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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

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AND

ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

RABAT, MOROCCO

PROJECT PROFILE

ON

OVERHEAD LINE ACCESSORIES

FINAL REPORT



DEVELOPMENT CONSULTANTS INTERNATIONAL LIMITED

MANAGEMENT CONSULTANCY DIVISION

24-B PARK STREET, CALCUTTA 700 016, INDIA

**PROJECT PROFILE
ON
OVERHEAD LINE ACCESSORIES**

MARCH 1996

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DCIL-105/AC-5/1102

March 6, 1996

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Attn : Mr V. Kolonkov

Project Profile on Overhead Line Accessories

Dear Sirs :

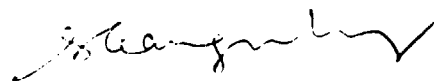
We take pleasure in submitting to you twenty (20) copies of our Final Report on the above subject.

We trust that you will find the present report useful and responsive to your requirement.

We look forward to further association with your organisation in future.

Thanking you,

Very truly yours :
DEVELOPMENT CONSULTANTS
INTERNATIONAL LIMITED



Siddhartha Ganguly
Project Coordinator

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LIST OF ABBREVIATIONS

AAC	All Aluminium Conductor
ACSR	Aluminium Conductor Steel Reinforced
ASTM	American Society for Testing and Materials
AC	Alternating Current
BS	British Standards
BHN	Brinell Hardness Number
CC	Cubic Centimetre
CIF	Cost, Insurance and Freight
DC	Director Current
DPR	Detailed Project Report
EOT	Electric Overhead Travelling
FOB	Free on Board
GVW	Gross Vehicle Weight
HV	High Voltage
Hz	Hertz
IRR	Internal Rate of Return
LV	Low Voltage
MCC	Machine Control Centre
MT	Metric Tonne
MV	Medium Voltage
O/H	Overhead
p.a.	Per Annum
RCC	Reinforced Concrete Construction
RPM	Revolutions Per Minute
SWG	Standard Wire Gauge
SWL	Safe Working Load
T&D	Transmission and Distribution
TPA	Tonnes per annum
TR	Tonnes Rating
UAE	United Arab Emirates
UHV	Ultra High Voltage

SECTION - 1
INTRODUCTION

INTRGDUCTION

The Sixth Arab Industrial Development Conference held in Damascus in October 1984, stressed on the importance of setting up facilities in the Arab region for manufacture of products used in electricity generation, transmission and distribution. Subsequently, the Arab Industrial Development & Mining Organization (AIDMO), prepared a Sectoral Report on the status of electricity generation, growth prospects in the region and requirement of equipment/facilities thereof. The study covered 21 Arab countries for the period 1986-2010 AD.

Based on the findings of the Sectoral study, the AIDMO in consultation with United Nations Industrial Development Organization (UNIDO), shortlisted 8 products for which it wanted to get project profiles prepared. One of the designated products is Overhead Line Accessories. The objective of the project profile is to provide sufficient information so that prospective promoters and sponsors find themselves in a position to evaluate the project.

The Scope of Work for this Project Profile includes the following :

- o Description, special characteristics, features and uses of the product
- o Identification of major end-user industries
- o Assessment of present production capacity
- o Identification of demand-supply gap and evaluation of the possibility of entering the market

- o Description of basic manufacturing process
- o Process flow chart
- o Brief specifications of plant and machinery and their indicative prices
- o Estimated requirements of raw materials, their sources and prices
- o Estimated requirements of utilities such as power, water, compressed air, fuel oil, etc.
- o Estimated requirement of manpower
- o Estimated requirement of space, and plant layout
- o Plant location
- o Project cost estimate
- o Project financial analysis and evaluation
- o Project implementation schedule

This study is confined to the following 13 countries -

Algeria	Bahrain
Egypt	Iraq
Jordan	Kuwait
Libya	Morocco
Saudi Arabia	Sudan
Syria	Tunisia
U.A.E.	

A separate market survey, according to the AIDMO, was not required to be carried out prior to preparing this project profile, since the information and projections contained in

The Sectoral study conducted by them was indicated to be adequate for the purpose. Therefore, the Section on 'Market Analysis' is based entirely on the Sectoral study carried out by the AIDMO.

The contents of this Report have been organised in a manner as to present the reader with a logical sequence of analysis and findings.

Salient features of the project have been summarised in the following Section. The Section presented thereafter describes the product with a view to familiarise the reader with its features, characteristics and uses. The Section on 'Market Analysis' provides demand projections. Plant capacities and recommended locations for establishing the proposed manufacturing facilities are discussed in the next Section.

Manufacturing process is dealt with in a separate Section, titled 'Manufacturing Process'. This is followed by a Section on 'Plant and Equipment'. Estimates of raw materials and other inputs, requirement of utilities, and estimates of space and layout are presented in separate Sections. These are followed by a Section on estimated requirement of manpower and the recommended organisation structure.

SECTION - 2
SUMMARY OF FINDINGS

SUMMARY OF FINDINGS

It is recommended that two plants, each with a capacity of 12,000 tonnes per annum (TPA), be set up to manufacture overhead line accessories within the designated region. These plants would, by increasing the number of shifts from two to three, be able to cater to the demand for accessories right up to 2010 AD.

Further, it is recommended that these plants be set up in Tunisia and Jordan. The plant in Tunisia will cater to the Afro-Arabian market, viz., Algeria, Egypt, Libya, Morocco, Sudan and Tunisia while the plant in Jordan will serve the Middle-East region, viz., Bahrain, Iraq, Jordan, Kuwait, Saudi Arabia, Syria and the UAE.

Our study shows that with the increase in power consumption, more overhead transmission lines would be laid, justifying the establishment of these plants.

Summary of basic parameters and significant features of the Project is presented in Exhibit-1.

JOB NO. : DCIL-105

EXHIBIT : 1

**UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION**

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

SUMMARY OF FINDINGS

Sl. No.	Particulars	Plants	
		1	2
1.	Location	Jordan	Tunisia
2.	Plant Capacity (TPA)	12,000	12,000
3.	Area Requirement (Square Metres)	57,000	57,000
4.	Manpower Requirement (Numbers)	1,148	1,148
5.	Implementation Period (Months)	36	36
6.	Project Cost (Million \$)	44.43	41.82
7.	Break-Even Point (%)	72.20	63.00
8.	IRR (%)	20.10	22.80

SECTION - 3
PRODUCT ANALYSIS

PRODUCT ANALYSIS

Overhead line accessories are important components of overhead transmission and distribution systems. They are required for the following purposes :

- o To anchor towers
- o To join the conductors at the supply take-off and the mid-span points
- o To support conductors on insulators
- o To mount insulators on towers and to protect them from flashovers
- o To maintain suitable distance between sub-conductors of a bundle conductor
- o To reduce vibrations in conductors

In order to carry out the above functions, various types of overhead line accessories are available. These include :

- o Suspension clamps
- o Strain clamps
- o Dead-end clamps
- o Vibration dampers
- o Spacers
- o Joints
- o Guys and anchors
- o Insulator fittings, exclusive of their main body (porcelain part) and protective and grading devices
- o Corona shields
- o Hardware

All these accessories are designed to withstand mechanical, thermal and electrical stresses. In general, their design allows for a safety factor of 2 to 2.5 times the ultimate tensile strength of the material used. The accessories are given a smooth surface finish without sharp edges or corners, to reduce the Corona effect. Accessories like conductor clamps are designed to have a large surface area so that heat generated in the clamped part of the conductor is dissipated faster.

Accessories are generally made up of aluminium alloy die castings. Aluminium, which is a good electrical and thermal conductor, also possesses high strength-to-weight ratio. Further, it is non-corrosive and non-magnetic. Accessories made of magnetic materials, if fitted with the current carrying parts, generate heat due to hysteresis and eddy currents. This causes considerable loss of electric power in the transmission and distribution system. Therefore, use of magnetic materials is generally avoided. Hardwares made of steel or malleable iron castings are hot-dip galvanized. Although eddy currents can also be generated in all electrical conducting materials resulting in heat losses, accessories made of aluminium castings are generally preferred. This is because of their light weight which is utilised for their larger heat dissipating area. Ultimately a compromise is made between the size of the accessory and the heat loss.

SUSPENSION CLAMPS

Suspension clamps support the weight of conductors and prevent longitudinal movements that may arise due to unequal tensions in adjacent spans. Even if the conductor shifts, suspension clamps are expected to hold the conductor in place, without letting it slip. However, it is difficult to

design a light flexible clamp that will not allow any slip under such a contingency. Usually, clamps are designed so as to hold the conductor under normal conditions; allowing it to slip at 150% of the maximum tension, in case of a break. Such design results in lighter tower structures due to substantially reduced longitudinal design loads.

The clamps are also designed to eliminate the effect of excessive compressive loads. Besides, these are designed to be Corona free.

Exhibit-2 gives a schematic outline of a suspension clamp.

STRAIN CLAMPS

Strain clamps are used to clamp conductors on strain towers, or on towers having large angle of transmission line deviation. They may be of two types - single-bolt and multi-bolt. Multi-bolt clamps are generally used on a HV/UHV transmission line. Diagram of a multi-bolt type strain clamp is given in Exhibit-3.

DEAD-END CLAMPS

Dead-end clamps are used for clamping one end of a conductor on dead-end towers. These may be of the bolt or the compression type. Bolted clamps are similar to strain clamps. Compression type clamps consist of a steel sleeve with clevis or eye-type end. The steel sleeve is covered with an aluminium sleeve along its length. While fitting the dead-end assembly with the conductor, an aluminium sleeve is slipped on the conductor. After the steel sleeve is fitted over the core of the conductor, the aluminium sleeve is

slipped back till it touches the shoulder of the steel sleeve. The electrical connector tongue on the aluminium body is aligned with the clevis or eye of the steel core dead-end as required. Thereafter, the aluminium body is filled with non-oxidising compounds and compressed. Similar pressed-on dead-ends are available for copper welded and other conductors.

A compression type dead-end clamp is shown in Exhibit-4. These clamps are used for larger Aluminium Conductor Steel Reinforced (ACSR).

VIBRATION DAMPERS

Vibration dampers are designed to effectively control high frequency aeolian vibrations of conductors by the simplest possible means. A vibration damper for a 400 KV line is shown in Exhibit-5. These dampers, metallic in construction, provide a satisfactory grip on the conductor without clamping it in any way. They employ a single-bolt fixing arrangement. The dampers are shaped in a manner to minimise Corona and radio interference. Weights employed in dampers are made of galvanised cast iron. The bolt and lock washers are of galvanised mild steel, whereas the messenger wire is of galvanised high tensile steel. The clamp protective sleeveings, end fittings and tapered sleeves are all made of high purity aluminium.

SPACERS

Spacers are fitted at specified intervals on overhead transmission lines having more than one sub-conductor per phase. They maintain the specified spacing between the conductors of that phase under normal operating conditions.

and prevent horizontal twin bundle conductors from coming into contact with each other.

Some types of spacers used in transmission lines are described in the following paragraphs.

Rigid Spacers

Rigid spacers consist of a central steel bar with clamps at both the ends. This type of spacer prevents movement of the conductor. Rigid spacers can cause severe damage to the conductor. Hence, they are no longer used, except in case of jumpers.

Armour Grip Spacers

This type of spacer is shown in Figure 1 of Exhibit-6. Though composed of rigid components, clamp-conductor interface is made flexible by employing an elastomeric lining on the clamp. This spacer consists of an aluminium alloy tube frame whose ends are cushioned with a thick coating of neoprene, moulded integrally. The spacer is fastened to transmission wires using twisted (preformed) aluminium alloy retaining rods. This arrangement not only eliminates use of bolts and screws but also distributes the load over the conductor, thereby minimising stress concentration. Armour grip spacers can be installed manually.

Neoprene Cushioned Pin-locked Spacers

Neoprene cushioned pin-locked spacer consists of an aluminium alloy body with a pair of clamps at both ends. The clamps are rubber lined. A locking pin is used to avoid the use of nuts and bolts. One of the two halves of the clamp is connected to the main body while the other half is hinged to

it. The rubber lining maintains gentle, yet firm grip and permits longitudinal and angular movements. This type of spacer is shown in Figure 2 of Exhibit-6.

Ring Spacers

In Ring spacers, shown in Figure 3 of Exhibit-6, the connecting element is a flexible ring made of a stranded, high tensile, galvanised steel wire. The clamps made from aluminium alloys are permanently mould casted on the steel wire ring.

Spring Spacers

Spring spacer consists of a spring made of stainless steel as the central member, with aluminium alloy clamps at both ends. Clamps may have one bolt or two bolt ends. Clamp springs may be of the closed or open type. Such a spacer collapses under fault conditions, resulting in less stress on the conductor. It restores itself to the initial spacing after the fault is cleared. The spring used should be of good quality and have enough strength to ensure that it does not lose its flexibility due to various stresses induced by wind and other loads. Figure 4 of Exhibit-6 shows a typical spring spacer.

Elastomeric Insert Spacers

This type of spacer is composed of rigid components, with flexibility introduced in the joints between components. The joints may contain springs or elastomeric inserts. In this type of spacer, the conductors are held by single-bolt cantilever clamps. The clamps are joined to the central member by rubber bushes which facilitate relative movement.

of the conductor in the longitudinal, vertical and angular directions without damage. The rubber bush should, however, be able to withstand the effect of atmospheric ozone, corrosion, high and low temperature, and wind induced oscillations.

SPACER DAMPERS

Spacer dampers are used to maintain the geometry of bundle conductors. They also damp out aeolian vibrations and sub-span oscillations.

Twin spacer dampers are used to maintain desired nominal separation between sub-conductors. A typical twin spacer damper is shown in Exhibit-7. The clamps are designed in a manner to ensure adequate grip on the conductor.

In addition to fulfilling basic functions of spacers, spacer dampers have significant articulation, flexibility and damping capabilities in the transverse plane of the bundle to control cyclic motions of conductors. The bundle of rubber bushes provided in the damper act as pivots, connecting each conductor via a rigid arm to the rigid centre frame. There is a positive mechanical interlock between the inner metal sleeves of the bush and the central frame.

The loads imposed by conductors under short circuit conditions generate the most severe forces on the spacer dampers. The unit is designed to withstand these loads without impairing its capability.

The principal members of a spacer damper are made up of corrosion resistant aluminium alloy. Ferrous components in the damper are hot-dip galvanised before assembly.

JOINTS

There are two types of joints, used in overhead transmission lines, namely, twisting joints and compression joints. Schematic diagram of these two types of joints is shown in Exhibit-8.

Twisting Joints

Twisting joints consist of seamless copper or aluminium tubing of oval cross-section, into which the conductors are pushed from opposite ends. The tube is then twisted to give it the required number of turns, by special tools. Each joint covers a specific range of conductors. A twisting joint requires one tube for AAC, two tubes for ACSR and three tubes for high strength ACSR. When used correctly, twisting joints develop as much as 90% the ultimate tensile strength of the conductor, and satisfactory electrical efficiencies. Twisting joint wrenches and dies are required for fixing the twisting joint tube with the conductor.

Compression Joints

Compression joints are primarily used for ACSRs. This type of joint consists of two parts, a steel tube and an aluminium tube. The jointing method followed is briefly described below.

The aluminium strands at each end of ACSR are cut carefully back without damaging the steel core. The length of the cut is half an inch more than one half the length of the steel sleeve. This is done to ensure that the elongation of the steel sleeve, on compression, will not interfere with the free lay of the aluminium strands. The steel sleeve is put

in place and compressed, working outwards from the centre. The aluminium sleeve is next slipped into place and filled with a non-oxidizing compound. Filler holes are then plugged, and the sleeve is compressed by working outwards from the center. The middle section of the aluminium sleeve over the steel sleeve is not compressed.

GUYS

Guy wires are used for supporting tower structures. Most commonly used guy wires are double galvanised stranded steel wires of 10 mm size.

ANCHORS

Steel anchors set in the ground with protective coatings are best suited for tangent and small angle towers. The most satisfactory type of steel anchor is of the pyramidal or square type. These types of anchors, shown in Exhibit-9, resist shear and bending stress satisfactorily.

INSULATOR FITTINGS

Insulator fittings consist of hardware, and tension and suspension strings. The following string assemblies are shown in Exhibits 10 through 17 respectively.

- o Tangent, single conductor, single string suspension
- o Tangent, double conductor, single vee string suspension
- o Angle, double conductor, single string suspension
- o Angle, double conductor, single vee string suspension

- o Dead-end, single conductor, dual string suspension
- o Jumper, double conductor, single string suspension
- o Jumper, tripple conductor, triangular, single string suspension
- o Angle, double conductor, horizontal, single vee string suspension

PROTECTIVE AND GRADING DEVICES

Damage to insulators from heavy arcs causes serious maintenance problems. Some of the devices that are used to prevent damage to the insulator are described below.

Arcing Horns

Arcing horns are used to reduce flashover voltage or to increase the number of insulators in one string. Arcing horns are attached at the top and bottom of the insulator. They have a large spread, both at the top of the insulator and at the clamp. On being subjected to the lightning impulse, the arc tends to cascade the string. For arcing horns to be effective, they should have a large spread and the distance between the horns should be considerably less than the length of the insulator string.

Arcing horns are made from mild steel flats which are hot-dip galvanised.

Arcing Rings

The main function of an arcing ring or grading shield is to improve the voltage distribution over the insulator string. Efficient rings are rather large in diameter. It should be

ensured that the clearance from the structure and the spacing between rings are adequate.

Protective Tubes

The protective tube prevents insulator flashovers when lightning strikes, by providing the current a path to ground. It is designed to have an appreciably lower impulse spark-over voltage than the line insulation.

CORONA SHIELDS

Corona shields are used on the energised end of dead-end hardware assemblies to relieve electrical stresses on the line and insulators. They also suppress Resilient Impulse Voltages (RIV) levels and Corona formation on the hardware. These are generally fabricated from aluminium alloy tubing of Grade 6063-T4. The finish is smooth and free from fins, burrs, scratches and surface roughness. This allows for Corona-free operation. The diameter of tubing is dependent on the operating voltage level. Two types of Corona shields are shown in Exhibit-18.

ARMOUR RODS

Armour rods are generally used on ACSR lines as a protection against fatigue of the aluminium strands caused due to vibrations. Armour rods consist of a bundle of aluminium rods which are larger in diameter than the strands of the conductor. These are laid parallel to the length of the conductor and are arranged to form a complete covering. They are spirally twisted by a tool to lie approximately parallel to the lay of the strands in the conductor, and are clamped in place at each end. The suspension clamp is attached at the centre with the armour extending 2 ft to 3 ft on each

side. The bending stresses caused by vibration are reduced by the increased diameter and area of metal, and distributed over a larger section of the conductor.

For fitting armour rods on the conductor, special purpose tools like wrenches, dies, ferrules and ferrule press dies are required.

HARDWARE

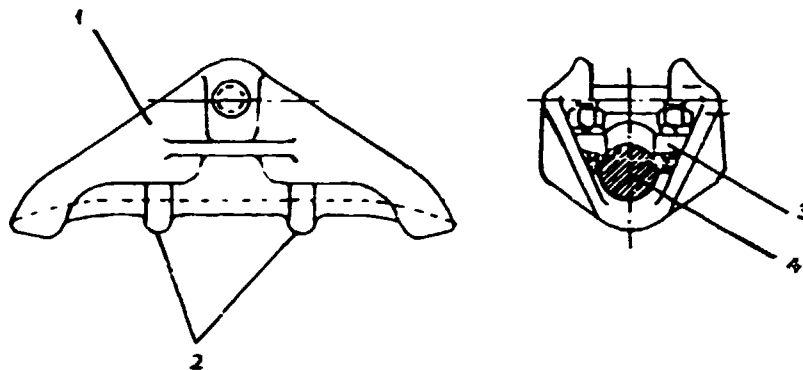
Ball hook, ball clevis, socket clevis, clevis eye, socket eye, yoke plate, cross arm strap, anchor shackle and link chain are some of the hardware used in overhead lines. The types and sizes of these hardware are standardised. These are generally forged from mild steel or high strength steel and hot-dip galvanised. These have smooth surface which is free from sharp corners and bends, so as to minimise Corona effect.

JOB NO. DCIL-105

EXHIBIT : 2

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION
PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

SUSPENSION CLAMP



LEGEND

1. Body
2. Keeper bolt
3. Cotter pin
4. Conductor

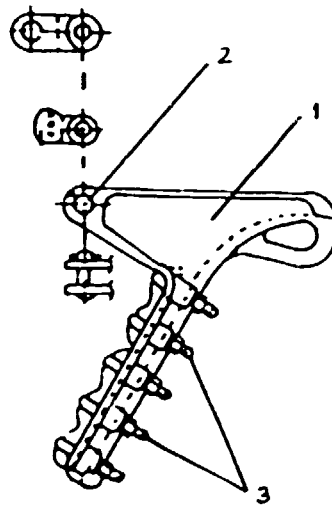
JOB NO. DCIL-105

EXHIBIT : 3

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

MULTI-BOLT TYPE STRAIN CLAMP



LEGEND

- 1. Body
- 2. Cotter pin
- 3. Bolts

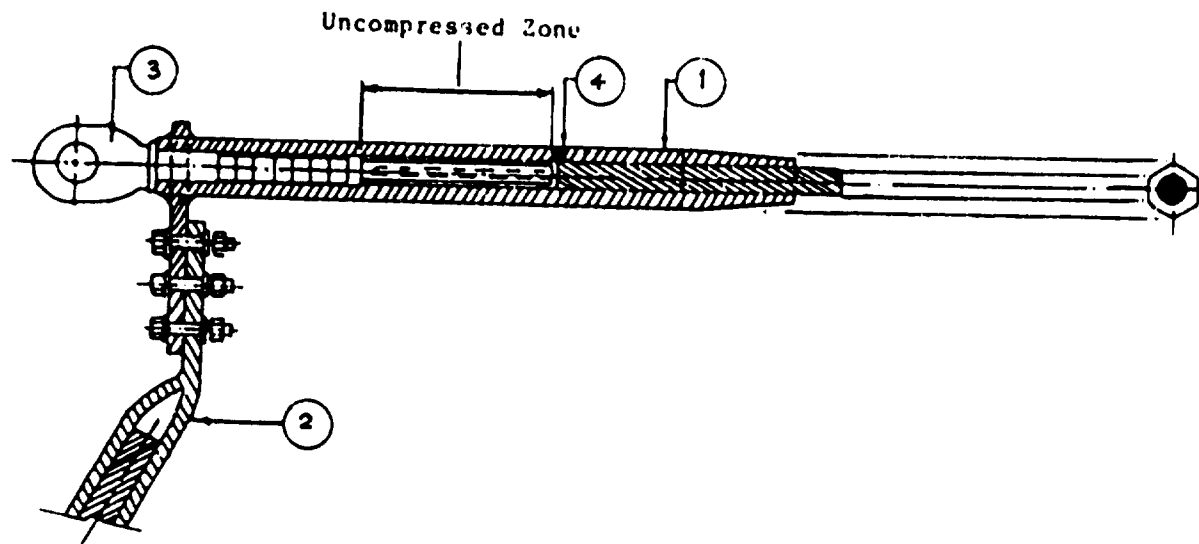
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EXHIBIT : 4

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AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

COMPRESSION-TYPE DEAD-END CLAMP



LEGEND

- | | |
|-----------------------|------------------------------|
| 1. Aluminium dead-end | 2. Aluminium jumper terminal |
| 3. Steel dead-end | 4. Aluminium filler plug |

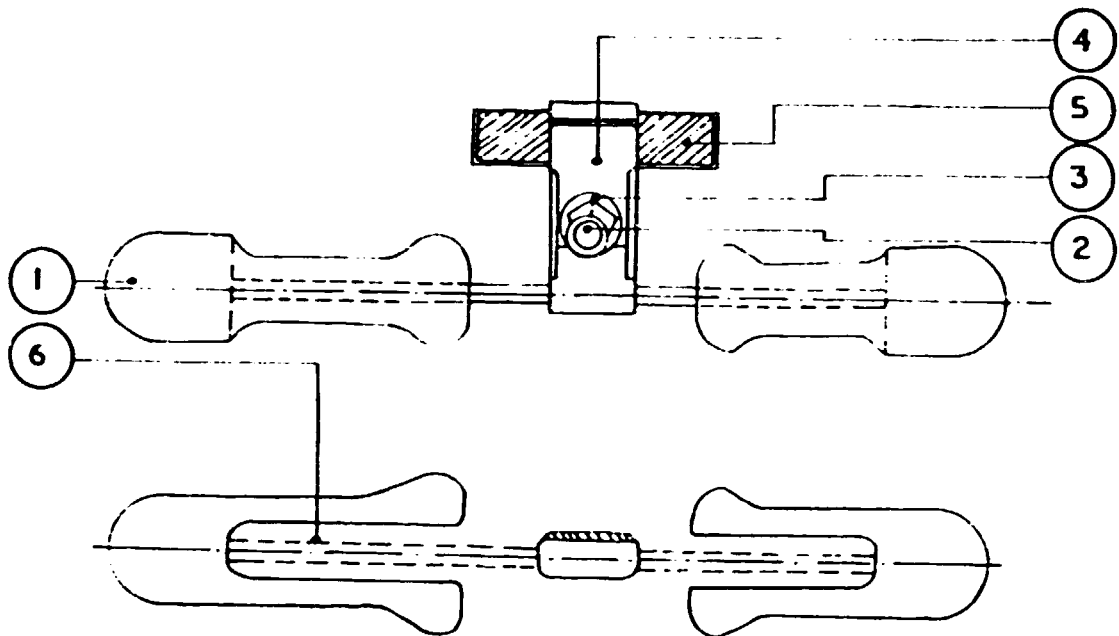
JOB NO. : UCIL-105

EXHIBIT : 5

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

VIBRATION DAMPER FOR 400 KV LINE



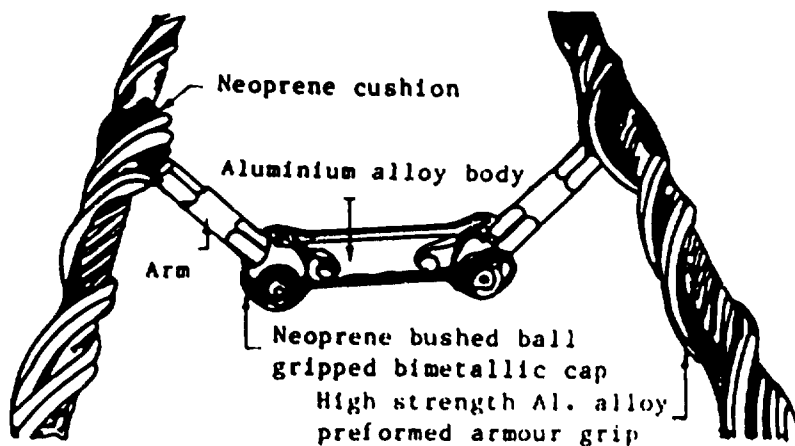
LEGEND

- | | |
|----------------|------------------------------|
| 1. Weight | 4. Clamp protective sleeving |
| 2. Bolt | 5. End seal |
| 3. Lock washer | 6. Conductor |

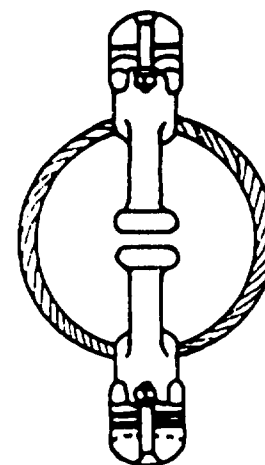
UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

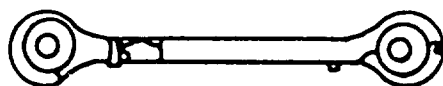
DIFFERENT TYPES OF SPACERS



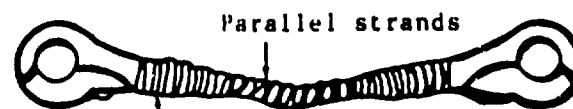
Armour Grip Type Spacer
Fig - 1



Ring Type Spacer
Fig - 3



Neoprene Cushioned
Pin-Locked Spacer
Fig - 2



Parallel strands
Helical spring
Spring Type Spacer
Fig - 4

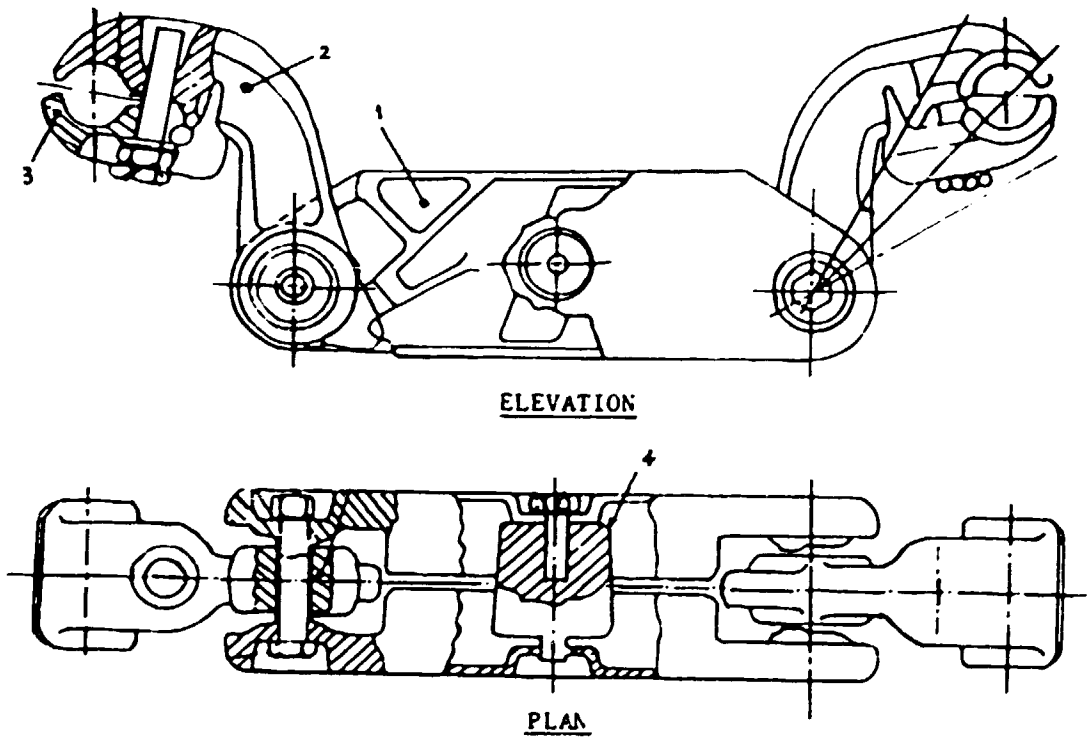
JOB NO. : DCIL-105

EXHIBIT : 7

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

TYPICAL TWIN SPACER DAMPER

LEGEND

- | | |
|-----------------|--------------|
| 1. Centre frame | 2. Clamp arm |
| 3. Clamp cap | 4. Weight |

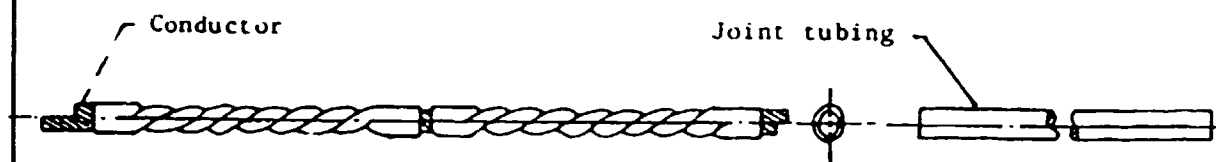
JOB NO. : DCIL-105

EXHIBIT : 8

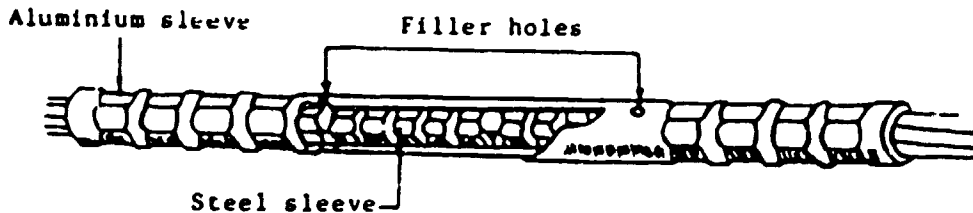
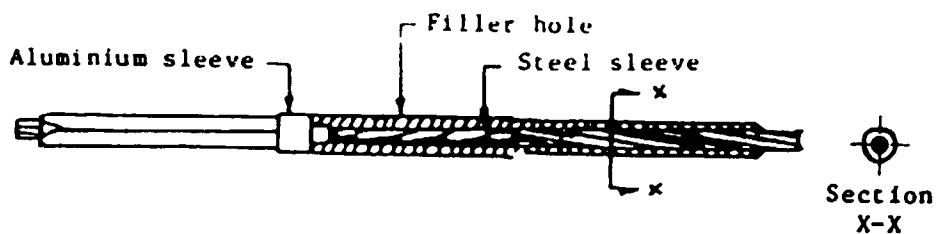
UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

TYPICAL JOINTS USED IN O/H LINES



TWISTING JOINT



TUBULAR TYPE COMPRESSION JOINT

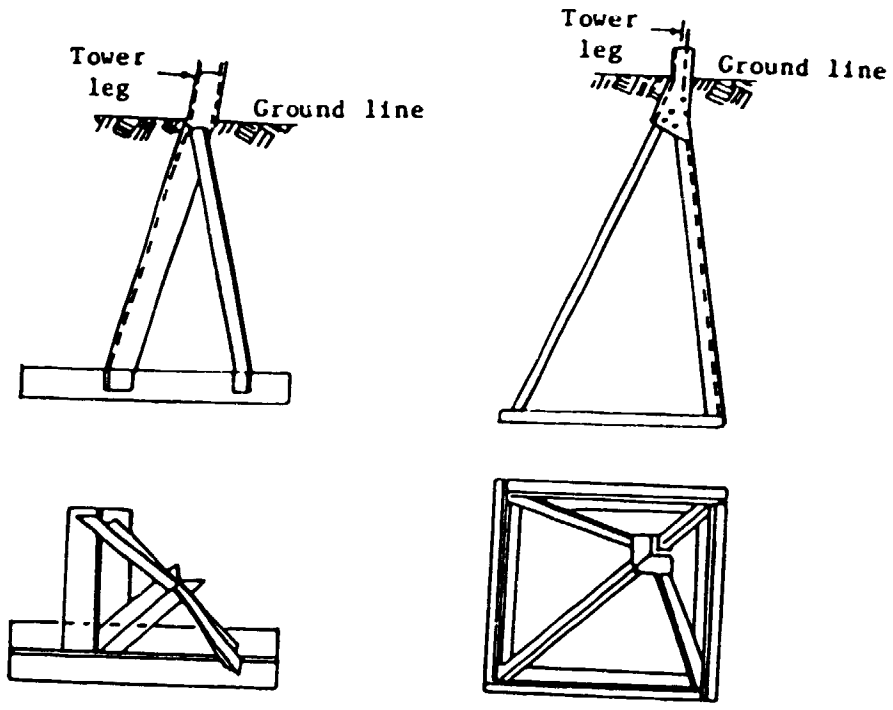
JOB NO. : DCIL-105

EXHIBIT : 9

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

TYPES OF ANCHORS



Steel Anchor with Triangular
Grillage

Steel Anchor with Square
Grillage

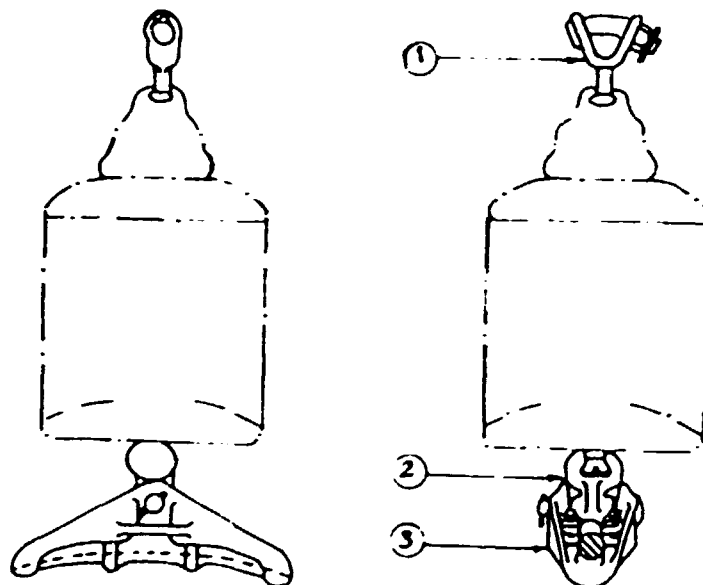
JOB NO. : DCIL-105

EXHIBIT : 10

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

TANGENT, SINGLE CONDUCTOR, SINGLE STRING SUSPENSION



LEGEND

1. Y-Clevis ball
2. Socket eye
3. Corona free suspension clamp

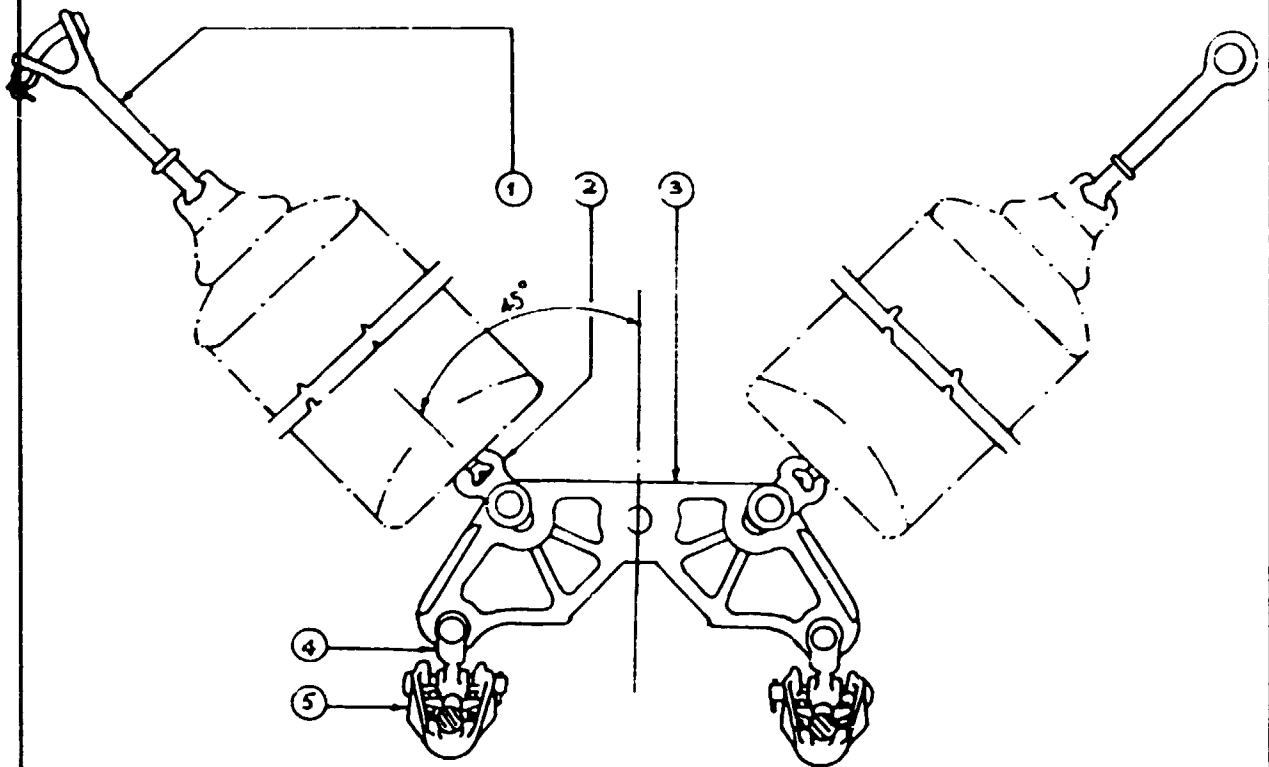
JOB NO. : DCIL-105

EXHIBIT : 11

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

TANGENT, DOUBLE CONDUCTOR, SINGLE VEE STRING SUSPENSION



LEGEND

1. Y-Clevis ball, hot line
2. Socket Y-clevis
3. Suspension yoke
4. 90° Y-Clevis eye
5. Corona free suspension clamp

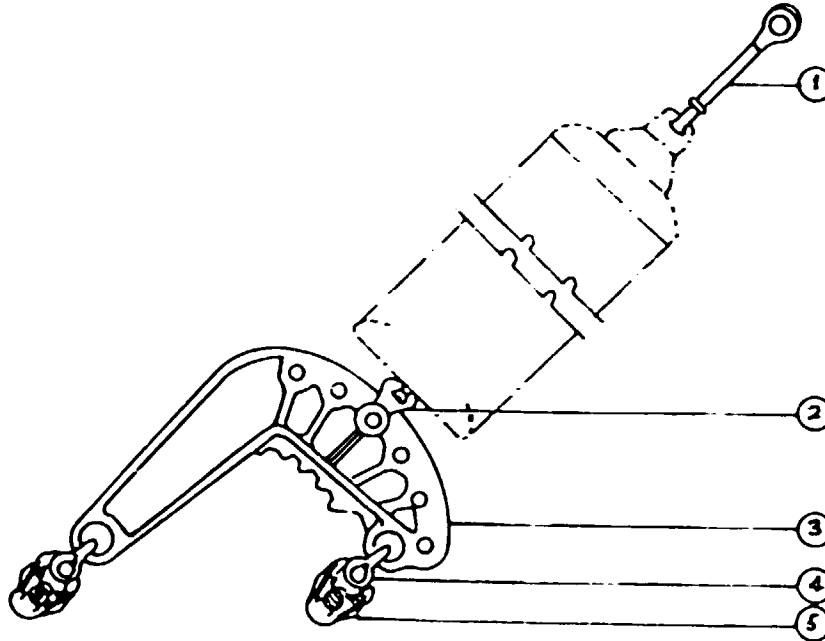
JOB NO. : DCIL-105

EXHIBIT : 12

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

ANGLE, DOUBLE CONDUCTOR, SINGLE STRING SUSPENSION



LEGEND

1. Y-Clevis ball, hot line
2. Socket Y-clevis
3. Yoke - Variable angle
4. Universal shackle
5. Corona free suspension clamp

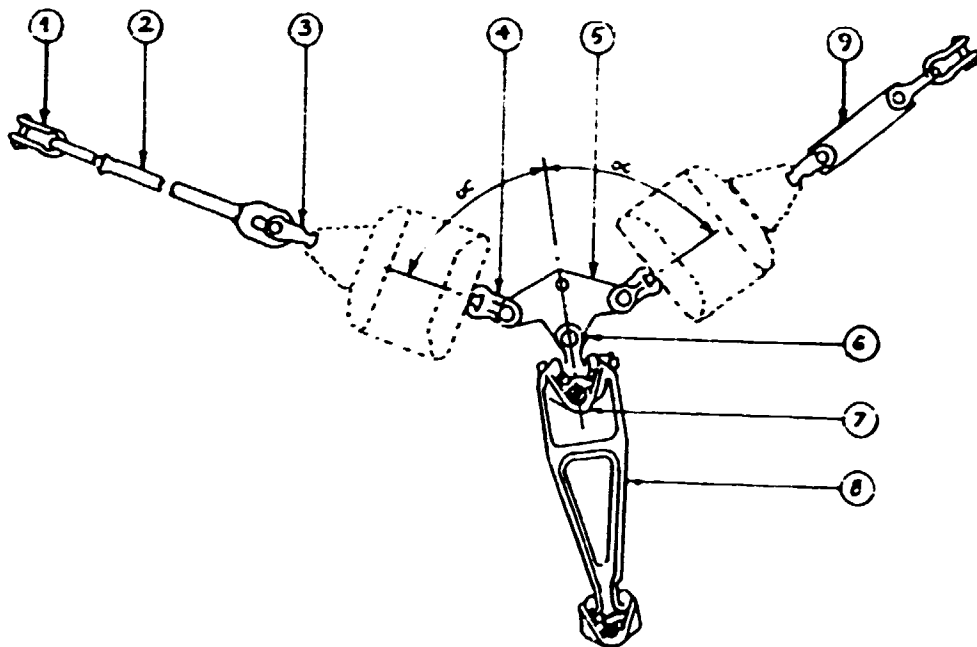
JOB NO. : DCIL-105

EXHIBIT : 13

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

ANGLE, DOUBLE CONDUCTOR, SINGLE VEE STRING SUSPENSION



LEGEND

- | | |
|---|---------------------------------|
| 1. Anchor shackle | 6. 90°- Y - Clevis eye |
| 2. 90°- Oval eye/oval eye link | 7. Corona free suspension clamp |
| 3. Clevis ball | 8. Vertical bundle yoke |
| 4. Socket - Y - Clevis with spherical nut | 9. Extension link |
| 5. Insulator yoke | |

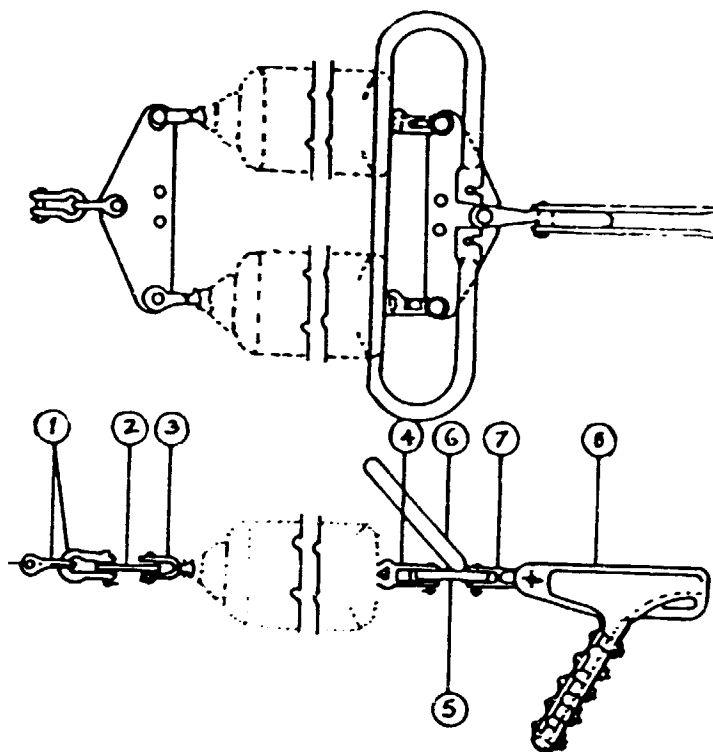
JOB NO. : DCIL-105

EXHIBIT : 14

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

DEAD-END, SINGLE CONDUCTOR, DUAL STRING SUSPENSION



LEGEND

- | | |
|------------------------|-------------------------|
| 1. Anchor shackle | 5. Line end yoke |
| 2. Insulator yoke | 6. Corona shield |
| 3. Clevis ball | 7. 90° Clevis eye, long |
| 4. Socket clevis, long | 8. Strain clamp |

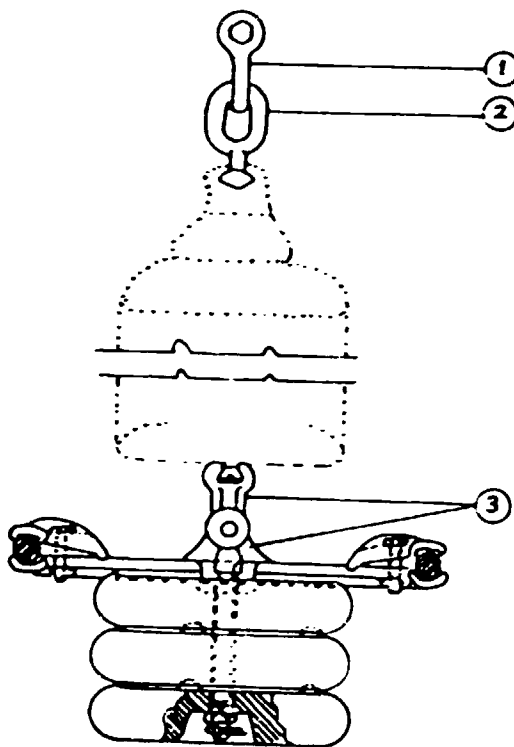
JOB NO. : DCIL-105

EXHIBIT : 15

UNITED NATIONS INDUSTRIAL, DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL, DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

JUMPER, DOUBLE CONDUCTOR, SINGLE STRING SUSPENSION



LEGEND

1. Anchor shackle
2. Oval eye ball
3. Jumper yoke

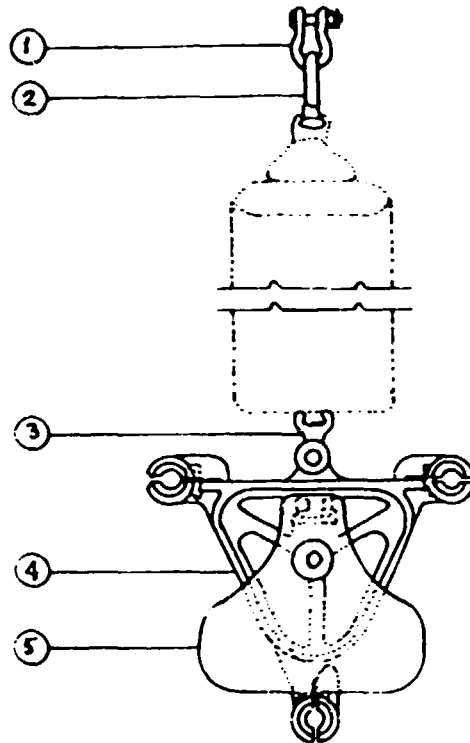
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EXHIBIT : 16

UNITED NATIONS INDUSTRIAL, DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL, DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

JUMPER, TRIPLE CONDUCTOR, TRIANGULAR, SINGLE STRING SUSPENSION



LEGEND

1. Anchor shackle
2. Oval eye bolt
3. Socket clevis
4. Clamp yoke
5. 300 lb. weight assy.

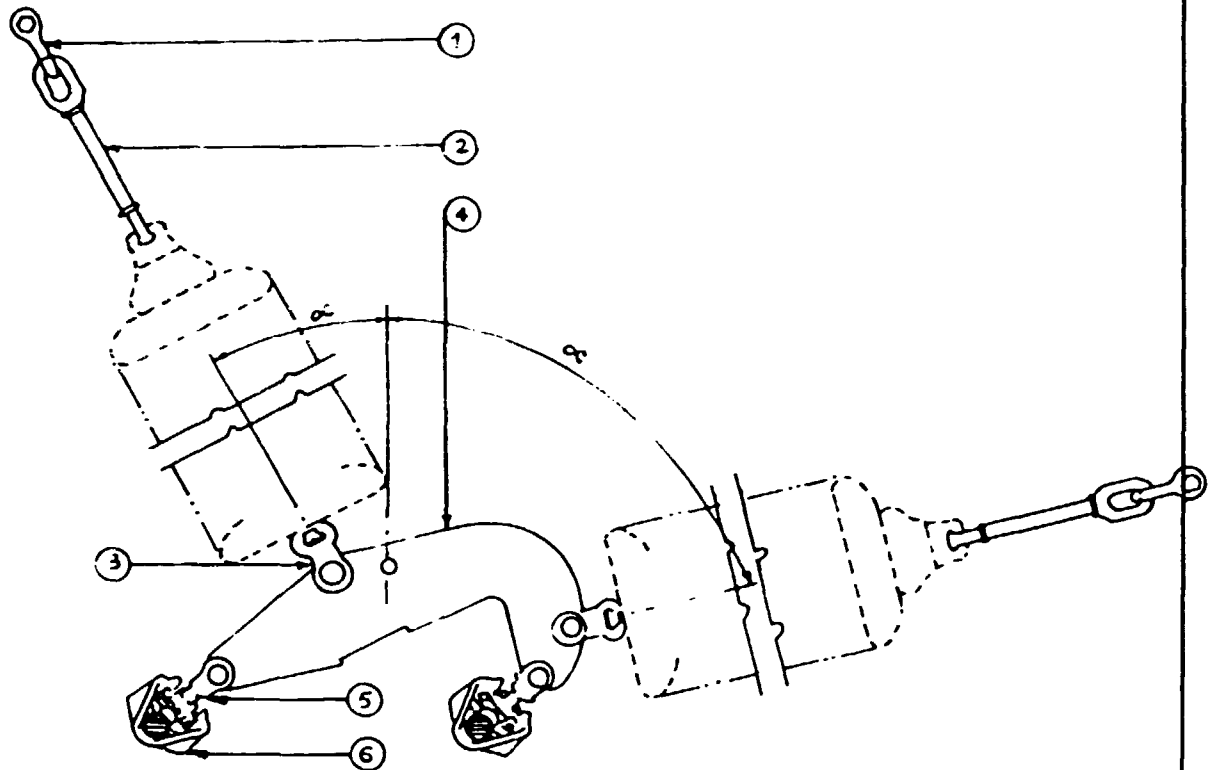
JOB NO. : DCIL-105

EXHIBIT : 17

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

ANGLE, DOUBLE CONDUCTOR, HORIZONTAL, SINGLE VEE STRING SUSPENSION



LEGEND

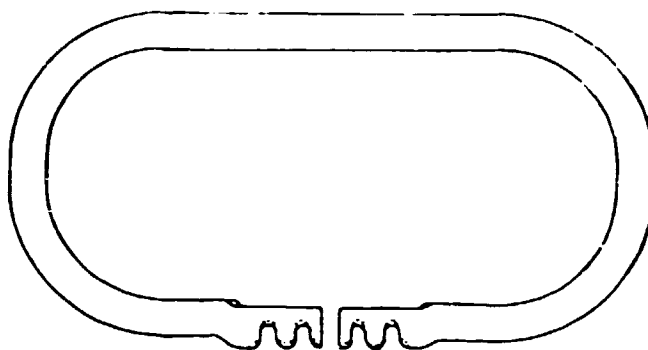
1. Anchor shackle
2. Oval eye ball, hot line
3. Socket Y - clevis with spherical nut
4. Suspension angle yoke
5. 90° Y - Clevis eye
6. Corona free suspension clamp

JOB NO. DCIL-105

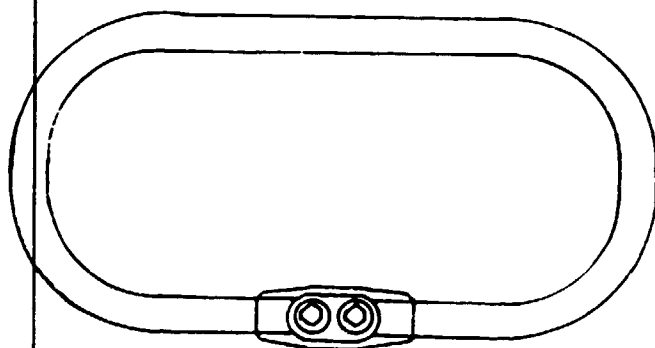
EXHIBIT : 18

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES
TYPES OF CORONA SHIELDS, ARCING HORNS AND OTHER HARDWARES

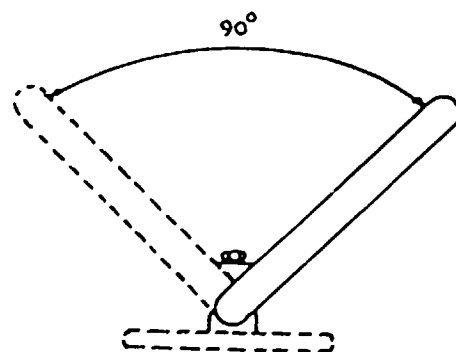


TYPE ASM-522 SERIES



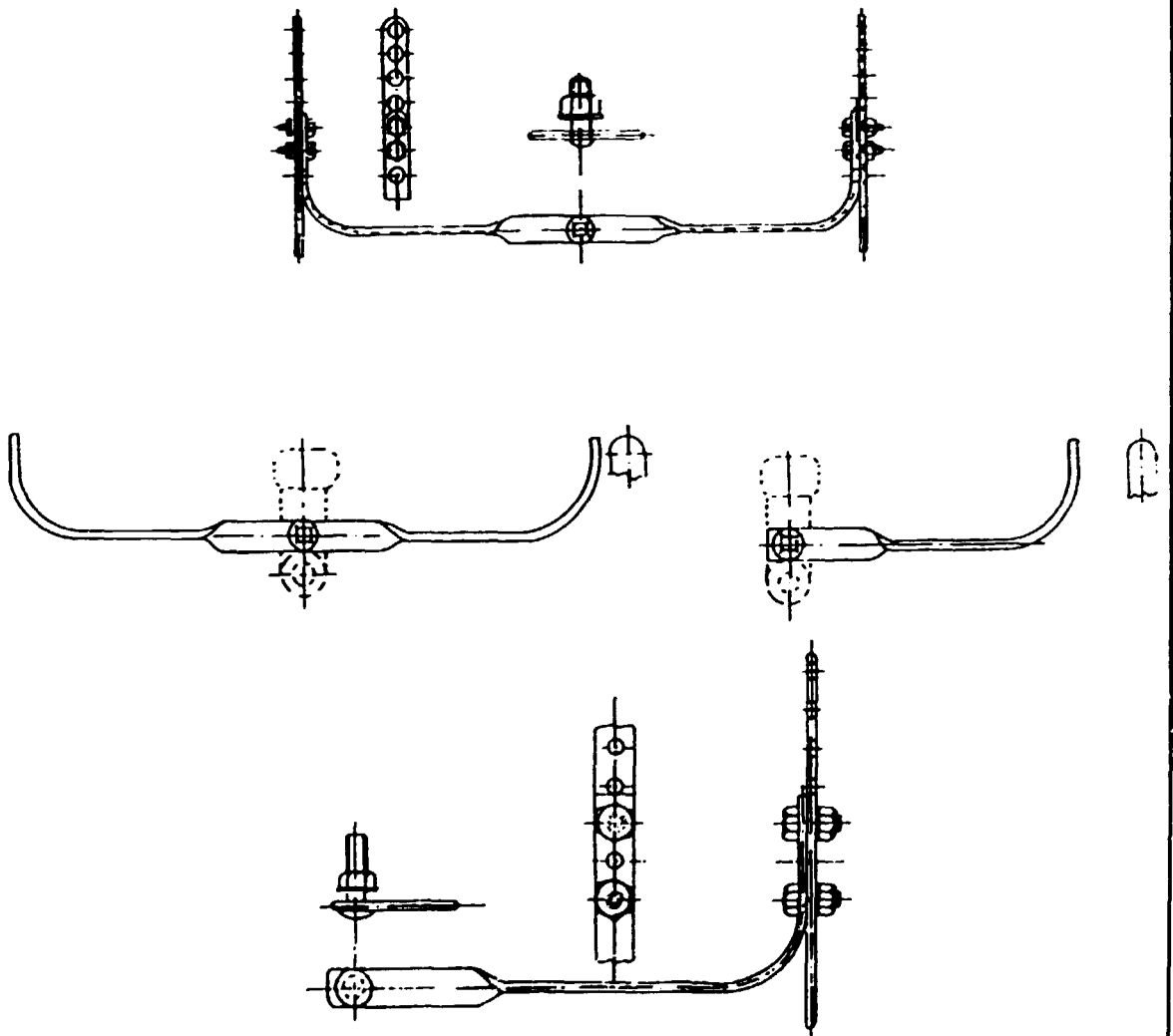
TYPE ASM-324 SERIES

CORONA SHIELDS



JOB NO. DC11-105

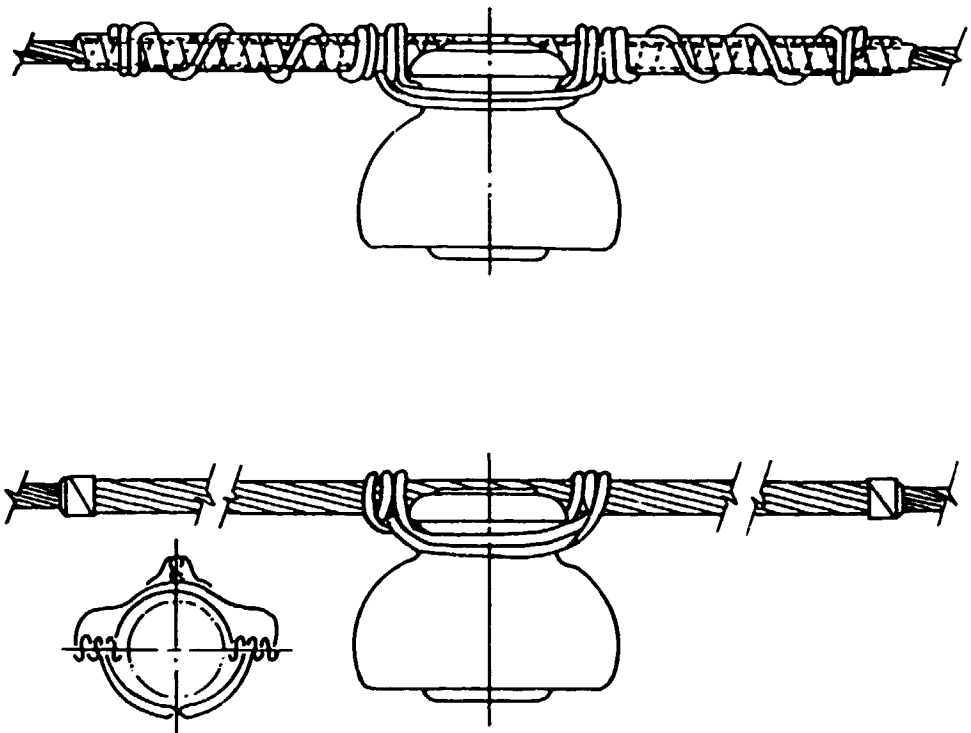
EXHIBIT : 18



ARCING HORNS

JOB NO. DCIL-105

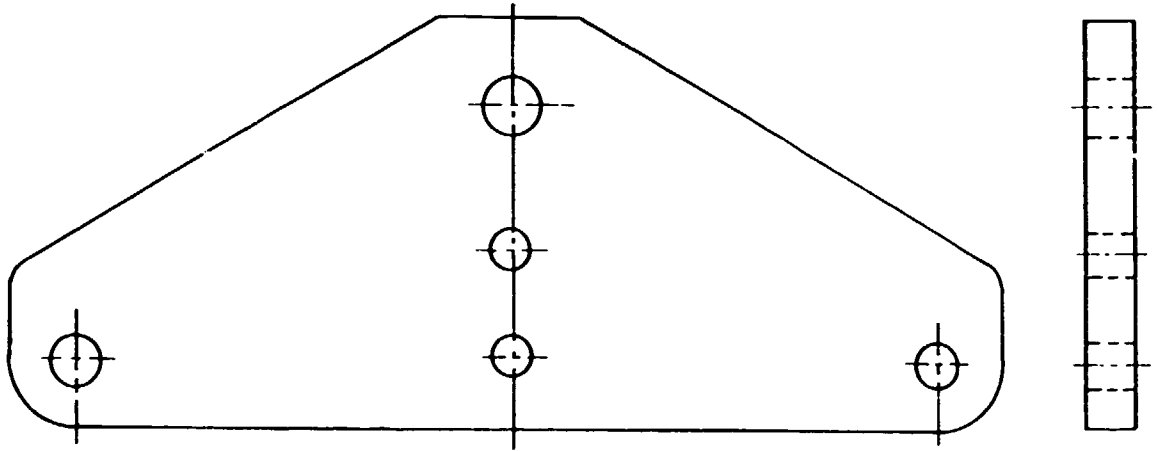
EXHIBIT : 18



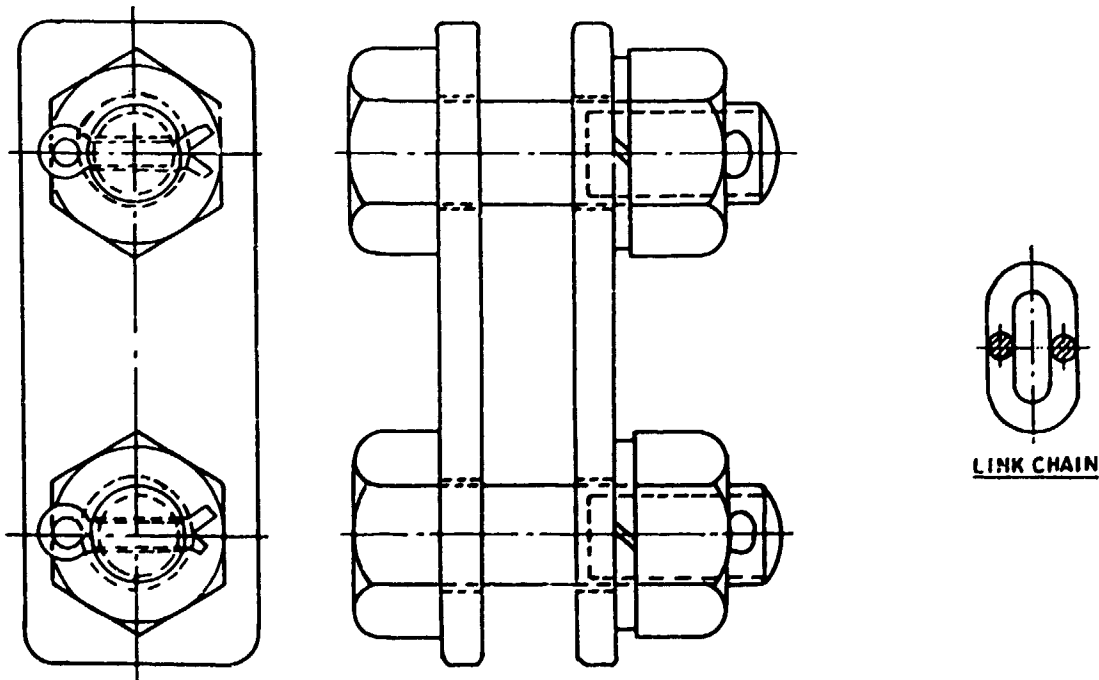
FLAT ARMOR WIRE AND ROUND TIE WIRE

JOB NO. DC11-105

EXHIBIT : 18



YOKE PLATE

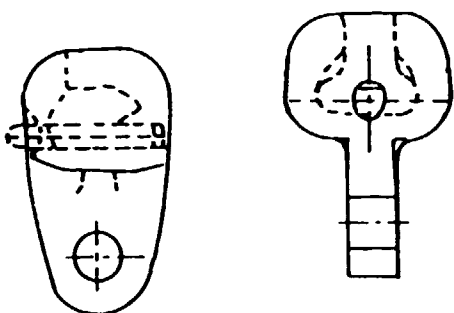


EXTENSION STRAPS

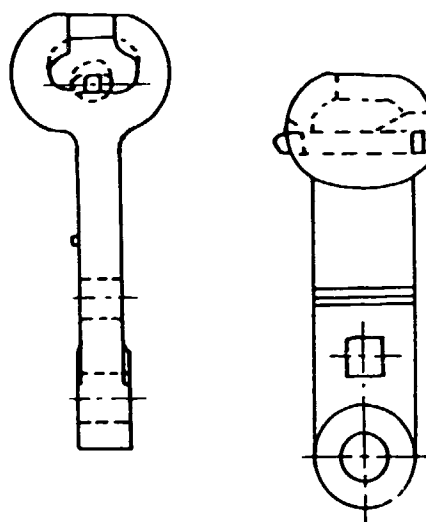
LINK CHAIN

JOB NO. DC11-105

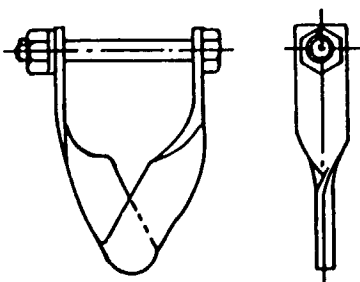
EXHIBIT : 18



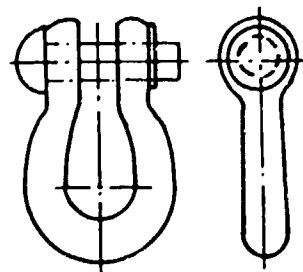
SOCKET EYES



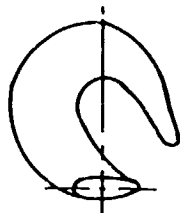
SOCKET EYES SUITABLE FOR
FITTING ARCING HORNS



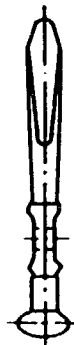
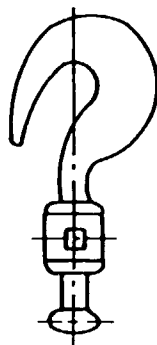
CROSS ARM STRAPS



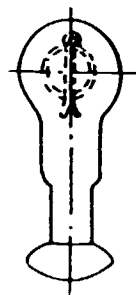
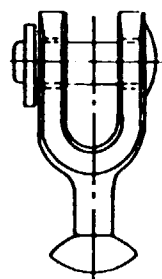
ANCHOR SHACKLE



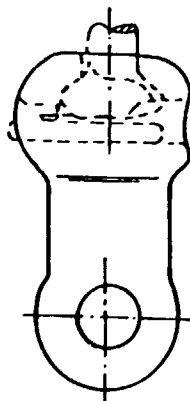
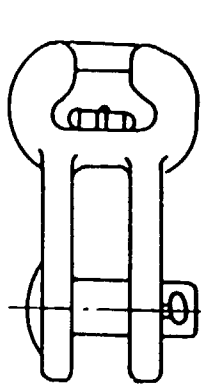
BALL HOOKS



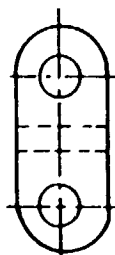
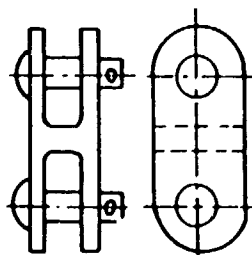
BALL HOOKS



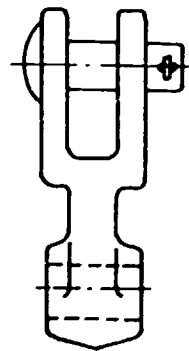
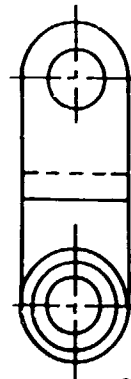
BALL HOOKS SUITABLE
FOR FITTING ARCING
HORNS



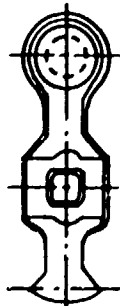
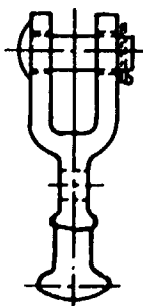
SOCKET CLEVISES



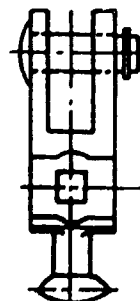
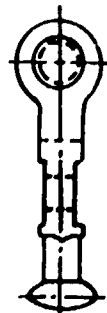
CLEVIS CLEVISES



CLEVIS EYE



BALL CLEVISES



BALL CLEVISES SUITABLE FOR
FITTING ARCING HORNS

SECTION - 4
MARKET ANALYSIS

MARKET ANALYSIS

Overhead line accessories such as clamps, joints, dampers, spacers, etc., are essential for efficient operation of the transmission and distribution (T & D) system. As accessories are used together with conductors, the quantity of accessories required in the T & D system is directly proportional to the quantity of conductors used.

According to the Sectoral study carried out by the AIDMO, the average annual increase in power generating capacity in the designated region is likely to range from 6,700 MW in the early 1990s to nearly 9,300 MW by 2010 AD. Correspondingly, demand for various electrical equipment including overhead line accessories is estimated to increase substantially to be able to distribute the additional power generated.

Projected additions to the overhead transmission and distribution network, as extracted from the AIDMO Report on Sectoral study for the period 1991-2010, are given in Exhibit-19. Transmission and distribution voltages have been grouped in this Exhibit in the following manner :

Ultra High Voltage (UHV)	-	≥ 300 KV
High Voltage (HV)	-	60 KV to 225 KV
Medium Voltage (MV)	-	1.1 KV to 33 KV
Low Voltage (LV)	-	≤ 440 Volts

This Exhibit gives country-wise additions to overhead transmission/distribution network by different voltage classes for four 5-year periods between 1991 and 2010 AD. Exhibit-20 presents the projected average annual addition to

the transmission and distribution network, by voltage class and country for the same periods.

These projections are based on the additional generating capacities projected by the AIDMO. However, it was observed that the actual additions to capacity in many countries during the period 1986-90, were only about 50-80% of the projections made by the AIDMO. As a conservative estimate, it is assumed that only 70% of the additional generating capacity proposed in the AIDMO Report will actually be implemented. Accordingly, the annual demand for conductors is taken at to be 70% of the projections made by the AIDMO.

The transmission network in the designated region is partly of the double-circuit and partly of the single-circuit type. UHV and LV networks are by and large of the double-circuit type, while HV and MV networks are generally of the single-circuit type. Exhibit-21 presents the estimated average annual demand for conductors in the designated region over four 5-year periods between 1991 and 2010 AD, by country, weight and voltage-class. These estimates were arrived at, based on the following norms used in the AIDMO Report -

Voltage Class of Conductor	Tonnes/ckt Km
UHV	20.00
HV	6.50
MV	1.22
LV	1.75

As mentioned earlier in this Section, the demand for overhead line accessories is directly proportional to the quantity of conductors required. For conductors of different voltage classes, the AIDMO Report has used the following norms to arrive at the demand for accessories -

Voltage Class of Conductor	Demand for Accessories expressed as % of Weight of Conductors
UHV	25
HV	20
MV	15
LV	15

Exhibit-22 presents the estimated average annual demand for overhead line accessories worked out for four successive 5-year periods between 1991 and 2010 AD. The average annual demand for accessories increases from about 27,000 tonnes during 1991-95, to about 35,000 tonnes during 2006-2010.

At present, nearly the entire demand in the region is met through imports. On a conservative basis, it is recommended that two plants of about 12,000 tonnes per year, each working in two shifts, be set up to manufacture different types of overhead accessories. Identical plant sizes will not only facilitate implementation, but also help in attending to operational problems with greater ease.

These plants will be able to meet about 90% of the estimated demand during 1991-95. Their capacities may be expanded to about 18,000 TPA by increasing the number of shifts to three, to cater to the entire demand during 2006-2010 AD.

One of the two plants may be set up in Tunisia, to cater primarily to the Arab-African market comprising Algeria, Egypt, Libya, Morocco, Sudan and Tunisia. The other plant may be located in Jordan to cater to the market in the Middle-East, viz., Bahrain, Iraq, Jordan, Kuwait, Saudi Arabia, Syria and the UAE.

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
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PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

PROJECTED ADDITIONAL OVERHEAD TRANSMISSION AND DISTRIBUTION NETWORK

(Figures in EM)

Country	1991-95				1996-2000				2001-2005				2006-2010			
	OHV	HV	NV	LV	OHV	HV	NV	LV	OHV	HV	NV	LV	OHV	HV	NV	LV
Algeria	-	4218	20985	22187	-	4287	21361	22585	-	4287	21361	22585	-	4287	21361	22585
Bahrain	-	100	715	865	-	160	1151	1393	-	160	1151	1393	-	160	1151	1393
Egypt	-	6778	34763	107824	-	8531	43750	135700	-	8531	43750	135700	-	8531	43750	135700
Iraq	3489	9866	21102	59520	4116	11639	24894	70215	4116	11639	24894	70215	4116	11639	24894	70215
Jordan	-	1457	1942	4928	-	1553	2021	5353	-	1553	2021	5353	-	1553	2021	5353
Kuwait	189	504	669	190	189	504	669	190	189	504	669	190	189	504	669	190
Libya	-	5112	5099	18350	-	5112	5099	18360	-	5112	5099	18360	-	5112	5099	18360
Morocco	-	2768	6605	17020	-	3816	9104	23460	-	3816	9104	23460	-	3816	9104	23460
S. Arabia	1175	2743	8086	922	1430	3337	9837	1122	1430	3337	9837	1122	1430	3337	9837	1122
Sudan	-	306	2694	4041	-	470	4142	6215	-	470	4142	6215	-	470	4142	6215
Syria	742	6673	46266	55700	1077	9693	67200	80902	1077	9693	67200	80902	1077	9693	67200	80902
Tunisia	-	859	6461	12496	-	822	6239	12065	-	916	6963	13465	-	916	6963	13465
U.A.E.	-	2630	4617	5277	1938	1938	6785	7754	1938	1938	6785	7754	1938	1938	6785	7754
Total	5595	44014	160004	309334	8750	51862	202252	385314	8750	51956	202976	386714	8750	51956	202976	386714

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANISATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANISATION
PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

PROJECTED AVERAGE ANNUAL ADDITIONS TO TRANSMISSION AND DISTRIBUTION NETWORK

(Figures in KM)

Country	1991-95				1996-2000				2001-2005				2006-2010			
	OHV	HV	MV	LV	OHV	HV	MV	LV	OHV	HV	MV	LV	OHV	HV	MV	LV
Algeria	-	844	4197	4437	-	857	4272	4517	-	857	4272	4517	-	857	4272	4517
Bahrain	-	20	143	173	-	32	230	279	-	32	230	279	-	32	230	279
Egypt	-	1356	6953	21565	-	1706	8750	27140	-	1706	8750	27140	-	1706	8750	27140
Iraq	698	1973	4220	11904	823	2328	4979	14043	823	2328	4979	14043	823	2328	4979	14043
Jordan	-	291	388	986	-	311	404	1071	-	311	404	1071	-	311	404	1071
Kuwait	38	101	134	38	38	101	134	38	38	101	134	38	38	101	134	38
Libya	-	1022	1020	3672	-	1022	1020	3672	-	1022	1020	3672	-	1022	1020	3672
Morocco	-	554	1321	3404	-	763	1821	4692	-	763	1821	4692	-	763	1821	4692
S. Arabia	235	549	1617	184	286	667	1967	224	286	667	1967	224	286	667	1967	224
Sudan	-	61	539	888	-	94	828	1243	-	94	828	1243	-	94	828	1243
Syria	148	1335	9253	11140	215	1939	13440	16180	215	1939	13440	16180	215	1939	13440	16180
Tunisia	-	172	1292	2499	-	164	1248	2413	-	183	1393	2693	-	183	1393	2693
U.A.E	-	526	923	1055	388	388	1357	1551	388	388	1357	1551	388	388	1357	1551
Total	1119	8004	32000	61865	1750	10372	40450	77063	1750	10391	40695	77343	1750	10391	40695	77343

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANISATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANISATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

ESTIMATED AVERAGE ANNUAL DEMAND FOR CONDUCTORS BY WEIGHT

(Figures in MT)

Country	1991-95				1996-2000				2001-2005				2006-2010			
	OHV	HV	MV	LV	OHV	HV	MV	LV	OHV	HV	MV	LV	OHV	HV	MV	LV
Algeria	-	3842	3584	5436	-	3900	3648	5534	-	3900	3648	5534	-	3900	3648	5534
Bahrain	-	91	122	212	-	143	196	341	-	143	196	341	-	143	196	341
Egypt	-	6168	5938	26416	-	7761	7473	33247	-	7761	7473	33247	-	7761	7473	33247
Iraq	9780	8977	3604	14583	11520	10595	4252	17202	11520	10595	4252	17202	11520	10595	4252	17202
Jordan	-	1326	332	1208	-	1417	345	1313	-	1417	345	1313	-	1417	345	1313
Kuwait	540	462	114	47	540	462	115	47	540	462	115	47	540	462	115	47
Libya	-	4647	871	4498	-	4648	871	4498	-	4648	871	4498	-	4648	871	4498
Morocco	-	2522	1129	4170	-	3471	1556	5747	-	3471	1556	5747	-	3471	1556	5747
S. Arabia	3280	2496	1381	226	4000	3035	1680	275	4000	3035	1680	275	4000	3035	1680	275
Sudan	-	279	460	991	-	429	708	1523	-	429	708	1523	-	429	708	1523
Syria	2080	6071	7902	13646	3000	8820	11478	19820	3000	8820	11478	19820	3000	8820	11478	19820
Tunisia	-	780	1103	3060	-	748	1066	2956	-	832	1190	3299	-	832	1190	3299
U.A.E	-	2392	788	1292	5440	1768	1159	1900	5440	1768	1159	1900	5440	1768	1159	1900
Total	15680	40053	27328	75784	24500	47197	34547	94402	24500	47281	34671	94745	24500	47281	34671	94745

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANISATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANISATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

ESTIMATED AVERAGE ANNUAL DEMAND FOR OVERHEAD LINE ACCESSORIES

(Figures in MT)

Country	1991-95				1996-2000				2001-2005				2006-2010			
	DHV	HV	MV	LV	DHV	HV	MV	LV	DHV	HV	MV	LV	DHV	HV	MV	LV
Algeria	-	768	538	815	-	780	547	830	-	780	547	830	-	780	547	830
Bahrain	-	18	18	32	-	29	29	51	-	29	29	51	-	29	29	51
Egypt	-	1234	891	3962	-	1552	1121	4987	-	1552	1121	4987	-	1552	1121	4987
Iraq	2445	1795	541	2188	2880	2119	638	2580	2880	2119	638	2580	2880	2119	638	2580
Jordan	-	265	50	181	-	283	52	197	-	283	52	197	-	283	52	197
Kuwait	135	92	17	7	135	92	17	7	135	92	17	7	135	92	17	7
Libya	-	929	131	675	-	930	131	675	-	930	131	675	-	930	131	675
Morocco	-	504	169	626	-	694	233	862	-	694	233	862	-	694	233	862
S. Arabia	820	499	207	34	1000	607	252	41	1000	607	252	41	1000	607	252	41
Sudan	-	56	69	149	-	86	106	229	-	86	106	229	-	86	106	229
Syria	520	1214	1185	2047	750	1764	1721	2973	750	1764	1721	2973	750	1764	1721	2973
Tunisia	-	158	166	459	-	150	160	443	-	166	179	495	-	166	179	495
U.A.E	-	478	118	194	1360	354	174	285	1360	354	174	285	1360	354	174	285
Total	3920	8010	4100	11369	6125	9440	5181	14160	6125	9456	5200	14213	6125	9456	5200	14213

SECTION - 5
PLANT LOCATION

PLANT LOCATION

In the previous Section it was recommended that 2 plants, each with a capacity of 12,000 TPA, be set up at Tunisia and Jordan to cater to the demand for accessories in the designated region. It is recommended that the sizes of the plants be approximately the same, to ensure interchangeability of parts, machinery, spares, etc., amongst them.

The selection of locations for establishing the manufacturing plants was made, based on the the following considerations :

- o size of the domestic market in each of the 13 countries within the designated region
- o availability of raw materials within the designated region
- o proximity to sources of raw materials, and the availability of road, rail or sea linkages
- o availability of essential infrastructural facilities such as power, water, labour, etc.
- o relationships and affiliations among different nations within the region
- o investment environment in different countries

In Exhibit-23, the average annual demand for overhead line accessories between 1991 and 1995 has been arranged country-wise under two sub-regions, to demarcate the markets served by each plant. The plant in Tunisia, after fulfilling the

rather small domestic requirement, will be able to meet the demand from five other countries - Egypt, Libya, Morocco, Sudan and Algeria.

It may be noted that Egypt accounts for nearly 50% of the demand in this sub-region. Nevertheless, it is recommended that the plant be located in Tunisia. Egypt, if required, can also source its requirement from the plant in Jordan which is located quite nearby. Although the technology and infrastructure required for manufacturing overhead line accessories exist both in Egypt and Tunisia, the latter is preferred as location for the plant as it will help in reducing regional imbalances. Tunisia will also be a convenient location for distributing the finished products in the Arab-African market. Also, according to the investment assessment in the Arab countries, the investment environment in Tunisia has improved tremendously in the recent years.

The plant in Jordan will, besides satisfying the domestic demand, be able to serve the entire Middle East consisting of Bahrain, Iraq, Kuwait, Saudi Arabia, Syria and the UAE. More than 50% of the demand in this region arises from Iraq itself, while about one-third is from Syria. The proximity of the Jordanian plant to both these markets will reduce costs of transporting the finished products to a great extent.

JOB NO. : DCIL-105

EXHIBIT : 23

**UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION**

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

**COUNTRY-WISE AVERAGE ANNUAL DEMAND FOR
OVERHEAD LINE ACCESSORIES (1991-95)**

(Figures in Tonnes)

Country	UHV	HV	MV	LV	Total
Algeria	-	768	538	815	2121
Egypt	-	1234	891	3962	6081
Libya	-	929	131	675	1735
Morocco	-	504	169	626	1299
Sudan	-	56	69	149	274
Tunisia*	-	158	166	459	783
Sub-total	-	3649	1964	6686	12299
Iraq	2445	1795	541	2188	6969
Bahrain	-	18	18	32	68
Jordan*	-	265	50	181	496
Kuwait	135	92	17	7	251
S. Arabia	820	499	207	34	1560
Syria	520	1214	1185	2047	4966
U.A.E.	-	478	118	194	790
Sub-Total	3920	4361	2136	4683	15100
Total	3920	8010	4100	11369	27399

* Location of Plants

SECTION - 6
MANUFACTURING PROCESS

MANUFACTURING PROCESS

The major processes involved in the manufacture of overhead line accessories are :

- o Forging of hardware like hooks, clevises, anchors, nuts, bolts, etc. The forged components are made either from mild steel or from high tensile steel.
- o Die casting of aluminium alloy components like conductor clamps, spacers, insulator fittings, etc.
- o Machining of forged and cast components.
- o Hot-dip galvanising of forged components.

FORGING

Forging is a forming process in which metal is plastically deformed into a predetermined size and shape. The process is carried out at elevated temperatures by applying a compressive force either by a hammer, press or upsetting machine. Forged materials have high strength and ductility, and offer great resistance to impact and fatigue loads. Forging also allows the material to be displaced where it is needed, thus effecting considerable reduction in weight and cost.

Forgings are classified, based on the method of forging, in the following manner :

- o Smith Forging
- o Drop Forging
- o Machine or Upset Forging
- o Press Forging

All the above methods produce forgings with similar mechanical and metallurgical properties. Selection of a particular method depends on the quantum of production desired and its comparative ability to make the grain flow lines follow the contour of the finished product. The process flow chart, showing different stages involved in forging of overhead line accessories, is given in Exhibit-24.

Preparation of Stock

The forging stock is generally a round, square or hexagonal bar, cut to length to provide the volume of metal needed for forging. The cut length also includes excess material to allow for flash and other wastage.

Hacksaw, bandsaw and circular cold saw are machines used for cutting the stock to size. Another cutting method used for cutting small sized stock is abrasive cutting. This method is very fast and is economical for large volume of production.

Heating

Maximum safe forging temperatures for carbon and alloy steels are given in Exhibit-25. The forging temperature decreases as the carbon content increases. The higher the forging temperature, the greater is the plasticity of the steel which results in better forging and less die wear. However, this exposes the material to the danger of overheating and excessive grain coarsening.

It is necessary for the heating time to be sufficient to bring the centre of the steel forging stock to the forging temperature. Heating the stock for a longer time than is

necessary leads to excessive decarburisation, scale and grain growth. The finishing temperature should be well above the transformation temperature of steel, to prevent excessive wear of the dies. However, it should be low enough to prevent excessive grain growth. For most carbon and alloy steels, the temperature range of 982 - 1093°C is suitable for finished forgings.

In general, batch type furnaces are employed for heating steel to forging temperatures. Slot-type batch furnaces may be oil fired or gas fired. Burner units are normally placed in the side walls of the furnace. Such furnaces heat 250 to 490 kg of steel per hour, per square metre of hearth. These furnaces are provided with temperature control devices like platinum thermocouples or radiation type pyrometers.

Descaling before Forging

Prevention of scale formation during heating, or removal of scale between heating and forging results in larger die life, smoother surface of the forging and improved dimensional control. Besides, a scaly forging makes hot inspection undesirable and increases the cost of cleaning. It is preferable to adopt controlled heating methods, to minimise scale formation.

Forging

Major types of forgings are briefly described below :

Smith Forging

Smith forgings are produced without the use of impression dies. The forging is done between flat dies. Sometimes, hand tools are used to obtain desired shape on the forged

material. These forgings are made where quantities are too small to justify the cost of impression die equipment or where sizes are too large or too irregular to contain them in the usual impression dies.

Drop Forging

Most drop forgings are produced by shaping hot plastic metal within closed dies. The die for drop forging contains the impression of the desired part, in addition to one or more preliminary impressions that may be required to shape and position the stock before it can be forged in the final impression. When preliminary forging steps are numerous or the forgings are large, two or more sets of forging dies may be required.

In general, gravity drop hammers or power drop hammers are used for producing closed die forgings. Rated size of these hammers may range from 500 lbs to as much as 30,000 lbs.

Upset Forging

Upset forging machines produce forgings by pushing or squeezing the metal under pressure. The number of passes or strokes may be only one or many depending on the volume of metal which must be upset.

The dies and tools most commonly used in an upset forging machine consist of a pair of rectangular blocks or inserts, and one or more heading punches. The mating faces of the two die blocks have suitable grooves in the horizontal position for gripping the forging stock. The punch end contains some or all of the die impressions. Rest of the impressions are contained in the gripping dies. The grade of material used

in the die block and punches is hot working steel. Both the dies and the punch are hardened.

Different sizes of nuts and bolts and other bar stock items are formed on this type of machine.

Press Forging

Forging presses incorporate a ram that moves in a vertical direction to exert a squeezing action on the workpiece; this is in contrast with the repeated blows made in upset forging. In general, presses can produce all types of forgings that hammers can produce. In addition, presses can forge some alloys of moderate ductility that would shatter under the blows of a hammer. Higher production rates are possible with presses rather than with hammers. Dies can be less bulky; therefore, it requires less tool steel to make dies. Presses deliver consecutive strokes of equal force, and are therefore less suitable for preliminary shaping operations such as fullering, edging, etc. However, they are not well suited for forging unsymmetrical workpieces and parts containing thin sections.

Trimming and Grinding

For small quantities or large sized forgings, sawing or other machining operations may be used to remove flash. For large quantities, the cost of trimming dies can usually be justified. Most forgings produced in closed dies are die trimmed. For purpose of die trimming, forging materials can be divided into two groups; those that can be trimmed cold and those that should be trimmed hot. Generally, a forging can be cold trimmed satisfactorily if the work metal in the "to be trimmed" condition has a tensile strength of not more than 100,000 psi, or a hardness of not more than 207 BHN.

Cold trimming refers to the trimming of metal flash at a temperature below 139°C. Hot trimming is done at temperatures as high as 982°C or above for steels or other ferrous alloys. When steel forgings are reheated specially for hot trimming, a temperature of about 538°C is ordinarily used in order to minimise scale formation. Generally, an increase in trimming temperature, results in a decrease in power requirement.

After the flash has been trimmed off, the forging is dressed up by hand grinding to remove burrs and other materials that stick in its holes or cavities.

Heat Treatment

Most forging specifications require heat treatment after forging, to obtain desired properties. The nature of treatment required depends on the type of steel used. Processes adopted for heat treatment of forgings include normalising, annealing, oil or water quenching and tempering.

The normalising process consists of heating the forging to a temperature which is just above its critical temperature (about 850°C for mild steel), and then allowing it to cool in air. This refines its structure and removes the stresses developed in it during hot working and irregular cooling.

Annealing is a similar process, but cooling is carried out very slowly. The softest possible condition for machining is achieved by this process.

During quenching, the steel is heated to a temperature above the critical temperature and immersed either in oil (for toughness) or in water (for hardness). It retains

permanently the free structure induced by heating above the critical temperatures. But the strains caused must be relieved by tempering. Alloy steels are rarely quenched in water.

Steel is reheated after tempering to a temperature below the critical point and then allowed to cool. This procedure relieves stresses, toughens the material and makes it less brittle.

Inspection and Testing of Forged Components

Routine inspection includes the following operations :

- o Checking the forging dies and tooling equipment for dimensions and surface condition
- o Inspection of forging stock for possible defects such as seams, piping and cracks
- o Inspection of forgings during the forging operations for proper die alignment, size, unfilled sections, cold shots and other defects visible to the eye
- o Cold inspection of forging for surface conditions and defects visible to the eye
- o Final inspection for size, alignment, tolerance and any other condition that might be routine for the component forged
- o Additional inspection generally carried out on sampling basis includes checking the forging stock for chemical composition, checking hardness after heat treatment, grain flow inspection, tensile and

notch impact tests, Magnaflux, Magnaglo or Zyglo inspection, macro or micro inspection, weighing, etc.

High quality forgings are also tested for internal defects by X-ray or ultrasonic equipment.

Cleaning of Forgings

The methods that are used most commonly for removing scale from forgings are :

- o Abrasive blasting
- o Tumbling
- o Brushing
- o Acid pickling
- o Salt bath descaling

Abrasive Blasting : Abrasive blasting is the most widely used process for removing scale. It is compatible with high volume production and can also be used for descaling a few forgings.

Tumbling : Barrel finishing (tumbling) is often used for removing scale, particularly from small symmetrical forgings. However, forgings of complex shape, with deep recesses or other irregularities cannot be descaled uniformly by tumbling. Size of the forging also limits the efficiency of tumbling.

Brushing : In the absence of any other descaling process, all forgings are at least brushed to remove scale adhering to their surface.

Pickling : The use of pickling as the only treatment for scale removal is on the decline. However, its use as supplementary treatment following abrasive blasting or salt bath descaling is more common. Forgings are pickled in a solution containing sulphuric acid or hydrochloric acid of 3% concentration at 60°C.

Salt Bath Descaling : Salt bath descaling followed by pickling as mentioned above is an effective method for removing scale from carbon, alloy and tool steels as well as for descaling other metals. However, this method requires relatively elaborate equipment, the cost of which cannot be justified except in case of continuous and/or high volume of production.

DIE CASTING

Most of the overhead line accessories are made of aluminium alloys because of their low weight, resistance to corrosion, high electrical conductivity and easy machinability. These are manufactured by die casting. Die casting process uses permanent metal moulds instead of sand moulds used in sand casting. Metal moulds produce castings with better surface quality and dimensional accuracy. The cooling rates in the metal mould castings are faster than in the sand moulds and thus parts manufactured using metal moulds have better refined grain structures.

There are two types of die casting - gravity die casting and pressure die casting. Mould filling in gravity die casting is by the force of gravity, whereas in pressure die casting the molten metal is forced at high velocities by applying pressure. Because of this type of filling, the pressure die casting process can produce shapes that are more complex than those produced by gravity die casting.

Process flow chart for die casting is shown in Exhibit-26.

Charging

The furnace charge may be made of either one or a combination of the returned gates and risers, returns from machining operations, pre-alloyed ingots, primary metal together with alloying elements, or hardeners. The selection of metal for the charge depends on melting equipment and capacity, composition and quality of the alloy needed and availability of analytical equipment.

In general, the plants producing aluminium alloy castings for overhead line accessories melt their charge in a low frequency induction furnace. The yield in these plants varies from 45-50%. Generally, the charge is made of 55% pre-alloyed ingots and 45% foundry returns in the form of gates, risers, sprues, etc. Therefore, it is necessary that all the foundry returns are collected, segregated on the basis of their chemical composition and stored separately. Alternatively, one may accumulate all the foundry scrap and remelt it in a reverberatory furnace, for processing into foundry pigs to be used as melting charge. However, this alternative is very expensive and may not be economical if the foundry scrap is not available in large quantities.

Melting

In most cases, electric furnace-melting of aluminium alloys for casting is done in low frequency induction furnace of the channel (core) and coreless type.

Channel induction furnaces for melting aluminium have power rating ranging from 20 to 200 KW, capacities of 320 to 1360 Kg of aluminium, and melting rates of 45 to 450 Kg per hour. They operate frequencies of 50/60 hertz and can melt about 2.2 Kg of aluminium per kilowatt hour.

Coreless furnaces have the same melting and steering action as channel furnaces and there is little loss of metal by oxidation. This type of furnace has no channels to clean and it is not necessary to keep the molten heel in the furnace. It is thus adaptable to batch type operation. The initial charge should consist of large shapes which occupy at least 15% of furnace capacity. Following melt down of the large shapes, subsequent charges may consist of any convenient forms or even fines.

Coreless frequency induction furnaces are made in sizes ranging from 75 to 750 KW with capacities of 160 to 3200 Kg and can melt 120 to 1600 Kg of aluminium per hour. These furnaces melt about 1.8 Kg of aluminium per kilowatt hour.

Transfer of Molten Aluminium

Because of its extremely high conductivity and its sensitivity to oxidation, molten aluminium must be transferred with as little turbulence as possible. It is preferable to have furnaces near the moulds and to pour the metal by hand, rather than to transfer it from a central furnace.

Where central melting is done, it is advisable to have several intermediate holding furnaces that can be hot charged directly from the central unit.

Pouring

Pouring temperature depends on die composition, moulding process used, section thickness and gating systems. If the metal is poured too cold, defects such as misruns, cold shots, and shrinkage are likely to occur. If the metal is poured too hot, then coarse grains, porosity, extreme shrinkage and hot tearing are likely to occur. For all aluminium alloys, the grain size increases as pouring temperature is increased. The best practice would be to pour the casting at the lowest temperature that will provide a defect-free forging.

Moulding Machine

Gravity Die Casting

Manually-operated gravity die casting machine may consist of the simple "book" mould arrangement shown in Exhibit-27. For castings with high ribs or walls that require mould retraction without rotation, the machine shown in Exhibit-28 can be used.

Pressure Die Casting

Cold chamber machines are almost universally used for pressure die casting of aluminium alloys. Hot chamber machines are unsatisfactory mainly because of the ready reactivity of molten aluminium with steel. The pick up of iron by aluminium in the cold chamber is negligible as the actual contact between the molten metal, the chamber and its plugger is only momentary.

Fettling and Grinding

After solidification and ejection, castings have gates, risers, sprues and flash materials attached to them. During fettling, these are removed by sawing. Any other foreign material adhering to the casting is ground off by hand grinders. The castings are cleaned to remove materials that may be adhering to the surface after the cutting/grinding operation. If the castings do not need any heat treatment, they are generally shot blasted to obtain a bright and smooth surface.

Heat Treatment

Three basic types of thermal treatment are commonly employed on aluminium alloys solution heat treatment, precipitation heat treatment and annealing.

Solution Heat Treatment : The solution heat treatment process consists of heating alloy castings to a temperature in the range of 482 to 540°C at which certain constituents go into solution. Thereafter, the casting is quenched to maintain these constituents in solution during the period of cooling.

Precipitation Heat Treatment : The precipitation heat treatment process consists of heating the alloy to about 120 to 204°C to accelerate precipitation and agglomeration of the constituents. This usually follows solution treatment.

Annealing : In the annealing process, castings are heated to a temperature which falls in the range between the solution and precipitation heat treatment temperatures. This is done with a view to attain complete precipitation and to remove residual strain.

Inspection and Quality Control)

Inspection and quality control procedures for checking size, shape, chemical composition, and external and internal surface defects are similar to these described in case of forged components.

Die Casting Dies

A die casting die consists of two halves arranged to open and close with a vertical parting on die casting machine. One die half, called the cover die, is stationary while the other die half, known as the ejector die, moves during opening and closing.

Gravity Die Casting Dies : The gravity die casting dies and cores are made of dense, heavy duty cast iron, i.e., mehanite or steel. There are two types of cores commonly used in gravity die casting namely fixed cores and movable cores.

The fixed cores can be withdrawn with the mould and are fastened to the mould body. On the other hand, movable cores are separate from the die blocks. They are drawn before parting the mould. These cores are withdrawn as soon as the metal starts to solidify, by means of the rack and pinion mechanism, screw mechanism or hydraulic mechanism.

The two halves of the die blocks may be mounted on a sliding carriage where one half is fixed on one side and other half is movable along a horizontal bend. Thickness of die block walls usually varies from 20 to 25 mm. Ribs and flanges are provided on the outer surfaces for strengthening the moulds. Moulds are usually coated with a refractory wash and then

with lamp black, to reduce the chilling effect on the metal and to facilitate the removal of the casting.

Castings are often removed before they are completely solidified to prevent cracks which may develop as a result of shrinkage strains.

Pressure Die Casting Dies : Pressure die casting dies for aluminium alloys are usually made of heat treated low alloy steel having high resistance to heat, erosion, wear, etc.

Die casting dies should be designed, taking into account the following :

- o the cost of flash removal
- o non-refractory nature of the die
- o artificial means of venting
- o location of the runners and risers to ensure easy removal of casting
- o proper type cores

MACHINING OF FORGED AND CAST COMPONENTS

In order to reduce Corona effect, the overhead line accessories are designed to have smooth surfaces and regular contours, without any sharp corners or bends. Holes, wherever required, are drilled to ensure accurate fastening. In order that the clamps hold the conductor properly, their bearing surfaces are grooved and machined. Fasteners like nuts and bolts are designed to have standard threads. In order to provide these characteristics, most of the forged or cast components must go through one or more of the following operations :

- o Turning
- o Chamfering
- o Milling
- o Plain surfacing and facing
- o Drilling and boring
- o Thread cutting and thread rolling

It is to be noted that overhead line accessories are fitted at locations where no rectifying facilities are available. Therefore, they need to be accurately processed and checked. They should be processed with the help of jigs and fixtures to maintain uniform accuracy and alignment.

In addition to the machines required for the above operations, the plant will also need machine tools for making forging and casting dies. The die making will need die sinking as well as precision boring machines.

HOT-DIP GALVANISING

Overhead line accessories made of iron/steel are exposed to the atmosphere. They are affected by corrosion caused by the sun, wind, rain, snow and damp soil. To prevent this, it is a general practice to give a hot-dip galvanised coating to the accessories. Thus, all the forged components made from mild steel or high tensile steel are galvanised in accordance with the standard specifications given by ASTM designation A-153.

To test the uniformity and thickness of the galvanised coating, the Preece Test as given by ASTM Designation A-90 is used.

Hot-dip galvanising involves the following stages :

- o acid pickling
- o water rinsing
- o fluxing and dipping
- o drying

Acid Pickling

An aqueous solution of sulphuric acid is commonly used to remove mill scale and rust from the steel parts prior to galvanising. The concentration of sulphuric acid in pickling baths normally ranges from 47 to 100 grams of sulphuric acid per litre of water. To increase their effectiveness, sulphuric acid solutions used are always hot (60 to 80°C).

In order to retard or stop the chemical action of the acid on base metal, a number of inhibitors are used. The most effective inhibitor is iron sulphate. Iron sulphate is produced by the action of sulphuric acid on the base metal. However, as its concentration increases in the acid solution, it inhibits the chemical action of the acid. In general, the concentration of iron sulphate is kept at 0.2% of the weight of sulphuric acid.

Water Rinsing

Pickled components are rinsed thoroughly in a mixture of hot water and 10% sodium hydroxide solution. Rinsing is done at 93°C to neutralise the residual acid, if any. The components are subsequently rinsed in hot water baths to remove traces of sodium hydroxide solution.

Fluxing and Dipping

Although pickling and water rinsing operations remove rust and scale from the components, small traces of impurities in the form of oxides, sulphates and sulphides may remain. These impurities, if present, interfere with the iron-zinc reaction when the steel parts are immersed in molten zinc. Flux is used to remove these impurities, and to keep that portion of the surface of the zinc bath in which the components are immersed, free from oxides. Zinc ammonium chloride is commonly used to provide a flux blanket on the molten zinc bath. This floats on the surface of the bath and wets the surface of the components dipped into the zinc bath.

The quality of zinc coating on the components depends on the following factors :

- o purity of zinc
- o bath temperature
- o bath alloying elements
- o immersion time
- o withdrawal rate
- o cooling of coated wires

Purity of Zinc : Pure zinc gives good bending property to the coatings and facilitates the formation of thick and uniform coatings. Impurities in zinc will result in scaling off of the layer of zinc coating.

Bath Temperature : Zinc baths are usually maintained at temperatures ranging from 443 to 465°C. If the bath temperature is raised beyond this range, formation of oxides at the bath surface is accelerated and the quality of coating is affected.

Bath Alloying Elements : Traces (0.02% to 1%) of alloying elements such as aluminium, tin and antimony are used to give brightness to the zinc coating.

Immersion Time : The thickness of coating increases with increase in immersion time. The duration of immersion is usually in the range of 1 to 5 minutes. For best results, the components should be submerged as rapidly as possible.

Withdrawal Rate : To provide a uniform coating of minimum thickness, the components are withdrawn from the zinc bath slowly and at a controlled rate, permitting maximum drainage. The optimum withdrawal rate for most articles is about 0.025 metres per second.

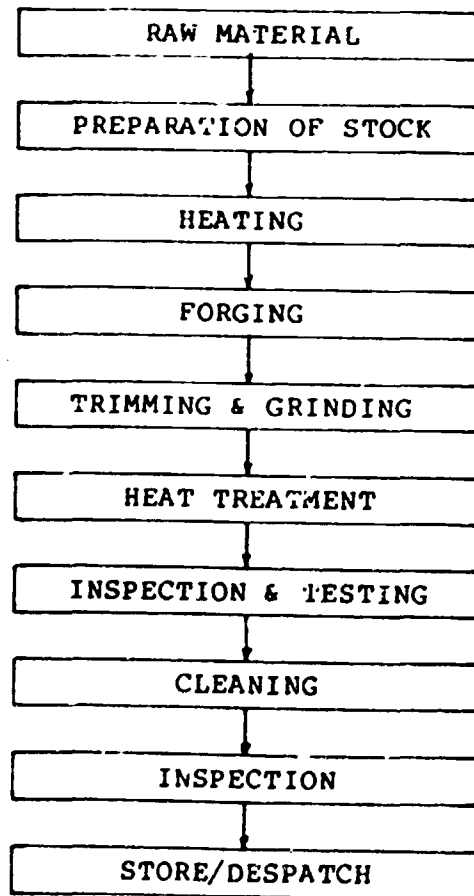
Cooling of Coated Wires : The coating can continue to diffuse at an elevated temperature, after the surface layer of zinc has frozen. This type of post-immersion diffusion may occur if cooling is hindered by stacking of the parts, or due to retention of heat in the excessive cross-sectional area of the part. Diffusion may convert a part or whole of the pure zinc layer to iron-zinc alloy, thus decolourising the surface and affecting its properties. To overcome this problem, parts taken out of the zinc bath should be spaced out adequately to ensure free circulation of air. Parts with heavy cross-sectional area will require forced cooling with air or water.

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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
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PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

PROCESS FLOW CHART : FORGING



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EXHIBIT : 25

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
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ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

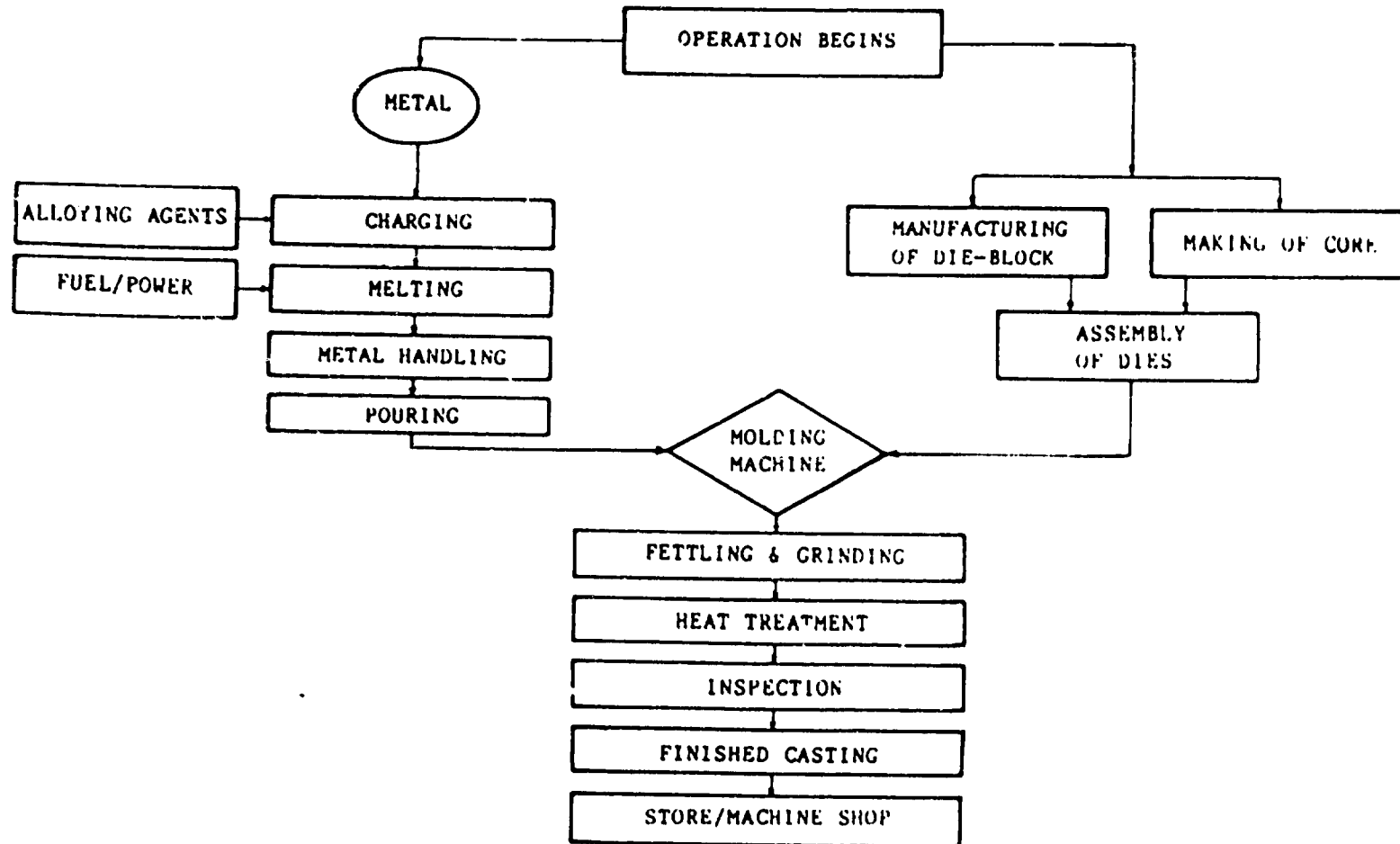
MAXIMUM SAFE FORGING TEMPERATURES FOR
CARBON AND ALLOY STEEL

Carbon Content (%)	Maximum Forging Temperature (°C)	
	Carbon Steel	Alloy Steel
0.10	1288	1260
0.20	1274	1246
0.30	1260	1232
0.40	1246	1232
0.50	1232	1232
0.60	1205	1205
0.70	1190	1177
0.90	1149	-
1.10	1207	-

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
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PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

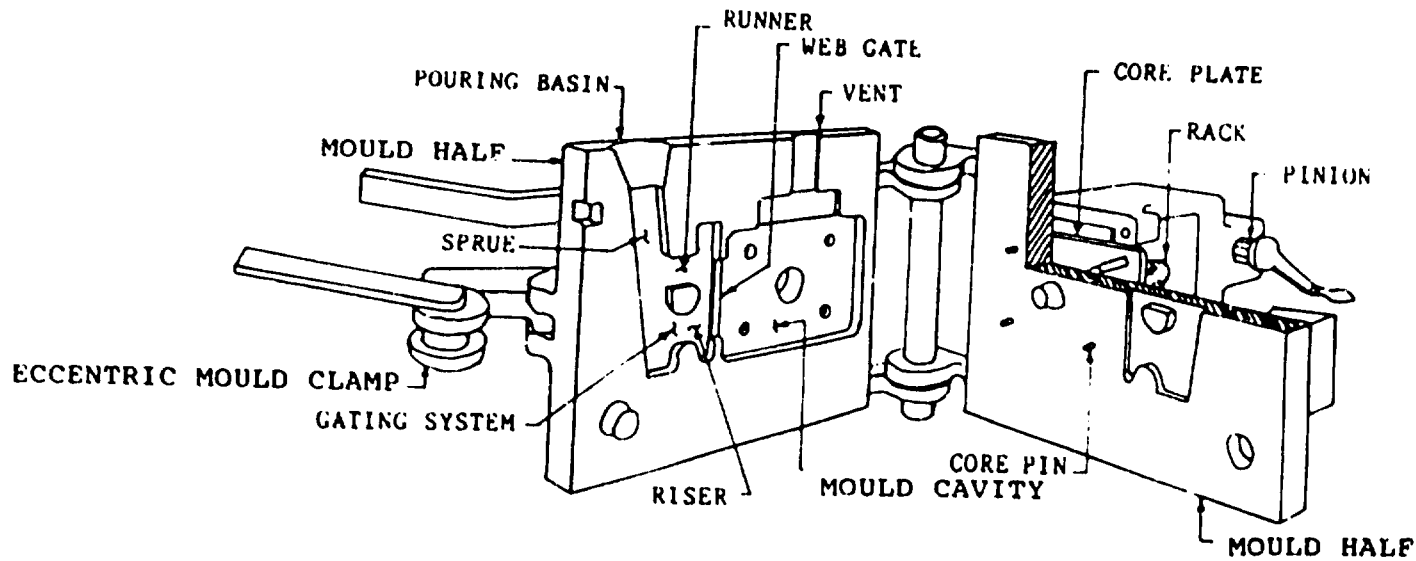
PROCESS FLOW CHART : DIE CASTING



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EXHIBIT : 27

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
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PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES
BOOK-TYPE MANUALLY OPERATED PERMANENT MOULD CASTING MACHINE

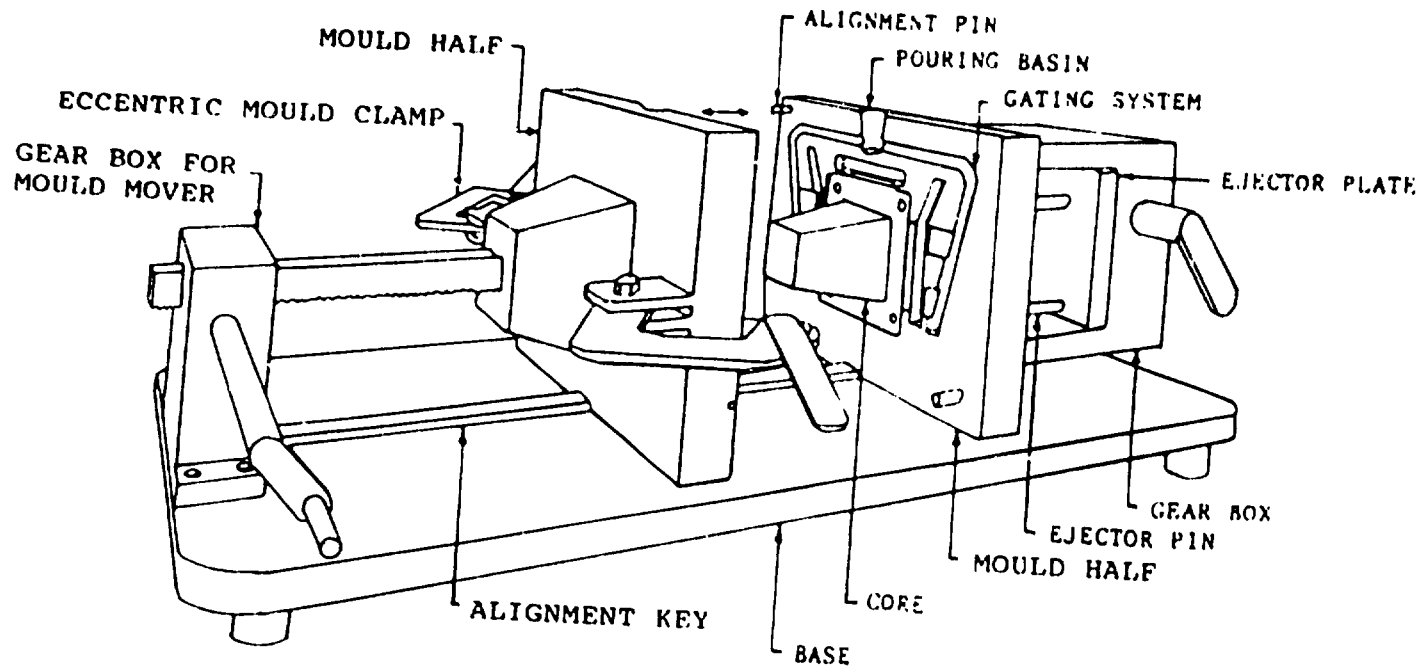


JOB NO. : DCIL-105

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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
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PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES
MANUALLY OPERATED PERMANENT MOULD CASTING MACHINE WITH STRAIGHT LINE RETRACTION



SECTION - 7
PLANT AND EQUIPMENT

PLANT AND EQUIPMENT

As mentioned in the Section on Market Analysis, the average annual demand for all types of overhead line accessories in the designated region during 1991-95 is estimated as about 27,000 TPA. This is estimated to grow to about 35,000 tonnes by 2010 AD. Product and operation-wise break-up of capacities of the recommended overhead line accessories plants is shown in Exhibit-29.

The total capacity has been fixed at 24,000 tonnes per annum, to be produced at two plants. While determining the capacities of the plants that will produce accessories, it is reckoned that by operating in two shifts these will be in a position to meet 90% of the estimated demand during the first 5-year period of 1991-95 and 70% of the demand envisaged during the last ten years, i.e., 2001-10.

Each plant will have the following facilities :

- o Aluminium Pressure Die Casting Shop
- o Forging Shop
- o Cast Iron Foundry
- o Forming and Fabrication Shop
- o Machine Shop, Tool Room and Die Repair Shop
- o Hot-dip Galvanising Shop
- o Quality Control and Material Testing Laboratory
- o Maintenance Shop
- o Auxiliary Equipment and Hand Tools Section

Each plant is designed, based on the following annual capacity :

o Aluminium Pressure Die Casting	900 Tonnes
o Steel Forging	3800 Tonnes
o Cast Iron Foundry	1000 Tonnes
o Aluminium and Steel Forming	2600 Tonnes
o Steel Fabrication	3900 Tonnes

Equipment for Aluminium Pressure Die Casting Foundry

The aluminium foundry has been provided with two induction melting furnaces, each with a 0.84 tonne crucible capacity. Two pressure die casting machines and two intermediate holding furnaces, each with a holding capacity of 0.84 tonne per hour have also been provided. The basis for selecting the above equipment is presented in Exhibit-30. All machines will be operated in two shifts.

Brief specifications of all major and auxiliary equipment along with their requirement of power, water, etc., are presented in Exhibit-31.

Equipment for Forging Shop

Forging shop has been provided with pneumatic hammers, power drop hammers, horizontal press, trimming press and other allied equipment. Brief specifications of these and material handling equipment are presented in Exhibit-32. The above Exhibit also shows the requirement of utilities such as power, water, etc. for each of the above equipment.

Pattern of material flow in the forging shop is shown in Exhibit-33.

Equipment for Cast Iron Foundry

The product-mix for the cast iron foundry shall be as follows :

- o Counter Weights and Jumper Weights (Cast Iron) 350 Tonnes
- o Vibration Damper Weights (Cast Iron) 600 Tonnes
- o Miscellaneous Items like Sockets, etc. (Ductile Iron) 50 Tonnes

In order to be able to achieve the above production targets, the foundry has been provided with two induction melting furnaces, each having crucible capacities of 0.81 tonne each. Besides, two sets of sand moulding machines, two heat treatment furnaces, a sand processing plant of 700 kg batch capacity, a shot blasting machine and allied equipment are also to be provided for. The plant is also provided with a sand and material testing laboratory. Basis of selection of the above equipment is presented in Exhibit-34.

Brief specifications of major and auxiliary equipment along with their power and water requirement are given in Exhibit-35.

As the types of castings made from the sand moulding process are few in number, requirement for the type of wooden patterns is also small. Thus, it is suggested that these be procured from external sources. However, necessary woodworking tools are being provided for repair of patterns, whenever needed.

The plant shall produce 50 tonnes of ductile iron castings annually. These castings will be made by the permanent mould process. These moulds shall be cast and machined in the plant itself.

Brief specifications of material handling equipment required in the plant are also presented in Exhibit-35. The flow of material in the foundry is shown in Exhibit-36.

Forming and Fabrication Shop

The forming and fabrication shop will manufacture the following types of items :

- o Cross-arms and brackets made of angle iron cross section
- o Yoke plates made of mild steel; mild steel plates will be cut to shape and size, and duly drilled
- o Earthing equipment like plates and pipes, cut to shape and size, and drilled
- o Guys made from steel wires. The steel wires will be cut to size and the ends spliced into loops
- o Armour rods which shall be made from aluminium wires, and cut to size
- o Corona shields and arcing horns, shall be made from aluminium tubes and pipes and bent to shape
- o Spacers shall be made from steel wires and bent into circular rings. Ends of the circular rings are to be joined by clamps. The steel wires shall be purchased from external sources, duly galvanised and stranded

- o Compression and mid-span joints comprising steel sleeves, aluminium sleeves and clamping wires - These items shall be cut to size from basic raw materials like tubes, sleeves and wires
- o Washers shall be punched from mild steel on to aluminium sheets

Brief specifications of the equipment required for manufacturing the above items are presented in Exhibit-37. It is observed that the above items will require a large volume of manual work. Accordingly, equipment like work benches, vises, surface plates, wire forming tools, hand oxy-acetylene cutting sets, welding sets, etc., that will be required have been specified later in this Section.

Most of the angles will require to be galvanised, facilities for which have been provided in the plant.

Machine Shop, Tool Room and Die Repair Shop

Most of the overhead line accessories need to be drilled after being cast, forged or fabricated. However, a few of them like nuts, bolts and stay rods will need turning and thread cutting. Considering the above requirement, the Machine Shop should include only drilling machines, automatic thread rolling machines, nut tappers and a turret lathe.

The plant will use a number of forging dies, pressure dies, casting moulds, permanent moulds for ductile castings, shearing and cropping blades, and a variety of drills, taps, thread rolling dies, etc. In order to repair and regrind the above mentioned tools, it is necessary that the plant should

be equipped with a number of machine tools like centre lathes, milling machines, die sinking machines, jig borers, surface and universal cylindrical grinders, etc. Exhibit-38 shows the equipment for the Machine Shop, Tool Room and Die repair Shop.

Hot-Dip Galvanising

All the overhead line accessories except for aluminium products are to be galvanised. An acid pickling tank with four chambers has been provided to pickle 8 tonnes of material. Cycle time for galvanising has been taken as 30 minutes. List of equipment required for Galvanising Shop is presented in Exhibit-39.

Quality Control and Material Testing Laboratory

To ensure that the accessories function as specified by the designer of the equipment, they must be made from raw material of good quality. This will enable them to fulfill the expected service requirements. Raw materials and finished products are to be tested before the manufacturer can provide assurance on product quality.

A material is tested to ascertain its physical and chemical properties. Physical properties of a material will, in general, include the following :

- o Tensile strength
- o Compression strength
- o Impact strength
- o Shearing strength
- o Bending strength
- o Elongation
- o Hardness

Chemical analysis involves testing of various amounts of elements present in a metal.

Apart from the above tests, metals are sometimes subjected to metallographic tests and/or non-destructive tests. In a metallographic test, the grain structure and the distribution pattern of various elements in the metal are observed. Non-destructive tests are carried out to detect the surface and sub-surface defects in castings and forgings, and some of the machined parts.

In the material testing laboratory, facilities to conduct various physical tests are provided. A material testing spectroscope and a carbon and sulphur analyser have also been provided to conduct chemical analysis of the molten metal from the induction furnace. Chemical analysis can be done for other material specimens also.

Non-destructive testing equipment like X-ray equipment, ultrasonic testing equipment and magnetic crack detectors have been provided to check castings and forgings for internal defects and sub-surface defects.

In addition to checking physical, chemical and mechanical properties of the components, it is necessary that each component is checked for its dimensional accuracy and surface finish. These are generally checked after every stage of the manufacturing process. For checking the profiles of various castings, forgings and machine parts, the plant will need a number of templates and gauges. These shall be made in the shop itself.

List of material testing equipment is presented in Exhibit-40. The measuring instruments have been listed in a separate Exhibit along with the hand tools.

Maintenance Shop

The overhead line accessories manufacturing plant is spread over a large area. The buildings include six main manufacturing shops, few utility centres, administrative building, etc. Each shop houses different types of equipment, and therefore has varying maintenance requirements. Considering the above factors, the plant maintenance function has been divided into two parts :

- o Central Maintenance Shop
- o Local Maintenance Centres

The function of the central maintenance shop will be to co-ordinate activities of the local maintenance centres as well as to provide help in terms of technical guidance and manpower in case of major break-down or major overhaul of the equipment. The central maintenance workshop shall also maintain utilities and their network. Maintenance of building, general environment and vehicles will be controlled by this department.

List of equipment required in the central maintenance shop is given in Exhibit-41. The central maintenance workshop is not provided with machine tools like lathes, drilling machine, shapers, etc. It is expected that such help, whenever required, shall be obtained from the machine shop, tool room or die-repair shop.

Each local maintenance centre shall be located in the individual manufacturing shop. These local centres will perform routine maintenance of the equipment in that shop. Each of these centres shall be equipped with maintenance kits and tools.

Auxiliary Equipment and Hand Tools

Each shop has been provided with a number of equipment for material handling. In estimating the type and number of shops, in-shop, intershop and intershop-store movement of materials have been given due consideration. Three forklift trucks, two inter-bay material transfer trollies, four hand push trollies and two trucks are prescribed for this purpose.

The requirement of these equipment has been determined, based on estimated number of unit load movements of materials. On this basis, the number of forklift trucks needed is estimated as two. This estimate is based on full load movement and may not be possible in all cases. Hence, another forklift truck has been provided which may serve as a standby.

Racks, wooden skids, pallets, bins, workers' benches, etc., are included for intermediate material storage and transfer of materials from shops to stores.

The above equipment along with their brief specifications are presented in Exhibit-42. Hand tools, measuring tools and other miscellaneous tools for production and maintenance needed for day-to-day operation are also presented in the same Exhibit.

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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
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PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

CAPACITY OF OVERHEAD LINE ACCESSORIES PLANT

(Figures in Tonnes)

Sl. No.	Type of Overhead Line Accessory	Capacity : Operation-wise						Capacity : Product-wise	
		Al Casting	Al Forming	Steel Forging	Steel Forming	Steel Fabrication	CI Casting		Cast-iron Casting
1.	Clamps and Yoke Plates	2020	22	10	-	562	-	26	2648
2.	Compression and Mid Span Joints	-	1679	-	50	-	-	-	1729
3.	Insulator Metallic Parts and its Protective Devices like Corona Shield Arcing Horn, etc.	-	63	6869	343	-	-	-	7275
4.	Spacer	190	-	-	443	-	-	-	633
5.	Armour Rods	-	2114	-	-	-	-	-	2114
6.	Vibration Damper, Counterweight and Jumper Weight	-	-	-	-	-	2785	-	2785
7.	Hardware								
	i) Nuts and Bolts	-	-	495	-	-	-	-	495
	ii) Socket, Clevis, Hooks, Shackles, Earthing Equipment and Other Miscellaneous Items	368	214	3168	-	740	-	122	4612
8.	Guy Wires	-	-	-	2594	-	-	-	2594
9.	Pole Fittings like Stay Rods, Washer Cross-arms, Staples, etc.	-	-	302	-	9719	-	-	10021
10.	Capacity Required	2578	4092	10844	3430	11027	2785	150	34906
11.	Capacity recommended for the region	1800	2800	7600	2400	7800	1900	100	24400
12.	Capacity of each plant	900	1400	3800	1200	3900	950	50	12200

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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
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PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

BASIS OF SELECTION OF MAJOR EQUIPMENT FOR
ALUMINIUM PRESSURE DIE CASTING FOUNDRY

1.	Annual demand for aluminium castings	1800 Tonnes
2.	Annual production load for each plant	900 Tonnes
3.	Annual requirement of sound casting	900 Tonnes
4.	Annual requirement of molten metal (on the basis of 45% yield)	2000 Tonnes
5.	Annual requirement of molten metal assuming a non-uniformity (diversity) factor of 1.15	2300 Tonnes
6.	No. of working days in a year	300
7.	Days allowed for routine repair of furnace	30
8.	Effective working days in a year	270
9.	Requirement of molten metal per day (assuming 80% efficiency)	10.7 Tonnes
10.	Requirement of molten metal per hour (two shift operation)	0.67 Tonnes
11.	Time presumed per heat (tap-to-tap time)	2 Hours
12.	Crucible capacity of the furnace (2 furnaces of 0.84 tonnes crucible capacity each)	1.34 Tonnes

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13.	Daily requirement of sound casting (assuming 85% utilisation)	3.92 Tonnes
14.	Average weight of each casting	2 kgs
15.	No. of castings per day	1960
16.	Time required for each casting	1.0 Minute
17.	Total time required	1960 Minutes
18.	Available working time in 16 hours	960 Minutes
19.	No. of die casting machines required	2

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PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

LIST OF EQUIPMENT FOR ALUMINIUM FOUNDRY

Sl. No.	Equipment	Brief Specifications	Nos. Required	Power Consumption (KW)	Water Requirement (Litres/Day)	Unit Price (US\$)	Total Price (US\$)
1.	Induction Furnace	Type : Main Frequency Coreless Induction Melting Furnace Output : 0.56 Tonnes/Hr Crucible Capacity : 0.84 Tonnes	2	640	10,880	2,20,800	4,41,600
2.	Die Casting Machine	Type : Horizontal, Cold Chamber fitted with Auto Die Spray equipped with Die-Heating and Lubricating Equipment Max. Shot Capacity : 6.8 kg Locking Force : 400 Tonnes	1	22.4	-	2,85,000	2,85,000

Sl. No.	Equipment	Brief Specifications	Nos. Required	Power Consumption (KW)	Water Requirement (Litrs/Day)	Unit Price (US\$)	Total Price (US\$)
3.	Die Casting Machine	Type : Horizontal Cold Chamber equipped with Die-Heating and Lubricating Equipment Max. Shot Capacity : 13.1 kg Locking Force : 660 Tonnes	1	44.7	-	4,01,450	4,01,450
4.	Pressure Die Casting Moulding Blocks, fully machined	Material : H 11 Silicon - 9.5% Manganese - 0.5% H 13 Copper - 3.5% Silicon - 9.0% Size of Die Block : 550 x 600 x 100 mm 660 x 700 x 300 mm	10 10	- -	- -	350 720	7,000 14,400
5.	Intermediate Holding Furnace	Max. Pouring Temperature : 750° C Holding Capacity : 0.84 Tonnes	1	17.1	10,880	1,40,000	2,80,000

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Sl. No.	Equipment	Brief Specifications	Nos. Required	Power Consumption (KW)	Water Requirement (Litrs/Day)	Unit Price (US\$)	Total Price (US\$)
6.	Foundry Laddles	Type : Carbon bonded Silicon Carbide					
		Capacity : 20 kg	10	-	-	1,700	17,000
		Capacity : 10 kg	10	-	-	1,400	14,000
7.	Vertical Metal Cutting Circular Band Saw (do all Saw)	Type : Contour Band Sawing Machine	3	11	-	49,000	1,47,000
		<u>Cutting Capacity</u>					
		Steel : 25 mm					
		Non-ferrous Metal : 150 mm					
		Size of Table : 600 mm x 600 mm					
8.	Trimming Press	Capacity : 250 tonnes	1	12	-	50,000	50,000
9.	Heat Treatment Furnace	Type : Electric Pit Forced Air Circulation	4	160	-	62,500	2,50,000
		Max. Temperature : 750° C					

Sl. No.	Equipment	Brief Specifications	Nos. Required	Power Consumption (KW)	Water Requirement (l./rs./Day)	Unit Price (US\$)	Total Price (US\$)
		<u>Useful Dimension</u>					
		Diameter : 1000 mm					
		Depth : 1500 mm					
10.	Shot Blasting Equipment	Batch Size : 750 kg Workload Capacity : 3.14 m ³ (Effective Volume)	1	15	-	40,000	40,000
11.	Pedestal Grinder	Type : Heavy duty double-ended Wheel Size : 450 x 75 x 150 mm	4	20	-	1,300	5,200
12.	Material Testing Spectroscope	Used for qualitative and quantitative analysis of aluminium samples using microphotometer and photographic plate or film for recording	1	-	-	500	500
13.	E.O.P. Crane	Type : Class iv Capacity (SWL) : 5 tonnes Span : 10.5 M	1	24	-	36,000	72,000

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Sl. No.	Equipment	Brief Specifications	Nos. Required	Power Consumption (KW)	Water Requirement (Litrs/Day)	Unit Price (US\$)	Total Price (US\$)
14.	Single Wheel Barrow	Capacity : 250 kg	2	-	-	150	300
15.	Push type Platform Trolley	Capacity : 500 kg	.	-	-	80	160
16.	Double Wheel Tipping Barrow	Type : Heavy Duty Capacity : 0.2 m ³	.	-	-	150	300
17.	Weighing Machine	Max. Weighing Capacity : 1000 kg	2	-	-	500	1,000
						TOTAL:	20,26,990

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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
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PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

LIST OF EQUIPMENT FOR FORGING SHOP

Sl. No.	Equipment	Brief Specifications	Nos. Required	Power Consumption (KW)	Water Requirement (Ltrs/Day)	Unit Price (US\$)	Total Price (US\$)
1.	Pneumatic Hammer	Force of Blow : 360 kg	1	10	10	68,700	68,700
2.	Power Drop Hammer	Full Blow Energy : 3600 kgm Weight of Falling Parts : 1200 kg	1	80	15	1,77,290	1,77,290
3.	Trimming Press	Capacity : 250 tonnes	1	13	-	39,000	78,000
4.	Pneumatic Hammer	Force of Blow : 690 kg	2	40	30	91,900	1,83,800
5.	Power Drop Hammer	Full Blow Energy : 7000 kgm Weight of Falling Parts : 2500 kg	2	120	30	2,10,000	2,10,000
6.	Trimming Press	Capacity : 315 tonnes	2	40	-	45,000	90,000

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Sl. No.	Equipment	Brief Specifications	Nos. required	Power Consumption (KW)	Water Requirement (Litrs./Day)	Unit Price (US\$)	Total Price (US\$)
7.	Forging and Trimming Die Blocks	Size : 600 x 600 x 150 mm	20	-	-	280	5,600
		900 x 900 x 200 mm	20	-	-	840	16,800
		450 x 450 x 100 mm	20	-	-	110	2,200
		300 x 300 x 100 mm	20	-	-	50	1,000
8.	Horizontal Forging Press	Capacity : 500 tonnes	1	10	20	22,000	22,000
9.	Bolt Making Equipment	Type : Double stroke solid die, cold heading machine with automatic head trimming arrangement.	1	10	-	18,000	18,000
		Length of Bolt : 12 - 125 mm					
		Dia of Bolt : 10 mm - 16 mm					
		Material : Mild steel					
10.	Nut Forming Machine	Type : Automatic cold forming, trimming and punching facilities.	1	10	-	16,000	16,000
		Dia of Nut : 10 mm - 16 mm					
		Material : Mild steel					

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Sl. No.	Equipment	Brief Specifications	Nos. Required	Power Consumption (KW)	Water Requirement (Litrs/Day)	Unit Price (US\$)	Total Price (US\$)
11.	Oil-fired Furnace	Size of Heating Chamber : 600 x 600 x 1500 mm	8	-	-	50,000	4,00,000
12.	Pedestal Grinder	Wheel Size : 400 x 50 x 127 mm Wheel Centre Distance : 745 mm	5	18	-	1,200	6,000
13.	Shot Blasting Equipment	Type : Apron Conveyor Barrel-Type Airless Blast Machine Batch Size : 750 kg Workload Capacity (Effective Volume) : 0.14 m ³	1	30	-	40,000	80,000
14.	Electric Heat Treatment Furnace	Temperature : 500 - 1050° C Size : 1000 x 600 x 1000 mm	7	630	-	65,000	4,55,000
15.	Abrasive Wheel Cutting Machine	Type : Dry Cutting with Pneumatic Chucking	1	15.0	-	15,000	15,000

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JOB NO. : DCIL-105

Sl. No.	Equipment	Brief Specifications	No. Required	Power Consumption (KW)	Water Requirement (litres/Day)	Unit Price (US\$)	Total Price (US\$)
<u>Cutting Capacity</u>							
	Solid Section	: 63 rs					
	Hollow Section	: 36 rs					
	Bevel Cut	: 45°					
16.	Circular Saw	Type : Semi-automatic	1	30	15	48,600	1,44,000
<u>Cutting Capacity</u>							
	Round	: 40-240 mm					
	Square	: 40-240 mm					
17.	Power Hacksaw	Type : Semi-automatic with hydraulically operated feed and automatic lift of blade on non-cutting stroke	1	10,000	10,000
<u>Cutting Capacity</u>							
	Round	: 40-240 mm					
	Square	: 40-240 mm					

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Sl. No.	Equipment	Brief Specifications	Nos. Required	Power Consumption (KW)	Water Requirement (Litrs/Day)	Unit Price (US\$)	Total Price (US\$)
18.	B.O.P. Crane	Type : Single girder Safe Working load : 3 Tonnes Span : 16 meters	1	10	-	25,000	25,000
19.	B.O.P. Crane	Type : Single girder Safe Working load : 3 Tonnes Span : 10 meters	1	10	-	21,000	21,000
20.	Single Wheelbarrow	Capacity : 250 kg	2	-	-	150	300
21.	Push Type Platform Trolley	Capacity : 500 kg	3	-	-	70	210
22.	Double Wheel Tipping Barrow	Type : Heavy duty Capacity : 0.2 m ³	2	-	-	100	200
						TOTAL	20,66,100

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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
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PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

MATERIAL FLOW IN FORGING SHOP

Sl. No.	Description of Movement	Mode of Transport	Unit Load (kgs)	No. of Unit Load Movements
1.	Bar stock from store to cut off machine	Crane	1500	9
2.	Cut stock to furnace	Trolley	400	18
3.	Trimming to Grinding/ Shot Blasting	Trolley	400	16
4.	Trimming to Heat Treatment	Trolley	400	12
5.	Heat Treatment to Shot Blasting	Trolley	400	12
6.	Die Setting	Crane	600	16
7.	To Store	Crane and Trolley	-	12
8.	Miscellaneous (Inspection, Consumables, Maintenance and Despatch)	Crane and Trolley	-	12

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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
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PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

BASIS OF SELECTION OF MAJOR EQUIPMENT
FOR CAST IRON FOUNDRY

Basic Data

1.	Annual demand for cast iron castings	2055 Tonnes
2.	Annual production load for each plant	1000 Tonnes
3.	Annual requirement of sound castings	1000 Tonnes
4.	Requirement of finished castings per day (Based on 270 working days, exclusive of 30 days required for routine maintenance of the furnace)	3.7 Tonnes
5.	Requirement of molten metal per day (based on 65% yield)	5.7 Tonnes

Melting Equipment

1.	No. of heats considered in 16 hours (4 hours tap to tap time)	4
2.	Crucible capacity of furnace	1.425 Tonnes
3.	Crucible Capacity selected	2 x 0.81 Tonnes

Sand Processing Plant

1.	Sand required per tonne of molten metal	7 Tonnes
2.	Sand required for 5.7 tonnes of molten metal	39.9 Tonnes

(A sand processing plant of 700 kg
batch capacity capable of processing
3-4 tonnes of sand per hour has been
provided. This shall operate for
2 shifts per day)

JOB NO. : DCIL-105

EXHIBIT : 34

Sand Moulding Machine

1. For Counter Weights and Jumper Weights

i)	Total weight of finished castings (annual)	350 Tonnes
ii)	Average weight of finished castings	25 kg
iii)	No. of finished castings per day (based on 270 working days)	52
iv)	No. of castings to be poured per day (based on 5% rejection)	55
v)	No. of flasks required	110
vi)	Time required to fill each flask	4 Minutes
vii)	Time required to fill 110 flasks	440 Minutes
viii)	Available time in 2 shifts (based on 60% efficiency)	576 Minutes
ix)	No. of moulding machines required	1

2. For Vibration Damper Weights

i)	Total weight of finished castings (annual)	600 Tonnes
ii)	Average weight of finished castings	3.5 kg
iii)	No. of finished castings per day (based on 270 working days)	634
iv)	No. of castings to be poured per day (based on 5% rejection)	667
v)	No. of castings that can be poured in one mould	3
vi)	No. of flasks required	446
vii)	Time required to fill each flask	3 Minutes
viii)	Time required to fill 446 flasks	1338 Minutes
ix)	Available time in 2 shifts (considering a 60% efficiency)	576 Minutes
x)	No. of machines required	2.32

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EXHIBIT : 34

Heat Treatment Furnace

- | | | |
|----|--|---------------------------|
| 1. | Annual requirement of ductile iron castings to be heat treated | 50 Tonnes |
| 2. | Daily requirement of castings to be heat treated (based on 270 working days) | .185 Tonnes |
| 3. | Floor loading rate of heat | 1.2 Tonnes/M ² |
| 4. | Floor area for 0.185 tonne of casting | 1540 cm ² |

Two heat treatment furnaces of chamber dimension 600 x 1800 x 900 mm has been provided.

Moulding Boxes

- | | | |
|----|---|----------------------------|
| 1. | For Counter Weights and Jumper Weights | |
| | i) Average weight of finished casting | 25 kg |
| | ii) Weight of molten metal to be poured (considering 70% yield) | 36 kg |
| | iii) Volume of molten metal | 4865 cc |
| | iv) Weight of sand in the mould | 144 kg |
| | v) Volume of sand | 57600 cc |
| | vi) Total volume of mould | 62465 cc |
| | vii) Volume of moulding box | 31233 cc |
| | viii) Size of moulding box | 560x450x150 mm
110 nos. |
| 2. | For Vibration Damper Weights | |
| | i) Average weight of finished castings | 3.5 kg |
| | ii) Weight of the molten metal to be poured in mould (assuming 70% yield) | 15 kg |
| | iii) Volume of molten metal | 2027 |

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EXHIBIT : 34

iv) Weight of the sand in the mould	60 kg
v) Volume of sand (cc)	24000
vi) Total volume of the mould	26027 cc
vii) Volume of each mould box	13014 cc
viii) Size of moulding box	450x355x100 mm 446 nos.

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EXHIBIT : 35

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
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PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

LIST OF EQUIPMENT FOR CAST IRON POUNDRY

Sl. No.	Equipment	Brief Specifications	Nos. Required	Power Consumption (KW)	Water Requirement (Litrs/Day)	Unit Price (US\$)	Total Price (US\$)
1.	Sand Preparation Plant	Type : Semi-automatic consisting of vibrating screen, magnetic separator, skip hoist, water meter, miller, aerator, charging hopper and dust hoods Batch Capacity : 700 kg Output : 4.0 to 4.5 Tonnes/hour	1	55	4000	1,10,000	1,10,000
2.	Sand Moulding Machine	Type : Pneumatically controlled, jolt-squeeze, pin lift type Max Plask Size : 650 x 450 x 150 mm	2	-	200	50,000	1,00,000
3.	Sand Moulding Machine	Type : Pneumatically controlled, jolt-squeeze, pin lift type Max Plask Size : 450 x 355 x 100 mm	2	-	200	45,000	90,000

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EXHIBIT : 35

Sl. No.	Equipment	Brief Specifications	Nos. Required	Power Consumption (KW)	Water Requirement (Litrs/Day)	Unit Price (US\$)	Total Price (US\$)
4.	Rotary Sand Dryer	Drying Capacity : 1.5 tonnes/hour	1	-	-	2,000	2,000
5.	Core Sand Mixer	Batch Capacity : 15 kg output per hour : 210 kg	1	1.4	50	4,000	4,000
6.	Core Blowing Machine	Table Size : 400 x 200 mm Weight of Core : 1 kg Sand Capacity of Blow Head : 1.4 kg	1	-	-	20,000	20,000
7.	Core Baking Oven	Type : Pneumatically operated and electrically heated Chamber Size : 450 x 450 x 100 mm	1	10	-	3,900	3,900
8.	Mould Filler and Ladle Preheater	Type : Foot operated Hand Pump Capacity : 2 litres of Kerosene oil	1	-	-	1,000	1,000

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EXHIBIT : 35

Sl. No.	Equipment	Brief Specifications	Nos. Required	Power Consumption (KW)	Water Requirement (Litrs/Day)	Unit Price (US\$)	Total Price (US\$)
9.	Mould Drying Oven	Type : Electrically heated with forced draught air circulation	1	74	-	12,000	12,000
		Chamber Size : 1700 x 3600 x 2000 mm					
10.	Moulding Box Pairs	Type : Welded steel construction with solid flanges and solid centre reinforcing ribs		-	-		
		Size : 560 x 450 x 150 mm	50	-	-	200	10,000
		Size : 450 x 355 x 100 mm	100	-	-	450	45,000
11.	Induction Melting Furnace	Type : Main frequency, coreless induction melting furnace	2	640	16640	1,90,000	3,80,000
		Crucible Capacity : 0.81 tonnes					
		Output : 0.66 tonnes/hour					
12.	Foundry Ladles	Type : Bottom pouring, crane lift with geared tilting mechanism	-	-	-		
		Capacity : 1000 kg	2	-	-	4,000	8,000
		500 kg	4	-	-	3,000	12,000
		100 kg	8	-	-	1,500	12,000
		50 kg	8	-	-	800	4,000

JOB NO. : DCTL-105

EXHIBIT : 35

Sl. No.	Equipment	Brief Specifications	Nos. Required	Power Consumption (KW)	Water Requirement (Liters/Day)	Unit Price (US\$)	Total Price (US\$)
13.	Shake out Machine	Size of Screen : 1500 x 1000 mm Load Lifting Capacity : 3000 kg	1	9	-	20,000	20,000
14.	Shot Blasting Machine	Type : rillens, swing table, airless blasting type with dust exhaust unit Workload Capacity of table : 500 kgs Flow Rate for each blasting unit : 160 kgs/minute Initial Charge : 250 kgs	1	11	-	38,000	38,000
15.	Rotary Blast Barrel	Barrel Dia : 1000 mm Length : 1200 mm Capacity : 300 kg	1	9	-	25,000	25,000

JOB NO. : DCIL-105

EXHIBIT : 35

Sl. No.	Equipment	Brief Specifications	Nos. Required	Power Consumption (KW)	Water Requirement (Litrs/Day)	Unit Price (US\$)	Total Price (US\$)
16.	Heat Treatment Furnace	Type : Electrically heated, batch type bogie hearth furnace Chamber Dia : 600 x 1800 x 900 mm Heat Treatment Temperature : 1100° C Max Furnace Temperature : 1150° C	1	90	-	55,000	55,000
17.	Heavy Duty Pedestal Grinding Machine	Type : Double ended Wheel Size : 450 x 75 x 150 mm	3	..	-	1,500	4,500
18.	Cut-off Machine	Type : Dry cutting with Pneumatic chucking <u>Cutting Capacity</u> Solid Section : 63 mm Hollow Section : 40 mm Bevel Cut : 45°	1	18.5	-	35,000	35,000

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JOB NO. : DCIL-105

EXHIBIT : 35

Sl. No.	Equipment	Brief Specifications	Nos. Required	Power Consumption (KW)	Water Requirement (Litrs/Day)	Unit Price (US\$)	Total Price (US\$)
19.	Laboratory Type Sand Mixer	Sand Charge : 6 kgs Pan Size : 465 mm Height : 290 mm	1	1	-	2,000	2,000
20.	Laboratory Type Sand Washer	Capacity of Glass Jar : 1 litre No. of Jaws : 4	1	0.1	-	1,200	1,200
21.	Laboratory Type Sand Grinder	Sand Sample Weight : 50 gms No. of Sieve Rockings per Minute : 100	1	0.1	-	2,500	2,500
22.	Laboratory Type Tester	Size of Specimen : 50 mm x Height 50 mm Height of Mallet : 50 x 0.2 mm	1	-	-	1,200	1,200

JOB NO. : DCIC-105

EXHIBIT : 35

Sl. No.	Equipment	Brief Specifications	Qty. Required	Power Consumption (KW)	Water Requirement (liters/day)	Unit Price (US\$)	Total Price (US\$)
23.	Moulding Sand Permeability Meter	Air Drum Pressure : 10 ± 0.1 cm water column Amount of Air Forced through Specimen : 2000 cu cm	1	-	-	1,500	1,500
24.	Sand Mixer Moisture Tester	Type : Infra-red lamp Pan Dia : 80 mm Sample Weight : 10 gm	2	-	-	600	1,200
25.	Dry Mould and Core Hardness Tester	Max Hardness Value : 100 units	2	-	-	600	1,200
26.	Green Mould Hardness Tester	Ball Tip Dia : 10 mm Pressure of Ball Tip : 1.1 ± 0.1 kg Max. Hardness Value : 100 units	2	-	-	250	500

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EXHIBIT : 35

Sl. No.	Equipment	Brief Specifications	Nos. Required	Power Consumption (KW)	Water Requirement (Litrs/Day)	Unit Price (US\$)	Total Price (US\$)
27.	Universal Sand Strength Testing Machine	<p>The Machine shall be designed for conducting tensile, compression, bending and shear strength tests of green and dry moulding sand mixtures</p> <p>Max Force on Upper bracket : 140 kgs</p> <p>Min Force on Lower bracket : 28 kgs</p>	1	-	-	4,500	4,500
28.	Revolving Rack Oven	No. of Cylindrical Specimens Loaded into Ovens : 50	1	4.8	-	3,000	3,000
29.	Apparatus for determination of Carbon and Sulphur	<p>Used for quantitative determination of carbon and sulphur</p> <p>Max Carbon Content : 4.5%</p> <p>Max Sulphur Content : 0.15%</p>	1	-	-	600	600

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EXHIBIT : 35

Sl. No.	Equipment	Brief Specifications	Nos. Required	Power Consumption (KW)	Water Requirement (liters/day)	Unit Price (US\$)	Total Price (US\$)
30.	Heavy Duty Transformer Arc Welding	Type : Single operator, oil cooled A.C. welding set Welding Current Range : 100 - 800 amps	1	64	-	2,575	5,150
31.	Underground Belt Conveyor	The conveyor shall be designed to carry burnt sand from shaking unit to sand preparation plant					
		1) Width of Belt : 600 mm Centre Distance: 20 m Capacity : 5 tons/hour	1	5	-	6,000	6,000
		2) Width of Belt : 600 mm Centre Distance: 15 m Capacity : 5 tons/hour	1	5	-	6,000	6,000
32.	Gravity Roller Conveyor	1) Length of Track: 12 m Width of Track : 900 mm	4	-	-	12,000	48,000

JOB NO. : DCIL-105

EXHIBIT : 35

Sl. No.	Equipment	Brief Specifications	Nos. Required	Power Consumption (KW)	Water Requirement (Ltrs/Day)	Unit Price (US\$)	Total Price (US\$)
		Max Weight of : 650 kg Flask					
		Size of Plank : 1000 x 800 x 350 mm					
		ii) Total length : 42 m of Track	2	-	-	14,000	28,000
		Width of Track : 600 mm					
		Max Weight of : 500 kgs Moulding Box					
		Size of Mould- : 500 x 400 x 400 mm ing Box					
		No. of Right : 2 Angle Bends					
		iii) Length of Track: 36 m	1	-	-	15,000	15,000
		Width of Track : 900 mm					
		Max Weight of : 1500 kgs Moulding Box					
		Max Size of : 1000 x 500 x 700 mm Moulding Box					

JOB NO. : DCIL-105

EXHIBIT : 35

Sl. No.	Equipment	Brief Specifications	Nos. Required	Power Consumption (KW)	Water Requirement (Ltrs/Day)	Unit Price (US\$)	Total Price (US\$)
		iv) Type : Bench type	4	-	-	12,000	48,000
		Length of Track : 12 m					
		Width of Track : 600 mm					
		Max Unit load : 125 kgs					
		Size of each Unit : 1000 x 800 x 700 mm					
33.	Sand Storage Bins	Mild steel fabricated bins with opening at the bottom	15	-	-	1,000	15,000
		i) Capacity : 1.5 tons					
		Size : 1500 x 1000 x 800 mm					
		ii) Capacity : 1 ton					
		Size : 1200 x 750 x 600 mm					
34.	E.O.T. Crane	Class : IV	1	??	-	40,000	40,000
		Capacity : 5 tonnes					

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EXHIBIT : 35

Sl. No.	Equipment	Brief Specifications	Nos. Required	Power Consumption (Kwh)	Water Requirement (Litrs/Day)	Unit Price (US\$)	Total Price (US\$)
		Span : 16 meters					
		Lifting Height : 8 meters					
35.	E.O.T. Crane	Class : IV	1	10	-	22,000	22,000
		Capacity : 3 Tonnes					
		Span : 10.5 meters					
36.	Portable Jib Crane	Type : Winch type	1	-	-	25,000	25,000
		Safe Working Load : 1.5 tons					
		Lift from Ground : 2104 mm Level					
		Overall Height : 2762 mm					
37.	Electric Operated Mono Rail with Pulley Block	Capacity : 3 tons	1	-	-	2,500	2,500
		Lift : 3 m					
		Pull on Hand Chain : 24 kgs					
		Track length : 48 m					

JOB NO. : DCIL-105

EXHIBIT : 35

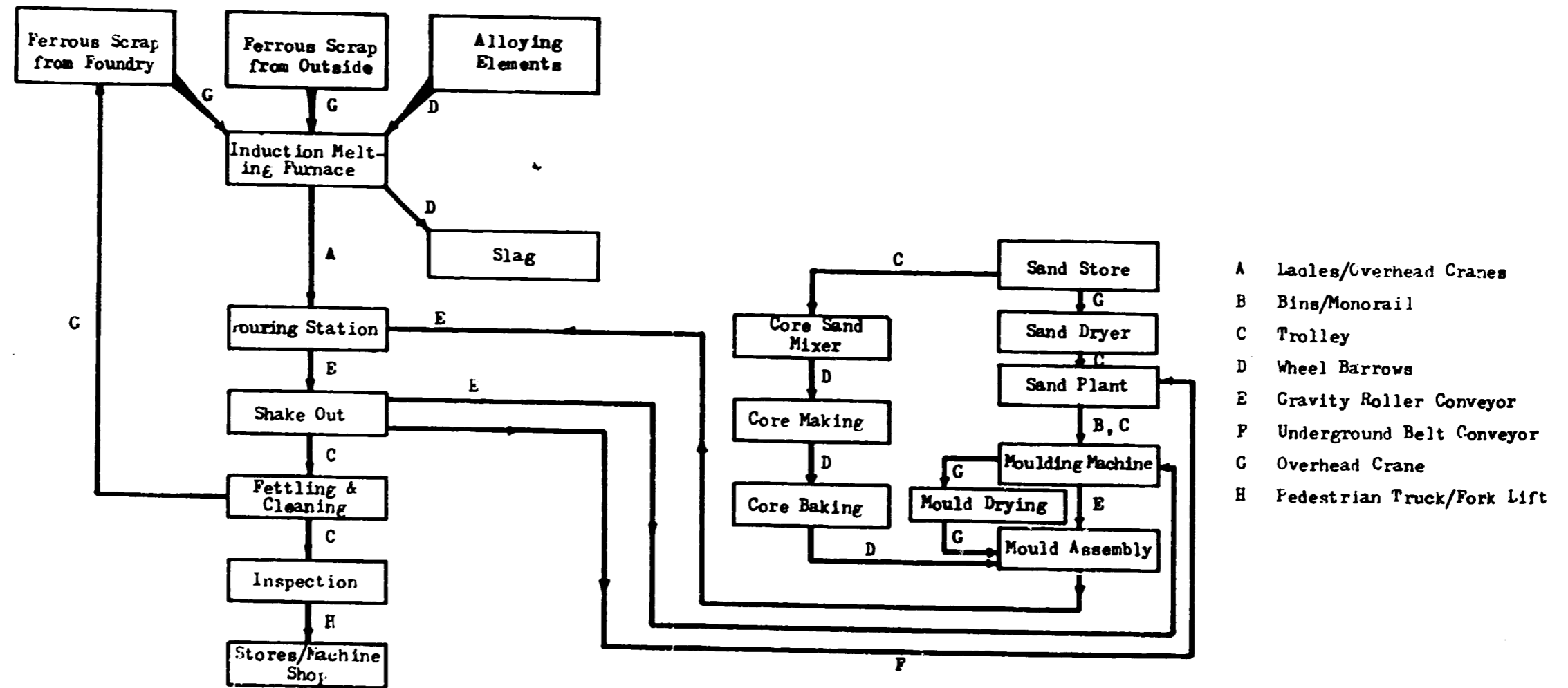
Sl. No.	Equipment	Brief Specifications	Nos. Required	Power Consumption (KW)	Water Requirement (LLrs/Day)	Unit Price (US\$)	Total Price (US\$)
38.	Single Wheel Barrow	Capacity : 250 kg	2	-	-	200	400
39.	Double Wheel Barrow	Type : Heavy Duty	2	-	-	250	500
		Capacity : 0.2 m ³					
40.	Push Type Platform Trolley	Capacity : 500 kg	2	-	-	200	400
41.	Trolley	Capacity : 250 kg	2	-	-	250	500
42.	Charge Loading Buckets	Capacity : 250 kg	2	-	-	200	400
43.	Tray Type Trolley	Capacity : 250 kg	2	-	-	250	500
44.	Portable Platform weighing Scale	Type : Arm Type	2	-	-		
		weighing Capacity : 1000 Kg				500	1,000
		: 500 Kg				300	300
TOTAL							12,75,450

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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
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PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

EXHIBIT : 36

MATERIAL FLOW IN CAST IRON FOUNDRY



JOB NO. : DCIL-105

REMITT : 37

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
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PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

LIST OF EQUIPMENT FOR FABRICATION SHOP

Sl. No.	Equipment	Brief Specifications	No. Required	Power Consumption (KW)	Unit Price (US\$)	Total Price (US\$)
1.	Universal Punching, Cropping, Shearing and Notching Machine	Max Capacity : 80 x 80 x 10 mm to cut Angles	2	5.0	47000	94000
2.	Abrasive Cut off Machine	Type : Dry cutting with pneumatic chucking <u>Cutting Capacity</u> Solid Section : Dia 63 mm Hollow Section : Dia 80 mm Bevel Cut : 45°	1	18.5	35000	35000
3.	Wire Straightening and Cutting of Machine	Max Thickness of Wire : 3 - 10 mm Length of Wire to Cut Automatically : 30 - 1000 mm	1	2.5	17000	17000
4.	Guillotine Shearing Machine	Type : Hydraulic Max Shearing Thickness : 10 mm in Mild Steel Shearing Length : 2500 mm	1	22.5	54500	54500
5.	Oxy-acetylene Profile Cutting Machine	Type : Cross Carriage Profile Cutting Machine Cutting Area : Any profile within a rectangle of 785 x 660 mm	1	0.75	18000	18000

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EXHIBIT : 37

Sl. No.	Equipment	Brief Specifications	Qty. Required	Power Consumption (KW)	Unit Price (US\$)	Total Price (US\$)
		Length : Largest straight cut of 1800 mm				
		Thickness : Up to 75 mm in Mild Steel				
6.	Vertical Metal Cutting Circular Band Saw (Do all Saw)	Type : Contour Band Sawing Machine <u>Cutting Capacity</u> Steel : 25 mm Non-ferrous Metal : 150 mm Size of Table : 600 x 600 mm	1	4.0	45000	45000
7.	Hydraulic Press	Type : Open throat type Capacity : 60 tonnes	1	7.5	3500	3500
8.	Arbour Press	Type : Compound hand type lever press Pressure : 22.7 tonnes	1	-	2500	2500
9.	Marking Press	Type : Hydraulic Capacity : 70 tonnes Marking : 8 letters at a time Marking Time : 30 seconds	2	15.0	4970	9940
10.	Pedestal Grinder	Type : Double ended Size of Grinding Wheel: 254 x 38 x 102 mm Wheel Centre Distance : 645 mm	4	6.0	1200	4800

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EXHIBIT : 37

Sl. No.	Equipment	Brief Specifications	Qty. Required	Power Consumption (KW)	Unit Price (US\$)	Total Price (US\$)
11.	Pipe Bending Machine	Type : Rotary Draw Type Bending Capacity : 3.5 to 50 mm	1	3.0	40000	40000
12.	Section Bending Machine	<u>Bending Capacity</u> Angles : 70 x 70 x 6 mm Channels : 100 x 50 mm Joist : 100 x 20 mm Square or Round Bars : Dia 20 mm Plats : 100 x 10 mm	1	6.0	49000	49000
13.	Plate Bending Rolls	Max Thickness of Plate: 10 mm Max Width of Plate : 1250 mm	1	5.0	48300	48300
14.	Pipe and Bolt Threading Machine	Pipe Threading : Dia 3 - 50 mm Rod Threading : Dia 6 - 50 mm	1	1.5	1680	1680
15.	Radial Drilling Machine with Tapping Attachment	Max Drilling Capacity : 25 mm in Steel Max Drilling Radius : 755 mm Min Table Dia : 330 mm	4	4.0	15000	60000
16.	Punching Press	Max Capacity : 10 Tonnes	6	10.0	4500	27000
17.	Deep Throat Swagging and Closing Machine	Max Capacity in Mild Steel : 60 SWG Depth of Gap to Gauge : 450 mm	1	1.5	7500	7500

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EXHIBIT : 37

Sl. No.	Equipment	Brief Specifications	No. Required	Power Consumption (KW)	Unit Price (US\$)	Total Price (US\$)
		Working Centre of Spindle : 75 mm				
18.	Transformer Arc Welding Set	Welding Current Range : 70 - 450 amp	2	24.0	655	1310
19.	MIG Welding Set	Welding Current : 250 amp	2	19.0	2400	4800
20.	D C Welding Set	Welding Current Range : 55 - 300 amp	1	18.0	2200	2200
21.	Surface Plate	Surface plate made of closed grain cast iron of 200 BHN sturdy angle iron frame and adjusting jacks Top Surface Size : 2000 x 1000 mm Overall Height of the Table : 286 mm	2	-	50	100
22.	E.O.T. Crane	Capacity : 5 tonnes Span : 16.0 M Class : III	1	12.0	37800	37800
23.	E.O.T. Crane	Capacity : 3 tonnes Span : 10.5 M Class : III	1	10.0	22000	22000
24.	Trolley	Unit Load : 200 kg	6	-	70	420
					TOTAL	586350

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EXHIBIT : 38

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANISATION
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PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

LIST OF EQUIPMENT FOR MACHINE SHOP, TOOL ROOM AND DIE REPAIR SHOP

Sl. No.	Equipment	Brief Specifications	Nos. Required	Power Consumption (KW)	Water Requirement (Litrs/Day)	Unit Price (US\$)	Total Price (US\$)
1.	Radial Drilling Machine with Tapping Arrangement	Max Drilling Capacity : 25 mm in Steel Max Drilling Radius : 755 mm Min Drilling Radius : 275 mm Table Diameter : 330 mm	6	6	18	26,000	1,56,000
2.	Column Drilling Machine with Tapping Arrangement	Max Drilling Capacity : 40 mm in Steel Table Size : 435 x 530 mm	6	22	25	2,000	12,000
3.	Centre Lathe	Centre Height : 260 mm Centre Distance : 3000 mm	1	11	7	32,440	32,440

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EXHIBIT : 30

Sl. No.	Equipment	Brief Specifications	Nos. Required	Power Consumption (KW)	Water Requirement (LLrs/Day)	Unit Price (US\$)	Total Price (US\$)
4.	Centre Lathe	Centre Height : 170 mm	1	7.5	7	17,900	17,900
		Centre Distance : 1000 mm					
5.	Turret Lathe	Max Swing Over Bed : 444 mm	1	8.3	7	39,570	39,570
		Max Distance between Spindle Nose and Turret Face : 1117 mm					
		Dia of Hole Through Spindle : 67 mm					
		<u>Chuck Admit</u>					
		Circular Bar : Dia 64 mm					
Hexagonal Bar : Dia 54.8 mm							
		Square Bar : 44.8 mm					
6.	Shaping Machine	Stroke Length : 630 mm	1	7.5	-	43,000	43,000
		Table Size : 630 x 400 mm					

Sl. No.	Equipment	Brief Specifications	Nos. Required	Power Consumption (KW)	Water Requirement (Ltrs/Day)	Unit Price (US\$)	Total Price (US\$)
7.	Shaping Machine	Stroke Length : 450 mm Table Size : 450 x 355	1	4	-	39,000	39,000
8.	Universal Milling Machine	Table Size : 1350 x 310 mm <u>Table Traverse</u> Longitudinal : 800 mm Cross : 265 mm Vertical : 400 mm	1	5.5	8	21,000	21,000
9.	Vertical Milling Machine	Table Size : 1070 x 230 mm <u>Table Traverse</u> Longitudinal : 560 mm Cross : 275 mm Vertical : 350 mm	1	3.0	8	13,700	13,700

JOB NO. : DCIL-105

EXHIBIT : 38

Sl. No.	Equipment	Brief Specifications	Nos. Required	Power Consumption (KW)	Water Requirement (litrs/Day)	Unit Price (US\$)	Total Price (US\$)
10.	Fine Boring Machine	Type : Vertical	1	11.0	-	9,000	9,000
		Useful Table Area : 400 x 630 mm					
		Reading Accuracy : 0.001 mm					
		Positioning Accuracy : 0.003 mm					
		Bore Tolerance : 175/176 (ISC Standard)					
11.	Slotting Machine	Slotting Length : 200 mm	1	6.0	5	6,000	6,000
		Table Dia : 800 mm					
12.	Power Hacksaw	Cuts Round Material upto : 225 mm	1	0.75	-	1,700	1,700
		Cuts Square Material upto : 200 mm					
13.	Automatic Cold Thread Rolling Machine	Type : Flat die arrangement to cut metric, BSW, UN, UNC and UNF threads	1	6	-	1,800	1,800

JOB NO. : DCIL-105

EXHIBIT : 38

Sl. No.	Equipment	Brief Specifications	Nos. Required	Power Consumption (KW)	Water Requirement (Litrs/Day)	Unit Price (US\$)	Total Price (US\$)
		<u>Mild Steel Bolt Size</u>					
		Length : 25 - 100 mm					
		Dia : 10 - 16 mm					
14.	Automatic Nut Tapper	Type : Horizontal fitted with lead screw mechanism, feeding and collecting devices, to cut metric, BSW, DIN, UNC and UNF threads	1	5	-	1,200	1,200
		Mild Steel Nut Dia : 16 - 32 mm					
15.	Arbour Press	Type : Compound hand type lever press	1	-	-	3,000	3,000
		Pressure : 22.7 tonnes					
16.	Abrasive Belt Grinder	Belt Size : 150 x 1219 mm	2	3	-	1,500	3,000
		Work Surface : 150 x 250 mm					

JOB NO. : DCIL-105

EXHIBIT : 30

Sl. No.	Equipment	Brief Specifications	Nos. Required	Power Consumption (KW)	Water Requirement (Litres/Day)	Unit Price (US\$)	Total Price (US\$)
17.	Universal Tool and Cutter Grinder	Max Swing Dia : 280 mm Length between Tail Stock Centres : 760 mm Working Surface : 980 x 140 mm	1	1	-	2,000	2,000
18.	Bench Grinder	Wheel Size : 250 x 25 x 25 mm	4	4	-	1,000	4,000
19.	Drill Point Grinder	Size of Drill to be ground : 6 - 50 mm Included Point Angles : 90° - 150° to be ground	3	6	-	1,100	3,300
20.	Electronic Die Sinking Machine	Table Size (Clamping Area) : 2020 x 635 mm	1	7.5	-	2,000	2,000
21.	Carbide Tool Lapping Machine	Wheel Size : 175 x 20 x 35	1	0.6	-	1,800	1,800

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EXHIBIT : 30

Sl. No.	Equipment	Brief Specifications	Nos. Required	Power Consumption (KW)	Water Requirement (Litrs/Day)	Unit Price (US\$)	Total Price (US\$)
22.	Circular Saw Sharpening Machine	<p>Dia of Circular Saw : 300 mm</p> <p>Dia of Grinding Wheel : 254 mm</p> <p>Grinding Capacity : 30/60 teeth per minute</p>	1	1.2	-	1,300	1,300
23.	Universal Internal and External Grinder	<p>Height of Centres : 175 mm</p> <p>Distance between Centres : 625 mm</p> <p>Internal Grinding Dia : 25 - 200 mm</p> <p>Depth of Grinding : 125 - 200 mm</p>	1	5.0	-	2,500	2,500
24.	Flexible Shaft Grinder	<p>Type : Motor swivel suspension and flexible shaft type two speed grinder</p> <p>Max Size of Grinding Wheel : 100 x 10 mm</p>	2	1.0	-	1,800	3,600

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Sl. No.	Equipment	Brief Specifications	No. Required	Power Consumption (KW)	Water Requirement (Litrs/Day)	Unit Price (US\$)	Total Price (US\$)
25.	Heat Treatment Furnace with Quenching Tank	Type : Electrically heated, batch type, bogie hearth furnace Chamber Dimension : 300 x 300 x 150 mm Temperature Range : 700 - 1250° C Cycle Time for Heating to Full Temperature : 2 hours	1	7.0	-	48,000	48,000
26.	Welding Set for Hard Facing	Welding Current : 350 A	1	14	-	1,600	1,600
27.	Transformer Welding Set	Current : 500 A	1	40	-	2,100	2,100
28.	Surface Grinder	Type : Hydraulically operated vertical surface grinder Table Clamping Area : 300 x 1500 mm Max Grinding Width : 300 mm Max Table Load : 400 kg	1	15	-	1,000	1,000

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EXHIBIT : 38

Sl. No.	Equipment	Brief Specifications	Nos. Required	Power Consumption (KW)	Water Requirement (Ltrs/Day)	Unit Price (\$)	Total Price (\$)
29.	Spray Metallizing Equipment	<p>Size of Spraying Wires : 0.8 to 4 mm</p> <p>Spraying Metals : Copper, Aluminium, Nickel-Copper, Brass, Molybdenum, lead, etc.</p> <p>Drive : Air turbine</p>	1	-	-	800	800
30.	E.O.P. Crane	<p>Capacity : 5 Tonnes</p> <p>Span : 16 M</p> <p>Class : III</p>	2	24	-	39,000	78,000
31.	Hand Push Trolley	Capacity : 200 kg	4	-	-	50	200
32.	Single Wheel Barrow	Capacity : 200 kgs	2	-	-	80	160
						5,52,670	

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EXHIBIT : 39

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PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

LIST OF EQUIPMENT FOR GALVANISING SHOP

Sl. No.	Equipment	Brief Specifications	Nos. Required	Power Consumption (KW)	Water Requirement (Litrs/Day)	Unit Price (US\$)	Total Price (US\$)
1.	E.O.T. Crane	Type : Single Girder Class : III Capacity : 3 Tonnes Span : 10.5	1	10	-	22,000	22,000
2.	Acid Pickling Tank	Type : Cement construction provided with oil-fired heating facilities and temperature control device Size : 20 m x 1.5 m x 1.5 m (in 4 compartments)	1	-	1,35,000	15,000	15,000

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Sl. No.	Equipment	Brief Specifications	Nos. Required	Power Consumption (KW)	Water Requirement (Litrs/Day)	Unit Price (US\$)	Total Price (US\$)
3.	Water Rinsing Tank	Type : Cement construction provided with water sprinkler, oil-fired heating facilities and temperature control device Size : 10 m x 1.5 m x 1.5 m	1	-	-	14,000	14,000
4.	Galvanising Tank	Type : Construction of boiler plate of (ASTM - A129) with suitable inner lining of firebrick or ceramic material provided with oil-fired heating facilities and temperature control devices Size : 5 m x 1.5 m x 1.5 m	1	-	-	9,000	9,000
5.	Cooling Water Tank	Type : Cement construction Size : 5 m x 1.5 m x 1.5 m	1	-	67,500	1,800	1,800
						TOTAL	61,800

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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANISATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

EQUIPMENT LIST FOR MATERIAL TESTING LABORATORY

Sl. No.	Equipment	Brief Specifications	Nos. Required	Power Consumption (KW)	Unit Price (\$)	Total Price (\$)
1.	Brinell Hardness Testing Machine	Type : Power operated Applied Load : 250 - 3000 kgs	1	1.0	11,170	11,170
2.	Rockwell Hardness Testing Machine	The machine shall use both steel ball and diamond cone Minor Load : 10 kg Major Load : 100 kg, 150 kg	1	1.0	9,080	9,080
3.	Portable Hardness Tester	Type : Poldi type hardness tester (ferrous and non-ferrous consisting of tester, standard test bar and measuring magnifiscope Indenter : 10 mm dia Brinell Ball	1	-	500	500
4.	Universal Testing Machine	Type : Hydraulically loaded Capacity : 60 tonnes	1	4.0	15,000	15,000
5.	Impact Testing Machine	Type : Pendulum type impact tester chirpy system <u>Capacity</u> With Complementary Weights : 30 kgs Without Complementary Weights : 15 kgs	1	1.0	1,000	1,000

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Sl. No.	Equipment	Brief Specifications	Nos. Required	Power Consumption (KW)	Unit Price (\$)	Total Price (\$)
6.	Metallographic Specimen Mounting Bakelite Press	Capacity : 8 tonnes	1	1.0	800	800
7.	Surface Grinder	Type : Swing type, floor model with cup wheel <u>Sample Size</u> Diameter : 30 - 50 mm Thickness : 3 - 35 mm	1	2.0	50	50
8.	Specimen Grinding and Polishing Machine for Metallography	Disc Size : 200 mm	1	1.0	500	500
9.	Electrolytic Polishing Apparatus	Type : Laboratory type, electrolytic polishing apparatus Max Sample Diameter : 250 mm Max Sample Height : 40 mm	1	1.0	200	200
10.	Metallographic Microscope	Type : Projection-cum-Photo-micrograph laboratory type microscope Magnification : 50 - 1800 dia	1	-	100	100
11.	Material Testing Spectroscope	Used for qualitative and quantitative analysis of samples using microphotometer and photographic plate or film for recording	1	-	500	500

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EXHIBIT : 40

Sl. No.	Equipment	Brief Specifications	Nos. Required	Power Consumption (KW)	Unit Price (\$)	Total Price (\$)
12.	Apparatus for Determination of Carbon and Sulphur	Max Carbon Content : 4.5% Max Sulphur Content : 0.15%	1	-	100	100
13.	Bench Drilling Machine	Dia of Hole : 13 mm Table Size : 350 x 50 mm	1	0.6	3,000	3,000
14.	Electric Muffle Furnace	Type : Laboratory Dimension : 475 x 175 x 175 mm	1	5.0	2,000	2,000
15.	Portable X-Ray Equipment	Type : Industrial Max Thickness : 100 mm Sensitivity : 1 - 2 %	1	-	600	600
16.	Ultrasonic Testing Equipment	Type : Ultrasonic, pulse reflection, portable type Measuring Range : 1 - 1000 cm in Steel Frequency Range : 0.5 - 10 Mc/s	1	-	26,000	26,000
17.	Magnetic Crack Detector	The detector shall produce both longitudinal and circular magnetic fields Current Range : 250 - 1200 amps Voltage Range : 4 - 8 volts	1	-	21,390	21,390

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Sl. No.	Equipment	Brief Specifications	Nos. Required	Power Consumption (KW)	Unit Price (\$)	Total Price (\$)
18.	Abrasive Cutting Machine	Type : Submerged type, wet oscillating cutting machine for laboratory use Max Cutting Capacity : 196 mm Dia of Cutting Wheel : 450 mm	1	12.0	8,000	8,000
19.	Weighing Machine	Type : Micro analytical balance Capacity : 20 gms Sensitivity per Scale Division : 0.01 mg	1	-	100	100
20.	Weighing Machine	Type : Analytical balance Capacity : 200 gms Sensitivity : 0.1 mg	1	-	150	150
						1,00,320

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PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

LIST OF EQUIPMENT FOR CENTRAL MAINTENANCE SHOP

Sl. No.	Equipment	Brief Specifications	Nos. Required	Power Consumption (KW)	Total Price (US\$)
1.	Hydraulic Jack	<p>Type : Remote Control pumping unit with screwed ram and safety lock, operating handle and high pressure metallic tube connection to feed oil</p> <p>Capacity : 10 Tonnes</p> <p>Closed Height : 298 mm</p> <p>Hydraulic Lift : 150 mm</p> <p>Max. Height : 448 mm</p>	4	-	800
2.	Screw Jack	<p>Type : Ratchet type, lifting and traversing screw jacks</p> <p>Capacity : 5 Tonnes</p> <p>Closed Height : 500 mm</p> <p>Lift : 200 mm</p> <p>Dia of Head : 88 mm</p>	4	-	1,200
3.	Chain Pulley Block	<p>Type : Balanced Spur Gear Fixed Mounting</p> <p>Load Capacity : 2 Tonnes SWL</p> <p>Lift : 3 m</p>	2	-	300

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Sl. No.	Equipment	Brief Specifications	Qty. Required	Power Consumption (kW)	Total Price (US\$)
4.	Collapsible Ladder	Type : Self-supporting extendable all-Aluminium Ladder Closed Height : 5 m Extended Height : 9 m	2	-	300
5.	Pressure Gauge	Pressure Range : 0-100 kg/cm ²	1	-	100
6.	Puller	3 legged forged pullers for bearings, gears, pulleys, etc. Size : 500 mm : 400 mm : 300 mm	2 2 2	- - -	50 50 50
7.	Plumb Ball	Brass with Steel Point Weight : 4 Oz	2	-	40
8.	Vibration Meter	Portable, battery operated	1	-	100
9.	Filling Press	Capacity : 30 tonnes	1	5	5,000
10.	Pillar Drilling Machine	Drilling Capacity : 13 mm in Steel Table Diameter : 300 mm	1	10	800
11.	Pedestal Grinder	Wheel Size : 178 x 25 x 20 mm Distance between Wheels : 432 mm	1	0.5	1,200
12.	Flexibile Grinder	Type : Motor axial suspension and flexible shaft type, low speed grinder	2	0.4	100

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EXHIBIT : 41

Sl. No.	Equipment	Brief Specifications	Nos. Required	Power Consumption (KW)	Total Price (US\$)
		Max Size of Grinding Wheel : 100 x 10 mm			
13.	Hydraulic Pipe Bending Machine	Type : Motorised pipe bending machine Pipe Size : 12 mm - 56 mm Puller Capacity : 20 tonnes	1	-	16,000
14.	Compressor Testing Machine	Capacity : 100 tonnes	1	1	1,200
15.	Arc Welding Sets	Welding Current : 70 - 450 Amp	2	24	9,000
16.	Hand Push Trolleys	Max Capacity : 200 kg	3	-	225
17.	B.O.P. Crane	Type : Single Girder Class : III Capacity : 3 tonnes Span : 10.5 M	1	10	25,000
18.	Bearing Heating Tank	Tank Size : 500 x 500 x 250 mm	1	-	18,750
19.	Oil Bath Heating Tank	Chamber Size : 600 x 640 x 480 mm Max. Temperature : 300° C	1	-	28,800
20.	Water Tank for Cleaning	Type : To clean parts with both kerosene and water with a grating in the chamber separating them Overall Chamber Size : 2000 x 1200 x 800 mm	2	-	4,800

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Sl. No.	Equipment	Brief Specifications	Nos. Required	Power Consumption (KW)	Total Price (US\$)
21.	Battery Charger	No. of Phases : 3 Input Voltage : 240 V Output Voltage : 36 V	2	-	100
22.	Ammeter	Type : Moving iron type suitable for both AC and DC upto 100 amps Accuracy : $\pm 1\%$ on effective scale	2	-	160
23.	Voltmeter	Type : Moving iron AC and DC type upto 500 volts Accuracy : $\pm 1\%$ on effective scale	2	-	200
24.	Mega Ohm Meter	Heavy duty hand-operated mega ohm meter with shielded voltage leads and ground leads Voltage Range : 0-11000 V	2	-	260
25.	Multimeter (Ava Meter)	Portable battery operated multimeter with built-in overload protective circuitry Voltage : 100-1500 V AC/DC Current : 100 mA - 2 A AC/DC Resistance : 100-200 meg ohm	2	-	260
26.	Electric Soldering Iron	Supply Voltage : 240 V Single Phase, 50 Hz Power Rating : 100 watts : 60 watts	2 2	- -	80 60
27.	Cable Tester	Type : Standard	1	-	100
				TOTAL	1,09,025

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EXHIBIT : 42

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
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PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

LIST OF AUXILIARY EQUIPMENT AND HAND TOOLS

Sl. No.	Name of the Equipment	Brief Specifications	Nos. Required	Total Price (R\$)
Material Handling				
1.	Forklift Truck	Type : Counter balanced battery operated Capacity : 2 Tonnes Max Lift : 3 M	2	52,000
2.	Forklift Truck	Type : Diesel-operated Capacity : 5 Tonnes Max Lift : 3 M	1	50,000
3.	Truck	G V W : 7000 kg	2	16,000
4.	Hand Push Trolley	Capacity : 500 kg Size : 1200 x 750 mm	4	280
5.	Battery Operated Inter-bay Material Transfer Trolleys	Capacity : 5 Tonnes	2	2,000
Auxiliary Equipment				
6.	Surface Plate	Surface plate made of close grained C.I. of 200 BHN sturdy angle iron frame and adjusting jacks Top Surface Size : 2000 x 1000 mm Overall Height of Table : 286 mm	10	

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Sl. No.	Name of the Equipment	Brief Specifications	Nos. Required	Total Price (\$)
7.	Work Bench	50 mm laminated wood top in a angle iron frame with four angle iron legs Area of Top Surface : 2000 x 850 mm Floor to Top Height : 900 mm	100	
8.	Work Table	All steel, welded construction work tables Top surface : 1000 x 3000 mm Min. Plate Thickness : 40 mm Height of Table : 950 mm	10	
9.	Workers' Tool Cabinet	Steel cabinets consisting of two shelves Size (W x D x H) : 600 x 450 x 750 mm	300	
10.	Bar, Pipe and Rod Storage Rack	Heavy duty double-arm six high storage rack of steel Capacity : 8 Tonnes	10	
11.	All Steel Open Storage Rack	The rack shall have six shelves Overall Size : 1200 x 450 x 1950 mm (W x D x H) Capacity : 1500 kg/cm ²	60	
12.	Heavy Duty Wooden Skid	Made of hard wood with metal frame Top Surface : 900 x 1000 mm Load Capacity : 1500 kgs	60	

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Sl. No.	Name of the Equipment	Brief Specifications	Nos. Required	Total Price (\$)
13.	Steel Tote Box	Welded steel construction covered with heavy duty wire mesh Size (L x W x D) : 1000 x 1000 x 450 mm	60	
14.	Closed Storage Shelf	Welded steel sheet shelf with lockable doors Overall Height : 2000 mm Tray Dimensions (W x D): 1000 x 450 mm Load Capacity : 500 kg/cm ²	60	
15.	Stillages	Stillages shall be used for storing sheets, plates and long rolled section. It shall be made of welded structure. Size (L x H) : 3000 x 750 mm Width of a Frame : 300 mm	10	
16.	Cradles	Type : Made out of steel angles or wire frames Carrying Capacity : 1 Tonne	30	
17.	Weighbridge	Type : Lever Type, Road Transport Capacity : 25 Tonnes Platform Size (L x W) : 8 x 3 m	1	
18.	Portable Platform Weighing Scale	Type : Arm type Capacity : 500 kgs	6	

Lum; sum 10,000

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Sl. No.	Name of the Equipment	Brief Specifications	Nos. Required	Total Price (\$)
Hand Tools				
19.	Hand Drill	Type : Pistol grip type drill Max Capacity to Drill : 8 mm in Mild Steel	2	
20.	Hand Grinder	Type : Hand held horizontal grinder Wheel Dia : 150 mm Speed : 4500 rpm	2	
21.	Tachometer	Speed Range : 0 - 5000 rpm	2	
22.	Tenon Saw	Size : 300 mm	2	
23.	Compass Saw	Size : 200 mm	2	
24.	Pattern Maker's Scale	Stainless steel contraction for steel, iron castings Length : 300 mm : 600 mm	4 (sets) 4	
25.	Pattern Maker's Kit	The kit shall consist of planes, smoothers, augur bits mortise and paring chisels, gauges, etc., of standard sizes	2	
26.	Moulding Tools Kit	The kit shall consist of riddle, floor and bench rammers, strike off bar, trowels, sticks, lifters, gate cutters and smoothers of standard sizes	2	

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EXHIBIT : 42

Sl. No.	Name of the Equipment	Brief Specifications	Nos. Required	Total Price (\$)
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Pneumatically Driven Power Hand Tools

27.	Pneumatic Chipping Hammer	Chipper hammer shall be used for chipping and cleaning welds and castings as well as for caulking. Hammer shall be supplied with 8" long flat finish chisel, bush cap nut and other standard accessories	8	
		No. of Strokes per Minute : 1050		
		Output H P : 0.32		
28.	Pneumatic Grinder	Type : Surface and cut-off grinder with reinforced hub wheel. Grinder shall be used for cutting of risers in casting and other grinding work	2	
		Wheel Dia : 180 mm		
		Prce Speed : 8000 rpm		
29.	Pneumatic Floor Rammer	The rammer shall be used for ramming foundry sand in large moulding boxes or pits and for ramming refractory linings, etc.	2	
		Piston Dia : 34 mm		
		Length of Stroke : 203 mm		
		Blows per Minute : 700		
30.	Spray Gun	Type : Gravity fed, top cup type spray gun with pot and nozzle	3	
		Capacity : 0.5 litre		
		Air Pressure : 3 - 4 kg/cm ²		

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EXHIBIT : 42

Sl. No.	Name of the Equipment	Brief Specifications	No. Required	Power Consumption (KW)	Total Price (US\$)
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Electric Motor Driven Power Hand Tools

31.	Electric Grinders	Type : Hand-held horizontal type Wheel Dia : 150 mm Speed : 4500 rpm	12	10	
32.	Electric Drill	Type : Pistol grip type Max. Drill Size : 9.5 mm Speed : 750 rpm	3	2	
33.	Electric Drill	Max. Drill Size : 25 mm	4	3	
34.	Electric Disc Sander	Type : Grip handle type Size : 200 mm	8	6	

35. Miscellaneous Hand Tools

o	Measuring and Marking Tools including Tape, Ruler, Caliper, etc.				
o	Vises and Clamps				
o	Saws, Files and Hammers				
o	Countersinks, Taps, Dies, Reamers, Milling Cutters, Grinding Wheel	Standard		Inspsum	7,000
o	Wrenches, Pliers and Screw Drivers				
o	Smithy Tools				
o	Welding Accessories				
o	Moulding Tools				

TOTAL 1,37,280

SECTION - 8
RAW MATERIALS AND OTHER INPUTS

RAW MATERIALS AND OTHER INPUTS

The overhead line accessories manufacturing plant is designed to manufacture about 12,000 tonnes of aluminium, steel and cast iron items annually. The basic materials, consumables and bought-out items required for manufacturing these have been classified under the following main groups :

- o Aluminium tubes, rounds and plates
- o Mild steel angles, plates, pipes and galvanised ropes
- o Materials like pre-alloyed ingots and foundry returns for aluminium pressure die-casting. This includes moulds, tool and die steel, and surface lining materials for ladles and furnaces
- o Mild steel rounds and squares, and tool and die steel for forging
- o Materials for cast iron foundry
- o Consumables for hot dip galvanising
- o Steel grits for shot blasting
- o Lubricants including oil and grease
- o Grinding wheel
- o Cutting and tapping tool
- o Arc welding electrodes
- o Steel for maintenance

- o Non-ferrous metals for maintenance
- o Tool and die steel
- o Packing wood for boxes
- o Hardware including nuts and bolts, wire ropes, slings, chains, fasteners, etc., and other miscellaneous items like paints, oxy-acetylene gases, cutting oil, soaps, cotton waste and electrical consumables

Technical specifications, annual requirement and prices of these materials are presented in Exhibit-43.

While estimating the requirement of tubes, pipes and rounds, a wastage factor of 10% has been taken into consideration. In case of angles and plates, the loss will be higher. Hence, a 20% wastage factor has been considered.

For production of aluminium pressure die castings, pre-alloyed ingots conforming to ASTM : A-360 or A-380 shall be used. In case of induction melting, there is practically no loss of alloying elements like copper, iron, silicon, manganese, zinc, nickel, chromium and titanium. Nevertheless, it is possible that there may be some loss in case of magnesium. This ingredient is added to the molten bath in an elementary form, to compensate for the losses of molten material. For calculating raw material requirements, a 45% yield factor has been assumed.

For estimating the annual requirement of cast iron foundry materials, the following charge composition has been considered :

Material	Charge Composition (%)
Steel Scrap	41.3
Grey Iron Borings	10.0
Foundry Returns	45.0
Carbon	1.7
50% Ferro Silicon	2.0

Requirement of alloying elements has been determined on the basis of the above charge composition.

It is affirmed that forgings, pressure die castings and other dies will be purchased from the market. However, to meet the contingency requirement of dies and tools, material for them has been provided.

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EXHIBIT : 43

**UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
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PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

REQUIREMENT OF RAW MATERIALS AND CONSUMABLES

Sl. No.	Raw Material/ Consumable	Material Specifications	Annual Requirement (Tonnes)	Total Price ('000 US\$)
Aluminium				
1.	Tubes (25 mm to 38 mm)	As per BS: 1473	646	2,435
2.	Rounds (10 mm to 12 mm)	As per BS: 1474	775	1,240
3.	Plates for Al Washer (1 mm to 30 mm)	As per BS: 1470	86	213
Mild Steel				
1.	Angles (45 x 45 x 6 mm to 50 x 50 x 6 mm)	Rolled Section as per BS: 4868 Part IV	589	190
2.	Plates (1 mm to 3 mm)	As per BS: 1449 Part I and II	298	432
	(12 mm to 20 mm)	-do-		
3.	Pipes (20 mm to 38 mm)	As per BS: 4825 Part I	279	1,032
4.	Galvanised Rope Spacers (5.5 mm to 40 mm)	As per BS: 215 Part II	162	162
	Guy - 10 mm	-do-	951	942
Aluminium Pressure Die Casting				
1.	Pre-alloyed Ingots	As per ASTM: A 360	1080	7,246
2.	Foundry Returns Available	Magnesium - 0.5% Silicon - 8.0%	840	4,200

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Sl. No.	Raw Material/ Consumable	Material Specifications	Annual Requirement (Tonnes)	Total Price ('000 US\$)
		AS per ASTM: A 386		
		Copper - 3.5%		
		Silicon - 8.5%		
3.	Magnesium Sticks	As per BS: 4727 Part 1, Group 7	10	25
4.	Furnace and Ladle Lining	High Alumina castable refractory	10	50
		Alumina - 60%		
		Standard Phosphoric Acid	0.5	
		Capacity : 20 kg-10 nos. 10 kg-10 nos.		
5.	Tool and Die Steel	As per AISI-SAE	4	4.8
		Wear Resistant Alloy Steel		
		Carbon - 0.55%		
		Manganese - 0.8%		
		Silicon - 0.25%		
		Chromium - 1.0%		
		Molybdenum - 0.45%		
		Vanadium - 0.08%		
		Hardness - 415 BHN		
Forging				
1.	Mild Steel Rounds (6 mm to 50 mm)	As per BS: 4670	4338	3,253
	Mild Steel Squares and Hexagonal Bars (16 mm to 50 mm)	-do-		

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Sl. No.	Raw Material/ Consumable	Material Specifications	Annual Requirement (Tonnes)	Total Price ('000 US\$)
2.	Forging Tool and Die Steel	As per AISI-SAE Wear Resistant Alloy Steel	4	3.2
		Carbon - 0.55%		
		Manganese - 0.8%		
		Silicon - 0.25%		
		Chromium - 1.0%		
		Molybdenum - 0.45%		
		Vanadium - 0.08%		
		Hardness - 415 BHN		
C.I. Foundry				
<u>Charge Material</u>				
1.	Steel Scrap	Fine Non-alloyed Steel	847	153
		Carbon - 0.2 to 0.5%		
2.	Grey Iron Borings	Clean, dry and free from rust, oil or grease	209	506
3.	Foundry Returns	Clean, dry and free from rust, oil or grease	724	3,620
4.	Carburiser	Carbon - 98% min Ash - 1% Volatile - 1% content Moisture - 0.5% Grain Size - 1-5 mm	25	25
5.	Ferro Silicon	Silicon - 50% min	40	88
<u>Furnace Lining</u>				
1.	Pure Silica Sand	Silica - 95%	38	3.8
2.	Boric Acid	Standard	0.8	1.1
3.	Asbestos	Standard		
4.	Fire Clay Plastic Refractories for Lining of Ladles	Graphite Bearing	10.0	2.0

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EXHIBIT : 43

Sl. No.	Raw Material/ Consumable	Material Specifications	Annual Requirement (Tonnes)	Total Price ('000 US\$)
<u>Moulding Materials</u>				
1.	Fresh Silica Sand	Bonding clay - 0.2 to 0.5% Silica - 98% Iron Oxide - 0.4% max Grain Size - 0.32/0.2/ 0.16 mm Sintering - 1400° C temperature Carbonates - 0.5% max	2400	240
2.	Bentonite	Monmorillonite - 75% Water - 6% Carbonates - 4% max Size - 0.16 mm Mesh - 2% Residue 0.56 mm - 20% Mesh Residue Compression- 1 kg/cm ² Strength at 3% Moisture	288	58
3.	Hard Coal Dust	Moisture content - 2% Volatile Content - 30% Ash - 4% Sulphur - 8% Grains - 10% max above 0.2%	192	39
4.	Dextrine (Corn Starch)	Standard	20	0.96
5.	Core Oil Mixture	Linseed Oil- 50 to 60% Resin - 25% Mineral Oil- 25 to 15%	12	1.10
6.	Silica Flour		12	1.20
7.	Chills, Chaplets, Springs	Standard		

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EXHIBIT : 43

Sl. No.	Raw Material/ Consumable	Material Specifications	Annual Requirement (Tonnes)	Total Price ('000 US\$)
Hot Dip Galvanising				
1.	Zinc	As per BS: 729	158	182
2.	Sulphuric Acid	As per BS: 753	15	13
3.	Hydrochloric Acid	As per BS: 976	42	25
4.	Iron Sulphate	Commercial	0.03	0.006
5.	Sodium Hydroxide	As per BS: 4130	50	5
6.	Ammonium Chloride	Commercial	9	1.5
<u>Bath Alloying Elements</u>				
1.	Aluminium	As per BS: 6536	0.5	1.1
2.	Tin	As per BS: 3252	8	50
3.	Antimony	As per BS: 729	1	5.1
Miscellaneous				
1.	Steel Grit for Shot Blasting	Chilled Steel Angular Shots Grade: 8-14 mesh	21	43
2.	Lubricant including Oil and Grease	Bearing Quality	1.5	1.3
3.	Furnace Oil	As per BS: 2869	580	563
4.	Grinding Wheel	Various Sizes	36 (nos.)	1.8
5.	Cutting and Tapping Tools	Various Sizes	200 (nos.)	42
6.	Arc Welding Electrodes	1 curtain of 55 pieces (5 mm dia)	3000 (curtains)	90
7.	Steel for Maintenance	Mild Steel	5	3

JOB NO. : DCIL-105

EXHIBIT : 43

Sl. No.	Raw Material/ Consumable	Material Specifications	Annual Requirement (Tonnes)	Total Price ('000 US\$)
8.	Non-ferrous Metals for Maintenance	Standard	1	0.3
9.	Steel for Tool and Die	As per AISI-SAE Wear Resistant Alloy Steel Carbon - 0.55% Manganese - 0.8% Silicon - 0.25% Chromium - 1.0% Molybdenum - 0.45% Vanadium - 0.08% Hardness - 415 BHN	2.5	1.5
10.	Packing Wood for Boxes	25 mm thick	43104 m ²	216
11.	Hardware, wire ropes, paints, fasteners, slings, chains, oxyacetylene gases, cutting oil, soaps, cotton waste, electrical consumables	Standard	lump sum	10
			TOTAL	27,411.766

SECTION - 9
UTILITIES

UTILITIES

Utilities required in the plant are power, water, compressed air and fuel oil. Apart from the above, facilities for air-conditioning of the administrative building and for fire-fighting have also been provided.

Power

Summary of power requirement is presented in Exhibit-44. While calculating the total load, power required for general lighting, air-conditioning, dust collection and fume control units, and for other utilities have also been considered. While calculating the lighting load for office building and aisles, it is assumed that these will have sufficient natural lighting. Since all of these will not be operated simultaneously, different load factors have been considered for different types of equipment or application.

Based on these load factors and a power factor of 0.8, total requirement of power in the plant is estimated as about 4,100 KVA. As the voltage rating required to operate major equipment and services is 415/220 volts, four transformers - each of 1000 KVA rating, have been provided. Further, it is assumed that power will be tapped from a 11 KV overhead transmission line. Therefore, the transformer will have a step down ratio from 11 KV to 415/220 volts. In order to reduce the fault level and fluctuations in the lighting line, three lighting transformers - each of 300 KVA capacity, have been provided.

Water

The induction furnace in the foundry plant needs demineralised water for cooling the induction coil and the power factor correction capacitor. Quantum of circulating water required for the above purpose is nearly 20 m³ per hour, and 13 m³ per hour for each furnace in the cast iron foundry and the aluminium foundry respectively. The total make-up water for these shops is estimated as 0.8 m³ per hour and 1.04 m³ per hour, respectively. Raw water requirement for the heat exchanger in each furnace is estimated as 60 m³ per hour, while 40 m³ per hour of water is required for cast iron foundry and aluminium foundry, respectively. The total make-up water in these is 4.8 m³ per hour and 6.4 m³ per hour, respectively. In addition, 2 m³ per hour of water will be required for 5 to 6 hours as an emergency measure. The total requirement of water for cast iron foundry and aluminium foundry, exclusive of emergency requirement adds up to 5.87 m³ per hour and 7.44 m³ per hour, respectively.

Water is also needed for :

- o Heat treatment
- o Sand conditioning plant
- o Metal cutting tools as coolant
- o Acid pickling and water rinsing of components to be galvanised
- o Cooling the central air-conditioning system

- o Cooling the air compressors
- o Drinking and cooking
- o Sanitation, gardening and shopfloor washing

Overall requirement of water for technological functions comes to nearly 31 m³ per hour.

The plant also needs water for :

- o Drinking and cooking purpose
- o Sanitation, gardening and shopfloor washing

The quantity of water required for process needs is estimated as about 28 m³ per hour, while air-conditioning may require 3 m³ per hour. Average consumption for sanitary and nutritive purpose is estimated as 4 m³ per hour. This is based on the assumption that a person requires 60 litres of water per 8-hour shift, on an average, for the above purpose. Peak consumption of water for sanitary and nutritive purpose at the plants is placed at about 20 m³ per hour.

Exhibit-45 presents the average and peak requirement of water at the accessories plants. These are estimated as 35 m³ per hour and 51 m³ per hour, respectively.

It is proposed that each of the two plants be equipped with a 4" dia deep tubewell; 2 pumps, each of 100 m³ per hour capacity and two overhead tanks, each of 250 m³ storing capacity.

Compressed Air

Compressed air is needed in the foundry plant for operating pneumatically-operated moulding machines, core blower,

chipping hammer, mould rammers and spray guns. It may also be occasionally required for operating the changeover switch, which is an important component of the induction furnace, and for opening or closing the door of the core baking oven.

Total compressed air requirement of equipment is estimated as 9.53 m³ per minute. This includes 4 m³ per minute of compressed air required for the 10 auxiliary equipment. Compressed air requirement for the plant is shown in Exhibit-46.

As the plant is spread over a large area, providing a centralised compressor house may not prove economical. Hence, it is suggested that two mobile compressors, each having 6 m³ per minute capacity be installed at the cast iron foundry and fabrication shop, respectively. Four mobile compressors, each having 1.5 m³ per minute capacity may be provided for other production units.

Fuel Oil

The furnaces in the foundries, forging shop, galvanising shop and acid pickling tank are all oil-fired. They require a constant supply of oil for their operation. It is estimated that the total oil requirement will be approximately 2,000 litres per day.

An overhead oil tank of 30 m³ capacity, from which the oil will be pumped to individual furnaces, has been provided. This oil tank should be capable of storing 30,000 litres of oil. Valves, piping and instruments should also be provided for distributing oil from the main tank to individual tanks.

Air-conditioning

It is proposed that the administrative building be centrally air-conditioned to create a conducive atmosphere for personnel housed in the building. For this purpose, a centralised air-conditioning system of 154 tonnes of refrigeration (TR) capacity, with individual air handling units for each floor, has been provided. The system shall have a separate cooling tower of the induced draft type for cooling water. The workshop has been provided with room coolers and air coolers for proper air circulation.

Major equipment and accessories for the above utilities along with their costs have been listed in Exhibit-47.

Fire Protection System

Fire extinguishers of different types have been provided for fighting fire inside the workshop premises. The entire fire fighting system/appliances have been classified into three major categories - portable extinguishers, wheeled extinguishers and fixed systems. Apart from the above, other appliances like a fire detector, an alarm, buckets for sand and water, etc., have also been provided.

Transport

The company will provide cars to the personnel up to level 2. For this purpose 2 cars have been provided. Four cars have been provided for other officials, while two mini buses are provided for workmen.

JOB NO. : DCIL-105

EXHIBIT : 44

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

SUMMARY OF POWER REQUIREMENT

Sl. No.	Purpose for which required	Connected Power (KW)	Load Factor	Max Demand (KW)
Voltage 415/220 Volts				
1.	Operating Major Equipment including Material Handling Equipment	4294	0.6	2577
2.	General Lighting	680	-	655
3.	Air-conditioning and Air Circulation, Environmental Dust and Fume Control Unit	300	-	
4.	Miscellaneous including Water Pumps and Compressors	120	0.4	48
	Total	5394		3280

KVA consumption (based on 0.8 power factor) - 4100

JOB NO. : DCIL-105

EXHIBIT : 45

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

SUMMARY OF WATER REQUIREMENT

Sl. No.	Description	Water Consumption (M ³ /Hour)
1.	Consumption in process	28
2.	Consumption in central air- conditioning plant	3
3.	Average Consumption for sanitary and nutritive purpose (for 893 persons)	4
4.	Peak consumption of sanitary and nutritive water	20
5.	Average requirement (1 + 2 + 3)	35
5.	Peak requirement (1 + 2 + 4)	51

JOB NO. : DCII,-105

EXHIBIT : 46

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

SUMMARY OF COMPRESSED AIR REQUIREMENT

Sl. No.	Description	Air Consumption (m ³ /Minute)
1.	Major and auxiliary equipment	5.53
2.	Hand tools	4.00
Total		9.53

JOB NO. : DCII.-105

EXHIBIT : 47

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES
MAJOR EQUIPMENT AND ACCESSORIES FOR UTILITIES

Sl. No.	Description	Total Price (US\$)
1. Electrical System		
o	4 x 1000 KVA step-down Oil Cooled Transformer (Step down ratio 11 KV : 415/220 volts, 3 phase, 50 Hz)	87,600
o	3 x 300 KVA (415/415 volts) Oil-cooled Lighting Transformer	19,200
o	11 KV Switchgears, Isolator, Accessories, MCC, Distribution Boards, Cables and Grounding Materials	4,000
o	Lighting, Fans and Room Coolers	9,000
o	Communication System	2,000
2. Water Supply System		
o	Two Water Pumps (100 m ³ /hour capacity each), 2 Overhead Tanks (250 m ³ capacity each), Valves and Other Fittings for water distribution and cost of digging 4" dia Tubewell	Pumps 10,600 Tanks 24,000
3. Compressed Air System		
o	Two Mobile Compressors of 6 m ³ per minute capacity each, and four Mobile Compressors of 1.5 m ³ per minute capacity each, delivering air at 7 kg per cm ² pressure	17,890 7,600

JOB NO. : DCIT-105

EXHIBIT : 47

Sl. No.	Description	Total Price (US\$)
4.	Fuel Oil System	
o	Overhead Fuel Oil Storage Tank (30 m ³ capacity) with individual Storage Tanks for Furnaces, Pumps, Valves, Piping and Instruments for Transfer of Fuel Oil	9,000
5.	Air-conditioning System for two storied Administrative Building - 154 TR Central Air-conditioning Unit with individual Air Handling Unit for each floor	1,73,870
6.	Fire-fighting Equipment	2,000
7.	Furnitures, Fittings, Drawing Equipment, File Cabinets, Phones, Office Equipment, etc.	3,000
8.	Transport (6 Cars and 2 Mini Buses)	90,000
	TOTAL	4,59,750

SECTION - 10
SPACE AND LAYOUT

SPACE AND LAYOUT

Space requirement for various Departments in the plant is given in Exhibit-48. Each Department of the plant comprises a number of Work Centres. The space for each Work Centre has been arrived at, based on the following requirements :

- o area occupied by equipment
- o working area
- o area for movement of men and materials
- o area for temporary storage of incoming and outgoing materials

The total built-up area adds up to 23,082 sq.m. The total land area, including about 10,000 sq.m. of land area earmarked for future expansion, is estimated at 57,000 sq.m.

Buildings in the plant are divided into the following three categories depending on their functions and constructional features :

- o Workshop building
- o Administrative building
- o Auxiliary buildings

Workshop Building

Layout of various Centres are presented in the following Exhibits :

Sl. No.	Work Centre	Exhibit No.
1.	Aluminium Foundry	49
2.	Forging Shop	50**
3.	Cast Iron Foundry	51**
4.	Fabrication Shop	52
5.	Machine Shop, Tool Room and Die Repair Shop	53
6.	Galvanising Shop	54
7.	Material Testing Laboratory	55

** These two Exhibits have been enclosed in pouches at the end of this Report.

While preparing the layout of machines in different Work Centres, care has been taken to ensure unidirectional flow of material as far as possible. Machines have been located to facilitate easy movement of men, material and material handling equipment.

It is envisaged that the Workshop building will be of complete reinforced concrete construction (RCC). The columns, roof, floor, etc., shall also be of RCC structure. The design of the building will ensure optimum use of natural lighting and ventilation. Sound-proof glass panes will be provided in the shop offices to aid supervision and control.

Administrative Building

This will be a two storeyed building made of RCC bricks.

Auxiliary Buildings

Auxiliary buildings include toilets and wash rooms, security office, transformer house, pump house, etc. All of these, shall be built with masonry bricks and cement.

Layout showing the relative location of different shops and buildings is presented in Exhibit-56, enclosed in a pouch at the end of this Report.

Estimated cost of civil work including land development, fencing, drainage, roads and building construction are shown in Exhibit-57.

JOB NO. : DCTI-105

EXHIBIT : 48

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

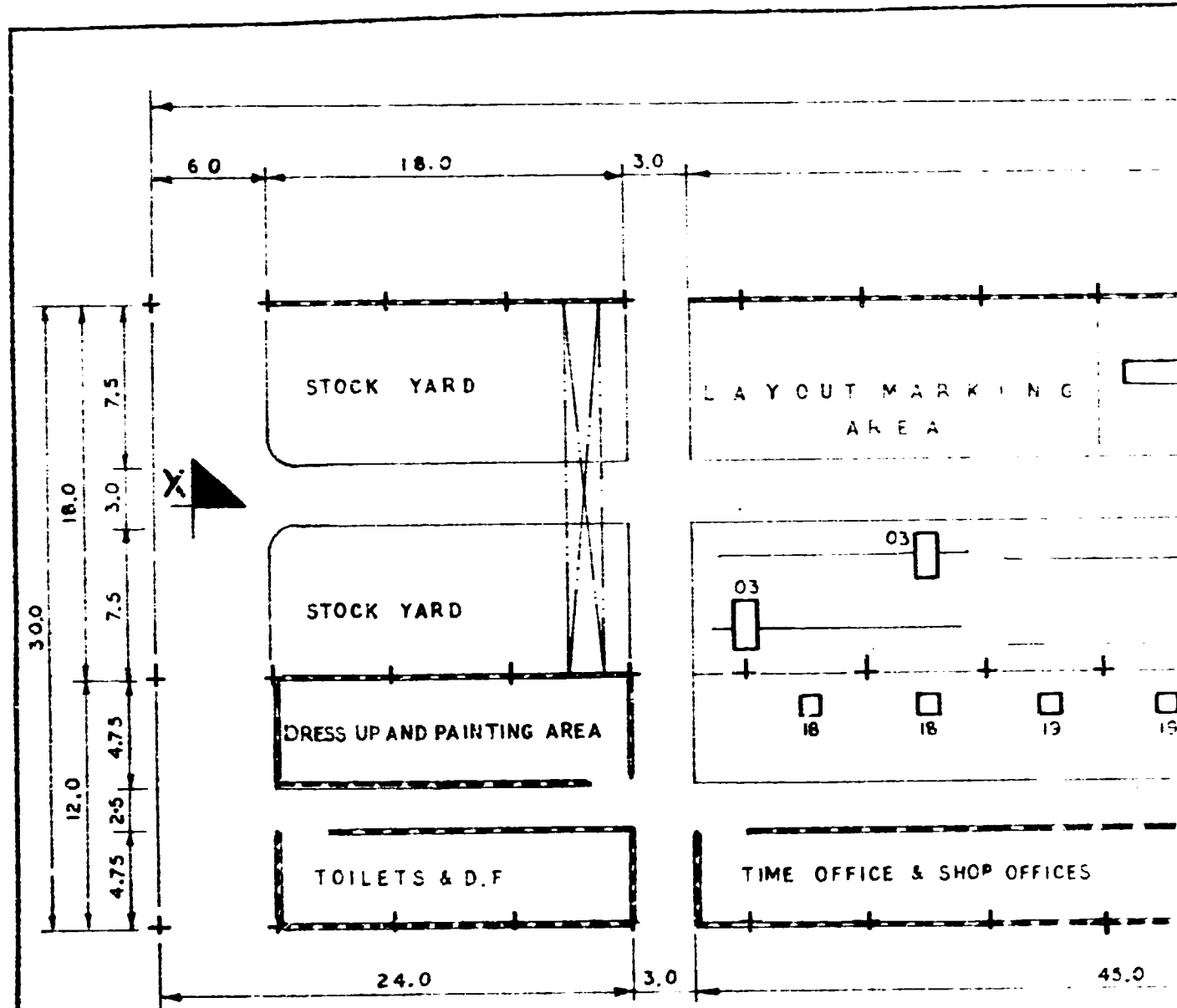
SUMMARY OF SPACE REQUIREMENT

Sl. No.	Description	Land Area (sq m)
A. Workshop		
o	Aluminium Foundry	3546
o	Forging Shop	3588
o	Cast Iron Foundry	4680
o	Fabrication Shop	3996
o	Machine Shop, Tool Room and Die Repair Shop	2070
o	Galvanising	1098
o	Material Testing Laboratory	936
o	Central Store	540
	Sub-Total	20454
B. Administrative Building - Double Storeyed		
		1152
C. Auxiliary Buildings		
o	Transformer House and Distribution Centre	216
o	Central Maintenance Shop and Garage	540

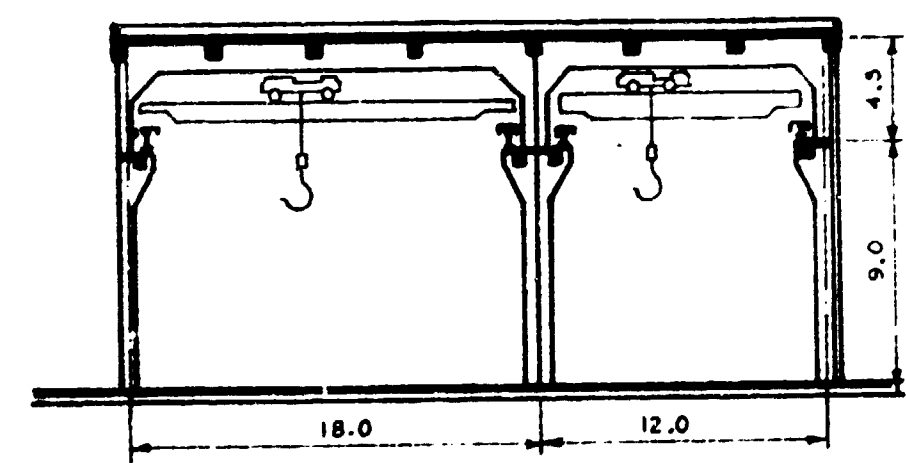
JOB NO. : DCIL-105

EXHIBIT : 48

Sl. No.	Description	Land Area (sq m)
	o Effluent Treatment Plant	108
	o Security and First-aid Centre	72
	o Training Centre	540
	Sub-total	1476
D.	Total Covered Land Area (A + B + C)	23082
E.	Land Area required at present (2D)	46164
F.	Area earmarked for future expansion (50% of A)	10227
G.	Total Land Area required in future after expansion (E + F)	56391
	Say : 57000	



SECTION 1



VIEW FROM -X

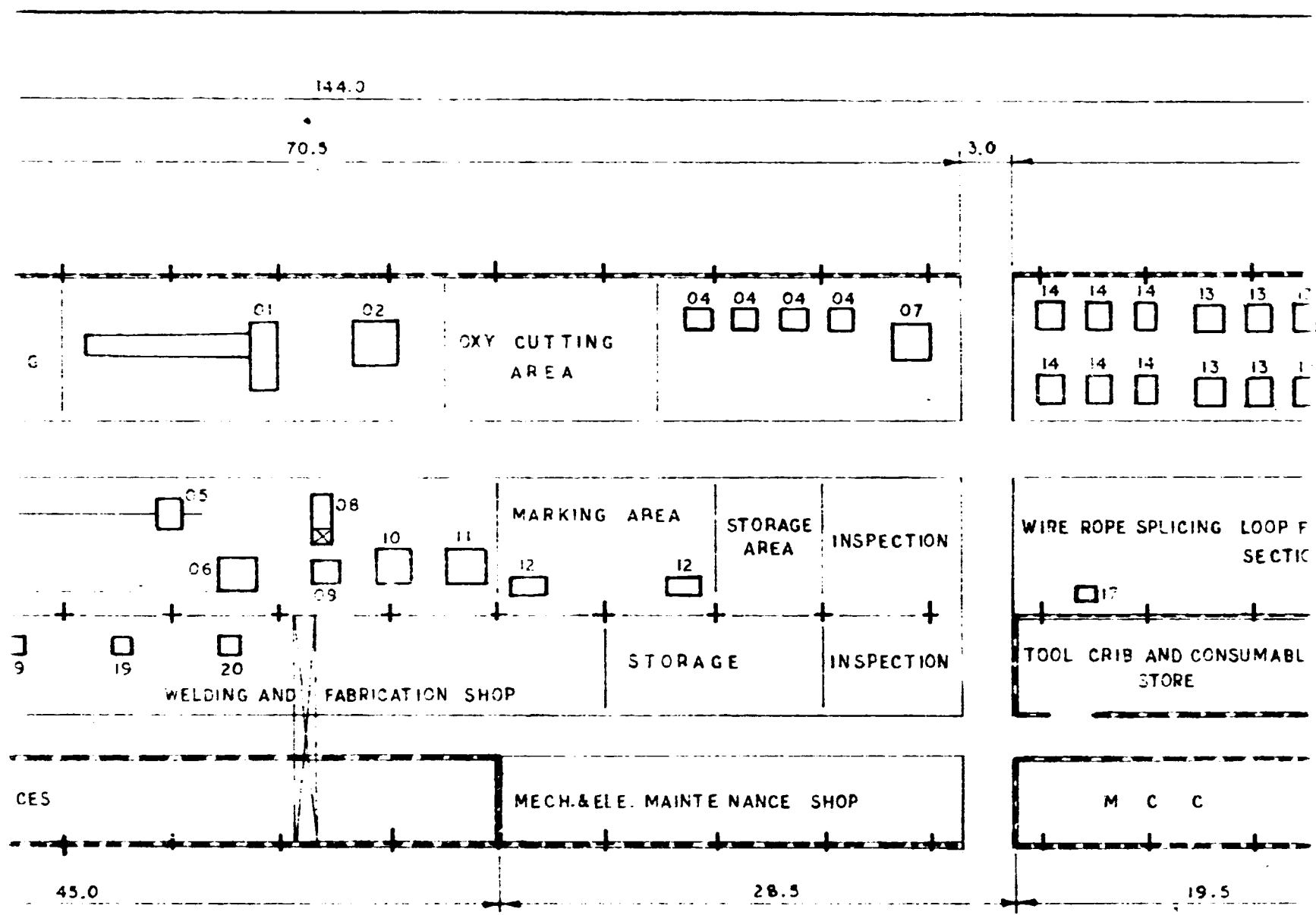
LEGEND

- 01 GUILLOTINE SHEARING MACHINE
- 02 OXY ACETYLENE PROFILE CUTTING MACHINE
- 03 UNIVERSAL PUNCHING CROPPING SHEARING & NOTCHING MACHINE
- 04 PEDESTAL GRINDERS - 4 Nos
- 05 ABRASIVE CUT OFF MACHINE
- 06 PIPE BENDING MACHINE
- 07 VERTICAL METAL CUTTING CIRCULAR BANDSAW
- 08 PLATE BENDING ROLLS
- 09 SECTION BENDING MACHINE
- 10 HYDRAULIC PRESS
- 11 DEEP THROAT SWAGING & CLOSING MACHINE
- 12 SURFACE FLAT ROLLER DRILLING MACHINE - 6 Nos
- 13

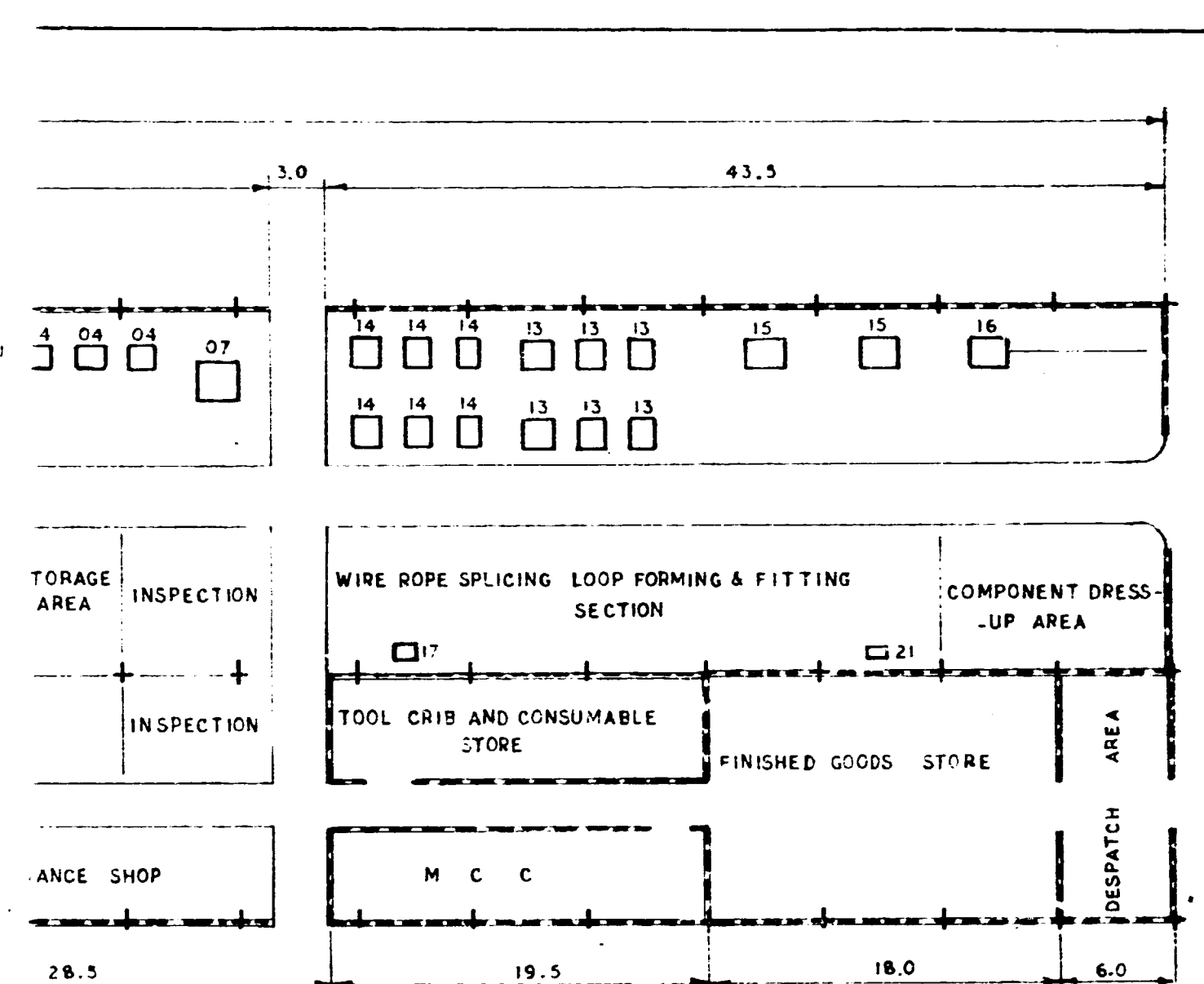
END

- 14 PUNCHING PRESS - 6 Nos.
- 15 MARKING PRESS - 2 Nos.
- 16 PIPE & BOLT THREADING MACHINE
- 17 ARBOUR PRESSES
- 18 TRANSFORMER ARC WELDING SETS - 2 Nos
- 19 MIG WELDING SETS - 2 Nos
- 20 D.C WELDING SET
- 21 WIRE CUTTING & STRAIGHTENING MACHINE

SECTION 2



FABRICATION SHOP

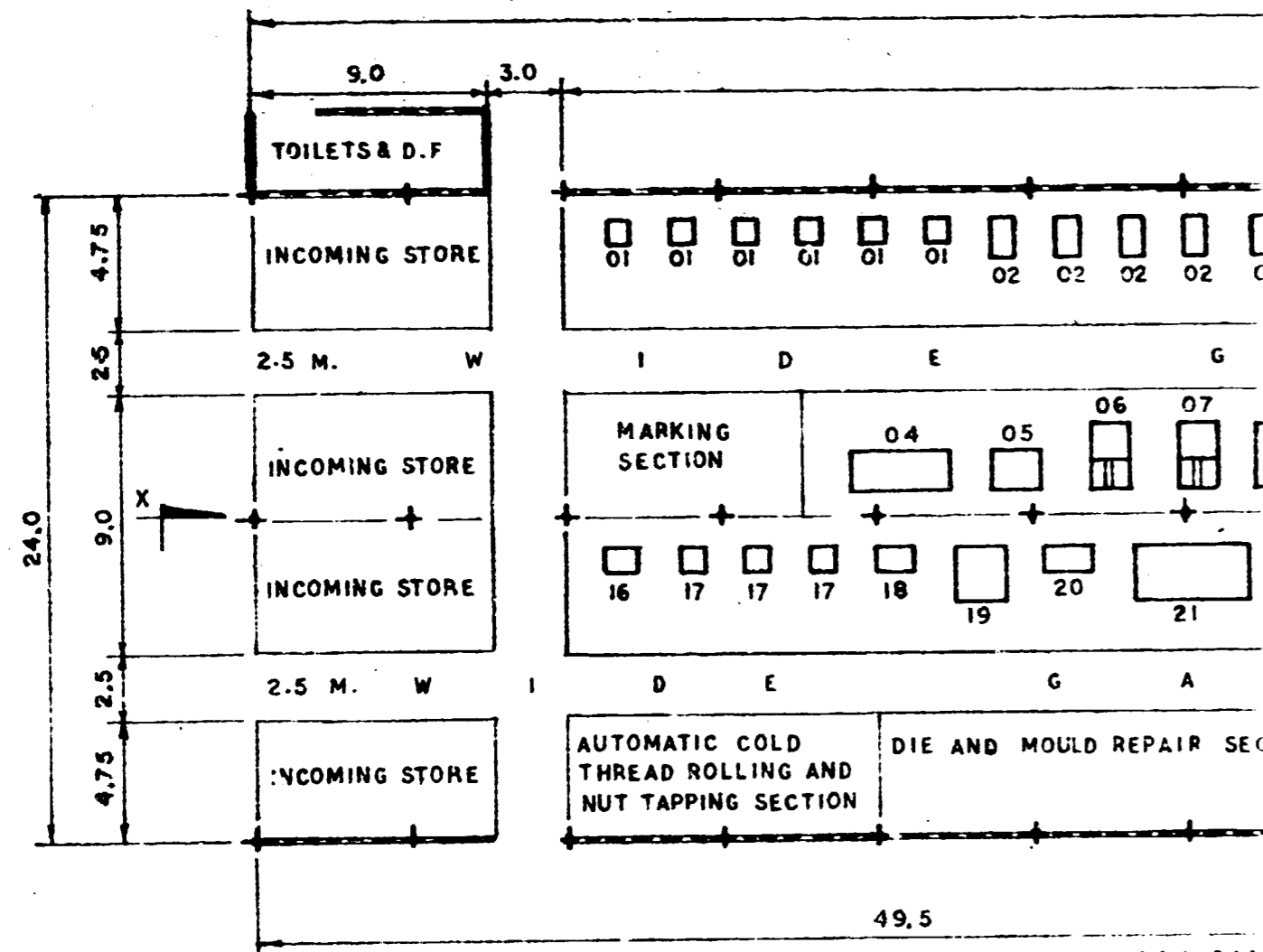


SECTION 3

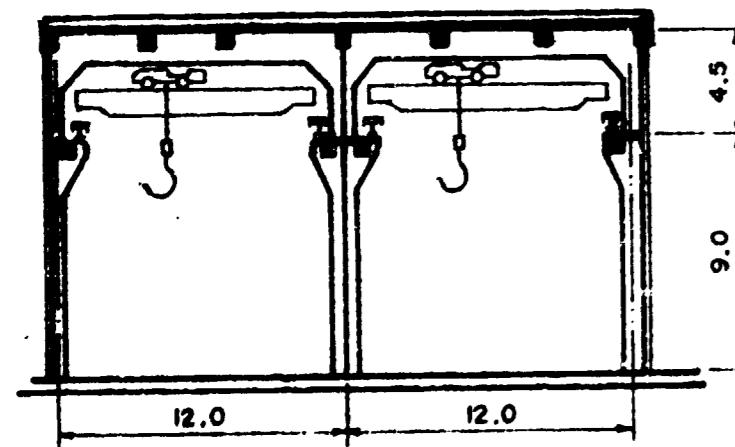
UNITED ARAB EMIRATES
 DRAWN BY M. CHOWDHURY
 PROF. ENGR.
 DEPT. HEAD
 DWG. NO.

- PUNCHING PRESS - 6 Nos.
- MARKING PRESS - 2 Nos.
- PIPE & BOLT THREADING MACHINE
- ARBOUR PRESSES
- TRANSFORMER ARC WELDING SETS - 2 Nos
- MIG WELDING SETS - 2 Nos
- D.C WELDING SET
- WIRE CUTTING & STRAIGHTENING MACHINE

LAYOUT OF FABRICATION SHOP
 UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
 ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION
 DEVELOPMENT CONSULTANTS CONSULTING ENGINEERS
 BOMBAY • CALCUTTA • MADRAS • NEW DELHI
 DRAWN: MUKUL CHOWDHURY DATE: 21.11.91
 PROJ. ENGR: PCD/MC SCALE: 1:300
 DEPT. HEAD: JOB NO. 45010
 DWG. NO. EXHIBIT_52



SECTION 1



VIEW FROM X

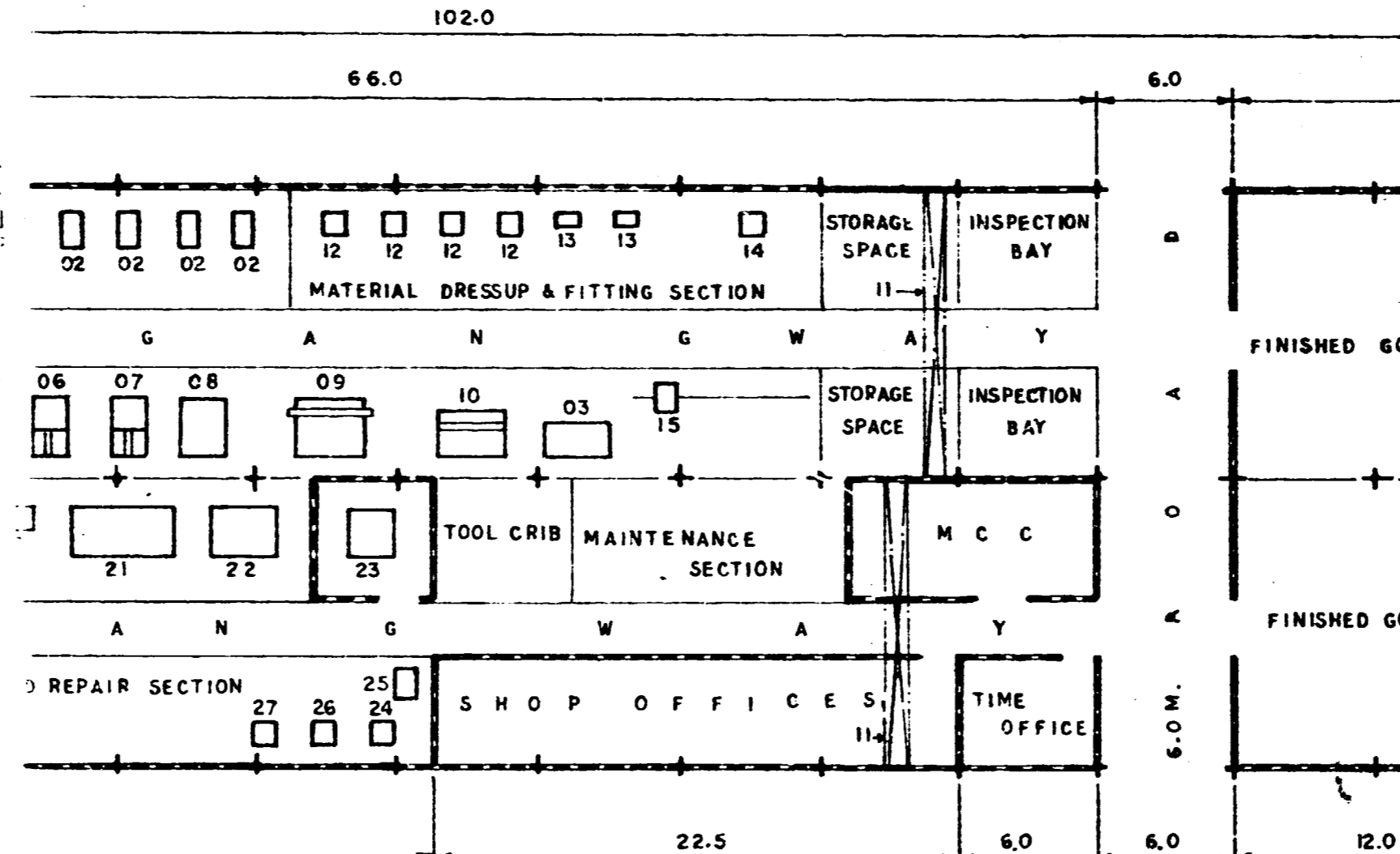
LEGEND

- 01 RADIAL DRILLING MACHINE _6 NOS
- 02 COLUMN DRILLING MACHINE _6 NOS
- 03 TURRET LATHE
- 04 CENTRE LATHE
- 05 CENTRE LATHE
- 06 SHAPING MACHINE
- 07 SHAPING MACHINE
- 08 SLOTTING MACHINE
- 09 UNIVERSAL MILLING MACHINE
- 10 VERTICAL MILLING MACHINE
- 11 E.O.T CRANE. 5 TON - 2 NOS
- 12 BENCH GRINDER
- 13 ABRASIVE BELT GRINDER - 4 NOS
- 14 AIR CUR PRESS

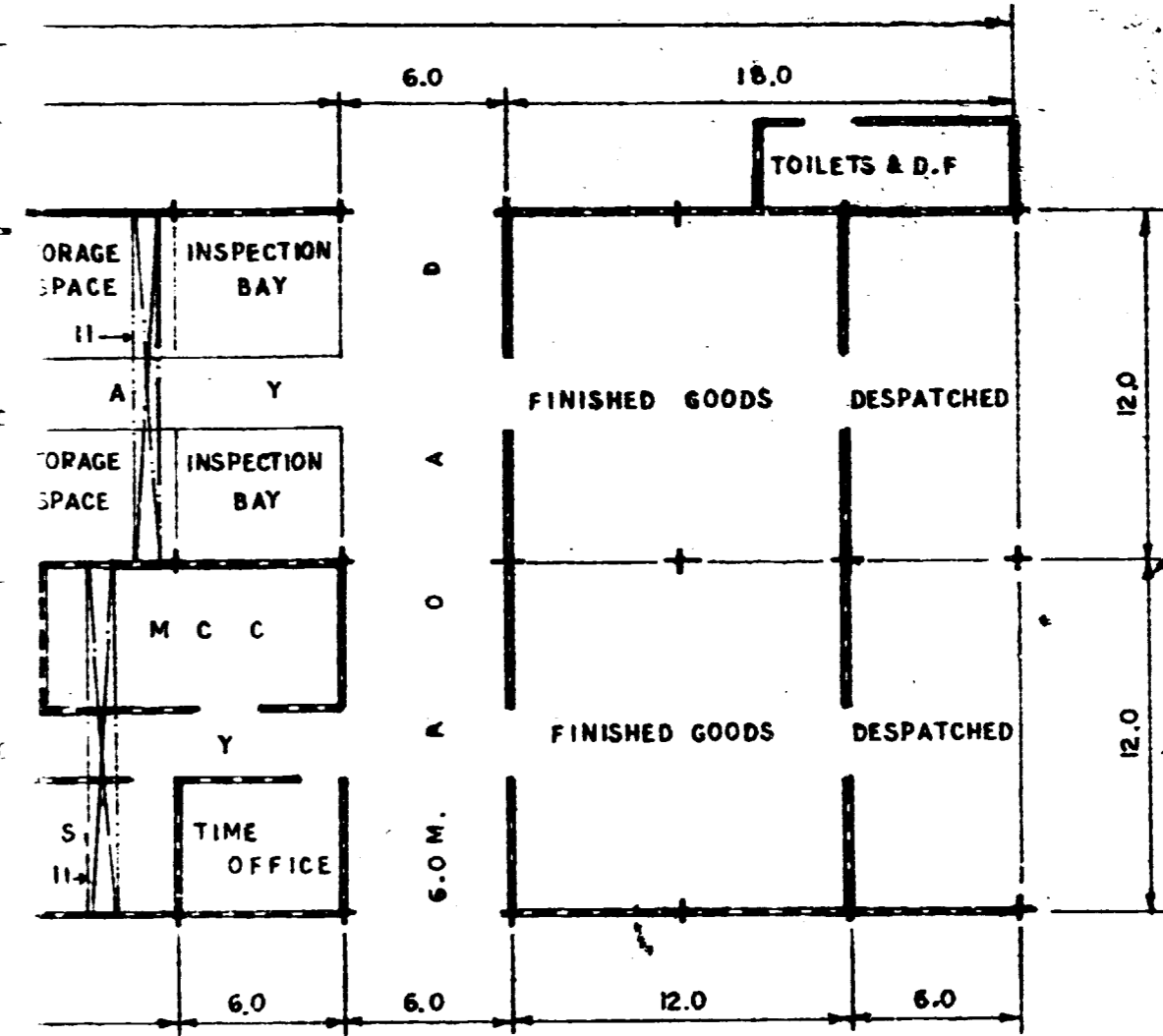
LEGEND

- 15 HACKSAW MACHINE
- 16 UNIVERSAL TOOL CUTTER GRINDER
- 17 DRILL POINT GRINDER _3 NOS
- 18 CARBIDE TOOL LAPPING MACHINE
- 19 CIRCULAR SAW SHARPENING MACHINE
- 20 UNIVERSAL INTERNAL & EXTERNAL GRINDER
- 21 VERTICAL SURFACE GRINDER
- 22 ELECTRONIC DIE SINKING MACHINE
- 23 FINE VERTICAL BORING MACHINE
- 24 ELECTRIC HEATING FURNACE
- 25 QUENCHING TANK
- 26 WELDING SET FOR HARD FACING
- 27 TRANSFORMER WELDING SET

SECTION 2



MACHINE SHOP, TOOLROOM & DIE REPAIR



SECTION 3

NOTE

NOTE

ALL DIMENSIONS ARE IN METER

LAYOUT

UNIFIED ARAB INDUSTRIAL DEVELOPMENT ORGANIZATION
 DRAWN BY
 PROJ. ENGR.
 DEPT. HEAD

DWG. NO.

LAYOUT OF MACHINE SHOP, TOOL ROOM AND DIE REPAIR SHOP

UNIFIED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
 ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

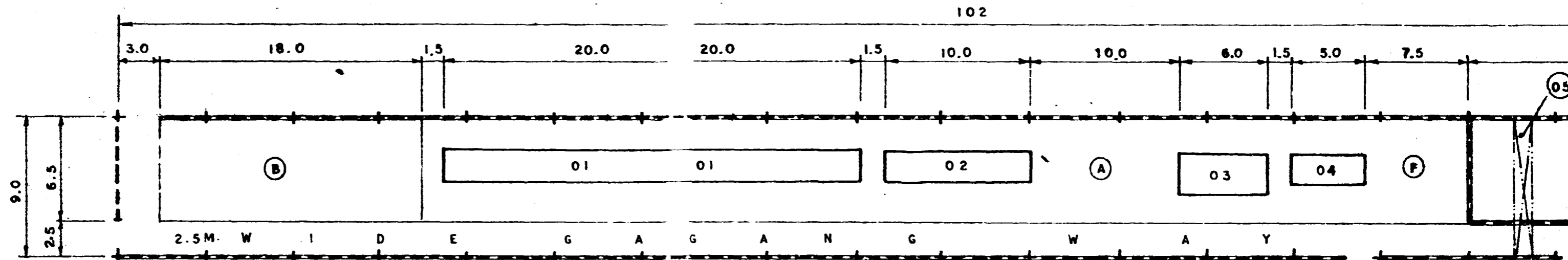
DEVELOPMENT CONSULTANTS
 CONSULTING ENGINEERS
 BOMBAY • CALCUTTA • MADRAS • NEW DELHI

DRAWN BY MUKUL CHOWDHURY DATE 25.11.91

PROJ. ENGR. PCD/M.C. SCALE 1:250

DEPT. HEAD JOB NO. 45010

DWG. NO. EXHIBIT 53 REV. NO.

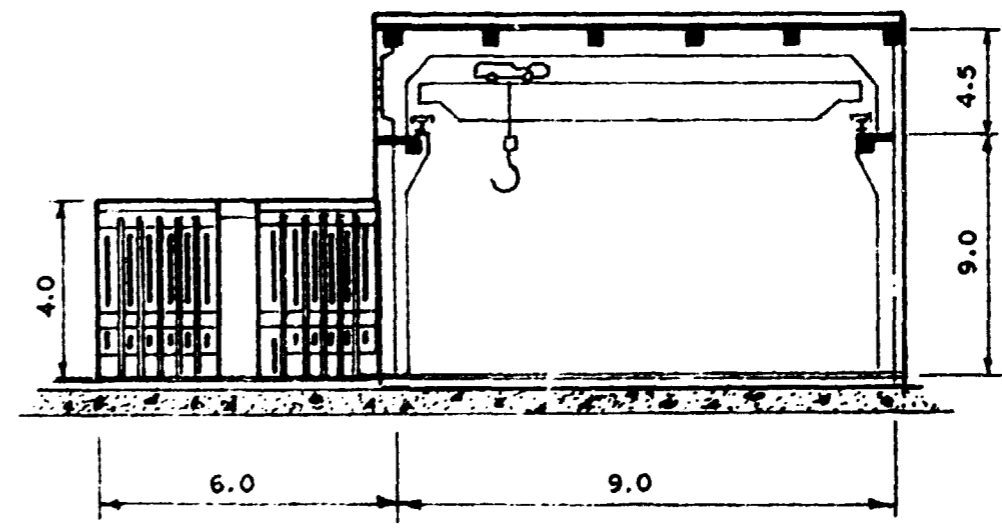


GALVANIZING SHOP

LEGEND

- | | | | |
|----|--------------------|---|-------------------------|
| 01 | ACID PICKLING TANK | A | DRYING SPACE |
| 02 | WATER RINSING TANK | B | INCOMING MATERIAL STORE |
| 03 | GALVANIZING TANK | C | FINISHED MATERIAL STORE |
| 04 | COOLING WATER TANK | D | OFFICE |
| 05 | E OT CRANE | E | CONTROL ROOM |
| | | F | DRYING SPACE |

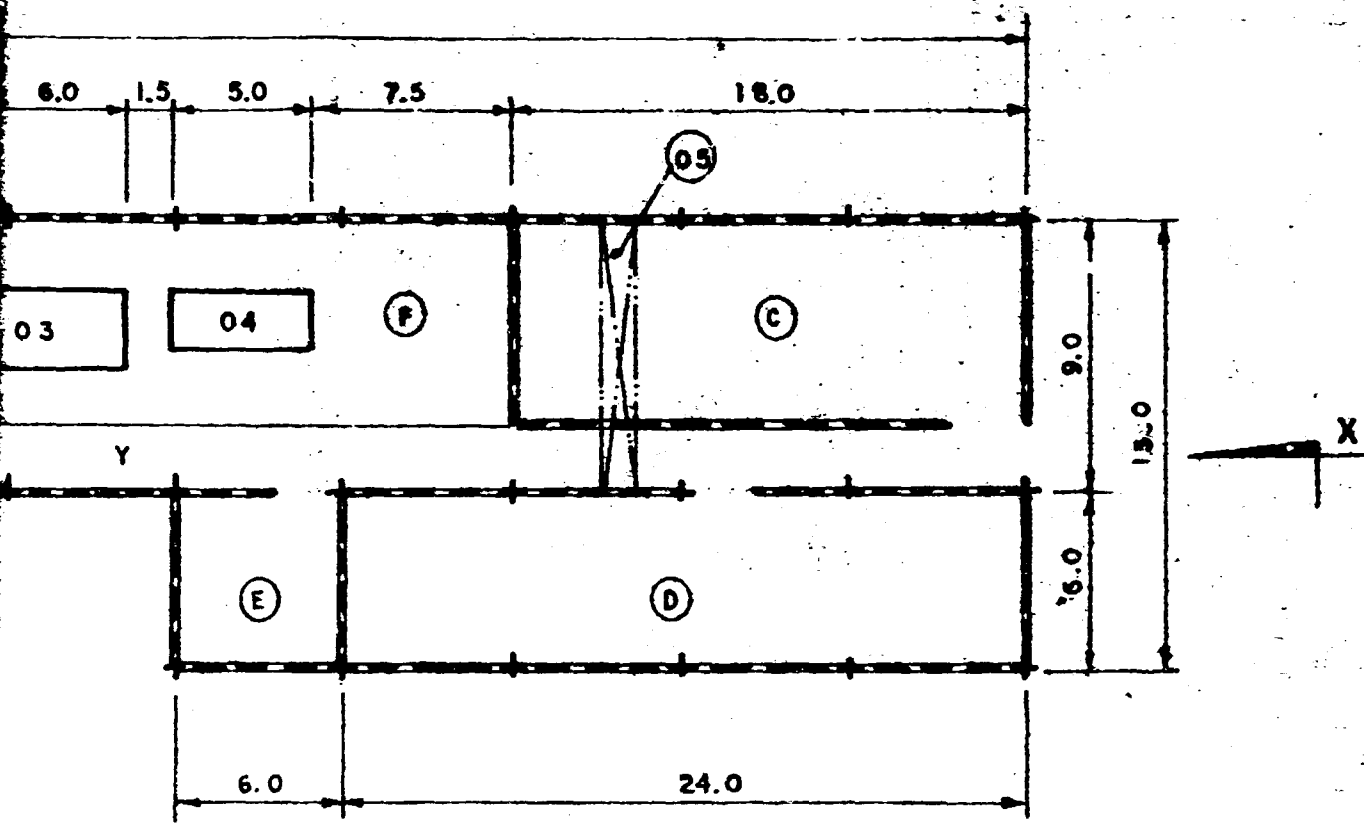
SECTION 2



SECTION 1

VIEW FROM X
SCALE_N.T.S

UNITED ARAB
DRAWN MU
FRS. ENGR.
DEPT. HEAD
DWG. NO



SECTION 3

LAYOUT OF GALVANIZING SHOP

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION



**DEVELOPMENT CONSULTANTS
CONSULTING ENGINEERS.
BOMBAY • CALCUTTA • MADRAS • NEW DELHI**

DRAWN MUKUL CHOWDHURY

DATE 1.12.91

PRJL ENGR. PCD/MC

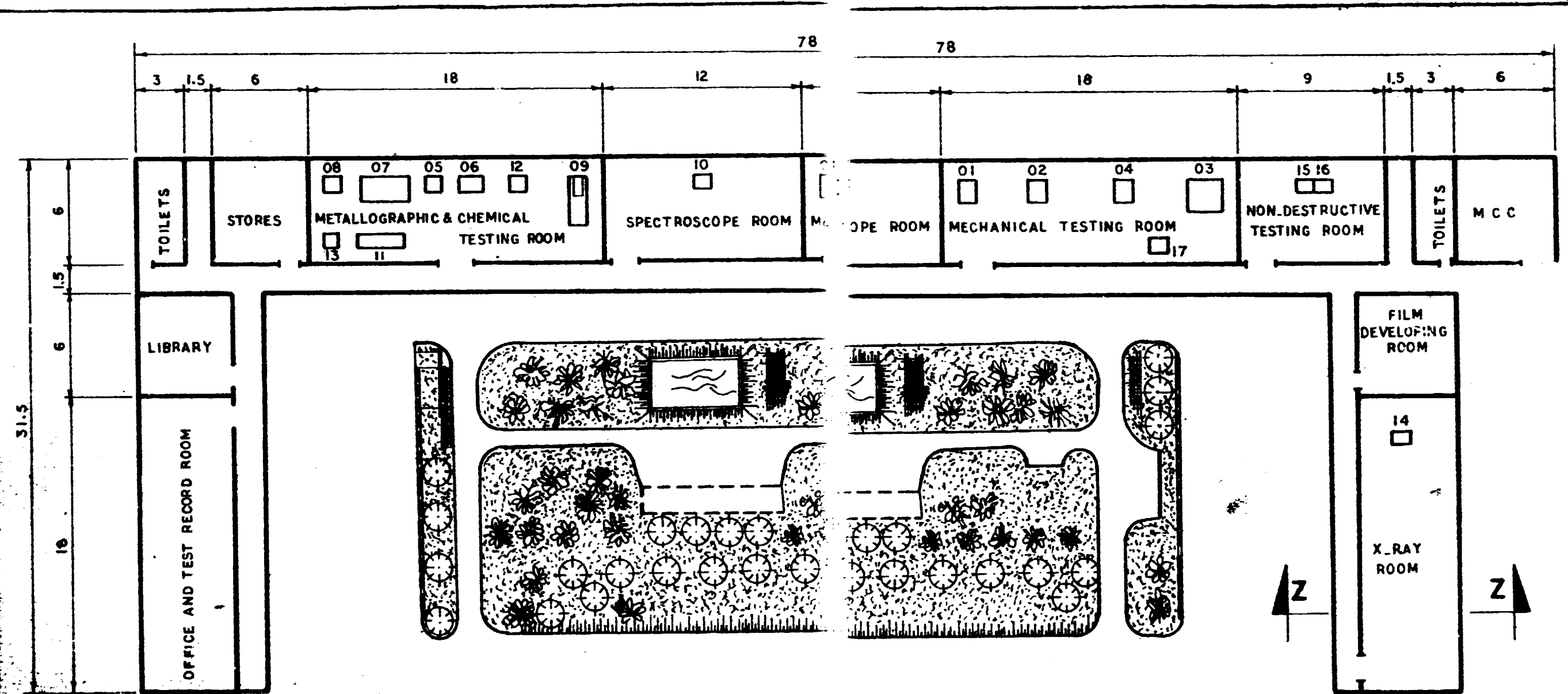
SCALE 1:250

DEPT. HEAD

JOB NO. 45010

DWG. NO. EXHIBIT -- 54

REV. NO.

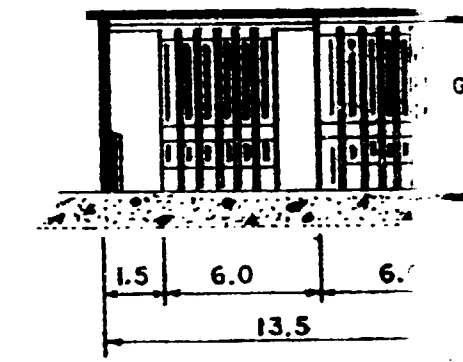


MATERIAL TESTING LABORATORY

LEGEND

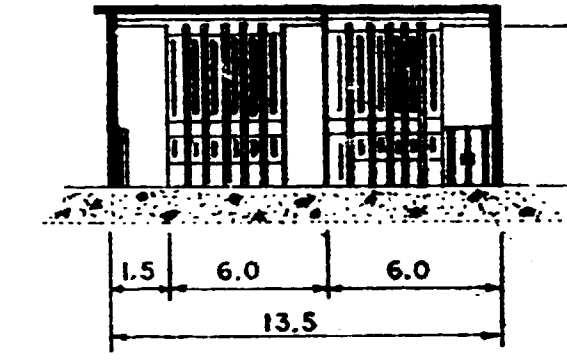
- | | | |
|-------------------------------------|--|----------------------------------|
| 01 BRINELL HARDNESS TESTER | 09 METALLOGRAPHIC MICROSCOPE | 10 MATERIAL TESTING SPECTROSCOPE |
| 02 ROCKWELL HARDNESS TESTER | 11 APPARATUS FOR DETERMINATION OF CARBON & SULPHUR | 12 BENCH DRILLING MACHINE |
| 03 UNIVERSAL TESTING MACHINE | 13 ELECTRIC MUFFLE FURNACE | 14 PORTABLE X-RAY EQUIPMENT |
| 04 IMPACT TESTING MACHINE | 14 PORTABLE X-RAY EQUIPMENT | 15 ULTRASONIC TESTING EQUIPMENT |
| 05 SPECIMEN MOUNTING PRESS | 16 MAGNETIC CRACK DETECTOR | 17 ABRASIVE CUTTING MACHINE |
| 06 SURFACE GRINDER | | |
| 07 SPECIMEN GRINDING & POLISHING | | |
| 08 ELECTROLYTIC POLISHING APPARATUS | | |

SECTION 2



VIEW_Z Z

NOTE
ALL DIMENSION



VIEW_Z Z

NOTE
ALL DIMENSIONS ARE IN METER

SECTION 3

SECTION 1

LAYOUT
UNITED
ARAB
DRAWN BY
PROF. ENGR.
DEPT. HEAD
DWG. NO.

LAYOUT OF MATERIAL TESTING LABORATORY	
UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION & ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION	
DEVELOPMENT CONSULTANTS CONSULTING ENGINEERS BOMBAY • CALCUTTA • MADRAS • NEW DELHI	
DRAWN BY MUKUL CHOWDHURY	DATE 16.11.91
PROF. ENGR. PCD/MC	SCALE 1:250
DEPT. HEAD	JOB NO. 45010
DWG. NO. EXHIBIT - 55	REV. NO.

JOB NO. : DCIL-105

EXHIBIT : 57

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

ESTIMATED COST OF CIVIL WORK

Sl. No.	Elements of Cost	Area (sq m)	Cost (Million US\$)	
			Jordan	Tunisia
1.	Land and Land Development including fencing, drainage and construction of roads	57,000	7.92	7.86
2.	Workshop Building having a height of 8 metres from floor to top of crane rail	20,454	14.81	14.19
3.	Administrative Building - double storeyed	2,304	0.99	0.96
4.	Auxiliary Buildings comprising workshop office, toilets and washrooms in workshop, refreshment centres, transformer house, pump house, first-aid centre, security, garage and control room	1,476	1.27	1.23
		Total	24.99	24.24

SECTION - 11
MANPOWER AND ORGANIZATION

MANPOWER AND ORGANISATION

The organisation has been designed to meet the functional needs of a plant in which about 12,000 tonnes of aluminium, steel and cast iron will be processed annually, to manufacture accessories of capacities ranging from 0.4 KV to 400 KV.

The organisation will operate for 300 days in a year and will carry out all the activities performed by a manufacturing unit. In order to plan, execute, co-ordinate and control all the necessary activities, manpower has been categorised under the following eight departments :

- o Production
- o Quality Control
- o Engineering
- o Materials
- o Maintenance
- o Marketing
- o Finance and Accounts
- o Personnel and Administration

The Director will head the entire complex, assisted by the Deputy Director (Technical). As shown in Exhibit-58, the Personnel Manager, the Marketing Manager, the Materials Manager and Chief Accountant will report directly to the Director. The Chief Engineer, the Production Manager, the Maintenance Manager and the Quality Control Manager, on the other hand, will report to the Deputy Director (Technical), who in turn, will report to the Director. These eight

managers head their respective departments. Exhibit-58 highlights the organisation structure for Managers (level 1 to 4) and Support Staff in the offices of Director and Deputy Director at each of the Accessories' plants.

Production

All Work Centres within the Production Department, except for the Galvanising Shop will work for 2 shifts. The Galvanising Shop will work for 3 shifts daily.

As the load in different Production Shops is not equal, they have been divided into two groups. While one of the two Senior Production Engineers shall be responsible for the Cast Iron Foundry, Aluminium Foundry and Forging Shop; the Machine Shop, Fabrication Shop and Galvanising Shop shall be headed by the other. Both of them will work in the general shift only.

The Central Progress Section will be managed by a Progress Engineer, who will report directly to the Production Manager. The function of this Section shall be to assign jobs to the respective Production Shops as soon as work orders are received from the Engineering Department. This Section shall also keep track of the jobs under process, and shall report their progress to the Production Department.

Manpower requirement and organisation chart for different shops within the Production Department and the Central Progress Section are shown in the respective Exhibits, as indicated below.

Sl. No.	Shop	Exhibit No. for Manpower	Exhibit No. for Organisation Chart
1.	Aluminium Foundry	59	60
2.	Forging Shop	61	62
3.	Cast Iron Foundry	63	64
4.	Fabrication Shop	65	66
5.	Machine Shop, Tool Room and Die Repair Shop	67	68
6.	Galvanising Shop	69	70
7.	Central Progress Section	71	72

Quality Control

The department would be headed by a Quality Control Manager, with one Senior Engineer (Mechanical Testing Laboratory) reporting to him. This department will inspect and approve materials in various stages - raw material, work-in-progress for finished product and recommend methods for improving quality of materials.

Manpower requirement and organisation chart for this Department are shown in Exhibit-73 and Exhibit-74 respectively.

Engineering

The department will be headed by the Chief Engineer. He will be assisted by two Process Planning Engineers and a Design Engineer.

The department's function will be to estimate time required to execute job orders, prepare and review drawings, issue

material requisitions to the Materials Department and issue work orders to the Production Department; with a view to expedite orders.

Manpower requirement and organisation chart for the Engineering Department are shown in Exhibit-75 and Exhibit-76 respectively.

Materials

This department will be headed by the Materials Manager. Both the Senior Materials Engineer and the Stores Officer, shall report directly to the Materials Manager. The Senior Materials Engineer shall be assisted by a Materials Engineer. While the Senior Engineer will look after imports, local procurements and inventory control shall be taken care of by the Materials Engineer. The Stores Officer shall be assisted by the Shop Storekeepers, who, in turn, will be assisted by Stores Assistants - for tools and machinery spares, raw materials and consumables, and finished goods respectively.

Manpower requirement and organisation chart for this Department are shown in Exhibit-77 and Exhibit-78 respectively.

Maintenance

The Overhead Line Accessories manufacturing plant is spread over a large area. Respective Production shops have been provided with maintenance facilities. The Maintenance Department will look after utilities & general maintenance, and co-ordinate maintenance activities of different departments. The Department shall be headed by the

Maintenance Manager. He shall be assisted by the Senior Maintenance Engineer, who will be assisted by three Maintenance Engineers - one for Electrical and two for Mechanical components.

Manpower requirement and organisation chart for the Maintenance Department are shown in Exhibit-79 and Exhibit-80 respectively.

Marketing

Headed by the Marketing Manager, this department will be responsible for securing orders for the plant and realising payments, etc. The Marketing Manager shall be assisted by two Senior Sales Engineers, each of whom will be assisted by two Sales Engineers.

Manpower requirement and organisation chart for the Marketing Department are shown in Exhibit-81 and Exhibit-82 respectively.

Finance and Accounts

The Chief Accountant will head this department, assisted by two Senior Accountants and five Accountants. This department will work in the general shift only.

Manpower requirement and organisation chart for this Department are presented in Exhibit-83 and Exhibit-84 respectively.

Personnel and Administration

This department will be headed by the Personnel Manager, who shall be assisted by the Personnel Officer, the Administrative Officer and the Training Officer.

Exhibit-85 presents the requirement of manpower for this department. Organisation chart is presented in Exhibit-86. A summary of manpower requirement is presented in Exhibit-87.

The designations, salary levels and number of personnel in the organisation structure of each department may be observed from relevant serial numbers as given in the exhibits relating to manpower requirement for respective departments.

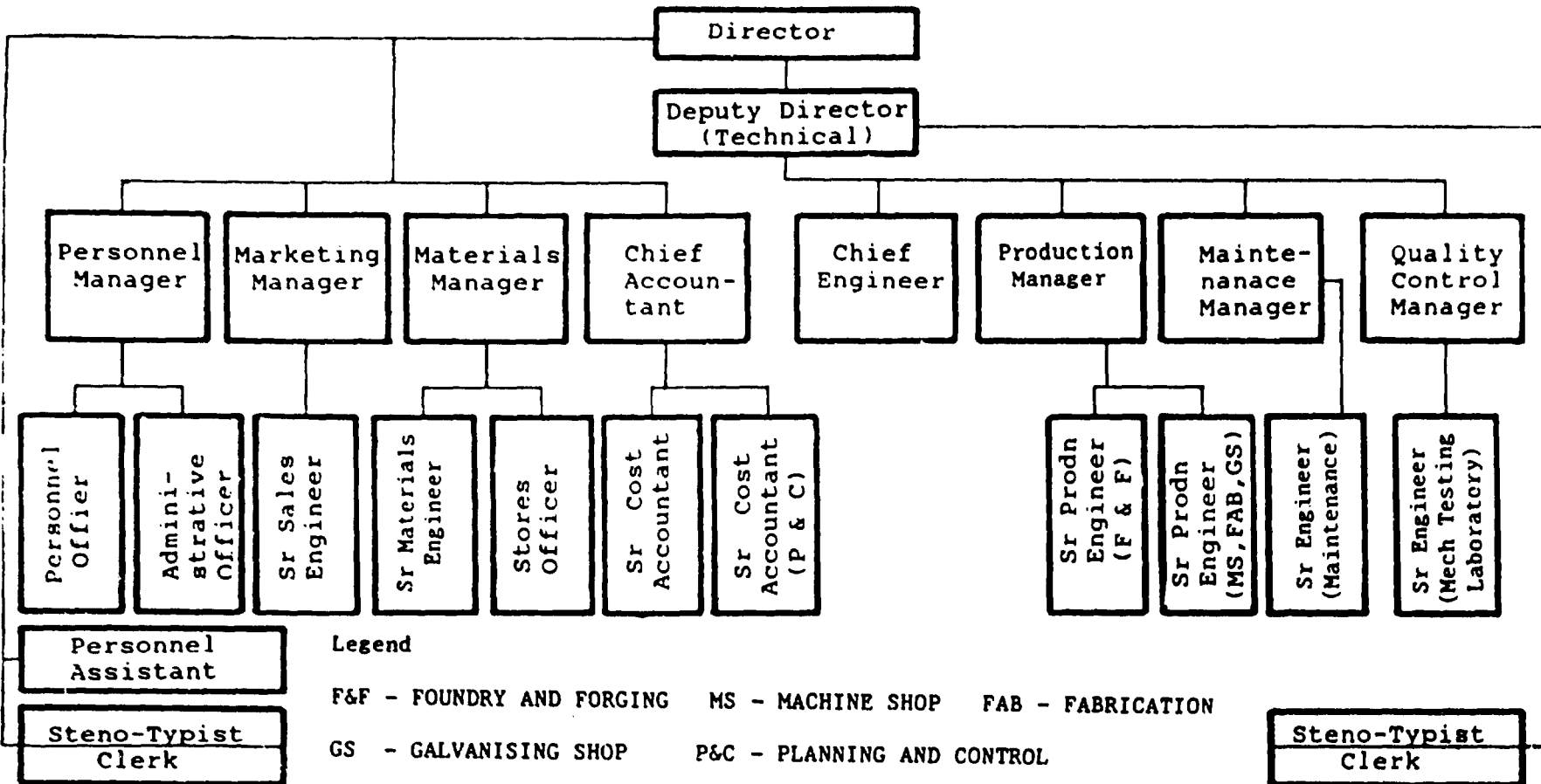
Manpower required in each of the two plants have been grouped into nine levels, with different salary grades. The statement of monthly salaries and wages is presented in Exhibit-88.

JOB NO. : DCIL-105

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

EXHIBIT : 58

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES
ORGANISATION CHART : MANAGERS AND OFFICE STAFF



DEVELOPMENT CONSULTANTS
CONSULTING ENGINEERS

JOB NO. : DCIL-105

EXHIBIT : 59

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

MANPOWER REQUIREMENT : ALUMINIUM FOUNDRY

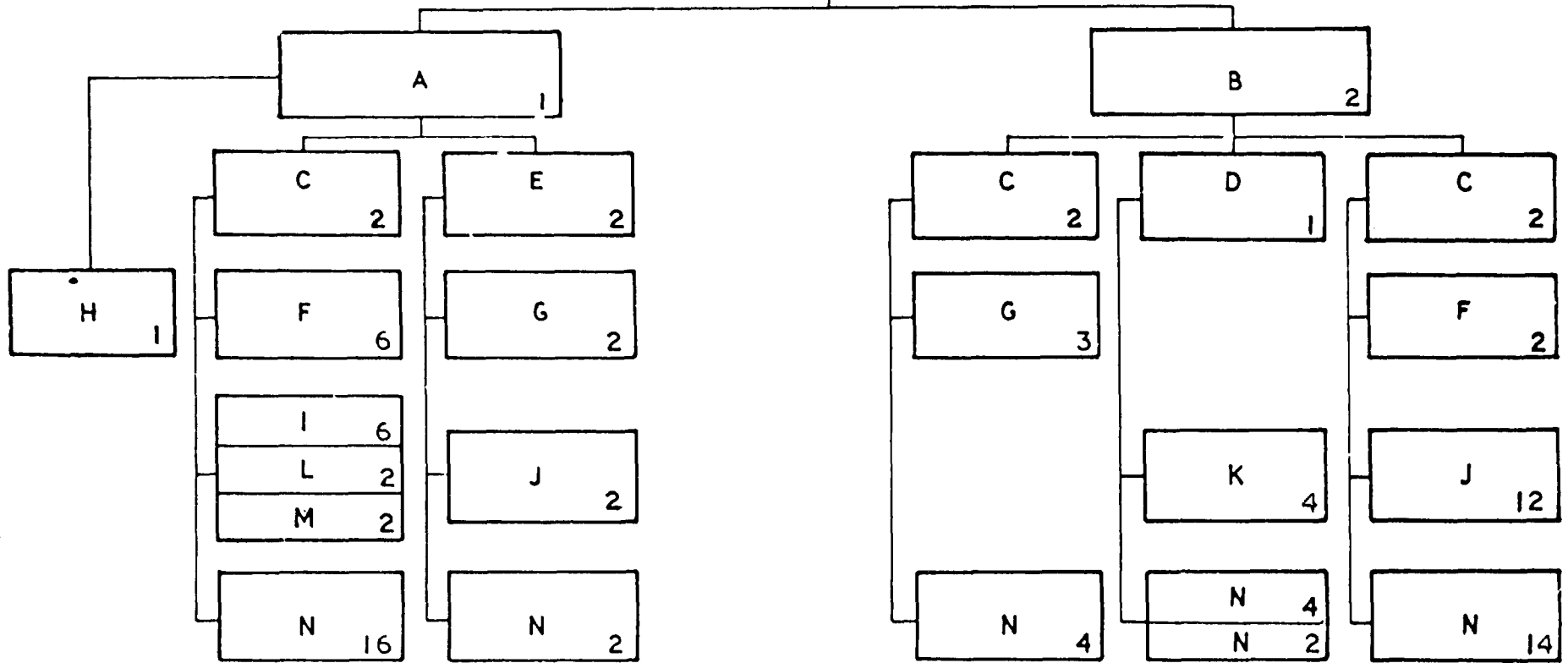
Sl. No.	Designation	Salary Level	Number(s)
A.	Metallurgist	5	1
B.	Production Engineer	5	2
C.	Foreman	6	6
D.	Technical Assistant	6	1
E.	Chemical Analyst	6	2
F.	Highly Skilled Furnace Operator	7	8
G.	Highly Skilled Machine Operator	7	5
H.	Steno Typist	7	1
I.	Skilled Furnace Operator	8	6
J.	Skilled Machine Operator	8	14
K.	Crane Driver	8	4
L.	Charge Maker	8	2
M.	Furnace and Ladle Lining Repairer	8	2
N.	Helper	9	42
	Total		96

JOB NO. : DCIL-105

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION
PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES
ORGANISATION CHART : ALUMINIUM FOUNDRY

EXHIBIT : 60

SR. PRODUCTION ENGINEER.
(FORGING & FOUNDRIES)



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DEVELOPMENT CONSULTANTS
CONSULTING ENGINEERS

JOB NO. : DCIL-105

EXHIBIT : 61

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

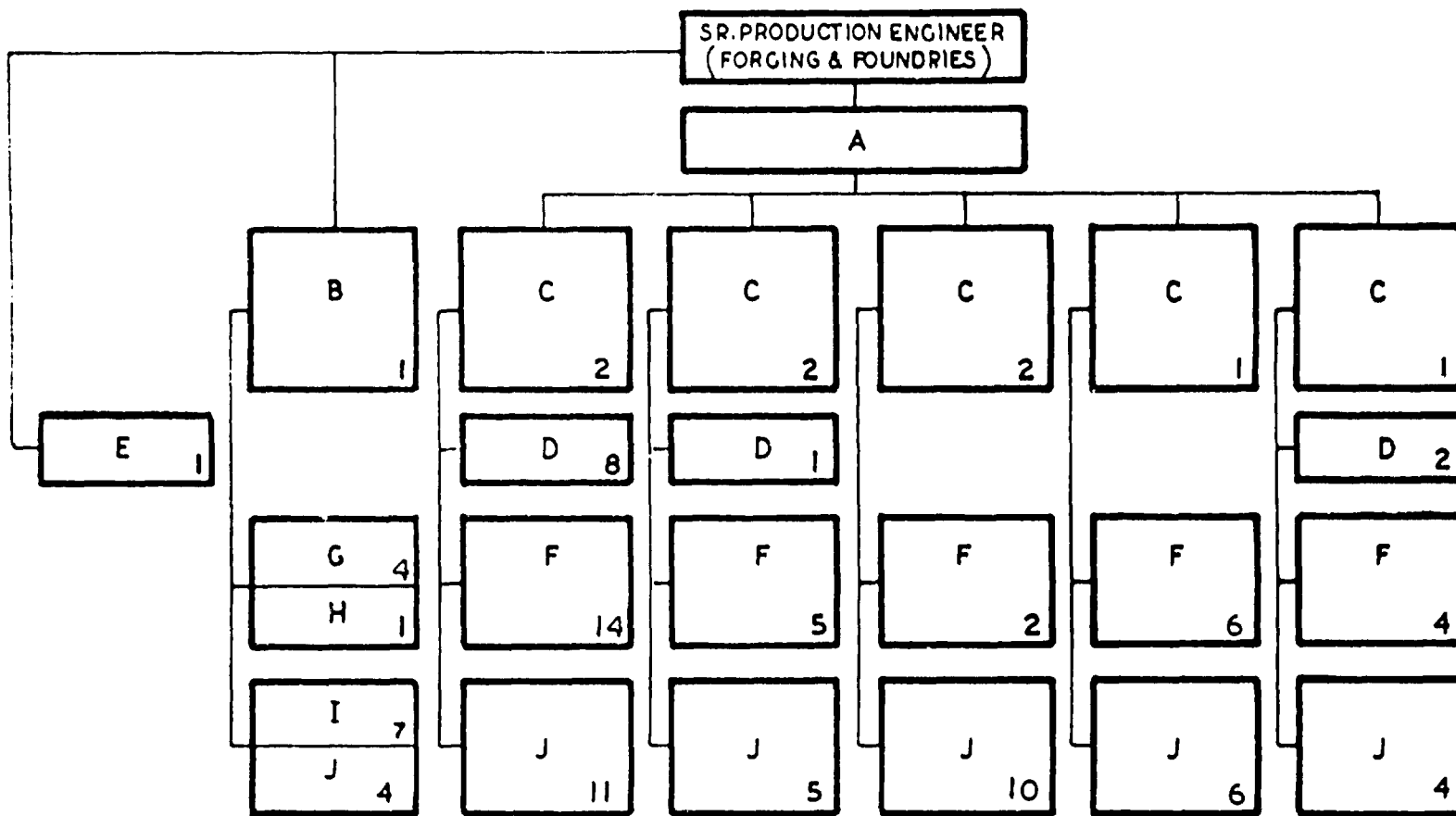
MANPOWER REQUIREMENT : FORGING SHOP

Sl. No.	Designation	Salary Level	Number(s)
A.	Production Engineer	5	2
B.	Technical Assistant	6	1
C.	Foreman	6	8
D.	Highly Skilled Machine Operator	7	11
E.	Steno Typist	7	1
F.	Skilled Machine Operator	8	31
G.	Crane Driver	8	4
H.	Progress Clerk	8	1
I.	Material Handler	9	7
J.	Unskilled Worker	9	40
	Total		106

JOB NO. : DCIL-105

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION
PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES
ORGANISATION CHART : FORGING SHOP

EXHIBIT : 62



DEVELOPMENT CONSULTANTS
CONSULTING ENGINEERS

11-11

JOB NO. : DCIL-105

EXHIBIT : 63

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

MANPOWER REQUIREMENT : CAST IRON FOUNDRY

Sl. No.	Designation	Salary Level	Number(s)
A.	Production Engineer	5	2
B.	Metallurgist	5	1
C.	Laboratory Chemist	6	1
D.	Foreman - Furnace Melting	6	2
E.	Foreman - Fettling and Heat Treatment	6	2
F.	Foreman - Sand Plant and Moulding	6	1
G.	Foreman - Core Section	6	1
H.	Technical Assistant	6	1
I.	Highly Skilled Furnace Operator	7	4
J.	Laboratory Assistant	8	2
K.	Chipper, Gas Cutter, Grinder and Cut off Machine Operator	8	8
L.	Wooden Pattern Repairer	8	2
M.	Skilled Machine Operator	8	24
N.	Skilled Furnace Operator	8	6
O.	Pourer	8	4
P.	Welder	8	4

JOB NO. : DCIL-105

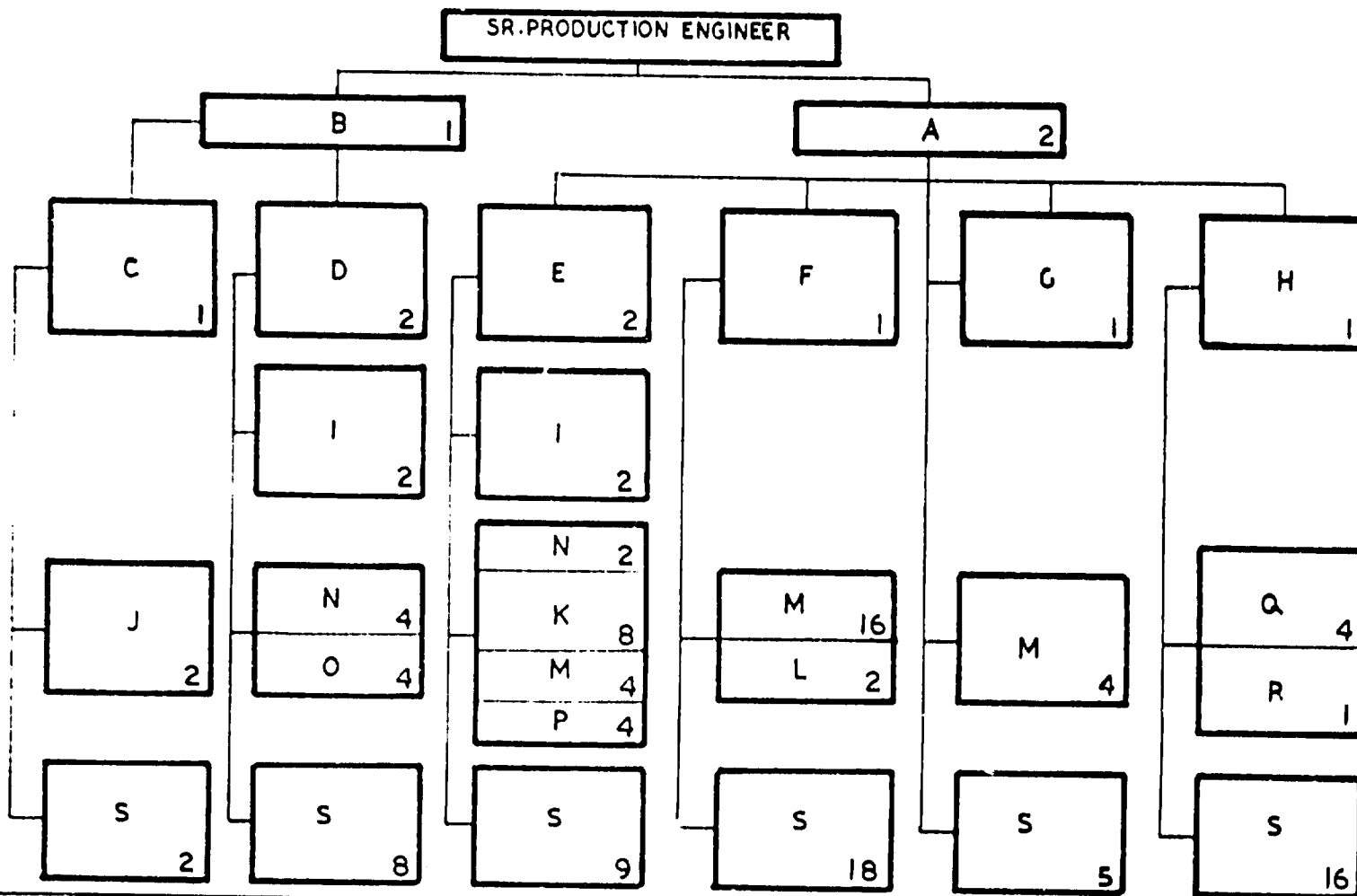
EXHIBIT : 63

Sl. No.	Designation	Salary Level	Number(s)
Q.	Crane Driver	8	4
R.	Progress Clerk-cum-Typist	8	1
S.	Unskilled Worker, Slingman and Helper	9	58
Total			128

JOB NO. : DCIL-105

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION
PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES
ORGANISATION CHART : CAST IRON FOUNDRY

EXHIBIT : 64



DEVELOPMENT CONSULTANTS

CONSULTING ENGINEERS

JOB NO. : DCIL-105

EXHIBIT : 65

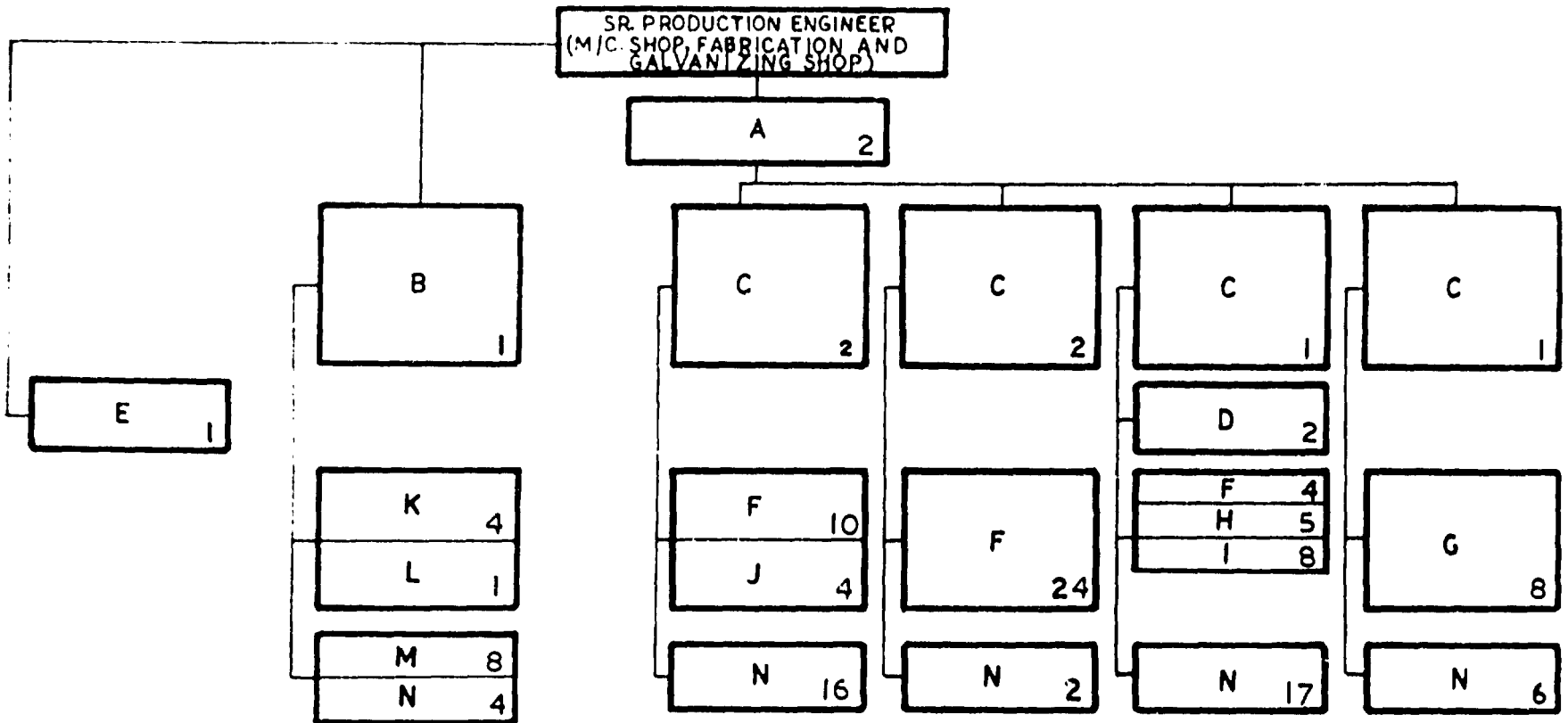
UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

MANPOWER REQUIREMENT : FABRICATION SHOP

Sl. No.	Designation	Salary Level	Number(s)
A.	Production Engineer	5	2
B.	Technical Assistant	6	1
C.	Foreman	6	6
D.	Highly Skilled Welder	7	2
E.	Steno-Typist	7	1
F.	Machine Operator	8	38
G.	Mechanical Fitter	8	8
H.	Welder	8	5
I.	Marker	8	8
J.	Hand Gas Cutter	8	4
K.	Crane Driver	8	4
L.	Progress Clerk	8	1
M.	Material Handler	9	8
N.	Unskilled Worker and Slingman	9	45
Total			133

ORGANISATION CHART : FABRICATION SHOP



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JOB NO. : DCIL-105

EXHIBIT : 67

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

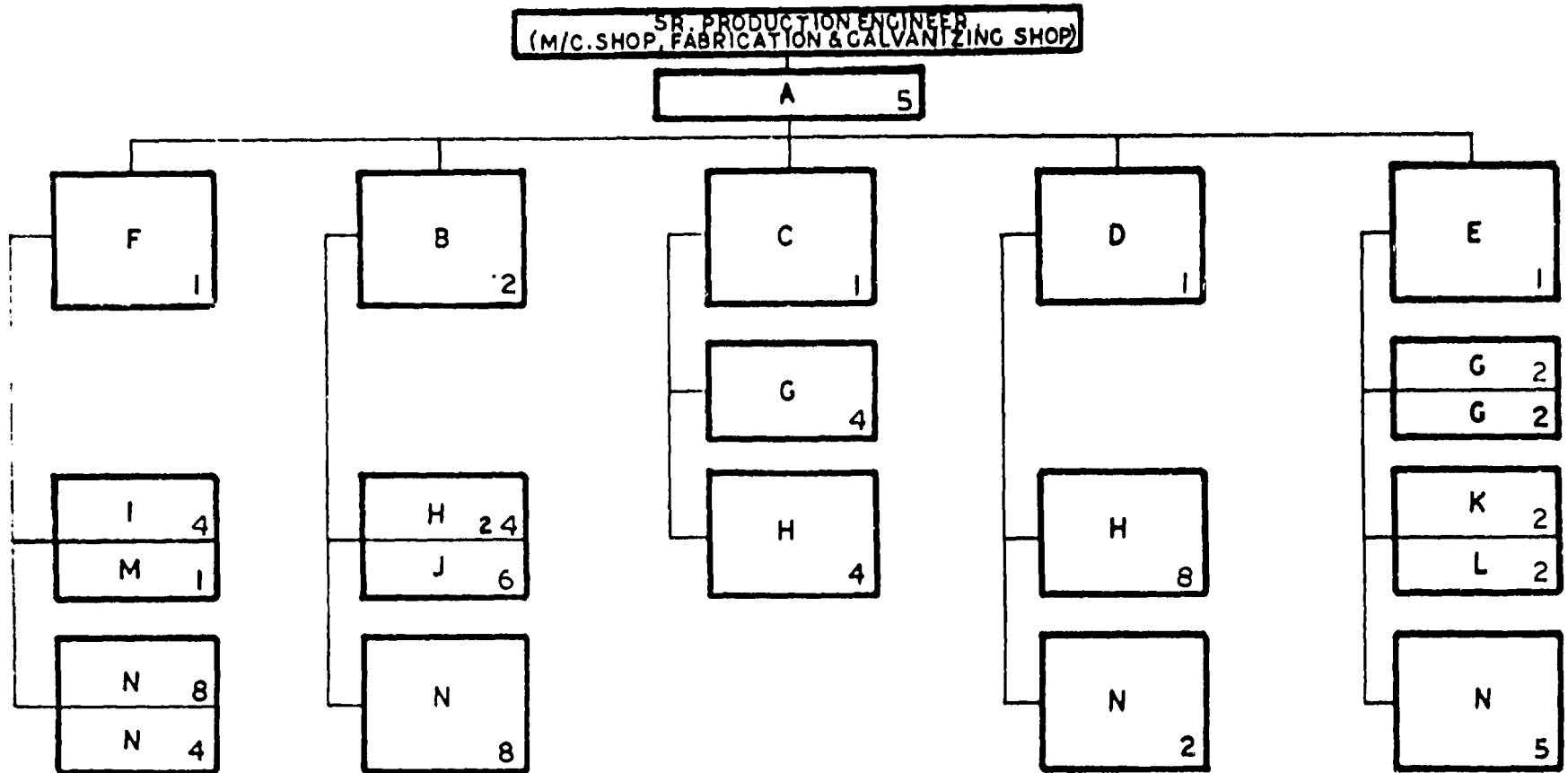
PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES
MANPOWER REQUIREMENT : MACHINE SHOP, TOOL ROOM
AND DIE REPAIR SHOP

Sl. No.	Designation	Salary Level	Number(s)
A.	Production Engineer	5	2
B.	Foreman - Drilling, Dressing up and Nut Tapping	6	2
C.	Foreman - Grinding, Jig Boring and Die Sinking	6	1
D.	Foreman - General Machine Tools	6	1
E.	Foreman - Die Fitting, Heat Treatment and Welding	6	1
F.	Technical Assistant	6	1
G.	Highly Skilled Machine Operators	7	8
H.	Skilled Machine Operator	8	36
I.	Crane Driver	8	4
J.	Bench Fitter	8	6
K.	Die Fitter	8	2
L.	Welder	8	2
M.	Progress Clerk cum Steno-Typist	8	1
N.	Unskilled Worker and Slingman	9	27
Total			94

JOB NO. : DCIL-105

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION
PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES
ORGANISATION CHART : MACHINE SHOP, TOOL ROOM, DIE REPAIR SHOP

EXHIBIT : 68



II - 1A



DEVELOPMENT CONSULTANTS
CONSULTING ENGINEERS

JOB NO. : DCIL-105

EXHIBIT : 69

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

MANPOWER REQUIREMENT : GALVANISING SHOP

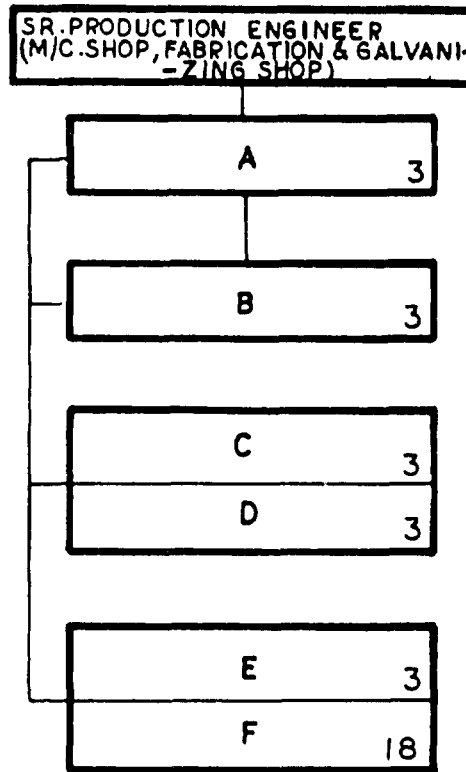
Sl. No.	Designation	Salary Level	Number(s)
A.	Chemist	6	3
B.	Galvaniser	7	3
C.	Crane Driver	8	3
D.	Pickler	8	3
E.	Slingman	9	3
F.	Helper - Material Stacking and Removal	9	18
Total			33

JOB NO. : DCIL-105

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION
PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

EXHIBIT : 70

ORGANISATION CHART : GALVANISING SHOP



DEVELOPMENT CONSULTANTS

CONSULTING ENGINEERS

JOB NO. : DCIL-105

EXHIBIT : 71

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

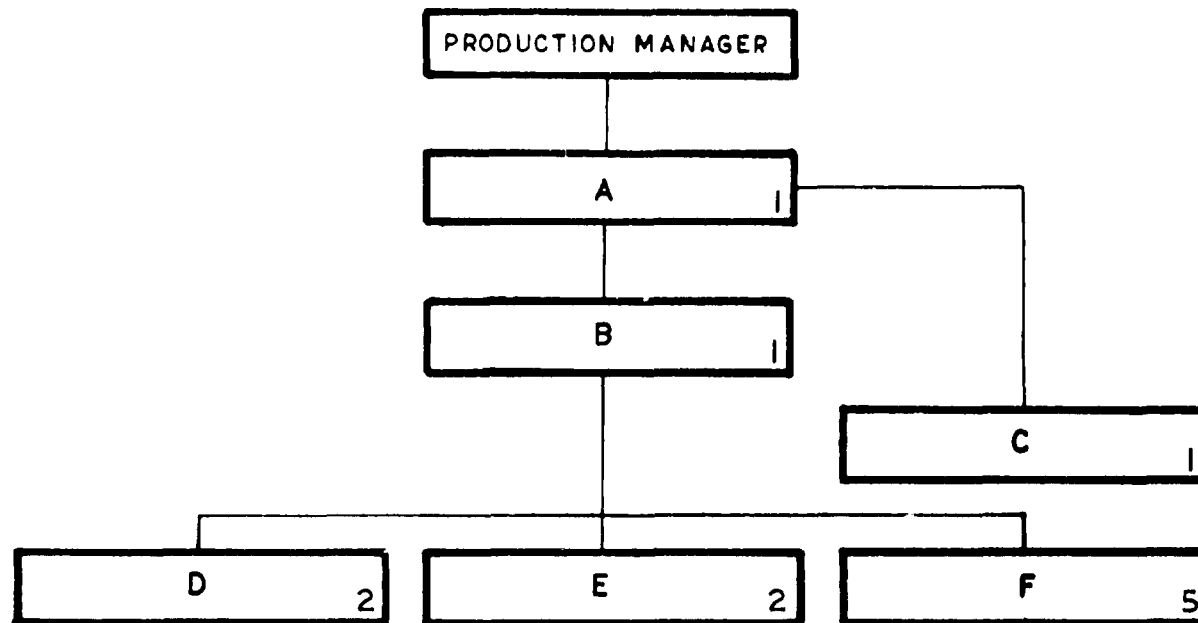
MANPOWER REQUIREMENT : CENTRAL, PROGRESS SECTION

Sl. No.	Designation	Salary Level	Number(s)
A.	Progress Engineer	5	1
B.	Movement Incharge	6	1
C.	Steno-Typist	7	1
D.	Progress Clerk	8	2
E.	Forklift Driver	8	2
F.	Pedestrian Truck Driver	8	5
Total			12

JOB NO. : DCIL-105

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION
PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES
ORGANISATION CHART : CENTRAL PROGRESS SECTION

EXHIBIT : 72



DEVELOPMENT CONSULTANTS
CONSULTING ENGINEERS

11-33

JOB NO. : DCIL-105

EXHIBIT : 73

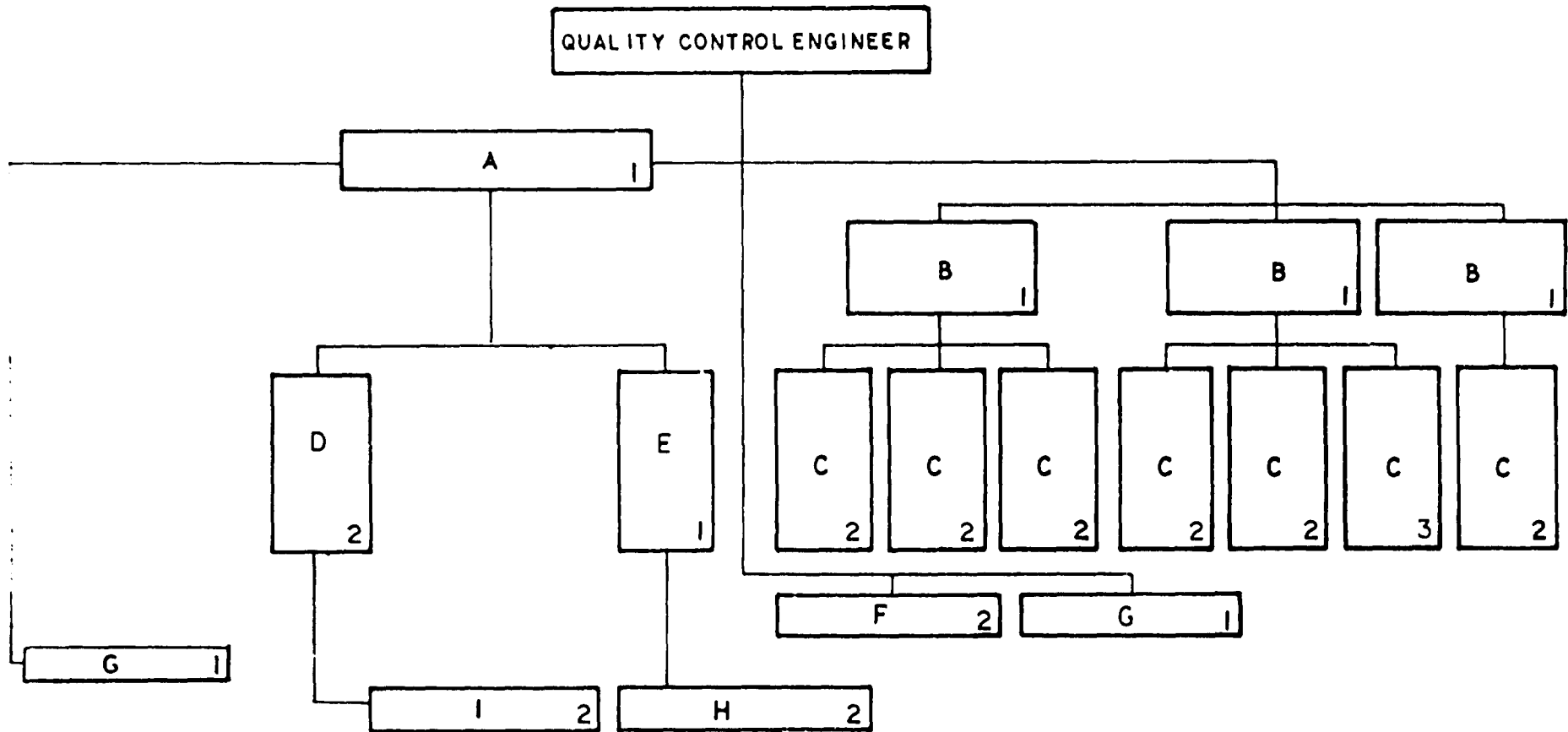
UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

MANPOWER REQUIREMENT : QUALITY CONTROL

Sl. No.	Designation	Salary Level	Number(s)
A.	Senior Engineer (Mechanical Testing Laboratory)	4	1
B.	Quality Control Engineer	5	3
C.	Inspector	6	15
D.	Machine Operator (Non-destructive Testing)	6	2
E.	Chemist	6	1
F.	Clerk	7	2
G.	Steno-Typist	7	2
H.	Laboratory Assistant	8	2
I.	Machine Operator	8	2
Total			30

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES
ORGANISATION CHART : QUALITY CONTROL



JOB NO. : DCIL-105

EXHIBIT : 75

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

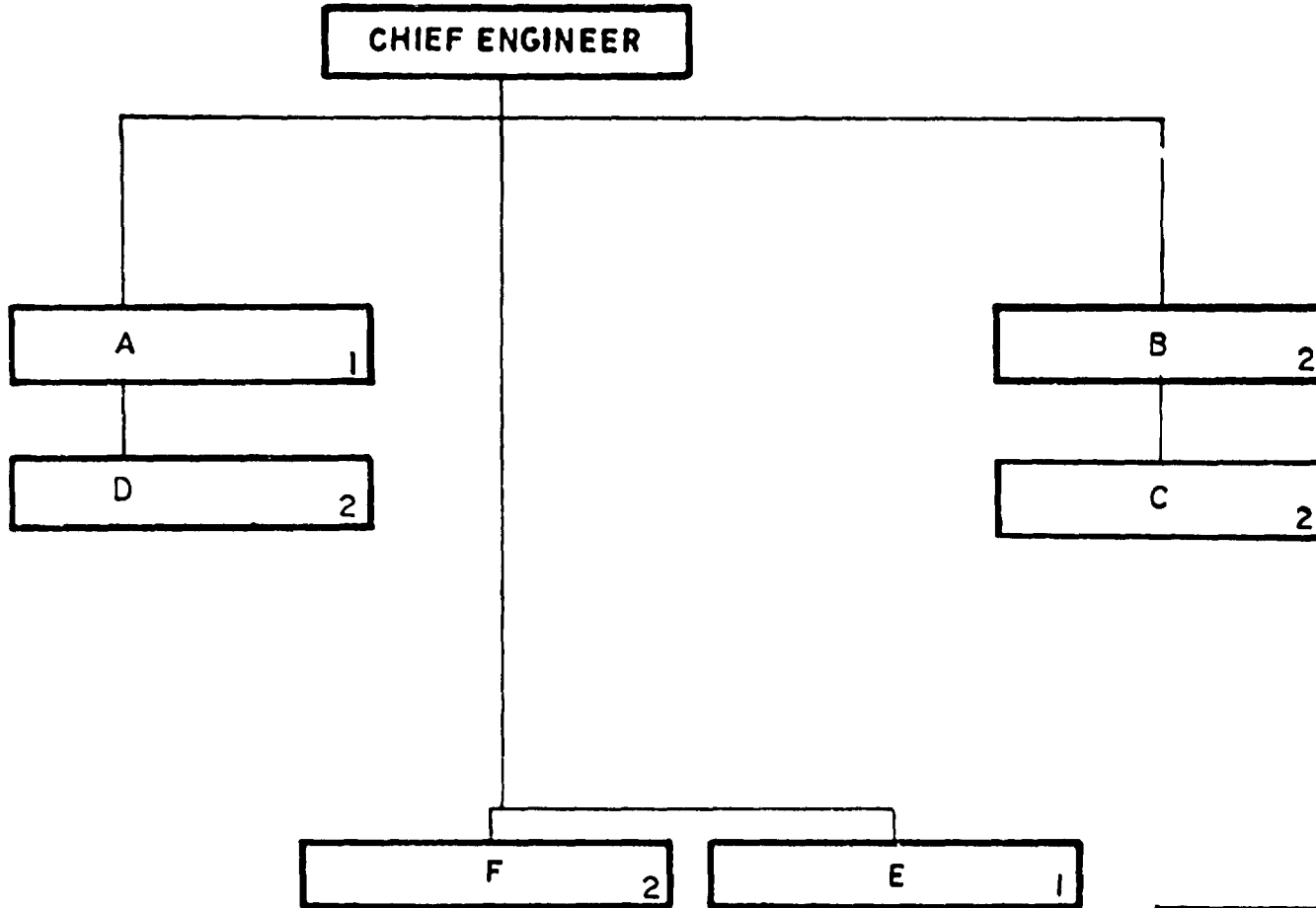
MANPOWER REQUIREMENT : ENGINEERING

Sl. No.	Designation	Salary Level	Number(s)
A.	Design Engineer	5	1
B.	Process Planning Engineer	5	2
C.	Technical Assistant	6	2
D.	Draftsman	6	2
E.	Steno-Typist	7	1
F.	Clerk	7	2
Total			10

JOB NO. : DCIL-105

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION
PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES
ORGANISATION CHART : ENGINEERING

EXHIBIT : 76



JOB NO. : DCIL-105

EXHIBIT : 77

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

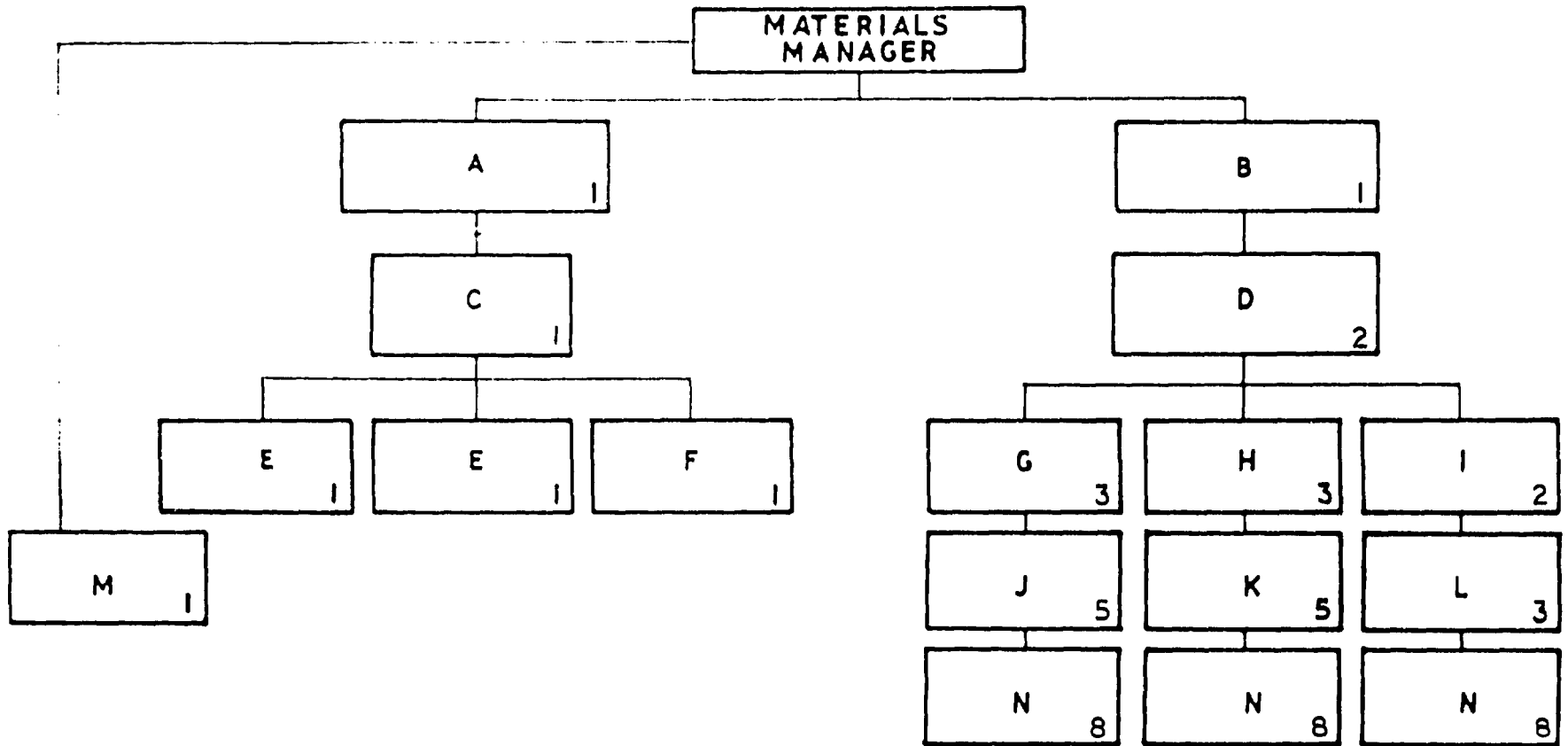
PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

MANPOWER REQUIREMENT : MATERIALS

Sl. No.	Designation	Salary Level	Number(s)
A.	Senior Materials Engineer	4	1
B.	Stores Officer	4	1
C.	Materials Engineer	5	1
D.	Storekeeper	5	2
E.	Purchase Assistant	6	2
F.	Stores Assistant	6	1
G.	Stores Assistant - Tool and Machine Spares	6	3
H.	Stores Assistant - Raw Materials and Consumables	6	3
I.	Stores Assistant - Finished Goods	6	2
J.	Tool Issue Clerk	7	5
K.	Receipt and Issue Clerk	7	5
L.	Receipt and Despatch Clerk	7	3
M.	Steno-Typist	7	1
N.	Handler	9	24
Total			54

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

ORGANISATION CHART : MATERIALS



JOB NO. : DCIL-105

EXHIBIT : 79

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

MANPOWER REQUIREMENT : MAINTENANCE

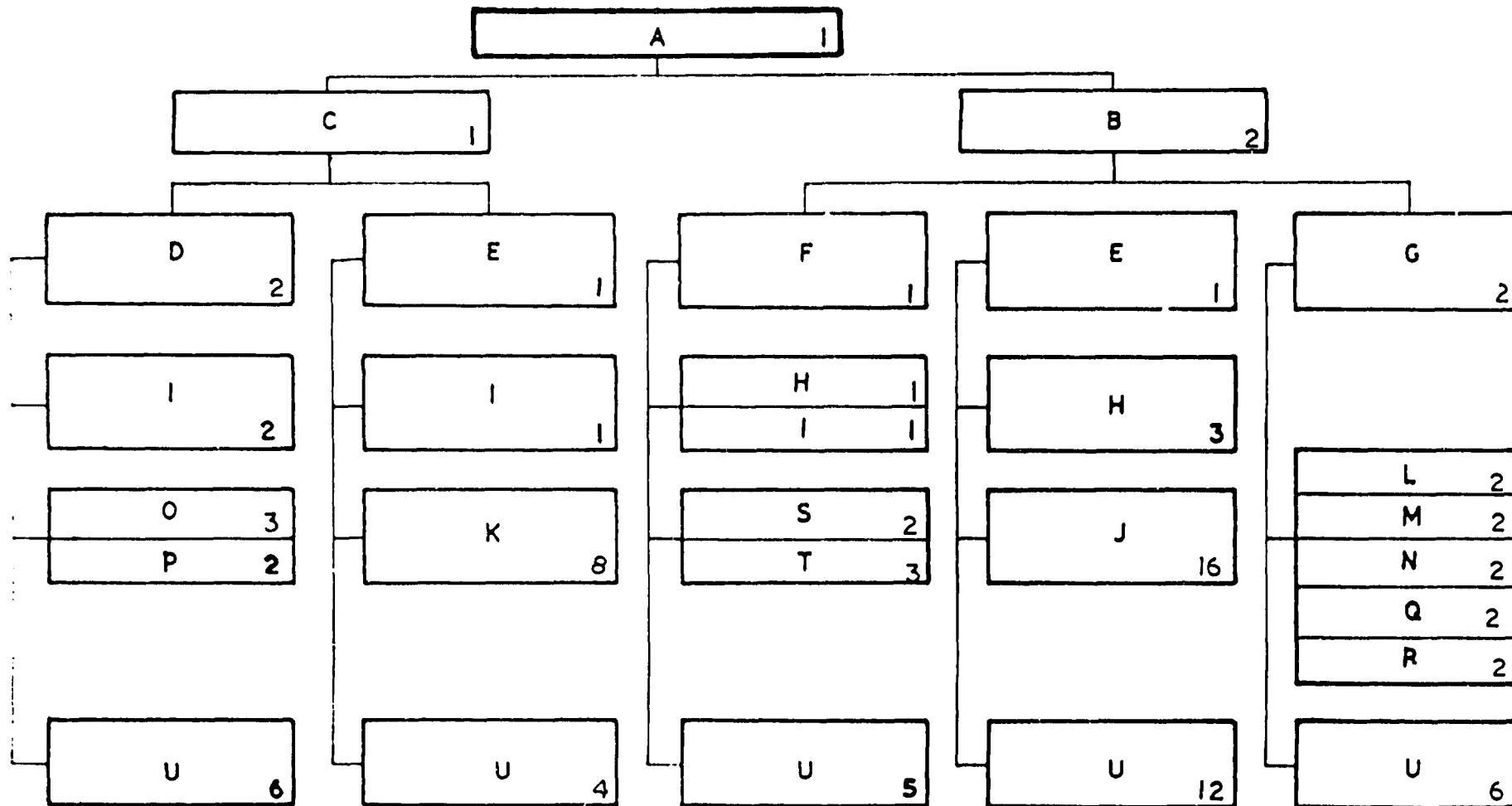
Sl. No.	Designation	Salary Level	Number(s)
A.	Senior Engineer (Maintenance)	4	1
B.	Maintenance Engineer - Mechanical	5	2
C.	Maintenance Engineer - Electrical	5	1
D.	Foreman - Transformer House and Distribution	6	2
E.	Foreman - Shop Maintenance	6	2
F.	Foreman - Central Maintenance Shop	6	1
G.	Foreman - Mechanical Utilities	6	2
H.	Highly Skilled Mechanical Fitter	7	4
I.	Highly Skilled Electricians	7	4
J.	Skilled Mechanical Fitter	8	16
K.	Skilled Electricians	8	8
L.	Mason	8	2
M.	Carpenter	8	2
N.	Plumber	8	2
O.	Electrician - Wiring	8	3
P.	Transformer House Attendant	8	2

JOB NO. : DCIL-105

EXHIBIT : 79

Sl. No.	Designation	Salary Level	Number(s)
Q.	Pump House Attendant	8	2
R.	Compressor House Attendant	8	2
S.	Welder	8	2
T.	Machine Operator - Maintenance	8	3
U.	Helper	9	33
Total			96

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION
PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES
ORGANISATION CHART : MAINTENANCE



JOB NO. : DCIL-105

EXHIBIT : 81

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

MANPOWER REQUIREMENT : MARKETING

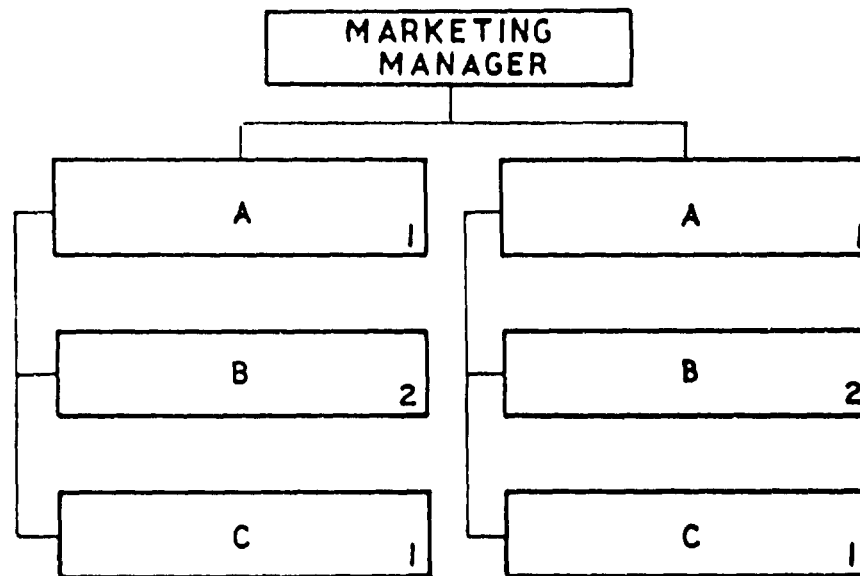
Sl. No.	Designation	Salary Level	Number(s)
A.	Senior Sales Engineer	4	2
B.	Sales Engineer	5	4
C.	Steno-Typist	7	2
Total			8

JOB NO. : DCIL-105

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION
PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

EXHIBIT : 82

ORGANISATION CHART : MARKETING



DEVELOPMENT CONSULTANTS
CONSULTING ENGINEERS

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JOB NO. : DCIL-105

EXHIBIT : 83

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

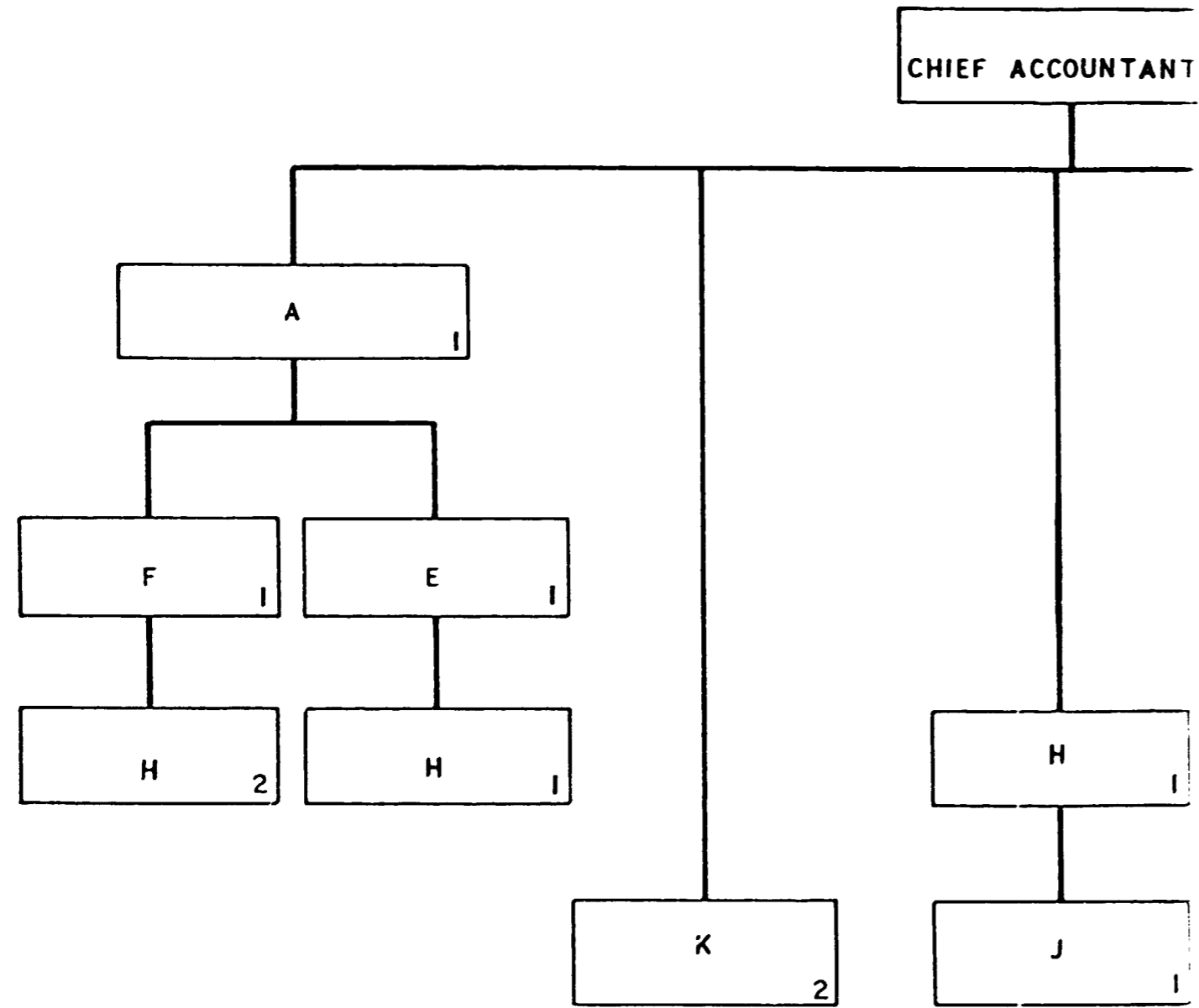
MANPOWER REQUIREMENT : FINANCE AND ACCOUNTS

Sl. No.	Designation	Salary Level	Number(s)
A.	Senior Cost Accountant	4	1
B.	Senior Accountant - Planning and Control	4	1
C.	Accountant - Wages and Salaries	5	1
D.	Accountant - Receipts and Payments	5	1
E.	Accountant - Costing	5	1
F.	Accountant - Budgets	5	1
G.	Accountant - Ledger and Book Keeping	5	1
H.	Accounts Assistant	6	8
I.	Cashier	6	1
J.	Accounts Clerk	7	4
K.	Steno-Typist	7	2
Total			22

JOB NO. : DCIL-105

UNITED NATIONS INDUSTRIAL DEV
AND
ARAB INDUSTRIAL DEVELOPMENT AN
PROJECT PROFILE ON OVERHEAT

ORGANISATION CHART : FINAN

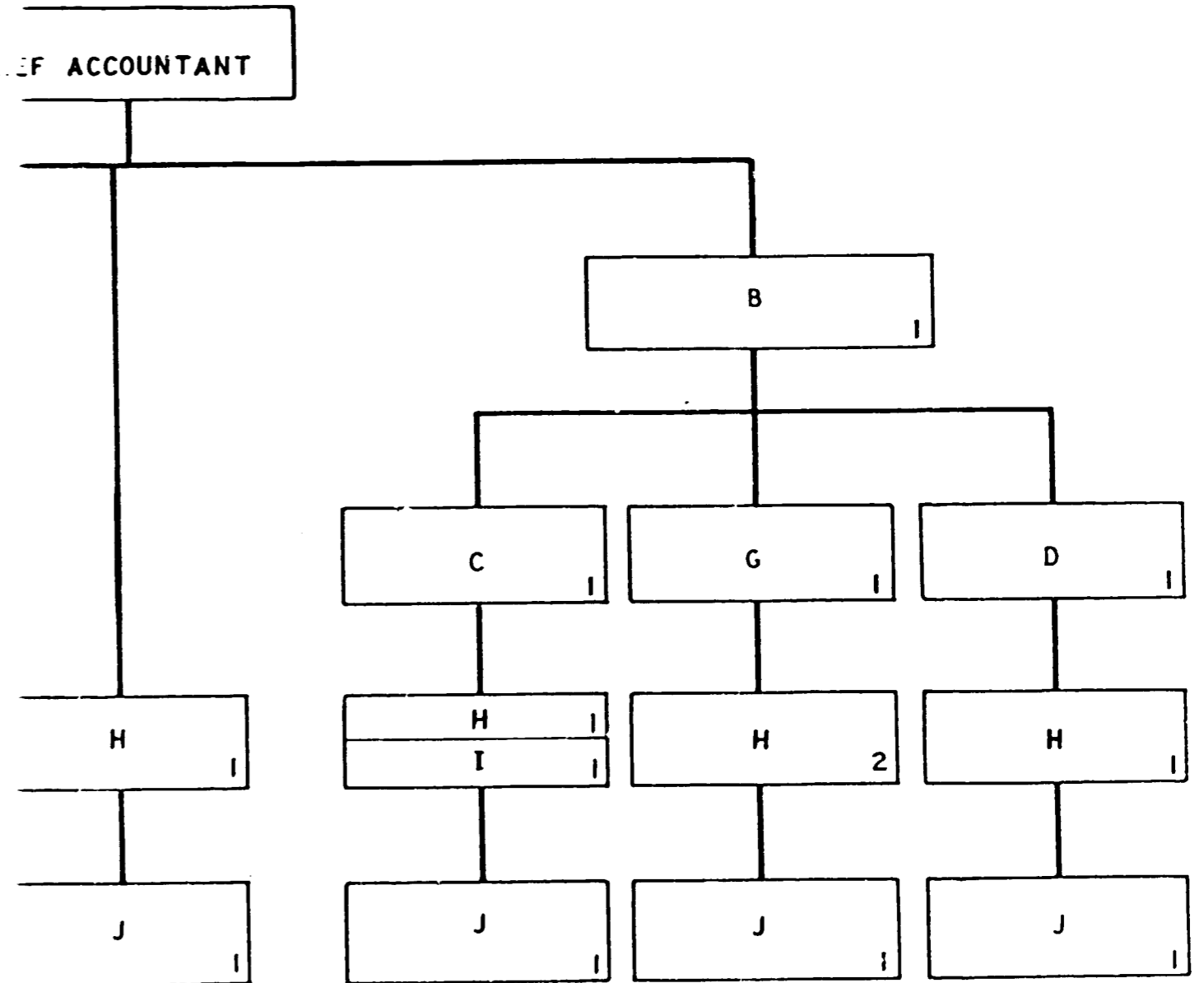


SECTION 1

INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
DEVELOPMENT AND MINING ORGANIZATION
PROFILE ON OVERHEAD LINE ACCESSORIES

ON CHART : FINANCE AND ACCOUNTS

EXHIBIT : 84



SECTION 2

JOB NO. : DCIL-105

EXHIBIT : 85

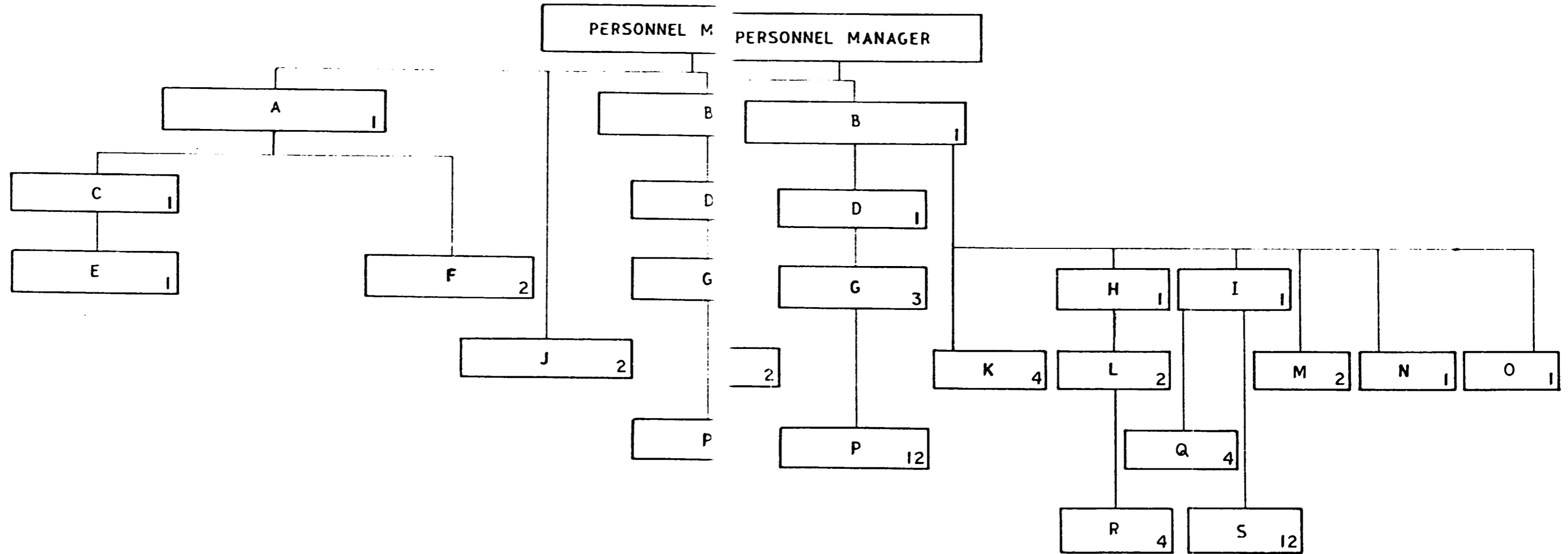
UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

MANPOWER REQUIREMENT : PERSONNEL AND ADMINISTRATION

Sl. No.	Designation	Salary Level	Number(s)
A.	Personnel Officer	4	1
B.	Administrative Officer	4	1
C.	Training Officer	5	1
D.	Chief Security Officer	5	1
E.	Librarian	6	1
F.	Personnel Assistant	6	2
G.	Security Guard	6	3
H.	Canteen in charge	6	1
I.	Housekeeper	6	1
J.	Steno-Typist	7	2
K.	Driver	7	4
L.	Cook	7	2
M.	Filing Clerk	7	2
N.	Telephone Operator-cum-Receptionist	7	1
O.	Despatch Clerk	7	1
P.	Watchman	8	12
Q.	Office Boy	8	4
R.	Waiter and Helper	9	4
S.	Sweeper and Gardener	9	12
Total			56

ORGANISATION CHART : PERSONNEL CHART : PERSONNEL AND ADMINISTRATION



SECTION 1

SECTION 2

JOB NO. : DCIL-105

EXHIBIT : 87

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

SUMMARY OF MANPOWER REQUIREMENT

Sl. No.	Designation/Department	Number(s)

Senior Managers (Level Nos. 1-3) and Office Staff		
1.	Director	1
2.	Deputy Director - Technical	1
3.	Chief Engineer	1
4.	Marketing Manager	1
5.	Chief Accountant	1
6.	Personnel and Administrative Manager	1
7.	Production Manager	1
8.	Maintenance Manager	1
9.	Materials Manager	1
10.	Quality Control Manager	1
11.	Personal Assistant to Director	1
12.	Steno-Typist to Director	1
13.	Steno-Typist to Deputy Director - Technical	1
14.	Clerk	2
15.	Sub-total (1 thru' 14)	15

JOB NO. : DCIL-105

EXHIBIT : 87

Sl. No.	Designation/Department	Number(s)
Others		
16.	Production	602
17.	Quality Control	30
18.	Engineering	10
19.	Materials	54
20.	Maintenance	96
21.	Marketing	8
22.	Finance and Accounts	22
23.	Personnel and Administration	56
24.	Sub-total (16 thru' 23)	878
25.	Total (15 + 24)	893

JOB NO. : DCIL-105

EXHIBIT : 88

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

STATEMENT OF MONTHLY SALARIES AND WAGES

Salary Level	Numbers	Monthly Basic Salary (US\$)		Total Monthly Salary (US\$)	
		Jordan	Tunisia	Jordan	Tunisia
1	1	9,000	9,000	9,000	9,000
2	1	8,000	6,000	8,000	6,000
3	8	6,000	3,000	48,000	24,000
4	11	4,042	1,510	44,462	16,610
5	36	2,648	989	95,328	35,604
6	100	1,800	800	1,80,000	80,000
7	98	1,338	500	1,31,124	49,000
8	317	900	400	2,85,300	1,26,800
9	321	557	208	1,78,797	66,768
TOTAL	893			9,80,011	4,13,782

SECTION - 12
FINANCIAL ANALYSIS AND EVALUATION

PLANT LOCATION : JORDAN

FINANCIAL ANALYSIS AND EVALUATION

The financial implications of the proposed projects are presented in this Section.

It may be mentioned here, that for the sake of uniformity, the prices of plant and equipment and raw materials have been considered identical for both the two countries, where the plants will be set up. Since most of the plant and equipment and raw materials are to be imported, the prevailing international prices of these items have been taken as the basis of calculation. For other cost parameters, which vary from country to country, the figures, as provided by the client has been considered.

COUNTRY : JORDAN

The financial analysis and evaluation of the proposed project for setting up of Overhead Line Accessories plant in this country are based on the capacity utilisation, price and costs.

Project Cost

The estimated cost of the project of setting up a 12,000 TPA plant is around US \$ 44.43 million as can be seen from Exhibit-89. The project cost includes the expenditure towards

- o Land and land development
- o Building and civil work
- o Plant and machinery
- o Miscellaneous fixed assets
- o Preliminary expenses

- o Pre-operative expenses
- o Technical know-how fees

Preliminary expenses have been assumed on a lumpsum basis on the project cost. Pre-operative expenses have three components, viz., establishment, travelling expenses and miscellaneous expenses. Establishment costs have been computed on the basis of salaries payable and overheads to various personnel who have to be recruited at various levels, during the construction period. Travelling expenses have been taken as approximately 10% of establishment costs from second to the last quarter of the construction period. Miscellaneous expenses have also been taken on a lumpsum basis. Technical know-how fees have been taken as 3.5% of the project cost excluding interest during construction and margin money for working capital.

5% cushion has been provided towards contingency. This cost also includes interest during construction and margin money for working capital.

Phasing of capital expenditure is based on implementation plan, and interest during construction has been computed based on the phasing. These two are presented in Exhibits 90 and 91 respectively.

Margin money for working capital is presented in Exhibit-92. In computing margin money it is assumed that adequate provisions have to be kept towards storage of raw materials and consumables required to be imported.

The project is assumed to be financed by Debt-Equity Ratio of 1:1.

Production, Sales and Revenue

Statement of production and sales of various product range and the revenue that will be generated from the sales of the products over the 10-year period is presented in Exhibit-93. Capacity utilisation is assumed at the rate of 80% in the first year, 90% in the second year and 100% from the third year onwards.

Costs

The annual costs of production and sales computed over 10 years are presented in Exhibit-94. In estimating these costs it is assumed that the salaries and wages will increase at the flat rate of 5% every year.

Profitability

Projected profitability statement is presented in Exhibit-95. The average profit before tax works out to 12.1% of average revenue.

Statement of fixed assets and depreciation under straight line method is presented in Exhibit-96. Tax computation and depreciation for tax are presented in Exhibits 97 and 98 respectively.

Working capital requirements are shown in Exhibit-99.

Projected cash flow statement and balance sheet over 10-year period are shown in Exhibits 100 and 101 respectively. The term loan will be repaid in 15 years including 2-year moratorium.

The project breaks even at around 72.2% and shows internal rate of return of 20.1% as can be seen from Exhibits 102 and 103 respectively. In computing internal rate of return, outflow is taken as the project cost and inflow is taken as the profit before interest, depreciation and tax.

JOB NO. : DCIL-105

EXHIBIT : 89

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

ESTIMATED PROJECT COST

('000 US \$)

Items	Value	Total
1. Land and Land Development (@ US\$ 139 per m ² for 57,000 m ²)	7923.00	7923.00
2. Building and Civil Work		
i) Workshop Building (@ US\$ 724 per m ² for 20,454 m ²)	14808.70	
ii) Administrative Building (@ US\$ 864 per m ² for 1,152 m ²)	995.33	
iii) Auxiliary Buildings (@ US\$ 864 per m ² for 1,476 m ²)	1275.26	
Sub-total (2)		17079.29
3. Plant and Machinery		
i) Imported		
- Aluminium Foundry	2026.99	
- Forging shop	2066.10	
- Cast Iron Foundry	1275.45	
- Fabrication shop	586.35	
- Machinshop, Toolroom & Die Repairshop	552.67	
- Galvanising shop	61.80	
- Material Testing Laboratory	100.32	
- Central Maintenance shop	109.03	
- Auxiliary Equipment & Handtools	137.28	
Total F.O.B. Value	6915.99	
ii) Insurance & Freight (@ 10% of FOB Value)	691.60	
iii) C.I.F. Value	7607.58	
iv) Import duty @ 6% on CIF value	456.46	
v) Transportation @ 1% of CIF Value	76.08	
Landed Cost at Site [Sub-total (3)]		8140.11

JOB NO. : DCIL-105

EXHIBIT : 89

('000 US \$)

Items	Value	Total
4. Miscellaneous Fixed Assets		
i) Transformers	106.80	
ii) Switchgears	4.00	
iii) Central Airconditioning system	173.87	
iv) Illumination, Fans and Room Coolers	9.00	
v) Water Pumps and Tank	34.60	
vi) Overhead fuel oil storage tank	9.00	
vii) Compressors	25.48	
viii) Fire fighting system	2.00	
ix) Telecommunication system	2.00	
x) Office Furniture and Equipment	3.00	
xi) Vehicles	90.00	
Sub-total (4)		459.75
5. Preliminary Expenses	50.00	50.00
6. Pre-operative Expenses		
i) Establishment	2213.06	
ii) Travelling Expenses	220.00	
iii) Miscellaneous	60.00	
		2493.06
7. Technical Know-how Fees	1379.00	1379.00
8. Sub-total (1 thru 7)	-	37524.21
9. Contingency @ 5% on above	-	1876.21
10. Sub-total (8 & 9)	-	39400.42
11. Interest during Construction	-	3957.61
12. Margin Money for Working Capital	-	1068.33
TOTAL COST	-	44426.36

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

PHASING OF CAPITAL EXPENDITURE

('000 US \$)

	Total	Construction Period in Quarters											
		1	2	3	4	5	6	7	8	9	10	11	12
1. Land and Land Development	7923.00	0.00	1980.75	1980.75	1980.75	1980.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2. Building and Civil Work	17079.29												
i) Workshop Building	14808.70	0.00	0.00	2115.53	2115.53	2115.53	2115.53	2115.53	2115.53	2115.52	0.00	0.00	0.00
ii) Administrative Building	995.33	0.00	0.00	0.00	0.00	248.83	248.83	248.83	248.84	0.00	0.00	0.00	0.00
iii) Auxiliary Buildings	1275.26	0.00	0.00	0.00	0.00	425.08	425.09	425.09	0.00	0.00	0.00	0.00	0.00
3. Plant and Machinery	8140.11												
i) Ordering	2442.03	0.00	0.00	0.00	1221.02	1221.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ii) Supply, delivery and installation at site	5698.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2777.81	2777.81	85.48	56.98

('000 US \$)

	Total	Construction Period in Quarters											
		1	2	3	4	5	6	7	8	9	10	11	12
4. Miscellaneous Fixed Assets	459.75												
i) Transformers	106.80	0.00	0.00	0.00	0.00	21.36	0.00	0.00	0.00	85.44	0.00	0.00	0.00
ii) Switchgears	4.00	0.00	0.00	0.00	0.00	0.80	0.00	0.00	3.20	0.00	0.00	0.00	0.00
iii) Central Airconditioning system	173.87	0.00	0.00	0.00	0.00	34.77	0.00	0.00	0.00	139.10	0.00	0.00	0.00
iv) Illumination, Fans and Room Coolers	9.00	0.45	0.00	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.45
v) Water Pumps and Tank	34.60	0.00	0.00	0.00	8.65	8.65	8.65	8.65	0.00	0.00	0.00	0.00	0.00
vi) Overhead fuel oil storage tank	9.00	0.00	0.00	0.00	0.00	4.50	4.50	0.00	0.00	0.00	0.00	0.00	0.00
vii) Compressors	25.48	0.00	0.00	0.00	0.00	5.10	0.00	0.00	0.00	0.00	20.38	0.00	0.00
viii) Fire fighting system	2.00	0.00	0.00	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
ix) Telecommunication system	2.00	0.00	0.20	0.00	0.00	0.20	0.20	0.20	0.20	0.00	0.00	0.00	1.00
x) Office Furniture and Equipment	3.00	0.00	0.15	0.15	0.00	0.00	0.15	0.00	0.00	0.15	0.00	0.40	2.00
xi) Vehicles	90.00	0.00	18.00	18.00	0.00	0.00	9.00	0.00	0.00	9.00	0.00	0.00	36.00
5. Preliminary Expenses	50.00	25.00	25.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6. Pre-operative Expenses	2493.06												
i) Establishment	2213.06	0.00	28.65	72.46	101.86	101.86	143.63	143.63	143.63	161.63	161.63	161.63	992.45
ii) Travelling Expenses	220.00	0.00	3.00	7.00	10.00	10.00	14.00	14.00	14.00	16.00	16.00	16.00	100.00
iii) Miscellaneous	60.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
7. Technical Know-how Fees	1379.00	68.95	68.95	137.90	137.90	137.90	137.90	137.90	137.90	137.90	137.90	68.95	68.95
8. Sub-total (1 thru 7)	37524.21	99.40	2129.70	4337.89	5581.81	6322.44	3113.58	3099.93	2669.40	5448.65	3119.82	338.56	1263.03
9. Contingency @ 5% on above	1876.21	4.97	106.49	216.89	279.09	316.12	155.68	155.00	133.47	272.43	155.99	16.93	63.15
10. Sub-total (8 & 9)	39400.42	104.37	2236.19	4554.78	5860.90	6638.56	3269.26	3254.93	2802.87	5721.08	3275.81	355.49	1326.18

JOB NO. : DCIL-105

EXHIBIT : 91

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

ESTIMATION OF INTEREST DURING CONSTRUCTION

('000 US \$)

	Construction Period in Quarters												Total
	1	2	3	4	5	6	7	8	9	10	11	12	
Capital Expenditure	104.37	2236.19	4554.78	5860.90	6638.56	3269.26	3254.93	2802.87	5721.08	3275.81	355.49	1326.19	39400.42
Margin Money	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1068.33	1068.33
Total	104.37	2236.19	4554.78	5860.90	6638.56	3269.26	3254.93	2802.87	5721.08	3275.81	355.49	2394.51	40468.75
Equity	52.58	1127.34	2312.43	3005.38	3442.56	1797.22	1817.16	1616.88	3111.45	1926.60	484.52	1519.06	22213.18
Loan	52.58	1127.34	2312.44	3005.37	3442.57	1797.21	1817.15	1616.88	3111.45	1926.60	484.53	1519.06	22213.18
Total	105.16	2254.68	4624.87	6010.75	6885.13	3594.43	3634.31	3233.76	6222.90	3853.20	969.05	3038.12	44426.36

JOB NO. : DCIL-105

EXHIBIT : 91

('000 US \$)

	Construction Period in Quarters												Total	
	1	2	3	4	5	6	7	8	9	10	11	12		
Interest on loan														
- @ 12% p.a.	0.79	15.91	34.69	45.08	51.64	26.96	27.26	24.25	46.67	28.90	7.27	22.79		333.21
		1.58	33.82	69.37	90.16	103.28	53.92	54.51	48.51	93.34	57.80	14.54		620.83
			1.58	33.82	69.37	90.16	103.28	53.92	54.51	48.51	93.34	57.80		606.29
				1.58	33.82	69.37	90.16	103.28	53.92	54.51	48.51	93.34		548.49
					1.58	33.82	69.37	90.16	103.28	53.92	54.51	48.51		455.15
						1.58	33.82	69.37	90.16	103.28	53.92	54.51		406.64
							1.58	33.82	69.37	90.16	103.28	53.92		352.13
								1.58	33.82	69.37	90.16	103.28		298.21
									1.58	33.82	69.37	90.16		194.93
										1.58	33.82	69.37		104.77
											1.58	33.82		35.40
												1.58		1.58
Total	0.79	18.49	70.09	149.85	246.57	325.17	379.38	430.89	501.82	577.39	611.56	643.61		3957.61
Debt/Equity	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00

MEANS OF FINANCING :

EQUITY	22213.18
LOAN	22213.18
TOTAL	44426.36

JOB NO. : DCIL-105

EXHIBIT : 92

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

MARGIN MONEY FOR WORKING CAPITAL

('000 US \$)

Sl. No.	Item	Period (Days)	Cost	Bank Available (%)	Finance Available (Amount)	Margin Money
1.	Raw materials and Consumables	90	5393.73	100%	5393.73	0.00
2.	Finished Stock	30	2600.74	100%	2600.74	0.00
3.	Sundry Debtors	30	2472.67	100%	2472.67	0.00
	Sub-total		10467.14		10467.14	0.00
4.	Expenses	30	1068.33	0%	0.00	1068.33
	Total		11535.47		10467.14	1068.33

JOB NO. : DCIL-105

EXHIBIT : 93

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

STATEMENT OF PRODUCTION, SALES AND REVENUE

(in MT)

	OPERATING YEARS									
	1	2	3	4	5	6	7	8	9	10
Working Days/Year	300	300	300	300	300	300	300	300	300	300
Utilisation	80%	90%	100%	100%	100%	100%	100%	100%	100%	100%
1) Clamps & Yoke Plates										
a) Aluminium	Capacity	708.00	708.00	708.00	708.00	708.00	708.00	708.00	708.00	708.00
	Opening stock	0.00	47.20	53.10	59.00	59.00	59.00	59.00	59.00	59.00
	Production	566.40	637.20	708.00	708.00	708.00	708.00	708.00	708.00	708.00
	Total	566.40	684.40	761.10	767.00	767.00	767.00	767.00	767.00	767.00
	Closing Stock	47.20	53.10	59.00	59.00	59.00	59.00	59.00	59.00	59.00
	Sales	519.20	631.30	702.10	708.00	708.00	708.00	708.00	708.00	708.00
	Price/MT US \$	15000.00	15000.00	15000.00	15000.00	15000.00	15000.00	15000.00	15000.00	15000.00
	Revenue ('000 US \$)	7788.00	9469.50	10531.50	10620.00	10620.00	10620.00	10620.00	10620.00	10620.00
b) Steel	Capacity	214.00	214.00	214.00	214.00	214.00	214.00	214.00	214.00	214.00
	Opening stock	0.00	14.27	16.05	17.83	17.83	17.83	17.83	17.83	17.83
	Production	171.20	192.60	214.00	214.00	214.00	214.00	214.00	214.00	214.00
	Total	171.20	206.87	230.05	231.83	231.83	231.83	231.83	231.83	231.83
	Closing Stock	14.27	16.05	17.83	17.83	17.83	17.83	17.83	17.83	17.83
	Sales	156.93	190.82	212.22	214.00	214.00	214.00	214.00	214.00	214.00
	Price/MT US \$	22300.00	22300.00	22300.00	22300.00	22300.00	22300.00	22300.00	22300.00	22300.00
	Revenue ('000 US \$)	3439.61	4255.21	4732.43	4772.20	4772.20	4772.20	4772.20	4772.20	4772.20

DEVELOPMENT
CONSULTANTS

JOB NO. : DCIL-105

EXHIBIT : 93
(in MT)

OPERATING YEARS

1 2 3 4 5 6 7 8 9 10

c) Ductile Iron	Capacity	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Opening Stock	0.00	0.67	0.75	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Production	8.00	9.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Total	8.00	9.67	10.75	10.83	10.83	10.83	10.83	10.83	10.83	10.83	10.83	10.83	10.83
Closing Stock	0.67	0.75	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Sales	7.33	8.92	9.92	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00

Price/MT US \$ 10000.00 10000.00 10000.00 10000.00 10000.00 10000.00 10000.00 10000.00 10000.00 10000.00 10000.00 10000.00 10000.00 10000.00

Revenue ('000 US \$) 73.33 89.17 99.17 100.00 100.00 100.00 100.00 100.00 100.00 100.00 100.00 100.00 100.00 100.00

2) Compression & Mid-span Joints

a) Aluminium	Capacity	580.00	580.00	580.00	580.00	580.00	580.00	580.00	580.00	580.00	580.00	580.00	580.00
Opening Stock	0.00	38.67	43.50	48.33	48.33	48.33	48.33	48.33	48.33	48.33	48.33	48.33	48.33
Production	464.00	522.00	580.00	580.00	580.00	580.00	580.00	580.00	580.00	580.00	580.00	580.00	580.00
Total	464.00	560.67	623.50	628.33	628.33	628.33	628.33	628.33	628.33	628.33	628.33	628.33	628.33
Closing Stock	38.67	43.50	48.33	48.33	48.33	48.33	48.33	48.33	48.33	48.33	48.33	48.33	48.33
Sales	425.33	517.17	575.17	580.00	580.00	580.00	580.00	580.00	580.00	580.00	580.00	580.00	580.00

Price/MT US \$ 15400.00 15400.00 15400.00 15400.00 15400.00 15400.00 15400.00 15400.00 15400.00 15400.00 15400.00 15400.00 15400.00 15400.00

Revenue ('000 US \$) 6550.13 7964.37 8857.57 8932.00 8932.00 8932.00 8932.00 8932.00 8932.00 8932.00 8932.00 8932.00 8932.00 8932.00

b) Steel	Capacity	17.00	17.00	17.00	17.00	17.00	17.00	17.00	17.00	17.00	17.00	17.00	17.00
Opening Stock	0.00	1.13	1.28	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42
Production	13.60	15.30	17.00	17.00	17.00	17.00	17.00	17.00	17.00	17.00	17.00	17.00	17.00
Total	13.60	16.43	18.28	18.42	18.42	18.42	18.42	18.42	18.42	18.42	18.42	18.42	18.42
Closing Stock	1.13	1.28	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42
Sales	12.47	15.16	16.86	17.00	17.00	17.00	17.00	17.00	17.00	17.00	17.00	17.00	17.00

Price/MT US \$ 34000.00 34000.00 34000.00 34000.00 34000.00 34000.00 34000.00 34000.00 34000.00 34000.00 34000.00 34000.00 34000.00 34000.00

Revenue ('000 US \$) 423.87 515.38 573.18 578.00 578.00 578.00 578.00 578.00 578.00 578.00 578.00 578.00 578.00 578.00

JOB NO. : DCIL-105

EXHIBIT : 93
(in MT)

OPERATING YEARS

1 2 3 4 5 6 7 8 9 10

3) Corena Shields & Arcing Horns

a) Aluminium	Capacity	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00
Opening stock		0.00	1.47	1.65	1.83	1.83	1.83	1.83	1.83	1.83	1.83
Production		17.60	19.80	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00
Total		17.60	21.27	23.65	23.83	23.83	23.83	23.83	23.83	23.83	23.83
Closing Stock		1.47	1.65	1.83	1.83	1.83	1.83	1.83	1.83	1.83	1.83
Sales		16.13	19.62	21.82	22.00	22.00	22.00	22.00	22.00	22.00	22.00
Price/MT US \$		40000.00	40000.00	40000.00	40000.00	40000.00	40000.00	40000.00	40000.00	40000.00	40000.00
Revenue ('000 US \$)		645.33	784.67	872.67	880.00	880.00	880.00	880.00	880.00	880.00	880.00

b) Steel	Capacity	2530.00	2530.00	2530.00	2530.00	2530.00	2530.00	2530.00	2530.00	2530.00	2530.00
Opening stock		0.00	168.67	189.75	210.83	210.83	210.83	210.83	210.83	210.83	210.83
Production		2024.00	2277.00	2530.00	2530.00	2530.00	2530.00	2530.00	2530.00	2530.00	2530.00
Total		2024.00	2445.67	2719.75	2740.83	2740.83	2740.83	2740.83	2740.83	2740.83	2740.83
Closing Stock		168.67	189.75	210.83	210.83	210.83	210.83	210.83	210.83	210.83	210.83
Sales		1855.33	2255.92	2508.92	2530.00	2530.00	2530.00	2530.00	2530.00	2530.00	2530.00
Price/MT US \$		1900.00	1900.00	1900.00	1900.00	1900.00	1900.00	1900.00	1900.00	1900.00	1900.00
Revenue ('000 US \$)		3525.13	4286.24	4766.94	4807.00	4807.00	4807.00	4807.00	4807.00	4807.00	4807.00

4) Spacer

a) Aluminium	Capacity	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00
Opening stock		0.00	4.67	5.25	5.83	5.83	5.83	5.83	5.83	5.83	5.83
Production		56.00	63.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00
Total		56.00	67.67	75.25	75.83	75.83	75.83	75.83	75.83	75.83	75.83
Closing Stock		4.67	5.25	5.83	5.83	5.83	5.83	5.83	5.83	5.83	5.83
Sales		51.33	62.42	69.42	70.00	70.00	70.00	70.00	70.00	70.00	70.00

JOB NO. : DCIL-105

EXHIBIT : 93
(in MT)

		O P P R A T I N G Y E A R S									
		1	2	3	4	5	6	7	8	9	10
Price/MT US \$		68000.00	68000.00	68000.00	68000.00	68000.00	68000.00	68000.00	68000.00	68000.00	68000.00
Revenue ('000 US \$)		3490.67	4244.33	4720.33	4760.00	4760.00	4760.00	4760.00	4760.00	4760.00	4760.00
b) Steel											
Capacity		155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00
Opening stock		0.00	10.33	11.63	12.92	12.92	12.92	12.92	12.92	12.92	12.92
Production		124.00	139.50	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00
Total		124.00	149.83	166.63	167.92	167.92	167.92	167.92	167.92	167.92	167.92
Closing Stock		10.33	11.63	12.92	12.92	12.92	12.92	12.92	12.92	12.92	12.92
Sales		113.67	138.21	153.71	155.00	155.00	155.00	155.00	155.00	155.00	155.00
Price/MT US \$		10000.00	10000.00	10000.00	10000.00	10000.00	10000.00	10000.00	10000.00	10000.00	10000.00
Revenue ('000 US \$)		1136.67	1382.08	1537.08	1550.00	1550.00	1550.00	1550.00	1550.00	1550.00	1550.00
5) Armour Rods											
a) Aluminium											
Capacity		730.00	730.00	730.00	730.00	730.00	730.00	730.00	730.00	730.00	730.00
Opening stock		0.00	48.67	54.75	60.83	60.83	60.83	60.83	60.83	60.83	60.83
Production		584.00	657.00	730.00	730.00	730.00	730.00	730.00	730.00	730.00	730.00
Total		584.00	705.67	784.75	790.83	790.83	790.83	790.83	790.83	790.83	790.83
Closing Stock		48.67	54.75	60.83	60.83	60.83	60.83	60.83	60.83	60.83	60.83
Sales		535.33	650.92	723.92	730.00	730.00	730.00	730.00	730.00	730.00	730.00
Price/MT US \$		15200.00	15200.00	15200.00	15200.00	15200.00	15200.00	15200.00	15200.00	15200.00	15200.00
Revenue ('000 US \$)		8137.07	9893.93	11003.53	11096.00	11096.00	11096.00	11096.00	11096.00	11096.00	11096.00
6) Vibration Damper											
a) Cast Iron											
Capacity		950.00	950.00	950.00	950.00	950.00	950.00	950.00	950.00	950.00	950.00
Opening stock		0.00	63.33	71.25	79.17	79.17	79.17	79.17	79.17	79.17	79.17
Production		760.00	855.00	950.00	950.00	950.00	950.00	950.00	950.00	950.00	950.00
Total		760.00	918.33	1021.25	1029.17	1029.17	1029.17	1029.17	1029.17	1029.17	1029.17

DEVELOPMENT
CONSULTANTS

JOB NO. : DCIL-105

EXHIBIT : 93

(in MT)

		OPERATING YEARS									
		1	2	3	4	5	6	7	8	9	10
Closing Stock		63.33	71.25	79.17	79.17	79.17	79.17	79.17	79.17	79.17	79.17
Sales		696.67	847.08	942.08	950.00	950.00	950.00	950.00	950.00	950.00	950.00
Price/MT US \$		1000.00	1000.00	1000.00	1000.00	1000.00	1000.00	1000.00	1000.00	1000.00	1000.00
Revenue ('000 US \$)		696.67	847.08	942.08	950.00	950.00	950.00	950.00	950.00	950.00	950.00
7)Nuts & Bolts											
a) Steel	Capacity	180.00	180.00	180.00	180.00	180.00	180.00	180.00	180.00	180.00	180.00
Opening stock		0.00	12.00	13.50	15.00	15.00	15.00	15.00	15.00	15.00	15.00
Production		144.00	162.00	180.00	180.00	180.00	180.00	180.00	180.00	180.00	180.00
Total		144.00	174.00	193.50	195.00	195.00	195.00	195.00	195.00	195.00	195.00
Closing Stock		12.00	13.50	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
Sales		132.00	160.50	178.50	180.00	180.00	180.00	180.00	180.00	180.00	180.00
Price/MT US \$		1600.00	1600.00	1600.00	1600.00	1600.00	1600.00	1600.00	1600.00	1600.00	1600.00
Revenue ('000 US \$)		211.20	256.80	285.60	288.00	288.00	288.00	288.00	288.00	288.00	288.00
8)Socket, Clevis & Hardwares											
a) Aluminum	Capacity	190.00	190.00	190.00	190.00	190.00	190.00	190.00	190.00	190.00	190.00
Opening stock		0.00	12.67	14.25	15.83	15.83	15.83	15.83	15.83	15.83	15.83
Production		152.00	171.00	190.00	190.00	190.00	190.00	190.00	190.00	190.00	190.00
Total		152.00	183.67	204.25	205.83	205.83	205.83	205.83	205.83	205.83	205.83
Closing Stock		12.67	14.25	15.83	15.83	15.83	15.83	15.83	15.83	15.83	15.83
Sales		139.33	169.42	188.42	190.00	190.00	190.00	190.00	190.00	190.00	190.00
Price/MT US \$		1500.00	1500.00	1500.00	1500.00	1500.00	1500.00	1500.00	1500.00	1500.00	1500.00
Revenue ('000 US \$)		209.00	254.13	282.63	285.00	285.00	285.00	285.00	285.00	285.00	285.00

JOB NO. : DCIL-105

EXHIBIT : 93

(in MT)

		OPERATING YEARS									
		1	2	3	4	5	6	7	8	9	10
b) Steel	Capacity	1370.00	1370.00	1370.00	1370.00	1370.00	1370.00	1370.00	1370.00	1370.00	1370.00
	Opening Stock	0.00	91.33	102.75	114.17	114.17	114.17	114.17	114.17	114.17	114.17
	Production	1096.00	1233.00	1370.00	1370.00	1370.00	1370.00	1370.00	1370.00	1370.00	1370.00
	Total	1096.00	1324.33	1472.75	1484.17	1484.17	1484.17	1484.17	1484.17	1484.17	1484.17
	Closing Stock	91.33	102.75	114.17	114.17	114.17	114.17	114.17	114.17	114.17	114.17
	Sales	1004.67	1221.58	1358.59	1370.00	1370.00	1370.00	1370.00	1370.00	1370.00	1370.00
	Price/MT US \$	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00
	Revenue ('000 US \$)	502.33	610.79	679.29	685.00	685.00	685.00	685.00	685.00	685.00	685.00
c) Ductile Iron	Capacity	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00
	Opening Stock	0.00	2.67	3.00	3.33	3.33	3.33	3.33	3.33	3.33	3.33
	Production	32.00	36.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00
	Total	32.00	38.67	43.00	43.33	43.33	43.33	43.33	43.33	43.33	43.33
	Closing Stock	2.67	3.00	3.33	3.33	3.33	3.33	3.33	3.33	3.33	3.33
	Sales	29.33	35.67	39.67	40.00	40.00	40.00	40.00	40.00	40.00	40.00
	Price/MT US \$	400.00	400.00	400.00	400.00	400.00	400.00	400.00	400.00	400.00	400.00
	Revenue ('000 US \$)	11.73	14.27	15.87	16.00	16.00	16.00	16.00	16.00	16.00	16.00
d) Guy Wires											
a) Steel	Capacity	908.00	908.00	908.00	908.00	908.00	908.00	908.00	908.00	908.00	908.00
	Opening Stock	0.00	60.53	68.10	75.67	75.67	75.67	75.67	75.67	75.67	75.67
	Production	726.40	817.20	908.00	908.00	908.00	908.00	908.00	908.00	908.00	908.00
	Total	726.40	877.73	976.10	983.67	983.67	983.67	983.67	983.67	983.67	983.67
	Closing Stock	60.53	68.10	75.67	75.67	75.67	75.67	75.67	75.67	75.67	75.67
	Sales	665.87	809.63	900.43	908.00	908.00	908.00	908.00	908.00	908.00	908.00

JOB NO. : DCIL-105

EXHIBIT : 93

(in MT)

OPERATING YEARS

	1	2	3	4	5	6	7	8	9	10
Price/MT US \$	700.00	700.00	700.00	700.00	700.00	700.00	700.00	700.00	700.00	700.00
Revenue ('000 US \$)	466.11	566.74	630.30	635.60	635.60	635.60	635.60	635.60	635.60	635.60
10) Stay Rods, Washers, Cross ATWS, etc.										
a) Steel	Capacity	3526.00	3526.00	3526.00	3526.00	3526.00	3526.00	3526.00	3526.00	3526.00
Opening stock		0.00	235.07	264.45	293.83	293.83	293.83	293.83	293.83	293.83
Production		2820.80	3173.40	3526.00	3526.00	3526.00	3526.00	3526.00	3526.00	3526.00
Total		2820.80	3408.47	3790.45	3819.83	3819.83	3819.83	3819.83	3819.83	3819.83
Closing Stock		235.07	264.45	293.83	293.83	293.83	293.83	293.83	293.83	293.83
Sales		2585.73	3144.02	3496.62	3526.00	3526.00	3526.00	3526.00	3526.00	3526.00
Price/MT US \$		1000.00	1000.00	1000.00	1000.00	1000.00	1000.00	1000.00	1000.00	1000.00
Revenue ('000 US \$)		2585.73	3144.02	3496.62	3526.00	3526.00	3526.00	3526.00	3526.00	3526.00
TOTAL REVENUE ('000 US \$)		39952.59	48578.71	54026.79	54480.80	54480.80	54480.80	54480.80	54480.80	54480.80

JOB NO. : DCIL-105

EXHIBIT : 94

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

COST OF PRODUCTION AND SALES

('000 US \$)

	O P E R A T I N G Y E A R S									
	1	2	3	4	5	6	7	8	9	10
A. Variable Cost										
Raw Materials and Consumables	20832.94	23437.06	26041.18	26041.18	26041.18	26041.18	26041.18	26041.18	26041.18	26041.18
Power	759.41	863.87	958.33	958.33	958.33	958.33	958.33	958.33	958.33	958.33
Water	63.17	71.06	78.96	78.96	78.96	78.96	78.96	78.96	78.96	78.96
Sub-total	21665.52	24371.99	27078.47	27078.47	27078.47	27078.47	27078.47	27078.47	27078.47	27078.47
Contingency (@ 5% on above)	1083.28	1218.60	1353.92	1353.92	1353.92	1353.92	1353.92	1353.92	1353.92	1353.92
Total 'A'	22748.79	25590.59	28432.40	28432.40	28432.40	28432.40	28432.40	28432.40	28432.40	28432.40
B. Fixed Cost										
i) Labour & Plant Overhead ²										
a) Direct labour	4997.09	5246.94	5496.80	5746.65	5996.51	6246.36	6496.21	6746.07	6995.92	7245.78
b) Indirect labour	2145.56	2252.84	2360.12	2467.40	2574.68	2681.96	2789.23	2896.51	3003.79	3111.07
c) Supervision	2160.00	2268.00	2376.00	2484.00	2592.00	2700.00	2808.00	2916.00	3024.00	3132.00
Sub-total	9302.65	9767.78	10232.92	10698.05	11163.18	11628.32	12093.45	12558.58	13023.71	13488.85

JOB NO. : DCIL-105

EXHIBIT : 94

('000 US \$)

	OPERATING YEARS									
	1	2	3	4	5	6	7	8	9	10

ii) Other Factory Expenses										
a) Maintenance @ 3%										
on Plant & Equipment	244.20	244.20	244.20	244.20	244.20	244.20	244.20	244.20	244.20	244.20
b) Maintenance @ 1%										
on Building & Civil Work	170.79	170.79	170.79	170.79	170.79	170.79	170.79	170.79	170.79	170.79
c) Miscellaneous	83.00	83.00	83.00	83.00	83.00	83.00	83.00	83.00	83.00	83.00
Sub-total	498.00	498.00	498.00	498.00	498.00	498.00	498.00	498.00	498.00	498.00

iii) Administrative & Sales Expenses										
a) Salaries ²	1313.54	1379.22	1444.90	1510.58	1576.25	1641.93	1707.61	1773.28	1838.96	1904.64
b) Overheads	262.71	275.84	288.98	302.12	315.25	328.39	341.52	354.66	367.79	380.93
Sub-total	1576.25	1655.07	1733.88	1812.69	1891.50	1970.32	2049.13	2127.94	2206.75	2285.57

Total (i+ii+iii)	11376.90	11920.85	12464.79	13008.74	13552.68	14096.63	14640.57	15184.52	15728.46	16272.41
Contingency (@ 5% on above)	568.85	596.04	623.24	650.44	677.63	704.83	732.03	759.23	786.42	813.62

Total 'B'	11945.75	12516.89	13088.03	13659.17	14230.32	14801.46	15372.61	15943.73	16514.89	17086.03

Total Cost of Production and Sales (A+B)	34694.54	38107.48	41520.43	42091.57	42662.71	43233.85	43805.01	44376.13	44947.28	45518.42

² Assumed to increase at the flat rate of 5% straight line every year

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

PROJECTED PROFITABILITY STATEMENT

('000 US \$)

Elements	OPERATING YEARS									
	1	2	3	4	5	6	7	8	9	10
Raw Materials and Consumables	20832.94	23437.06	26041.18	26041.18	26041.18	26041.18	26041.18	26041.18	26041.18	26041.18
Power	769.41	863.87	958.33	958.33	958.33	958.33	958.33	958.33	958.33	958.33
Water	63.17	71.06	78.96	78.96	78.96	78.96	78.96	78.96	78.96	78.96
Labour & Plant Overhead	9302.65	9767.78	10232.92	10698.05	11163.18	11628.32	12093.45	12558.58	13023.71	13488.85
Other Factory Expenses	498.00	498.00	498.00	498.00	498.00	498.00	498.00	498.00	498.00	498.00
Administrative & Sales Expenses	1576.25	1655.07	1733.88	1812.69	1891.50	1970.32	2049.13	2127.94	2206.75	2285.57
Sub-total	33042.42	36292.84	39543.27	40087.21	40631.15	41175.11	41719.04	42262.99	42806.93	43350.88
Contingency	1652.11	1814.64	1977.16	2004.36	2031.56	2058.76	2085.95	2113.15	2140.35	2167.54
Total	34694.54	38107.48	41520.43	42091.57	42662.71	43233.87	43805.00	44376.14	44947.28	45518.42
Stock Variation	-2600.74	-264.88	-264.88	-40.15	-40.14	-40.14	-40.14	-40.14	-40.14	-40.15
Cost of Production and Sales	32093.79	37842.60	41255.55	42051.42	42622.56	43193.73	43764.85	44336.00	44907.14	45478.27
PROJECTED REVENUE	4952.59	48578.71	54026.79	54480.80	54480.80	54480.80	54480.80	54480.80	54480.80	54480.80
Profit before Interest and Depreciation	7858.79	10736.11	12771.24	12429.38	11858.24	11287.07	10715.95	10144.80	9573.66	9002.53
Interest										
On Term Loan										
- @ 12% p.a.	2665.58	2665.58	2665.58	2460.54	2255.49	2050.45	1845.40	1640.36	1435.31	1230.26
On Working Capital Loan										
- @ 14% p.a.	0.00	0.00	1099.05	732.70	366.35	0.00	0.00	0.00	0.00	0.00
Sub-total	2665.58	2665.58	3764.63	3193.25	2621.84	2050.45	1845.40	1640.36	1435.31	1230.26

JOB NO. : DCIL-105

EXHIBIT : 95

('000 US \$)

Elements	OPERATING YEARS									
	1	2	3	4	5	6	7	8	9	10
Profit before Depreciation	5193.21	8070.53	9006.61	9236.14	9236.40	9236.62	8870.55	8504.44	8138.35	7772.26
Depreciation and Amortisation	1976.98	1976.98	1976.98	1976.98	1976.98	1976.98	1976.98	1976.98	1976.98	1976.98
Profit before Tax	3216.22	6093.54	7029.63	7259.16	7259.42	7259.64	6893.57	6527.46	6161.37	5795.29
Tax	804.06	1551.99	1812.59	1927.13	1950.21	1971.70	1900.16	1827.26	1753.16	1677.83
Distributable Profit	2412.16	4541.57	5217.04	5332.03	5309.21	5287.94	4993.41	4700.20	4408.25	4117.45
Dividend	0.00	2221.32	2221.32	2776.65	2776.65	3331.98	3331.98	3331.98	3331.98	3331.98
Retained Earnings	2412.16	2320.24	2995.71	2555.38	2532.57	1955.96	1661.43	1368.22	1076.27	785.47
Add Back : Depreciation & Amortisation	1976.98	1976.98	1976.98	1976.98	1976.98	1976.98	1976.98	1976.98	1976.98	1976.98
NET CASH ACCRUAL	4389.14	4297.23	4972.70	4532.35	4509.54	3932.94	3638.41	3345.20	3053.25	2762.45

JOB NO. : DCIL-105

EXHIBIT : 96

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

STATEMENT OF FIXED ASSETS AND DEPRECIATION UNDER STRAIGHT LINE METHOD

('000 US \$)

Description	Value	Technical Know-how Fees	Sub-Total	Contingency	Sub-Total	Interest during Construct	Sub-Total	50% of Pre-op Expenses	Total	Rate (%)	Amount
1. Land & Land Development	7923.00	0.00	7923.00	0.00	7923.00	0.00	7923.00	0.00	7923.00	0%	0.00
2. Building & Civil Work	17079.29	917.18	17996.47	1247.87	19244.34	2632.22	21876.56	828.77	22705.33	4%	908.21
3. Plant & Machinery	8140.11	437.13	8577.24	594.75	9171.99	1254.54	10426.53	394.99	10821.52	8%	865.72
4. Miscellaneous Fixed Assets	459.75	24.69	484.44	33.59	518.03	70.85	588.88	22.30	611.18	12%	73.34
5. Preliminary Expenses	50.00	0.00	50.00	0.00	50.00	0.00	50.00	0.00	50.00	10%	5.00
6. Pre-operative Expenses	2493.06	0.00	2493.06	0.00	2493.06	0.00	2493.06	-1246.06	1247.00	10%	124.70
7. Technical Know-how Fees	1379.00	-1379.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0%	0.00
Sub-total	37524.21		37524.21		39400.42		43358.03		43358.03		1976.98
8. Contingency	1876.21	0.00	1876.21	-1876.21	0.00	0.00	0.00	0.00	0.00		
Sub-total	39400.42		39400.42		39400.42		43358.03		43358.03		
9. Interest during Construction	3957.61	0.00	3957.61	0.00	3957.61	-3957.61	0.00	0.00	0.00		
Total	43358.03		43358.03		43358.03		43358.03		43358.03		

JOB NO. : DCIL-105

EXHIBIT : 97

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION
PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

TAX COMPUTATION

('000 US \$)

	O P E R A T I N G Y E A R S									
	1	2	3	4	5	6	7	8	9	10
Profit before Depreciation	5193.21	8070.53	9006.61	9236.14	9236.40	9236.62	8870.55	8504.44	8138.35	7772.26
Less : Current Depreciation	1976.98	1862.59	1756.25	1527.64	1435.57	1349.82	1269.91	1195.39	1125.86	1060.94
Balance	3216.23	6207.94	7250.35	7708.50	7800.83	7886.80	7600.64	7309.05	7012.49	6711.32
Less : Unabsorbed Depreciation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Taxable Income	3216.23	6207.94	7250.35	7708.50	7800.83	7886.80	7600.64	7309.05	7012.49	6711.32
Tax @ 25%	804.06	1551.99	1812.59	1927.13	1950.21	1971.70	1900.16	1827.26	1753.12	1677.83

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

DEPRECIATION FOR TAX

('000 US \$)

WDV Rate	Building & Civil Work 4%	Plant & Machinery 8%	Misc. Fixed Assets 12%	Amortisation 10%	Total
Value	22705.33	10821.52	611.18	1297.00	
Depreciation Year 1	908.21	865.72	73.34	129.70	1976.98
Balance	21797.12	9955.80	537.84	1167.30	
Depreciation Year 2	871.88	796.46	64.54	129.70	1862.59
Balance	20925.24	9159.34	473.30	1037.60	
Depreciation Year 3	837.01	732.75	56.80	129.70	1756.25
Balance	20088.23	8426.59	416.51	907.90	
Depreciation Year 4	803.53	674.13	49.98	129.70	1657.34
Balance	19284.70	7752.46	366.52	778.20	
Depreciation Year 5	771.39	620.20	43.98	129.70	1565.27
Balance	18513.31	7132.27	322.54	648.50	
Depreciation Year 6	740.53	570.58	38.71	129.70	1479.52
Balance	17772.78	6561.69	283.84	518.80	
Depreciation Year 7	710.91	524.93	34.06	129.70	1399.61
Balance	17061.87	6036.75	249.78	389.10	
Depreciation Year 8	682.47	482.94	29.97	129.70	1325.09
Balance	16379.39	5553.81	219.80	259.40	
Depreciation Year 9	655.18	444.30	26.38	129.70	1255.56
Balance	15724.22	5109.51	193.43	129.70	
Depreciation Year 10	628.97	408.76	23.21	129.70	1190.64
Balance	15095.25	4700.75	170.22	0.00	

WDV : Written Down Value

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

WORKING CAPITAL REQUIREMENTS
(Excluding Cash and bank Balances)

('000 US \$)

Items	O P E R A T I N G Y E A R									
	1	2	3	4	5	6	7	8	9	10
1. Raw materials & Consumables	5393.73	6067.95	6742.17	6742.17	6742.17	6742.17	6742.17	6742.17	6742.17	6742.17
2. Finished Stock	2600.74	2865.62	3130.50	3170.65	3210.79	3250.93	3291.07	3331.21	3371.35	3411.50
3. Sundry Debtors	2472.67	4048.23	4502.23	4540.07	4540.07	4540.07	4540.07	4540.07	4540.07	4540.07
TOTAL	10467.14	12981.80	14374.90	14452.89	14493.03	14533.17	14573.31	14613.45	14653.59	14693.74
Increase / (decrease)	10467.14	2514.66	1393.10	77.99	40.14	40.14	40.14	40.14	40.14	40.15
Stock Variation	2600.74	264.88	264.88	40.15	40.14	40.14	40.14	40.14	40.14	40.15

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

PROJECTED CASH FLOW STATEMENT

('000 US \$)

Construction Period	Y										
	1	2	3	4	5	6	7	8	9	10	
A. SOURCES											
Increase in Share Capital	22213.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Increase in Term Loan	22213.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Increase in Bank Loan	0.00	10467.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Profit before Tax with Interest added back	0.00	5881.81	8759.13	10794.26	10452.40	9881.26	9310.09	8738.97	8167.82	7596.68	7025.55
Depreciation	0.00	1976.98	1976.98	1976.98	1976.98	1976.98	1976.98	1976.98	1976.98	1976.98	1976.98
TOTAL 'A'	44426.36	18325.93	10736.11	12771.24	12429.38	11858.24	11287.07	10715.95	10144.80	9573.66	9002.53
B. APPLICATIONS											
Increase in Capital Expenditure	39400.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Increase/(Decrease) in Working Capital	0.00	10467.14	2514.66	1393.10	77.99	40.14	40.14	40.14	40.14	40.14	40.15

JOB NO. : DCIL-105

EXHIBIT : 100

('000 US \$)

Construction Period	Y E A R										
	1	2	3	4	5	6	7	8	9	10	
Interest											
On Term Loan - @ 12% p.a.	3957.61	2665.58	2665.58	2665.58	2460.54	2255.49	2050.45	1845.40	1640.36	1435.31	1230.26
On Working Capital Loan - @ 14% p.a.	0.00	0.00	0.00	1099.05	732.70	366.35	0.00	0.00	0.00	0.00	0.00
Total Interest	3957.61	2665.58	2665.58	3764.63	3193.24	2621.84	2050.45	1845.40	1640.36	1435.31	1230.26
Tax	0.00	804.06	1551.99	1812.59	1927.13	1950.21	1971.70	1906.16	1827.26	1753.12	1677.83
Dividend	0.00	0.00	2221.32	2221.32	2776.65	2776.65	3331.98	3331.98	3331.98	3331.98	3331.98
Repayment of Term Loan	0.00	0.00	0.00	1708.71	1708.71	1708.71	1708.71	1708.71	1708.71	1708.71	1708.71
Repayment of Working Capital Loan	0.00	0.00	2616.78	2616.78	2616.78	2616.80	0.00	0.00	0.00	0.00	0.00
TOTAL 'B'	43358.04	33936.78	11570.32	13517.13	12300.50	11714.35	9102.98	8826.39	8548.45	8269.26	7988.93
Opening Balance	0.00	1068.33	5457.47	4623.26	3877.37	4006.25	4150.14	6134.23	6223.79	9820.14	11124.53
Surplus / (Deficit) during the Year (A - B)	1068.33	4389.14	-834.22	-745.89	128.88	143.89	2184.09	1889.56	1596.35	1304.40	1013.60
Closing Balance	1068.33	5457.47	4623.26	3877.37	4006.25	4150.14	6134.23	6223.79	9820.14	11124.53	12138.13

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

PROJECTED BALANCE SHEET

('000 US \$)

		Y		E		A		R			
		1	2	3	4	5	6	7	8	9	10
Add:	Share Capital	22213.18	22213.18	22213.18	22213.18	22213.18	22213.18	22213.18	22213.18	22213.18	22213.18
	Reserves & Surplus	2412.16	4732.40	7728.13	10283.50	12816.07	14772.03	16433.46	17801.68	18877.95	19663.42
	SHAREHOLDERS' FUND	24625.35	26945.59	29941.31	32496.68	35029.25	36985.21	38646.64	40014.86	41091.13	41876.60
Less:	Intangible Assets	1167.30	1037.60	907.90	778.20	648.50	518.80	389.10	259.40	129.70	0.00
	TANGIBLE NET WORTH	23458.05	25907.99	29033.41	31718.48	34380.75	36466.41	38257.54	39755.46	40961.43	41876.60
Add:	Term Loan	22213.18	22213.18	20504.47	18795.76	17087.05	15378.34	13669.63	11960.92	10252.21	8543.50
	CAPITAL FUND	45671.23	48121.17	49537.88	50514.24	51467.80	51844.75	51927.17	51716.38	51213.64	50420.10
Less:	Net Fixed Assets	40213.75	38366.47	36519.19	34671.91	32824.63	30977.35	29130.07	27282.79	25435.51	23588.23
	NET CURRENT ASSETS	5457.47	9754.70	13018.69	15842.33	18643.17	20867.40	22797.10	24433.59	25778.13	26831.87
A. CURRENT ASSETS											
	Working Capital	10467.14	12981.80	14374.90	14452.89	14493.03	14533.17	14573.31	14613.45	14653.59	14693.74
	Cash & Bank Balance										
	as per Cash Flow Statement	5457.47	4623.26	3877.37	4006.25	4150.14	6334.23	8223.79	9820.14	11124.53	12138.13
	TOTAL 'A'	15924.61	17605.06	18252.27	18459.14	18643.17	20867.40	22797.10	24433.59	25778.13	26831.87
B. CURRENT LIABILITIES											
	Bank Loan	10467.14	7850.36	5233.58	2616.80	0.00	0.00	0.00	0.00	0.00	0.00
	TOTAL 'B'	10467.14	7850.36	5233.58	2616.80	0.00	0.00	0.00	0.00	0.00	0.00
	NET CURRENT ASSETS (A-B)	5457.47	9754.70	13018.69	15842.33	18643.17	20867.40	22797.10	24433.59	25778.13	26831.87

JOB NO. : DCIL-105

EXHIBIT : 102

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

BREAK-EVEN ANALYSIS

	('000 US \$)
	AMOUNT
1. Raw Materials and Consumables	26041.18
2. Power	958.33
3. Water	78.96
4. Sub-Total (1 thru 3)	27078.47
5. Contingency	1353.92
6. VARIABLE COSTS	28432.40
7. REVENUE	54480.80
8. CONTRIBUTION (7 - 6)	26048.40
9. Labour & Plant Overhead*	11395.75
10. Other Factory Expenses	498.00
11. Administrative & Sales Expenses*	1930.91
12. Sub-Total (9 thru 11)	13824.65
13. Contingency	691.23
14. Sub-Total (12+13)	14515.89
15. Interest*	2311.27
16. Depreciation	1976.98
17. FIXED COSTS	18804.13
BREAK-EVEN SALES	39329.24
BREAK-EVEN POINT	72.2%
CASH BREAK-EVEN SALES	35194.35
CASH BREAK-EVEN POINT	64.6%

* Average over 10 years

JOB NO. : DCIL-105

EXHIBIT : 103

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

INTERNAL RATE OF RETURN

('000 US \$)

Year	Outflow	Inflow	Net Inflow
0	-44426.36	0.00	-44426.36
1	0.00	7858.79	7858.79
2	0.00	10736.11	10736.11
3	0.00	12771.24	12771.24
4	0.00	12429.38	12429.38
5	0.00	11858.24	11858.24
6	0.00	11287.07	11287.07
7	0.00	10715.95	10715.95
8	0.00	10144.80	10144.80
9	0.00	9573.66	9573.66
10	0.00	9002.53	9002.53

IRR 20.1%

Outflow = Project Cost

Inflow = Profit before Interest, Depreciation and Tax

PLANT LOCATION : TUNISIA

COUNTRY : TUNISTA

The financial analysis and evaluation of the proposed project for setting up of Overhead Line Accessories plant in this country are based on the capacity utilisation, price and costs.

Project Cost

The estimated cost of the project of setting up a 12,000 TPA plant is around US \$ 41.82 million as can be seen from Exhibit-104. The project cost includes the expenditure towards

- o Land and land development.
- o Building and civil work
- o Plant and machinery
- o Miscellaneous fixed assets
- o Preliminary expenses
- o Pre-operative expenses
- o Technical know-how fees

Preliminary expenses have been assumed on a lumpsum basis on the project cost. Pre-operative expenses have three components, viz., establishment, travelling expenses and miscellaneous expenses. Establishment costs have been computed on the basis of salaries payable and overheads to various personnel who have to be recruited at various levels, during the construction period. Travelling expenses have been taken as approximately 10% of establishment costs from second to the last quarter of the construction period. Miscellaneous expenses have also been taken on a lumpsum basis. Technical know-how fees have been taken as 3.5% of the project cost excluding interest during construction and margin money for working capital.

5% cushion has been provided towards contingency. This cost also includes interest during construction and margin money for working capital.

Phasing of capital expenditure is based on implementation plan, and interest during construction has been computed based on the phasing. These two are presented in Exhibits 105 and 106 respectively.

Margin money for working capital is presented in Exhibit-107. In computing margin money it is assumed that adequate provisions have to be kept towards storage of raw materials and consumables required to be imported.

The project is assumed to be financed by Debt-Equity Ratio of 1:1.

Production, Sales and Revenue

Statement of production and sales of various product range and the revenue that will be generated from the sales of the products over the 10-year period is presented in Exhibit-108. Capacity utilisation is assumed at the rate of 80% in the first year, 90% in the second year and 100% from the third year onwards.

Costs

The annual costs of production and sales computed over 10 years are presented in Exhibit-109. In estimating these costs it is assumed that the salaries and wages will increase at the flat rate of 5% every year.

Profitability

Projected profitability statement is presented in Exhibit-110. The average profit before tax works out to 15% of average revenue.

Statement of fixed assets and depreciation under straight line method is presented in Exhibit-111. Tax computation and depreciation for tax are presented in Exhibits 112 and 113 respectively.

Working capital requirements are shown in Exhibit-114.

Projected cash flow statement and balance sheet over 10-year period are shown in Exhibits 115 and 116 respectively. The term loan will repaid in 15 years including 2-year moratorium.

The project breaks even at around 63.0% and shows internal rate of return of 22.8% as can be seen from Exhibits 117 and 118 respectively. In computing internal rate of return, outflow is taken as the project cost and inflow is taken as the profit before interest, depreciation and tax.

JOB NO. : DCIL-105

EXHIBIT : 104

**UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION**

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

ESTIMATED PROJECT COST

		('000 US \$)	
Items	Value	Total	
1. Land and Land Development (@ US\$ 138 per m ² for 57,000 m ²)	7866.00	7866.00	
2. Building and Civil Work			
i) Workshop Building (@ US\$ 694 per m ² for 20,454 m ²)	14195.08		
ii) Administrative Building (@ US\$ 833 per m ² for 1,152 m ²)	959.62		
iii) Auxiliary Buildings (@ US\$ 833 per m ² for 1,476 m ²)	1229.51		
Sub-total (2)		16384.21	
3. Plant and Machinery			
i) Imported			
- Aluminium Foundry	2026.99		
- Forging shop	2066.10		
- Cast Iron Foundry	1275.45		
- Fabrication shop	586.35		
- Machinshop, Toolroom & Die Repairshop	552.67		
- Galvanising shop	61.80		
- Material Testing Laboratory	100.32		
- Central Maintenance shop	109.03		
- Auxiliary Equipment & Handtools	137.28		
Total F.O.B. Value	6915.99		
ii) Insurance & Freight (@ 10% of FOB Value)	691.60		
iii) C.I.F. Value	7607.58		
iv) Import duty @ 6% on CIF value	456.46		
v) Transportation @ 1% of CIF Value	76.08		
Landed Cost at Site [Sub-total (3)]		8140.11	

DEVELOPMENT
CONSULTANTS

JOB NO. : DCIL-105

EXHIBIT : 104

('000 US \$)

Items	Value	Total
4. Miscellaneous Fixed Assets		
i) Transformers	106.80	
ii) Switchgears	4.00	
iii) Central Airconditioning system	173.87	
iv) Illumination, Fans and Room Coolers	9.00	
v) Water Pumps and Tank	34.60	
vi) Overhead fuel oil storage tank	9.00	
vii) Compressors	25.48	
viii) Fire fighting system	2.00	
ix) Telecommunication system	2.00	
x) Office Furniture and Equipment	3.00	
xi) Vehicles	90.00	

Sub-total (4)		459.75
5. Preliminary Expenses	50.00	50.00
6. Pre-operative Expenses		
i) Establishment	1268.68	
ii) Travelling Expenses	126.00	
iii) Miscellaneous	60.00	

		1454.68
7. Technical Know-how Fees	1311.00	1311.00
8. Sub-total (1 thru 7)	-	35665.75
9. Contingency @ 5% on above	-	1783.29

10. Sub-total (8 & 9)	-	37449.04
11. Interest during Construction	-	3821.66
12. Margin Money for Working Capital	-	552.44
TOTAL COST	-	41823.14

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

PHASING OF CAPITAL EXPENDITURE

('000 US \$)

	Total	Construction Period in Quarters											
		1	2	3	4	5	6	7	8	9	10	11	12
1. Land and Land Development	7866.00	0.00	1966.50	1966.50	1966.50	1966.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2. Building and Civil Work	16384.21												
i) Workshop Building	14195.08	0.00	0.00	2027.87	2027.87	2027.87	2027.87	2027.87	2027.87	2027.86	0.00	0.00	0.00
ii) Administrative Building	959.62	0.00	0.00	0.00	0.00	239.90	239.90	239.90	239.92	0.00	0.00	0.00	0.00
iii) Auxiliary Buildings	1229.51	0.00	0.00	0.00	0.00	409.83	409.84	409.84	0.00	0.00	0.00	0.00	0.00
3. Plant and Machinery	8140.11												
i) Ordering	2442.03	0.00	0.00	0.00	1221.02	1221.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ii) Supply, delivery and installation at site	5698.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2777.81	2777.81	85.48	56.98

('000 US \$)

	Total	Construction Period in Quarters											
		1	2	3	4	5	6	7	8	9	10	11	12
4. Miscellaneous Fixed Assets	459.75												
i) Transformers	106.80	0.00	0.00	0.00	0.00	21.36	0.00	0.00	0.00	85.44	0.00	0.00	0.00
ii) Switchgears	4.00	0.00	0.00	0.00	0.00	0.80	0.00	0.00	3.20	0.00	0.00	0.00	0.00
iii) Central Airconditioning system	173.87	0.00	0.00	0.00	0.00	34.77	0.00	0.00	0.00	139.10	0.00	0.00	0.00
iv) Illumination, Fans and Room Coolers	9.00	0.45	0.00	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.45
v) Water Pumps and Tank	34.60	0.00	0.00	0.00	8.65	8.65	8.65	8.65	0.00	0.00	0.00	0.00	0.00
vi) Overhead fuel oil storage tank	9.00	0.00	0.00	0.00	0.00	4.50	4.50	0.00	0.00	0.00	0.00	0.00	0.00
vii) Compressors	25.48	0.00	0.00	0.00	0.00	5.10	0.00	0.00	0.00	0.00	20.38	0.00	0.00
viii) Fire fighting system	2.00	0.00	0.00	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
ix) Telecommunication system	2.00	0.00	0.20	0.00	0.00	0.20	0.20	0.20	0.20	0.00	0.00	0.00	1.00
x) Office Furniture and Equipment	3.00	0.00	0.15	0.15	0.00	0.00	0.15	0.00	0.00	0.15	0.00	0.40	2.00
xi) Vehicles	90.00	0.00	18.00	18.00	0.00	0.00	9.00	0.00	0.00	9.00	0.00	0.00	36.00
5. Preliminary Expenses	50.00	25.00	25.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6. Pre-operative Expenses	1454.68												
i) Establishment	1268.68	0.00	22.30	53.40	73.80	73.80	89.79	89.79	89.79	98.79	98.79	98.79	479.64
ii) Travelling Expenses	126.00	0.00	2.00	5.00	7.00	7.00	9.00	9.00	9.00	10.00	10.00	10.00	48.00
iii) Miscellaneous	60.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
7. Technical Know-how Fees	1311.00	65.55	65.55	131.10	131.10	131.10	131.10	131.10	131.10	131.10	131.10	65.55	65.55
8. Sub-total (1 thru 7)	35665.75	96.00	2104.70	4208.12	5442.04	6158.49	2936.10	2922.45	2507.18	5285.35	3044.18	266.32	694.82
9. Contingency @ 5% on above	1783.29	4.80	105.23	210.41	272.10	307.92	146.80	146.12	125.36	264.27	152.21	13.32	34.75
10. Sub-Total (8 & 9)	37449.04	100.80	2209.93	4418.51	5714.15	6466.42	3082.90	3068.57	2632.54	5549.61	3196.39	279.65	729.57

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

ESTIMATION OF INTEREST DURING CONSTRUCTION

('000 US \$)

	Construction Period in Quarters												Total
	1	2	3	4	5	6	7	8	9	10	11	12	
Capital Expenditure	100.80	2209.93	4418.51	5714.15	6466.42	3082.90	3068.57	2632.54	5549.61	3196.39	279.65	729.57	37449.04
Margin Money	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	552.44	552.44
Total	100.80	2209.93	4418.51	5714.15	6466.42	3082.90	3068.57	2632.54	5549.61	3196.39	279.65	1282.01	38001.48
Equity	50.78	1114.08	2243.55	2930.18	3353.44	1699.57	1718.05	1524.35	3016.94	1877.04	436.01	947.57	20911.57
Loan	50.78	1114.08	2243.55	2930.17	3353.44	1699.58	1718.04	1524.35	3016.94	1877.04	436.02	947.57	20911.57
Total	101.56	2228.16	4487.10	5860.35	6706.88	3399.15	3436.09	3048.70	6033.88	3754.08	872.03	1895.14	41823.14

JOB NO. : DCIL-105

EXHIBIT : 106

('000 US \$)

	Construction Period in Quarters												Total
	1	2	3	4	5	6	7	8	9	10	11	12	
Interest on loan													
- @ 12% p.a.	0.76	16.71	33.65	43.95	50.30	25.49	25.77	22.87	45.25	28.16	6.54	14.21	313.66
		1.52	33.42	67.31	87.91	100.60	50.99	51.54	45.73	90.51	56.31	13.08	598.91
			1.52	33.42	67.31	87.91	100.60	50.99	51.54	45.73	90.51	56.31	585.83
				1.52	33.42	67.31	87.91	100.60	50.99	51.54	45.73	90.51	529.52
					1.52	33.42	67.31	87.91	100.60	50.99	51.54	45.73	439.01
						1.52	33.42	67.31	87.91	100.60	50.99	51.54	393.28
							1.52	33.42	67.31	87.91	100.60	50.99	341.74
								1.52	33.42	67.31	87.91	100.60	290.75
									1.52	33.42	67.31	87.91	190.15
										1.52	33.42	67.31	102.25
											1.52	33.42	34.94
												1.52	1.52
Total	0.76	18.23	68.59	146.20	240.46	316.25	367.52	416.16	484.27	557.69	592.38	613.13	3821.66
Debt/Equity	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

MEANS OF FINANCING :

EQUITY	20911.57
LOAN	20911.57
TOTAL	41823.14

JOB NO. : DCIL-105

EXHIBIT : 107

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

MARGIN MONEY FOR WORKING CAPITAL

('000 US \$)

Sl. No.	Item	Period (Days)	Cost	Bank Available (%)	Finance Available (Amount)	Margin Money
1.	Raw materials & Consumables	90	5393.73	100%	5393.73	0.00
2.	Finished Stock	30	2131.97	100%	2131.97	0.00
3.	Sundry Debtors	30	2472.67	100%	2472.67	0.00
	Sub-total		9998.37		9998.37	0.00
4.	Expenses	30	552.44	0%	0.00	552.44
	Total		10550.81		9998.37	552.44

JOB NO. : DCIL-105

EXHIBIT : 108

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

STATEMENT OF PRODUCTION, SALES AND REVENUE

(in MT)

	OPERATING YEARS									
	1	2	3	4	5	6	7	8	9	10
Working Days/Year	300	300	300	300	300	300	300	300	300	300
Utilisation	80%	90%	100%	100%	100%	100%	100%	100%	100%	100%
1) Clamps & Yoke Plates										
a) Aluminium	Capacity	708.00	708.00	708.00	708.00	708.00	708.00	708.00	708.00	708.00
	Opening stock	0.00	47.20	53.10	59.00	59.00	59.00	59.00	59.00	59.00
	Production	566.40	637.20	708.00	708.00	708.00	708.00	708.00	708.00	708.00
	Total	566.40	684.40	761.10	767.00	767.00	767.00	767.00	767.00	767.00
	Closing Stock	47.20	53.10	59.00	59.00	59.00	59.00	59.00	59.00	59.00
	Sales	519.20	631.30	702.10	708.00	708.00	708.00	708.00	708.00	708.00
	Price/MT US \$	12000.00	12000.00	12000.00	12000.00	12000.00	12000.00	12000.00	12000.00	12000.00
	Revenue ('000 US \$)	6230.40	7575.60	8425.20	8496.00	8496.00	8496.00	8496.00	8496.00	8496.00
b) Steel	Capacity	214.00	214.00	214.00	214.00	214.00	214.00	214.00	214.00	214.00
	Opening stock	0.00	14.27	16.05	17.83	17.83	17.83	17.83	17.83	17.83
	Production	171.20	192.60	214.00	214.00	214.00	214.00	214.00	214.00	214.00
	Total	171.20	206.87	230.05	231.83	231.83	231.83	231.83	231.83	231.83
	Closing Stock	14.27	16.05	17.83	17.83	17.83	17.83	17.83	17.83	17.83
	Sales	156.93	190.82	212.22	214.00	214.00	214.00	214.00	214.00	214.00
	Price/MT US \$	22300.00	22300.00	22300.00	22300.00	22300.00	22300.00	22300.00	22300.00	22300.00
	Revenue ('000 US \$)	3499.61	4255.21	4732.43	4772.20	4772.20	4772.20	4772.20	4772.20	4772.25

JOB NO. : DCIL-105

EXHIBIT : 100

(in MT)

		OPERATING YEARS									
		1	2	3	4	5	6	7	8	9	10
c) Ductile Iron											
	Capacity	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
	Opening stock	0.00	0.67	0.75	0.83	0.83	0.83	0.83	0.83	0.83	0.83
	Production	8.00	9.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
	Total	8.00	9.67	10.75	10.83	10.83	10.83	10.83	10.83	10.83	10.83
	Closing Stock	0.67	0.75	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
	Sales	7.33	8.92	9.92	10.00	10.00	10.00	10.00	10.00	10.00	10.00
	Price/MT US \$	10000.00	10000.00	10000.00	10000.00	10000.00	10000.00	10000.00	10000.00	10000.00	10000.00
	Revenue ('000 US \$)	73.33	89.17	99.17	100.00	100.00	100.00	100.00	100.00	100.00	100.00
2) Compression & Mid-span Joints											
a) Aluminium											
	Capacity	580.00	580.00	580.00	580.00	580.00	580.00	580.00	580.00	580.00	580.00
	Opening stock	0.00	38.67	43.50	48.33	48.33	48.33	48.33	48.33	48.33	48.33
	Production	464.00	522.00	580.00	580.00	580.00	580.00	580.00	580.00	580.00	580.00
	Total	464.00	560.67	623.50	628.33	628.33	628.33	628.33	628.33	628.33	628.33
	Closing Stock	38.67	43.50	48.33	48.33	48.33	48.33	48.33	48.33	48.33	48.33
	Sales	425.33	517.17	575.17	580.00	580.00	580.00	580.00	580.00	580.00	580.00
	Price/MT US \$	13400.00	13400.00	13400.00	13400.00	13400.00	13400.00	13400.00	13400.00	13400.00	13400.00
	Revenue ('000 US \$)	5699.47	6930.03	7707.23	7772.00	7772.00	7772.00	7772.00	7772.00	7772.00	7772.00
b) Steel											
	Capacity	17.00	17.00	17.00	17.00	17.00	17.00	17.00	17.00	17.00	17.00
	Opening stock	0.00	1.13	1.28	1.42	1.42	1.42	1.42	1.42	1.42	1.42
	Production	13.60	15.30	17.00	17.00	17.00	17.00	17.00	17.00	17.00	17.00
	Total	13.60	16.43	18.28	18.42	18.42	18.42	18.42	18.42	18.42	18.42
	Closing Stock	1.13	1.28	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42
	Sales	12.47	15.16	16.86	17.00	17.00	17.00	17.00	17.00	17.00	17.00

JOB NO. : DC16-105

EXHIBIT : 108

(in MT)

		OPERATING YEARS									
		1	2	3	4	5	6	7	8	9	10
Price/MT US \$		34000.00	34000.00	34000.00	34000.00	34000.00	34000.00	34000.00	34000.00	34000.00	34000.00
Revenue ('000 US \$)		423.87	515.38	573.18	578.00	578.00	578.00	578.00	578.00	578.00	578.00
3) Corona Shields & Arcing Horns											
a) Aluminium	Capacity	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00
	Opening stock	0.00	1.47	1.65	1.83	1.83	1.83	1.83	1.83	1.83	1.83
	Production	17.60	19.80	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00
	Total	17.60	21.27	23.65	23.83	23.83	23.83	23.83	23.83	23.83	23.83
	Closing Stock	1.47	1.65	1.83	1.83	1.83	1.83	1.83	1.83	1.83	1.83
	Sales	16.13	19.62	21.82	22.00	22.00	22.00	22.00	22.00	22.00	22.00
Price/MT US \$		40000.00	40000.00	40000.00	40000.00	40000.00	40000.00	40000.00	40000.00	40000.00	40000.00
Revenue ('000 US \$)		645.33	784.67	872.67	880.00	880.00	880.00	880.00	880.00	880.00	880.00
b) Steel	Capacity	2530.00	2530.00	2530.00	2530.00	2530.00	2530.00	2530.00	2530.00	2530.00	2530.00
	Opening stock	0.00	168.67	189.75	210.83	210.83	210.83	210.83	210.83	210.83	210.83
	Production	2024.00	2277.00	2530.00	2530.00	2530.00	2530.00	2530.00	2530.00	2530.00	2530.00
	Total	2024.00	2445.67	2719.75	2740.83	2740.83	2740.83	2740.83	2740.83	2740.83	2740.83
	Closing Stock	168.67	189.75	210.83	210.83	210.83	210.83	210.83	210.83	210.83	210.83
	Sales	1855.33	2255.92	2508.92	2530.00	2530.00	2530.00	2530.00	2530.00	2530.00	2530.00
Price/MT US \$		1900.00	1900.00	1900.00	1900.00	1900.00	1900.00	1900.00	1900.00	1900.00	1900.00
Revenue ('000 US \$)		3525.13	4286.24	4766.94	4807.00	4807.00	4807.00	4807.00	4807.00	4807.00	4807.00
4) Spacer											
a) Aluminium	Capacity	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00
	Opening stock	0.00	4.67	5.25	5.83	5.83	5.83	5.83	5.83	5.83	5.83
	Production	56.00	63.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00

JOB NO. : DCIL-105

EXHIBIT : 108

(in MT)

		O P E R A T I N G Y E A R S									
		1	2	3	4	5	6	7	8	9	10
Total		56.00	67.67	75.25	75.83	75.83	75.83	75.83	75.83	75.83	75.83
Closing Stock		4.67	5.25	5.83	5.83	5.83	5.83	5.83	5.83	5.83	5.83
Sales		51.33	62.42	69.42	70.00	70.00	70.00	70.00	70.00	70.00	70.00
Price/MT US \$		68000.00	68000.00	68000.00	68000.00	68000.00	68000.00	68000.00	68000.00	68000.00	68000.00
Revenue ('000 US \$)		3490.67	4244.33	4720.33	4760.00	4760.00	4760.00	4760.00	4760.00	4760.00	4760.00
b) Steel	Capacity	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00
Opening stock		0.00	10.33	11.63	12.92	12.92	12.92	12.92	12.92	12.92	12.92
Production		124.00	139.50	155.00	155.00	155.00	155.00	155.00	155.00	155.00	155.00
Total		124.00	149.83	166.63	167.92	167.92	167.92	167.92	167.92	167.92	167.92
Closing Stock		10.33	11.63	12.92	12.92	12.92	12.92	12.92	12.92	12.92	12.92
Sales		113.67	138.21	153.71	155.00	155.00	155.00	155.00	155.00	155.00	155.00
Price/MT US \$		10000.00	10000.00	10000.00	10000.00	10000.00	10000.00	10000.00	10000.00	10000.00	10000.00
Revenue ('000 US \$)		1136.67	1382.08	1537.08	1550.00	1550.00	1550.00	1550.00	1550.00	1550.00	1550.00
5) Armour Rods											
a) Aluminium	Capacity	730.00	730.00	730.00	730.00	730.00	730.00	730.00	730.00	730.00	730.00
Opening stock		0.00	48.67	54.75	60.83	60.83	60.83	60.83	60.83	60.83	60.83
Production		584.00	657.00	730.00	730.00	730.00	730.00	730.00	730.00	730.00	730.00
Total		584.00	705.67	784.75	790.83	790.83	790.83	790.83	790.83	790.83	790.83
Closing Stock		48.67	54.75	60.83	60.83	60.83	60.83	60.83	60.83	60.83	60.83
Sales		535.33	650.92	723.92	730.00	730.00	730.00	730.00	730.00	730.00	730.00
Price/MT US \$		10200.00	10200.00	10200.00	10200.00	10200.00	10200.00	10200.00	10200.00	10200.00	10200.00
Revenue ('000 US \$)		5460.40	6639.35	7383.95	7446.00	7446.00	7446.00	7446.00	7446.00	7446.00	7446.00

JOB NO. : DCIL-105

EXHIBIT : 108

(in MT)

OPERATING YEARS

		1	2	3	4	5	6	7	8	9	10
6) Vibration Damper											
a) Cast Iron	Capacity	950.00	950.00	950.00	950.00	950.00	950.00	950.00	950.00	950.00	950.00
	Opening stock	0.00	63.33	71.25	79.17	79.17	79.17	79.17	79.17	79.17	79.17
	Production	760.00	855.00	950.00	950.00	950.00	950.00	950.00	950.00	950.00	950.00
	Total	760.00	918.33	1021.25	1029.17	1029.17	1029.17	1029.17	1029.17	1029.17	1029.17
	Closing Stock	63.33	71.25	79.17	79.17	79.17	79.17	79.17	79.17	79.17	79.17
	Sales	696.67	847.08	942.08	950.00	950.00	950.00	950.00	950.00	950.00	950.00
	Price/MT US \$	1000.00	1000.00	1000.00	1000.00	1000.00	1000.00	1000.00	1000.00	1000.00	1000.00
	Revenue ('000 US \$)	696.67	847.08	942.08	950.00	950.00	950.00	950.00	950.00	950.00	950.00
7) Nuts & Bolts											
a) Steel	Capacity	180.00	180.00	180.00	180.00	180.00	180.00	180.00	180.00	180.00	180.00
	Opening stock	0.00	12.00	13.50	15.00	15.00	15.00	15.00	15.00	15.00	15.00
	Production	144.00	162.00	180.00	180.00	180.00	180.00	180.00	180.00	180.00	180.00
	Total	144.00	174.00	193.50	195.00	195.00	195.00	195.00	195.00	195.00	195.00
	Closing Stock	12.00	13.50	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
	Sales	132.00	160.50	179.50	180.00	180.00	180.00	180.00	180.00	180.00	180.00
	Price/MT US \$	1600.00	1600.00	1600.00	1600.00	1600.00	1600.00	1600.00	1600.00	1600.00	1600.00
	Revenue ('000 US \$)	211.20	256.80	285.60	288.00	288.00	288.00	288.00	288.00	288.00	288.00
8) Socket, Clevis & Hardwares											
a) Aluminium	Capacity	190.00	190.00	190.00	190.00	190.00	190.00	190.00	190.00	190.00	190.00
	Opening stock	0.00	12.67	14.25	15.83	15.83	15.83	15.83	15.83	15.83	15.83
	Production	152.00	171.00	190.00	190.00	190.00	190.00	190.00	190.00	190.00	190.00
	Total	152.00	183.67	204.25	205.83	205.83	205.83	205.83	205.83	205.83	205.83

(in MT)

OPERATING YEARS

		1	2	3	4	5	6	7	8	9	10
Closing Stock		12.67	14.25	15.83	15.83	15.83	15.83	15.83	15.83	15.83	15.83
Sales		139.33	169.42	188.42	190.00	190.00	190.00	190.00	190.00	190.00	190.00
Price/MT US \$		1500.00	1500.00	1500.00	1500.00	1500.00	1500.00	1500.00	1500.00	1500.00	1500.00
Revenue ('000 US \$)		209.00	254.13	282.63	285.00	285.00	285.00	285.00	285.00	285.00	285.00
b) Steel	Capacity	1370.00	1370.00	1370.00	1370.00	1370.00	1370.00	1370.00	1370.00	1370.00	1370.00
Opening stock		0.00	91.33	102.75	114.17	114.17	114.17	114.17	114.17	114.17	114.17
Production		1096.00	1233.00	1370.00	1370.00	1370.00	1370.00	1370.00	1370.00	1370.00	1370.00
Total		1096.00	1324.33	1472.75	1484.17	1484.17	1484.17	1484.17	1484.17	1484.17	1484.17
Closing Stock		91.33	102.75	114.17	114.17	114.17	114.17	114.17	114.17	114.17	114.17
Sales		1004.67	1221.58	1358.58	1370.00	1370.00	1370.00	1370.00	1370.00	1370.00	1370.00
Price/MT US \$		300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00
Revenue ('000 US \$)		301.40	366.48	407.58	411.00	411.00	411.00	411.00	411.00	411.00	411.00
c) Ductile Iron	Capacity	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00
Opening stock		0.00	2.67	3.00	3.33	3.33	3.33	3.33	3.33	3.33	3.33
Production		32.00	36.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00
Total		32.00	38.67	43.00	43.33	43.33	43.33	43.33	43.33	43.33	43.33
Closing Stock		2.67	3.00	3.33	3.33	3.33	3.33	3.33	3.33	3.33	3.33
Sales		29.33	35.67	39.67	40.00	40.00	40.00	40.00	40.00	40.00	40.00
Price/MT US \$		400.00	400.00	400.00	400.00	400.00	400.00	400.00	400.00	400.00	400.00
Revenue ('000 US \$)		11.73	14.27	15.87	16.00	16.00	16.00	16.00	16.00	16.00	16.00

JOB NO. : DCIL-105

EXHIBIT : 108

(in MT)

OPERATING YEARS

		1	2	3	4	5	6	7	8	9	10
9) Guy Wires											
a) Steel	Capacity	908.00	908.00	908.00	908.00	908.00	908.00	908.00	908.00	908.00	908.00
	Opening stock	0.00	60.53	68.10	75.67	75.67	75.67	75.67	75.67	75.67	75.67
	Production	726.40	817.20	908.00	908.00	908.00	908.00	908.00	908.00	908.00	908.00
	Total	726.40	877.73	976.10	983.67	983.67	983.67	983.67	983.67	983.67	983.67
	Closing Stock	60.53	68.10	75.67	75.67	75.67	75.67	75.67	75.67	75.67	75.67
	Sales	665.87	809.63	900.43	908.00	908.00	908.00	908.00	908.00	908.00	908.00
	Price/MT US \$	700.00	700.00	700.00	700.00	700.00	700.00	700.00	700.00	700.00	700.00
	Revenue ('000 US \$)	466.11	566.74	630.30	635.60	635.60	635.60	635.60	635.60	635.60	635.60
10) Stay Rods, Washers, Cross Arms, etc.											
a) Steel	Capacity	3526.00	3526.00	3526.00	3526.00	3526.00	3526.00	3526.00	3526.00	3526.00	3526.00
	Opening stock	0.00	235.07	264.45	293.83	293.83	293.83	293.83	293.83	293.83	293.83
	Production	2820.80	3173.40	3526.00	3526.00	3526.00	3526.00	3526.00	3526.00	3526.00	3526.00
	Total	2820.80	3408.47	3790.45	3819.83	3819.83	3819.83	3819.83	3819.83	3819.83	3819.83
	Closing Stock	235.07	264.45	293.83	293.83	293.83	293.83	293.83	293.83	293.83	293.83
	Sales	2585.73	3144.02	3496.62	3526.00	3526.00	3526.00	3526.00	3526.00	3526.00	3526.00
	Price/MT US \$	1000.00	1000.00	1000.00	1000.00	1000.00	1000.00	1000.00	1000.00	1000.00	1000.00
	Revenue ('000 US \$)	2585.73	3144.02	3496.62	3526.00	3526.00	3526.00	3526.00	3526.00	3526.00	3526.00
TOTAL	REVENUE ('000 US \$)	34666.72	42151.58	46878.86	47272.80	47272.80	47272.80	47272.80	47272.80	47272.80	47272.80

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

COST OF PRODUCTION AND SALES

('000 US \$)

OPERATING YEARS

	1	2	3	4	5	6	7	8	9	10
A. Variable Cost										
Raw Materials and Consumables	20832.94	23437.06	26041.18	26041.18	26041.18	26041.18	26041.18	26041.18	26041.18	26041.18
Power	1090.28	1225.68	1361.08	1361.08	1361.08	1361.08	1361.08	1361.08	1361.08	1361.08
Water	62.09	69.85	77.62	77.62	77.62	77.62	77.62	77.62	77.62	77.62
Sub-total	21985.32	24732.59	27479.87	27479.87	27479.87	27479.87	27479.87	27479.87	27479.87	27479.87
Contingency (@ 5% on above)	1099.27	1236.63	1373.99	1373.99	1373.99	1373.99	1373.99	1373.99	1373.99	1373.99
Total 'A'	23084.58	25969.22	28853.86	28853.86	28853.86	28853.86	28853.86	28853.86	28853.86	28853.86
B. Fixed Cost										
1) Labour & Plant Overhead *										
a) Direct labour	2109.60	2215.08	2320.56	2426.04	2531.52	2637.00	2742.48	2847.96	2953.44	3058.92
b) Indirect labour	801.22	841.28	881.34	921.40	961.46	1001.52	1041.58	1081.64	1121.70	1161.76
c) Supervision	960.00	1008.00	1056.00	1104.00	1152.00	1200.00	1248.00	1296.00	1344.00	1392.00
Sub-total	3870.82	4064.36	4257.90	4451.44	4644.98	4838.52	5032.06	5225.60	5419.14	5612.68

JOB NO. : DCIL-105

EXHIBIT : 109

('000 US \$)

	OPERATING YEARS									
	1	2	3	4	5	6	7	8	9	10

ii) Other Factory Expenses										
a) Maintenance @ 3%										
on Plant & Equipment	244.20	244.20	244.20	244.20	244.20	244.20	244.20	244.20	244.20	244.20
b) Maintenance @ 1%										
on Building & Civil Work	163.84	163.84	163.84	163.84	163.84	163.84	163.84	163.84	163.84	163.84
c) Miscellaneous	81.61	81.61	81.61	81.61	81.61	81.61	81.61	81.61	81.61	81.61
Sub-total	489.65	489.65	489.65	489.65	489.65	489.65	489.65	489.65	489.65	489.65

iii) Administrative & Sales Expenses										
a) Salaries *	667.32	700.69	734.05	767.42	800.78	834.15	867.52	900.88	934.25	967.61
b) Overheads	133.46	140.14	146.81	153.48	160.16	166.83	173.50	180.18	186.85	193.52
Sub-total	800.78	840.82	880.86	920.90	960.94	1000.98	1041.02	1081.06	1121.10	1161.14
Total (i+ii+iii)	5161.25	5394.83	5628.41	5861.99	6095.57	6329.15	6562.73	6796.31	7029.89	7263.47
Contingency (@ 5% on above)	258.06	269.74	281.42	293.10	304.78	316.46	328.14	339.82	351.49	363.17
Total 'B'	5419.32	5664.58	5909.84	6155.09	6400.35	6645.61	6890.88	7136.12	7381.39	7626.65
Total Cost of Production and Sales (A+B)	28503.90	31633.80	34763.70	35008.96	35254.22	35499.48	35744.75	35989.98	36235.25	36480.51

* Assumed to increase at the flat rate of 5% straight line every year

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

PROJECTED PROFITABILITY STATEMENT

('000 US \$)

Elements	OPERATING YEARS									
	1	2	3	4	5	6	7	8	9	10
Raw Materials and Consumables	20832.94	23437.06	26041.18	26041.18	26041.18	26041.18	26041.18	26041.18	26041.18	26041.18
Power	1090.28	1225.68	1361.08	1361.08	1361.08	1361.08	1361.08	1361.08	1361.08	1361.08
Water	62.09	69.85	77.62	77.62	77.62	77.62	77.62	77.62	77.62	77.62
Labour & Plant Overhead	3870.82	4064.36	4257.90	4451.44	4644.98	4838.52	5032.06	5225.60	5419.14	5612.68
Other Factory Expenses	489.65	489.65	489.65	489.65	489.65	489.65	489.65	489.65	489.65	489.65
Administrative & Sales Expenses	800.78	840.82	880.86	920.90	960.94	1000.98	1041.02	1081.06	1121.10	1161.14
Sub-Total	27146.57	30127.43	33108.29	33341.87	33575.45	33809.03	34042.61	34276.19	34509.77	34743.35
Contingency	1357.32	1506.37	1655.41	1667.09	1678.77	1690.45	1702.13	1713.81	1725.49	1737.17
Total	28503.90	31633.80	34763.70	35008.96	35254.22	35499.48	35744.74	35989.99	36235.25	36480.52
Stock Variation	-2131.97	-241.44	-241.44	-16.70	-16.71	-16.70	-16.70	-16.71	-16.70	-16.70
Cost of Production and Sales	26371.93	31392.36	34522.26	34992.26	35237.49	35482.77	35728.03	35973.28	36218.55	36463.82
PROJECTED REVENUE	34666.72	42151.58	46878.86	47272.80	47272.80	47272.80	47272.80	47272.80	47272.80	47272.80
Profit before Interest and Depreciation	8294.79	10759.22	12356.60	12280.54	12035.31	11790.03	11544.77	11299.52	11054.25	10808.98

JOB NO. : DCIL-105

EXHIBIT : 110

('000 US \$)

Elements	OPERATING YEARS										
	1	2	3	4	5	6	7	8	9	10	
Interest											
On Term Loan											
- @ 12% p.a.	2509.39	2509.39	2509.39	2316.36	2123.33	1930.30	1737.27	1544.24	1351.21	1158.18	
On Working Capital Loan											
- @ 14% p.a.	1399.77	1399.77	1049.83	699.89	349.94	0.00	0.00	0.00	0.00	0.00	
Sub-total	3909.16	3909.16	3559.22	3016.25	2473.27	1930.30	1737.27	1544.24	1351.21	1158.18	
Profit before Depreciation	4385.63	6850.06	8797.38	9264.30	9562.03	9859.73	9807.50	9755.28	9703.04	9650.80	
Depreciation and Amortisation	1856.06	1856.06	1856.06	1856.06	1856.06	1856.06	1856.06	1856.06	1856.06	1856.06	
Profit before Tax	2529.57	4994.00	6941.33	7408.24	7705.97	8003.67	7951.44	7899.22	7846.98	7794.74	
Tax	632.39	1276.23	1788.83	1948.94	2045.66	2140.84	2147.11	2152.07	2155.81	2158.43	
Distributable Profit	1897.18	3717.77	5152.50	5459.30	5660.31	5862.83	5804.33	5747.15	5691.17	5636.31	
Dividend	0.00	2091.16	2091.16	2613.95	2613.95	3136.73	3136.73	3136.73	4182.31	4182.31	
Retained Earnings	1897.18	1626.62	3061.34	2845.36	3046.37	2726.10	2667.60	2610.41	1508.86	1454.00	
Add Back : Depreciation & Amortisation	1856.06	1856.06	1856.06	1856.06	1856.06	1856.06	1856.06	1856.06	1856.06	1856.06	
NET CASH ACCRUAL	3753.24	3482.68	4917.40	4761.41	4902.43	4582.16	4523.66	4466.47	3364.92	3310.06	

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

STATEMENT OF FIXED ASSETS AND DEPRECIATION UNDER STRAIGHT LINE METHOD

('000 US \$)

Description	Value	Technical Know-how Fees	Sub- Total	Contin- gency	Sub- Total	Interest during Construct	Sub- Total	50% of Pre-op Expenses	Total	Rate (%)	Amount
1. Land & Land Development	7866.00	0.00	7866.00	0.00	7866.00	0.00	7866.00	0.00	7866.00	0%	0.00
2. Building & Civil Work	16384.21	859.74	17243.95	1169.46	18413.41	2506.19	20919.60	477.20	21396.80	4%	855.87
3. Plant & Machinery	8140.11	427.14	8567.25	581.02	9148.27	1245.14	10393.41	237.09	10630.51	8%	850.44
4. Miscellaneous Fixed Assets	459.75	24.12	483.87	32.81	516.68	70.33	587.01	13.38	600.39	12%	72.05
5. Preliminary Expenses	50.00	0.00	50.00	0.00	50.00	0.00	50.00	0.00	50.00	10%	5.00
6. Pre-operative Expenses	1454.68	0.00	1454.68	0.00	1454.68	0.00	1454.68	-727.68	727.00	10%	72.70
7. Technical Know-how Fees	1311.00	-1311.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0%	0.00
Sub-total	35665.75		35665.75		37449.04		41270.70		41270.70		1856.06
8. Contingency	1783.29	0.00	1783.29	-1783.29	0.00	0.00	0.00	0.00	0.00		
Sub-total	37449.04		37449.04		37449.04		41270.70		41270.70		
9. Interest during Construction	3821.66	0.00	3821.66	0.00	3821.66	-3821.66	0.00	0.00	0.00		
Total	41270.70		41270.70		41270.70		41270.70		41270.70		

JOB NO. : DCIL-105

EXHIBIT : 112

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

TAX COMPUTATION

('000 US \$)

	OPERATING YEARS									
	1	2	3	4	5	6	7	8	9	10
Profit before Depreciation	4385.63	6850.06	8797.38	9264.30	9562.03	9859.73	9807.50	9755.28	9703.04	9650.80
Less : Current Depreciation	1856.06	1745.14	1642.08	1468.55	1379.39	1296.39	1219.07	1147.00	1079.79	1017.07
Balance	2529.57	5104.92	7155.31	7795.75	8182.64	8563.34	8588.43	8608.28	8623.25	8633.73
Less : Unabsorbed Depreciation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Taxable Income	2529.57	5104.92	7155.31	7795.75	8182.64	8563.34	8588.43	8608.28	8623.25	8633.73
Tax @ 25%	632.39	1276.23	1788.83	1948.94	2045.66	2140.84	2147.11	2152.07	2155.81	2158.43

JOB NO. : DCIL-105

EXHIBIT : 113

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

DEPRECIATION FOR TAX

('000 US \$)

WDV Rate	Building & Civil Work 4%	Plant & Machinery 8%	Misc. Fixed Assets 12%	Amortisation 10%	Total
Value	21396.80	10630.51	600.39	777.00	
Depreciation Year 1	855.87	850.44	72.05	77.70	1856.06
Balance	20540.93	9780.07	528.34	699.30	
Depreciation Year 2	821.64	782.41	63.40	77.70	1745.14
Balance	19719.29	8997.66	464.94	621.60	
Depreciation Year 3	788.77	719.81	55.79	77.70	1642.08
Balance	18930.52	8277.85	409.15	543.90	
Depreciation Year 4	757.22	662.23	49.10	77.70	1546.25
Balance	18173.30	7615.62	360.05	466.20	
Depreciation Year 5	726.93	609.25	43.21	77.70	1457.09
Balance	17446.37	7006.37	316.84	388.50	
Depreciation Year 6	697.85	560.51	38.02	77.70	1374.09
Balance	16748.51	6445.86	278.82	310.80	
Depreciation Year 7	669.94	515.67	33.46	77.70	1296.77
Balance	16078.57	5930.19	245.36	233.10	
Depreciation Year 8	643.14	474.42	29.44	77.70	1224.70
Balance	15435.43	5455.78	215.92	155.40	
Depreciation Year 9	617.42	436.46	25.91	77.70	1157.49
Balance	14818.01	5019.32	190.01	77.70	
Depreciation Year 10	592.72	401.55	22.80	77.70	1094.77
Balance	14225.29	4617.77	167.21	0.00	

WDV : Written Down Value

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

WORKING CAPITAL REQUIREMENTS
(Excluding Cash and bank Balances)

('000 US \$)

Items	O P E R A T I N G Y E A R									
	1	2	3	4	5	6	7	8	9	10
1. Raw materials & Consumables	5393.73	6067.95	6742.17	6742.17	6742.17	6742.17	6742.17	6742.17	6742.17	6742.17
2. Finished Stock	2131.97	2373.41	2614.85	2631.55	2648.26	2664.96	2681.66	2698.37	2715.07	2731.77
3. Sundry Debtors	2472.67	3464.51	3853.06	3885.44	3885.44	3885.44	3885.44	3885.44	3885.44	3885.44
TOTAL	9998.37	11905.87	13210.08	13259.16	13275.87	13292.57	13309.27	13325.98	13342.68	13359.38
Increase /(decrease)	9998.37	1907.50	1304.21	49.08	16.71	16.70	16.70	16.71	16.70	16.70
Stock Variation	2131.97	241.44	241.44	16.70	16.71	16.70	16.70	16.71	16.70	16.70

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

PROJECTED CASH FLOW STATEMENT

('000 US \$)

Construction Period	Y		E		A		R				
	1	2	3	4	5	6	7	8	9	10	
A. SOURCE S											
Increase in Share Capital	20911.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Increase in Term Loan	20911.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Increase in Bank Loan	0.00	9998.37	0.00	0.00	0.00	6.00	0.00	0.00	0.00	0.00	0.00
Profit before Tax with Interest added back	0.00	6438.73	8903.16	10500.54	10424.48	10179.25	9933.97	9688.71	9443.46	9198.19	8952.92
Depreciation.	0.00	1856.06	1856.06	1856.06	1856.06	1856.06	1856.06	1856.06	1856.06	1856.06	1856.06
TOTAL 'A'	41823.14	18293.16	10759.23	12356.60	12280.54	12035.31	11790.63	11544.77	11299.52	11054.25	10808.98
B. APPLICATIONS											
Increase in Capital Expenditure	37449.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Increase/(Decrease) in Working Capital	0.00	9998.37	1907.50	1304.21	49.08	16.71	16.70	16.70	16.71	16.70	16.70

JOB NO. : DCIL-105

EXHIBIT : 115

('000 US \$)

Construction Period	I		E		A		B				
	1	2	3	4	5	6	7	8	9	10	
Interest											
On Term Loan - @ 12% p.a.	3821.66	2509.39	2509.39	2509.39	2316.36	2123.33	1930.30	1737.27	1544.24	1351.21	1158.18
On Working Capital Loan - @ 14% p.a.	0.00	1399.77	1399.77	1049.83	699.89	349.94	0.00	0.00	0.00	0.00	0.00
Total Interest	3821.66	3909.16	3909.16	3559.22	3016.25	2473.27	1930.30	1737.27	1544.24	1351.21	1158.18
Tax	0.00	632.39	1276.23	1788.83	1948.94	2045.66	2140.84	2147.11	2152.07	2155.81	2158.43
Dividend	0.00	0.00	2091.16	2091.16	2613.95	2613.95	3136.73	3136.73	3136.73	4182.31	4182.31
Repayment of Term Loan	0.00	0.00	0.00	1608.58	1608.58	1608.58	1608.58	1608.58	1608.58	1608.58	1608.58
Repayment of Working Capital Loan	0.00	0.00	2499.59	2499.59	2499.59	2499.60	0.00	0.00	0.00	0.00	0.00
TOTAL 'B'	41270.70	14539.93	11683.65	12851.58	11736.39	11257.77	8833.15	8646.39	8458.33	8314.61	9124.20
Opening Balance	0.00	552.44	4305.68	3381.26	2886.29	3430.45	4207.99	7164.86	10063.24	12904.43	14644.07
Surplus / (Deficit) during the Year (A - B)	552.44	3753.24	-924.42	-494.98	544.17	777.54	2956.87	2898.38	2841.19	1739.64	1684.78
Closing Balance	552.44	4305.68	3381.26	2886.29	3430.45	4207.99	7164.86	10063.24	12904.43	14644.07	16328.85

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

PROJECTED BALANCE SHEET

('000 US \$)

		Y		E		A		R			
		1	2	3	4	5	6	7	8	9	10
Add:	Share Capital	20911.57	20911.57	20911.57	20911.57	20911.57	20911.57	20911.57	20911.57	20911.57	20911.57
	Reserves & Surplus	1897.18	3523.79	6585.14	9430.49	12476.86	15202.96	17870.55	20480.97	21989.83	23443.83
	SHAREHOLDERS' FUND	22808.75	24435.36	27496.71	30342.06	33388.42	36114.52	38782.12	41392.54	42901.40	44355.40
Less:	Intangible Assets	699.30	621.60	543.90	466.20	388.50	310.80	233.10	155.40	77.70	0.00
	TANGIBLE NET WORTH	22109.45	23813.76	26952.81	29875.86	32999.92	35803.72	38549.02	41237.14	42823.70	44355.40
Add:	Term Loan	20911.57	20911.57	19302.99	17694.41	16085.83	14477.25	12868.67	11260.09	9651.51	8042.93
	CAPITAL FUND	43021.02	44725.33	46255.80	47570.27	49085.75	50280.98	51417.69	52497.23	52475.21	52398.33
Less:	Net Fixed Assets	38715.34	36936.98	35158.62	33380.26	31601.90	29823.54	28045.18	26266.82	24488.46	22710.10
	NET CURRENT ASSETS	4305.68	7788.35	11097.18	14190.01	17483.86	20457.44	23372.51	26230.41	27986.75	29688.23
A. CURRENT ASSETS		-----									
	Working Capital	9998.37	11905.87	13210.08	13259.16	13275.87	13292.57	13309.27	13325.98	13342.68	13359.38
	Cash & Bank Balance as per Cash Flow Statement	4305.68	3381.26	2886.29	3430.45	4207.99	7164.86	10063.24	12904.43	14644.07	16328.85
	TOTAL 'A'	14304.05	15287.13	16096.37	16689.61	17483.86	20457.44	23372.51	26230.41	27986.75	29688.23
B. CURRENT LIABILITIES		-----									
	Bank Loan	9998.37	7498.78	4999.19	2499.60	0.00	0.00	0.00	0.00	0.00	0.00
	TOTAL 'B'	9998.37	7498.78	4999.19	2499.60	0.00	0.00	0.00	0.00	0.00	0.00
	NET CURRENT ASSETS (A-B)	4305.68	7788.35	11097.18	14190.01	17483.86	20457.44	23372.51	26230.41	27986.75	29688.23

JOB NO. : DCIL-105

EXHIBIT : 117

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

BREAK-EVEN ANALYSIS

('000 US \$)

Sl. No.	Particulars	Amount
1.	Raw Materials and Consumables	26041.18
2.	Power	1361.08
3.	Water	77.62
4.	Sub-Total (1 thru 3)	27479.87
5.	Contingency	1373.99
6.	VARIABLE COSTS	28853.86
7.	REVENUE	47272.80
8.	CONTRIBUTION (7 - 6)	18418.94
9.	Labour & Plant Overhead*	4741.75
10.	Other Factory Expenses	489.65
11.	Administrative & Sales Expenses*	980.96
12.	Sub-Total (9 thru 11)	6212.36
13.	Contingency	310.62
14.	Sub-Total (12+13)	6522.98
15.	Interest**	4917.65
16.	Depreciation	1856.06
17.	FIXED COSTS	13296.69
	BREAK-EVEN SALES 17*7/8	34126.40
	BREAK-EVEN POINT	63.0%
	CASH BREAK-EVEN SALES	29362.76
	CASH BREAK-EVEN POINT	54.2%

* Average over 10 years

** Average over 5 years

JOB NO. : DCIL-105

EXHIBIT : 118

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
AND
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION
PROJECT PROFILE ON OVERHEAD LINE ACCESSORIES

INTERNAL RATE OF RETURN

('000 US \$)

Year	Outflow	Inflow	Net Inflow
0	-41823.14	0.00	-41823.14
1	0.00	8294.79	8294.79
2	0.00	10759.22	10759.22
3	0.00	12356.60	12356.60
4	0.00	12280.54	12280.54
5	0.00	12035.31	12035.31
6	0.00	11790.03	11790.03
7	0.00	11544.77	11544.77
8	0.00	11299.52	11299.52
9	0.00	11054.25	11054.25
10	0.00	10808.98	10808.98

IRR 22.8%

Outflow = Project Cost

Inflow = Profit before Interest, Depreciation and Tax

SECTION - 13
PROJECT IMPLEMENTATION PLAN

PROJECT IMPLEMENTATION PLAN

There will be two Overhead Line Accessories manufacturing plant to cater to the demand in the designated region.

The implementation schedule of the key activities involved in setting up these is presented in Exhibit-119.

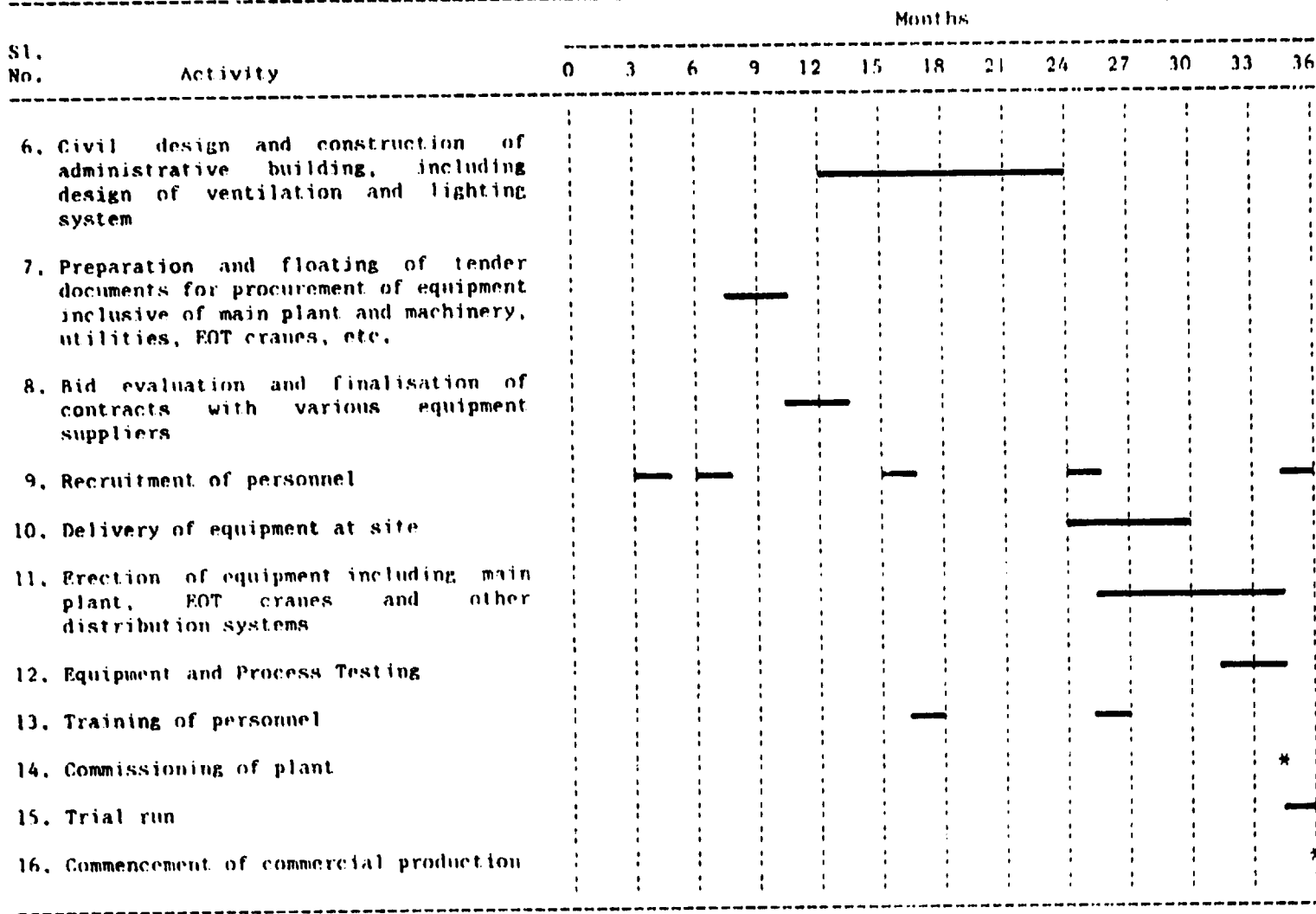
The programme covers a time span of 36 months starting from the preparation and finalisation of Detailed Project Report (DPR) and ending on the commencement of commercial production. The relatively longer implementation schedule of 3 years is due to the fact that these plants will include separate aluminium foundry, cast iron foundry, forging shop, fabrication shops, etc., to attain self-sufficiency in production. It allows adequate time for procurement and erection of the equipment. Erection of heavier equipment, especially foundry and forge shop equipment will become easier if procurement and installation of EOT cranes is speeded up. The total time span of 12 to 18 months for delivery of equipment at site have to be strictly adhered to, as this will involve international competitive bidding. Any delay in this stage will adversely affect the commissioning of the plant in time. Also, the erection will take about 9 months' time mainly due to installation of critical equipment like furnaces and pressure die-casting machines.

Recruitment of personnel has been shown in various key points during the implementation stage. Experienced personnel will be recruited within the first six quarters for senior levels.

Though not included in the key activities, it is important that the client applies for and obtains the necessary funds from the concerned financial institution well in time.

JOB NO. : DCIL-105

EXHIBIT : 119



DEVELOPMENT
CONSULTANTS

SEC 1

SEC 2

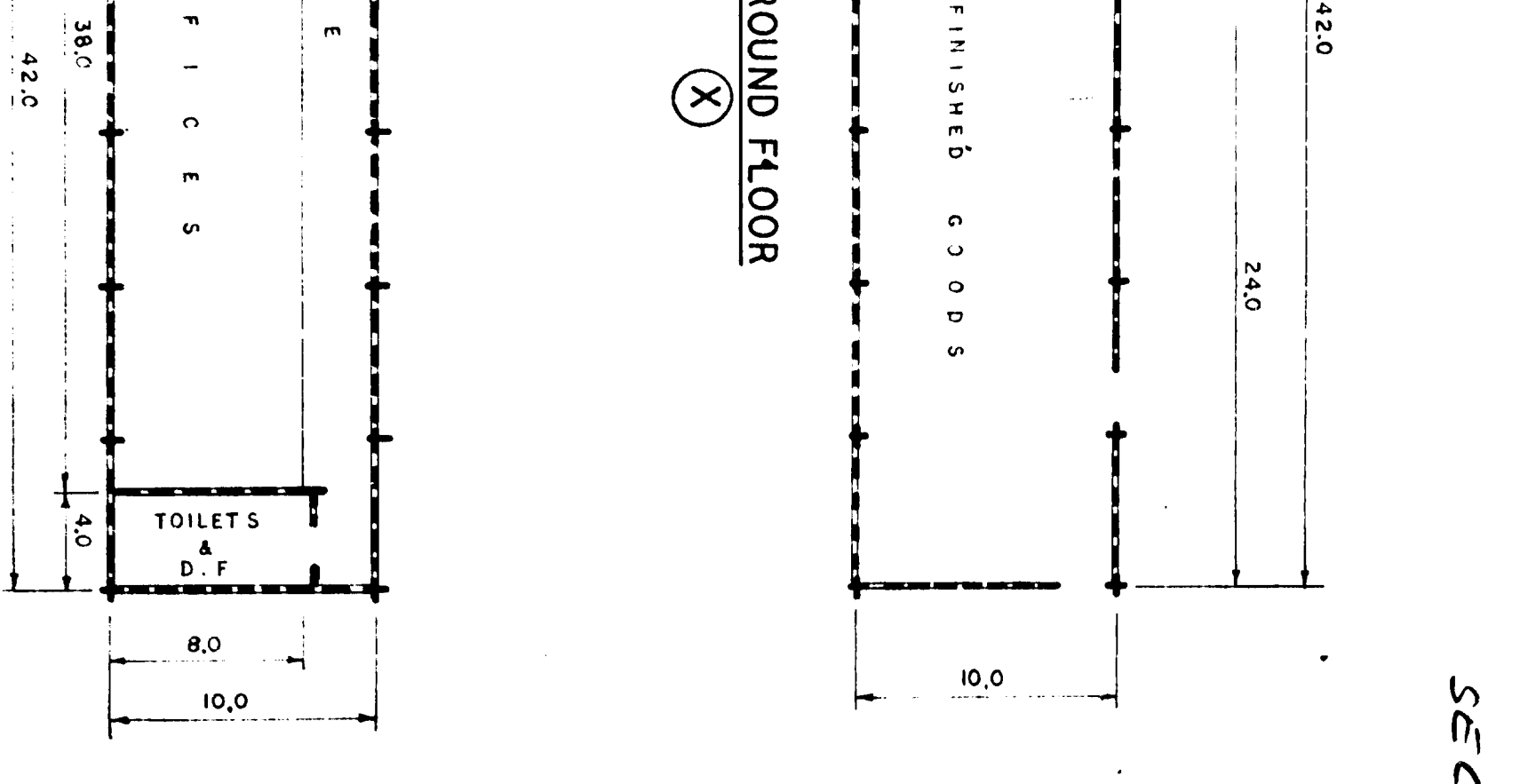
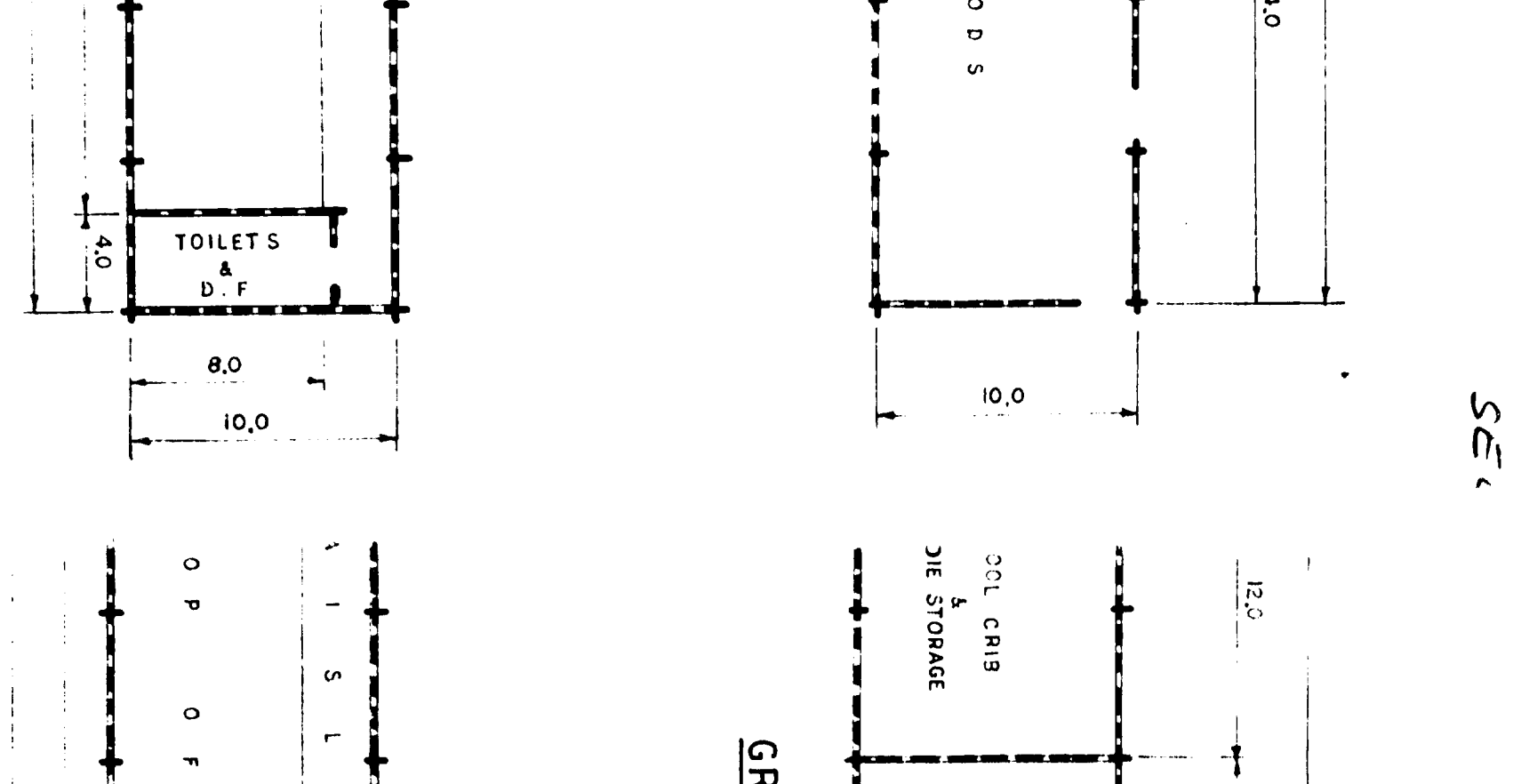
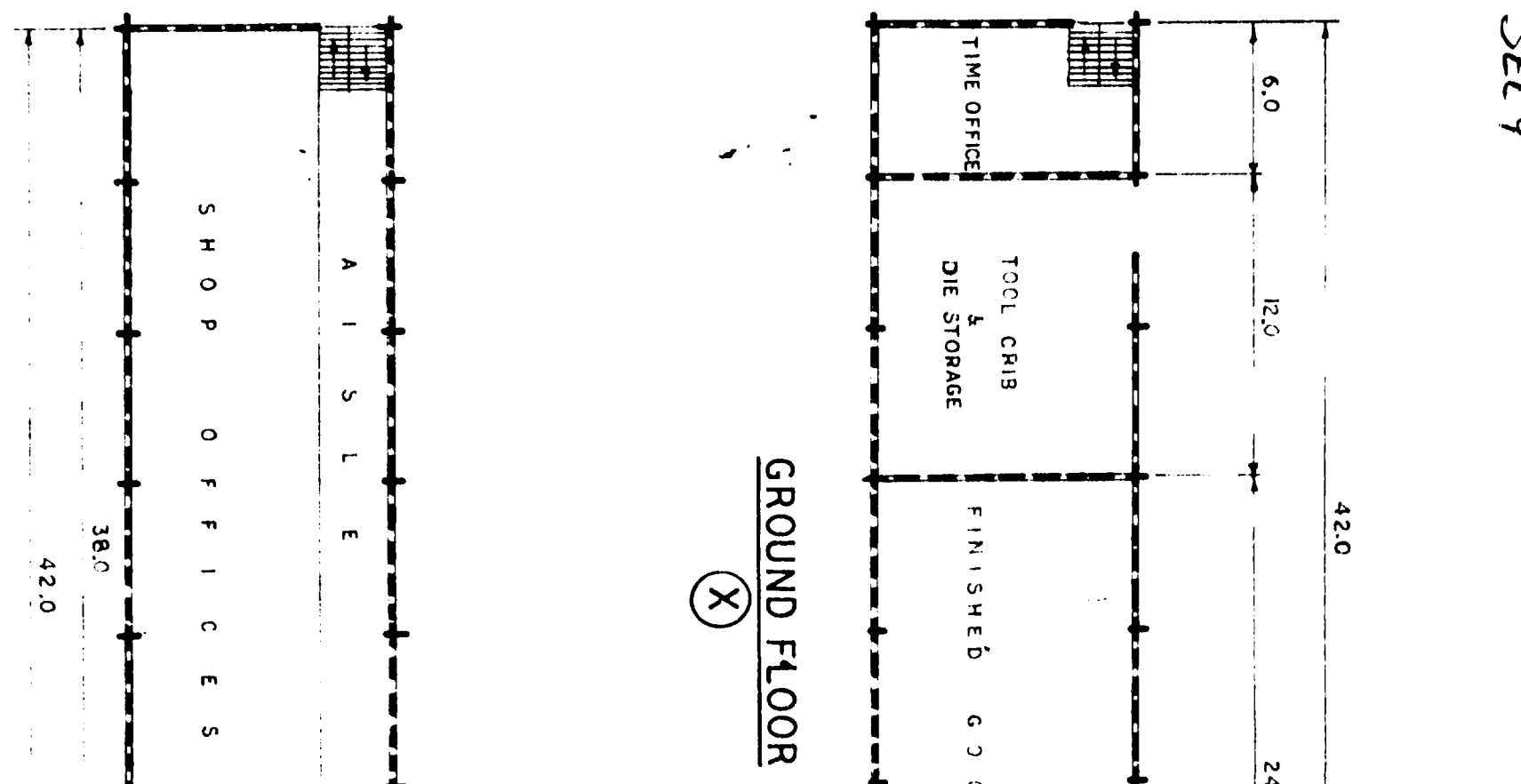
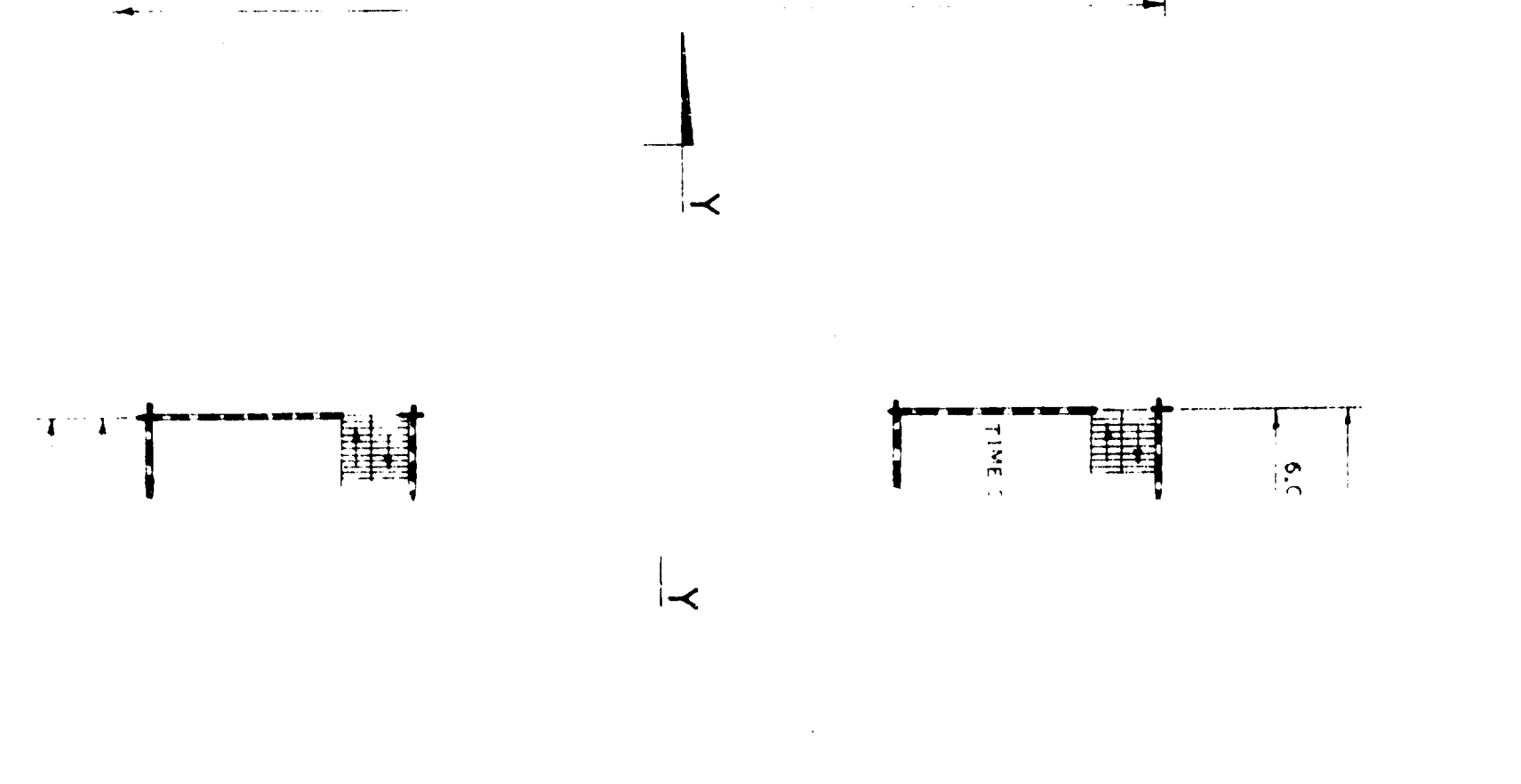
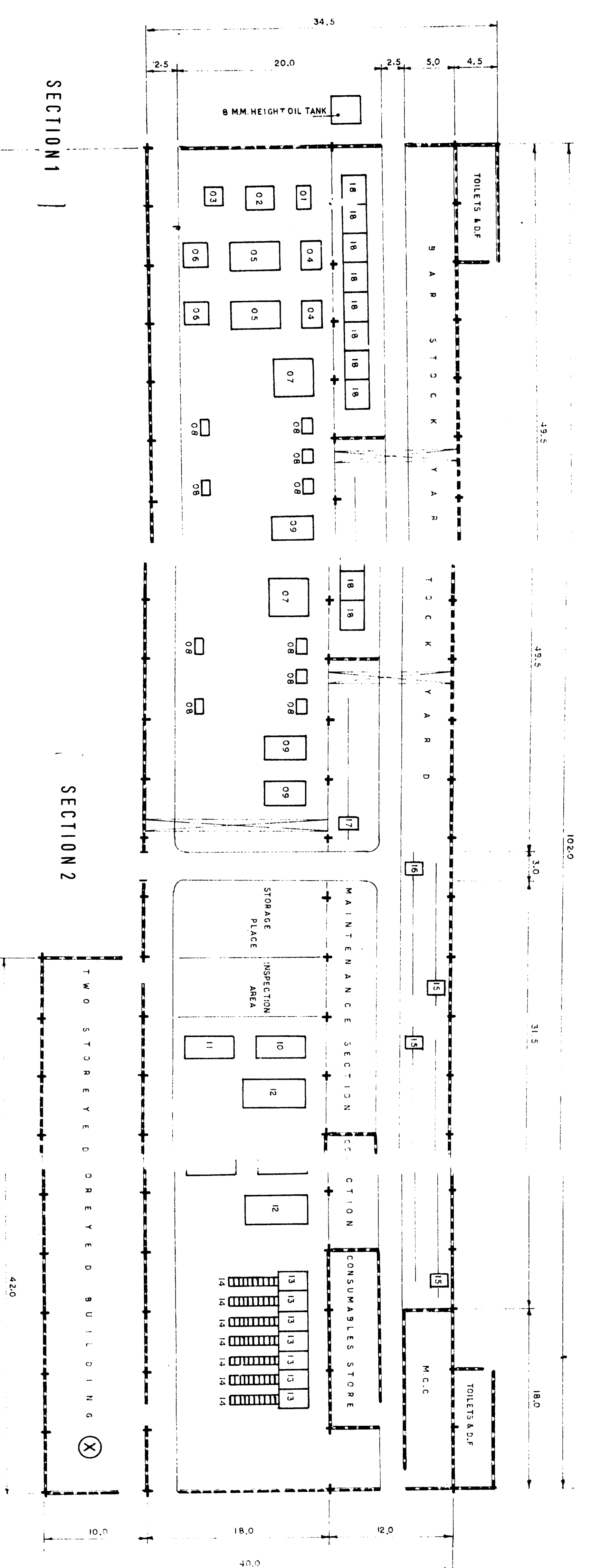
SEC 3

SEC 4

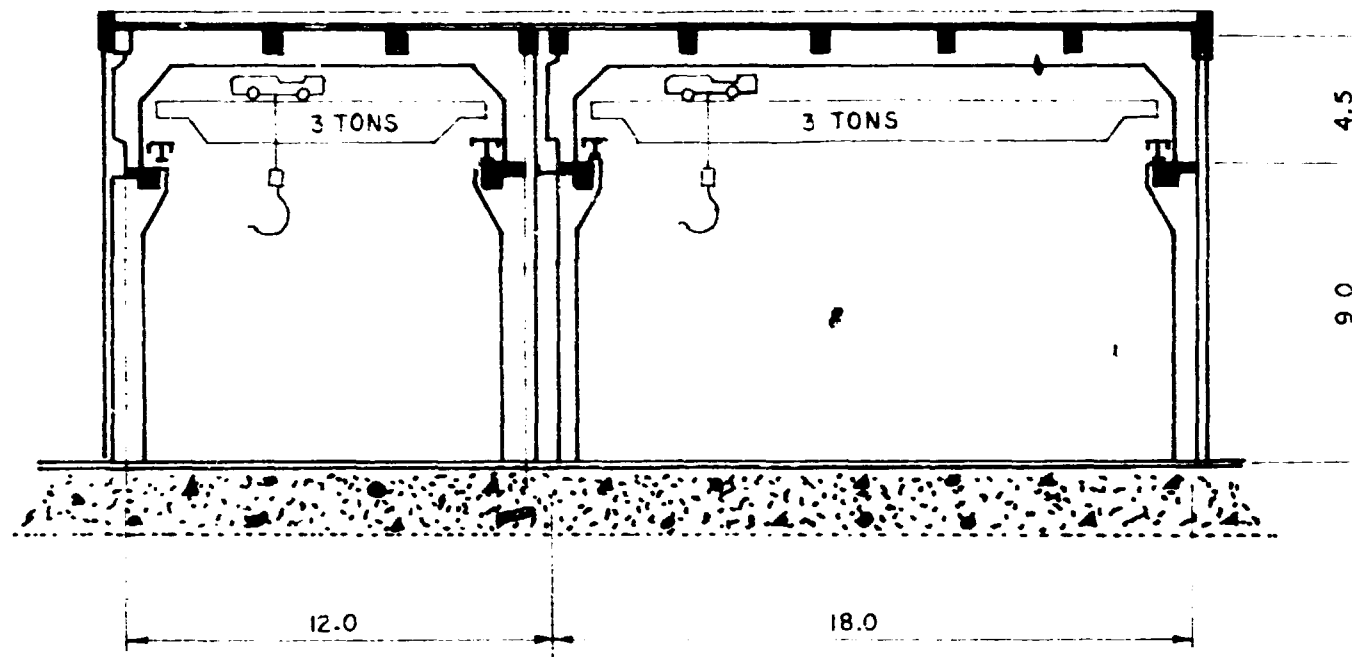
SEC 5

SEC 6

SEC 7

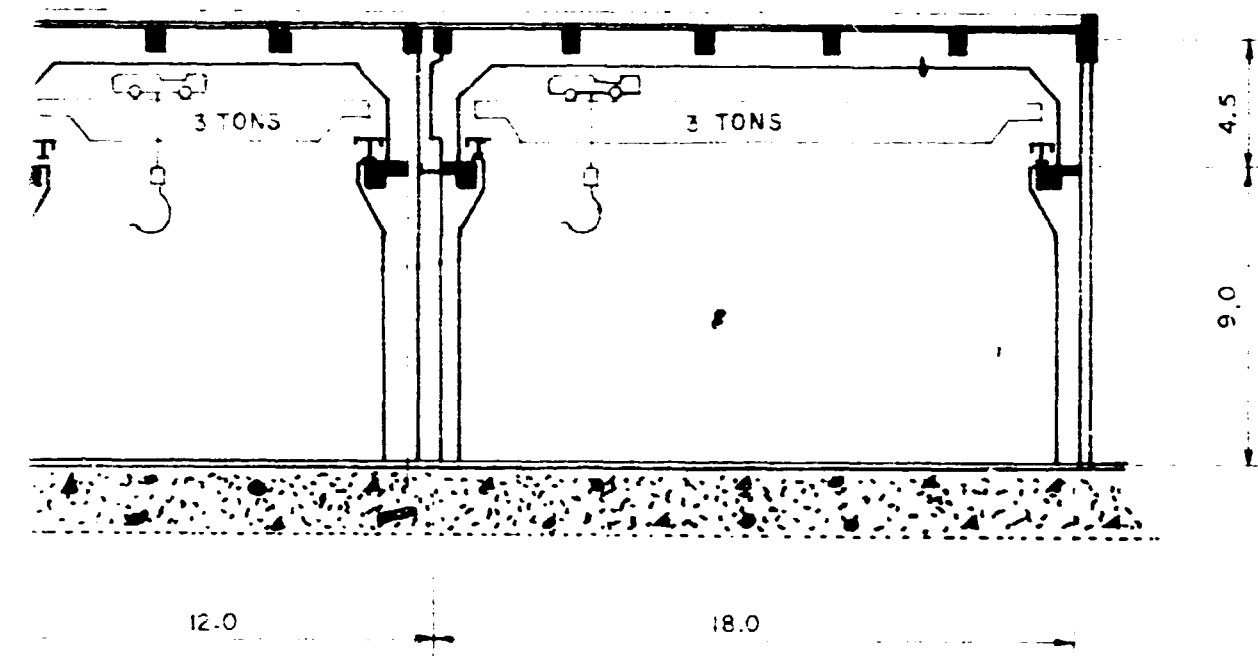


SEC 4

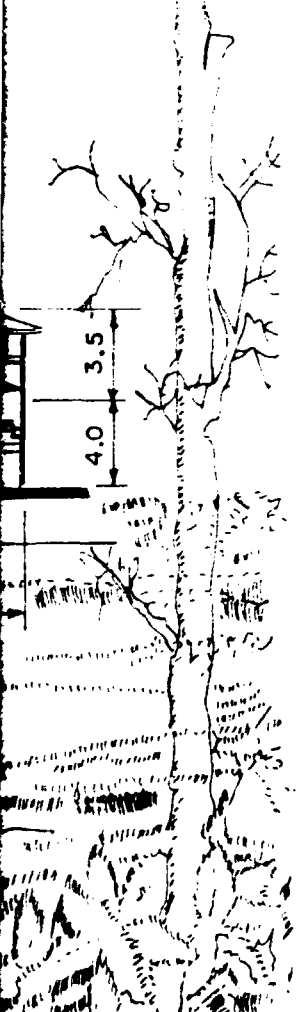


VIEW FROM Y

SEC 10



VIEW FROM Y



LAYOUT OF FORGING SHOP.

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

DEVELOPMENT CONSULTANTS
CONSULTING ENGINEERS
BOMBAY • CALCUTTA • MADRAS • NEW DELHI

RELEASE STATUS	DATE	SIGNATURE
PRELIMINARY		
FOR TENDER ONLY		
FOR CONSTRUCTION		

CHECKED BY	ARCH.		
	STR.		
	MECH.		
	ELEC.		

DRAWN MUKUL	DESIGNED MUKUL	SCALE
PROJ. ENGR.	ISTC ENGR.	DATE
DEPT. HEAD		JOB

DWG. NO. EXHIBIT — 50

LAYOUT OF FORGING SHOP.

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
ARAB INDUSTRIAL DEVELOPMENT AND MINING ORGANIZATION

DEVELOPMENT CONSULTANTS
CONSULTING ENGINEERS
BOMBAY • CALCUTTA • MADRAS • NEW DELHI

RELEASE STATUS	DATE	SIGNATURE
PRELIMINARY		
FOR TENDER ONLY		
FOR CONSTRUCTION		

CHECKED BY	ARCH.		
	STR.		
	MECH.		
	ELEC.		

DRAWN MUKUL	DESIGNED MUKUL	SCALE 1:250
PROJ. ENGR.	ISTC ENGR.	DATE 18.11.91
DEPT. HEAD		JOB NO. 45010

DWG. NO. EXHIBIT — 50

REV. NO.

REV. NO.

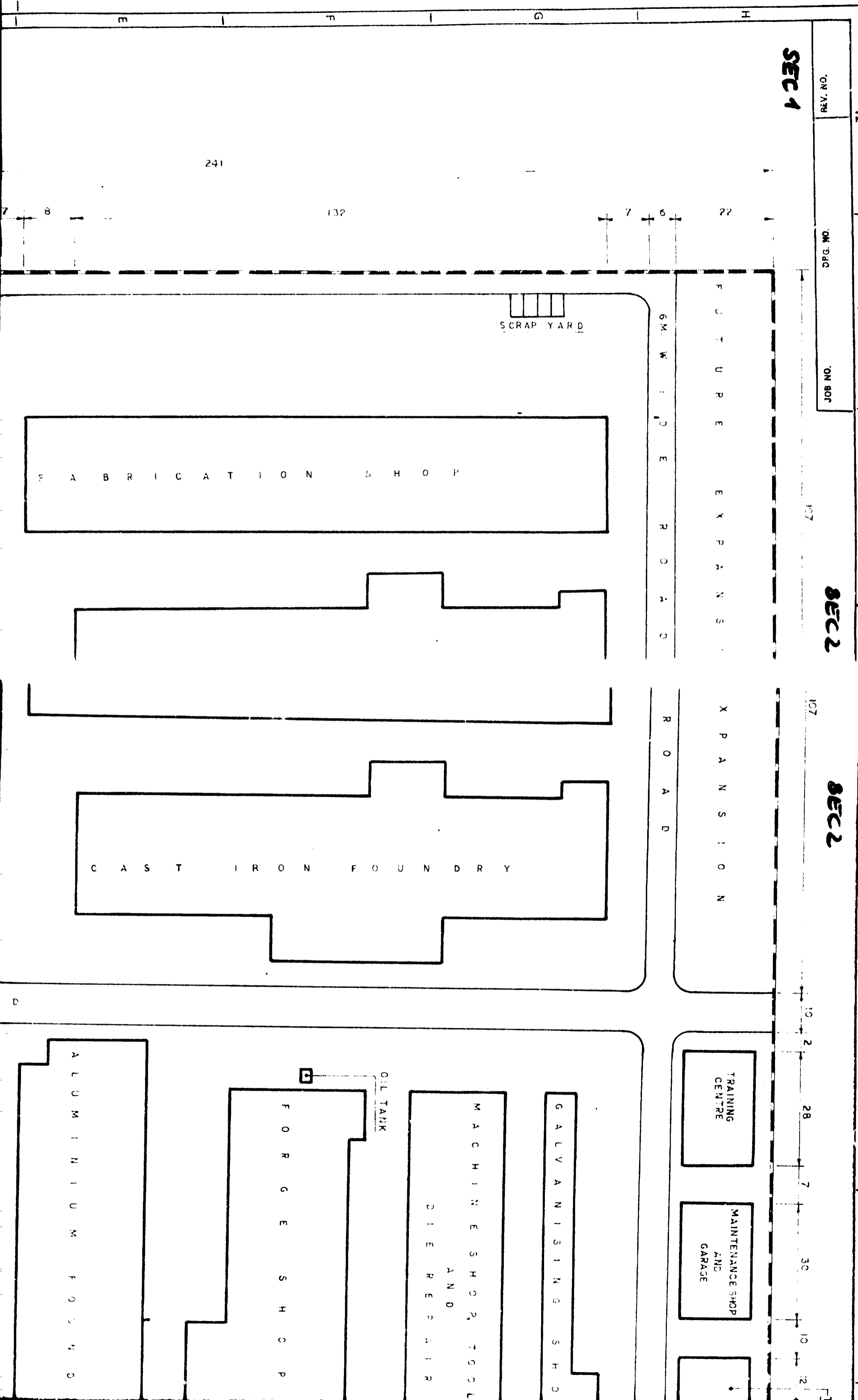
DWG. NO.

JOB NO.

SEC 1

SEC 2

SEC 2



241

132

SCRAP YARD

F A B R I C A T I O N S H O P

C A S T I R O N F O U N D R Y

TRAINING CENTRE

MAINTENANCE SHOP AND GARAGE

G A L V A N I Z I N G S H O P

M A C H I N E S H O P, T O O L A N D D I E R E S A I R

F O R G I N G S H O P

OIL TANK

A L U M I N I U M F O U N D R Y

SEC 3

SEC 3

SEC 4

SEC 5

SEC 5

TRANSFORMER HOUSE AND DISTRIBUTION CENTRE

EFFLUENT TREATMENT PLANT

PUMP HOUSE

MAINTENANCE SHOP
AND
GARAGE

WASHING SHOPS

WORKSHOP, TOOL ROOM
AND
REPAIR

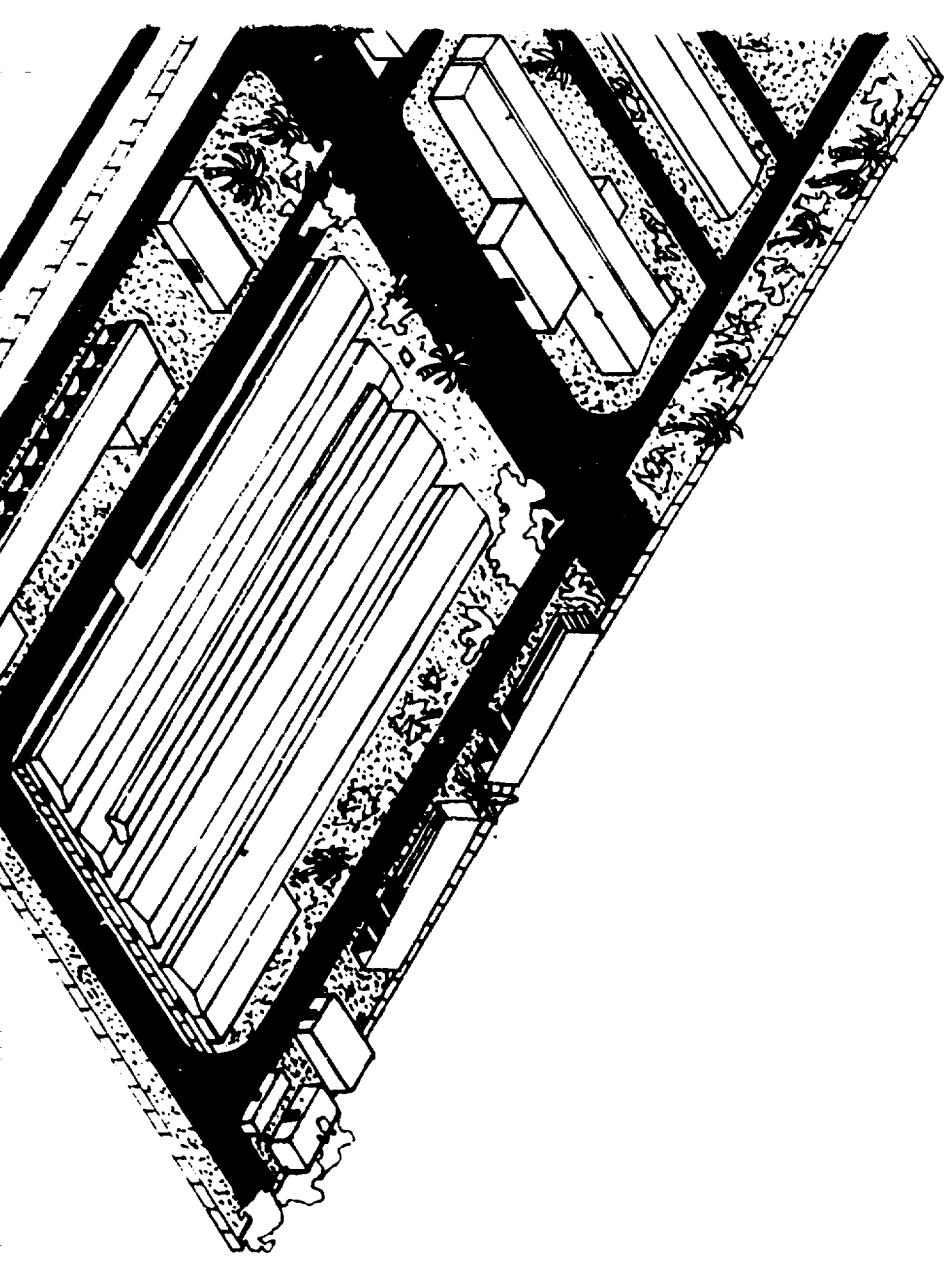
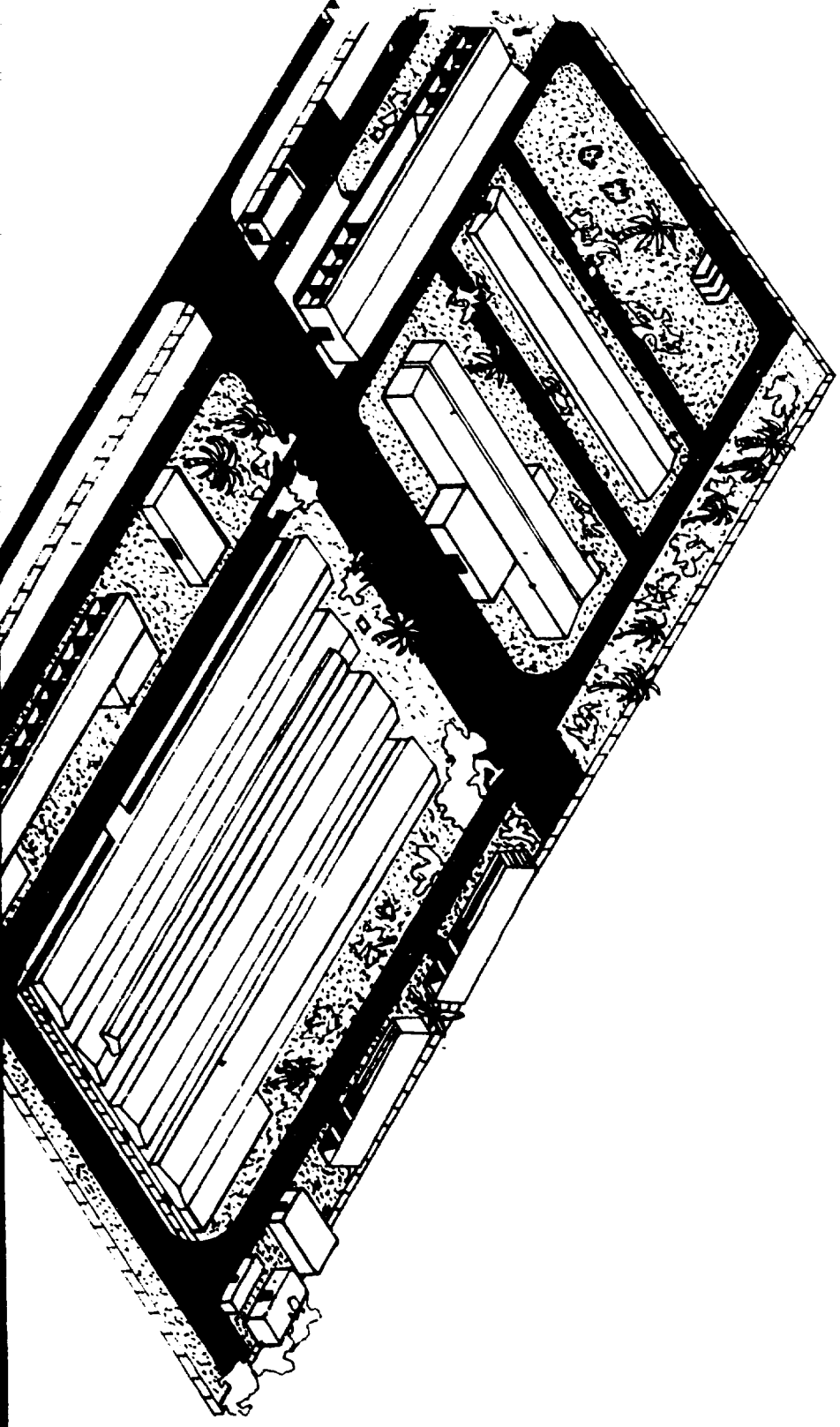
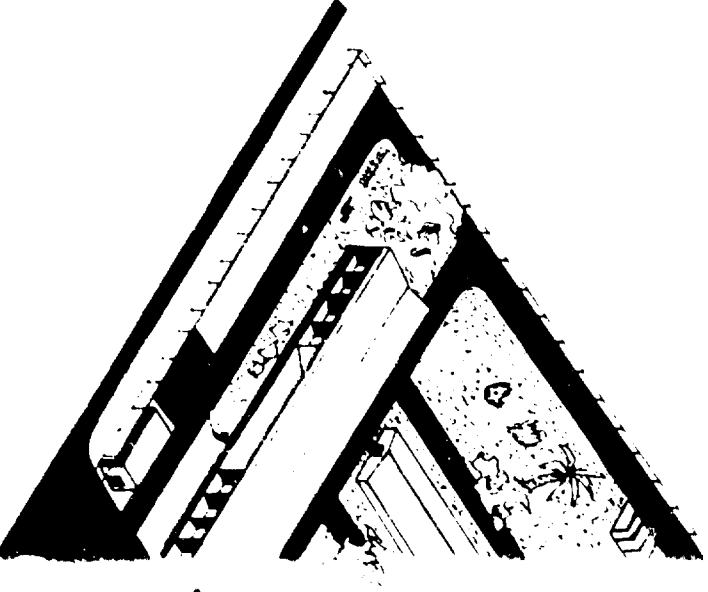
WORKSHOP

FOOD CRY

30 10 2 15 9 9

6 M W I P E R O A D

1 1.5 8 1.5 6 7 15 8 24 8 44.5 10 11.5 6



E F G H

