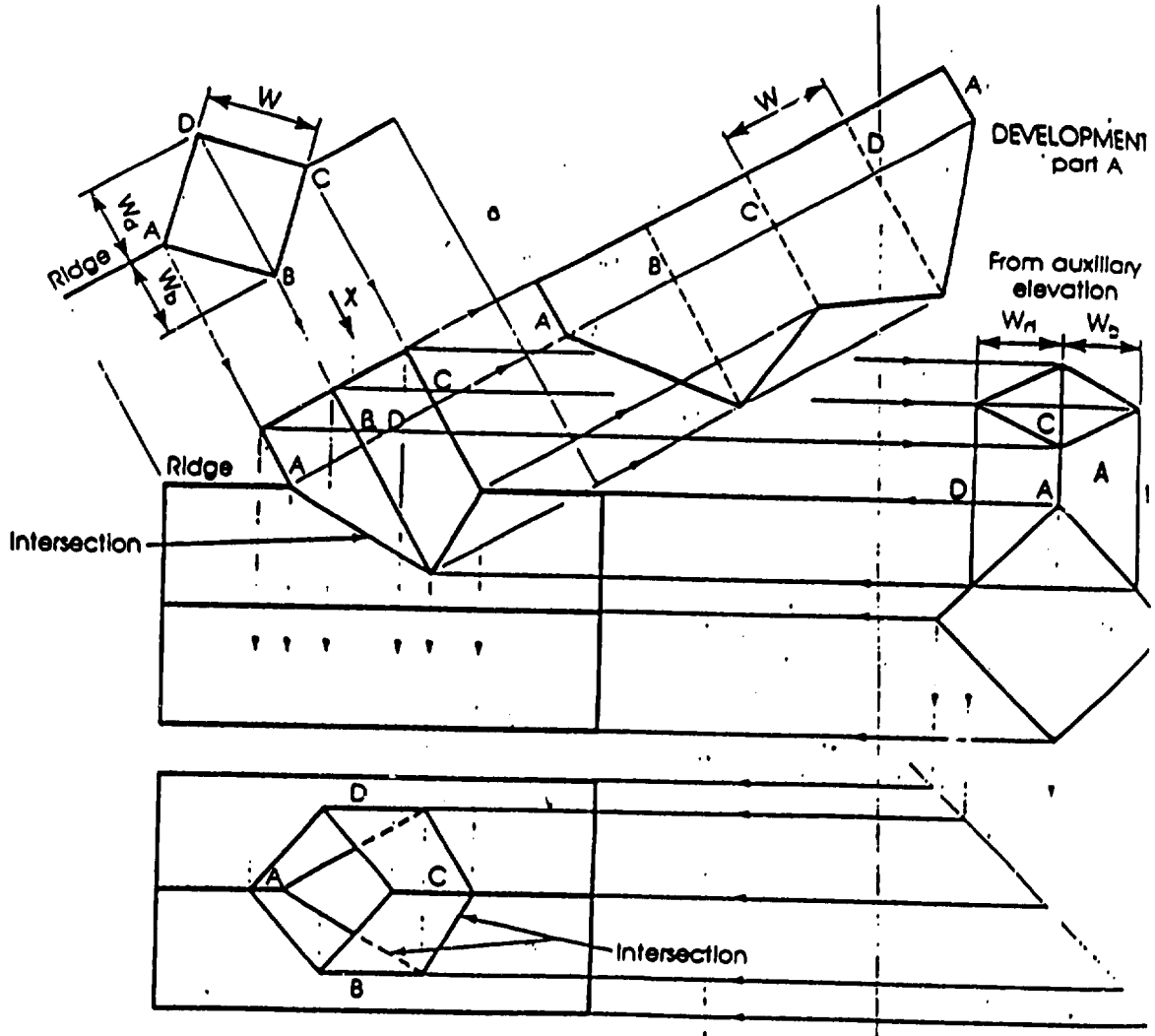


DEVELOPMENT Of
PIPE 'A'



Other examples of interpenetration are here shown below:-

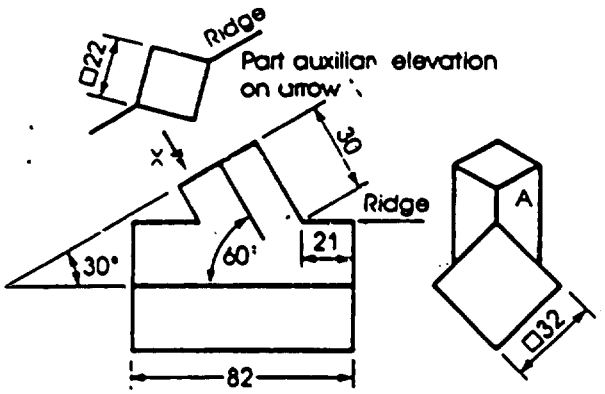




Note: Mixed projection is not generally recommended. In this case the auxiliary view is a construction to help in producing the other views (it would not be retained on an original drawing). Since the auxiliary view relates more directly to the view with which it is concerned by using the Third Angle position, mixed projection is acceptable practice.
Drawing to First Angle would either require more space or construction from the auxiliary would interfere with the plan view.

TITLE: Lines of intersection or interpenetration (square prisms).

NOTE: First Angle projection used as indicated.



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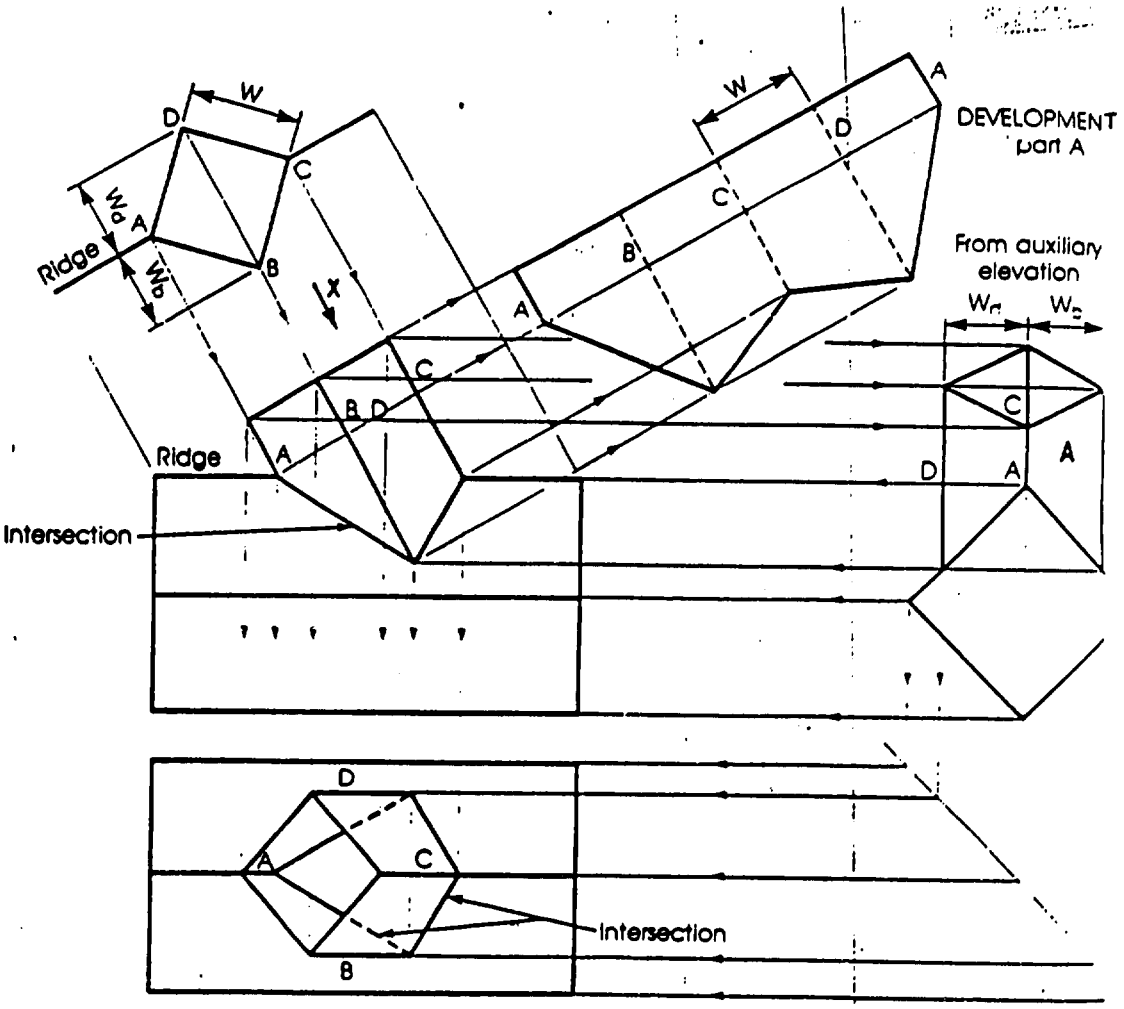
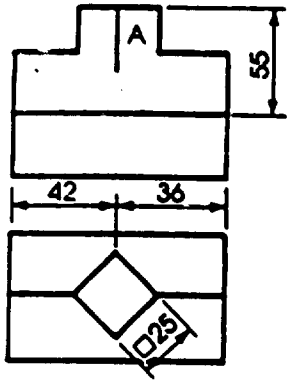
Drawing to First Angle would either require more space or construction from the auxiliary would interfere with the plan view.

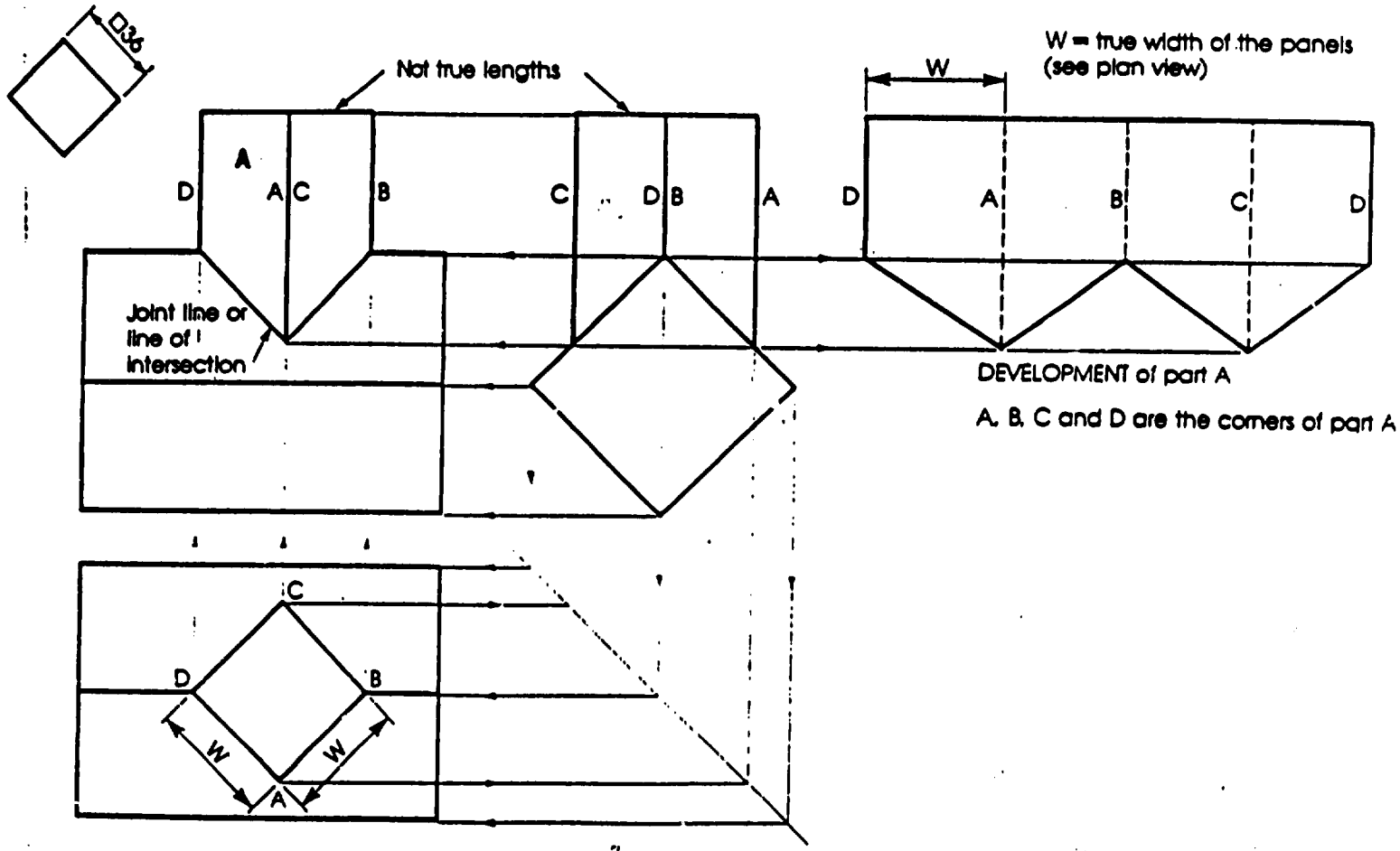


TITLE: **Lines of intersection or interpenetration (square prisms).**

NOTE: **First Angle projection used as indicated.**

Draw and complete the elevations and plan of the right-angled tee junction between the square tubes. Produce the development of part A.

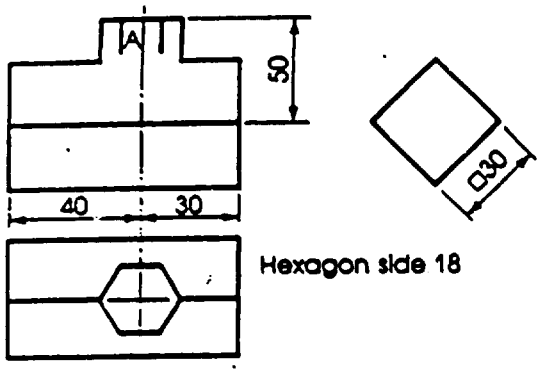




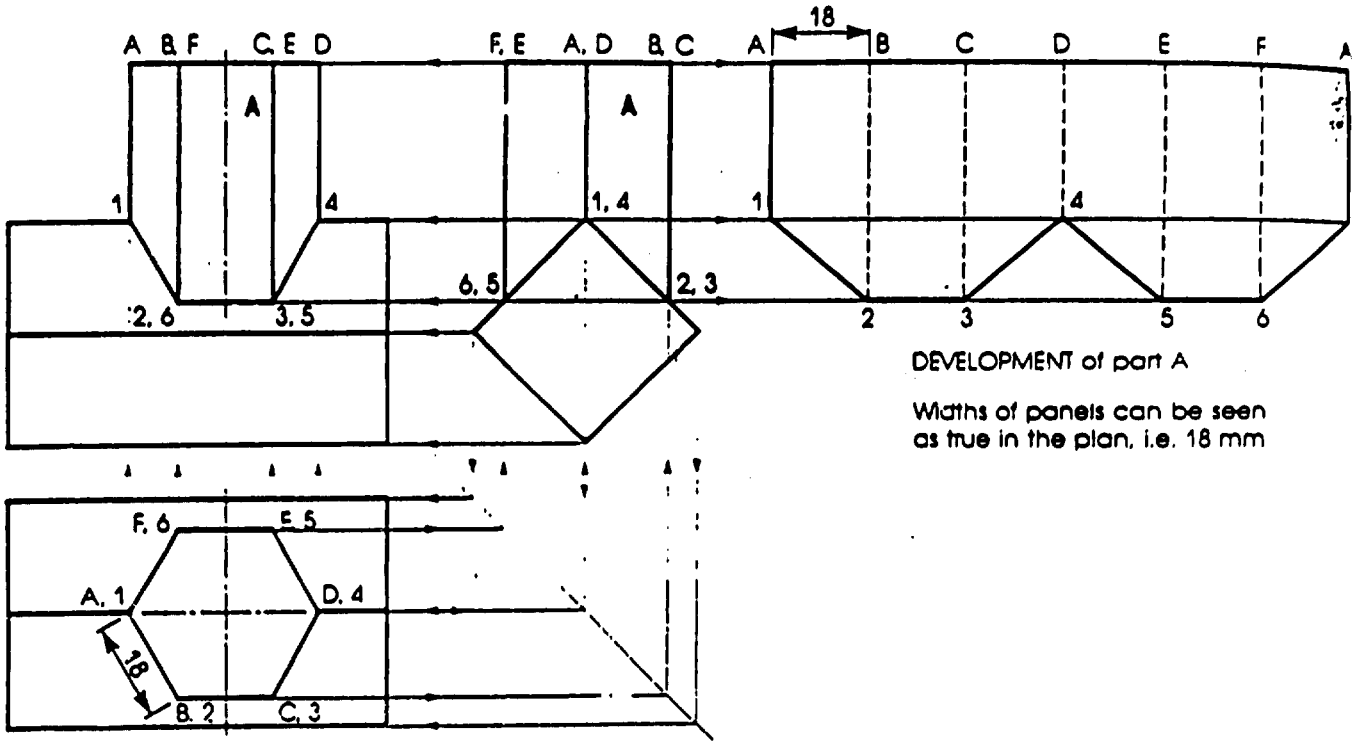
TITLE: Lines of intersection or interpenetration (square prisms).

NOTE: **First Angle projection used.**

elevations showing the intersection between the hexagonal and square tubes. Develop part A.



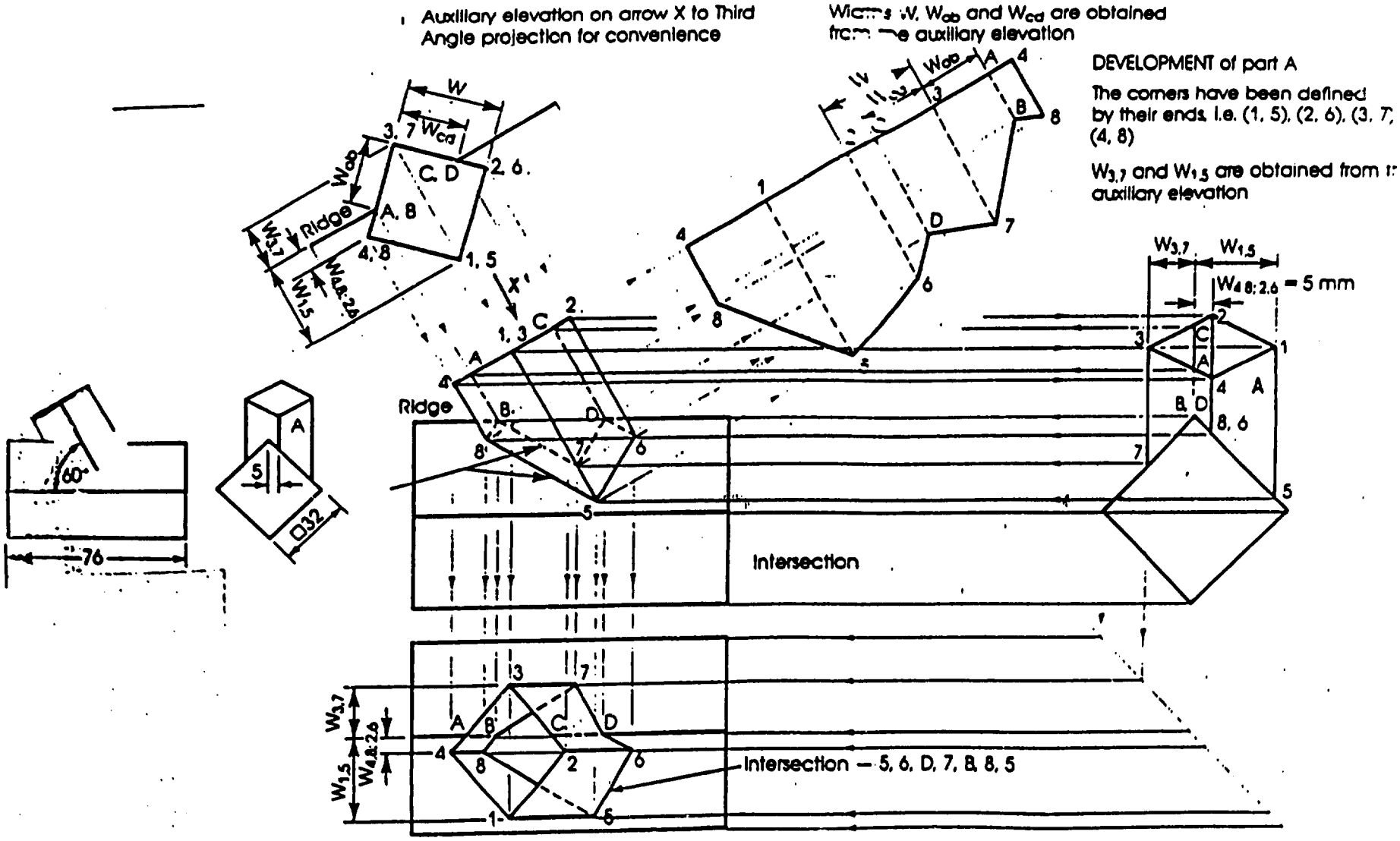
Hexagon side 18



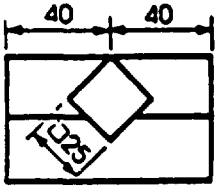
DEVELOPMENT of part A

Widths of panels can be seen as true in the plan, i.e. 18 mm

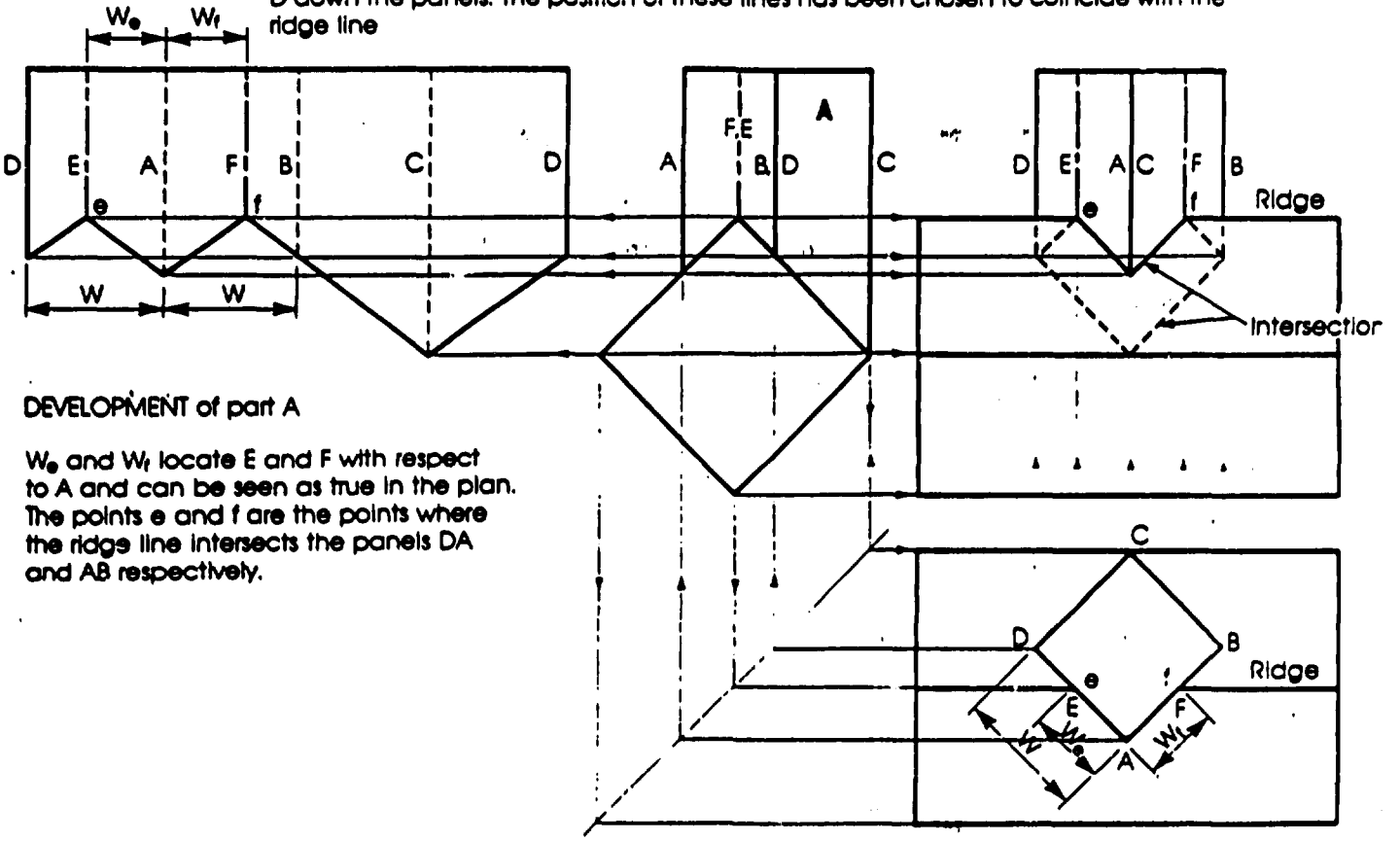
TITLE: Lines of intersection (hexagonal with square prisms).	NOTE: First Angle projection used.


Auxiliary elevation on arrow X to Third Angle projection for convenience
Widths W, Wab and Wcd are obtained from the auxiliary elevation
DEVELOPMENT of part A
The corners have been defined by their ends, i.e. (1, 5), (2, 6), (3, 7), (4, 8)
W3,7 and W1,5 are obtained from the auxiliary elevation
W
Wcd
Wab
Ridge
W3,7
W1,5
W4,8; 2,6
A, 8
C, D
1, 5
2, 6
3, 7
4, 8
X
1, 3
Ridge
Intersection
Intersection — 5, 6, D, 7, B, 8, 5
W3,7
W1,5
W4,8; 2,6 = 5 mm
60°
76
5
Ø32

Front elevation?



W_e and W_f are the widths of imaginary lines drawn parallel to the corners A, B, C and D down the panels. The position of these lines has been chosen to coincide with the ridge line

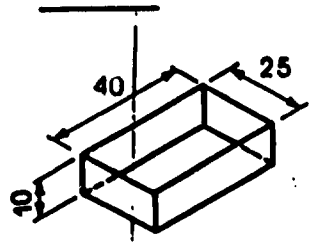


DEVELOPMENT of part A

W_e and W_f locate E and F with respect to A and can be seen as true in the plan. The points e and f are the points where the ridge line intersects the panels DA and AB respectively.

TITLE: **Lines of intersection or interpenetration (square prisms).**	NOTE: **First Angle projection used.**

Produce the development of the open-topped box shown.



Developments

A development is the shape produced when a 3-dimensional object which is made from thin sheet material is unfolded and laid flat on a plane surface. This can often be achieved in several ways as shown. Fig A shows the most economical method of development as this would create least waste in multiple production, be folded by a simpler design of folding tool and be jointed by welding more quickly due to shorter seams.

All the examples given have been developed with respect to the shortest seam but for various design reasons this may not always be possible, e.g. grain flow of material may affect strength.

True lengths only must be used for developments.

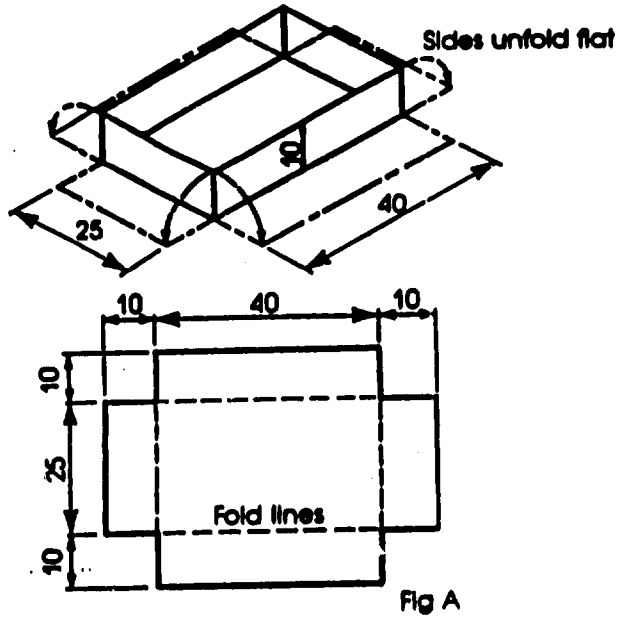
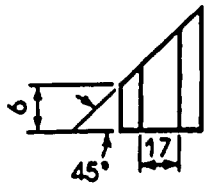
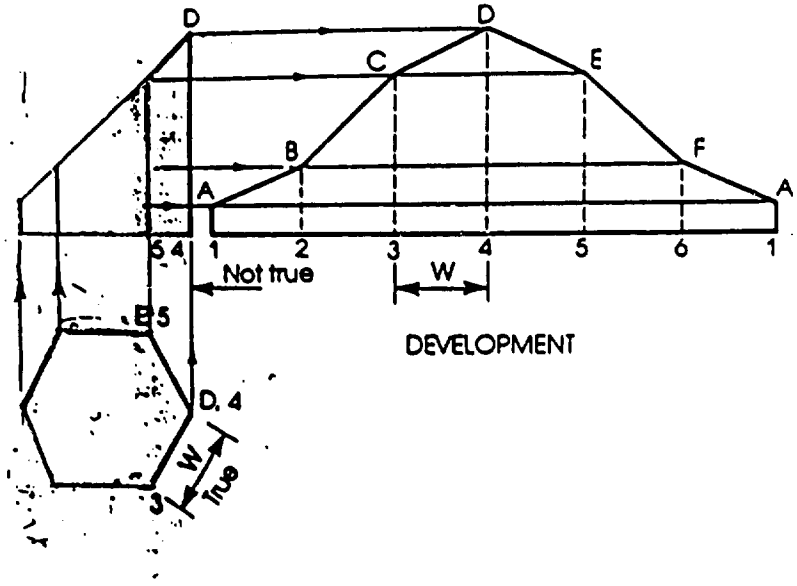


Fig A

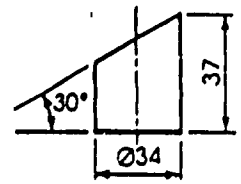
TITLE: **Introduction to developments.**



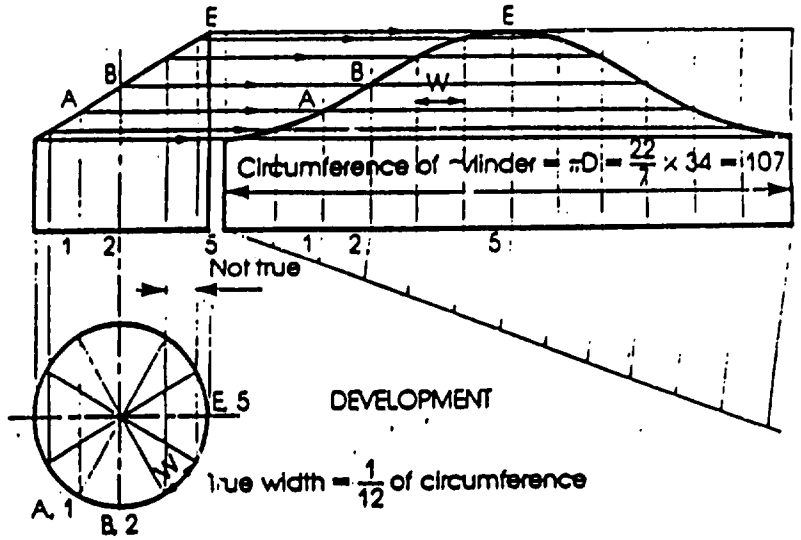


DEVELOPMENT

Produce the development of the open-ended cylinder shown.



Note: points are joined by curves of good fit, i.e. interpolation. In plan, AB is curved.



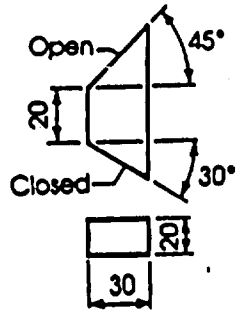
DEVELOPMENT

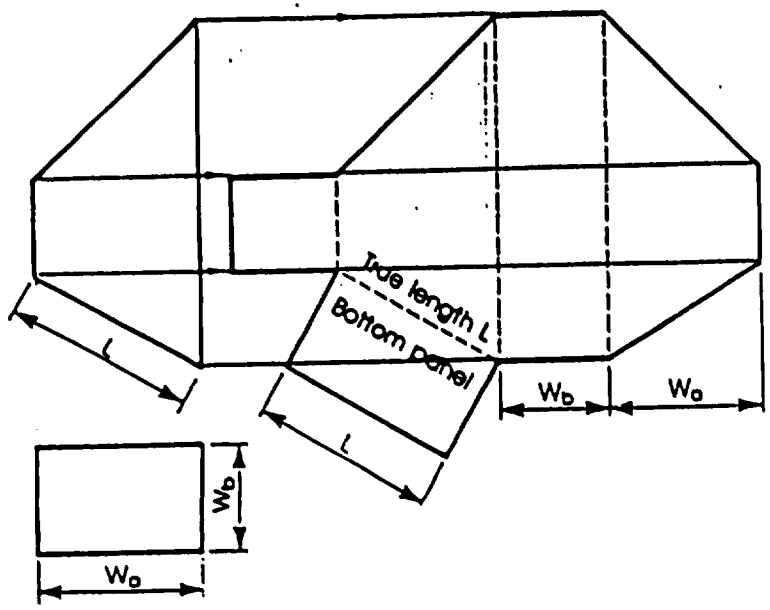
Unfortunately the cylinder has no corners, so invent some e.g. A 1 B 2 etc.

TITLE: **Introduction to developments. Prisms and cylinders.**

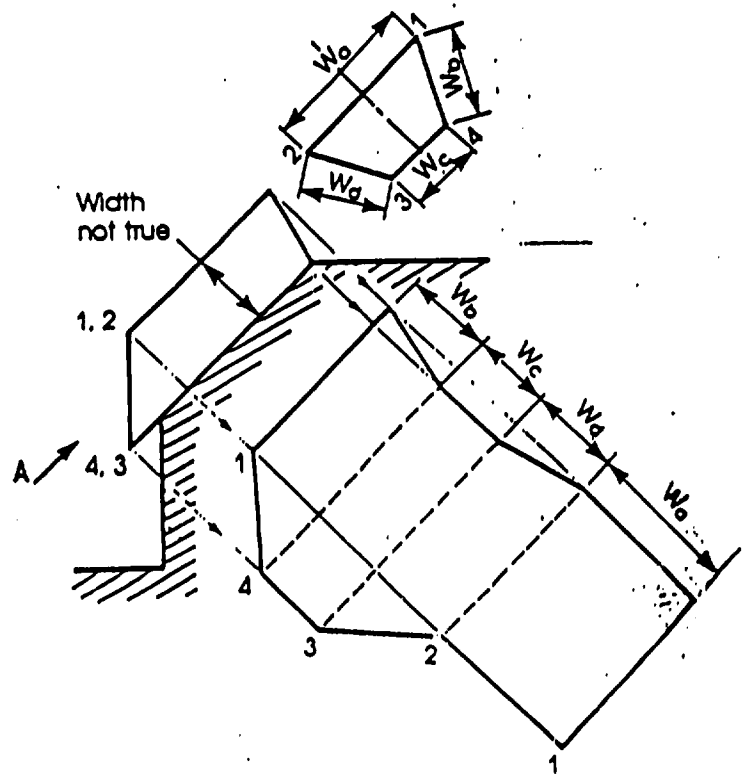
NOTE: **First Angle projection used.**

The storage bin shown is to be produced from sheet metal. The bottom is to be sealed and the top left open. Produce the shape of the cut-sheet prior to folding to shape and welding.



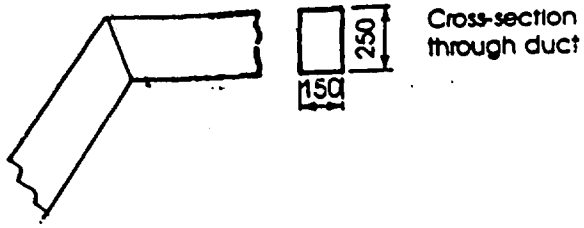


The front elevation of a loading chute is given together with an auxiliary elevation showing its cross-sectional form. Produce a development of the chute to a scale 1:10.

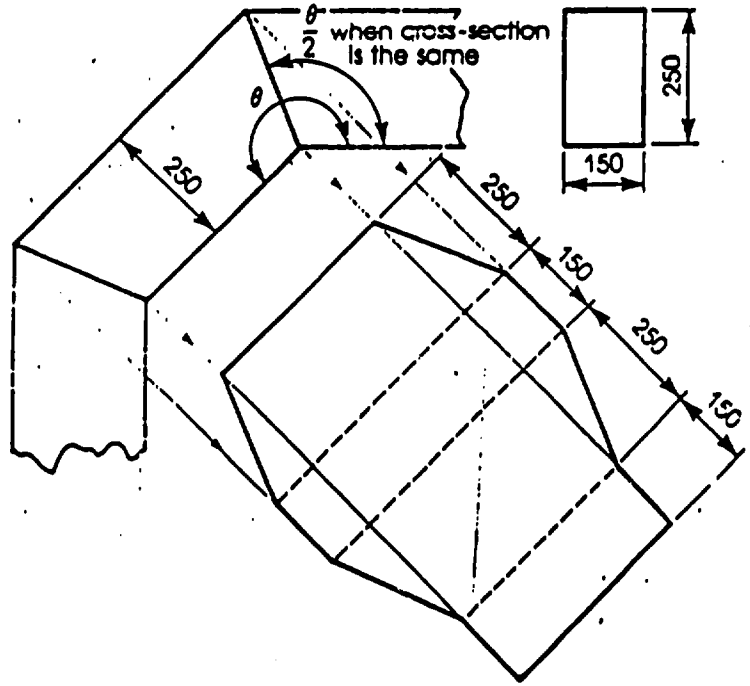


TITLE: **Introduction to developments. Prisms.**

NOTE: **First Angle projection used.**

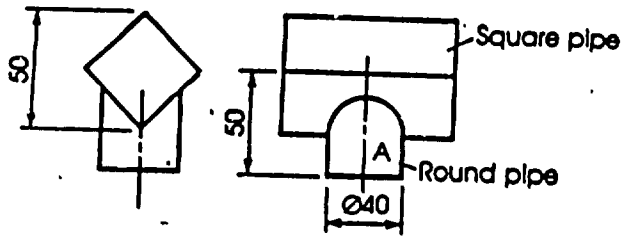


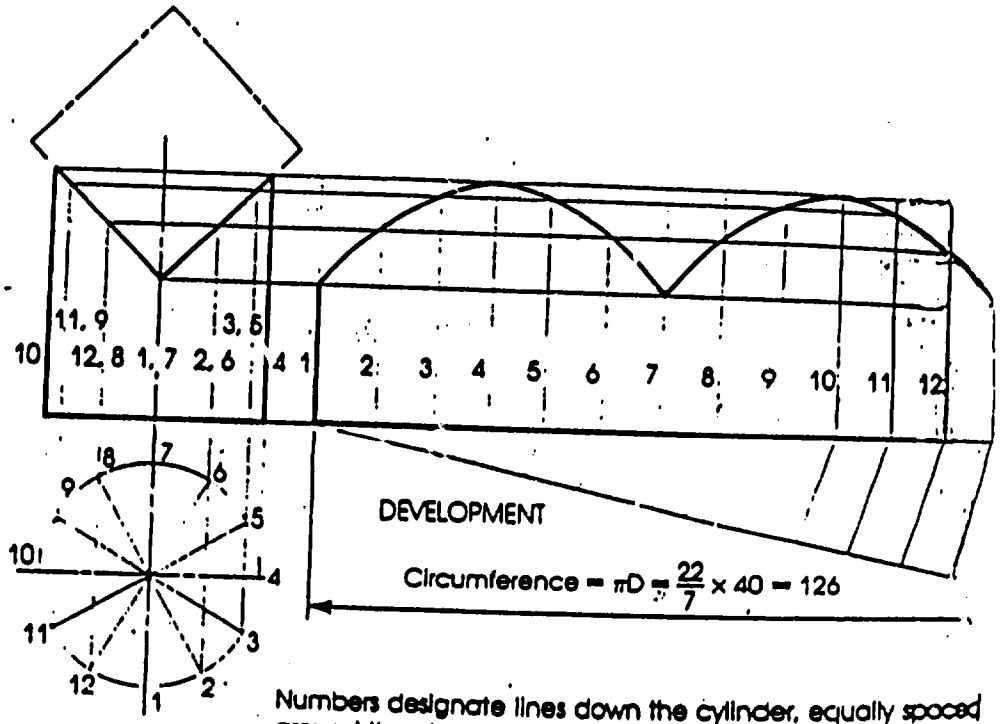
Cross-section through duct



TITLE: **Introduction to developments.**

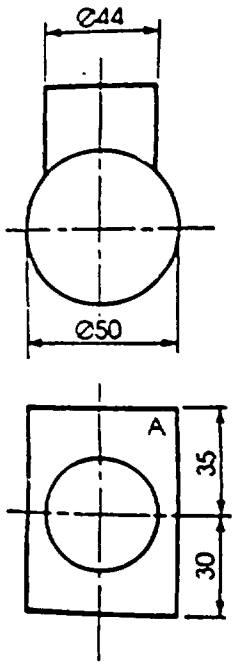
NOTE: **First Angle projection used.**

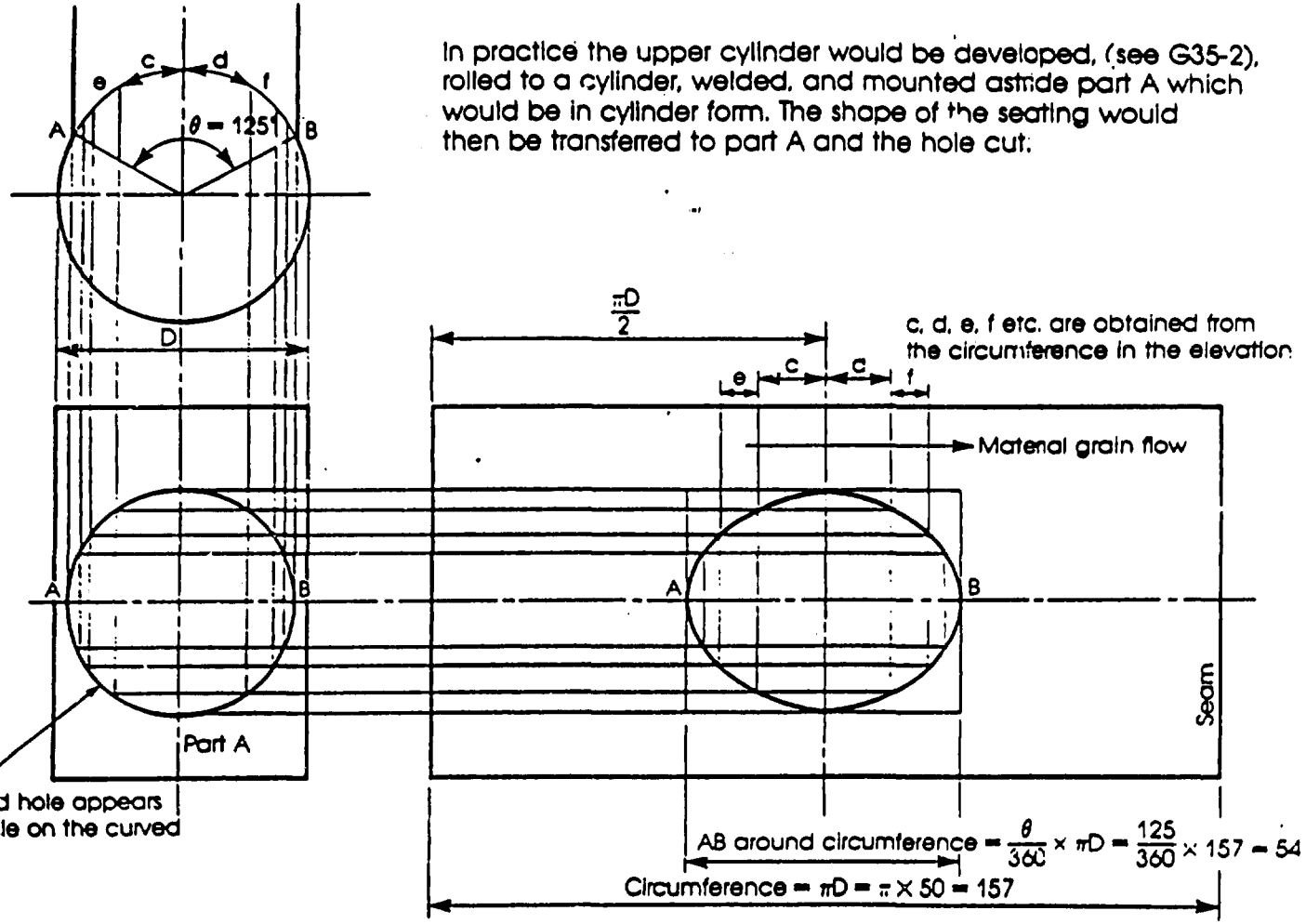




Numbers designate lines down the cylinder, equally spaced around the circumference — see development

TITLE: **Developments of the cylinder.**	NOTE: **First Angle projection used.**



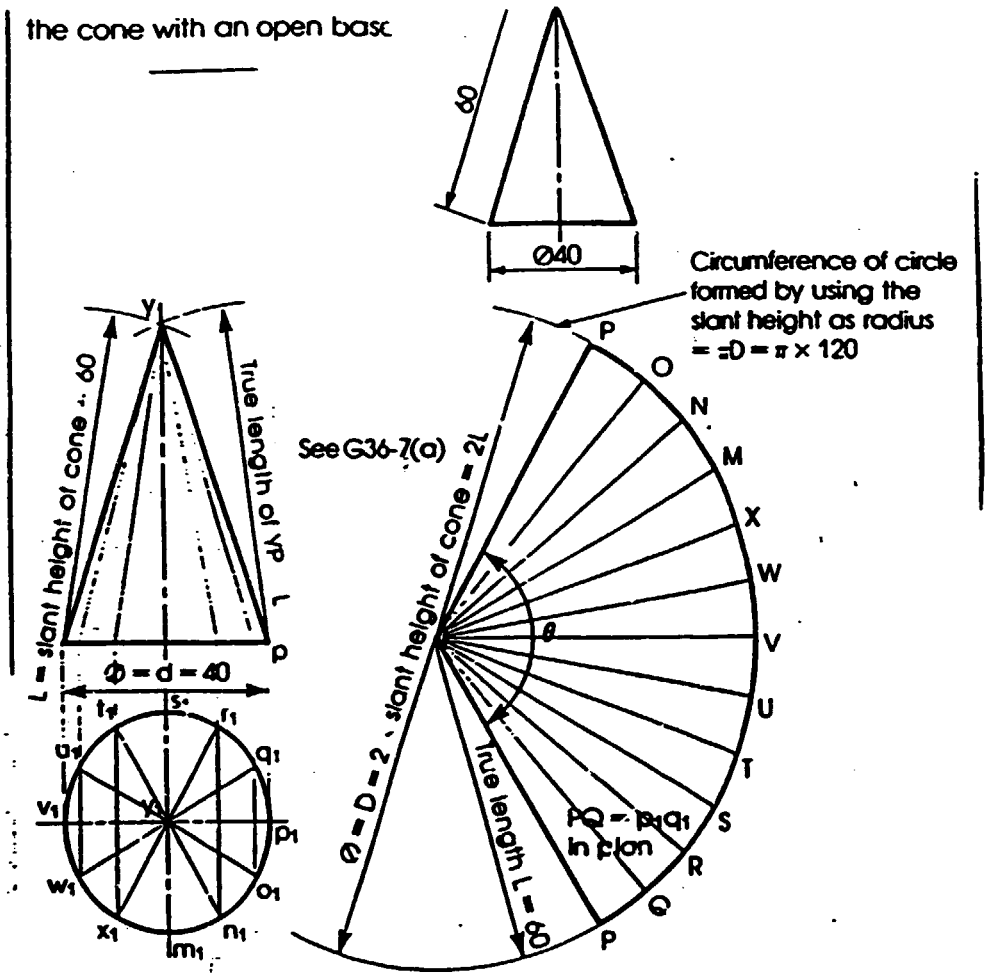


In practice the upper cylinder would be developed, (see G35-2), rolled to a cylinder, welded, and mounted astride part A which would be in cylinder form. The shape of the seating would then be transferred to part A and the hole cut.

DEVELOPMENT
This development has been produced with the longer seam in order to utilise the inherent strength in the grain flow, strengthening the hole side.

TITLE: **Developments of the cylinder.**	NOTE: **First Angle projection used.**

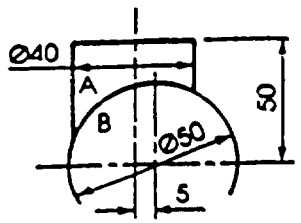
the cone with an open base

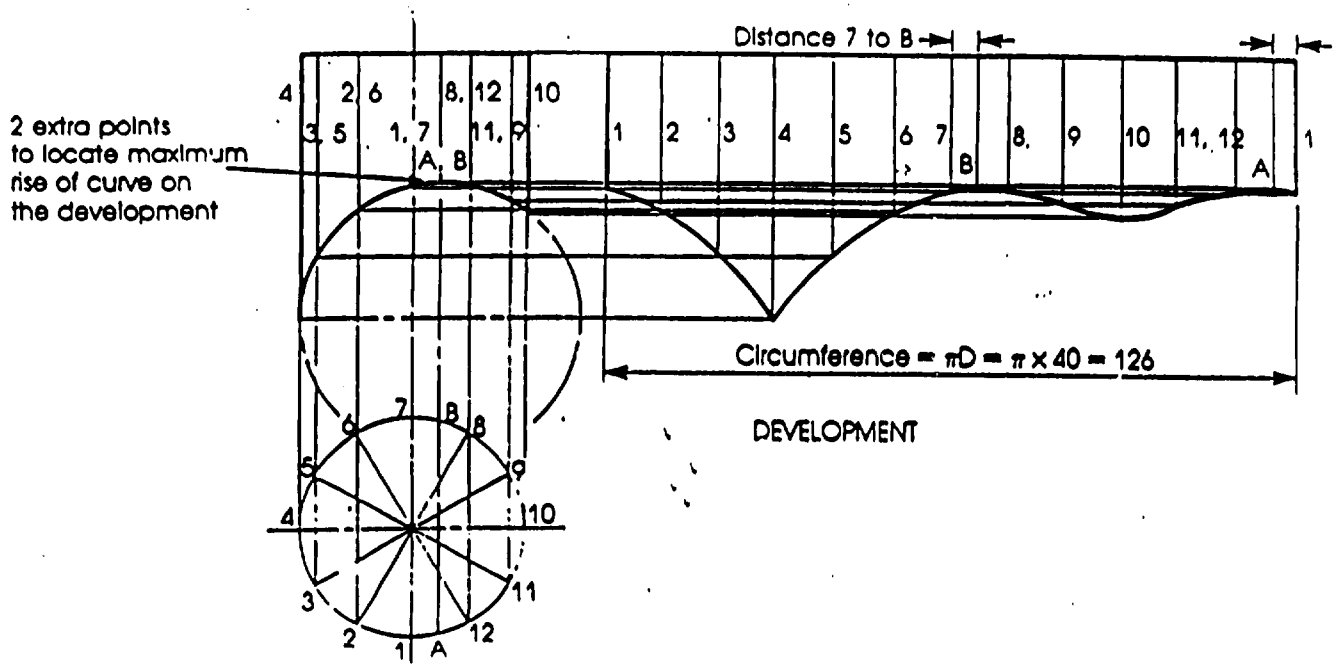


Circumference of the cone base circle = πd = π × 40 (see G36-7a)
θ is the angle produced when the base circumference is measured around the circle which is produced by the slant height $\theta = \frac{\pi d}{\pi D} \times 360°$

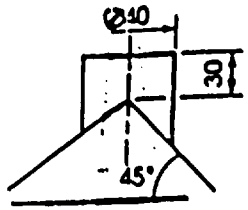
$\therefore \theta = \frac{\pi 40}{\pi 120} \times 360° = 120°$

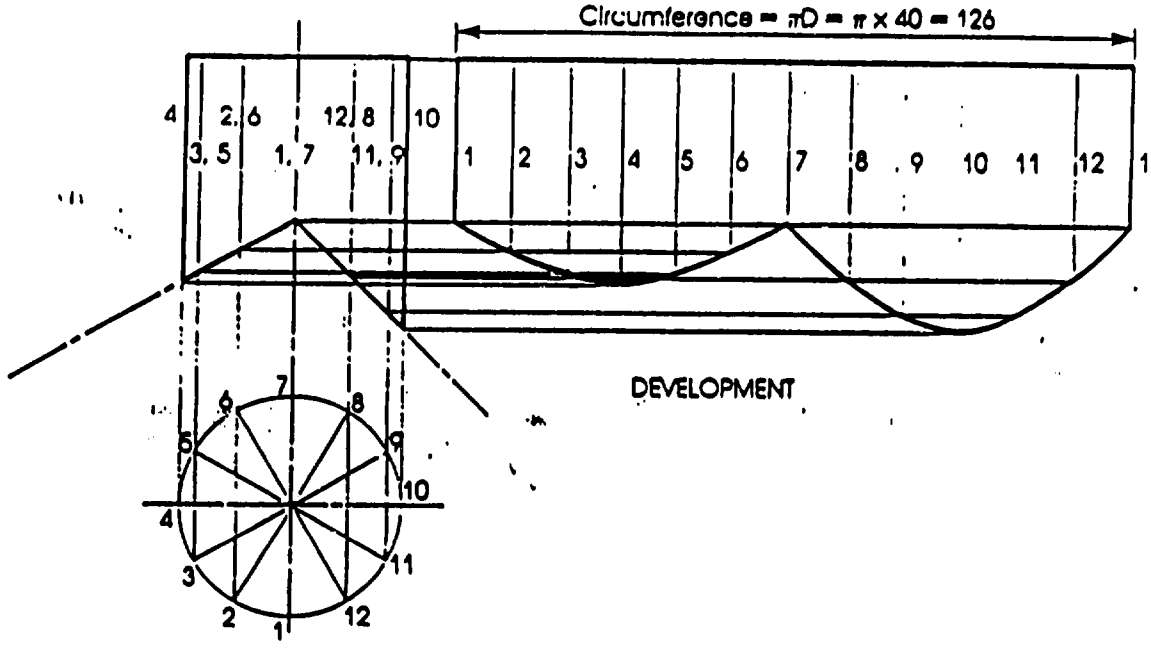
NOTE: **First Angle projection used.**



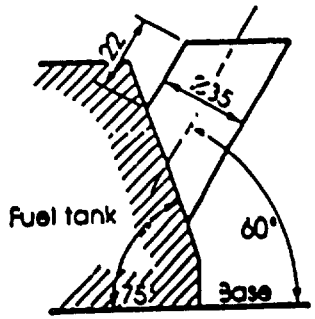


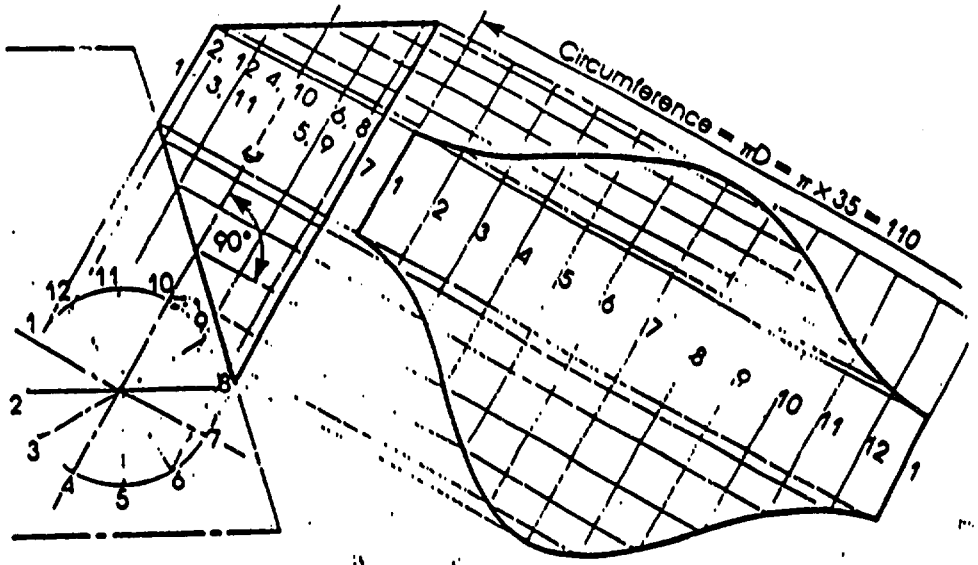
TITLE: **Developments of the cylinder.**	NOTE: **First Angle projection used.**





TITLE: Developments of the cylinder.	NOTE: First Angle projection used.

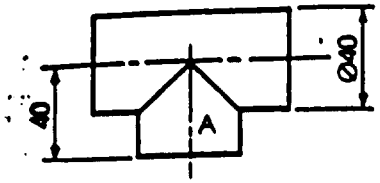


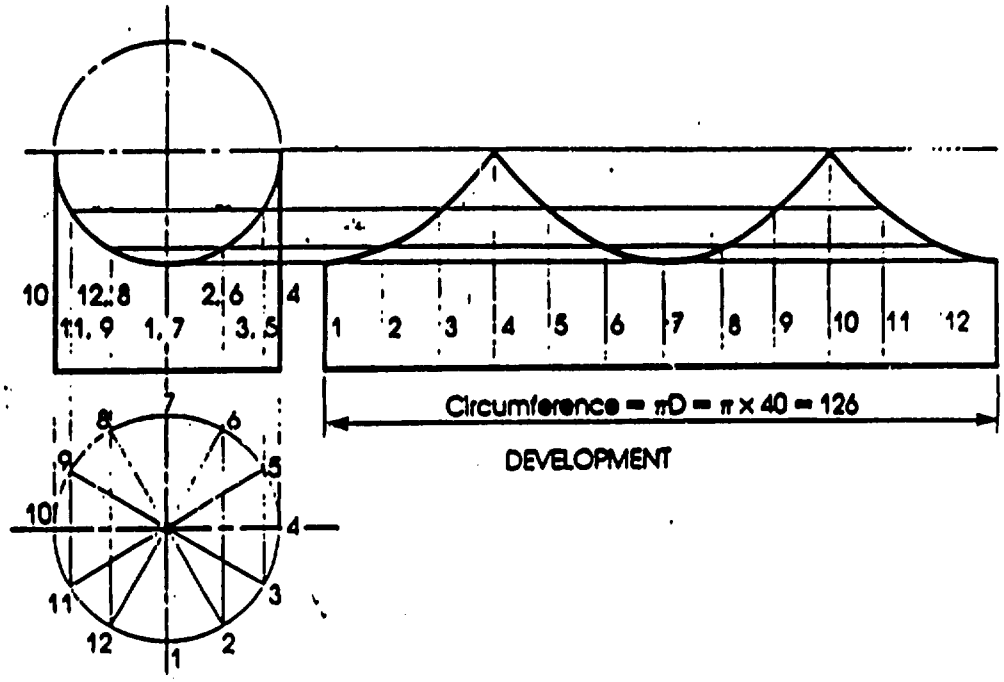


Develop at 90°. to ℄ axis of cylinder, i.e. unwrap the cylinder

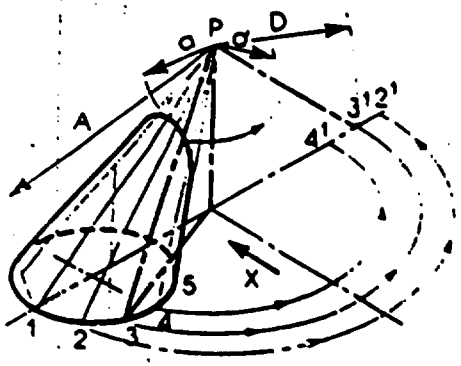
TITLE: **Developments of the cylinder.**

NOTE: **First Angle projection used.**



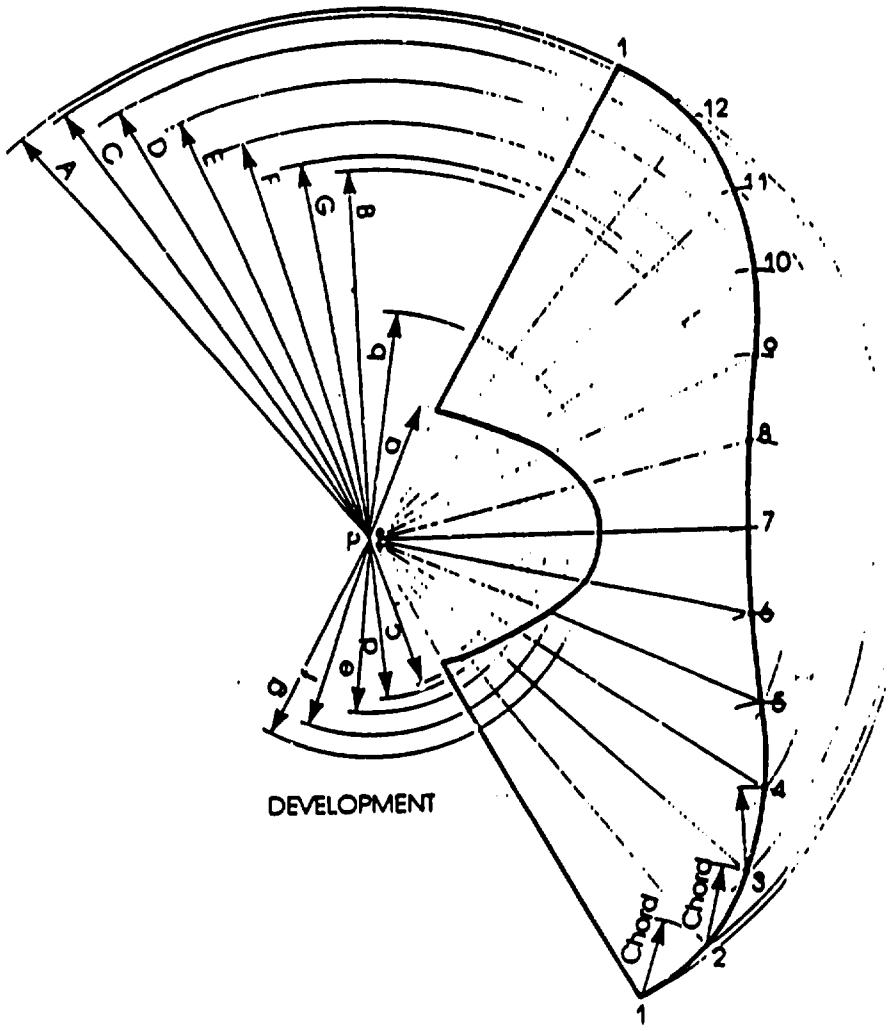


TITLE: **Developments of the cylinder.**	NOTE: **First Angle projection used.**



D is the true length of P to 3 when viewed on arrow X. The true length from P to the position where P3 is cut is the length d.

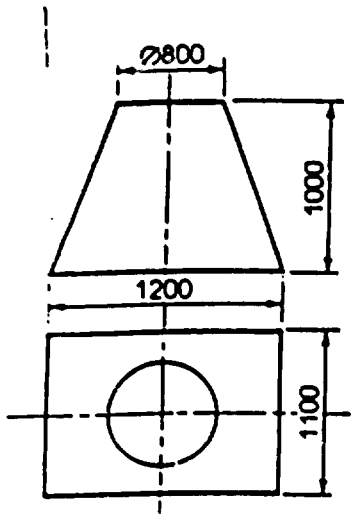
Note: P3 = P11, P4 = P10, etc. Base is not circular in the development as P1 does not equal P2 or P3 etc., therefore triangulation using chords for the base curve has been illustrated.

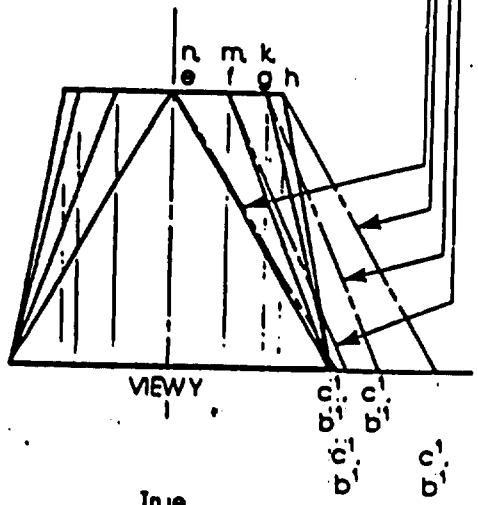


DEVELOPMENT

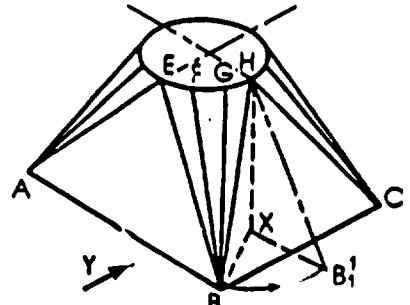
TITLE: **Developments of the cone**

A hood to extract fumes from a machine has a rectangular base but tapers to allow a circular pipe to be attached to the top. Produce the development of the transitional tapered hood to a scale of 1:20.

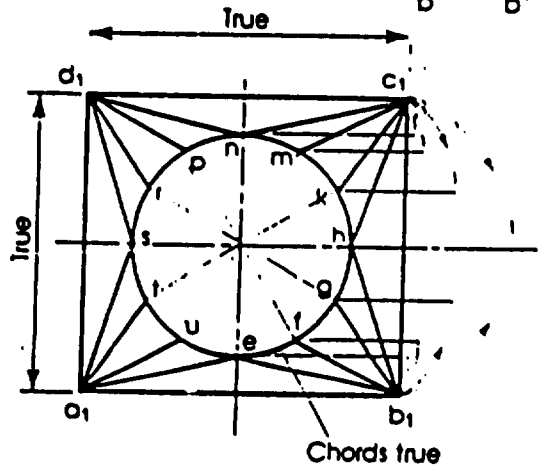




True length of EB = b^1e = EA and NC = ND = c^1n
True length of HB = b^1h = SA and HC = SD = c^1h
True length of GB = b^1g = TA and KC = RD = c^1k
True length of FB = b^1f = UA and MC = PD = c^1m

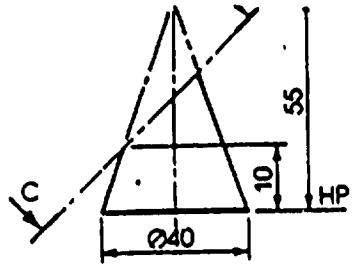


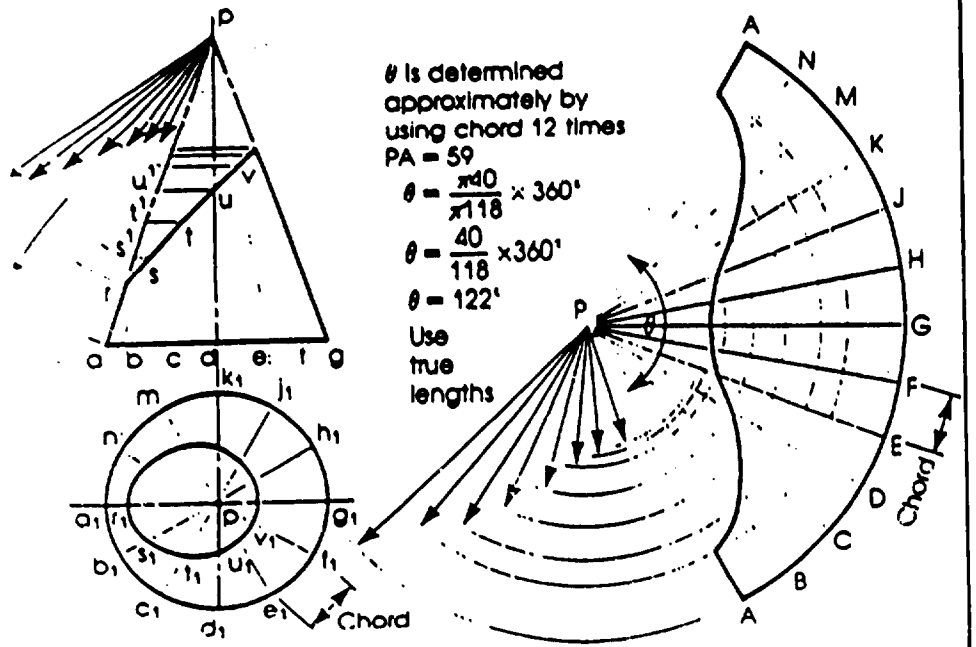
Pivot triangle HBX about HX to observe the true length of HB in the view on arrow Y



TITLE: **Developments of the cone and an introduction to triangulation.**

NOTE: **First Angle projection used.**





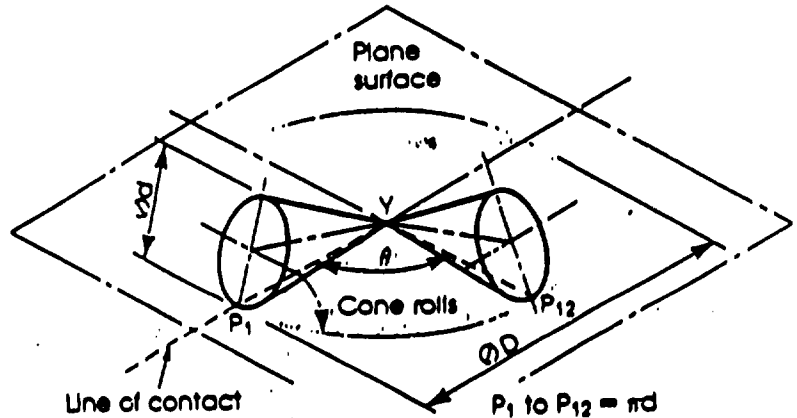
θ is determined approximately by using chord 12 times PA = 59

$\theta = \frac{\pi d}{\pi 118} \times 360°$

$\theta = \frac{40}{118} \times 360°$

$\theta = 122°$

Use true lengths



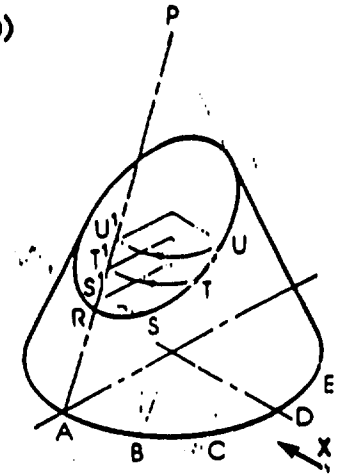
Line of contact between cone and surface

P_1 to $P_{12} = \pi d$

Cone rolls around Y. P_1 moves to P_{12} in one revolution.

Ød = 15, ØD = 60 — Therefore $\theta = \frac{\pi d}{\pi D} \times 360 = \frac{15}{60} \times 360 = 90°$

(b)



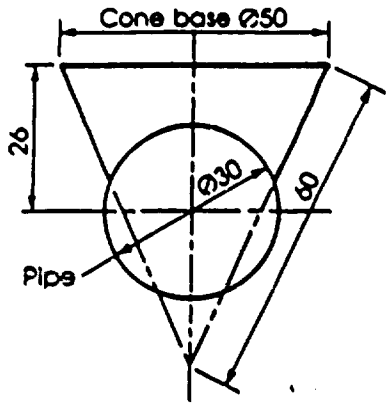
Not to scale

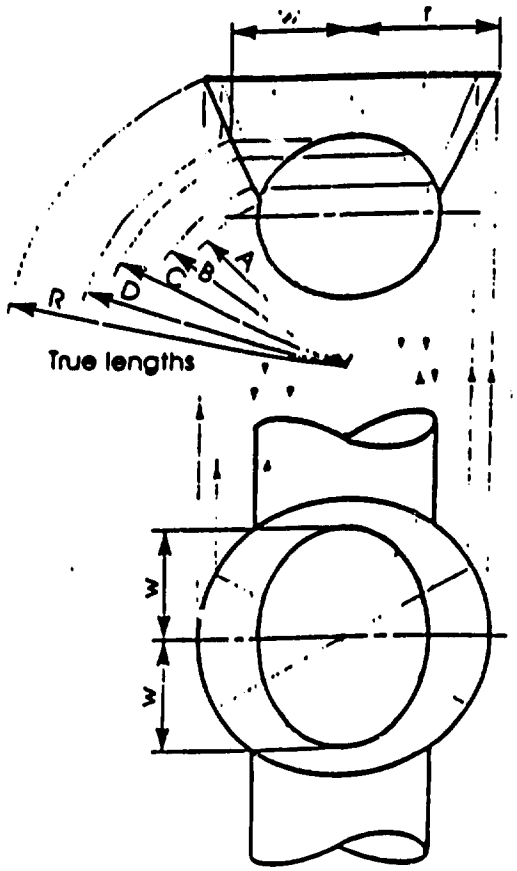
True lengths of UD, TC and SB can be seen in view X if they are pivoted to positions U^1, T^1, S^1. RA is seen as a true length from X. See G36-6 opposite

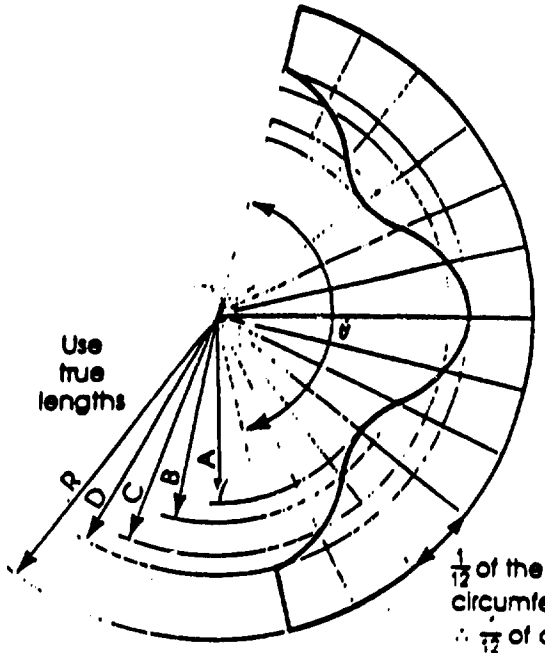
TITLE: **Developments of cones.**

NOTE: **First Angle projection used.**

Develop the part of the cone which forms the hopper and sits astride the pipe.







DEVELOPMENT

$\frac{1}{12}$ of the base circumference
$\therefore \frac{1}{12}$ of angle θ
$= 12\frac{1}{2}°$

$\theta = \frac{\pi d}{\pi D} \times 360$

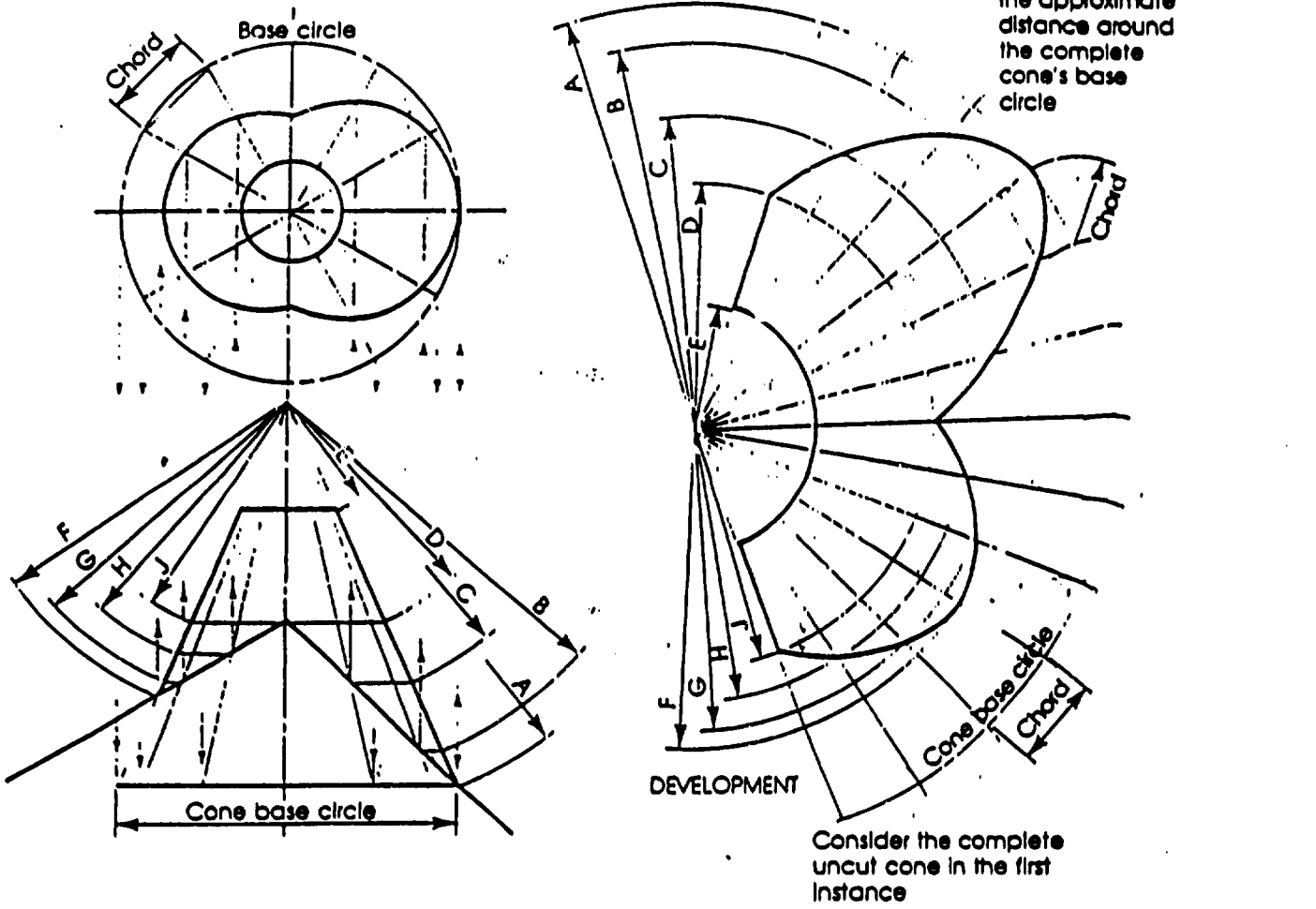
Since $\frac{r}{R} = \frac{d}{D}$ and π cancels out

$\theta = \frac{r}{R} \times 360 = \frac{25}{60} \times 360 = \frac{5}{12} \times 360$

$\theta = 150°$

TITLE: **Developments of the cone and an introduction to triangulation.**

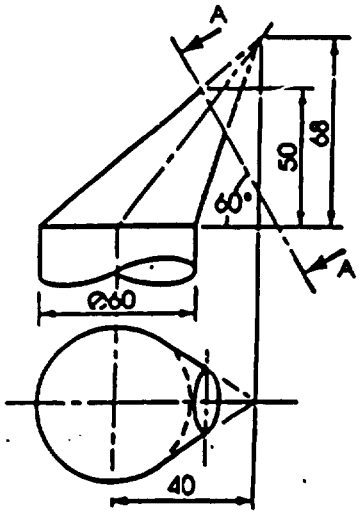
NOTE: **First Angle projection used.**

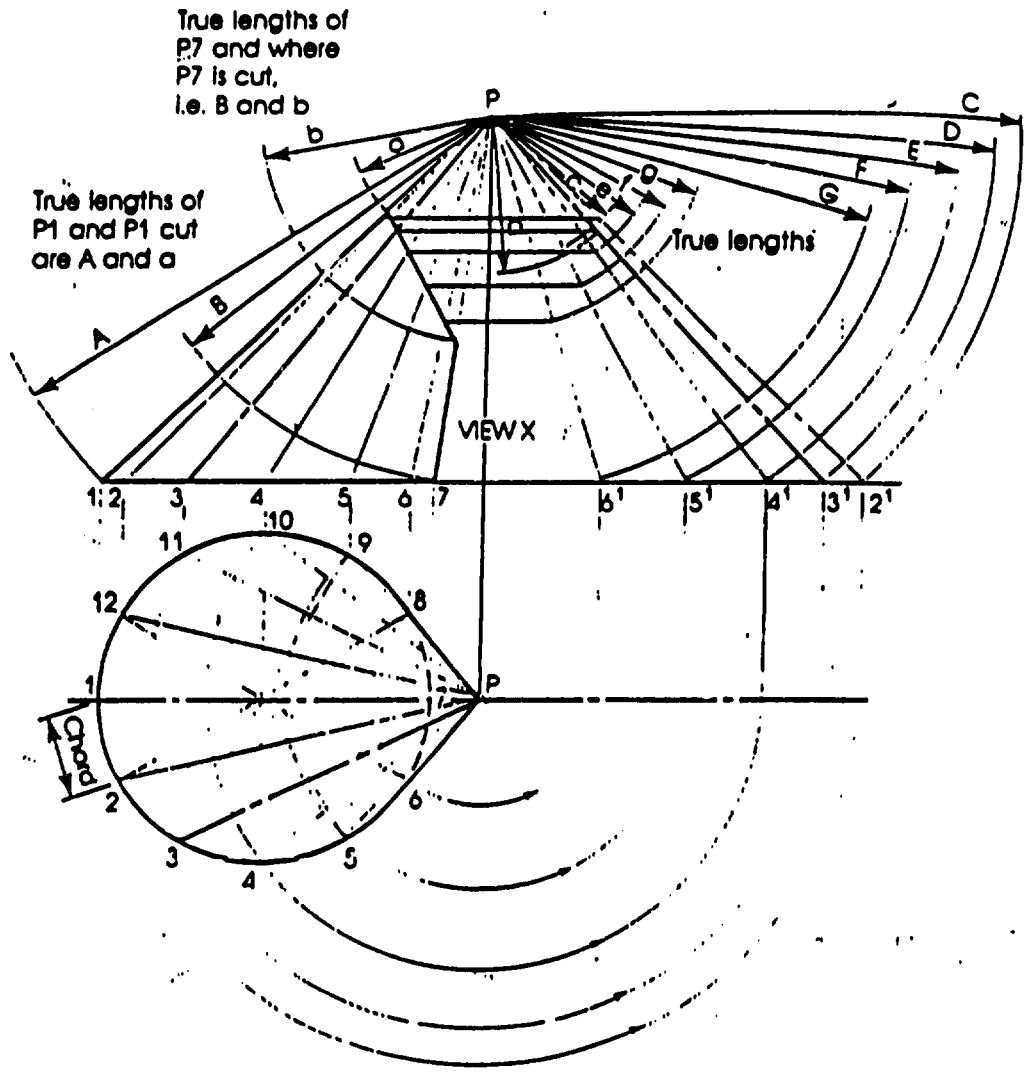


TITLE: **Developments of the cone and an introduction to triangulation.**

NOTE: **First Angle projection used.**

Plane A-A





TITLE: **Developments of the cone and an introduction to triangulation.**	NOTE: **First Angle projection used.**

SECTIONAL VIEWS

Quite often an outside view of an object does not describe it adequately as no internal features are shown. Usually such details (internal features) are indicated by dotted lines and as such are known as hidden details. This however does not always show very clearly what the inside details are. In order to show the internal features without excessive use of hidden detail -lines, the object is imagined to be cut along a plane called a Cutting plane.

The cut portion near to the observer is removed and the remaining part is shown as a Sectional view. Figure g.(i) below illustrates the cutting plane as applied to the hollow block and the resulting Section-face of the block.

Cutting plane

fig.g (i)

Surfaces in Section can be imaganed to be cut along the cutting plane with an imaginary tool and imaginary cutting marks are represented by equidistant hatching lines as shown in the figure above:

Sectional views are therefore produced to:-

(a) Clarify details of the object.

(b) Illustrate internal features clearly.

(c) reduce the number of hidden-details lines.

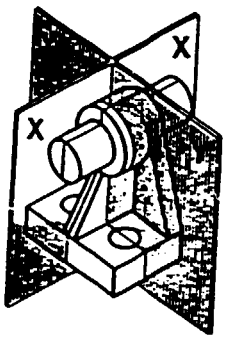
(d) facilitate the dimensioning of internal features.

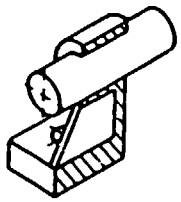
(e) show the shape of the cross-section.

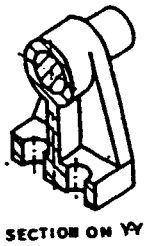
(f) show clearly the relative positions of parts forming an assembly.

Note: Certain parts are not sectioned if they are cut by the section plane but are left in position and only drawn in their outside elevation. This is because such objects are solid without any internal features and a sectional view would not make the drawing any clearer.

Such parts that do not need sectioning when the cutting plane passes through them are:- Shafts, Bolts and Nuts, Studs, Rivets, Ribs and Keys. Figure g (ii) below shows a shaft in an assembly through which a cutting-plane passes. Note that in the sectional end view of the block, the shaft is just drawn in its outside elevation.

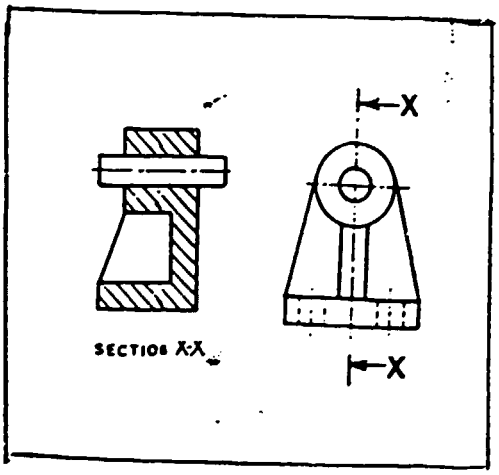




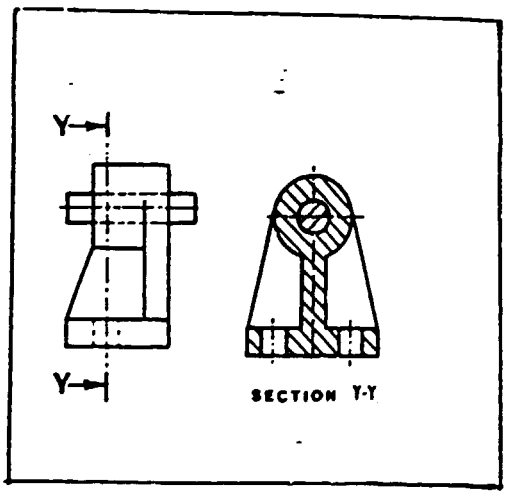


Further examples of Sectional Views are in figure g.(ii) (1) ----(]

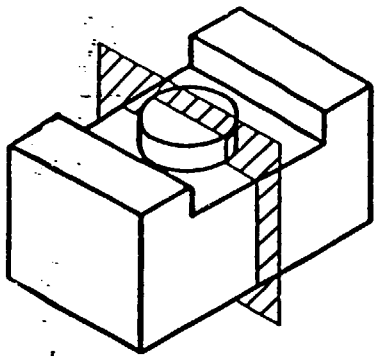
Fig.g(ii)



(a)

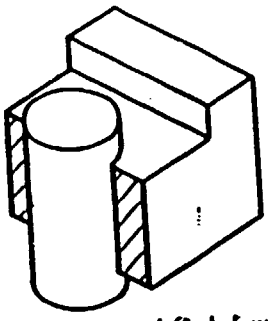


(b)

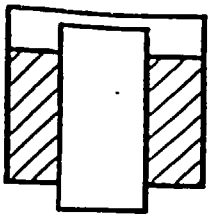


Isometric projection showing culling plane

(1)

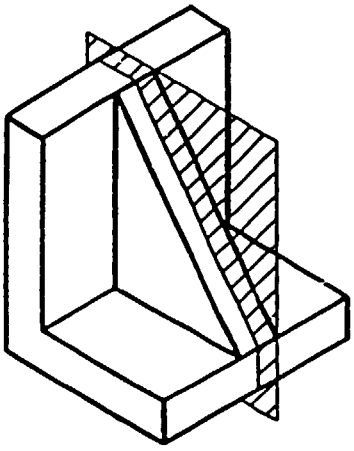


As diagram on left but with front portion and culling plane removed



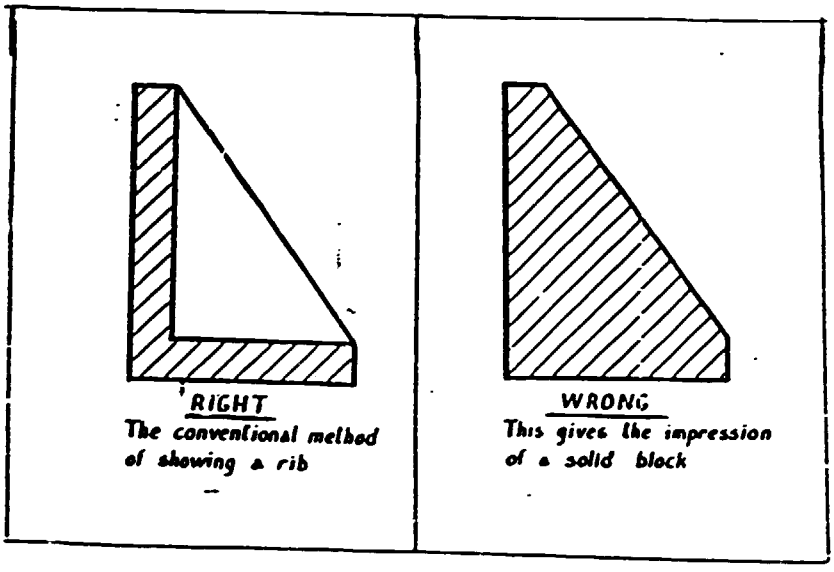
Sectional end view of block

(2)

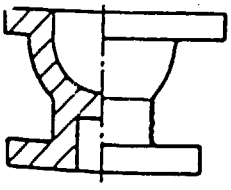


Isometric projection showing culling plane through rib

(3)

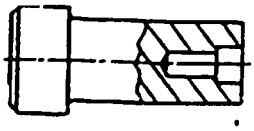


(4)



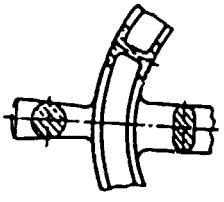
Half section

(5)



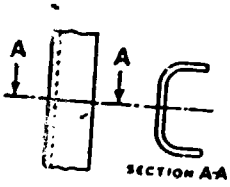
Local section

(6)



Revolved section

(7)

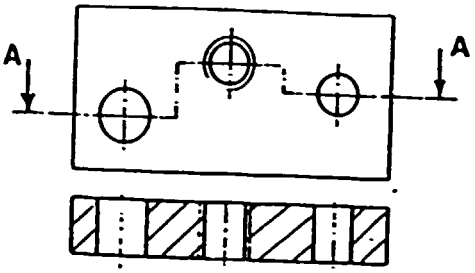


Removed section

(8)

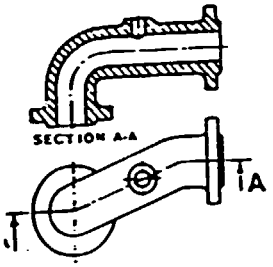
Thin section

(9)

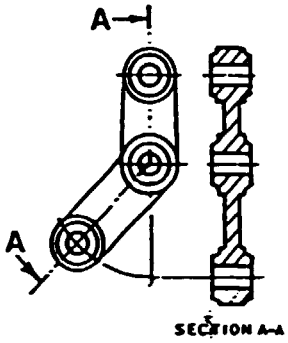


Parallel cutting planes

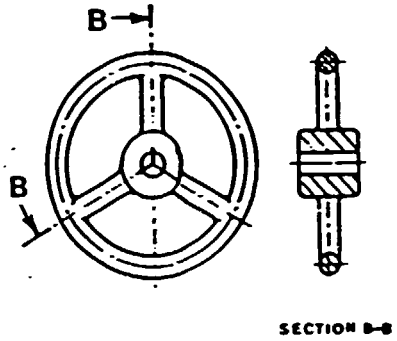
(10)



(11)

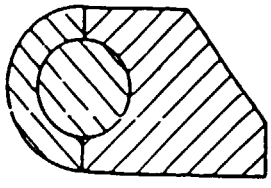


(12)

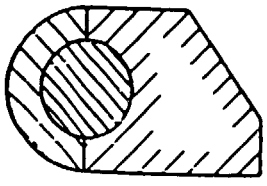


(13)

Adjacent components should be hatched in opposite directions. Hatching lines for additional adjacent parts can be offset or, alternatively, spacing between the lines may be increased or reduced, as shown for the internal part in fig. 5.28(a) and (b).



(14)

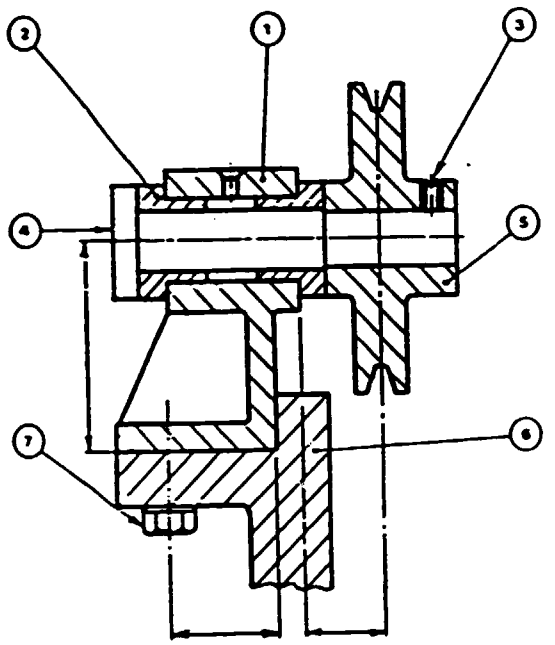


(15)

Assembly Drawing:

Drawings of parts assembled together in their respective positions often become necessary to be produced to clearly illustrate the functioning aspects of the equipment. To show the internal features clearly, the equipment is sectioned so that the position of parts inside can be seen clearly. Figure g.(iv) below shows Sectional View of parts assembled as required. The parts are numbered and parts list is given underneath.

Fig. g.(iv)



1	BRACKET	1
2	BUSH	2
3	GRUB SCREW	1
4	SHAFT	1
5	PULLEY	1
6	TABLE	1
7	BOLT AND NUT	2

Assembly with parts list

READING & INTERPRETING A GIVEN TECHNICAL DRAWING

To read and interprate a drawing is to obtain a clear mental picture of what the person who prepared the drawing wishes to convey. In Orthorgraphic projection, at least two views are required for a full description of an object. For practical purposes, it is therefore essential to acquire the ability to read a given drawing and to visualize the object it represents. The process of reading a drawing calls for much patience as systematic reference is made back and forth from one view to another. During this process, the reader must imagine a three dimensional object and NOT a two-dimensional flat surface.

A sketch of a three dimensional rectangular block is usually a useful start, followed by attempts to place the views accordingly on the three visible surfaces of the block. Fig. 9 (iv) shows an orthographic first angle projection of a stepped block. The three views (F.V,E.V & Plan) are clearly shown in projection with each other. A three dimensional drawing of the block is also given in figure 9(v). Note that the picture of the stepped block is drawn with the help of the rectangular block ABCDEFG.

Procedure:

- the block as seen in the direction of arrow F.V. is developed from the surface ABCG
- the end view of the block is developed from surface AFEG.
- the block as seen from top (plan) is developed from surface EDCG.

Through systematic reference back anf forth from one view to the other, visible edges are drawn until the picture of the stepped block is obtained.

ORTHOGRAPHIC — FIRST ANGLE PROJECTION

Fig (V).

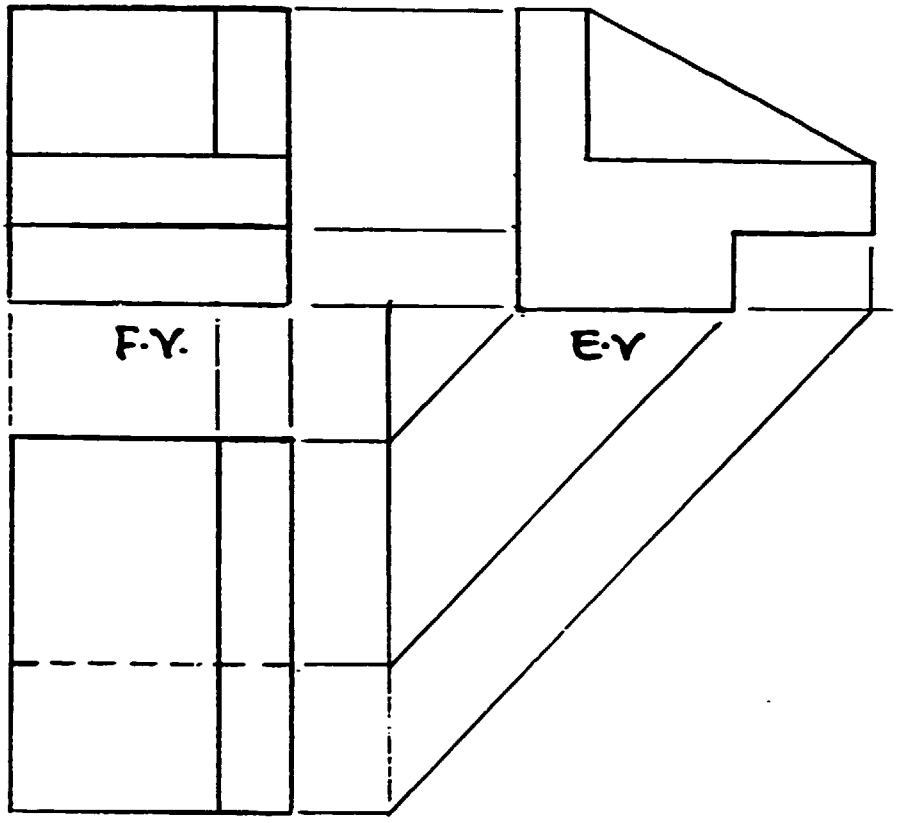
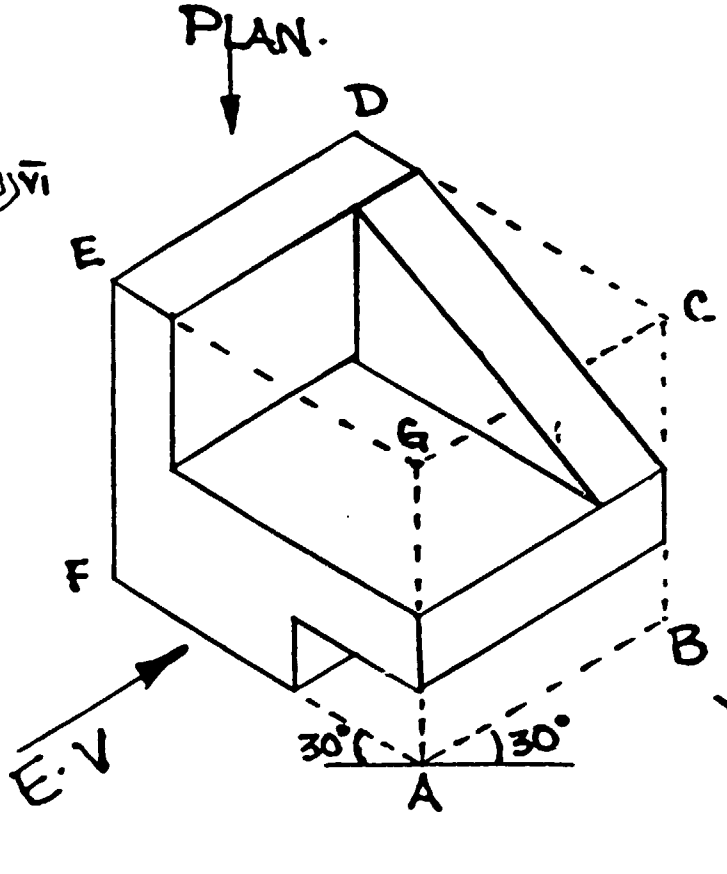


Fig (VI)



F.V :- FRONT VIEW
E.V :- END VIEW

THREE DIMENSIONAL DRAWING OF THE OBJECT

The ability to interprate a given drawing in Orthographic projection, to a three dimensional pictorial view requires much practice and can only be fully achieved with time. No matter how complecated a drawing may appear, the principle of interpretation is one i.e. the picture of most objects originates from the simple sketch of a rectangular block as seen in figure 9(VI) above.

The reader should therefore face any given drawing with courage and petience and try to visualize slowly how the given views "position themselves" on the three visible surfaces of the imaginary rectangular block.

Interpretation of a given drawing is even more important than making a drawing. The reader should therefore get to the habit of working with a pen or pencil and a paper when ever faced with the task of interprating a drawing from a customer in order to manufacture the item accurately. It is only when the "fundi" is convinced that the three-dimensional pictorial sketch he has drawn on a paper, is the true representation of the given drawing, is when he may proceed with the manufacture of the item.

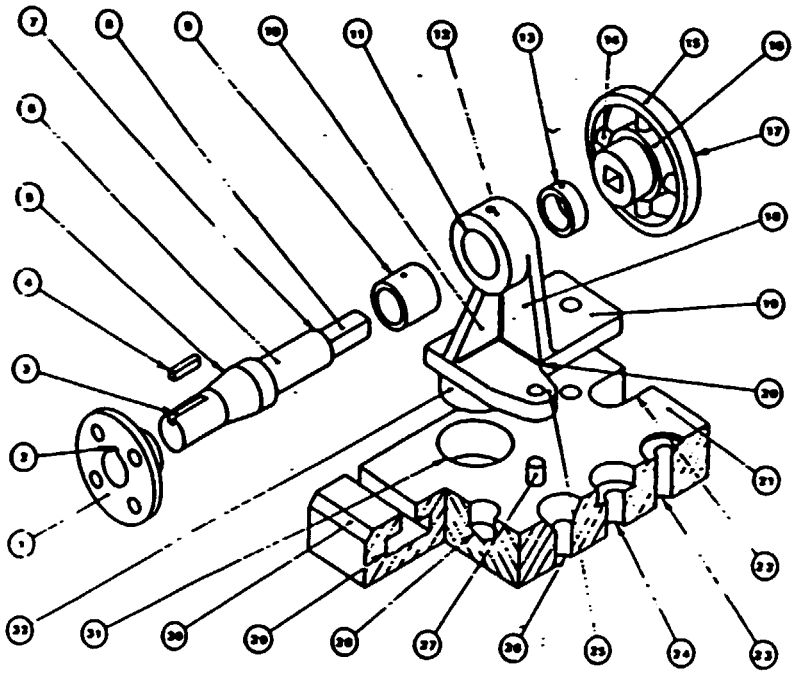
This is a technical skill and the "fundi" is therefore reminded to observe the "golden" rule that:-

"PRACTICE MAKES PERFECT"

DESCRIPTION OF SOME COMPONENTS USED IN MECHANICAL ASSEMBLY

1.7 Technical terms

It is necessary for engineers to know and understand the technical terms describing components and their features.



1. A *flange* is a projecting thin disc on pipes or couplings joining two shaft ends together.
2. and 3. A *keyway* is a groove in a shaft or a hub machined to accommodate a corresponding key.
4. A *key* is a piece of shaped metal which is inserted in a shaft and a hub to prevent relative movement between those two parts.
5. A *taper* is a gradual change in diameter of a component along its length.
6. A *shaft* is a cylindrical rotating rod upon which parts are fixed, used for transmission of motion.
7. A *shoulder* is a sudden change in diameter.
8. A *square on a shaft* is a length of the shaft with a square cross-section.
9. A *bush* is a plain bearing supporting a rotating shaft and can be easily replaced when worn out.
10. A *web* is a thin flat part connecting heavier parts of a component.
11. A *bore* is a cylindrical hole along a tube or a boss.

12. A *boss* is an enlarged protruding round part of a casting, used to accommodate a hole.
13. A *collar* is a separate ring of rectangular section or an integral part of a shaft used for axial location.
14. *Spokes* are rods radiating from the hub to the rim of a wheel.
15. A *rim* is the outer part of a wheel.
16. A *hub* is the inner part of a wheel.
17. A *pulley* is a small wheel with a flat or grooved rim to carry a belt, rope, etc.
18. A *rib* is a thin part used to support or strengthen heavier parts of a component.
19. A *bracket base* is the bottom part of a projecting support, usually fixed to a flat surface.
20. A *fillet* is an internal corner of a casting etc. which is curved to assist the flow of molten metal during casting and also to make the corner stronger by reducing stress concentrations.
21. A *table* is the flat top on which working components can be fixed.
22. A *slot* is an elongated hole or groove.
23. A *spot-faced* surface is a flat circular surface concentric with a hole, used for seating screw heads etc.
24. A *counterbored hole* is a hole, part of which is of larger diameter and flat-bottomed to conceal screw heads etc.
25. A *lug* is a projection from a casting etc., used for fastening and adjusting purposes.
26. A *countersunk hole* is a hole, part of which is conical to receive screw heads.
27. A *dowel* is a headless cylindrical pin used for precise-location purposes.
28. A *blind-drilled hole* is a hole which does not pass completely through the component.
29. A *tee groove* or *tee slot* is a long aperture used to accommodate fixing bolts, preventing them turning.
30. A *chamfer* is a surface produced by bevelling square edges.
31. A *recess* is a shallow hole to suit the shape of a spigot or a similar matching part.
32. A *spigot* is a projection which fits into a corresponding recess and is used for precise-location purposes.

ANNEXURE 5

SKILL UPGRADING

PRODUCTION OF FIBRE

CONCRETE ROOFING TILES

DP/KEN/87/009

KIE/UNIDO

TECHNICAL COURSE FOR KIE/UNIDO

FIBRE CONCRETE ROOFING TILE PRODUCERS

ENTREPRENEUR TRAINING

NOVEMBER 1990

INITIATED UNDER

PROJECT DP/KEN/87/009

UNDP/UNIDO TECHNICAL SUPPORT FOR

KIE ASSISTED PRODUCERS IN NYANZA PROVINCE

KENYA

CONDUCTED BY: INTERMEDIATE TECHNOLOGY DEVELOPMENT GROUP

HELD AT: KISUMU INDUSTRIAL TRAINING CENTRE

CONTENTS

APPENDIXES

A. BACKGROUND TO FIBRE CONCRETE ROOFING TILES IN KENYA

Fibre Concrete Roofing (FCR) tiles are one of the most recently developed roofing components available in Kenya, and are becoming accepted and well known throughout the country as an alternative to the commonly seen C.I.S. or mabati, and other more expensive products such as clay and concrete tiles and asbestos sheets. FCR is produced from a Portland Cement and sand mixture with the addition of a small quantity of natural fibre. The fibres are normally low modulus and are not used to reinforce the concrete, as is the case in glass fibre concrete, but rather to increase the moulding capacity of the concrete when in a wet state.

The principal advantages of FCR as roofing material are the following:

a) Production equipment and methods are ideally suited to small-scale, decentralised, labour intensive production. One production unit will produce 1,000 tiles per week, sufficient to roof a small house and provide work-places directly for 3-4 persons.

b) High quality, durable roofing materials are produced at a cost lower than other industrialised roofing materials.

c) Production requires only locally available resources and raw materials.

FCR technology in its earlier form (roofing sheets as opposed to tiles) was pioneered to a large extent in Kenya at Kenyatta University College in the 60' and early 70's. Later development work, which led to the introduction of the lighter, cheaper, and more convenient pantiles was undertaken by Intermediate Technology Workshops (ITW) of Britain and this project was partly funded by Intermediate Technology Development Group (ITDG). The technology was introduced to Kenya through pilot projects initiated by Action Aid-Kenya, ITW's Karen Training Centre and Housing Research and Development Unit of University of Nairobi where their performance was monitored and evaluated over a period of time before all three organisations, satisfied with the relevance and viability of FCR in the Kenyan situation began actively promoting the technology.

Most of the initial producers of FCR tiles in Kenya were NGOs (missions, development organisations, aid agencies, etc.) who were producing them for their own use. There was little evidence of people setting up commercial production units and selling tiles on the open market. The reason for this was the need for access to foreign exchange to purchase the equipment,

but there were also other technical and market-acceptability reasons which were clearly inhibiting the adoption of the technology on a commercial scale. The need for training of potential tile producers and end users was one such factor and another was the need to exercise strict quality control in the manufacture of the product.

Late in 1986, ITDG became actively involved in the dissemination and promotion of FCR tiles by providing a support package to would-be producers and encouraging the commercial dissemination of the technology with a complementary objective of providing work-places for the rural poor.

Very many structures, in different settings and scattered all over the country, have been successfully roofed with FCR tiles since 1983 and all 'authorities' on the subject do now accept that FCR has passed the test and come of age.

For this reason Action Aid-Kenya, HRDU, ITDG and other agencies are active on a programme of dissemination, promotion, technical back-up and training in order to enhance local awareness of this new product and to encourage its more widespread use.

B. BACKGROUND TO THIS TRAINING

The Kenya Industrial Estates (KIE) is an organization that seeks to assist the industrialists and businessmen of this country in both financial and technical matters related to development of small-scale industries and micro-enterprises.

During 1989/90 KIE received 14 applications from Nyanza, Western, Central and Rift Valley Provinces to fund production of FCR tiles. Of these, 10 applications were approved loans totalling KShs. 1,572,252/=. Of the remaining four, one is a comparatively larger investment proposed in Central Province and the total of the four loan applications amounts to KShs. 1,159,300.00.

The FCR tile is a relatively new product in the country, thus UNIDO decided to sponsor and organize a training course to equip the proposed producers (KIE clients) with technical knowledge on how best to produce and to manage their factories and also how to market tiles so as to make good profit margins.

UNIDO called a meeting in September 1990 for the KIE clients to discuss their needs, and approached Intermediate Technology Development Group for technical advice and training support.

This meeting produced the framework for the training course: A UNIDO/ITDG initiative. A draft curriculum and timetable was prepared and circulated to the participants and ammended on the strength of their comments.

The training course was thus designed in collaboration with and to serve the needs of the participants. This was critical to the value of the course and contributed substantially to the quality of the training.

C. OBJECTIVES

The objective of this course was to train the K.I.E. promoted entrepreneurs interested in setting up or already operating projects for the manufacture of Fibre Concrete Roofing Tiles (FCR Tiles).

By the end of the 30 hour intensive training, the trainee should be better able to produce, cost and market good quality tiles and also make tile moulds and advise on or supervise tile laying. The trainees were invited in 3 categories: the technical staff, the tile lavers and the owner managers from the same production unit.

D. CONTENT

i) Syllabus of the subject

The course design was prepared with the assumption that:

a) the participants (trainees) had not started production at all and,

b) that the producers (technical staff) had a basic knowledge of construction.

The main topics of the course and their time allocation are listed below:

1. Selection of raw materials and testing - 2 hrs
2. Use and types of equipment and tools - 2.5 hrs

3. Production procedures, site organizations and labour management - 1.5 hrs
4. Tile making practicals - 2 hrs
5. Concrete mould making - 1.5 hrs
6. Concrete mould making practicals - 2 hrs
7. Demoulding, curing and colouring of tiles - 2 hrs
8. Quality control and cement theory - 1 hr
9. Loading and transportation - 1.5 hrs
10. Roof structures - 1.5 hrs
11. Construction of roof structures - 1.5 hrs
12. Tile laying - 2 hrs
13. Tile cutting - 1 hr
14. Records, Book-keeping and Pricing - 1.5 hrs
15. Marketing - 1.5 hrs

ii) **Training Methodology**

Various topics had different methods of approach but the course was planned to be as practical as possible. All the equipment for the production process of tiles was available and a hands-on oriented approach was used rather than a lecture style.

The following tables show the objectives and key points for each topic together with a list of teaching aids and activities of the trainees. The rationale for training style adopted and a brief explanation of the importance of each topic is discussed below each tabular presentation.

Topic	Objective/ (Purpose)	Key Points	Teaching Aids	Trainee Activity
1.Raw materials selection & testing	i)identify and test good quality materials used for FCR tile production viz:	-sand testing -role of cement -identification of sisal	Bottle, water, sand, oxides, salt	Bottle test the sand to determine clay content.
	-sisal -sand -water		Handouts	Take notes

1A) The quality of F.C.R. is greatly determined by the quality of raw materials used. Sand, which constitutes 2/3 fo the total raw material in each tile, was analysed at length. The simple bottle test used to determine the amount of clay contents in sand was discussed and demonstrated. This gave the producers a very practical solution to controlling one of their major production problems. The role of cement and fibre was also discussed and the benefits of using different colouring oxides were analysed. This gave the participants a clear understanding of the quality of raw materials required for F.C.R.

2.Equip.& Tools	i)State the role of vibrator	-Role of vibrator -Mechanism of vibration	-Vibrators -contact addresses for vibrator & equipment manufacturers	Take notes
	ii)State advantages of the local & imported equipment	-Advantage and disadvantages of locally and imported equipment	Handout	

2A) The role of the vibrator and other tools required was analysed in detail. The equipment available locally and imported ones were discussed weighing both the advantages and disadvantages. Of particular importance was the equipment maintenance which was discussed at length. This left the producers and participants with a clear picture of what to expect from local compared to imported equipment. A list of different suppliers for different equipments was made available to the participants.

Topic	Objective/ (Purpose)	Key Points	Teaching Aids	Trainee Activity
3.Production process & labour organiz.	i)Analyse a a systematic approach in a production process ii)produce tiles of both mould types	-material selection & preparation. Production, curing and stacking.	Production process Practicals Vibrators moulds and all the tools required for tile production.	Take notes. wash sand. prepare materials. Each trainee had an opportunity to produce tiles Demould tiles Stack tiles

3A) A systematic approach of tile production was gone through and analysed. This was done step by step right from materials preparation to the final curing of tiles. The importance of every single step was explained and why no short cuts should be taken. This explained most of the reasons why things go wrong and how to avoid them. This was followed by a practical demonstration of how everything should be done. During the tile production process, the effects of excessive clay in the sand was evident to the participants due to the immediate cracking which appeared on the tiles. Participants were also shown how to clean the sand to avoid this common problem.

4.Making concrete moulds & racks.	i)Make concrete moulds for both Pantile and Roman tiles. ii)Construct a timber rack for moulds.	-Framework for grandmother mould -Mother mould casting. -Tile mould Casting - Timber racks construction.	Mould kits timber rack Handout	-make mother mould -take notes

4A) Though mould making is not a direct activity of production, the whole process of mould making was covered. The resource persons demonstrated the method of mould making using a "mould making kit" that can be purchased in Kenya. This gave the participants a solution of how to solve the problem of mould shortage. This topic brought some complaints of some poor quality moulds which apparently are on sale to some producers. Though this is highly doubtful, a follow-up is required to the mould producer to assess this situation before it goes out of control. During this session, a total of 10 moulds were fabricated.

Topic	Objective/ (Purpose)	Key Points	Teaching Aids	Trainee Activity
5.Quality control	-Field test the tiles produced to meet the KBS standard. -State the procedure for applying for KBS.Mark.	-Permeability. -Dimensions -Strength -Voids	copy of KBS standard KS02 747 Handout Tiles	Test the tiles for Dimensions voids, 'lug' strength.

5A) The requirements of Kenya Bureau of Standards (KBS) as per the draft standard was fully covered. This gave the participants a clear picture of what they are expected to produce and the possible consequence. Various problems associated with the production such as cracks and voids were analysed and the possible causes and solutions. This gave the producers a ready answer in case they encounter such problems.

The various field tests used to determine the quality of finished tiles in terms of permeability, transverse strength and impact resistance were all analysed. This gave the producers a sure and simple way of determining the quality of their products. These tests are all described in the summarized version of the KBS Standard which is attached as an annexe to this report.

6.Loading & Transport-ation.	Load the tiles well to avoid breakage during transportation.	-Method of of stacking -Cushioning material.		Take notes

6A) Improper loading and poor stacking of tiles and careless driving during transportation are some of the major causes of breakages. The proper methods of stacking, cushioning and tightening them together was explained and demonstrated. The tiles should be stacked as tight to each other as possible not to allow any movement. Tile transporters should also be warned to drive cautiously when transporting tiles since they are quite fragile.

Topic	Objective/ (Purpose)	Key Points	Teaching Aids	Trainee Activity
7.Roof structures and tile laying & cutting	-Identify the roof structures for tiles ii)lay tiles iii)cut tiles iv) laying procedures	-Various types of roofs. -Batten spacing -methods of laying	-Roof model -Tiles -Pincers	-Nail battens -Lay tiles -Cut valley & hip tiles

7A) The aim of this subject was to provide the participants with an understanding of how simple F.C.R. structures should be constructed. This mainly dealt with spacing of trusses and rafters. Other roof members such as wind braces were explained and their roles. The maximum batten spacing was described as was the tile laying procedure.

A half scale roof was built which made things more clear for the participants. Cutting of tiles was demonstrated.

As part of roofing, a thorough and a basic tile estimate procedure was discussed. This was mainly to equip the producers with a basic knowleuge of estimating numbers of tile required for simple buildings for their clients.

8.Record & Book-keeping for a tile production unit	i)Prepare a business plan. ii)Keep the books properly. iii)Identify which account to use for business	-components of a business plan. -list of book-keeping documents and their use. -various accounts	-sample business plan. -sample of .receipt .cashbook .invoice .delivery note. .stock card Handout	Take notes and drawings

8A) The components of a business plan and management system specifically in relation to a tile production unit were itemised and the purpose and methods of writing it were explained. The importance of keeping of records for a business was discussed and the various book-keeping documents described and the procedure for filling them shown.

Topic	Objective/ (Purpose)	Key Points	Teaching Aids	Trainee Activity
Costing & Pricing	i)Calculate the various costs to produce the tile.	-direct & indirect cost. -capital costs. -depreciation -overheads -profit	-Calculators -list of costs. of all items to be used in tile production -Handout	Calculate costs. Take notes

9A) Most of the participants had different methods of calculating the costs oftheir tiles.

A systematic approach to cost the production of a tile which included the capital direct, indirect, and depreciation costs were all considered to be the components of the cost of tile production. Overheads and profit were discussed with indication of the range. The participants contributed in the calculation of the unit rate.

Marketing	-work out a marketing strategy and market their tiles successfully. market offer. -market cultivation .sale .advertising	-demands of client -setting market goals and priorities -shaping of the market.	Handout	

The marketing session was prepared with the intention of stressing the importance of marketing as a distinct and vital component of small enterprise management. The session commenced with a general outline of different marketing strategies and then continued with techniques that are specific to building materials and to FCR in Western Kenya in particular.

The participants contributed by their enthusiasm for information on how to improve their sales.

E. EVALUATION

The purpose of the evaluation was to provide information on the effectiveness of the training for the three organizations responsible: KIE, UNIDO and ITDG. It will also help the KIE in providing follow-up support to the training participants. Evaluation of the training was conducted in two systems, namely:

i) On a daily basis, by participants completing a questionnaire about each topic.

ii) At the end of the course with participants sitting in short exam and by offering their own assessment of the course's value.

The evaluation enlightened the organizers on how every topic was handled with regard to time allocation, topic relevancy and to indicate of whether new skills were learnt well. The other purpose was to judge the suitability of the time allocation for the course and the general organization of the training. This was done at the end of the course whereas the former was done at the end of every topic. The analysis of this evaluation and sample copies of the evaluation forms are attached to this report. Appendix 1.

From the evaluation reports completed by the trainees during the course, it can be deduced that the course was generally well organized and most of the participants (40%) indicated that the time allocated to the course was enough whereas (30%) of the participants indicated that aspects of the course needed more time. Based on these findings and noting that most of the participants are businessmen, it appeared that the time allocation for this course was enough.

Additional time may have been useful for one or two participants, but well planned follow-up visits (See Recommendations (a)) will certainly be a more useful and cost effective way of supporting individual producers, each of whom faces problems that may be peculiar to himself.

In addition to the participants' evaluation reports, the resource persons responsible for day to day training also assessed the course. Each of the three trainers indicated that the course design was likely to produce the anticipated outcome - more effective tile producers - and all three stressed that efficient organization on the part of KIE, UNIDO and the MTTAT had contributed substantially to the quality of the training being offered.

The last section of this report, derived partly from the evaluation, gives a clear indication of the follow-up actions by KIE, ITDG and the participants that are desirable.

F. CONCLUSIONS

The training course achieved its primary objective of giving technical and theoretical guidance to KIE loanees. The objective was met particularly because the course participants were given every opportunity to influence the course curriculum and content.

Inevitably when a diverse group of existing and would-be producers gather together, it is impossible to cover every interesting topic to the full satisfaction of each and every producer. But the combination of the participative planning and the experience and expertize of the course organizers allowed for the maximum possible benefit the shortest possible time. Any shortcomings that have become apparent from the evaluation may be covered by the follow-up actions detailed in the Recommendations (below).

All major aspects of tile production were covered during the training. All participants had an opportunity during the practical sessions to gain hands-on experience, and all had a chance to discuss individual problems with the organizers throughout the training week.

This training was beneficial not only to the participants. The organizers and resouce persons, KIE/UNIDO, ITDG and the Kisumu Industrial Training Centre also gained through the experience.

G. RECOMMENDATIONS

i) The training course and the evaluation has indicated that the FCR producers in Western Kenya (and elsewhere in Kenya) gain substantial benefit from participating in a training such as this. But it is also clear that small-scale producers, particularly when they are manufacturing a new product need as much on-going support as can be made available.

This part of the report, derived largely from experience by the producers and the course organizers but supplemented by ITDG's understanding of the current state of the FCR industry in Kenya, outlines what the producers need and what could or should be offered in the way of support by KIE, by UNIDO and by ITDG.

ii) **Trainee Needs -**

From this course, trainee needs fall into two categories:-

a) Marketing and business management support
b) Production support

Both categories may be covered either by follow-up visits to the producers, by individual producers or by collaborative action by a group of producers. Firstly, each producer/loanee should be visited by KIE extension staff to check that they are putting into practice the information and skills that they were offered during the course.

Secondly, from the evaluation, a major area of concern for all producers is the availability of raw materials to sustain continuous production. All the producers expressed concern that colouring oxides may not be readily available in Kisumu and that cement shortages could restrict production. They requested, as a group, that KIE might intervene in the supply and marketing of oxides and cement on their behalf, perhaps by making bulk purchase of these materials for onward sale and distribution to the producers. ITDG will discuss this with the KIE and the producers during follow-up visits.

iii) **KIE support to producers/loanees/course participants -**

KIE has committed substantial investment to FCR technology in Western Kenya through producer loans and through the sponsoring of this training course. It is therefore in KIE's own interest to continue, via its extension training and advisory divisions to support its FCR loanees so as to increase the likelihood of loan repayment schedules being met. Also, KIE will be tangibly, though indirectly contributing to the National Housing Strategy's goal of improving access to affordable building materials by continuing to support its FCR Producer loanees.

The KIE continuing support package should include:-

a) Follow-up support to all participants through regular visits.

These visits should be planned to assess each producer's performance and may be structured, initially, around the topics covered during the course. KIE extension staff should give particular attention to the quality of tiles being produced (checking may be done using the KBS guidelines included in this report) and to the marketing strategy being adopted by each producer.

Each visit should identify any areas of technical concern that may be beyond the capacity of KIE staff to respond to so that outside advice can be sought (perhaps from ITDG).

Following each visit the KIE officer should report the findings of his visit to his superiors, and a plan of action for solving the producer's problems should be drawn-up.

b) Continuing contact with the ITDG staff who will be available to offer technical and business management guidance to the producers via KIE.

iv) ITDG support to producers/loanees.

ITDG has an ongoing programme of support to FCR producers nationwide; this training was incorporated in that programme. ITDG's programme includes a package of technical, business management and marketing support activities that are being offered to all the course participants, as well as other producers. This training course has enhanced its understanding of producers' needs. The immediate post training activity plan for ITDG is:-

a) In conjuction with KIE extension staff (see above), to visit each of the participants to assess their production and entrepreneurial capacity and to draw up a plan to respond to any perceived shortcomings.

b) To incorporate all the participants in ITDG's ongoing FCR Producer Support and Dissemination Programme.

v) Course participants

a) Maintain regular contact with KIE, to inform KIE of post training progress and to highlight any production and entrepreneurial needs that arise.

b) Maintain contact with other participants and FCR producers via the FCR Producers Association that was formed during the training course.

EVALUATION SHEET A. (TOPIC BY TOPIC)
(To be completed after every topic)

Instructions:

Indicate on each topic column the response you select from the choices given - Letter A B or C. to fill in right for each of the following statements. Do not fill on the sentences

		Raw materials identification & selection	Equipment types use & maintenance	Production process: Grid, Labour organization	Mould making	Quality Control	Roof structures	Tile laying & cutting	Record, Book-keeping & Pricing	Marketing	Loading and transportation
1.	The topic was ..... to understa A. Very easy B. Moderate C. Difficult.										
2.	The topic was allocated ..... time A. Too much B. Adequate C. Not enough.										
3.	I learnt ..... new skills from this topic A. Very many B. A few C. No										
4.	The facilitator to this topic was ..... A. Very competent B. Just competent C. Incompetent										
5.	The handouts and teaching materials provided were ..... to understand A. Difficult B. Moderate C. Easy										
6.	The new skills and knowledge learnt will ..... applicable to my project A. be Very B. be just C. not be										
7.	The topic was ..... to my project A. Very relevant B. Relevant C Not relevant										

EVALUATION SHEET B.

(To be completed at the end of the course. List where appropriate and circle the selected choice)

1. List the three most interesting and useful topics learnt during the course.

i)
ii)
iii)

2. List two least important topics learnt during the course.

i)
ii)

3. List three new skills/knowledge learnt and their proposed application in your project.

New skill learnt	Proposed application
i)	
ii)	
iii)	

4. Who else in your opinion should have attended this course.

i)
ii)

5. The time allocated for the whole course was

A. Too much B. Enough C. Not enough

6. If your answer to Q5 is A or C, how many days should be adequate for this course.

... days.

7. Which other subject(s) should have been included in this course.

i)
ii)
iii)

Facilities (circle as appropriate)

8. The Workshops and classrooms were

A. Very spacious B. Adequate C. Not enough

9. The tools and equipment used were

A. Very appropriate and enough B. Appropriate
C. Not appropriate and not enough D. Appropriate and not enough

10. Materials used

A. Very relevant and enough B. Relevant
C. Irrelevant and enough D. Irrelevant and not enough

11. The meals were

A. Very good B. Average C. Poor

12. The boarding facilities were

A. Excellent B. Comfortable C. Poor

13. Generally the course was organized

A. Very well B. Well C. Not well

BASIC INFORMATION ON FCR TILE PRODUCERS

1) ORGANIZATION OR COMPANY NAME: .....

NATURE OF ORGANIZATIONAL (COMPANY LTD. PARTNERSHIP. SOLE ETC.): .....

CONTACT PERSON: .....

ADDRESS: .....

.....

LOCATION OF UNIT: DISTRICT .....

DIVISION .....

LOCATION .....

COMMENCEMENT OF PRODUCTION: .....

2) EQUIPMENT:

a) Number of vibrators - i) Manual .....
ii) Battery Driven.....
iii) Electrical Driven .....

b) Type of Moulds - i) Pantile Moulds .....
ii) Romantile Moulds .....
iii) Other types of mould .....

c) Capacity of curing tanks .. ..

3) PRODUCTION:

Item	Daily Capacity	Daily Actual
Roman Tiles	.....	.....
Pan Tiles	.....	.....
Other Products		
.....	.....	.....
.....	.....	.....
.....	.....	.....

4) RAW MATERIALS:

Type of Fibre .....

Mixing Ratio: Cement .... Sand .... Fibre .... Water ....

Measured by: Weight .... Volume ....

Both weight & volume ... (Tick as appropriate)

5) PERSONS EMPLOYED:

Category	Permanent(No.)	Casual(No.)
Supervisor	.....	.....
Skilled	.....	.....
Unskilled	.....	.....
Clerical	.....	.....
Watchman	.....	.....
Cleaner	.....	.....
Others	.....	.....

6) MARKET: (State number and type of purchaser of tiles during the last 6 months)

			No. of Tiles
a) Institutions	- Schools	.....	
	- Hospitals	.....	.....
	- Offices	.....	.....
	- Others	.....	.....
b) Individuals	- Low Income	.....	.....
	- Middle Income	.....	.....
	- High Income	.....	.....
	Total No. of Tiles		

7) TRANSPORTATION:

- Client provides transport .....%
- Producer " " .....%

8) ROOFING:

Who lays the FCR tiles your unit produces?

- FCR Producer .....
- Recommends tile layers to client .....
- Client looks for tile layers .....

9) STATE FOUR FACTORS THAT HINDERS YOUR PROJECT FROM ATTAINING THE:

i) Maximum production capacity .....

ii) Maximum selling levels .....

Make suggestion(s) on how the problems you have stated can be resolved to assure a successful tile business.

10) ANY OTHER INFORMATION.

Name:..... Signature .....

Designation ..... Date. .....

APPENDIX 2

HOW TO MAKE

FIBRE

CONCRETE

ROOFING TILES

Production Procedures, Roofing and costing guide line

By S. M. Mwangi

CONTENTS

0.1 INTRODUCTION AND BACKGROUND

There has always been a need for a cheaper and durable roof cladding to replace the commonly used Galvanised corrugated iron sheets (mabati) which highly relies on imported steel and less durable. This inevitably has led a number of Agencies to research in to other roofing materials.

The research in Fibre Concrete Roofing (F.C.R) was to a large extent pioneered here in Kenya at Kenyatta University College in the late 60's and early 70's. This research was more oriented in producing a roofing sheet format largely as a substitute for asbestos cement roofing products. Earlier work with F.C.R sheets led to some failures due to the high level of supervision and quality control required during manufacture and installation.

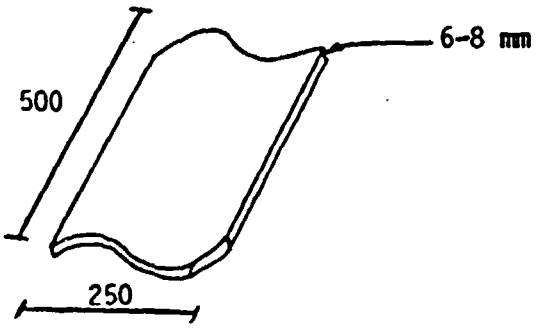
In the early 80's Intermediate Technology Workshop (I.T.W) of Parry Associates based in U.K carried out further research and development and came up with an F.C.R tile. I.T.W adapted a "Pantile" shape based on a traditional tile form in use in Europe and Asia for hundred of years. The manufacturing system also adapted was semi-mechanized removing most of the human error factor associated with F.C.R sheets.

In Kenya the F.C.R tile technology was first introduced by I.T.W at Karen in Nairobi in 1983. This technology was given a further boost by ActionAid-Kenya, in several pilot projects throughout the country in their building programme. Other agencies such as housing research and development unit (H.R.D.U) and Intermediate Technology Development Group (I.T.D.G) got involved in the promotion and dissemination of F.C.R tiles.

To date, there are over 1ootile producers in the country with approximately 50 active one.

2.0 WHAT IS AN F.C.R TILE?

An F.C.R tile is 500mm x 250mm x 6-8mm thick cement and sand mixture with an additional of a small percentage of fibres. This mixture is then vibrated on a vibrating table and then plated on a mould where it is formed into a pantile, romantile or interlocking tile.



2.1 Materials required for F.C.R tiles and their qualities

The main raw materials required to produce F.C.R tiles are:

(i) Sand

(ii) Cement

(iii) Fibre

(iv) Water

(v) Colourings (pigments)

(i) Sand

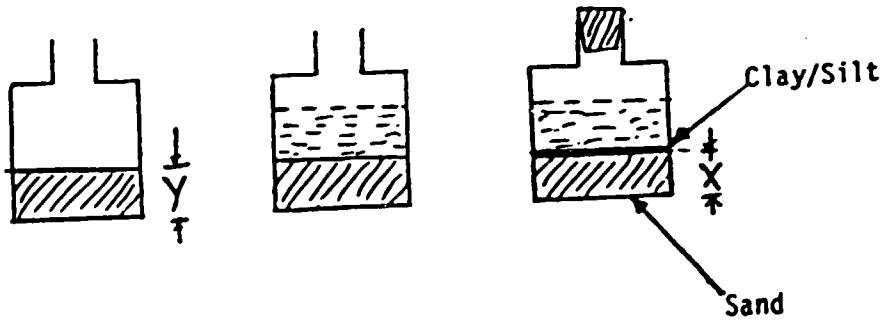
Sand constitues approximately two thirds of the tiles main raw materials. A good quality of sand for making FCR tiles is the one which is evenly graded and does not contain more than 10% clay/silt content. The sand must also be passed through a 2 or 3 mm sieve to remove any particles bigger than 2 mm.

The sand must also be tested to determine the amount of clay/silt content.
A simple way to test sand is described below:

- Take a clear straight sided jar or bottle.
- Fill the jar or bottle now approximately 1/3 with already sieved sand. record this height as Y.
- Fill the jar or bottle now with water approximately $\frac{2}{3}$" full now. Add a small pinch of salt.
- Shake the contents thoroughly for at least a minute and leave the mixture for approximately 30 minutes to settle. All the sand particles will settle at the bottom and the clay slit will settle at the top.
- measure the geight of the sand from the bottom of the bottle to the bottom of the clay/silt. Record this height as "X".

The clay/silt content is expressed as a percentage of the sand using this formular:

- Y - X = clay/silt content
- $\frac{Y - X}{Y} \times 100$ = % clay/silt content in sand



If the sand has a clay/silt content bigger than 10%, use a different supplier or wash the sand.

Warning:

Always test a few samples of sand before making any large scale orders.

(ii) Cement

The cement recommended for making F.C.R tiles is ordinary Portland cement. Cement must be kept dry and not longer than 2 months. Cement which has already formed lumps should never be used to make F.C.R tiles.

(iii) Fibre

Fibre used to make F.C.R tiles should be clean and flexible. Fibre which is stiff and contains sugar or is oily or contaminated with impurities which may react with cement should never be used. In normal cases, clean sisal fibre has been found to be universaly suitable. However, there are simple fibre tests which can be carried out if necessary.

(iv) Water

Water used to make F.C.R tiles should be clean and not salty to taste. Ordinary drinking water is suitable.

(v) Colourings

Pigments used to colour F.C.R tiles should not have negative effects on the cement. Normally Oxides used to colour concrete floors are suitable.

3.0 EQUIPMENT AND TOOLS

To make F.C.R tiles, the following equipment and tools will be required.

1. Vibrating table and frames
2. Moulds (for tile and ridges)
3. Plastic Interface sheets
4. Batching boxes
5. 3mm Sand sieve
6. Bench
7. Weigh scales for weighing fibre
8. Wheelbarrow
9. Battery or battery charger
10. Watering cans and buckets
11. Broom and brush
12. Hand tools (shovels, panga, plastering trowels
13. Karais
14. Hand glooves
15. Simple tools - spanners, screw drivers and pliers
16. Oil can
17. Curing tanks

Warning:

Always wash the tools and equipment and wipe them with an oily rug for a maximum working life.

4.0 PRODUCTION PROCEDURE

The following procedure is followed to make F.C.R tiles:

4.1 PREPARATION OF RAW MATERIALS

- Sand and cement are dry mixed in the ratio of 3:1 respectively by weight. Standard batch boxes are used to fasten this process.

- Chopped sisal fibre of approximately 10-12 mm is added as the mixing continues. This is 0.5% of both the weight of cement and sand. A typical mix is one - 50kg bag of cement mixed with 150kg of sand and 1kg fibre. If coloured tiles are required, the colouring or Oxide is added at this stage of dry mixing.

- A controlled amount of water is added as the mixing goes on. Care must be taken at this stage to avoid adding excessive water. While using 50kg cement and 150kg sand approximately 35 litres of water is adequate while using typically dry sand.

4.2 MAKING THE TILE

- A polythene sheet is placed on the screeding table and the hinged tile frame locked in position.

- A measured quantity of the ready mortar is placed on the table top and vibration started by switching on the machine.

- As the machine vibrates, the operator screeds the mixture levelling the screed with the top of the frame. This operation takes approximately 50 seconds or until you see a thin film of water forming on top of the screed. The vibration forces out all the air bubbles and the result is a compact hamogenous screed.

- The vibrator is switched off and some mortar is placed in the nib former and vibrated so that it binds well with the rest of the screed. A hole is then punched through the nib or a loop of galvanized wire is fixed to the nib.

- The vibrator is then switched off again and the tile frame opened taking care not to damage the already formed wet nib. The screed is left on the polythene sheet.

- The screed is transferred to the mould by holding the polythene sheet diagonally at corners. It is then aligned correctly on the mould which is then removed for stacking and initial drying of the new tile.

  * The newly formed tiles will stay on the mould for a minimum of 24 hours. Depending on the conditions of the weather, the tiles can stay longer.

4.3 CURING

The tiles are demoulded after the initial 24 hours setting for the next stage of curing.

- Tiles are demoulded carefully and excess mortar flushing trimmed off. The tiles are very weak at this stage and should be handled with maximum care.

- The demoulded tiles are carefully put in a curing tank standing vertically leaning against the sides of the tank.

- The tiles are then sprayed with water and covered with a polythene sheet preferably black tightly and left to cure for a minimum of 5 day. Alternatively tiles are put in a curing tank filled with water and completely submerged. They should stay under water for a minimum of 7 days.

- The tiles are then removed from the curing tanks and left to dry in the open air for another 7 days after which they are ready for use.

Warning:

Luck of adequate or proper curing of tiles will result in weak and substandard tiles which will not be acceptable to the Kenya Bureau of Standards (KBS).

4.4 COMMON DEFECTS IN F.C.R. TILES

Just like any other product, some tiles will be condemed as unacceptable and therefore not fit for roofing purpose. Most of the problems or defects which makes a tile unacceptable can be eliminated or controlled during the early stages of production.

Most new tile producers will experience some of these problems which will eventually be eliminated with experience.

The table below analyses some of the defects and their causes:

DEFECT	CAUSE	SOLUTION
1. Voids	- Under vibration	Minimum vibrating time for a tile is 45 seconds. Your battery must always be recharged every 3 days
	- Too wet, or too dry mix.	Control the amount of water. Water/cement ratio not to exceed 0.7
2. Cracks	- A lot of clay/silt in sand.	Test your sand again
	- Rapid evaporation.	Ensure that your tiles are totally sheltered from wind and direct sunlight
3. Shape	- Mis-alighnment.	Always ensure your green tile is alighned with the margin provided on the mould
	- Too wet mix.	Control the water you put in the mix

5.0 TRANSPORTATION OF TILES

F.C.R. tiles can be transported for long distances and even on some of the most corrugated roads with minimal breakages. Past experience has shown that a 0% breakage is achievable with the maximum care. The secret behind 0% breakage in transportation is the package of tiles in the pick-up or lorry.

The following procedure is recommended:

- Spread some saw dust, grass, sand or any other soft material, a minimum of 50mm on the floor of the lorry.
- Start arranging the tiles from the end next to the drivers cabin. Do not let the tiles lean direct to the body of the lorry. Use some soft materials such as grass or old sacks between the tiles and the sides of the lorry. The tiles are packed standing vertically.
- For maximum capacity, arrange tiles stacked in two's.
- Pack your tiles very tightly without allowing even the slightest movement.
- If a gap is left between the last row of tiles, this should be filled up with soft materials tightly packed such as grass or old sacks.
- When you are through with the packing, tie them tightly with a rope and fill any gaps left with soft materials.

The tiles can now be transported confidently. The driver must always take extra care when driving along the very rough sections of the road. This way, you are assured of minimum breakage or no breakage at all.

6.0 ROOFING GUIDELINES

Weight of a tile

The weight of a 6mm thick F.C.R. tile is on average 1.7 kg. 13 tiles are required to cover 1 m^2 including the overlaps. The average weight of 1 m^2 of roofing is 22 kg. This is approximately half the weight of other concrete and clay tiles which weigh 45 kg/m^2.

This implies that for an F.C.R. tile roof, a light roof structure will be required compared to other tiles.

Technical Information

PITCH

(i) Low wind areas - rise of the roof = ¼ the span of building

(ii) High wind areas - rise of the roof = 1/3 the span of building

RAFTERS

(i) Spans up to 6m wide - use 100 x 50 mm at 1 m spacing

(ii) Spans more than 6 m - use 150 x 50 mm at 1 m spacing

TIE BEAM

(i) Spans upto 6 m wide - use 100 x 50 mm. tie beams

(ii) Spans more than 6 m wide - use 150 x 50 mm tie beams

BATTENS

50 x 25 mm battens spaced at 400 mm top to top are recommended.

TILES

13 tiles cover an area of 1 m^2, overlaps included.
5 ridge tiles cover a length of 1 m overlaps included

NOTE:

Straight gumpole, wattle poles or any other straight poles can be used for the roof structure where sawn timber is unavailable. However, you must always use sawn timber for the battens.

HOW MUCH SHOULD YOU SELL YOUR TILES?

A good or fair price of a tile must:

- include all costs of manufacture and a reasonable profit
- be able to compete with other roofing materials available

To make a correct costing of a tile, the following items must be included:

1. Raw materials
   - sand, cement, fibre, colourings and water
2. Labour
3. Rent of a workshop
4. Equipment depreciation
5. Overheads
6. Profit

Useful Information

- From a 50 kg bag of cement, you get an average of 100, 6 mm tiles.
- From a 7 ton lorry load of sand, you get an average of 4,000, 6 mm tiles.
- For every one (50 kg) bag of cement, you need 150 kg sand, 1 kg fibre and approximately 35 litres of water.

ASSUMTIONS

It is assumed that - 1 bag of cement costs = 100.00
1 ton of sand " = 200.00
1 kg of fibre " = 20.00
1 litre of water " = 0.50

Pricing a tile

1. Raw Materials

Cement	- 1 bag is required for 100 tiles	@	100.00 a bag	= 100.0(
Sand	- 150 kg sand is needed for 100 tiles	@	0.20 a kg	= 30.0(
Fibre	- 1 kg fibre is required for 100 tiles	@	20.00 a kg	= 20.0(
Water	- 35 litres of water is needed for 100 tiles	@	0.50 a litre	= 17.5(
	Sub total for raw materials 100 tiles			= 167.5(

Therefore, materials for 1 tile will cost $\frac{\text{K.Shs.167.50}}{\text{100 tiles}}$ = 1.675/=

2. Labour

Normally, 3 experienced tile makers can produce 300 tiles in an eight hours working day.
Assuming each is paid 50/= a day, then the labour cost per tile will be:

$$\frac{\text{3 people x 50/-}}{\text{300 tiles}}$$

$$\frac{150.00}{\text{300 tiles}} = 0.50/-$$

The labour input per tile will cost 0.50/-

3. Rent of Workshop

If you do not have your own workshop, then you will most likely have to rent a place. Even if you have your own place, it is advisable to charge some cost to cover depreciation of the building.

Assumtions

A typical workshop will cost approximately K.Shs.1,000/= a month in rural areas. If 300 tiles are made every day, five days a week, 4 weeks in a month then: (300 x 5 x 4) = 6,000 tiles will be made in a month.
Renting cost per tile will be $\frac{1,000/=}{6000 \text{ tiles}}$ = 0.17/- per tile

4. Equipment Depreciation

Assumming that all your equipment costed you K.Shs.5C 000/= and you will have to replace it after 3 years, then depreciation cost per tile =

$$\frac{\text{Cost of Equipment}}{\text{Tiles made in a day x 5 days a week x 4 weeks a month x 12 months a year x 3 years}}$$

$$= \frac{50{,}000/-}{300 \text{ tiles x 5 days x 4 weeks x 12 month x 3 years}}$$

= 0.23/- per tile

Sub total cost of a tile is:

Materials	=	1.675
Labour	=	0.50
Workshop rent	=	0.17
Equipment depreciation	=	0.23
	=	2.575

5. Overheads

Add 20% overheads = 20/100 x 2.575 = 0.515

Sub-total = 0.515 + 2.575 = 3.09

6. Profit

Add 20% profit = 20/100 x 3.09 = 0.618

Cost of a tile = 0.618 + 3.09 = 3.708

A 6 mm plain tile will sell at approximately K.Shs.3.80

APPENDIX 3

MAKING YOUR OWN CONCRETE MOULDS

To make your own concrete moulds for F.C. tiles, you need the following equipment .

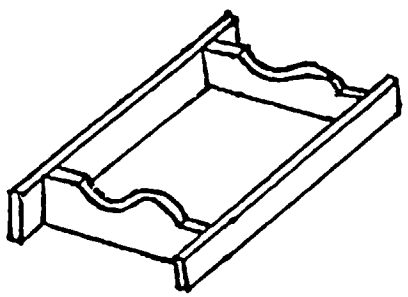
1. Timber frame work for moulding grand-mother mould.
2. Grandmother mould
3. Mother mould
4. Angle line bar.
5. Basic tools trowel. brush, float

The main raw materials are:

1. Cement
2. Sand
3. Old or new engine oil.
4. Timber for making racks.

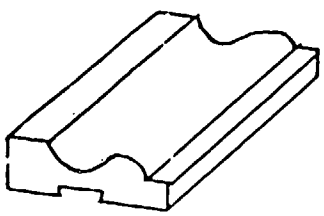
DEFINITIONS

FRAME WORK FOR GRAND MOTHER MOULD



You need this timber framework to cast the grandmother concrete mould. The profile is exactly the same as the tile mould. This must be very accurately made as any mistakes will be copied on any future moulds casted.

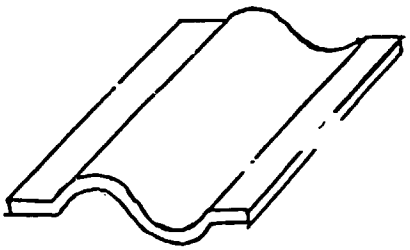
GRANDMOTHER MOULD



The concrete grandmother mould should look like this when it is complete. The face side is exactly the same as the final concrete mould.

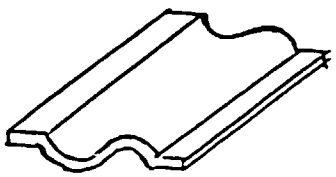
MOTHER MOULD

A mother mould is the reverse or the opposite face of the grandmother mould. With the mother mould, concrete tile moulds are casted. The mother mould should exactly fit on top of the grandmother mould.



TILE MOULD

A tile mould is the reverse now of the mother mould. This is casted on top of the face of the mother mould. This is eventually making the face of the Grandmother mould but in a thinner concrete section.



THE WHOLE PROCESS OF MAKING YOUR OWN CONCRETE TILE MOULDS

The process of making your own concrete moulds has been designed in such away that it is impossible to make even the slightest mistakes, once you start fabricating them. That is why it is first important to define the terminologies used clearly to elimate any confusion. You could be tempted to skip some of the steps suggested in this manual but then you may end up in different moulds of different profiles therefore making different tiles which would be difficulty to fit in a roof. Once you have the frame work for the grandmother mould the right profile, then you are guranteed of making thousands of concrete moulds of exactly the same profilte. Every stage in the whole process is as important as any other and there are no short cuts.

FRAME WORK FOR GRANDMOTHER Mould

This is made from timber. It should be fixed at corners with screws so that

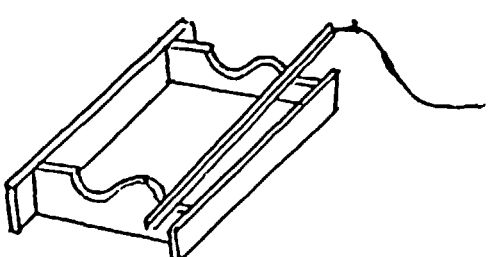
you can open it quite easily when demoulding the concrete mould. It is also suggested that you have it made from hard wood(25mm) sections well planed and treated with a preserver. This preserver will prevent from any warping or twisting and will also gurantee a longer life period. It is of utmost importance that you get a good carpenter to make this frame work precisely to the profile required.

CASTING THE GRAND MOTHER MOULD

- Assemble your timber frame work on a flat concrete base on top of an oiled surface or polythene sheet.
- Oil the inside of the timber frame work.
- Mix cement and sand in the ratio of1cement to 3 sand. The mix should just have enough water to make it workable.
- Fill in you mould box with the mortar and tamp it filling all the corners.
- Take your angle line bar and scrap of the excess mortar as you shape the top to the profile of the mould.
- Make sure that all the sharp corners and edges are finished straight, parallel and sharp. Finish the top smooth.
- Leave the mould to set for 24 hours.
- After 24 hours, remove the timber frame.
- Make a cement slurry and brush it on top of the mould surface to fill any voids finishing it smooth.
- Start curing you newly make grandmother mould in the normal way you cure concrete for at least 7 days.

NOTE

Treat your grandmother mould with care as you will need it to make future mother moulds.



Casting the grandmother mould.

CASTING THE MOTHER MOULD

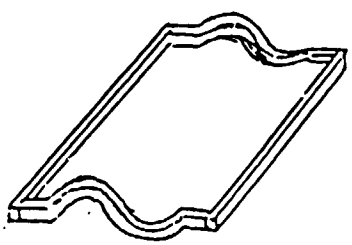
- Take your grandmother mould and oil it on top.
- Fit in the timber frame work to the grandmother mould and jack it up by about 25mm so that it protrudes by the same on top of the grandmother mould. This is actually the thickness of your mother mould.
- Using the same ratio of 1 cement to 3sand, cast your mother mould on top of the grandmother mould.
- The mother mould will inherit the reverse of the grandmother mould.
-Demould the mould after 24 hours. The oil applied earlier on makes it easier to demould as the mother mould wount stick on the grandmother mould.

CASTING THE TILE MOULD

The tile mould is casted onthe face side of the mother mould. A 25mm metal or timber gauge is used to gauge the tile moulds so that you can have all the same thickness.

PROCEDURE

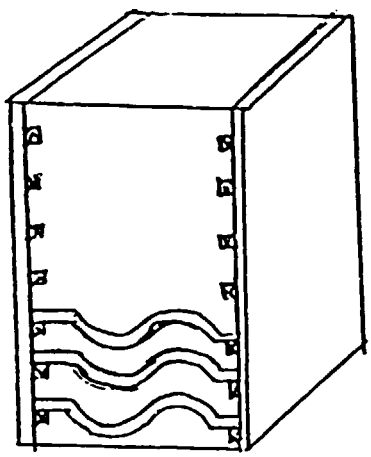
- Oil the face of your mother mould.
- Fit the thickness gauge on top. This determines the thickness of every mould.
- Make a mortar mix of cement /sand ratio 1:3 dont make it too wet.
- Fill in the gauge and tamp it gently ensuring that all the corners are well filled.
- Leave it to set for a minimum of 24 hours before demoulding.
- Demould gently, the face side of the mould should be finished smooth with a cement slurry applied by a paint brush. This gives you a hard wearing and smooth surface.
- The moulds should be wet cured for a minimum of 7 days before dispatching them.



TIMBER RACKS

The concrete tile moulds you have made do not stack on each other like the fibre glass or plastic moulds. It is therefore important that you make racks where you can shelve the moulds and tiles. This will ensure that the tiles are well protected and cured during the first 24hours. Polythene sheet is used to cover the tiles all around the racks. This ensures that the moisture do not escape outside with the wind or sunlight.

TIMBER RACK



Summary

In practice you need at lease 200 tile moulds a day.
Therefore:

- make one grandmother mould.
- From one grandmother mould, make 5 mother moulds one each day
- From 5 mother moulds, you can make 5 tile moulds a day. In 5 days, you can make 25 moulds, in 20 days, you will have made 200 tile moulds.

Technology adapted from Charles Thomson,
Notes, Drawings and Pictures compiled by
Solomon Mwangi
Intermediate Technology
P.O Box 45156
NAIROBI.

APPENDIX 4

K.I.E./U.N.I.D.O.

FIBRE CONCRETE ROOFING TILES

PRODUCERS COURSE

TOPIC: BUSINESS MANAGEMENT

COURSE CONTENT:
- Preparation of a Business Plan
- Record & Book-Keeping
- Banking
- Stores & Stock Control
- Costing & Pricing

Amon N. Nganga

PLANNING FOR THE NEW ENTERPRISE

Purpose of a Business plan. (done before the start of business)

i) A business plan forces one to take an objective, critical, unemotional look at your business project in its entirely.

ii) It specifies procedures for achieving objectives which makes it an operating tool which when properly used will help you manage your business and work toward success.

iii) **A business plan is the means for communicating your ideas** to others and provides the basis for financial proposal. It also convinces bankers, financiers, customers and partners that you can be able to sell your products.

4. It weighs the consequences of cost and effect and considers risk in the content of rewards and penalties.

WRITING A BUSINESS PLAN

When you are seeking to borrow money to start a new business, your personal experience and character enhanced by a first rate business plan are all the prospective lender has to go on. It is therefore important that you make it look as good as possible.

Components of a Business Plan

1. Cover Sheet.

   This should include the name of the business, names of principals, address and phone numbers and the physical location of the business.

2. Executive Summary

   This should be no more than a one page summary of what is contained in the business plan. Be sure to highlight all the key points in your executive summary because the reader may not have the time nor the desire to go through the rest of the document.

3. DESCRIPTION OF BUSINESS

4. **Whether you business is a:**

   i) **Sole Proprietor (one person operation. He owns and operates the business and takes the responsibility of profit or losses made by the business.**

ii) Partnership. (an association of two or more persons (partners) to carry on as co-owners of a business for profit. A partnership is formed by contract between or among the partners specifying how the business is to be operated and how the profit and losses are to be divided. The contract agreement should be written and legally binding

iii) Private Company or limited liability company - has a range of 2-50 members formed by either families or a certain group of individuals. The shares are only sold to particular people but not to public.

- Public company - This has a range of 7 to infinity members. Shares are sold to public who are regarded as shareholders.

Your may want to include an organization chart if the size of your staff warrants this.

B. Market

Write a detailed description about the market in which you will operate business. You need to know the vital market for your type of business. You should try to answer the following question. Who are your target customer(s) and what are they seeking from you?

C. Competition

List your competitions including their location geographic proximity to your firm, their major strengths and weaknesses. how those strengths and weaknesses compares with your major differences between your operation and theirs and how you intend to capitalize or minimize these differences.

D. Marketing Plan

Your marketing plan should have a detailed comprehensive blueprint that sets forth well in advance exactly how sales increases and profit goals are to be achieved. In other words what exactly are you going to do to attract customers to your business? What advantages will you offer customers that the competition is not already offering? How will you promote your products or services?

E. Facilities

Describe your physical location space available and potential for expansion if relevant and applicable. Include floor plan drawings if available.

F. Management

If you plan to use your Business Plan as a tool for borrowing money, then the prospective tenders are going to be interested in knowing your expertise and experience in the business you are venturing into. Include the CVs of the partners and key employees.

G. Other relevant facts and documents.

4. FINANCIAL DATA

A. **Business Financial Statements (Accounnts):**

For an existing firm, include a balance sheet and a income (profit and loss) statement as currennt as possible.

For a new firm, provide a pro-forma statement (i.e. projected financial statement)

B. **Profit Forecast**

Include a 2 year cashflow analysis and profit forecast.

C. **Use of Loan Funds**

Spell out very carefully exactly how you will use the proceeds from the loan if granted. Provide a complete list of the collateral you are pledging to secure the loan (if any). The listing of the collateral should include the current value of each item and serial numbers and/or description.

5. SUPPORTING DOCUMENTS

Include copies of your lease agreement, partnership agreements, articles of incorporation, letter of reference, job description, copies of any contracts and anything else of relevance to the plan.

BOOK-KEEPING

To run any business effectively, one must keep a record of all transactions that take place in a business. This helps in knowing where the money is going and coming from. This is what is regarded as book-keeping.

For our case, we will limit ourselves to a simple book-keeping method which can supply the information required.

List of book-keeping documents and their use

Cash book

This is a book which helps to keep a daily record of the money that comes in and goes out. This book has three narrow columns.

- The first column is for all the money that comes into the business from sales or payment of debts. It is referred to as the IN column.
- The second column is for all the money that goes out of the business for purchases of goods or payment of debts.
- The third column indicates the balance of money in the cash box.

NB. A cash book is used to record transactions involved in cash money which is in the cash box or drawer.

An example of a cash book

Date	Description	Cash in	Cash out	Balance
12th March 1986	Sales	400.00		400.00
13th March 1986	Payment of rent		150.00	250.00
15th March 1986	Sales	200.00		450.00

Receipt book

This is a book used to confirm that payments have been received for goods sold or services rendered. This is normally filled in carbon. The original is given to the customer and the business retains the carbon.

This way, the customer has proof of having paid for an item and the business has a convenient record of the transaction from the carbon.

An example of a receipt

Receipt No:.....

Date: .....

Received from:.....

Amount in words:.....

.....

For payment of:.....

.....

Cash/Cheque with thanks

Shs. .....

Purchase book

This is a book for recording purchases made on credit. What is normally recorded in this book is:-

- name of supplier
- date of supply
- types of goods
- amount of money due

An example of a purchase book

Date: 10.6.85

Company: Victoria Industries

Goods: 30 packets of cement

Value: Kshs.3,000 due on 7.7.85

Order book

This is a book used to record goods ordered by customers. There is an order book also known as local purchase order for purchase of goods when the payment is to be made later after delivery.

Invoice book

This is a book or document used to demand payment for goods delivered on order or services rendered.

An example of an invoice book

INVOICE

Date: 12.10.85 No: 10

To Kabati Primary School

Order No: 210

Item No:	Particulars	Quantity	Price
1	Tiles	300	900.00

Total due: Kshs.9000/=

BANKING

What is a bank?

A bank in its simplest form is an institution or company that deals with money.

Functions of a bank

A bank provides the following services:-

- allows customers to deposit cash and other valuables for safe keeping.
- gives their customers loans for development of businesses, farms etc.
- facilities import and export trade

Types of banks

There are 3 different types of banks namely:-

- central bank
- commercial banks
- merchants banks

We shall only deal with commercial banks which are relevant with our needs. The following are the commercial banks which are well located in many areas in Kenya:-

1. Barclays bank
2. Standard bank
3. Kenya Commercial bank
4. National bank of Kenya

The above mentioned banks operates the following types of accounts:-

- Saving account

This type of account is suitable for individuals and small business. To run this account, you need to maintain a fixed deposit which is normally decided by the bank. Depositing or withdrawing money is done by means of a bank pass book or slips which are given to you by the bank. With a saving account a certain fixed minimum deposit must always be maintained. Withdrawals are normally limited to seven working days. Interest is normally paid monthly for money saved.

- Current account

This type of account is best suited for big companies and business men. Unlike a saving account, there is no interest earned, instead the bank charges you some commission for ledger fees and the cost of cheque books. However, a current account has the following advantages:-

- there is no restriction as to the number of time you can withdraw as long as there is money in your account.
- with a current account, you can make payments through cheques to different people without you visiting the bank
- an overdraft which is a short term loan is only available to current account holders.

STORES AND STOCK CONTROL

A store is a room or house where goods or materials are kept. Materials or goods in the store represent cash value and care should be taken to them as strictly as cash is looked after.

A good store should:-

- be secure with lockable doors and windows
- have a good roof which does not leak
- located at a convenient place for easy access.

Stock card

This is a card kept by the storekeeper where details of individual items are located. It keeps a clear record of goods coming in and going out and the dates.

Delivery note

To make sure that goods arrived at their desired destination in good condition, they should be accompanied by a delivery note. A delivery note contains details of goods sent and have a place to be signed by the recepient after satisfying that goods sent are correct and in good order.

Storekeeper

This is the person employed to be in charge of all the things which happen in the store. The storekeeper receives goods coming in the store and issues goods going out of the store. All these transactions are recorded in the stock card.

Stock taking

The main purpose of stock taking is to:-

- ensure that stock cards are correctly filled.
- discover losses of goods in the stores or any other mistakes.
- enable in making correct profit or loss calculations when writing final accounts.
- confirm stock balances on hand at a given date.

COSTING AND PRICING

The price of any manufactured item is derived from:-

1. cost to produce that item which includes raw materials labour and any machinery used.
2. overheads and profit

It is of vital importance to consider these two points so that you can be able to sell your products without making loss.

A good or fair price must include

- all costs of manufacture and responsible profit.
- be able to compete with other businesses

To make a correct costing of any item, we shall be considering two different types of costs.

1. Direct costs

These are normally the raw materials. This is the cost of all items which are part of the items produced. This should include labour costs.

While making tiles for instance, the following raw materials are used:

- sand
- cement
- fibre
- water
- labour

These automatically come as the direct cost of producing a tile.

2. Indirect costs

These are costs which are mostly forgotten or unseen. These sort of costs may include, rent, electricity bills, transport etc. Typically for somebody making tiles, the cost of battery charging machine depreciation should be included in the final cost of a tile.

5.0 BASIC TILE PRODUCTION COSTS AND TILE ESTIMATING

5.1 Capital Costs

5.1.1. Overview

To start up a tile production unit one will incur the following expenditures:

- Cost of buying or acquiring land
- Cost of erecting workshop and the necessary infrastructure
- Cost of laying tools and equipment
- Working capital for at least 3 months

The capital costs will vary greatly, depending on the following factors:-

(1) Land costs
(2) The type of equipment used

For the purposes of this manual the issue of land is omitted from the costing. This is partly due to great variations in land prices. However, the tile production unit should ideally be located at or near a market centre within easy access to the road and water.

5.1.2 Equipment:

The investment costs will to a very large extent be influenced by the type of equipment chosen. The most expensive equipment is the imported type from Parry Associates (ITW) of U.K. These are sold in packages. A complete package consists of 200 moulds, batch boxes, spare parts, polythene sheet, vibrator, weighing balances accessories, etc. This package was selling at KShs. 122,300/= (as per December, 1989).

The cheapest package on the market is the combination of the following:

- 1 No. Undugu vibrator at KShs. 4,500/=
- 200 No. concrete moulds at KShs. 40/= (inclusive of timber racks)
- 10 Plywood/timber ridge moulds at KShs. 70/= = 700/=
- Polythene sheets at say = 1,000/=
- Hand tools and accessories = 4,000/=

Sub total 18,200/=

As seen from above, the package costs approximately KShs. 19,000/= as per December, 1989.

5.1.3 Workshop and associated infrastructure:

Workshop at	KShs.	25,000/=
2 No. batteries @ 2,000/=	=	4,000/=
4 No. curing tanks @1,200=	=	4,800/=
A working capital for 3 months @10,000	=	30,000/=
Sub total	=	63,800/=

The total capital (i.e the cost of equipment and workshop) costs will thus vary from KShs. 82,000 to 185,000, when using local and imported equipment respectively.

5.2 Costing of Tiles

5.2.1 Overview

To start a viable and sustainable tile production unit, all costs incurred including direct and indirect costs, overheads and profit must be accurately assessed and included in the final price of a tile.

The direct costs include the costs of:

- cement
- sand
- fibre
- labour
- pigments (where specified)

The indirect costs include:

- depreciation on capital goods
- overhead
- interest rate capital

5.2.2 Calculating Direct Costs

The following assumptions have been made:

1. That plain tiles without pigments are used.
2. That a 50kg bag of cement costs KShs. 100/=.
3a. That a 7 ton lorry of sand costs KShs. 1,800/=.
3b. That 15% of sand is washed through sieving, hence from 7 tons of sand purchased, only 5.95 tons are actually available for use on site. Thus 1kg of sieved sand costs about KShs. 0.30.
4. That from 5.95 tons of sieved sand, about 3960 tiles are made.
5. That 1 kg of sisal fibre costs KShs. 10/=.
6. That 1 litre of water costs KShs. 0.20.
7. That 30 litres of water are required to make 100 tiles.
8. That from 1 kg of sisal fibre, about 100 tiles are made.
9. That 3 men can produce 200 tiles and 20 ridges per day.
10. That a labourer is paid 50/= per day.
11. That the battery will be charged after every 3 days of full production at cost of KShs. .....
12. That to produce one tile we need 0.5kg of cement, 1.5kg of sand and 10 grams of sisal fibre.

Based on the above assumptions, the direct cost of a tile can be worked out easily. The direct cost of producing 100 tiles can be worked out as follows:-

Cost of 50kg cement for producing 100 tiles	=	KShs. 100/=
" " 150kg sand for " " "	=	" 45/=
" " 1kg sisal fibre for " " "	=	10/=
" " 30 litres of water for " " "	=	6/=
" " 3 labourers for " " "	=	75/=
" " wastage at 5%	=	11/80
" " charging batteries	=	10/=
The total direct cost for 100 tiles	=	257/80

Therefore the total direct cost per tile = KShs. 2/60

5.2.3 Calculating Indirect Cost

The following assumptions are made:-

1. That the Undugu vibrator costing KShs. 4,500/= is used.
2. That 200 tiles are produced per day with a 5% breakage rate.
3. That 5 day week is used and that 48 weeks are worked in a year.
4. That equipment has a life span of 5 years.
5. That the hand tools have a life span of two and a half years.
6. That 25% of the total required capital has been raised by the entrepreneur.
7. That the building has a life span of 30 years.
8. That 16% per annum interest is charged on capital.
9. That 200 fibre glass moulds costing 180/= per each are used.
10. That a heavy duty battery at rate of KShs. 2,000/= is used. This has a life span of one year.

Using the above assumptions, the depreciation cost per tile can be worked out:-

(1) The total number of tiles in 5 years = $200 \times 5 \times 48 \times 5 \times \frac{95}{100}$

= 228,000 tiles

(2) The equipment cost is made up as follows:

i)	Vibrator	= 4,500/=
ii)	200 moulds @ 180/=	= 36,000/=
iii)	10 double plywood ridge moulds @ 70/=	= 700/=
iv)	5 Batteries @ 2000/=	= 10,000/=
v)	Hand tools @ 4000 x 2	= 8,000/=
		59,200/=

Therefore depreciation cost per tile = $\frac{59200}{228000}$ = KShs. 0.26

(3) Depreciation in building/workshop including the curing tanks:

Depreciation per tile = $\frac{29800}{1,368,000}$ = KShs. 0.02

(Assumed 30 years' life span for workshop and its related infrastructure)

(4) Interest on borrowed money:

From the total start up capital of KShs. 82,000, 75% of this is borrowed.

Therefore the total interest payable over 3 years period = KShs. 29,520/=.

Therefore the interest recoverable from each tile = $\frac{29520}{136800}$

= KShs. 0.20

Sub-total for indirect costs	= 0.48
Sub-total for direct and indirect costs	= 2.98
Allow 20% for overheads	= 0.596
Sub-total	= 3.576
Allow 20% profit	= 0.7152
Total	= 4.2912

(5) Therefore the total price of tile = approx. KES. 4.30.

(6) A 6mm plain tile should therefore sell for between KShs. 4.30 and 5/=.

Costing of Ridge Tiles:

A ridge tile is normally 10mm thick. It is therefore 4mm (40%) thicker than the 6mm tile. It would therefore follow that the ridge tile should sell at 40% more than the ordinary tile. The selling price of the ridge tile should therefore vary between KShs. 6/30 to KShs. 7/=.

FCR MARKETING GUIDE - WORKING PAPER

GENERAL RULES	FCR-SPECIFIC RULES
Details see annex 1: draft by JM Baumer	Details see annex 2: draft by J. Wells

1. KNOW THE NEEDS AND DEMANDS OF THE CLIENT

Accurate information is needed on:

- How the market develops ?
- How clients needs and demands develop?
- How the competition develops ?
- How clients compare us with the competitors ?
- Collect a little but well targeted information.
- Proper and immediate use of information.

- NEED is not the same as effective DEMAND.
- What kind of roofing material are people (possible clients) using now ?
- Do FCR tiles have a clear cost advantage over other types of roofing (fill in the points J. Wells made under this head).
- What are the other advantages / disadvantages of FCR tiles ? (Fill in the points J Wells made under this heading).

2. SET MARKETING GOALS AND PRIORITIES

- Few happy clients rather then many unhappy clients.
- What product for what market ?
- Profit goal, short term or long term as a component of the price policy.

WHAT MARKET SECTION TO BE TARGETED ?

- Do not neglect the institutional market
- The institutional market may be easier to penetrate than the private market
- Middle and upper income groups should perhaps be targetted first

GENERAL RULES	FCR-SPECIFIC RULES

3. THE SHAPING OF THE MARKET OFFER

* Distribution channels and premises.
* Assortment, product quality, function and design.
* Services going with the product.
* Price - well set in the market.
* Replace market looser products.
* Offer packages: product & service.
* Not the best quality, but the quality the clients asks for is correct.
* No sudden price increase, but constant adjustment of prices.

AT WHAT PRICE SHOULD THE TILES BE SOLD ?

* If the price is higher then that of alternative materials, it is unlikely that the tiles will sell.
* The price must be set high enough for the producer to make a profit etc.

WHAT KIND OF SERVICE SHOULD BE OFFERED ?

* "Supply and fix" service may be best.
* The tile producer must be responsible for the roof sub-structure and for the laying of the tiles, at least at the starting phase.
* After sales service is essential.

WHAT QUALITY GUARANTEE CAN YOU GIVE ?

* Compliance with a standard.
* Guarantee to replace faulty tiles and repair of leaking roofs.
* Stamping, trade mark.

GENERAL RULES	FCR-SPECIFIC RULES
4. MARKET CULTIVATION	
• Regards existing and new markets. • Orient to the most important group of clients. The "ABCD-methode" helps to define this group. • Recommendations for targeting new markets:.....	"Fill in the example J.M Baumer gave of the "ABCD methode" applied for tiles (in annex 1). ARE THERE ANY BARRIERS TO THE SALE OF FCR TILES IN ANY SECTION OF THE MARKET ? • Absence of tile laying skills. • Institutional and legal barriers, lack of official standards. • Negative attitude of customers towards new technologies. • Social barriers, question of status. • Uncertainty about the performance and the absence of a guarantee. • Uncertainty about risks of FCR, specially the low-income segment can not take risks.

GENERAL RULES	FCR-SPECIFIC RULES

5. INSTRUMENTS FOR MARKET CULTIVATION: SALE

- Sale is the most prominent way of market cultivation.
- Tasks of the sales department:....
- Forms of sale:....
- Components of sales-organisation:....
- Some questions to check the sales organisation:....
- Sales promotion:...

WHAT ARE THE MARKETING CHANNELS ?

- Dense retail network is required, but difficult to achieve.
- Marketing system for FCR must be competitive to CGI marketing system.
- Retail outlets not recommended.
- "Shop front" as an alternative.

GENERAL RULES	FCR-SPECIFIC RULES

6. INSTRUMENTS FOR MARKET CULTIVATION: ADVERTISEMENT

- Personal sales talk.
- Advertisement: Whom to address
  What message
  How, what media

WHAT KIND OF PUBLICITY IS EFFECTIVE ?

- Construction of high profile demonstration roofs.
- Coordinated campaign is needed, producers must cooperate.
- Demonstration of tiles at shows and exhibitions.
- Example on prominet institutional buildings.
- Production and display of coloured tiles
- Promotional material produced by FAS/SKAT.
- Publicity in news papers, radio, TV.
- Advertisement on billboards, roofs, in news papers, with pamphlets, writing articles, talking to potential clients.
- Use of FCR on prominent institutional buildings.

7. LEADERSHIP AND ORGANISATION IN MARKETING

- set the marketing goals.
- work out the sales plans.
- assure the coordination of all marketing activities.
- Team work is needed.
- Delegate matters to experts.

4. How do clients compare us with the competitors

- Our supply in comparison to the competitors regarding clients needs and demands.
- Product features like reliability, design, durability, functionality
- Services like instruction on handling, assembling, warranty, repair, maintenance, period of delivery
- Price, financial services
- Sale like distribution channels, means of distribution ....
- Advertisement

First of all, a small entrepreneur is responsible for marketing, because marketing sets the direction in which a company is going. The four questions outlined before

- how do markets develop
- how do clients needs and demands develop
- how does the competition develop
- how do clients compare with competitors

must always be answered with clear, short and precise information.

A little, well targeted, information is better than mountains of information

Information sources are :

- Questionnaires filled in by clients
- Results of Market Analysis
- Statistical yearbooks
- Magazines
- Reports of Associatons
- Directories
- Press-Clippings

Smaller enterprises will concentrate on :

- Personal contacts with important clients
- Contacts with clients through sales, extension and repair personnel
- Exchange of experience in Producers Meetings
- Observation of competitors

Small entrepreneurs should also subscribe to professional magazines.

Information must be properly used immediately

Never classify information in a desk. Go across your enterprise and tell people what you learnt. Talk to your people in the Purchase Department, your salesmen, your engineers in the Construction Department. Give them a constant flow of clear and precise information about trends, discuss it intensively with them and let them use their imagination to develop technical and institutional answers to the new challenges.

The knowledge about the needs and demands of clients must be diffused and transformed into market-oriented actions by the company.

III SET MARKETING GOALS AND PRIORITIES

Happy clients in a few markets are better than unhappy clients in many markets.

The entrepreneur or marketing manager has to decide two questions :

- In what markets do we sell to what kind of clients ?
- what product do we offer ?

Smaller enterprises usually decide first on the second question; this decision helps to answer the first question. It is useful to jump several times from one to the other question and backward; both questions are interlinked.

Only a clear and precise determination of "what markets" and "what products" makes an effective cultivation of markets possible. "What markets" and "what products" must however always be re-examined.

What markets should the enterprise cultivate intensively ?
They should be segmented into

- regions
- income-classes, languages, sex of clients
- other criteria

For example :

- public enterprises in the Federal District
- small to medium construction firms in the eastern part of the country
- the multinational enterprises in the "industrial parks" of the country.

Once having decided "what markets" and "what products", the entrepreneur has to decide what instruments can be used to reach the clients. What are these instruments to get into the markets ?

- Sales; personal sale-talk, sale by telephone ?
- Advertising; newspapers, letters ?
- Distribution; channels, institutions ?
- Premises of distribution ?

First: What is the importance of the four elements ? Is advertising at all important ? Is it crucial that the premises of distribution are close to the clients ?

Second: Clear answers must be given to the four questions!
All sale-talks will be personal. We use existing distribution channels at wholesale level. We advertise only by personal letter. The premises of distribution have to be within one hours' reach of the cities.

Beside the market instruments the entrepreneur has to decide on the shaping of his offer in the market.
What are the elements of this decision ?
. Assortment; depth, width, quantity ?
. Product; quality, function, design ?
. Price; level, discounts, other conditions ?

Again: the more precise the answers, the more effective will be the market-offer.

Once - "the markets" and its instruments
- "the products" and its shaping
are determined, the entrepreneur has to fix quantitative goals of turnover. This is a sales-budget.

The growth of turnover comes from
. the growth of markets, and
. the activities of the entrepreneur in cultivating the markets.

Turnover and growth of turnover itself has no meaning with respect to profits! To succeed in the markets, profits are indispensable. In case
. in specific markets and/or
. for specific products
no profit occurs, these must be skipped or re-defined with respect to other markets and/or other products.

The annual sales-budget must show the planned margin between total cost and revenue from sales, i.e. the profits. The constant check of sales-budget with the reality allows for swift changes in the two key-parameters :
. "what markets"
. "what products".

VII INSTRUMENTS FOR MARKET CULTIVATION : ADVERTISEMENT

Advertisement : Lying about product features is worse than no advertisement. Advertising is an appropriate instrument for market cultivation. It therefore needs very careful planning.

Three questions must be answered :

- Whom do we address, i.e. the target ?
- What do we want to say, i.e. the message ?
- How does the message reach the target, i.e. the medium ?

The target — The more precisely the target group is defined the less advertisment cost is wasted. What persons should be addressed, economically, socially, culturally, educationwise ?

The message — Classifies special features, quality, uses, prices. It should emphazise product properties that coincide with clients needs and demands. In many cases the collaboration with an expert in this field is of advantage. The message has to be short, impressive, true, surprising, funny, memorable : a difficult task.

The medium — Is it TV, radio, newspapers, magazines, letters, telephone calls, posters, T-shirts, balloons, paintings or writing on buildings, or what else could you imagine ?

If an enterprise seeks professional help in an advertisement agency, it is also imperative that the three questions be answered very clearly. The more the commissioned agency knows, the more effective its work will be.

Distribution means by what channels do the products reach the clients ? There are wholesalers, retail-salers, or direct sale to enterprises or households. Also the type of transportation must be decided on : rail, trucks, bring - or get - distribution ?

Any entrepreneur shall seek the least costly system, but also pay attention to the distance to clients as well as speed of delivery.

Three questions must be answered :

- special execution of orders ?
- optimal stockpolicy; large enough for rapid delivery, but small enough to reduce storage-cost
- effective package; protecting the product, marking the product, advertising the product and allowing optimal storage.

Coordination	Sale, sales promotion, advertisement and distribution have to be coordinated with regard to the factor "time" ! Imagine a costly advertising campaign, but when clients come to the shops, the products are not available.
Concentration	The market cultivation must be oriented to the most important groups of clients.

VIII LEADERSHIP AND ORGANISATION IN MARKETING

A strong and decisive leadership combined with a flexible organisation increases the impact of marketing !

Small enterprises cannot spend a lot on marketing; they can achieve a high impact nevertheless. Their comparative advantage to large firms is their close relationship to clients. It is therefore easier for small firms to orient and adapt their marketing to clients needs and demands.

The entrepreneur should
- set the marketing-goals
- work out the sales plans
- assure the coordination of all marketing activities

Leadership in marketing of smaller enterprises shall be very practical and systematical. The process of marketing should include the following steps :
- Evaluation of newest market information
- Where are we in the market respectively to our goals ?
- Fixing of next years' marketing goals
- Establishment of sales plans, production plans and plans for the market cultivation, i.e. sale, advertisement and distribution
- Calculation of short-term budgets regarding sale, advertisement, production, etc.
- Planning of specific actions for first quarter of next year

Teamwork is needed for the above mentioned work-tasks; many collaborators of the firm must participate in this planning-process. An effective way is to constitute a working team in marketing, with each member from another department responsible for a specific task.

Complicated matters - i.e. formulation of advertisement messages should be left to real experts.

Here is a general checklist for the evaluation of your marketing

Criteria	Comparison to competitors		
	weak/bad	middle	strong/good
. Reputation of enterprise			
. Image of products			
. Marketshare			
. Brand / Name			
. Assortment			
. Specialities			
. Quality of product			
. Innovation			
. Quality of services			
. Quality of advice to clients			
. Pricelevel			
. Paying conditions, discounts			
. Number of external salesmen			
. Acquisition-potential of external sales organisation			
. Quality of salesmen			
. Quality of internal sales-organisation			
. Sales promotion			
. Advertisement resources			
. Impact and style of advertisement			
. Media of advertisement			
. Distribution systems			
. Own location			
. Distribution cost			

APPENDIX 6

SUMMARY OF THE KENYA STANDARD SPECIFICATION FOR THE FIBRE CONCRETE ROOFING TILES FROM THE KENYA BUREAU OF STANDARDS

This summary is extracted from the Kenya Bureau of Standards specification on the Fibre Concrete Roofing (FCR) Tiles Standard Specification KS02 - 749.

In this summary the suitable or desirable properties of fibre concrete roofing tiles are enumerated.

The standard does not dwell on the details of the tile production since this is available in the producer's manual; but strictly emphasizes on the quality production of the tiles and the various tests carried out to make them acceptable. It is hoped that this standard will control the variations of quality of tiles being produced by the manufacturers and will realize the production of high quality and durable roofing tiles.

A permit to use the Standardization Mark in obtainable from Kenya Bureau of Standards (KBS). This permit is available after the producer applies to KBS and the latter's officers picking some samples at random and taking them for various tests as indicated in this summary. It is only after the tiles have satisfactorily passed these tests that the permit is granted . The presence of this Mark on a product is an assurance to the consumers that the product has been produced to comply with the requirements of a Kenya Standard under a system of supervision, control and testing operated during manufacture and including periodical inspection at manufacturer's works in accordance with the certification marking scheme.

The manufacturers, should aim at producing the best of these tiles to be able to pass the tests outlined in this summary.

a) **Fibre content** - 2% of dry weight or volume

b) **Size**-500mm (+10mm)x250mm(+0.5mm)x6mm or 8mm (+0.5mm)
Effective width not less than 200mm
Effective cover not less than 0.08mm sq.

c) **Batten lug** - 25mmx15mm thick parallel to the tile width and have a 3mm diametre hole parallel to the length and shall be 6-8mm from the underside of the tile.

Wires used shall be of galvanized or stainless steel of diametre of at least 0.9mm. If copper wire is used, should be of diametre of at least 1.22mm.

1. **Colour**

Permanent colour throughout surface coating should not contain any toxic material.

2. SIZE OF DEFECTS

Allowable **holes** should be 1mm deep and 3mm Surface dimension and not more than 10 such holes in a tile.

a) No visible **cracks** of length greater than 5mm shall be allowed on the tiles.

b) No **fibres** shall be visible on the top surface of the tiles.

c) The **upper** surface of the tile shall be reasonably **smooth** and without wrinkles.

d) The manufacturer's name or trade mark shall be legibly impressesive or shall be legibly and indelibly marked on each tile.

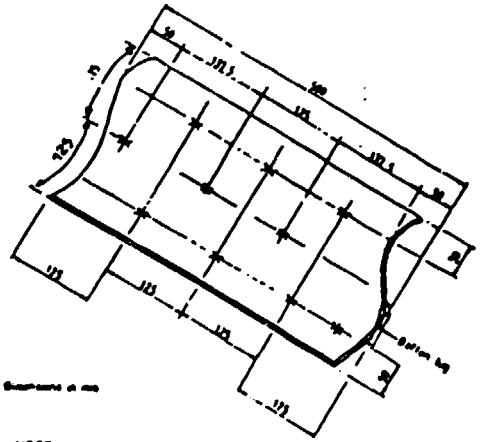
SAMPLING

Ten tiles and five ridges shall be selected at random from a batch of **1000 tiles.** Each sample shall be marked so as to identify the batch from which selected. The samples shall be carefully handled and stored during the testing period.

TESTS

3. **Dimensions** - Refer to drawing length and width - 3 positions, thickness - 10 positions. (Fig. 2)

IS02-749



NOTE:

Width measurements are done on the curved distances and not along the plan width

x - indicates positions where thickness measurements should be carried

FIGURE 2 - ARRANGEMENT OF DIMENSIONS OF TILES

4. PERMEABILITY

Use 5 tiles and 2 ridges trough with concrete on the two ends so that no water passes through. Fill trough with water upto the brim and let it stand. Observe underside of tile after every 1 hour for water drops on the undersurface of the tile. After six hours no tile shall have any drops on the undersurface.

5) BEARING STRENGTH OF LUGS

The test specimen shall be completely immersed in water at room temperature (25 - 5 Degrees Cent.) for 24 hours after which the tile shall be removed, wiped clean and clamped upright as shown in the drawing. The weight shall be applied to the lug and increased by unit of until it fractures off from the tile. The lug when used to suspend the tile freely shall have sufficient strength to support at least 150 N (15kgf) when tested. (Fig. 3)

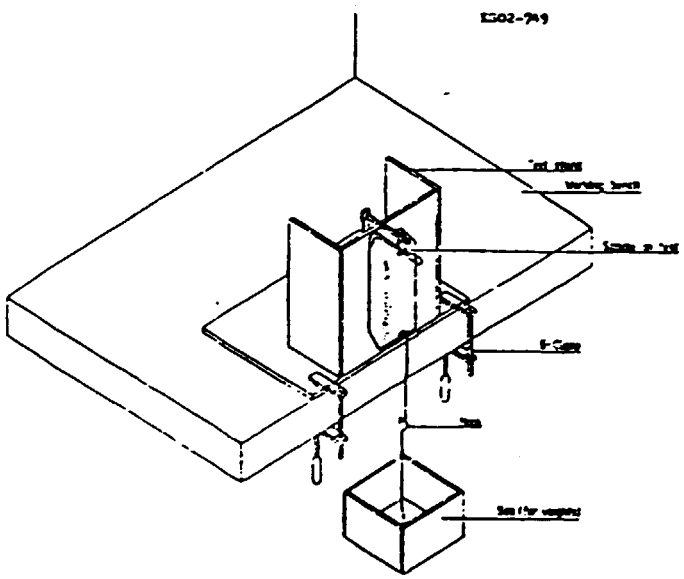


FIGURE 3. TYPICAL APPARATUS FOR DETERMINATION OF BEARING STRENGTH OF LUGS.

Drop Test on Lugs

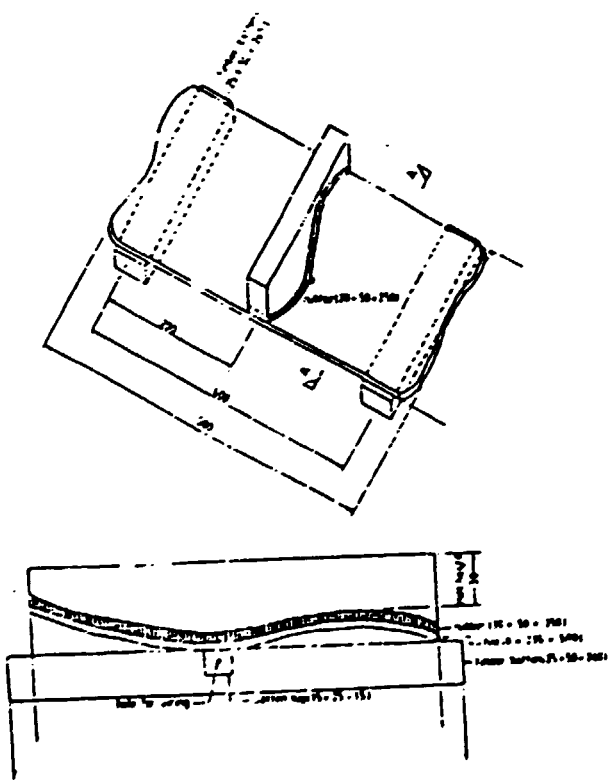
One of the specimen tiles shall be mounted vertically with the head of the tile on the top (after immersing it in water at room temparature for 24 hours).

The second specimen tile shall be let to slide on the first tile from a height of 10mm so that its lug drops on the head of the first tile. This procedure shall be repeated with height increments of 10mm until the lug breaks. The lug shall not fail at less than 300mm drop.

6. DETERMINATION OF TRANSVERSE STRENGTH

The apparatus shall consist of two supports made from timber battens 50mm wide x 25mm thick x 260mm long fully supported and spaced parallel to each other with a centre to centre spacing of 400mm.

Rubber having international rubber hardness of 70 degrees and dimension 50mm wide x 20m thick shall be attached to the bottom surface of the timber block 50mm wide x 250mm long and having a minimum thickness of 30mm with a flat top surface and a bottom profile similar to that of the tile. Completely immerse the tile to be tested in water at room temparature for 24 hours and immediately after that support each tile on the timber supports such that the inner face of the lug is in contact with one of the supports. Apply the load at mid-span through the shaped timber block at a uniform rate of 0.5KN/min until fracture occurs and calculate the breaking load of the tile in Newtons. (Fig. 4)



SECTION A-A

FIGURE 4. DETAILS OF ARRANGEMENT FOR DETERMINATION OF TRANSVERSE STRENGTH.

ii) **Ridge Tiles** .

Completely immerse the ridge tiles to be tested in water at room temparature for 24 hours. Remove the tiles and place them on their edges on a flat surface as shown in drawing. Apply the load through a timber block of 50x50mm cross section with a length equal to the ridge tile. The load shall be applied at midspan at a uniform rate of 0.5 KN/min until fracture occurs. The tiles shall have an average breaking load of 350N. (35kgf) and a minimum breaking load of 250N (2kgf). (Fig. 5)

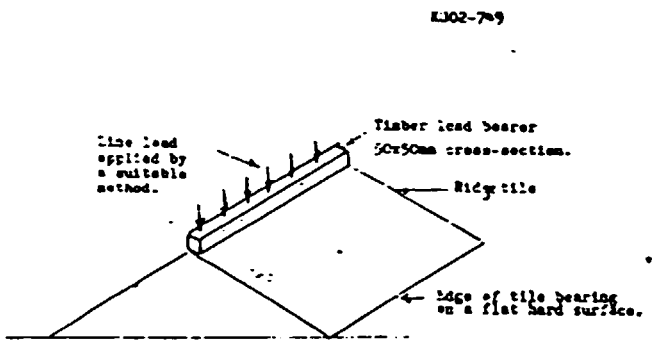


FIGURE 5. - ARRANGEMENT FOR DETERMINATION OF TRANSVERSE STRENGTH OF RIDGE TILES.

7. DETERMINATION OF WATER ABSORPTION

Completely immerse the tile specimens in water at room temparature for 24 hours and then remove, wipe clean and weigh and record the weight as M2 in grammes (The balance used shall be sensitive to within 0.5% of the weight of the smallest specimen tested).

Dry all the specimens in a ventilated oven at 100 Degrees - 115 Degrees Centigrade for not less than 24 hours and until two successive weights measured at intervals of at least one hour are within one percent of each other and then weigh - M1 in grammes.

Calculate the water absorption as follows:-

Water absorption, per cent.

$$\frac{M2 - M1 \times 100}{M1}$$

The average percentage of water absorption shall be not more than 14% and no single individual tile shall have a water absorption greater than 16%.

8. MEASUREMENT OF APPARENT DENSITY

Determine the mass of drying out the test piece in an oven maintained at 100 Degrees Centigrade until the difference between the two consecutive weighings made at an interval of not less than two hours is less than 0.2%.

Determine the volume by a method having an accuracy of 2%. In the case of immersion in water, the test piece shall be saturated in water beforehand.

The apparent density - $\frac{M}{V}$

Where M is the mass in grammes of the test piece after drying;

V is the apparent volume in Cubic Centimetres of the test piece.

The mean density shall not be less than 1300 - 10% kg/Cubic Metres.

APPENDIX 7

LIST OF PARTICIPANTS

No.	Name	Address
1.	E.A. Khakaba	P.O. Box 1211. Kakamega
2.	J.N. Omollo	P.O. Box 492. Homa Bay.
3.	HA.A. Amoth	P.O. Box 185. Siaya
4.	J.K. Rebo	P.O. Box 820. Kericho
5.	B. Adongo	P.O. Box 1211. Kakamega
6.	J.K. Karu	P.O. Box 496. Embu
7.	J.O. Onyango	P.O. Box 10. Mutumbu
8.	D.K. Malombe	P.O. Box 86. Kitui
9.	P.K. Kosgey	P.O. Box 88. Siongiroi via Sotik
10.	W.O. Ongodo	P.O. Box 43. Oyugis
11.	Charles Manga	P.O. Box 1394. Kisumu
12.	H.A. Ogembo	P.O. Box 82. Kendu Bay
13.	S.A. Odidi	P.O. Box 250. Kendu Bay.
14.	Willishon Obilo	P.O. Box 250. Kendu Bay.
15.	J.O. Kireta	P.O. Box 82. Kendu Bay.
16.	E.N. Omondi	P.O. Box 777. Siaya
17.	Stanley Nyagitari	P.O. Box 1516. Kisii
18.	John Kinyua	P.O. BOX 1060. Embu
19.	S.O. Miduda	P.O. Box 219. Muhoroni

LIST OF ORGANIZERS AND RESOURCE PEOPLE

1.	N.L. Hall	Projects Manager - Kenya I.T.D.G. P.O. Box 39493 NAIROBI
2.	A.N. Nganga	Projects Officer I.T.D.G. P.O. Box 39493 NAIROBI
3.	S.M. Mwangi	Technical Advisor P.O. Box 10973 NAIROBI
4.	V. Cumarasamy	UNIDO Project Coordinator K.I.E. Kisumu P.O. Box 1360 KISUMU
5.	H.N. Jura	Regional Manager K.I.E. Kisumu P.O. Box 1360 KISUMU

UNIDO

KENYA INDUSTRIAL ESTATES LIMITED

Entrepreneurial Training Programme 1990

This is to certify that

_____

of _____

has successfully completed a one week Technical Course on Fibre Concrete Roofing Tile Production

Sponsored by K.I.E. Ltd. and U.N.I.D.O. with U.N.D.P. financing and conducted with the Technical support of Intermediate Technology Development Group Kenya from 26th to 30th November, 1990

PROJECT MANAGER
UNITED NATIONS INDUSTRIAL
DEVELOPMENT ORGANIZATION

MANAGING DIRECTOR
KENYA INDUSTRIAL ESTATES LTD.

ANNEXURE 6

KIE/UNIDO

UNDP/UNIDO PROJECT
DP/KEN/87/009

KENYA

TRAINING FOR KIE CLIENTS ON PRODUCTION OF

TRICYCLE FOR CRIPPLED PERSONS

FEBRUARY 1990 AND MARCH/APRIL 1991

CONTENTS

PREFACE

UNDP/UNIDO Project KEN/87/009 was designed to provide Technical Support for Small Industries/Micro Enterprises assisted by the Kenya Industrial Estates Ltd. in Nyanza Province.

One of the objectives of the project being to meet the training needs of the K.I.E. Clients, the UNIDO Team in Kisumu along with the K.I.E. Regional Staff developed and conducted Skill Upgrading Technical courses covering several of the activities promoted by the K.I.E. in the Province.

In this effort, the expertise and facilities available at the Kisumu Industrial Training Centre (K.I.T.C.) were utilised to provide training in the Light Engineering Industry Sector. The results of training to Welders and General Fitters in 1989 prompted discussion on the feasibility of introducing training to develop a specific product.

Tricycle for the Crippled - its fabrication and assembly was identified as appropriate for the purpose and in February 1990 a two weeks intensive course was conducted by Technical Staff of the K.I.T.C. for ten K.I.E. Clients from all over Nyanza Province.

The skill and capability of the K.I.E. Clients to produce the tricycle was established and the Danish Embassy in Kenya, responded to the request of UNDP/UNIDO and offered to donate 10 tricycles produced by K.I.E. Clients to the Joyland Special School for Cripples in Kisumu.

Technical guidance in the form of a PRODUCTION MANUAL is presented in this document to assist the K.I.E. Client trainees. A special feature of this MANUAL is that the draft was discussed with the concerned client trainees to up-date and facilitate proper understanding and application of the various aspects of production which had been covered in earlier training. Client Trainees response and participation has been most encouraging.

K.I.E. Client Trainees have commenced production of the tricycles and it is hoped that this first offer by the Danish Embassy will enable the K.I.E. to develop commercial scale production of tricycles for crippled persons, by its clients in Nyanza and in other regions.

The training given by the K.I.T.C.; cooperation extended by the Joyland Special School for the Cripples, and the Danida - K.I.T.C. Project coordinator in Kisumu; and finally the sponsorship by the Danish Embassy in Kenya are greatly appreciated and acknowledged.

1.0 - INTRODUCTION

The aim of this manual is to give guidance, step by step on how to fabricate, assemble and finally produce a tricycle for use by a crippled person. It describes in sequence, the logical procedures which must be followed to arrive at the final product. Therefore, with appropriate training, materials and correct tools and equipment as described in the manual, one should be able to follow and apply the production process and come up with a standard tricycle as shown in picture on the last page.

1.1. Arrangements

The manual is divided into sections and each section describes several processes. The sections are subdivided into paragraphs numbered with decimal points e.g. 2.1, 2.2, 2.3 etc. Each paragraph describes a set of tasks for producing different components parts.

The most critical production processes are described in Sections 2.0, 3.0 and 4.0.

Section 2.0 describes the construction of the tricycle frame. This is mainly Fabrication work and it involves the application of welding and fitting techniques. The ability to interpret and apply technical drawing is very important at this stage. Accuracy in measurements will ensure correct assembly of standard parts.

Section 3.0 describes both the raw material for the construction of the tricycle frame in 2.0 and the standard cycle parts. Raw material include pipes, flat bars, round bars, angle irons and electrodes. Their detailed description are contained in the manual and must be strictly adhered to produce a tricycle suited to local conditions. The standard cycle parts are, however available in the local market and may be purchased from a bicycle parts dealer.

Section 4.0 describes the assembly procedure. This involves meticulously fitting the bits and parts of the standard parts of a cycle together on to the main frame to make a complete tricycle assembly. This will not cause a problem if only the steps in 2.0 are properly observed. Adjustments for final balance and alignment may be facilitated, with the services of bicycle mechanic.

2:0 CONSTRUCTION OF TRI-CYCLE FRAME

2:1 MAIN FRAME

Material: To be able to make the main frame, bent to shape as shown in figure 2:1 (b), the following raw material are required:-

- mild steel black pipe diameter 19mm (3/4")
- Fine dry sand.
- Wooden plugs rounded off on one end to fit the bore of the pipe.

Pipe Preparation and bending procedure

1. Clamp the pipe securely in a bench vice and mark out a length of 2854mm.
2. Cut off the marked length using a hacksaw and remove any sharp edges formed during cutting - by using half round file.
3. Mark out the details along the pipe piece as shown on drawing figure 2:1(a)

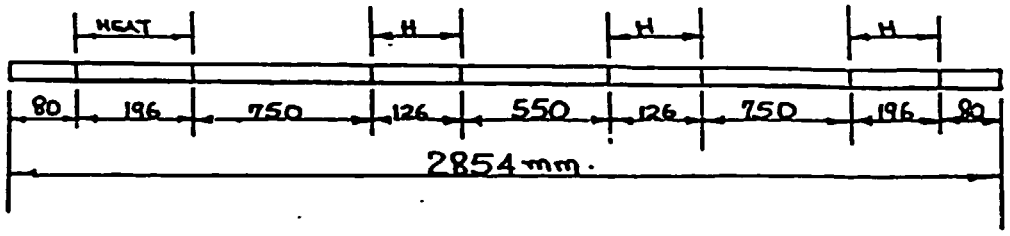


Fig 2:1(a)

4. Using a piece of white chalk, shade the portions marked "Heat" to guide you during the heating and bending process.
5. Release the pipe from the vice Jaws.
6. Fit one wooden plug to one end of the pipe piece and fill the pipe with fine dry sand.
7. "Stem up" the pipe with a mullet or piece of wood to ensure that the sand properly settles in the pipe.
8. Fit the other wooden plug to the remaining free end of the pipe.
9. Clamp the pipe again in the vice on its end dimensioned 80mm.
10. Light the heating equipment and set the flame to neutral heating.
11. Holding the heating torch at a safe distance, heat to red hot the area marked "Heat" next to the vice Jaw and draw out the first bend to shape to a radius of 62.5mm as shown in figure 2:1(b).

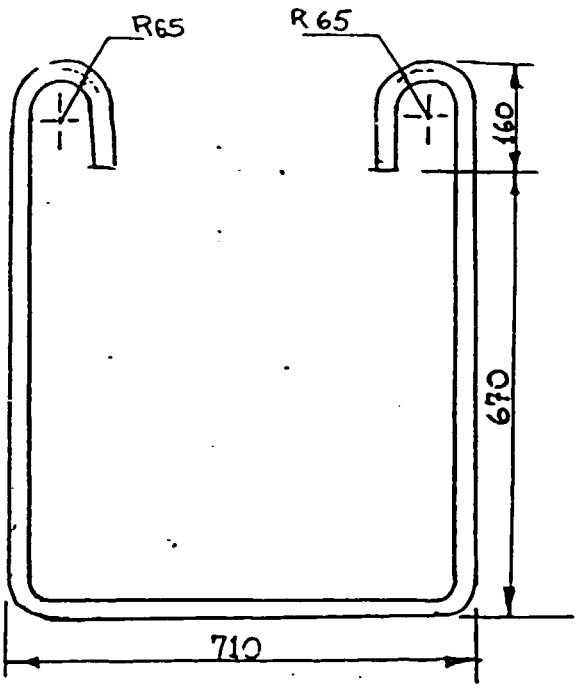


Fig. 2:1 (b)

12. Check the radius for accuracy by using a template maoe from thin mild steel sheet and if correct, remove the scales on the bent part of the pipe and cool it in water.

13. Release the vice and clamp the pipe again at the next portion dimentioned 750 mm. Repeat the steps as above until all the bends are complete remembering at every stage to use a radius template to check radius or trysquare to check for 90 degree angle as appropriate.

14. Cool the body of the frame and test it for flatness by either using a spirit level or by simply placing it on a flat surface.

Note: If the frame is found not to be completely flat, reheat the appropriate portion and knock it lightly with a mullet to allign it accurately. See fig. 2:1(b) above.

2:2 MAIN FRAME MEMBER (1)

The main frame has twc sets of members which are directly welded onto it and hence forming the initial outline of the tri-cycle framework. Each set has two pieces and to produce the first set of these members, material the same as those for part No. 2:1 are required e.g.
- mild steel black pipe of diameter 3/4" (19mm)
- fine dry sand
- wooden plugs rounded from one end.

The procedure for producing this part is as follows:-

1. Clamp the pipe in the vice and mark off a length 1347 mm.

2. Cut off this length with a hacksaw and remove any burrs formed by using a half round file.

3. On the piece of pipe 1347 mm long, mark out with sharpened chalk, the steps as shown on the drawing figure 2:2 (a).

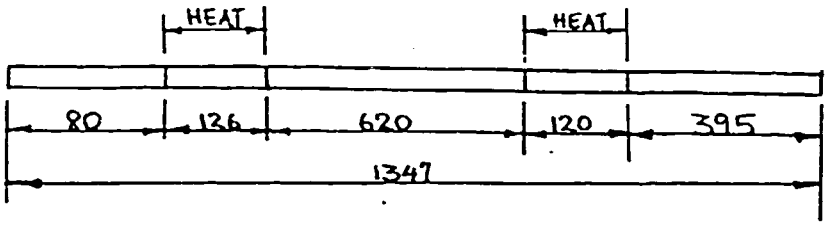


Fig. 2:2(a)

4. Using chalk, shade clearly the portions marked "Heat" to guide you during heat and bending.

5. Fit-in one wooden plug from one end of the pipe and fill the pipe with fine dry sand.

6. Stem-up properly with mullet or a piece of wood and fix the remaining plug from the opposite end of the pipe.

7. Clamp the pipe piece securely on one end in the vice.

8. Light-up the heating equipment e.g. gas set and adjust the flame to neutral.

9. Heat to red-hot the shaded portion next to the vice Jaw and draw-up the first bend accurately as shown by the drawing figure 2:2 (b).

10. Check for accuracy of the angle with a trysquare, remove the scales with a flat file and cool the hot portion.

11. Repeate the process for the next bend and test the frame for flatness as was done in part 2:1.

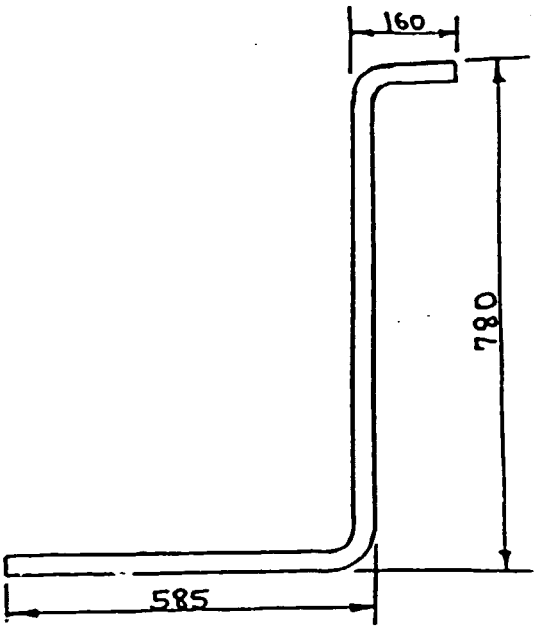


Fig. 2:2(b)

2:3 MAIN FRAME MEMBER (2)

This is the 2nd set of members welded to the main frame as already mentioned. To produce it, material similar to those of the parts above is needed:
- Mild steel black pipe of diameter 3/4" (19mm).
- Fine dry sand.
- Wooden plugs as already used.

To produce this part the following procedure is applicable:

1. Clamp the pipe in the vice and mark out a length 931 mm.

2. Cut off this length with a hack saw and file off any burrs using a half round file.

3. On This piece 931 mm long, mark out the steps as shown on drawing figure 2:3 (a).

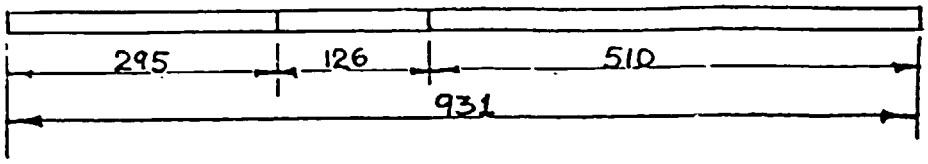


Fig. 2:3(a)

4. Shade the portion marked "Heat" with chalk and fit in the wooden plug from one end.

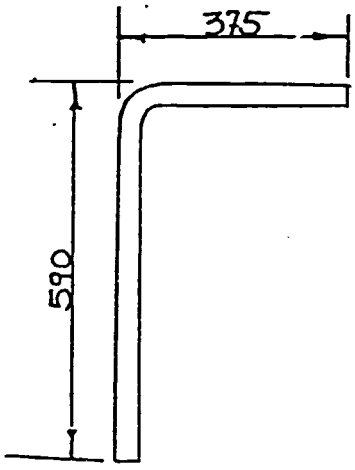
5. Fill the pipe with fine dry sand from the opposite end and stem-up properly using a mullet or a piece of wood.

6. Fit the remaining plug into the other end of the pipe and clamp the pipe in the vice leaving free the portion marked "Heat".

7. Light the heating equipment and again set the flame to neutral.

8. Heat the pipe to red hot at the portion marked "heat" and draw the bend as shown in figure 2:3(b).

Fig. 2:3(b)



2:4 & 2:5 - UPPER AND LOWER SUPPORT PIPES

These parts are identical and are obtained by cutting off from the mild steel black pipe of diameter 3/4" (19mm)

- Clump the pipe in the vice and mark out two pieces of length 450mm each as shown in figure 2:4 below.

- Cut off the two pieces and file off the edges smooth using a half round file.

Fig. 2:4

2:6 - BACK REST FRAME

The back rest is made of a timber frame and cushion material covered with p.v.c. sheet. This is then screwed onto a vertical metal frame of the tricycle. The frame is made of the following material:

- Mild steel angle iron 3mm (1/8"x1").
- Flat Bar 3mm x 25mm
- Welding electrodes of diameter 2.5mm or 3.25mm.

To make the metal frame as shown in figure 2:6 below proceed as follows:-

1. Straighten the angle iron on an envil using a steel hammer.

2. Clamp it in a vice and using a tape measure, sharpened chalk and trysquare, mark out three pieces of length. 225mm (2NO) and 450mm.

3. Cut off the pieces to length 225mm with a hacksaw and file off the edges smooth with a flat file.

4. Clamp the flat bar 3mm x 25mm in the vice and mark out two pieces of length 334mm each.

5. Cut off the two pieces to length 334mm and remove any sharp edges by filing.

6. Mark out the hole centres 110mm from each end of the flat bar pieces.

7. Centre punch these centres and drill the holes to diameter 4mm using either a portable drilling machine or standard workshop drilling machine.

8. Arrange the parts as shown in figure 2:6 and weld them properly to form the back rest body frame.

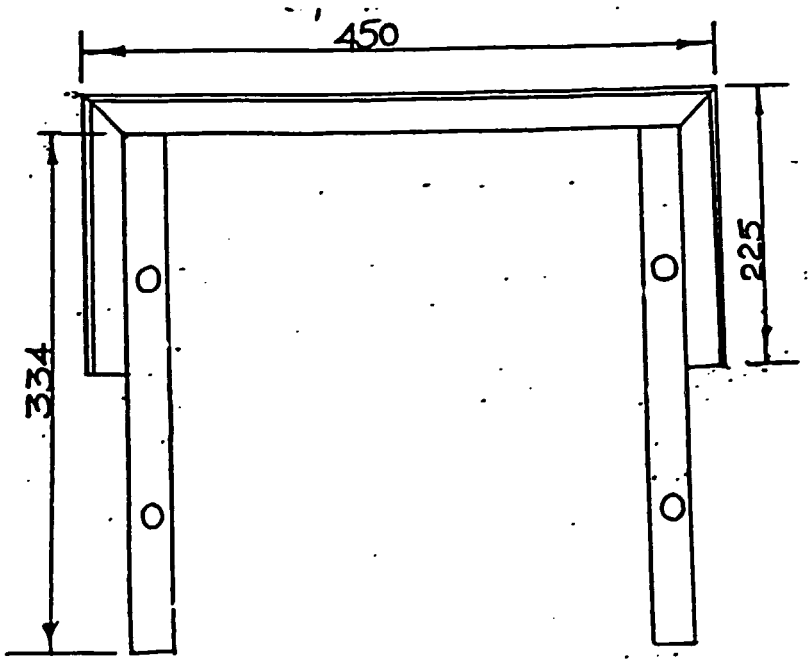
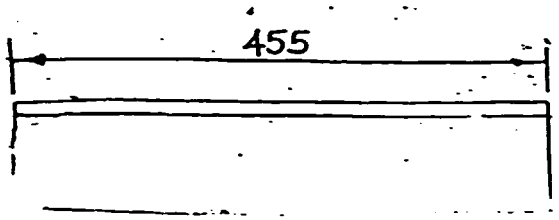


Fig. 2:6

2:7 - SEAT FRAME

The seat frame is made of two pieces of mild steel angle iron (3mm x 25mm) cut to length 455mm each. After preparing the pieces as shown below, figure 2:7; they are welded in position on the main frame members to support the seat which is made in a similar way as the back rest already mentioned.

Fig. 2:7



2:8 - ARM REST SUPPORT BRACKETS

These are four simply U - shaped brackets made from a thin mild steel flat bar of 3mm x 25mm cross-section. They are fabricated in the following manner:-

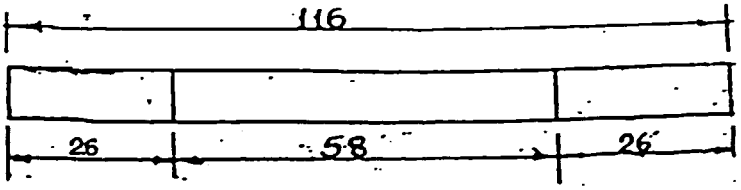
- Straighten the mild steel flat bar on an anvil or a flat steel top by gently hammering with a steel hammer.

- Place the bar on a work bench and mark out four lengths of 116mm each.

- Cut off the four pieces 116mm each and file off the cut edges smooth.

- Using a steel rule, mark out the hole centres 12mm from each end of the pieces as shown in figure 2:8(a)

Fig. 2:8(a)



- Centre punch the marked hole centres and drill the holes to 4mm diameter.

- Using a steel rule, trysquare and scriber, clearly mark the positions of the bends 26mm from each end of the metal pieces.

- Set the first piece in the vice jaws and grip accurately along the marked line.

- With the help of a hammer, knock the metal to bend at 90 degrees.

- Release the vice, set the opposite end and proceed in a similar manner to produce the other bend to form a U-shaped bracket as shown in figure 2:8(B).

- Repeat the same process for the remaining pieces until all the four brackets are produced.

Fig. 2:8(b)

2:9 - REAR WHEEL SUPPORTS (OUTER)

These are two brackets welded on the main frame one on each side. Their purpose on the tri-cycle is to support and secure the two rear wheels in position. They are made from mild steel flat bar 6mm x 38mm (1/4"xland half) and the procedure for their production is as follows:-

- Place the flat bar on a level surface e.g. workbench and mark out two lengths of 104mm.

- Cut the two pieces to lengths and remove any sharp edges formed during cutting by filing.

- From one end mark a slope to suit the profile of the frame it is to be welded on.

- From the opposite end mark out the slot accurately as shown in the drawing figure 2:9.

- Using a hacksaw, cut the metal accurately along the marks to produce both the slopy edge and slot shown.

- Chisel out the metal cut to produce the slot.

- Remove any sharp edges formed during cutting by filing.

- Proceed in a similar manner to produce the next piece.

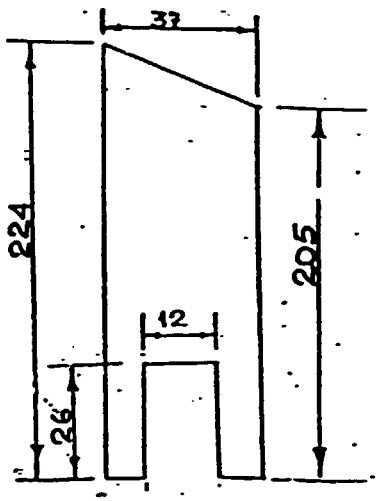


Fig 2:9

2:10 - REAR WHEEL SUPPORT (INNER)

This is produced in a similar manner as the outer one except none of its edge is sloped.

Material required is the flat bar 6mm x 38mm (1/4" x 1 and half).

- Mark out two length 104mm each.

- Cut off the piece to length and remove any sharp edges by filing.

- Mark the slot as shown and cut accurately along the mark.

- Chisel out the middle metal to produce the slot as shown in figure 2:10.

- Remove any sharp edges by filing with a hand file.

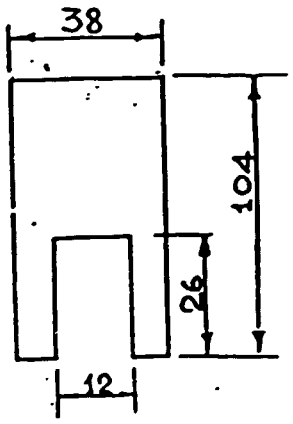


Fig. 2:10

2:11 - LIFTING FRAME

This is a U-shaped pipe frame welded to the lower part of the main frame members so as to protrude backwards. Its purpose is to enable a helper to lift the front wheel by st pping onto it, to enable the tri-cycle to pass over a raised place e.g. a door step. The material and procedure for its fabrication is as follows:-

Material:

- Mild steel black pipe of diameter 13mm (1/2").
- Fine dry sand.
- Two wooden plugs rounded off from one end to fit the bore of the 13mm diameter pipe.

Pipe preparation and bending procedure

- Clamp the pipe length in a vice and mark a length 922mm.
- Cut out the pipe piece to the marked length and file off any sharp edges formed during cutting.
- Place the piece on a worktop and mark the details a long it as shown in figure 2:11(a).

- Shade clearly the areas marked "heat" to guide you during heating and bending process.

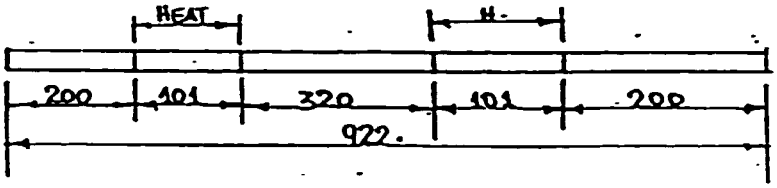


Fig. 2:11(a)

1. Fit-in one wooden plug from one end of the pipe.

2. Fill the pipe with the fine dry sand and stem-up properly using a mullet or a piece of wood.

3. Fit-in the other plug from the opposite end of the pipe piece.

4. Clamp the pipe along one of the portions, mark 200mm leaving the other end hanging free from any obstacle.

5. Light-up the heating equipment and set the flame to neutral.

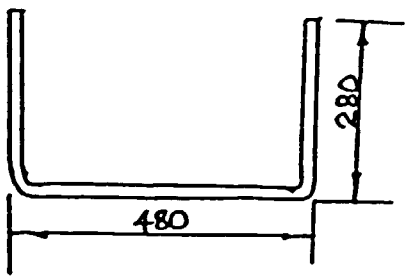


Fig. 2:11(b)

6. Holding the heating torch at a safe distance, heat the shaded area next to the vice jaw, until it is red hot and draw out the bend to an angle of 90 degrees.

7. Remove scales formed during bending, by filing and cool the pipe.

8. Proceed in a similar manner to produce the next bend and the frame will take the shape shown in figure 2:11(b).

9. Use a trysquare to check the 90 degrees angle and place the frame on flat surface to test for flatness. If not flat, re-heat and adjust accordingly.

10. Cool the whole frame and remove the plugs to enable you also to remove the sand.

2:12 - UPPER MUDGUARD SUPPORT-BRACKET

This is a metal bracket shaped as shown in figure 2:12(b), and welded onto the main frame in an upright position. It links with the mudguard to prevent the mudguard from rubbing onto the tyre of the wheel. It is made from a thin flat bar of cross-section 3mm x 25mm (1/8"x1"), cut and bent to shape as follows:-

1. Mark out two lengths of 315mm each from the flat bar.

2. Cut out the pieces accurately using a hacksaw and remove any sharp edges by filing.

3. On each of the pieces, mark out the detail-steps as shown in figure 2:12(a)

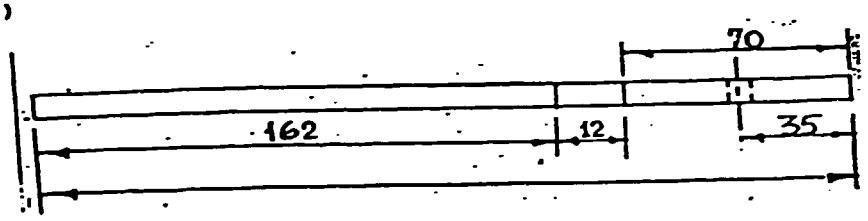


Fig. 2:12(a)

4. Drill the marked hole to diameter 4mm as indicated on the drawing.

5. From the same end, bend the metal to suit the inner profile of a mudguard as shown in figure 2:12(b).

6. Complete the next bend at 90 degrees until the mudguard support bracket takes the shape shown in the figure.

7. Repeat the same process to produce the second bracket.

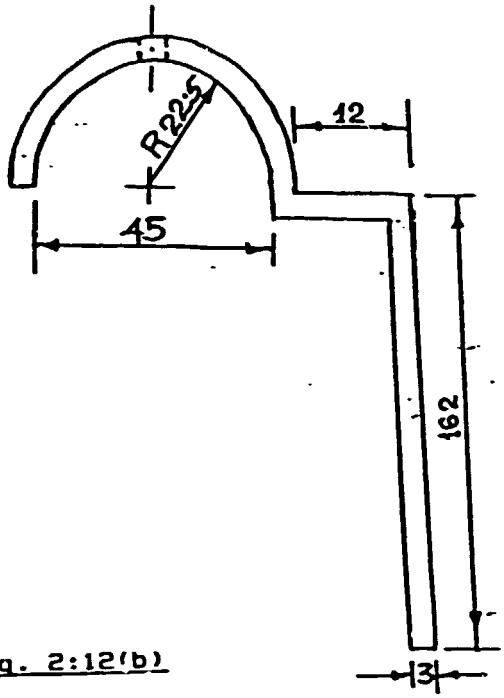


Fig. 2:12(b)

2:13 - LOWER MUDGUARD SUPPORT PIPE

These are two short pieces of mild steel pipe of diameter 13mm (1/2").

1. From the pipe length mark out two pieces of 109mm each and cut them accurately along the marks - figure 2:13.

2. File off any sharp edges using a half round file.

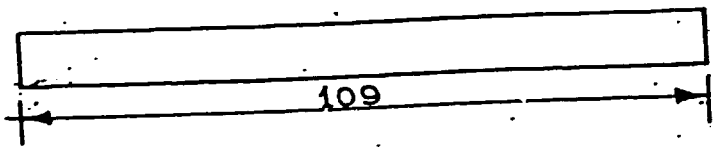


Fig. 2.13

2:14 - LONG FRONT WHEEL FRAME

This is simply a piece of mild steel black pipe bent to shape as shown in figure 2:14(b). Onto it is welded the fork assembly which secures the front wheel in position. Since the bending radii are difficult to establish as par of the dimensions, the right profile is achieved by trial and error. It is therefore important to note that this part should only be made after assembling the main frame to its members, so that it can be tried in position to determine whether it is suitable. If not so, then the appropriate place reheated and the bend re-adjusted. The following will - therefore serve as fundamental procedure for producing it.

Material:- Mild steel blackpipe diameter 19mm (3/4")
- Fine dry sand
- Wooden plugs as used before.

Procedure:

1. Clamp the pipe length in a bench vice and mark from one end a length 710mm.
2. Cut this to size and remove sharp edges from the cut end using a half round file.
3. Mark out the details along its length as shown in figure 2:14(a).

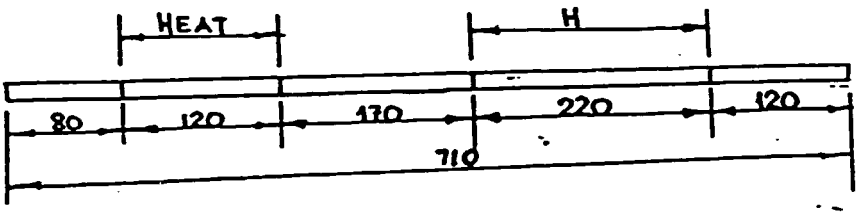


Fig. 2:14(a)

4. Shade with chalk the portions marked "H" and fit in one wooden plug from one end.
5. Fill the pipe with the sand and stem up properly with a mullet or a piece of wood.
6. Plug the remaining end and clamp the pipe in the vice at one end.
7. Heat to red hot the portion marked "H" and draw out the first bend to shape as shown on the drawing figure 2:14(b).

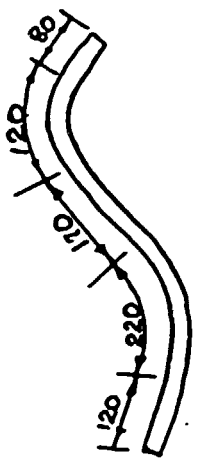


Fig. 2:14(b)

8. Cool it in water and clamp the opposite end in the bench vice.

9. Heat the next position to red hot and draw out the bend to shape as shown above.

10. Try it on the main frame work and if not found suitable re-heat the appropriate position of the pipe and adjust the bend until it is able to support the front wheel accurately in position.

2:15 - SHORT FRONT WHEEL FRAME SUPPORT

This is simply a short piece of pipe welded in position to re-enforce the long front wheel frame (see part No. 2:14). It is cut from a black pipe of dia 19mm (3/4"), the size also used for the long front wheel frame.

Material: Mild steel black pipe dia 19mm (3/4")

Procedure:

1. Mark out a length 420mm from the pipe and cut it accurately on the mark.

2. With a hacksaw, cut a bevel on one end of the pipe to suit the position of the long front wheel frame - see figure 2:15 below.

3. Remove any sharp edges formed during cutting by filing off with a half round fil.

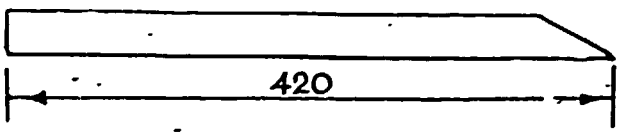


Fig. 2:15

2:16 - SEAT SIDE PLATES

On each side of the tri-cycle seat, are pieces of mild steel sheets welded to the side frame to form a proper sitting area. These pieces, 4NO are cut from a 1mm thick mild steel sheet and one corner rounded off as shown on the drawing figure 2:16 below.

Material - Black mild steel sheet 1mm thick.

Procedure:

1. Mark out from a mild steel sheet the four pieces of size 485mm x 360mm each.

2. Using a pair of tinsnips, cut the pieces to size and file off their edge smooth.

3. On one corner of each piece round off the edge by cutting and finally filing smooth. See figure 2:16.

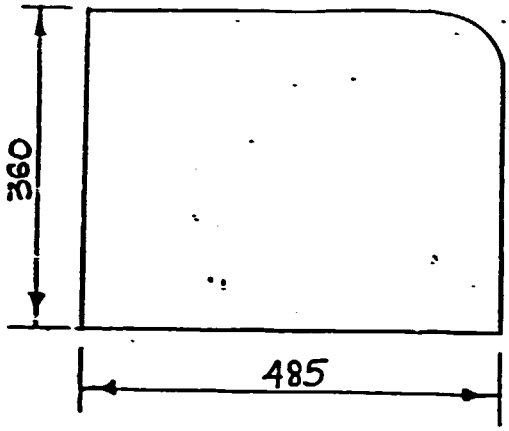


Fig. 2:16

2:17 - FOOT REST

This is composed of two pieces of mild steel plate, one welded to the foot frame horizontally while the other is welded vertically to stop the foot from falling off backwards.

Material: - The material required for this part is similar to that used for part 2:16 above e.g. 1mm thick black mild steel sheet.

Procedure:

1. Mark out the two pieces from the m/s sheet to sizes

   480mm x 175mm - 1 piece

   457mm x 170mm - 1 piece

2. Using a pair of tinsnips cut the pieces to size as indicated in the drawing, figure 2:17(a) & (b).

3. Use a flat file to make their edges smooth.

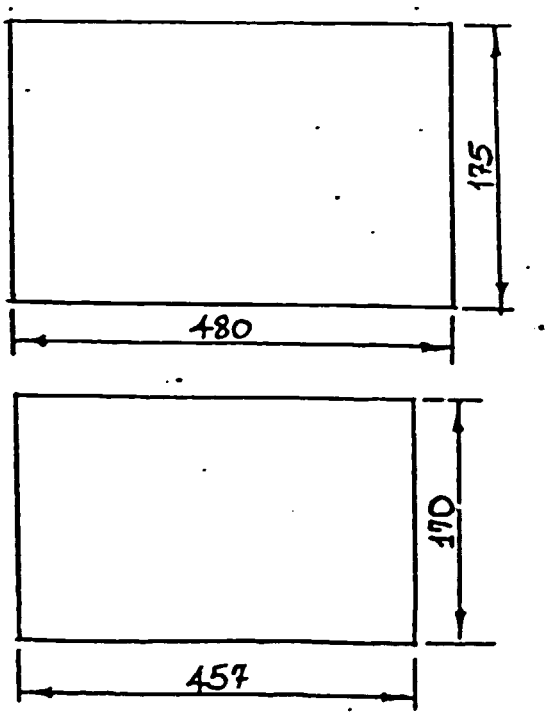


Fig. 2:17

2:18 - CARRIER UNIT

The carrier recommended here is similar to an enclosed box with its door. It is fixed to the back of the main frame and its door is provided with brackets to enable locking by a small sized padlock. The frame work of the carrier is made of mild steel angle iron and the body is covered by welding pieces of mild steel sheets onto the frame. This carrier takes a shape similar to the illustration in figure 2:18 below.

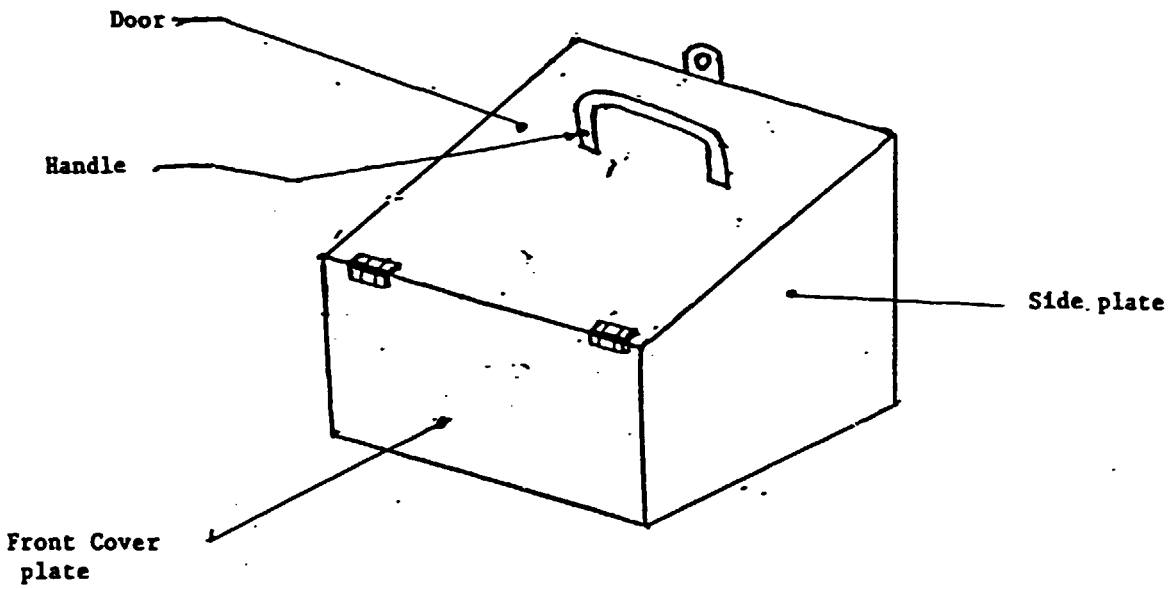


Fig. 2:18

Note:

The frame of the carrier is built by welding pieces of mild steel angle iron to the existing frame work of the tri-cycle. These members are pieces of the angle iron cut to the appropriate lengths and welded in position to form shap as shown above. The pieces of mild steel plate are then welded around the framework to complete the carrier. Note that the door is hinged on its lower edge and the handle welded to the door as shown. The locking brackets are drilled to hole sizes 6mm diameter to be able to accommodate the shackle of a small sized padlock. The parts for building the carrier are therefore as follows:-

2:18(a) - Carrier Framework pieces

Door Frame

Frame supporting the door:- is composed of two pieces of mild steel andle iro of cross-section 3mm x 25mm (1/8"x1") cut to lengths of 315mm each.

Procedure:-

1. Mark two pieces 315mm each from a length of angle iron.

2. Cut the two pieces accurately to size and bevel one end on each to suit the position of the backrest frame - See figure 2:18(a).

3. File off all edges smooth using a flat file.

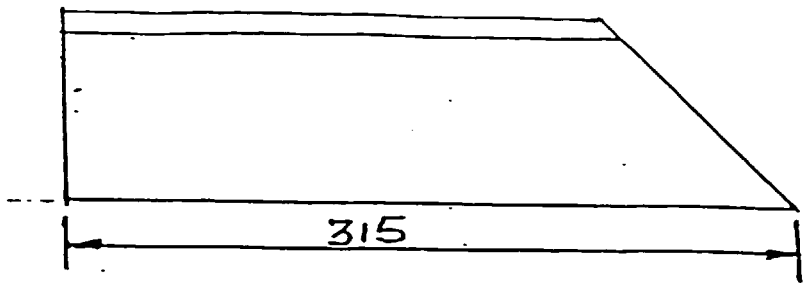


Fig. 2:18(a)

2:19(b) - Back plate frame

Material:- Mild steel angle iron 3mm x 25mm.

Procedure:-

1. Mark out two pieces of length 134mm each - figure 2:18(b).

2. Cut them accurately to length and remove any sharp edges by filing off.

   - These pieces will be welded vertically in position to form the carrier back frame.

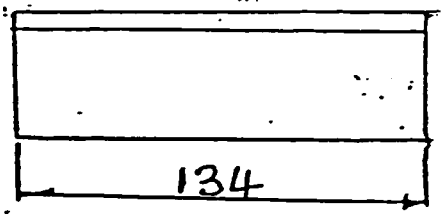


Fig. 2:18(b)

2:19(c) - Carrier bottom frame work

This is the frame onto which the bottom plate is welded. It is made of 4 pieces of mild steel angle iron 3mm x 25mm Cross Section.

The procedure for preparing the pieces is as follows:-

1. From the length of the angle iron mark and cut four pieces of lengths:
   440mm - 2NO
   230mm - 2NO

   See fig. 2:18(c)

2. Using a trysquare, mark 45 degrees bevels on each end of the pieces and cut these bevels accurately with a hacksaw.

3. File off the edges smooth and set the pieces end to end to form a rectangular frame and weld accurately.

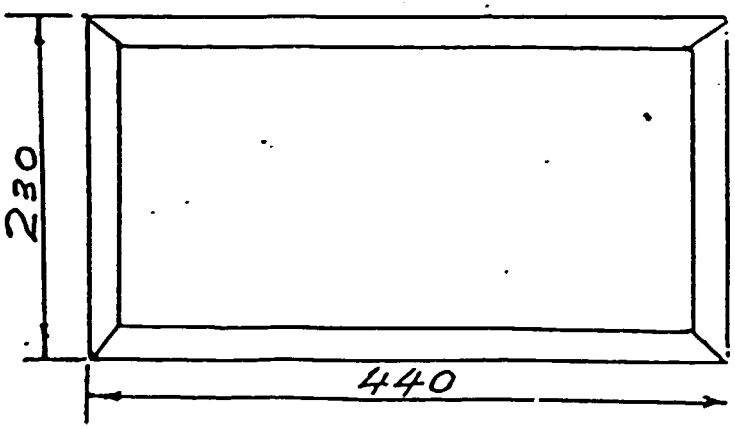


Fig. 2:18(c)

4. Cut a piece of mild steel plate to size 224 x 436mm and weld this plate inside the frame to form the bottom.

(d) Other pieces of mild steel sheet required to complete the body of the carrier are as follows:

(i) Carrier side plates - 2 pieces.
figure 2:18d(i)

- Mark out and cut to sizes two pieces of mild steel sheet as shown here in figure 2:18(d)(i).

- File off the edges smooth using a flat file.

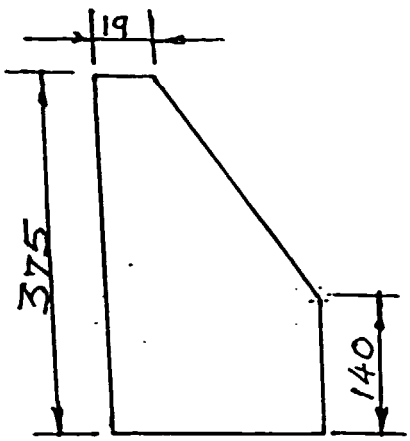
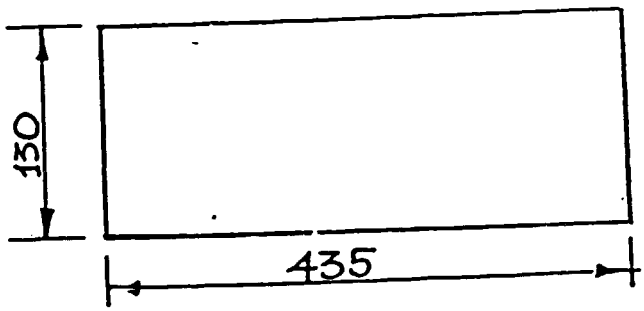


Fig. 2:18(d)I

(ii) Carrier Vertical back plate.

This plate is welded on the carrier back frame, below the hinges of the door. It is a piece of mild steel sheet of size 130mm x 435mm.

Fig. 2:18(e)



- Mark out from the mild steel sheet a piece 130mm x 435mm and cut accurately with a pair of tinsnips.

- File off the edges smooth using a flat file.

(iii) Carrier door.

This is also a piece of mild steel sheet of 1.5mm thick. It is hinged a shown above and opens downwards.

- Mark out a piece 320mm x 408mm from the 1.5mm m/s sheet - See figure 2:18(f).

- Using a pair of snips or a shearing machine cut accurately along the mark.

- File off the edges smooth using a flat file.

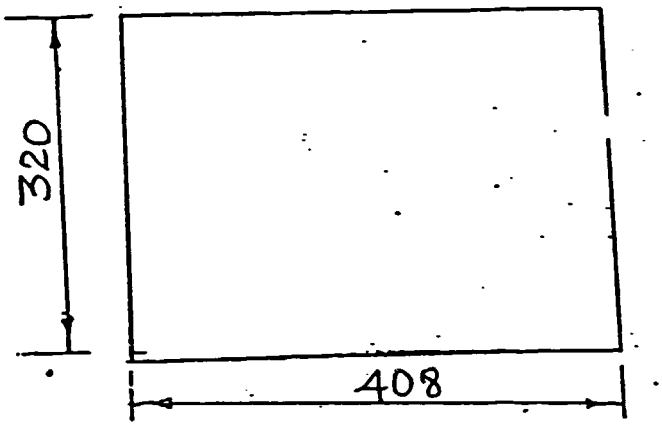


Fig. 2:18(f)

- Obtain a mild steel round bar dia 8mm and cut a length 220mm for the door handle.

- Mark the piece and cold bend on bench vice to shape as shown here. figure 2:19 d(iv)

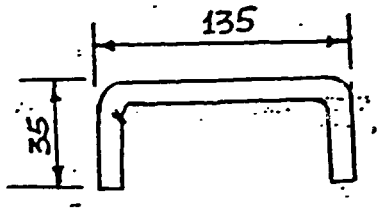


Fig. 2:18(g)

2:19 - BRAKING SYSTEM

2:19(i) - Braking Rod:

This is made from mild steel roundbar of 12mm diameter. The material is cut to size and bent to shape similar to the drawing - fig. 2:19(i).

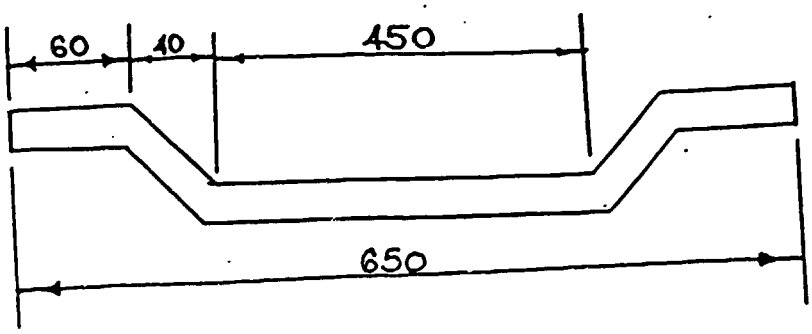


Fig. 2:19 I

Procedure:

1. Mark out a length 700mm from the mild steel round bar.
2. Using a hacksaw, cut to size and file off the edges smooth with a fiat file.
3. Mark out the portions to be bent as shown in fig. 2:19(ii) below.
4. Using a bench vice and a hammer bend the rod to shape to suit the position of the rear tyres of the tri-cycle - see figure 2:19(ii).

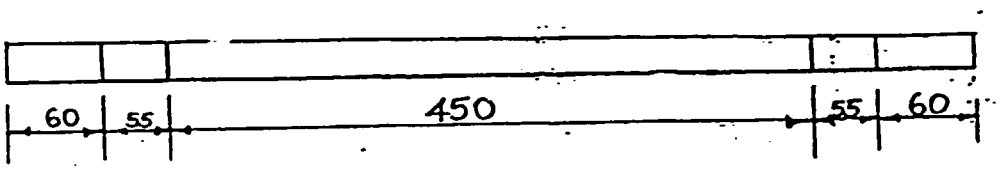


Fig. 2:19 II

2:19(iii) - Braking Rod Support Brackets - 2 NO

These are two brackets welded in position, one on each side of the tri-cycle to carry the braking rod. Each end of the braking rod passes through the holes drilled through the brackets and further connected to other linkages of the braking system.

The bracket is simply made from mild steel flat bar and bent to shape as show in figure 2:19(iii) below:

Material - Mild steel flat bar 3mm x 38mm
1/8" x 1 and half inch.

Procedure:

1. Mark out two pieces of length 155mm each
2. Cut them to size and remove any sharp edges by filing.
3. Mark each piece as shown in fig. 2:19(iii) below and drill the holes to 12mm diameter.

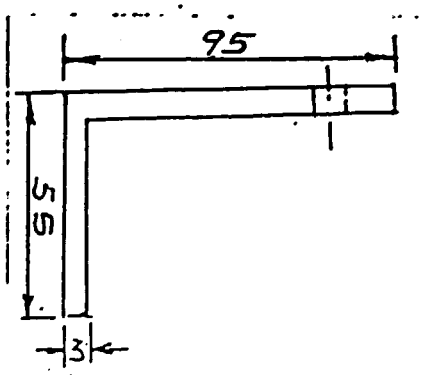


Fig. 2:19 III

4. Using a bench vice and hammer, bend the bracket to shape as already shown.

5. Repeat the same procedure to make the 2nd bracket to size and shape.

2:19(iv) - Braking spring hooks - 2 NO

The braking system is provided with a spring to help in keeping the breaking link away from the tyres when the brake is not applied. This spring is kept in position on the tri-cycle by two hooks, one welded onto the lower framework and the other welded on an L-shaped bracket attached to the braking handle.

Material:
- Mild steel rod diameter 6mm (1/4").

Procedure:

1. Mark out two pieces of length 100mm from the steel rod and cut out the marked lengths.

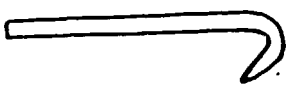
2. On each piece 100mm long mark out the portion to be bent i.e. 30mm from one end.

3. Grip one piece in the vice setting the 30mm portion to protrude above the vice jaws.

4. Using a hammar, knock that portion to bend to shape as shown in figure 2:19(iv)

5. Repeat the same procedure to bend the next piece.

Fig. 2:19 IV



2:19(v) - BRAKE HANDLE

As with most braking systems, there is a handle or a pedal on which braking force is applied to operate the braking links. This brake-system is operated by a handle made of mild steel pipe. The handle is strongly welded in position on a linkage and protrudes adequately upwards to enable easy operation of the brake.

Material - Mild steel blackpipe of diameter 13mm (1/2")

Procedure:

1. Markout a length of 580mm from the mild steel pipe.

2. Cut accurately on the mark by using a hacksaw and file off the edges smooth using a half round file.

3. Mark a length 50mm from one end of the pipe piece.

4. Light the heating equipment to neutral flame and heat the 50mm portion to red hot.

5. On a steel top use a hammer to flatten this heated portion to the shape shown in figure 2:19(v).

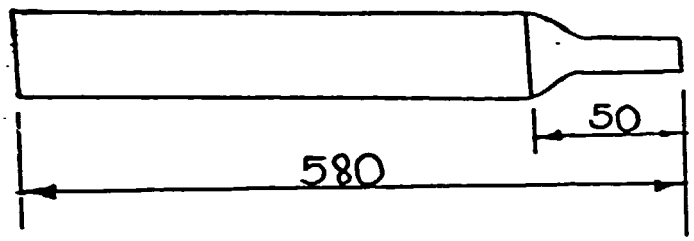


Fig. 2:19 V

6. Seal the remaining end by welding a piece of metal to it and file smooth.

2:19(vi) - Brake Handle Stopper

Due to the action of the spring attached to the brake handle system, the handle may tend to move very much backwards when the brake is released. Thismovement may cause the handle to rub both on the mudguard and the seat handle. To avoid this a stopper is welded appropriately on the frame work to stop the handle at a safe position.

Material: Mild steel flat bar 3mm x 38mm (1/8"x1 and half inch).

Procedure:

1. Mark a length 40mm on the flat bar.

2. Use a hacksaw to cut the piece accurately on the mark and file off any sharp edges.
   See drawing figure 2:19(vi).

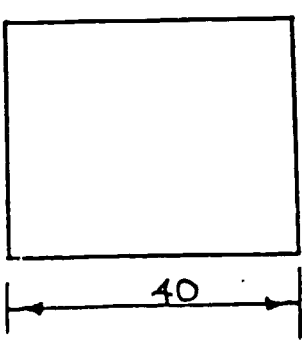


Fig. 2.19 VI

2:19(vii) - Brake rod - Handle, Linkage

This is L-shaped metal piece made from mild steel rod. This part links the brake-rod with the brake handle - and on it is welded the hook (see part 2:19(iv) above) which is attached to one end of the operating spring.

Material:

- Mild steel rod of dia 10mm.

Procedure

1. Mark out a length 130mm from the steel rod.
2. Using a hacksaw, cut the piece accurately on the mark.
3. File off any sharp edges and mark from the end of the metal rods a distance 55mm as shown on drawing figure 2:19(vii)(a) below.

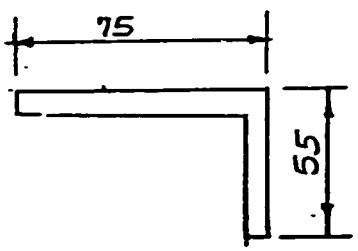


Fig. 2:19 VII

4. Clamp one piece in the vice setting it to protrude with a length of 55mm
5. Light the heating equipment and heat up the metal on the mark.
6. Using a hammer and benchvice, bend the metal accurately as shown above.
7. Check for 90 degrees with a trysquare and cool the metal in water.
8. Repeat the same procedure to bend the next one.

MATERIAL FOR CONSTRUCTION OF
ONE TRI-CYCLE FOR CRIPPLES

No.	MATERIAL	PARTS TO BE MADE FROM THE MATERIAL	No. OF SUCH PARTS	TOTAL MATERIAL REQUIRED
1.	Mild Steel Black Pipe Dia 19mm (3/4")	2:1 - Main Frame	1	285mm
	-"-	2:2 - Main Frame member (1)	2	2694mm
	-"-	2:3-Main Frame member(2	2	1883mm
	-"-	2:4-Upper Support Pipe	1	450mm
	-"-	2:5-Lower Support Pipe	1	450mm
	-"-	2:14-Long Front Wheel Frame	1	710mm
	-"-	2:15-Short Front Wheel Frame Support	1	420
				9451mm
2.	Mild Steel Angle Iron 3mm x 25mm (1/8"x1")	2:4-Back rest body frame	whole unit	900mm
	-"-	2:7-Seat Frame	2 Pieces	900mm
	-"-	2:18(a)-Carrier Door Frame	2 Pieces	630mm
	-"-	2:18(b)-Carrier Back Plate frame	2 Pieces	268mm
	-"-	2:18(c)-Carrier Bottom frame	4 Pieces	1340mm
				4038mm
3.	Mild Steel Flat Bar 8mmx25mm (1/8"x1")	2:6-Back rest frame	2 Pieces	668mm
	-"-	2:8-Arm rest support Brackets	4 Pieces	464mm
	-"-	2:12-Upper Mudguard Support Bracket	2 pieces	650mm
				1782mm
	Mild Steel Flat Bar 6 x 38mm (1/4 x1 and half inch)	2:9-Rear Wheel Support (outer)	2 No	448mm
	-"-	2:10-Rear Wheel Support (Inner)	2 No	208mm
				656mm

5.	Mild Steel Flat Bar 3x38mm(1/8"x1 and half) -"-	2:19(vi)-Braking Rod Support Brackets 2:19(vii)-Brake Handle Stopper	2 No 1 No	300mm 40mm 340mm
6.	Mild Steel Black Pipe Dia 13mm (1/2") -"- -"-	2:11-Lifting Frame 2:13-Lower Mudguard Support 2:20-Brake Handle	1 No 1 No 1	922mm 109mm 580mm 1611mm
7.	Mild Steel Fod Dia 12mm (1/2")	2:19(i)-Braking Rod	1 No	750mm 750mm
8.	Mild Steel Rod Dia 8mm -"-	2:19(iv)-Door Handle Braking Spring Hooks	1 No 2 No	220mm 200mm 420mm
9.	Mild Steel Rod Dia 10mm	2:19(vii)-Brake rod-Handle Linkage		260mm 260mm
10.	Mild Steel Sheet 1mm thick	2:16-Seat side Plates 2:17-Foot Rests 2:18d(i)-Carrier side Plates 2:18d(ii)-Carrier Vertical Back Plate 2:18d(iii)-Carrier door	4 pieces 2 pieces 2 pieces 1 piece 1 piece	$\frac{1}{2}$ Sheet $\frac{1}{2}$ Sheet
11.	Welding Electrodes Dia 3.25mm	All arc welding work		5 kg
12.	Paint Black oxide Chramic Prime Crown	All painting work		1 litre

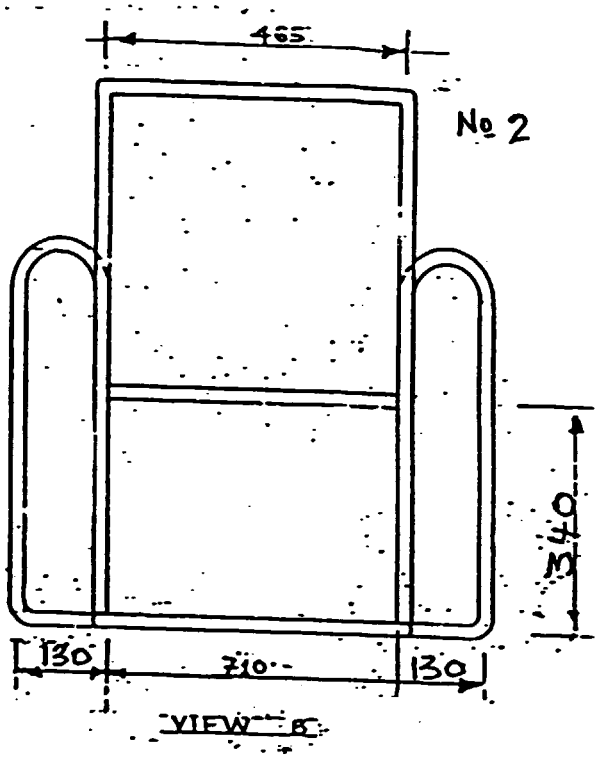
ASSEMBLY OF TRICYCLE - 4:0

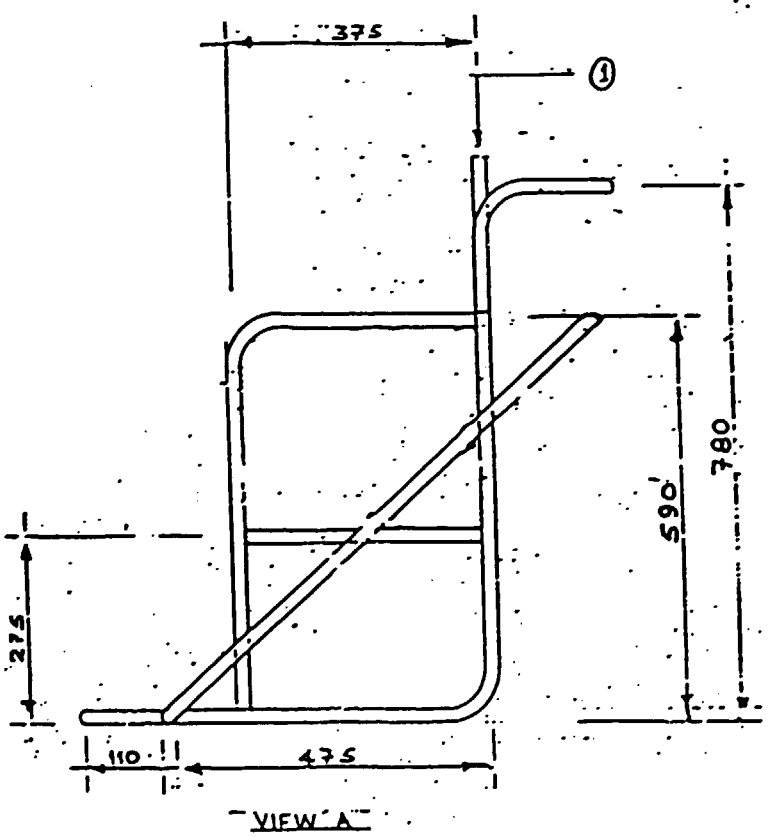
2:1 - Procedure: After the parts have been constructed by various workshop processes, they are further assembled as follows:-

Main frame 2:1 is tackwelded to member Nos. 2:2 and 2:3 by arcwelding process as shown in VIEW B in drawing No. 2.

- Uprightness of parts 2:2 and 2:3 is checked with spirit level, and using tape measure measurements 130mm, 710 and 465mm are checked. Frame supp rt parts 2:5 are tackwelded at top and bottom to member Nos. 2:3 to 2:2. Member support pipes 2:24 are tackwelded to each side of frame members 2:2 and 2:3 to give height 275mm and 590mm respectively.

The main frame is then fully welded at joints shown above in views A & B.





Body side plates Fig. 2:16 are tackwelded to each side of frame member 2:2 and 2:3 inside and outside as shown in Fig. 1. Using long tackwelds

- Weld the seat frame 2:7 on the main frame members as shown in View C of drawing No. 2. 275mm from the floor. See View C

- Weld back seat frame to frame side plates

- Weld inner and outer Wheel Supports 110mm from end of frame 2:2 to main frame 2:1 and support pipes as shown in Drawing No.1.

- Weld lifting frame 2:11 to member 2:2

- Weld arm rest supports 2:8 to member 2:3.

- Weld backrest seat frame (2:6) to member 2:3

- Weld carrier (2:19) to 2:6 and 2:5.

- Weld the frame carrier side plates, bottom plate (b). Carrier vertical cover 2:19 and carrier door (b)

- Weld carrier locking brackets and handle.

- Assemble the rear wheels in position.

- Set mudguard rods to Wheel Supports.

- Set position for rear mudguards and weld lower mudguard supports 2:13 to main frame 2:1 and 2:3.
Reset position for upper mudguard supports.

- Weld upper mudguard supports (2:12)

- Fit mudguard to lower mudguard support.

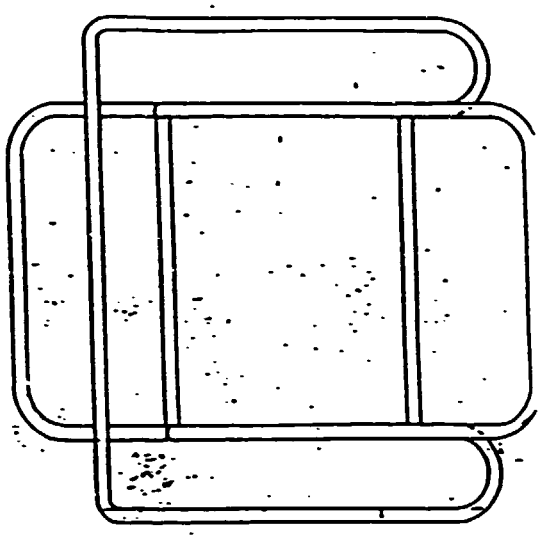
- Set position for upper mudguard bolt.

- Mark and drill to required bolt diameter.

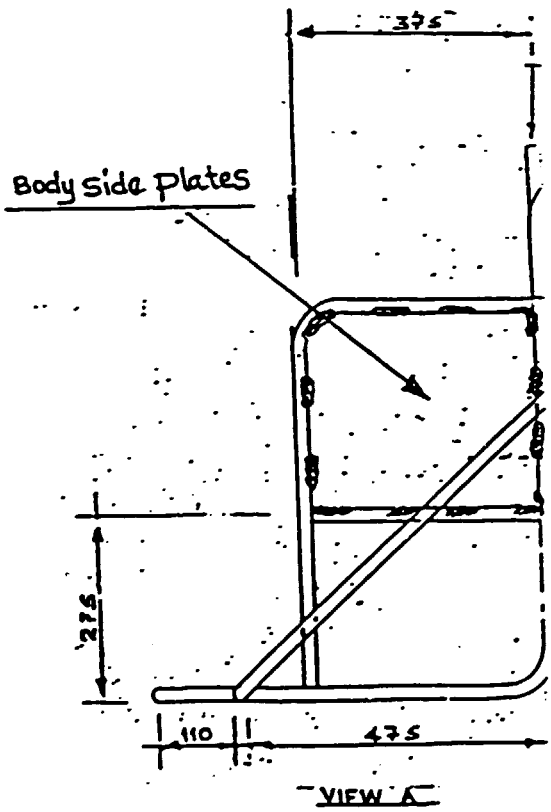
- Tackweld front Wheel frame 2:14 to main frame.

- Set front Wheel and folk assembly in position

- Tackweld the short pipe to frame 2:14.



VIEW C



VIEW A

- Tackweld the front wheel frame support pipe.
- Weld the front wheel frame.
- Weld the short pipe
- Fit brake support 2:23(ii) to rod 2:23(i)
- Set brake rod supports 2:23(ii) to frame 2:2
- Position brake rod to touch the rear tyres.
- Tackweld rod support 2:23(ii) to frame 2:2
- Tackweld hook support 2:23(iii) to brake rod 2:23(i).
- Tackweld brake handle 2:23(iv) to 2:23(iii)
- Tackweld spring hooks 2:23(vi)
- Fully weld the parts 2:23(i) - (iv).
- Fit spring 2:23(vii)
- Position and weld handle stopper 2:23(v)
- Weld the horizontal foot rest (2:17) to frame member 2:2
- Weld the vertical foot rest (2:18) to frame member 2:3.
- Weld crank pipe to crank.
- Fit falk to short pipe on front wheel frame.
- Fit Crank to Falk and lock with falk fittings.
- Fit pedals to Crank.
- Fit front wheel mudguard rods to Horizontal bolt holding the hub.
- Fit mudguard to rods.
- Fix one side of mudguard to falk
- Weld remaining end to mudguard.
- Fix bell to Crank pipe.
- Fit and tension the sprokets and chain.
- Seal Front and rear mudguards with paper.
- Seal falk with paper.
- Paint the tri-cycle.
- Fix the seats with wood screw.

5:0 - WORKSHOP REQUIREMENT

5:1 - Complete Gas Welding Set:

(a) Oxygen Cylinder
(b) Acetylene Cylinder
(c) Oxygen regulator
(d) Acetylene regulator
(e) Oxygen hose
(f) Acetylene hose
(g) Saffire 3 compact set
(h) Gas welding goggle
(i) Cylinder Trolley
(j) Cylinder key (spindle key)
(k) Spanner for an oxy-acetylene welding set.

5:2 - Arc Welding Set:

Welding transformer (180-220 AMPS) complete with return (earth) and electrode holder cables.

3 Anvil (or a 6ft Rail track beam)

4 Bench vice

5 Workshop Bench

6 Drilling machine (manual or power operated)

7 Grinding machine (Angle grinder)

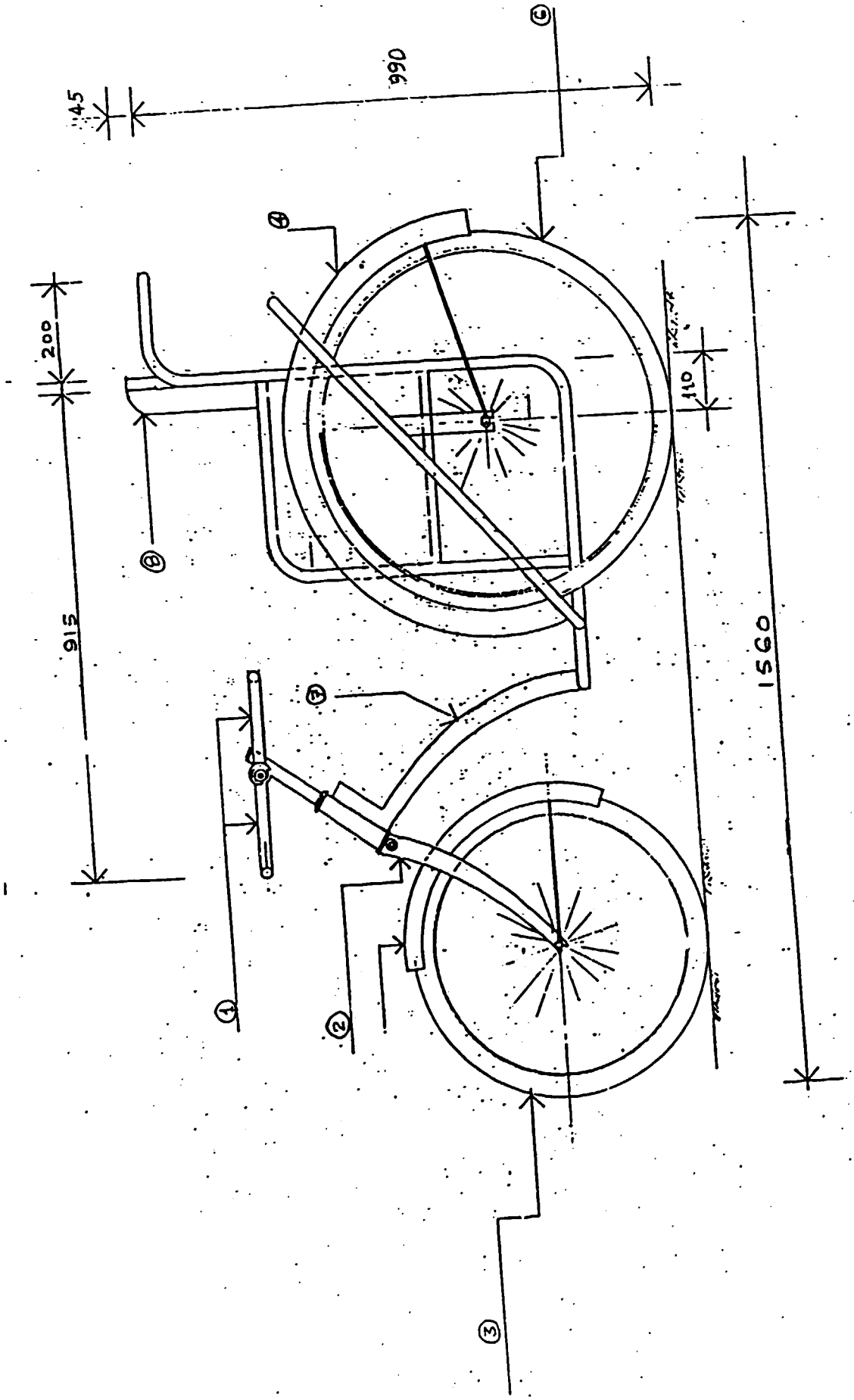
8 Tube bending machine (manual) if gas heating process is not available.

S:3 - TOOL KIT (TOOL BOX)

	ITEM	QUANTITY
1.	Ball pein hammer	1
2.	Chipping Hammer	1
3.	Wire brush	1
4.	Hand shield or helmet	1
5.	Steel rule (500mm)	1
6.	Tape measure (3m)	1
7	Trysquare	1
8.	Scriber	1
9.	Pair of dividers (midium size)	1
10.	Centre punch	1
11.	Hacksaw frame	1
12.	Screw spanner (small) 4" - 6"	1
13.	Screw spanner (8" - 12")	1
14.	Spirit level (wooden or metal) 500mm	1
15.	Set of drill bits (3-10mm)	1
16.	Hand vice (for holding jobs being drilled)	1
17.	Pair of pliers (flat nose)	1
18.	Side cut pliers	1
19.	Chisel (cross cut)	1
20.	Chisel (flat)	1
21.	Mullet	1
22.	Flat File (2nd cut) small or midium	1
23.	Round file (small or midium	1
24.	Half round file (small or midium	1
25.	Pair of Tongs (Round nose)	1
26.	Pair of Tongs (Flat nose)	1

STANDARD CYCLE PARTS

No.	STANDARD PARTS	QUANTITY
1.	Rear Rim (Complete with fittings)	2
2.	Front Rim with tube & tyre	1
3.	Rear tyres	2
4.	Rear tubes	2
5.	Chain wheel	1
6.	Chain	1
7.	Pedals	2
8.	Short pipe	1
9.	Free wheel	1
10.	B.B. Cell Complete (Engine)	1
11.	Fork	1
12.	Fork Fittings	1
13.	Rear Mudguards	2
14.	Front Mudguard	1
15.	Expander Bolt	1
16.	Cotta Pin	1
17.	Steel Balls for fork fittings	50
18.	Crank	1
19.	Steel Balls for B.B Cell	10
20.	Bell	1
21.	Hinges (1" and 1/4")	2
22.	Brass Chain (for carrier)	300mm
23.	Spring	1 No.


45
990
200
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1560
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6

MACHENARY MAINTENANCE TRAINING(Posho Mills)

ANNEXURE 7
(6 Pages)

TROUBLE SHOOTING CHECKING LIST

TROUBLE AREAS

DIFFICULT STARTING

CAUSES	REMEDIES	ACTION BY
(a) Overload trip not lifted (Lister)	Lift to give extra fuel for starting in cold weather.	Operator
(b) Unsuitable Lubricating oil (too heavy)	Dram Sump and refill with correct grade of oil.	Operator
(c) Unsteady fuel flow or incorrect grade of fuel	Drain system, and refill with correct fuel and prime.	Operator or Technician in complicated cases.
(d) No fuel in tank or chocked fuel filter.	Fill the tank, clean the filter element and prime the system.	Operator
(e) Air lock in the fuel system	Prime the system and make sure all pipe connections are tightened.	Operator
(f) Incorrect beginnirg of fuel delivery.	Adjust according to the recommended procedure.	Technician.
(g) Injector nozzle valve stuck open or worn out.	Clean or replace the nozzle, or injector complete.	Technician
(h) Incorrect valve clearance	Adjust according to recommended procedure.	Technician
(i) In cold weather, Lub oil becomes too viscous rendering the engine heavy to start.	On engines provided with a condensor (Peneri Engines) pour hot water in the condensor and preheat Lub oil (not on external fire before starting engine.	Operator or Technician.
(j) In sufficient compression in the cylinder as a result of worn and leaking valves, worn piston rings, pistons, and the cylinder liner.	Regrind the valves or replace valve and guide. Replace worn piston rings or replace Piston Assembly. If liner is worn arrange for the fitting new liner (sleeve).	Technician
(k) Sticking exhaust valve	Clean stem and the guide. Check the lubrication of the valve gear.	Technician
(l) Sticking ring	Decarbonize and check oil	Technician.

2. KNOCKING

CAUSES	REMEDIES	ACTION BY
(a) Valve, mostly exhaust, sticking in guide and touching the piston.	Clean stem and guide	Technician
(b) Worn out or stuck bearings	Check if the crankshaft is not worn and replace the shells.	Technician.
(c) Worn out gudgeon, pin bush or small end bearings	Renew the worn out parts	Technician
(d) Insufficient clearance between piston and cylinder head.	Adjust to the correct clearance by means of shims.	Technician.
(e) Flywheel coupling or pulley loose.	Check and tighten.	Operator or Technician.
(f) Too much crankshaft end float.	Renew the thrust washers	Technician
(g) Excessive carbon deposit on piston.	Decarbonize	Technician
3. SMOKY EXHAUST (BLACK SMOKE)		
Incomplete combustion of fuel due to:- (1) Faulty Injector (2) Chocked air filter; (3) Incorrect beginning of fuel injection. (4) Incorrect fuel or water contermination of fuel; (5) overload.	Check the injector nozzles, clean or replace. Drain the fuel tank thoroughly clean and replace.	Technician.
HEAVY BLUE SMOKE		
Due to lubricating oil passing through the piston rings as a result of stuck, worn or broken piston rings. May be worn cylinder liner.	Replace the new piston rings or cylinder liner.	Technician.
4. LOSS OF POWER		
(a) Causes of Loss of Power are similar to those resulting in difficult starting.	The corrective measures are the same.	Operator/ Technician.

5. OVER- HEATING

CAUSES	REMEDIES	ACTION BY
(a) Injection timing faulty	To be checked and corrected.	Technician
(b) Overload	Reduce load by checking the setting of overload stop.	Technician
(c) Lubricating oil or cooling water level too low.	Check and replenish	Operator
6.	ENGINE STOPS	
(a) Lack of fuel	Fill tank and prime system	Operator
(b) Air or water in fuel system	Drain off water and vent system	Operator.
(c) Chocked fuel filter or blocked nozzle.	Check and rectify	Technician.
(d) Overheating	As at para 5 above	Technician/ Operator
(e) Loss of compression	Check valves, piston rings and cylinder wear.	Technician.

ROUTINE MAINTENANCE OF WHEN THE ENGINE IS IN CONTINUOUS USE

DAILY

1. Check level of fuel oil - (Diesel)
2. Check level and condition of Lubricating oil.
3. Check cooling water level
4. Clean Air cleaner under very dusty conditions.

EVERY 100 HOURS - (2 weeks)

1. Clean Air cleaner under moderately dusty conditions
2. Check for fuel and lubricating oil leaks, tighten nuts and other fittings as necessary
3. Wipe Engine and Baseplate clean.

EVERY 250 HOURS - (1 Month)

1. Drain lubricating oil and refill with correct grade and type.
2. Check injector sprays and clean if necessary (There are 4 per injector)

EVERY 500 HOURS - (2 Months)

1. Decarbonise if engine shows loss of compression, or blow - by past the piston, but do not disturb otherwise.
2. Adjust valve tappet clearances
3. Wash engine down with paraffin or fuel oil.
4. Renew lubricating oil filter element.

EVERY 1500 HOURS - (6 Months)

1. Decarbonize
2. Clean Inlet manifold and Exhaust system
3. Examine fan blades and clean
4. Check free working of Governor Linkage
5. Drain and clean fuel tank
6. Renew fuel filter element.
7. Clean Injector Nozzles or replace by serviced ones.
8. Adjust Injector pressure settings
9. Check fuel Pump timing and balancing.

5000 HOURS

1. Check Big End and Main Bearings
2. Inspect camshaft bearings and tappets

   Renew valve springs.

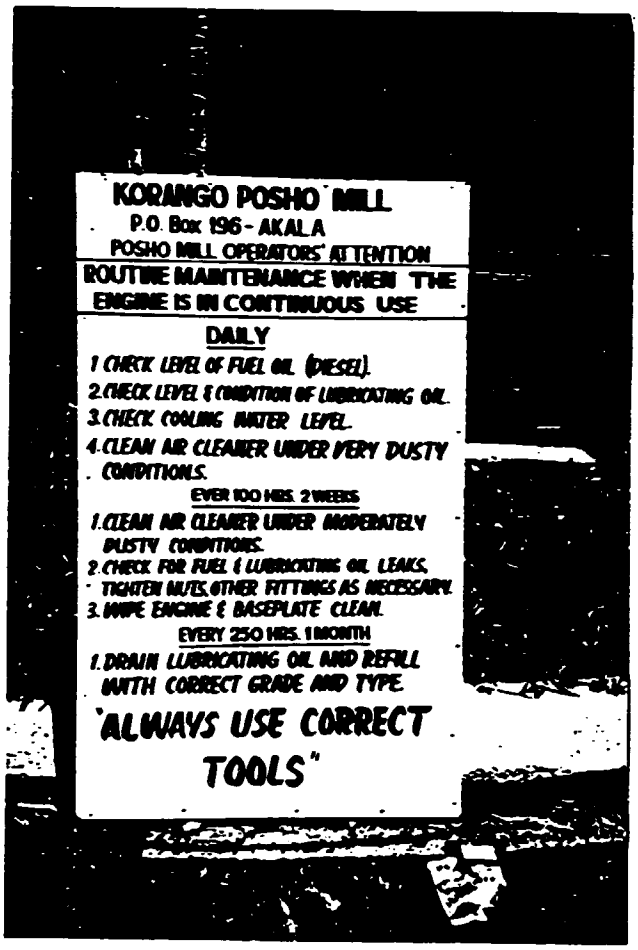
The above routine is given as a guide but operating conditions will decide the actual Hours worked before carrying out the Maintenance.

REQUISITE TOOLS & EQUIPMENTS

1. Thick and thin grinding paste.
2. Screw Driver
3. Pair of Pliers
4. Oil can
5. Double open ended spanner 8 x 10 and Ring Spanner of the same size
6. Double open ended spanner 12 x 14 - do -
7. - do - 14 x 17 - do -
8. - do - 17 x 19 - do -
9. - do - 22 x 24 - do -
10. Adjustable spanner -
11. Pipe wrench -
12. Feeler Gauge -
13. Grease Gun -

FOR LISTER POSHO MILLS

1. 7/16" x ½ A.F. Open ended and Ring spanners.
2. 9/16" x 5/8 A, F. - do -
3. 3/8" x 7/16 Whit - do -
4. 3/4" x 7/8" AF - do -
5. 7/16" x A.F. ½ Whit - do -
6. 9/16" x 5/6" Whit - do -


KORANGO POSHO MILL
P.O. Box 196 - AKALA
POSHO MILL OPERATORS' ATTENTION
ROUTINE MAINTENANCE WHEN THE ENGINE IS IN CONTINUOUS USE
DAILY
1. CHECK LEVEL OF FUEL OIL (DIESEL).
2. CHECK LEVEL & CONDITION OF LUBRICATING OIL.
3. CHECK COOLING WATER LEVEL.
4. CLEAN AIR CLEANER UNDER VERY DUSTY CONDITIONS.
EVERY 100 HRS. 2 WEEKS
1. CLEAN AIR CLEANER UNDER MODERATELY DUSTY CONDITIONS.
2. CHECK FOR FUEL & LUBRICATING OIL LEAKS. TIGHTEN NUTS, OTHER FITTINGS AS NECESSARY.
3. WIPE ENGINE & BASEPLATE CLEAN.
EVERY 250 HRS. 1 MONTH
1. DRAIN LUBRICATING OIL AND REFILL WITH CORRECT GRADE AND TYPE.
"ALWAYS USE CORRECT TOOLS"

ANNEXURE No. 8
(05 Pages)

KIE / UNIDO ENTREPRENEURSHIP DEVELOPMENT PROGRAMME 1990

S E M I N A R

FOR KIE PROMOTED WOMEN ENTREPRENEURS

23-2-90

P R O G R A M M E

8.15 a.m. - Participants assemble in Meeting Hall of Tom Mboya Labour College

SESSION I

8.30 - 10.00 - Conducted by KIE's Senior Project Officer Kisumu District, Mrs R. Kalui assisted by KIE's Centre Managers and Field Officers, Nyanza Region.

- Presentation of objectives of the Seminar.
- Self Introduction by participants.
- Participants form into groups and inter act with KIE officials and fellow participants.
- Discuss aspirations, common problems etc. and Representative of each group prepares brief summary of observations.

10.00-10.30 a.m. - T E A B R E A K

SESSION II

10.30a.m.-12.30p.m - Arrival of Managing Director, KIE, UNDP/UNIDO visitors.
- Introduction by Regional Manager, KIE
- Address by KIE Managing Director and Visitors.

12.30-2.00 p.m - L U N C H

.....1"./2

SESSION III

2.00p.m.-3.30p.m. - Sharing Management Experiences

- Remarks by Representative KIE promoted activities
- Womens Group Societies
- Shoe Making
- Fish Processing
- Tailoring
- Metal Fabrication
- Tyre Repairing
- Hair Saloon

3.30p.m.-4.00p.m - T E A B R E A K

SESSION IV

4.00p.m.-5.00p.m - O P E N H O U S E

Suggestions and Comments by Participants.

- Remarks of Group Representatives
- Adoption of Seminar Proposals.

5.00 - 5.30 p.m - Observations by visitors.

Closing of Seminar by Managing Director, KIE

6.00 - 7.00 p.m - Reception to participants and visitors at Tom Mboya Labour College Cafeteria by KIE/UNIDO.

KENYA INDUSTRIAL ESTATES LIMITED

TELEPHONE

TELEGRAM NAINDEST

BRANCH OFFICE:

YOUR REF.

VC/KMC.34/VOL.1/4

OUR REF.

5th February, 1990

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DATE

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Dear Madam,

KIE/UNIDO ENTREPRENEUR DEVELOPMENT PROGRAMME

WOMEN ENTREPRENEURS SEMINAR

23 - 2 - 1990

We are pleased to invite you to attend the above seminar which will be held at the Tom Mboya Labour College Kisumu.

Women are involved in K.I.E. promoted projects in Nyanza Region, in 3 broad categories.

a) Office Bearers of women groups/societies

b) Owners/Co-owners of Projects and

c) Managers of Projects

The proposed seminar will be an occasion for all concerned to gather as a group to discuss overall objectives of the seminar which are proposed as follows:-

a) To enable KIE's women entrepreneurs to gain mutual appreciation and understanding of their activities and and performance.

b) To motivate and encourage KIE's women entrepreneurs to achieve improved results in their projects.

c) To provide an opportunity for KIE's women entrepreneurs themselves define their problems, suggest solutions and have them discussed.

The Managing Director of KIE and representatives of UNDP/UNIDO are also invited to address the seminar. You will thus have the opportunity to know the increased attention that is given by National and International Organisations for Women's Development.

We wish that you fully participate in the discussions and make suggestions on the effective support needed to develop your projects and improve performance.

Please note the following:-

22nd February - Arrival of participants at 5.00 p.m. at the Tom Mboya Labour College

23rd February - SEMINAR

24th February - Departure of participants after breakfast in the morning.

You will be accommodated at the Tom Mboya Labour College. Cost of your accommodation from 22nd evening to 24th morning and all meals will be paid by UNIDO. Your travel to Kisumu and return will have to be met by you.

Please complete the attached form and return it to at the earliest.

We look forward to your participation.

Yours faithfully.

V. Cumarasamy
UNIDO Project Manager-Kisumu
For: Regional Manager-Kisumu
KENYA INDUSTRIAL ESTATES LTD.

/mcc