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The United Nations Industrial Development Organization, Vienna
Executing Agency for UNDP

Feasibility Study on a Welded Steel Pipe Plant in the Socialist Republic of the Union of Burma

Project DP/BUR/80/015
UNIDO Contract No. 85/107

PART I

EISENBAU ESSEN GMBH
Essen, West Germany

July 1986

The United Nations Industrial Development Organization, Vienna
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In presenting this document EBE herewith offers its special thanks to the Burmese Ministry of Number 1 Industry and to the other Ministries and organizations who assisted in the preparation of this Study through their contributions of valuable information and data relating to market and site conditions within the Country.

Our gratitude also goes out to the UNIDO staff in Vienna who on behalf of UNDP awarded EBE the contract and helped through their suggestions to perform the Study and especially to the UNIDO personnel in Rangoon who so kindly offered their assistance and support to our study team during their fact-finding mission in Burma.

EBE

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CHAPTER I

EXECUTIVE SUMMARY

Introduction

As part of its on-going endeavour to improve the standard of living of its people the Burmese Government has declared its policy of providing ample potable water to all its citizens by the year 2000.

To assist in implementing this policy the UNIDO in Vienna, Austria, acting as executing agency for UNDP, pledged their participation and contracted Eisenbau Essen GmbH as consultants to conduct a feasibility study for a welded steel pipe plant in Burma. The main purpose of the study was to assess the local market conditions for using steel pipes in IWSSD and related potable water projects together with the economics of producing the pipes in Burma.

In brief, the study assimilated and evaluated the following technical and commercial aspects:

- Local market requirements and conditions
- Selection of the production programme based upon the actual market requirements
- Selection of the most suitable technological processes to produce welded steel pipe
- Layout and basic design of plant and plant facilities
- Site investigations
- Materials
- Manpower requirements and training
- Project implementation schedule
- Financial analysis and overall economic feasibility
- Considerations for project fianancing possibilities.

Market

The market survey indicated that for water related applications the majority of small diameter pipes, between 1/2" to 4" would be made of plastic. The pipes with diameters between 6" and 12" would be in steel.

An analysis of water system projects recently completed or still under construction in the country provided factual data on the amounts of pipe actually consumed. The data was then interpolated to provide per capita consumption figures which were then projected over the population, their place of residence, rural or urban, and the known and expected water development projects up to the year 2000.

For water applications only, the market survey indicates a yearly steel pipe requirement of 24,903 tonnes for the 6" to 12" diameter range.

Since such pipes make ideal electrical transmission towers an estimate of 10,639 tonnes per annum was calculated for this purpose from the known national electrification grid expansion plans.

Other known consumers of large diameter pipe are the mining, construction and petrochemical industries with an indicated total yearly requirement of 885 tonnes.

Based on the information obtained for pipe consumption for gas and oil pipeline networks it was estimated that approximately only 6,000 tpy would be consumed. This tonnage was not considered in the study because the additional costs of plant and test equipment to produce API line pipe is not justifiable for such a small production.

Adding an amount of 7,286 tpy for undefined users the combined tonnage demand of large diameter pipes which can be realistically calculated is therefore 43,713 tonnes per annum.

The Study was able to realistically assess national demand. It was not however able to judge if in the future the Burmese Government will be in a position to finance the foreign exchange needed to buy or to produce these amounts of pipe. And in fact the Study considered this question outside of its scope.

Plant capacity

Any specific pipe welding machine can only produce a certain limited range of pipe diameters. To cover the range of pipe for drinking water supply at least two different machines are needed: One machine which can produce pipe from 1/2" to 4" and another which covers the range from 6" to 12" diameter. Each of these machines has its own inherent installed production capacity with the only variations coming from the number of shifts worked and limited speed control of the line.

The Study investigated and analysed 2 plant alternatives. Alternative I is a single line plant layout capable of producing pipes having diamters between 6" and 12"; with cement lining and bitumen coating facilities. Since the capacity of this machine exceeds the combined local market requirements of 43,713 tonnes of large diameter pipes the study also considered an export programme of 38,170 tonnes for a total production programme of 81,883 tonnes per annum.

Alternative II considers a 2 machine plant layout. It combines Alternative I together with a second welding line for producing the small diameter pipes in the range from 1/2" to 4" as well as a galvanizing line. In effect, Alternative II would provide Burma with a pipe making capacity ranging from 1/2" to 12" and which would be capable of the vast majority of any country's total steel pipe requirements for water supply.

The envisaged capacity of the small dia. line was established at 31,256 tonnes giving Alternative II a combined capacity of 112,139 tonnes per annum.

The plant layout as presented in the study shows Alternative I as a configuration set out to produce large diameter pipe only. The equipment, buildings and facilities have been so layed out that the small diameter line can be executed together with large line as an integrated project, Alternative II, or added on at a later date as an independent project extension programme.

The Study's findings show that, considering prevailing world market prices and local demand, it is at present not feasible to build production facilities for small diameter (1/2" to 4") steel pipe.

The production of large diameter steel pipe is however extremely viable. A strong local demand and a profitable export market exists for these pipes.

Such a plant with one (1) welding line has an annual production capacity of 81,883 tonnes (main equipment utilized 2 shifts per day). The plant would serve the national market (43,713 tpy) and could produce also for export (38,170 tpy) (Alternative I).

The plant can also produce profitably even at half capacity (main equipment utilized 1 shift per day) and would then produce 40,940 tpy for the local market.

Raw Materials

The main raw material for production of welded steel pipe is coiled sheet. At present Burma has no production facilities for this material and we do not expect that such facilities will be available in Burma in the near future. Consequently the Study assumes that sheet coil for pipe production will be imported.The necessity to import almost all raw materials - which constitute the main part of the factory cost - naturally is a burden for the project. However the feasibility calculations show that production of steel pipe for the Burmese market provides substantial foreign currency savings against imports; additional production for export result in export earnings sufficient to pay for imported production equipment and for part of the imported raw materials.

Site

The study examined two pre-selected locations as potential sites for constructing the pipe plant. The first site is at Shwedaung which is situated approximately 7 km from Prome and 172 km from Rangoon.

The second site is near Ywama which is a suburb of Rangoon and situated approximately 12 km upriver from Rangoon harbour next to the existing Ywama steel plant.

All relevant site data and information was evaluated and a detailed estimated cost comparison was made between the two locations. The comparison included availability and proximity of utilities; road, rail and water transport and distribution networks; existing support facilities and infrastructure.

The result of the Study's site investigations and evaluations and comparison clearly indicate that from the logistical as well as the financial side Ywama is by far the most suitable location for constructing the welded steel pipe plant.

The study therefore recommends that the welded steel pipe plant be built at the Ywama site as indicated in the study. Feasibility calculations are based on cost estimates for Ywama.

Schedule

The Study schedules, bar chart and CPM system provide for a project implementation period of 30 calendar months.

This is starting with the selection of an engineering firm on through all activities including preparation of tender specifications, engineering, erection, start-up and commissioning of the plant and related utilities.

During the first year of operation it is expected the plant would operate at 70% capacity, 80% during the second year and reach full operation capacity during the third year.

Taxes

Taxes and duties were not considered in order to evaluate the overall feasibility comparison in relationship to the international market where Burma has to purchase imported pipe products .

It would be extemely difficult to calculate the feasibility of importing finished products versus semi-finished materials for local completion if any of the various taxes and duties are included in the calculations.

Financial and Economic Evaluation

The financial analysis for the investment assures that all local payments as well as the first foreign currency payments will be covered by equity. All other foreign currency payments including the provision of initial working capital will be covered by a loan.

Sources of Funds / Project Cost in Million US $

Source		Alt I	Alt IA	Alt II
Equity	30%	5.94	5.49	8.85
Loan	70%	13.86	12.81	20.65
Total	100%	19.80	18.30	29.50
Foreign portion		82.9%	81.6%	84.9%

Sales revenues are calculated based on international market prices. Operating expenses and sales revenues are calculated on the basis of 1986 prices and from thereon increased by an annual inflation rate of 3%. Investment is calculated as executed for ordering in 1988.

The Study investigates both Alternatives I and II but concentrates on Alternative I which offers the best results and is recommended for implementation. For this reason a variant of Alternative I is also investigated whereby the plant operates at half capacity serving the national market. This variant is called Alternative IA.

The financial results - especially for the recommended Alternative I/IA are excellent:

Annual cash surplus		Alternative I	Alternative IA
1990	mio. US$	1.9	0.6
1993	mio. US$	6.0	1.8
1997	mio. US$	9.7	4.8

Return on Investment (R.O.I.)		
1990	9%	3%
1993	30%	9%
1997	49%	24%

Break - Even Production		
1990	49%	84%
1993	35%	60%
1997	7.5%	8.8%

National Net Value Added		
1990-2004 mio.US$	105.7	38.9

Foreign Exchange Savings		
1990-2004 mio.US$	77.2	68.1

Foreign Exchange Earings		
1990-2004 mio.US$	67.4	-

Conclusions

The cash flow projection of the overall total cost calculation is positive for Alternative I and Alternative II.

Alternative I has better results and a higher internal rate of return on investment in comparison to Alternative II. The difference between both alternatives is approximately 40%. The main reason for this is the relatively low sales prices of the galvanized pipes (1/2" - 4"). This results in lower profits for finished products when compared to the coated and lined large diameter pipes.

In both alternatives the IRR on total investment is high:

Alternative I	37 %
Alternative II	26 %

The main reasons for these good results are

- the calculations consider no taxes
- Burma has extremely low labour costs
- the coated and lined pipes of Alternative I have a good sales result

Although the added value between imported coils and finished pipe is only a factor of 1.45 or approximately US$ 125/tonne in 1986, this is offset by the relatively high turnover. This consequently adds to the extremely favourable result.

Recommendations

After carefully evaluating all the information, data and findings concluded in the Study the following recommendations can be presented:

It is economically feasible to build a large diameter welded steel pipe plant in Burma as described under Alternative I and IA.

The plant should produce pipes having diameters between 6" and 12". The programme should include black pipe as well as pipe internally cement lined and externally bitumen coated.

Initial plant capacity should be 81,883 tonnes per annum with main equipment operated in two (2) shifts (Alternative I) or 40,940 tonnes per annum with main equipment operated in one (1) shift (Alternative IA).
Production up to 43,713 tonnes per annum can be sold on the national market, surplus production can be exported.

The plant location should be the site situated next to the existing Ywama Steel Mill near Rangoon.

The plant construction period would be 30 calendar months from project implementation to start-up.

The main input material for the plant is steel coils. These would be purchased on the international steel market and imported into the country.

The turn-key cost of the pipe plant including initial working capital would be

Alternative I:	US $ 19,800,000.-
Alternative IA:	US $ 18,300,000.-

In the first year of production the plant will earn the capital costs for repayment of the foreign currency loans even if the plant operates at only half capacity.

The foreign currency loan portion is based on 1 1/2 years disbursement, 1 year grace period and a 7 year payback period after start-up of production.

The implementation of the project will contribute to improvement of social conditions in Burma by accelerating the realisation of the drinking water programme. Substantial foreign exchange savings will be achieved by production of the necessary pipes in Burma. The foreign exchange outlays will be reduced through foreign exchange earnings achieved through exports. At the same time the project will contribute to Burma's industrial development by bringing new technologies and industrial possibilities. The project will help to raise the national income through its substantial national net value added.

CHAPTER II

PROJECT BACKGROUND AND HISTORY

General Information

The Socialist Republic of the Union of Burma is located in South East Asia. It is bordered by Thailand and Laos in the east, China in the north, Bangladesh in the west, the Bay of Bengal in the southwest and the Gulf of Martaban and the Andaman Sea in the south.

It covers a land area of 658,880 km² and has an approximate length of 2000 km along the north-south axis and about 900 km along the east-west axis.

The land slopes from its highest elevation in the north, the Hkakabo Razi (5967 m) down to sea level in the Irawadi and Sittang Deltas in the south. The country's topography clearly displays five (5) distinct regions, the northern mountains, the western mountain chain, the eastern high plane, the central basin and the coastal regions.

Central Burma encompasses the fertile plane areas of the 2012 km long Irrawaddi River and its tributaries, including the 800 km long Tchindwin and the 560 km Sittang Rivers.

Since 1974 the country has experienced a yearly population growth rate declining from 2.05 to 2.00 %. In 1984/85, the population is estimated to be 36.4 million persons. By the year 2000 the population is therefore expected to be 49.5 million and to reach 82 million by the year 2025.

The population density is calculated at 55 persons/km² with the 3 largest cities being the capital Rangoon with 2.62 million persons, Mandalay with 568,800 persons and Moulmein with 234,832 persons.

Presently about 24% of the population live in urban areas and 76% live in rural areas with the vast majority of people being congregated in the valleys of the major rivers and in the coastal areas. By the Year 2000 it is expected that the percentages will then be 36.9% of the population in urban areas and 63.1% living rurally.

The majority of the rural settlements are concentrated around the middle and lower Irawadi in Arakan and in the northern part of Tenasserim. The mountainous regions are much more sparsly populated having only a population density of about 10 persons/km².

The country is made up of 7 States and 7 Divisions, 14 regions in all. These 14 administrative regions are then subdivided into 314 townships and the townships in turn comprise 13,500 village tracts. Each village tract contains on an average 5 villages or hamlets and is presently the smallest administrative unit in the country.

Project Background

The Socialist Republic of the Union of Burma is giving the highest priority to raising the living standards and general well-being of its people by instigating broad improvements and changes in the economic and social sectors throughout the country.

Included under the list of improvements is a determined major emphasis for the establishment and implementation of an extensive public health services programme including the provision of a secure and ample supply of potable (drinking) water together with the provision of modern sanitation systems for all the population.

During the last 10 years the Government under the auspices of the Urban Water Supply Division and the Rural Water Supply Division has successfully implemented, on a limited scale, various water supply and sanitation projects. These projects were initially done by utilizing the limited local resources, but more recently with the support of substantial foreign aid and loan programmes.

In 1980, the Socialist Republic of the Union of Burma presented it's 'Country Report' for the International Drinking Water, Supply and Sanitation Decade (IDWSSD). Of general interest is a brief synopsis of the work and plans made up to the time of the report.

Background

"The basic objectives of the (Burmese) Twenty Year Plan in which is included the Fourth Four Year Plan (April 1982 to March 1986) and the Fifth Four Year Plan (April 1986 to March 1990) are to promote the economic and social sectors with priority to the rural population. Health is one of the important subsectors of the social sector and "Health for All by the Year 2000 A.D." has been adopted by the country as a member of the international community. In this context, safe drinking water and sanitation are seen as prerequisites to health."

"During the first and second four year plans, water supply and sanitation works were mainly implemented with local resources. Starting with the Third Four Year Plan, sizeable foreign assistance was received for the implementation of water supply and sanitation works. All ready mentioned in the Sectoral Overview, approximately thirty million U.S. Dollars worth of pipes, casings, drilling rigs, pumps and engines have been received as grant aid for drinking water supplies and sanitation to the villages while over twenty million U.S. dollars have been taken as loans for building a water supply reservoir for Rangoon. The necessary local currency allocations have been made for these works. This shows substantive increased priority to Water Supply and Sanitation."

"Though the achievements during the Third Four Year phase have been impressive, in terms of over two thousand villages provided with deep tubewells, it is necessary to remind ourselves of the large population remaining unserved."

"Though the global goal for the Decade has been mentioned as safe drinking water and sanitation for all by 1990, a rough calculation based on the experience of the Four Year 3,000 Villages Water Supply Project, showed that it would be unrealistic to set such a goal because there are 65,000 villages and hamlets in the country. Instead, a more realistic target would be to provide drinking water supply and sanitation (WSS) to 50% (fifty percent) of the country's population by 1990 and to cover the whole country by the year 2,000 A.D."

"Even with this reduced target for the Decade proper, there would be an estimate 2 1/2 times (or 250 percent) increase in coverage from the present situation. In terms of actual numbers of people involved, there would have to be an increase of at least twlelve million villagers to be provided with WSS facilities by 1990 so that half the estimated rural population of 32 million at that time could be covered."

"Regarding the priority, it is proposed that (during the coming Decade) 13,500 villages, each representing one of the 13,500 village tracts throughout the whole country, be included in the national IDWSSD programme."

This report outlined the severe constraints to its implementation programme. The high cost of importing steel pipe and the lack of foreign currency (the available consumption figures for steel pipe tend to back-up the facts) being a major problem in development of the schemes. This led to the conclusion that a steel pipe production plant might be feasible.

Although raw materials to produce pipe within Burma would still have to be imported, cost of steel coil is considerably less expensive than finished pipe, thus giving Burma two immediate advantages:

Reduction in foreign currency outlays.

Availability of steel pipe on demand.

In order to overcome the constraints outlined in the 'Country Report' the Government approached the United Nations Development Programme and the United Nations Industrial Development Organization, Vienna (UNDP/UNIDO) for technical assistance and support in expediting certain projects and studies related to the supply of potable water and sanitary systems.

In this respect UNICEF has been involved with the rural water supply in the "dry zone" of the country, (north of Prome).

UNICEF future regional work will be in the "delta area" and in upper Burma while an Australian aid programme will take over the "dry zone".

The Burmese Ministry of N°. 1 Industry, is concerned with some of the projects relating to the production plants to produce the materials and products required for implementation of the IDWSSD programme. The plants include plastic appliances extrusion plants, the production of plastic feed stock pellets, a welded steel pipe plant and mini cement plants.

It was agreed between the respective parties that a feasibility study for each of the sub-groups would make up part of the UNDP/UNIDO Technical Assistance Programme and that the studies would be sub-contracted to and executed by qualified consulting companies.

In this respect, on November 1, 1985, the United Nations Industrial Development Organization (UNIDO), Head Purchase and Contract Service Division of Industrial Operations (PAC/DIO), P.O. Box 300, A-1400 Vienna, Austria, awarded to Eisenbau Essen GmbH, (EBE), Hohenzollernstr. 24, D- 4300 Essen, Federal Republic of Germany, a contract on their behalf to execute a Feasibility Study for a Welded Steel Pipe Plant. EBE commenced work on the Study on November 4, 1985.

Some preliminary work on investigating the pipe plant had already been conducted, the results of which have been made available to EBE. The information covered actual and forcasted pipe consumption; price information for energy (oil, gas, electricity), construction work and building materials; basic information on the power supply system within Burma; import data on steel and iron tubular products; construction work agencies; wages and salaries in Burma; a general profile on the education system in Burma; and finally a synopsis of likely sites for the proposed plant.

All of this information was carefully re-examined, cross-checked, updated and when applicable used in the preparation of the Study.

Project Concept

Work on the Study commenced with EBE establishing the philosophy and thereby concept by which all criteria, data and other relevant information was evaluated, interpreted and used in the Study.

A primary consideration in this respect is the fact that the Government of Burma operates a planned economy and that industrial projects whilst expected to attain (or approach) commercial profitability over the longer term are also assessed by their overall contribution to the national economy and well-being.

Progressing from this consideration the Study's concept was formulated on the premise that the country's existing water and sanitary systems have to be improved, modernized and greatly expanded over the coming years but that at the same time the country also has other priorities which must be taken into consideration when analysing the potential feasibility of a project of the magnitude of a welded steel pipe plant.

It therefore follows that a country having the size and population of Burma must have an ongoing need for locally manufactured pipe and pipe based products. The data and past import statistics relating to Burmese pipe imports were considered rather irrelevant since these are only illusionary indications of aggregate demand of the current effective demand in the country and are undoubtedly subjected to the influence of and supressed through exchange restrictions that vary as a result of the foreign currencies available in any given year.

To obtain a more realistic indication of Burma's actual pipe requirements for IDWSSD related projects over the next 14 years and to make allowances for any future re-emphasis or realocations of priorities the Study's concept therefore includes the pipe requirements for other industrial and commercial sectors within the Country.

Based upon this premise the Study parameters were then established whereby the major emphasis of the work was concentrated on realistically calculating the pipe needs for IDWSSD and other related water and sanitary projects. This was done by establishing the minimum per capita daily potable water production and distribution requirements for the urban and rural populations and then determining the types, sizes and amounts of pipe required to meet these needs. In this respect the actual pipe consumption figures for several new and revamp water system projects recently conducted in Burma proved invaluable.

The pipe requirements for other industrial and commercial segments of the economy were given less emphasis and are therefore based largely upon information gleaned from sources, data and statistics available from international publications as well as that ascertained through live interviews with Federal and Local Government Authorities as well as with industrial and commercial representatives. This data was then cross-checked, interpolated and evaluated in respect to the more known pipe requirements and consumption figures in other developing countries in South East Asia.

In both instances for assessing pipe consumption requirements the starting-point was that the pipe was to be considered to be available from an indigenous source. The welded steel pipe plant's production capacity as shown in the study therefore includes realistic per annum tonnages for conducting a moderate on-going IDWSSD and water related development programme plus additional tonnages for other key sectors of the economy. It does not include however, all the pipe that could possibly be consumed by the population if a higher degree of industrialization existed.

The list of local agencies responsible for IDWSSD related projects is as follows:

Implementing Agencies

Agency	Function of project
Rural Water Supply Division, Agricultural Mechanisation Department, Ministry of Agriculture and Forests	Water supply to villages by means of tubewells or piped inter-village systems
Environmental Sanitation Division, Department of Health, Ministry of Health	Water supply to remaining villages by means of other methods such as dug-wells, ponds, etc., sanitation works for all villages

Agency	Function of project
Urban Water Supply and Sanitation Division, Housing Department, Ministry of Construction	Urban water supply and sanitation for the towns (other than Rangoon and Mandalay), prefeasibility studies and planning up to construction stage
Water and Sanitary Division, Construction Corporation, Ministry of Construction	Construction of urban water supply, distribution and sanitation systems
Irrigation Department, Ministry of Agriculture and Forests	Supply of water mainly for agricultural purposes, with drinking water, as a possible by-product
Technical Services Corporation and Petrochemical Industries Corporation, Ministry of No. (2) Industry	Project for the production of plastic pellets from local raw materials by means of batch-type process (Feasibility study and project implementation).
Technical Services Corporation and Heavy Industries Corporation, Ministry of No. (2) Industry	Project for the production of water pumps, engines, motors and water meters (feasibility study and project implementation)
Industrial Planning Department and Metal Industries Corporation, Ministry of No. (1) Industry	Project for the production of water pipes from iron and steel (feasibility study and project implementation)

Agency	Function of project
Industrial Planning Department and Ceramic Industries Corporation, Ministry of No.(1) Industry and Cottage Industries Department, Ministry of Cooperatives.	Project for setting up Mini-cement Production Units using appropriate technology (feasibility study and project implementation)
Rangoon Institute of Technology, Department of Higher Education, Ministry of Education	Higher education for water and sanitation engineers
Department of Technical, Agricultural and Vocational Education, Ministry of Education	Technical education for water and sanitation technicians
Training School, Construction Corporation and Training School, Department of Health	In-service training for water and sanitation workers
Health Education Bureau, Department of Health, Ministry of Health	Health education activities and community participation
Geology Department, Rangoon University and Applied Geology Department, Department of Higher Education, Ministry of Education	Preparation of a national hydrogeologic map and hydrogeological training

RWSD, Irrigation Department, Department of Meteorology and Hydrology and other agencies collecting hydrological and hydro-geological data	Collection of hydrological and hydrogeological data; analysis, storage and retrieval of such data for the IDWSSD programme

Collaborating Agencies

Agency	Function of project
Project Appraisal and Progress Reporting Department, Ministry of Planning and Finance	Monitoring and evaluation of projects
Foreign Economic Relations Department, Planning Department, Budget Department, Ministry of Planning and Finance	Coordination, provision of local financing and foreign aid
General Department, Ministry of Home and Religious Affairs; Housing Department and Corporation, Ministry of Construction; Planning and Statistics Department, Ministry of Agriculture and Forests and Department of Health, Ministry of Health	Coordination and general administrative support to the divisions under their control which are implementing or supporting the IDWSSD programme

Parameters

The major parameters of the Study were established from interlinking data and statistics obtained from the on-site live interviews and surveys as well as from various international trade, health, industrial, commercial and government journals, reports and studies.

Particular emphasis was given to the demographic and geographic statistics relating to the present population and its distribution and especially the expected growth trends and distributions over the next 14 years.

The next parameter which was set down was product mix.

In this respect a primary factor was the fact that a considerable amount of the total costs expended for executing such an industrial project are for infrastructures, civil and structural work, utilities and installation and erection.

It therefore follows that the optimum plant layout should be sized to include sufficient production machinery and equipment to produce as wide a range of pipe and sizes as is economically and technically feasible within the overall concept of the Study.

Further Project Studies

The Study has evaluated in detail the actual IDWSSD market demands as well as those for other industries and thereby established the product mix, plant layout, equipment and input materials to meet the demands.

It then established a realistic production programme and working schedule and economics to produce the pipe quantities and sizes to embark upon a modest IDWSSD programme as well as to provide input materials for other sectors of the economy.

As part of the Study field exercise, two pre-selected site locations were investigated and recommendations made as to the most suitable location for the plant.

It can therefore be concluded that all the relevant preliminary work for reaching a decission on the feasibility and practicability of constructing a welded steel pipe plant in Burma has been completed.

The study work yet to be completed either before or in tandem with the commencement of basic engineering is:

- Detailed site survey and layout markings:
- Soil survey:
  Soil tests should be conducted. This will include a drilling programme with tests on site and in laboratories. The evaluation of the tests will give information on soil bearing capacity, data for piling, data for settlement and data on sub-soil water. This is of major importance in determing the actual civil works costs.
- Investigation of the river levels adjacent the site
- Details and costs of above are included in Schedule 2.

Economic and Social Aspects

In addition to raising the general health standards and well-being of the Burmese people through IDWSSD related projects construction of the welded steel pipe plant and use of the products manufactured therein would provide the impetus for other eco-social improvements and further industrial developments in the country.

It is envisaged that the establishment of a welded pipe plant (alternative I) having a capacity of 82,000 tpy

(2 shifts operation) would employ about 231 full time plant workers and 41 commercial managerial staff. The alternative II would increase pipe production to about 113,000 tpy and raise employment to about 356 persons.

With locally available pipe, secondary industries would evolve in which the pipe would be used as the primary input material to manufacture locally made finished products. These could include the manufacture of carts, wagons and trailers, electrical conduit and fittings, furniture, scaffolding, structural columns and roof trusses, electrical transmission masts, street light masts, etc.

As a result of expanding and modernizing the water and sanitary systems within the country, Burma would become more attractive to the international tourist trade. With its varied but mild climatic zones, beautiful scenery, historical background, outstanding Buddhist temples, shrines and monuments and because of its prime location at the thresh-hold of South East Asia, Burma could become the first stop-over for the European tourists on their way to Thailand, Singapore, Malaysia, Indonesia, etc.

A pre-requisit for this however, is the establishment of adequate hotels having internationally acceptable amenities including ample water supplies and modern sanitary facilities.

As in other parts of the world the tourists bring in considerable foreign exchanges and their very presence causes the growth of a considerable local tourist, catering and servicing industry.

Another sector which would be directly influenced by the availability of locally manufactured pipe is agriculture.

Approximately 30% of the country's land area is suitable for agriculture but less than half of this is presently under cultivation.

Even modest efforts and results to expand the potable water supply and the amount of arable land under irrigation and cultivation, (boreholes, gathering, distribution), would considerably contribute to the well-being of the people and the GNP of the country. The mechanism for this is improvement and upgrading of the diets of the people, and also the possibility of increased export of food surpluses. This aspect is of special significance since over 60% of the population is rural.

A further, although long term benefit of developing a steel pipe production plant is that it will form a major step towards the development of an indigenous integrated steel industry. Even in more industrially developed countries today's economic pressures on basic industries have forced a new concept onto the steel industry commonly known as reverse integration. This is simply starting with the construction of plants to produce the end products first (e.g. steel pipe, wire rod, etc.) and then follow-up at a later date with the iron and steel making facilities.

Since Burma already has a fledging steel industry and related infrastructure the addition of pipe-making facilities at this time would act as a further impetus to the ultimate goal of the Ministry of No. 1 Industry in making Burma self-sufficient in iron and steel products.

Exports

International import-export statistics indicate that the following 8 Asian countries imported from Japan alone a combined average annual tonnage of welded steel pipes in excess of 240,000 tonnes in 1983/84.

Country	Tonnnes
Bangladesh	3,870
China	57,600
India	56,370
Indonesia	49,900
Malaysia	46,970
Pakistan	2,760
Philippines	6,370
Thailand	19,050

Providing the pipe produced in Burma meets international standards and norms and is competitively priced it can safely be assumed there is a ready export market for any extra pipe which could be produced beyond the country's own immediate market requirements.

Any such exports would have the positive effect of providing an additional source of foreign currencies which in turn could be used to help off-set the foreign currency expenditures needed for importing steel coils for production of pipe.

In laying out the basic plant design the country's priority and then the export market potential was considered.

Product and Product Mix

Since in general practice there are two basic economical longitudinal welded pipe machine configurations the selection of which preliminary concept to follow was relatively fixed.

The first basic design produces pipe having diameters ranging between 6" to 12".

The second configuration is designed to produce welded pipe with diameters ranging between 1/2" to 12".

In evaluating the pipe requirements for IDWSSD, other related projects and other industries it was determined that the pipe sizes most required were within the 1/2" to 12" range although import figures also indicate limited consumption of pipes having diameters larger than 12". The study investigations however concluded that to feasibly cover IDWSSD related requirements as well as other industrial needs the product range should be for pipes with diameters between 6" to 12"; the pipe range 1/2" to 4" could best be added at a later date and due to the fact that pipe with greater than 12" dia requires a different technique for production it should not be considered.

These pipe sizes will not only cover most water and sanitary needs but also the majority of pipe requirements for other industrial sectors including mining, construction etc. In conducting the Study 2 basic layouts were considered and evaluated.

The layout is for a plant operating with a single welding line to produce on a 2 shift operation up to 82,000 tonnes of pipe ranging in diameter between 6" to 12", including cement/bitumen internal/external lining facilities. Allowances in the infrastructures and utilities have been considered to allow the plant to be expanded by a second welding machine.

The alternative 2 is for a plant operating with two welding lines to produce pipe with diameters ranging between 1/2" and 12" and having a yearly 2 shift capacity of 113,000 tonnes. This layout also includes galvanizing for the smaller sizes.

The economic viability for both has been calculated and presented in this study.

Going beyond 12" diameter pipe would require the installation of a third machine line, a so-called spiral welded pipe making machine. Due to the completely different secondary and auxiliary equipment needed for operating and servicing this type of machine and because of the limited applications for such large diameter pipe, spiral welded pipe was not included as a part of the study or as an alternative to the longitudinal welded pipe machine(s).

Plant Capacity

To avoid increased original investment costs by having special machines designed and manufactured it was decided to conduct the Study using the standard pipe making equipment as available from a variety of international equipment manufacturers. In so doing this decission determined the plant's initial production capacity at approx. 82,000 tpy per one machine line operating on a 2 shift schedule for the larger diameters and a total of 113,000 tpy for a combination of the small and large pipe sizes.

The marketing portion and analysis of the Study goes into considerable detail to demonstrate that the stated capacities are by no means excessive under the developing industrial and infrastructural market conditions prevailing and expected to prevail in Burma in the coming years.

All the individual aspects of the Study; markets, market requirements, product mix, equipment availability and size, versatility and economics indicate that the most advantageous plant layout for the welded steel pipe plant is the one which produces a range of pipe having diameters ranging from 6" to 12".

Financial

The economic and financial viability of the project was then evaluated on the basis of the international availability and costs of the input material, steel coils, versus the costs of finished pipe products. This calculation was conducted under a number of different scenarios whereby it was considered that an excess of steel and steel products exist on the world's markets to the other extreme where for various reasons shortages occur especially in finished pipe products.

The production costs within Burma were then evaluated together with the capital expenditures, financial charges, operations, product distribution and all related costs. These were then analysized to give a true picture of the projects viability. The analysis indicated that a project of this type should be positively considered and providing international financing can be arranged a welded pipe plant should be constructed in Burma. Various financial models for the execution of this project are detailed under Chapter X.

Schedule 2 Estimate of investment cost: pre-investment studies and preparatory investigations

ESTIMATE OF INVESTMENT COST

Pre-investment studies and preparatory investigations

No.	Quantity	Item description	Quantity	Unit	Unit Cost L US$	Unit Cost F US$	Total Cost L US$	Total Cost F US$
		Preparatory Investigations						
1	1	Detailed site survey with lay-out markings	6	ha	2,500	-	15,000	-
2	1	Soil survey: bore holes, site tests, lab, tests, river investigation	10	hole	1,500	-	5,000	-
3	1	Supervision by Metal Industries Corporation	-	-	15%	-	4,500	-
		Total					19,500	-

L = Local

F = Foreign

Cost of the pre-feasibility and feasibility studies have been financed by UNDP.

CHAPTER III

MARKET AND PLANT CAPACITY

Market and Plant Capacity

The critical factor in demand and market analysis is normally an estimate of the demand for a product, in this instance welded steel pipe, over the life span of a project. Although the demand is normally a function of several variables within a country, this Study places its main emphasis on the existing and anticipated demands for potable water and the Government's continuing efforts to improve the socio-hygenic conditions for the entire population.

In addition the Study also took into consideration other, existing and potential industrial and municipal customers pipe needs and also the possibility of export sales.

To avoid an excess production apacity the demand appraisal was conducted to identify the individual pipe mix requirements to fulfill each particular aspect of the overall demand.

For convenience sake the term present demand or market as used in the Study takes into account the modernization work which should be started immediately as well as population growth up to the year 2000. With considerations for engineering, construction and operational start-up the time span of the report covers approx. 12 years of on-stream operations.

A normal starting point in assessing market demand for a product is to analyse historical market statistics. Therefore the Central Statistics organization Rangoon was approached for information on welded pipe imports. Table number 3.1 shows a summary of the information obtained.

For a country of Burma's size this is a very small amount of pipe which leads to the conclusion that the actual import of pipe must be greater or the consumption must have been suppressed by outside factors (the most probable being restriction on imports due to the shortage of foreign currency). Further investigation did in actual fact show that pipe consumed within an industrial or development project does not necessarily appear as a specific item (i.e. steel pipe) in the import figures but may well be classified under other data or not at all and hence unidentifiable.

Table 3.1 Import of Tubes and Pipes of Iron or Steel *)

	1983/84		1984/85 (provisional)	
	Kyatt	Tonnes	Kyatt	Tonnes
Seamless 2" and above	11,558,000	7,362	15,881,000	10,085
Seamless below 2"	114,000	94	-	-
Welded 2" and above	864,000	150	6,493,000	620
Welded below 2"	5,654,000	1,689	6,345,000	956
Cast iron	834,566	707	-	-

*) Central Statistics Organization (CSO), Rangoon, Burma

Sales Forecast

An alternate and more realistic method for determining the current effective demand for pipe in Burma is to calculate the amounts of pipe required for immediate IDWSSD and related development and modernization projects for replacing existing distribution systems and expanding the systems to accommodate the ever increasing population. As the water supply situation differs considerably between rural and urban projects the study investigates the two situations as independent entities.

Table 3.2 shows population estimates to the mid-fiscal year 1984/85 and Table 3.3 breaks down the population into "urban and rural" with estimates up to the year 2000. There are also numerous other water and irrigation projects which have to be taken into consideration when planning for a primary industry such as a pipe plant.

The majority of the older cities throughout the world had their infrastructures and utility systems installed at the end of the last or early part of this century. At that time the water distribution networks and systems, including tie-ins and internal residential and domestic lines, were mostly made of galvanized iron (G.I.) and lead piping. In the meantime it has been proven that lead waterlines present a severe health hazard to the population and must be replaced as soon as possible. Due to the critical nature of the problem it can therefore be concluded that replacing the old pipe distribution systems in the urban areas is of primary importance to the Government as well as the IDWSSD. It can also be concluded that all existing pipes will have to be replaced in its entirity. Also, of primary importance is to provide more potable water for the ever increasing population.

Investigations within Burma have shown that more modern installation programmes have turned to the utilization of plastic piping. Plastic piping is cheaper, it has no great corrosion problems, it has less risk of internal encrustation forming than iron or steel pipe (due to its very smooth surface) and it is easier to handle (light and flexible, and HDPE pipe up to 90 mm diameter can be supplied in coils). However, due to its lower material strength compared to steel or iron pipe it is limited in its use up to a maximum of 4" diam. and occassionally for very low pressures 6".

UNICEF/ADB who are at present undertaking rural water supply programmes within Burma were able to confirm this information. They use HDPE and PVC pipe for all diameters up to 110 mm and in some cases even up to 140 mm. They also say that in the future they expect to replace half of their 4" and 6" steel well-casing pipe consumption with plastic.

Information received from the General Affairs Department of the Ministry of Home and Religious Affairs also shows that for town water supply the situation is similar. For the Mandalay water project (financed by OPEC and ADB) the department used HDPE for house connections and mains up to 63 mm diam. Mains above this were constructed from cement lined steel or ductile iron with epoxy coated outer surface.

The following shows the present and anticipated urban population figures up to the year 2000.

Table 3.2 Population Estimates

Year	Population	Annual Growth Rate
1974/75	29,778,000	2.05%
1975/76	30,389,000	2.05%
1976/77	31,009,000	2.04%
1977/78	31,642,000	2.04%
1978/79	32,284,000	2.03%
1979/80	32,939,000	2.03%
1980/81	33,608,000	2.03%
1981/82	34,287,000	2.02%
1982/83	34,976,000	2.01%
1983/84	35,680,000	2.01%
1984/85	36,392,000	2.00%

Note: Population estimates are based on 1973 and 1983 censuses.

Source: Report to the Pyithu Hluttaw 1985/86.

Table 3.3 Population in Urban and Rural Communities

		1973 census	1983 census	1990 estimate by EBE	2000 estimate by EBE
Total population	million	28.9	35.3	40.6	49.5
In towns		19%	24%	28.5%	36.9%
	million	5.5	8.5	11.6	18.3
In rural communities		81%	76%	71.5%	63.1%
	million	23.4	26.8	29.0	31.2

Source: Country Report Burma 1984
(West German Federal Statistics Office).

Urban Water Supply

In order to be able to make reliable estimates for pipe consumption in piping and/or re-piping programmes some sort of historic base is required from which realistic assumptions can be made.

In calculating the urban requirements for pipe, information was obtained from the General Affairs Department of the Ministry of Home and Religious Affairs and Ministry of Construction. This information is summarized in Table 3.4 and gives relevant data regarding pipe consumption in five water supply projects. Using data from this table in conjunction with Tables 3.2 and 3.3 an estimate of future demand can be made. The basis for these calculations were:

Total population of Burma in the year 2000 = 49,500,000 = 100 %
Portion of urban population in the year 2000= 18,300,000 = 36.9%
Number of years which projection covers: 12 yrs (1988-2000)
Table 3.5 tabulates the result of these calculations.

Table 3.4 Examples for Pipe Demand for Urban Water Supply: Designed/Executed

City/Location	Number of Persons served	Nominal Diameter millimeters/inch 1050 42"	1000 40"	900 36"	800 32"	750 30"	600 24"	450 18"	400 16"
		Pipe Length (meters)							
Prome *)	86,000	-	-	-	-	-	-	-	-
Mague *)	54,000	-	-	-	-	-	-	-	-
Mudon **)	39,700	-	-	-	-	-	-	-	500
Mandalay **)	532,000	-	-	1,330	8,170	-	10,890	-	10,030
Rangoon **)	2,458,700	5,060	-	10,580	-	15,150	91,340	-	28,930
Total	3,170,400	5,060	-	11,910	8,170	15,150	102,230	-	39,460
Meters/Person		0.0016	-	0.0038	0.0026	0.0048	0.0322	-	0.0124

	Nominal Diameter millimeters/inch 200 8"	150 6"	100 4"	80 3"	63 2.5"	50 2"	37 1.5"	32 1.25"
	Pipe Length (meters)							
Prome	4,050	30,500	-	-	-	-	-	-
Mague	5,760	24,100	4,57	-	-	-	-	-
Mudon	3,020	5,890	9,700	850	-	-	-	3.000
Mandalay	34,150	87,730	136,000	100	70,400	-	-	52,060
Rangoon	274,400	865,900	250,000	-	-	-	-	-
Total	321,380	1,014,120	400,270	950	70,400	-	-	55,060
Meters/Pers.	0.1014	0.3199	0.1263	0.0003	0.0222	-	-	0.0174

*) Source: General Affairs Department, Ministry of Home and Religious Affairs
**) Source: Housing Department, Ministry of Construction

Note: Pipe demand for house connections (60 to 90 m pipe per connection) is not included (made Prome, Mague, Mudon and Mandalay implementation 1983-87, Rangoon designed only.

pe Demand for Urban Water Supply: Designed/Executed Projects

Diameter millimeters/inch

900	800	750	600	450	400	300	250
36"	32"	30"	24"	18"	16"	12"	10"
e Length (meters)							
-	-	-	-	-	-	2,250	1,750
-	-	-	-	-	-	-	4,950
-	-	-	-	-	500	3,020	1,250
1,330	8,170	-	10,890	-	10,030	13,960	8,540
0,580	-	15,150	91,340	-	28,930	286,600	-
1,910	8,170	15,150	102,230	-	39,460	305,830	16,490
.0038	0.0026	0.0048	0.0322	-	0.0124	0.0965	0.0052

Diameter millimeters/inch

80	63	50	37	32	25	20
3"	2.5"	2"	1.5"	1.25"	1"	0.75"
e Length (meters)						
-	-	-	-	-	-	-
-	-	-	-	-	-	-
850	-	-	-	3.000	12,000	45,000
100	70,400	-	-	52,060	294,530	320,000
-	-	-	-	-	-	-
950	70,400	-	-	55,060	306,530	365,000
0.0003	0.0222	-	-	0.0174	0.0967	0.1151

try of Home and Religious Affairs
try of Construction

to 90 m pipe per connection) is not included (made by private owners)
entation 1983-87, Rangoon designed only.

Table 3.5 Annual Steel Pipe Demand in the Range 6" to 12" for Urban Water Supply

		Nominal Pipe Diameter			millimeter / inch
		300	250	200	150
		12"	10"	8"	6"
Distribution Lines Average demand per person	m/p	0.09965	0.0052	0.1014	0.3199
Annual demand (coated pipe) (18,300,000 persons within 12 Years)	m/p	147,200	7,900	154,600	487,900
Well Casings (estimate) (Black pipe)	m/yr	20,000	20,000	-	-
Total consumption	m/yr	167,200	27,900	154,600	487,900

Rural Water Supply

In most areas of the country the rural population will for the foreseeable future continue to be dependent on well water as their main source of potable water. Any plans to increase the water supply will therefore require additional wells and main distribution network.

By the year 2000 the rural population is expected to increase to 31,200,000 people. To provide sufficient potable water for this population UNICEF estimates between 1986 and the year 2000 (14 years) it will be necessary to have 15,000 new deep tubewells with an average depth of 91.4 m and 40,000 new shallow tubewells at an average depth of 46 m.

For shallow wells UNICEF will use 2" dia. plastic pipe as casings. For the deep wells UNICEF expects to use 4" and 6" dia. pipe; half the amount in plastic and half in steel. We expect however that all 4" casings will be of plastic and all 6" casings will be of steel.

15,000 systems of deep wells

6,000 systems with dia. 4" casings (plastic)
9,000 systems with dia. 6" casings (steel)

6" steel casings

9,000 x 91.4 = 822,600 m in total
58,800 m/yr.

The field market survey personnel approached several individual governmental departments and others regarding their anticipated steel pipe requirements the results of which are summarized in the following pages.

Water Supply for Government Buildings

Table 3.6 is based on information given by the Construction Corporation, Ministry of Construction who estimate their future annual consumption to be:

- supply lines dia. 1/2" to 6" 200,000 m/yr
- deep well casing dia 4" to 10" 6,000 to 10,000 m/yr

  1/2" to 4" dia. plastic pipe; 6" dia. and above steel pipe

It has also been assumed that there will also be a demand for 12" casing as well as capacities must be expanded.

Table 3.6 Steel Pipe Demand for Government Buildings (6"-12").

	Black Welded Steel Pipe				Coated/lined welded Steel Pipe			
	Nominal Dia. mm/inch				Nominal Dia. mm/inch			
	300	250	200	150	300	250	200	150
	12"	10"	8"	6"	12"	10"	8"	6"
Supply Lines (m/yr)	-	-	-	-	-	-	-	35,000
Deep Well Casing (m/yr)	2000	2000	2000	2000	-	-	-	-

Irrigation

Approximately 30% of Burma's land area, 20 million hectares, is suitable for agriculture. At the present time however, less than half of this area is being productively utilized. Since the acreage is generally located along or relatively near the rivers or in moderately rainy regions only 12.4% of the total farm acreage is presently under irrigation.

As the general population increases more and more acreage will have to be brought under cultivation to ensure ample food stocks to feed the people. As the new areas to be brought under cultivation become more distant from the rivers and easily accessible water there will be an ever increasing dependence on water wells and pipe irrigation systems to irrigate the land. Even though there are only 1.1 million hectares of land presently being irrigated the number will rise considerably over the next 14 years. In order to get some background data on irrigation projects the Irrigation Department, Ministry of Agriculture was approached. They were able to furnish data on a proposed 42,000 acres irrigation project, the estimates from which were based upon a present 3 years' project to irrigate 20,000 acres. From this an annual estimate of steel pipe consumption for irrigation purposes was made. A summary of the results is shown in Table 3.7.

Table 3.7 Steel Pipe Demand for Irrigation (6"-12")

		Black Pipe		Pipe, Coated and lined	
		Nominal Dia. millimeters inch		Nominal Dia millimeters inch	
		300	250	200	150
		12"	10"	8"	6"
Well casing	m/yr	2,600	1,700	-	-
Mains	m/yr	-	-	26,700	26,700

Electric Power Transmission Support Poles

When nationally produced steel profiles and good cement posts are scarce, freely available steel pipe would become the ideal material for construction of electrical distribution line supports. Pipe has the advantage of easy fabrication, transportation, installation and maintenance. The mileage of transmission lines (230 to 66 kV) is increasing every year and with it the mileage of distribution networks (33 down to 0.4 kV). To calculate pipe demand only distribution lines are considered. The mileage provided during 1984/85 plus 10% was taken as a basis and are shown in table 3.8 below.

Table 3.8 Mileage of Overhead Distribution Lines

	1983/84 existing miles	1984/85 existing miles	1984/85 increase miles	as before + 10% miles
33 kV	1170	1316	146	160
11 kV	2542	2678	136	150
6.6 kV	215	242	27	30
3.3 kV	14	14	-	-
0.4 kV	4140	4292	152	170

Source: Report to the Pyithu Hluttaw, 1985/86.

In addition lamp posts will partly be made of steel pipe. These posts will also be used to carry electricity lines. We think that, considering for the year 2000 an urban population of 18.3 millions, an annual demand of 2000 new posts (average height 8 m, dia. 6") is very conservative.

For maintenance and repair of existing installations (approx. 2% of the above) will be needed. (Steel pipe is also ideal for repair of installations made of other materials).

Table 3.9 Pipe for Electrical Transmission Line Support and Lamp Posts

Overhead Distribution	Annual Increase	Posts per Mile	Pipe Length per Post	Main Pipe dia	Annual Pipe Demand dia 6"	dia. 8"	dia. 10"	dia. 12"
	miles	no.	m	inch	m	m	m	m
33 kV	160	30	24	12"	-	-	-	115,200
11 kV	150	40	10	12"	-	-	-	60,000
6.6 kV	30	40	10	10"	-	-	12,000	-
3.3 kV	-	40	10	8"	-	-	-	-
0.4 kV	170	50	10	8"	-	85,000	-	-
Lamp Posts	-	-	8	6"	1,600	-	-	-
Repairs	-	-	-	all dia.	-	1,700	200	3,500
Total	Annual Demand				1,600	86,700	12,200	178,700

Pipe for the Petrochemical Industry

The Petrochemical Industries Corporation (P.I.C.) is responsible for all petrochemical and chemical plant projects.

Data obtained from the Corporation indicates that they consume a range of pipe between 1/2" and 8" all to API standard 5L 80-85% of which is welded and the remainder threaded. The data was further broken down to show.

Pipe diameter	% (by length)
1/2"-2 1/2"	15%
3"-4"	70%
6"-8"	15%

PIC also stated that on average they consume 2000 m of pipe per year (in the above ratio) for maintenance work and approximately 1000 tpy of pipe on new projects 40% of which is welded steel pipe, again broken down into the above ratio. On the assumption that equal quantities of 6" and 8" pipe are used and a general increase of 1.5 times past use will be needed in the future it is possible to calculate a reliable future annual demand. The following table summarizes the result of this calculation.

Table 3.10 Pipe for the Petrochemical Industry

		Black Pipe	
		Norm Dia.	millimeters inch
		200	150
		8"	6"
Maintenance	m/yr	200	200
New plant	m/yr	4,100	4,100
		4,300	4,300

Pipe for Ministry of Defence Use

The Director of procurement for the Ministry of Defence furnished data on pipe consumption by the military during 1985. No discussions were possible at the Ministry and it was considered that the figures supplied were rather conservative. To allow for future increase 50% was added to the figures obtained so giving the following future demand:

8" pipe	2,700 m/yr
6" pipe	13,800 m/yr

Pipe for Myanma Oil Corporation

The Oil Corporation furnished information on their estimated consumption for the next five years. Their requirements were then calculated from this and showed the following in the 6 to 12 inch range:

Pipe size (in)	Working pressure (psi)	Annual consumption (m)
10	150 - 1000	61,000
8	150 - 1000	46,000
6	150 - 1000	45,000

To produce this pipe to API oil line standard requires additional special equipment and for such a relatively small amount of pipe the additional investment is not feasible. Therefore no allowance for oil pipe manufacture has been made in the production programme.

Other Outlets for Pipe

Usually products are manufactured to market demand but often availability of a product on the market tends to generate an otherwise latent demand. This is especially true in a situation where a readily available product can be substituted for one which is not easily obtainable. From this point of view an additional outlet for welded steel pipe can be identified. It can be expected that such as the construction mining industries would consume more pipe for applications which anyhow utilizes pipe and also as a substitute for profile steel (such as "I" beams, angles etc.). As it is very difficult to quantify such a market the study set a nominal 7,600 tonnes/yr as the initial level.

Table 3.11 gives a complete summary of the pipe market estimates as discussed in the previous pages.

Table 3.11 Summary of Annual Steel Pipe Demand in the Range 6" to 12"

	Nominal Diameter in millimeters and inch						
	300 mm / 12"		250 mm / 10"		200 mm / 8"		150
Field of Application	black	coated lined	black	coated lined	black	coated lined	black
	m/year	m/year	m/year	m/year	m/year	m/year	m/year
Urban Water Supply	20,000	147,200	20,000	7,900	-	154,600	-
Rural Water Supply	-	-	-	-	-	-	58,800
Water Supply f. Government Bldgs.	2,000	-	2,000	-	2,000	-	2,000
Manufacture of Electr. Distr. Posts	178,700	-	12,200	-	86,700	-	1,600
Irrigation	2,600	-	1,700	-	-	26,700	-
Ministry of Defence	-	-	-	-	2,700	-	13,800
Petrochemical Industries Corp.	-	-	-	-	4,300	-	4,300
Ministry of Mining	1,000	1,000	1,000	1,000	2,000	2,000	2,000
Others	67,390	-	8,700	-	50,970	-	114,960
Total	271,690	148,200	45,600	8,900	148,670	183,300	197,460
1,626,900	419,890		54,500		331,970		7

Demand in the Range 6" to 12"

ameter in millimeters and inch

12"	250 mm / 10"		200 mm / 8"		150 mm / 6"	
coated lined	black	coated lined	black	coated lined	black	coated lined
m/year	m/year	m/year	m/year	m/year	m/year	m/year
147,200	20,000	7,900	-	154,600	-	487,900
-	-	-	-	-	58,800	-
-	2,000	-	2,000	-	2,000	35,000
-	12,200	-	86,700	-	1,600	-
-	1,700	-	-	26,700	-	26,700
-	-	-	2,700	-	13,800	-
-	-	-	4,300	-	4,300	-
1,000	1,000	1,000	2,000	2,000	2,000	2,000
-	8,700	-	50,970	-	114,960	-
148,200	45,600	8,900	148,670	183,300	197,460	551,600
0	54,500		331,970		749,060	

Export Potential

Although the basic philosophy for this project is to provide a pipe manufacturing facility to supply pipe for Burma's own consumption certain factors make it necessary to consider wider horizons than the indigenous market.

The necessary product mix to satisfy the majority of the demands of the Burmese market covers a range of pipes between 6" and 12". Unfortunately the technical limitations imposed on pipe manufacture dictate that the production line which must be installed to cover this wide range of pipes, gives a large total production capacity of the plant. Obviously then, to maximize the full production capabilities of the plant it should be operated at its maximum capacity to ensure an adequate return on investment. In practical terms therefore, the output of pipe, especially in the early years of production will certainly exceed the internal market needs.

Also, the input material for pipe manufacture (i.e. steel coils) must still be imported. Although costs of importing steel coil as opposed to importing pipe means a considerable saving in foreign currency for the Burmese Government there still remains the need to spend foreign currency on imports. If such import costs can be offset against earnings from exports of pipe then this would be an obvious advantage for the project.

The above considerations therefore lead to the conclusion that the export market should be considered.

The main requirements for any exporting nation are that their products must be manufactured to a suitable standard, the cost of products must be competitive and the exporter must set up an efficient marketing organization. The question of quality is not a problem as the production lines are designed to manufacture pipe to the recognised international standards. Also, cost of pipe should not be difficult to maintain at general world prices and further, provided the export markets are carefully selected so that transportation costs can be held to a minimum Burma could have a distinct advantage over its competitors. Marketing of the product can be easily achieved provided it is started in advance of production and the supply of the product can be proved to be reliable in terms of set delivery dates.

Plant Capacity

The capacity of the welded pipe production plant has been determined on the basis of our market investigations, the results of which are shown in the annexed Table 2. Table 2 indicates the market demand in the pipe range from 6" to 12".

As far as we have been able to find out, the market for the size range from 1/2" to 4" is presently taken up by plastic pipes, whilst all the bigger pipes in the range from 6" to 12" are imported as iron or steel pipes. As shown on Table 1 the market demand for pipes from 6" to 12" is approx. 44,000 tonnes per year.

On considering the whole pipe size range from 1/2" to 12" the technological criteria of pipe welding plants suggest a split into two welding lines with different features. The first welding line would cover the size range from 1/2" to 4", and the second would produce pipes in the range from 6" to 12" nominal diameter. The split between the two welding lines is also consistent with the split in the market between plastic pipes and (imported) steel pipes.

Consequently the study has been based on a production unit to cover the 6" to 12" pipe diameter range. However, for completeness a second alternative has also been included whereby the full range of pipe (1/2" to 12") could be produced.

Working Hours

days per year		365 d/y
working days Monday through Friday		260 d/y
total holidays 21 d/y average number of holidays Mondays through Fridays	./.	15 d/y
working days per year		245 d/y

8 hours per shift

1 shift operation	1,960 h/y
2 shift operation	3,920 h/y
3 shift operation	5,880 h/y

Alternative I

Pipe production plant in the pipe size range from 6" to 12" with a capacity of approx. 82,000 tons per year, covering the internal market demand of 44,000 tons and 38,000 tons to be exported.

The exported quantity being necessary to utilize the production potential of the plant.

Alternative II

Pipe production plant in the pipe size range from 1/2" to 12", i.e. comprising to welding lines (1/2" to 4" and 6" to 12") with a total capacity of approx. 112,000 tons per year. Although the present demand of 1/2" to 4" pipe may be covered by plastic pipes there is the possibility of steel pipes supplementing the plastic pipes. In addition, the output of the plant could be assigned to be exported.

The features of the two alternatives are summarized below:

Alternative I

- Pipe size range produced		6 to 12 inch
- Welding plant capacity based on 2 shift operation (3920 h)	approx.	82,000 tpy
- Output for internal demand	approx.	44,000 tpy
- Output to be exported	approx.	38,000 tpy
- Time utilization factor		0.5
- Average pipe length		10 m
- Pipe wall thickness range		3.18-6.35 mm

The pipes produced in the plant are partly supplied as black pipes or with internal cement lining and external bitumen coating (see also breakdown in annexed Table 3).

Accordingly, the plant includes facilities for inner lining and exterior coating as well as all the other necessary equipment for cutting, facing, non-destructive testing, marking and bundling.

Upstream of the pipe welding line a slitting line is required which splits the coiled strip supplied as raw material into skelps of the required widths.

The particulars of this alternative can also be taken from the annexed tables:

Table 4

Strip Slitting Line

Table 5

Tube Welding Plant
Output for Internal Market Demand

Table 6

Tube Welding Plant
Output on 2-shift basis

Table 7

Tube Welding Plant
Output destined for export

In addition, the annexed flowsheet shows the main units of the plant as well as the input and output tonnages of the different production stages.

Alternative II

- Pipe size range produced	1/2 - 12 inch
- Range of 1st welding line	1/2 - 4 inch
- Range of 2nd welding line	6 - 12 inch
- Average pipe length 1st welding line	6 m
- Average pipe length 2nd welding line	10 m
- Wall thickness range 1st welding line	2.0 - 4.5 mm
- Wall thickness range 2nd welding line	3.18 - 6.35 mm
Total output	approx. 112,000 tpy

Time utilization factors:

- 1st welding line (1/2 - 4 inch) 0.7
- 2nd welding line (6 - 12 inch) 0.5

(The different factors derive from the fact that the first welding line works with a strip storage looper whilst the second welding line is without a looper). The output of the first welding line (approx. 30,000 tons per year) is passed partly through a galvanizing line to produce galvanized pipes (approx. 22,900 tons) and the rest comes from the plant as black pipes (approx. 7,350 tons).

The plant includes all facilities to produce black as well as galvanized/threaded pipes such as equipment for cutting, end facing, non-destructive testing, pickling, galvanizing, straightening, threading, screw-on of couplings, fitting of protection caps, marking and bundling.

Upstream of the two welding lines, a slitting line is provided which splits the coiled strip into skelps of the required widths.

The particulars of this alternative can also be taken from the annexed tables:

<u>Table 4a</u>

Strip Slitting Line

<u>Table 8</u>

Tube Welding Plant

<u>Table 9</u>

Tube Galvanizing Plant

The annexed Flowsheet for Alternative II shows the main units of the plant as well as the different input and output tonnages of the different production steps.

The plant design has been chosen and presented in such a manner that it was possible to study the feasibility and to construct the pipe plant in any one of the two configurations (alternatives) or as a combination of them both.

The project feasibility analysis has examined and evaluated each of the above concepts. The results of the evaluations confirm that the most advantageous and therefore feasible layout is the one for the large dia. pipes only. This does not however exclude the possibility of adding a second phase (small dia. pipes) at a later date.

Since without a doubt there is essentially a strong local as well as an export market for all the pipe products which could be produced in the plant the final decision on which plant configuration the project should be initially selected will depend mainly on the Government's internal priorities.

Production Costs and Product-Price Relationship

The Study's on-site personal interviews and investigations indicate that product pricing does not have a significant influence in the volume of expected sales as long as the pipe products are readily available on the market and can be purchased for local currency.

Since it is envisaged that the pipe plant would operate as a monopolistic enterprise under the direct guidance of the Government and therefore protected by regulatory import actions the pipe could be theoretically sold at the maximum prices obtainable and considerably above the actual production costs. The price structure for exporting pipe however, will have to be in line with the international steel market prices then prevailing in the area. In the Study's evaluation of the internal prices and wage structures within the country there is every indication that pipe produced in Burma could be competitively priced on the regional market.

A major factor in determining the actual production costs and possibly the plant's capacity is the fact that the majority of input materials must be imported and therefore purchased on international markets for foreign currency. Since such market prices may be subject to wide fluctuations the production costs would have to be altered accordingly. The prices used as a basis in the Study are therefore the average prices paid for said input materials over the last years plus an inflation factor to account for the inflationary tendencies. Base prices were obtained through international steel traders and shipping companies.

Since the majority of pipe products will be controlled and consumed by various governmental enterprises the distribution system and outlets would be through the existing respective government stores and supply depots. The costs for distribution, storage and sales are therefore a summation of these actual costs. Internal transport costs for moving imported raw materials to the plant site versus finished products over the distribution systems of the country were a main factor in site selection.

Burma has a very complex system of import duties and sales taxes. Therefore in order to achieve a realistic view of the feasibility of producing pipe in an indigenous plant the study excluded all duties, taxes and fees on imports and local trade procedures within the country.

The sales prices of the products from the plant are indicative of international prices cif Rangoon. Where prices for Rangoon could not be obtained cif prices for other parts in the region were taken. The feasibility calculations are therefore also based on these international prices to show the potential profit/loss of a plant operating inside Burma in comparison to the cost of pipe being shipped to Burma from abroad.

SCHEDULE 3-1/1 ESTIMATE OF SALES REVENUE FOR PIPE - ALTERNATIVE I

Products				YEAR 1						YEAR 2			
Description			Unit price US$/ton	Quantity Tonnes export	local	total	Sales revenue US$ export	local	total	Quantity Tonnes export	local	total	S export
Dia. inch	W.thickn. mm	Specification											
6	4.78	black	374	1,948	2,231	4,179	729,317	835,270	1,564,588	2,226	2,250	4,476	833,398
6	6.35	black	374	493	564	1,057	184,576	211,158	395,733	563	645	1,208	210,783
6	3.18	lined/coated	529	211	242	453	111,341	127,699	239,039	241	277	518	127,171
6	4.78	lined/coated	529	6,173	7,069	13,242	3,257,370	3,730,171	6,987,541	7,055	8,079	15,134	3,722,784
8	5.16	black	354	2,236	2,560	4,796	791,442	906,124	1,697,566	2,555	2,926	5,481	904,354
8	6.35	black	354	289	331	620	[illegible]	117,159	219,452	330	378	708	116,805
8	3.18	lined/coated	470	276	316	592	129,742	148,546	278,288	315	361	676	148,076
8	3.18	lined/coated	470	2,603	2,982	5,586	1,223,622	1,401,782	2,625,404	2,975	3,346	6,321	1,398,472
10	2.96	black	323	28	31	59	9,052	10,022	19,075	32	35	67	10,346
10	5.56	black	323	924	1,058	1,982	298,728	342,048	640,775	1,056	1,209	2,265	341,402
10	6.35	black	323	69	79	148	22,307	25,540	47,848	79	90	169	25,540
10	5.56	lined/coated	423	199	229	428	84,118	96,799	180,916	227	262	489	95,953
12	4.37	black	310	54	63	117	16,756	19,548	36,304	62	72	134	19,238
12	5.56	black	310	6,605	7,564	14,169	2,049,471	2,347,046	4,396,516	7,549	8,645	16,194	2,342,355
12	6.35	black	310	653	751	1,407	202,551	232,028	434,579	750	859	1,609	232,718
12	5.56	lined/coated	406	3,955	4,529	8,494	1,605,648	1,838,680	3,444,328	4,520	5,176	9,696	1,835,026
Subtotals				26,719	30,599	57,318	10,818,333	12,389,613	23,207,946	30,535	34,609	65,144	11,354,471

Price basis: 1986   No inflation considered

YEAR 1			YEAR 2						YEAR 3					
Sales revenue US$			Quantity Tonnes			Sales revenue US$			Quantity Tonnes			Sales revenue US$		
export	local	total	export	local	total	export	local	total	export	local	total	export	local	total
729,317	835,270	1,564,588	2,226	2,250	4,476	833,398	842,384	1,675,782	2,783	3,187	5,970	1,041,882	1,193,243	2,235,125
184,576	211,158	395,733	563	646	1,209	210,783	241,483	452,267	704	806	1,510	263,680	301,654	565,333
111,341	127,697	239,039	241	277	518	127,171	146,167	273,339	301	346	647	159,058	182,427	341,484
3,227,370	3,710,171	6,937,541	7,055	8,079	15,134	3,722,784	4,263,128	7,985,912	8,819	10,099	18,917	4,653,396	5,328,816	9,982,202
791,442	906,124	1,697,566	2,555	2,926	5,481	904,354	1,035,671	1,940,025	3,194	3,657	6,851	1,130,632	1,294,462	2,425,094
102,293	117,159	219,452	330	378	708	116,605	133,795	250,400	413	473	886	146,133	167,370	313,503
126,742	145,546	272,288	315	361	676	148,076	169,699	317,775	394	451	846	185,346	212,209	397,554
1,223,622	1,401,782	2,625,404	1,975	2,346	4,321	1,398,492	1,572,892	2,971,384	3,719	4,260	7,979	1,748,031	2,002,546	3,750,577
9,052	10,022	19,075	32	35	67	10,346	11,315	21,661	40	44	84	12,932	14,317	27,249
298,726	342,048	640,775	1,056	1,209	2,265	341,402	390,866	732,268	1,320	1,511	2,831	426,752	488,640	915,392
22,307	25,540	47,848	79	90	169	25,540	29,097	54,637	99	113	211	31,869	36,485	68,354
84,118	96,799	180,916	227	262	489	95,953	110,748	206,701	284	327	611	120,158	138,294	258,452
14,756	19,548	34,304	62	72	134	19,238	22,341	41,579	77	90	167	23,937	27,926	51,863
2,048,471	2,347,344	4,395,815	7,549	8,645	16,194	2,342,385	2,682,464	5,024,849	9,435	10,806	20,241	2,927,815	3,352,914	6,280,729
203,551	233,028	436,579	750	859	1,609	232,718	266,230	498,949	937	1,073	2,010	290,787	332,898	623,685
1,605,648	1,838,680	3,444,328	4,320	5,176	9,496	1,835,028	2,101,349	3,936,377	5,650	6,470	12,120	2,293,783	2,626,686	4,920,469
16,019,322	18,390,617	34,409,939	[illegible]	[illegible]	[illegible]	11,364,471	14,019,659	25,384,130	38,170	43,713	81,883	15,455,180	[illegible]	[illegible]

SCHEDULE 3-1/2 ESTIMATE OF SALES REVENUE FOR PIPE - ALTERNATIVE II

Products				YEAR 1						YEAR 2				
Description			Unit price US$/ton	Quantity Tonnes			Sales revenue US$			Quantity Tonnes			Sales re US$	
Dia. inch	W.thickn. mm	Specification		export	local	total	export	local	total	export	local	total	export	loca
1/2	2.00	black	376	209	-	209	78,584	-	78,584	239	-	239	89,864	-
1/2	2.00	galv./threaded	421	1,299	-	1,299	546,879	-	546,879	1485	-	1485	625,185	-
3/4	2.65	black	348	263	-	263	91,524	-	91,524	301	-	301	104,748	-
3/4	2.35	black	340	428	-	428	142,944	-	142,944	489	-	489	[illegible]	-
3/4	2.65	galv./threaded	390	973	-	973	379,470	-	379,470	1112	-	1112	433,680	-
1	3.25	black	355	507	-	507	179,985	-	179,985	579	-	579	205,545	-
1	2.65	black	355	42	-	42	14,910	-	14,910	48	-	48	17,040	-
1	3.25	galv./threaded	398	1,834	-	1,834	729,932	-	729,932	2096	-	2096	834,208	-
1 1/4	3.25	black	350	514	-	514	179,900	-	179,900	587	-	587	205,450	-
1 1/4	3.25	galv./threaded	392	484	-	484	189,728	-	189,728	553	-	553	216,776	-
1 1/2	3.25	black	344	471	-	471	162,024	-	162,024	538	-	538	185,072	-
1 1/2	2.90	black	344	182	-	182	62,608	-	62,608	208	-	208	71,552	-
1 1/2	3.25	galv./threaded	385	3,826	-	3,826	1,473,010	-	1,473,010	4372	-	4372	1,683,220	-
2	3.65	black	341	779	-	779	265,639	-	265,639	890	-	890	303,490	-
2	3.65	galv./threaded	382	1,478	-	1,478	564,596	-	564,596	1689	-	1689	645,198	-
2 1/2	3.65	black	341	55	-	55	18,755	-	18,755	62	-	62	21,142	-
2 1/2	3.65	galv./threaded	382	1,002	-	1,002	382,764	-	382,764	1146	-	1146	437,772	-
3	4.05	black	339	527	-	527	178,653	-	178,653	602	-	602	204,078	-
3	4.05	galv./threaded	380	2,496	-	2,496	948,480	-	948,480	2852	-	2852	1,083,760	-
4	4.50	black	389	1,169	-	1,169	454,741	-	454,741	1336	-	1336	519,704	-
4	4.50	galv./threaded	436	2,643	-	2,643	1,152,348	-	1,152,348	3020	-	3020	1,316,720	-
Subtotal 1/2 TO 4 inch pipe				21,181		21,181	8,202,474		8,202,474	24,204		24,204	9,374,376	
subtotal [illegible] Table 10*				26,717		55,318	10,819,332	10,391,610	21,210,942	30,535	34,609	65,144	12,364,47	,019
Grand total Alternative II*				47,900		76,499	19,022,806	10,390,615	29,411,420	54,73	34,609	89,348	21,738,847	,019

*) [illegible] prices 1986 - no inflation considered

II

YEAR 1						YEAR 2						YEAR 3		
Sales revenue US$			Quantity Tonnes			Sales revenue US$			Quantity Tonnes			Sales revenue US$		
export	local	total	export	local	total	export	local	total	export	local	total	export	local	total
78,584	-	78,584	279	-	279	89,864	-	89,864	299	-	299	112,424	-	112,424
546,879	-	546,879	1485	-	1485	625,185	-	625,185	1,856	-	1,856	781,376	-	781,376
91,524	-	91,524	301	-	301	104,748	-	104,748	376	-	376	130,848	-	130,848
140,944	-	140,944	489	-	489	170,172	-	170,172	611	-	611	212,626	-	212,626
379,470	-	379,470	1112	-	1112	433,680	-	433,680	1,390	-	1,390	542,100	-	542,100
179,905	-	179,905	579	-	579	205,545	-	205,545	724	-	724	257,020	-	257,020
14,910	-	14,910	48	-	48	17,040	-	17,040	60	-	60	21,300	-	21,300
729,532	-	729,932	2096	-	2096	834,208	-	834,208	2,620	-	2,620	1,042,760	-	1,042,760
179,900	-	179,900	587	-	587	205,450	-	205,450	734	-	734	256,900	-	256,900
189,722	-	189,722	553	-	553	216,776	-	216,776	691	-	691	270,872	-	270,872
162,024	-	162,024	538	-	538	185,072	-	185,072	673	-	673	231,512	-	231,512
62,608	-	62,608	208	-	208	71,532	-	71,532	260	-	260	89,446	-	89,440
,473,010	-	1,473,010	4372	-	4372	1,683,220	-	1,683,220	5,465	-	5,465	2,104,025	-	2,104,025
263,639	-	263,639	890	-	890	301,490	-	301,490	1,113	-	1,113	[illegible]	-	[illegible]
564,596	-	564,596	1699	-	1699	645,198	-	645,198	2,111	-	2,111	806,402	-	806,402
18,755	-	18,755	62	-	62	21,142	-	21,142	78	-	78	26,598	-	26,598
382,764	-	382,764	1146	-	1146	437,772	-	437,772	1,432	-	1,432	547,024	-	547,024
178,655	-	178,655	602	-	602	204,078	-	204,078	753	-	753	255,267	-	255,267
948,480	-	948,480	2852	-	2852	1,083,760	-	1,083,760	3,565	-	3,565	1,354,700	-	1,354,700
454,741	-	454,741	1336	-	1336	519,704	-	519,704	1,670	-	1,670	649,630	-	649,630
,152,349	-	1,152,349	3020	-	3020	1,316,720	-	1,316,720	3,775	-	3,775	1,645,900	-	1,645,900
,203,474		8,203,474	24,204		24,204	9,374,376		9,374,376	30,256		30,256	11,718,259		11,718,259
,819,332	12,390,615	23,209,946	30,535	34,609	65,144	[illegible]	[illegible]	21,384,104	[illegible]	[illegible]	61,830	[illegible]	[illegible]	[illegible]
,022,806	12,390,615	31,412,421	[illegible]	34,609	89,348	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Schedule 3-2/1 Estimate of production cost: sales and distribution costs

Price basis 1986

ESTIMATE OF PRODUCTION COST

Sales and distribution costs - Alternative I

				Cost US$		
No	Item desctiption	Loc.	For.	Foreign	Local	Total
1	SALES COSTS					
	Training	Yes	No	-	5,000	5,000
	Advertising etc.	Yes	Yes	30,000	20,000	50,000
	Travel expenses	Yes	Yes	60,000	25,000	85,000
	After sales service	Yes	Yes	30,000	30,000	60,000
	Communication	Yes	Yes	40,000	20,000	60,000
2	DISTRIBUTION COSTS					
	Strapping for pipes	Yes	No	-	20,000	20,000
	Freight charges not considered - all prices quoted ex-works					
	Total			160,000	120,000	280,000

Schedule 3-2/2 Estimate of production cost: sales and distribution costs

Price basis 1986

ESTIMATE OF PRODUCTION COST

Sales and distribution costs - Alternative II

				Cost US$		
No	Item desctiption	Loc.	For.	Foreign	Local	Total
1	SALES COSTS					
	Training	Yes	No	-	5,000	5,000
	Advertising etc.	Yes	Yes	30,000	30,000	60,000
	Travel expenses	Yes	Yes	100,000	50,000	150,000
	After sales service	Yes	Yes	40,000	40,000	80,000
	Communication	Yes	Yes	45,000	25,000	70,000
2	DISTRIBUTION COSTS					
	Strapping for pipes	Yes	No	-	30,000	30,000
	Freight charges not considered - all prices quoted ex-works					
	Total			215,000	180,000	395,000

Schedule 3-3/1 Production Programme - Alternative I

Products, Wastes			Unit at 100% Capacity (tonnes)	Year 1		Year 2
				Capacity (%)	Units	Capacity (%)
Diam. inches	Wall thickness mm	Specification				
6	4.78	black	5,970	70	4,179	80
6	6.35	black	1,510		1,058	
6	3.18	lined/coated	647		453	
6	4.78	lined/coated	18,197		13,242	
8	5.16	black	6,851	70	4,796	80
8	6.35	black	886		620	
8	3.18	lined/coated	846		592	
8	5.16	lined/coated	7,979		5,585	
10	3.96	black	84	70	59	80
10	5.56	black	2,832		1,976	
10	6.35	black	211		148	
10	5.56	lined/coated	612		428	
12	4.37	black	168	70	118	80
12	5.56	black	20,242		14,169	
12	6.35	black	2,010		1,407	
12	5.56	lined/coated	12,120		8,484	
		Total			57,314	
Steel scrap			6,820	70	4,774	80
Bitumen waste			220		154	
Cement mix waste			1,350		945	
		Total			5,873	

tive I

Year 1		Year 2		Year 3	
Capacity (%)	Units	Capacity (%)	Units	Capacity (%)	Unit
70	4,179	80	4,776	100	5,970
	1,058		1,210		1,510
	453		518		647
	13,242		15,134		18,917
70	4,796	80	5,481	100	6,851
	620		709		886
	592		677		846
	5,585		6,383		7,979
70	59	80	67	100	84
	1,976		2,266		2,832
	148		169		211
	428		490		612
70	118	80	134	100	168
	14,169		16,194		20,242
	1,407		1,608		2,010
	8,484		9,696		12,120
	57,314		65,512		81,884
70	4,774	80	5,456	100	6,820
	154		176		220
	945		1,080		1,350
	5,873		6,712		8,390

Schedule 3-3/2 Production Programme - Alternative II

Products, Wastes			Unit at 100% Capacity (tonnes)	Year 1		Year 2
				Capacity (%)	Units	Capacity (%)
Diam. inches	Wall thick-ness mm	Specification				
6	4.78	black	5,970	70	4,179	80
6	6.35	black	1,510		1,058	
6	3.18	lined/coated	647		453	
6	4.78	lined/coated	18,917		13,242	
8	5.16	black	6,851	70	4,796	80
8	6.35	black	886		620	
8	3.18	lined/coated	846		592	
8	5.16	lined/coated	7,979		5,585	
10	3.96	black	84	70	59	80
10	5.56	black	2,832		1,976	
10	6.35	black	211		148	
10	5.56	lined/coated	612		428	
12	4.37	black	168	70	118	80
12	5.56	black	20,242		14,169	
12	6.35	black	2,010		1,407	
12	5.56	lined/coated	12,120		8,484	
1/2	2.00	black	299	70	209	80
1/2	2.00	galv./threaded	1,856		1,299	
3/4	2.65	black	376	70	263	80
3/4	2.35	black	611		428	
3/4	2.65	galv./threaded	1,390		973	
1	3.25	black	724	70	507	80
1	2.65	black	60		42	
1	3.25	galv./threaded	2,620		1,834	
1 1/4	3.25	black	734	70	514	80
1 1/4	3.25	galv./threaded	691		484	
1 1/2	3.25	black	673	70	471	80
1 1/2	2.90	black	260		182	
1 1/2	3.25	galv./threaded	5,465		3,826	
2	3.65	black	1,113	70	779	80
2	3.65	galv./threaded	2,111		1,478	

ative II

Year 1		Year 2		Year 3	
Capacity (%)	Units	Capacity (%)	Units	Capacity (%)	Unit
70	4,179	80	4,776	100	5,970
	1,058		1,210		1,510
	453		518		647
	13,242		15,134		18,917
70	4,796	80	5,481	100	6,851
	620		709		886
	592		677		846
	5,585		6,383		7,979
70	59	80	67	100	84
	1,976		2,266		2,832
	148		169		211
	428		490		612
70	118	80	134	10	168
	14,169		16,194		20,242
	1,407		1,608		2,010
	8,484		9,696		12,120
70	209	80	239	100	299
	1,299		1,485		1,856
70	263	80	301	100	376
	428		489		611
	973		1,112		1,390
70	507	80	579	100	724
	42		48		60
	1,834		2,096		2,620
70	514	80	587	100	734
	484		553		691
70	471	80	538	100	673
	182		208		260
	3,826		4,372		5,465
70	779	80	890	100	1,113
	1,478		1,689		2,111

Schedule 3-3/2 (cont.) Production Programme - Alternative II

Products, Wastes			Unit at 100% Capacity (tonnes)	Year 1		Year 2	
				Capacity (%)	Units	Capacity (%)	Units
Diam. inches	Wall thickness mm	Specification					
2 1/2	3.65	black	78	70	55	80	62
2 1/2	3.65	galv./threaded	1,432		1,002		1,146
3	4.05	black	753	70	527	80	602
3	4.05	galv./threaded	3,565		2,495		2,852
4	4.50	black	1,670	70	1,169	80	1,336
4	4.50	galv./threaded	3,775		2,643		3,020
		Total			79,494		89,716
Steel scrap			9,946		6,962		7,957
Zinc			102		71		82
Bitumen			220		154		176
Cement mix			1,350		945		1,080
		Total			8,132		9,295

Alternative II

	Year 1		Year 2		Year 3	
y)	Capacity (%)	Units	Capacity (%)	Units	Capacity (%)	Units
	70	55	80	62	100	78
		1,002		1,146		1,432
	70	527	80	602	100	753
		2,495		2,852		3,565
	70	1,169	80	1,336	100	1,670
		2,643		3,020		3,775
		79,494		89,716		112,140
		6,962		7,957		9,946
		71		82		102
		154		176		220
		945		1,080		1,350
		8,132		9,295		11,618

Schedule 3-4/1 Estimate of production cost: emmissions disposal

Price basis 1986

ESTIMATE OF PRODUCTION COST

Emmissions disposal - Alternative I

					Cost		
No.	Unit	Quantity	Item	Unit cost	Foreign	Local	Total
1.	t	1,350	Disposal of cement waste	lumpsum		2,000	2,500
2.	t	88	Disposal of bitumen	lumpsum		500	500
3.			Sewage *)	lumpsum		-	-
			Total			2,500	2,500

*) investment "civil" and maintenance "civil" include sewage disposal system

Schedule 3-4/2 Estimate of production cost: emmissions disposal

Price basis 1986

ESTIMATE OF PRODUCTION COST

Emmissions disposal - Alternative II

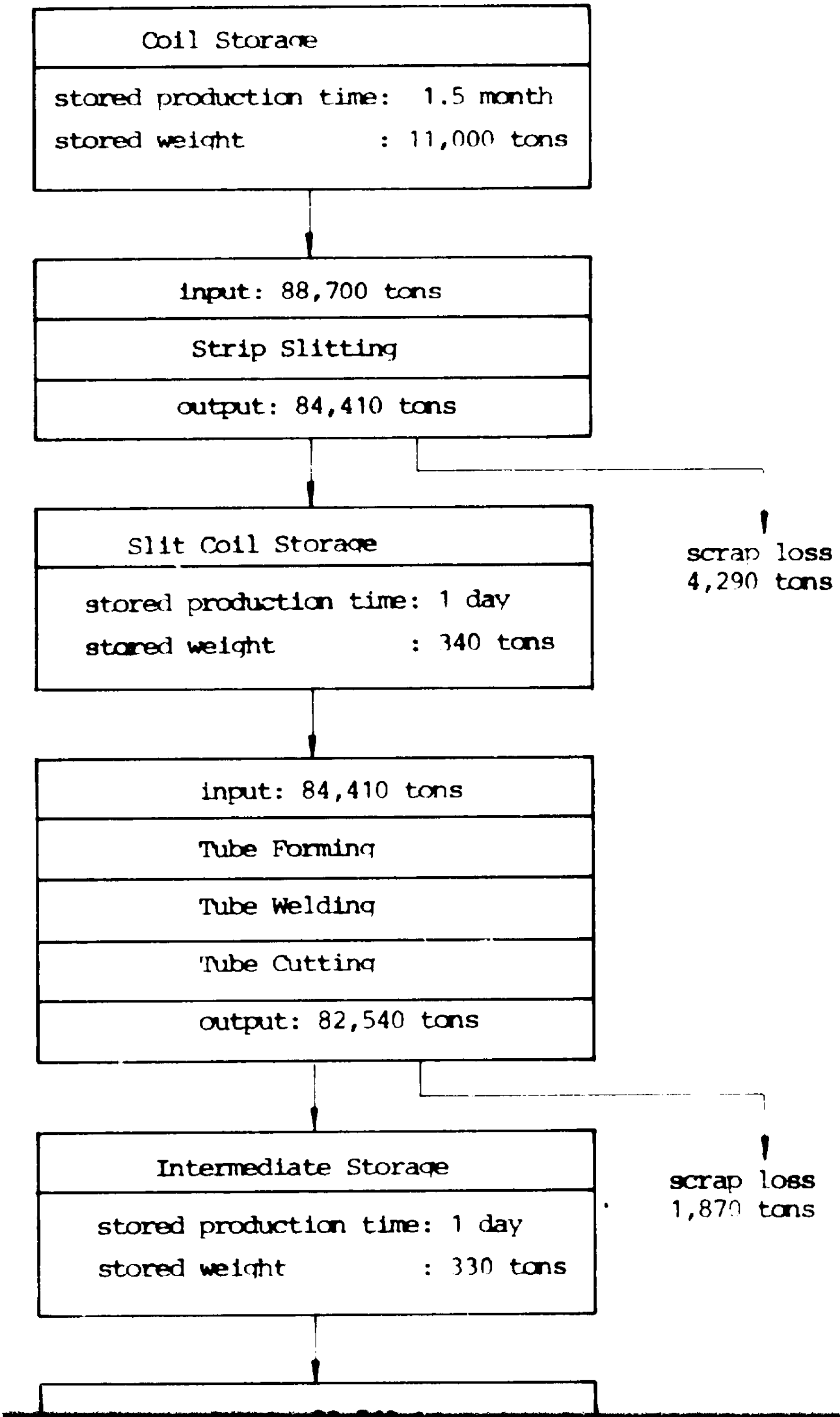
					Cost		
No.	Unit	Quantity	Item	Unit cost	Foreign	Local	Total
1.	t	1,350	Disposal of cement waste	lumpsum		2,000	2,500
2.	t	88	Disposal of bitumen	lumpsum		500	500
3.			Sewage *)	-		-	-
4.			Disposal of waste from pickling	lumpsum		5,000	5,000
			Total			7,500	7,500

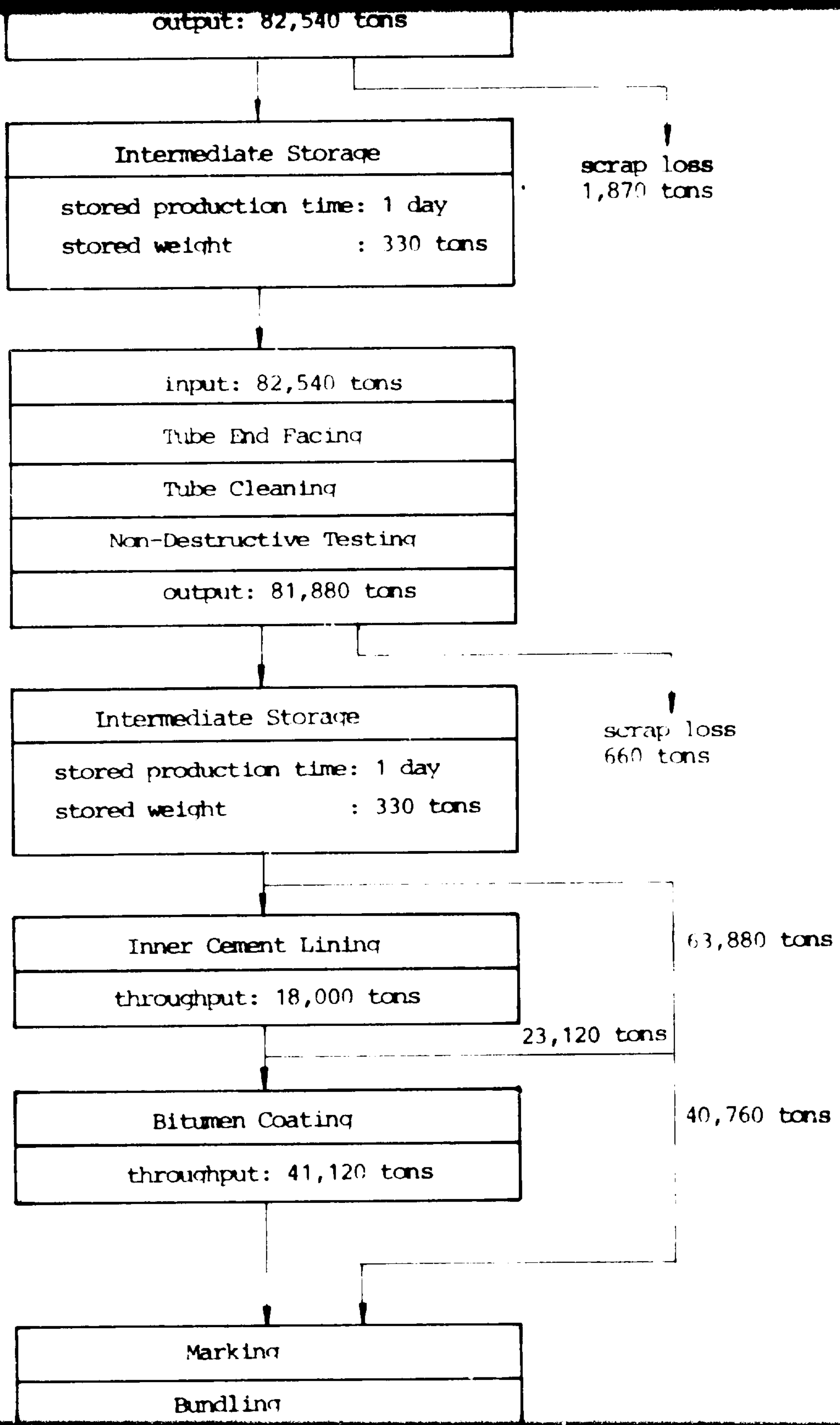
*) investment "civil" and maintenance "civil" include sewage disposal system

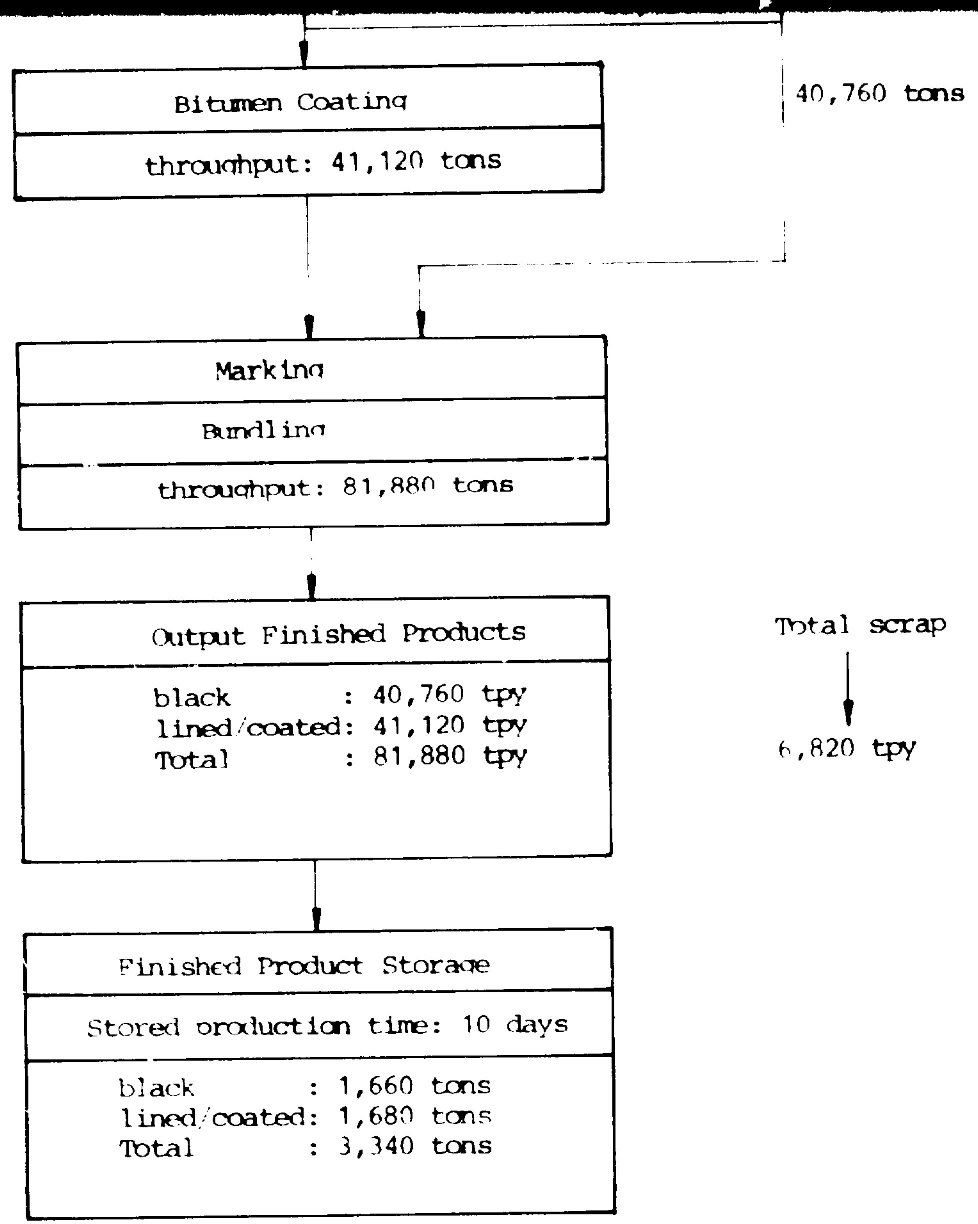
ANNEX OF TABLES AND FLOW SHEETS

Annex

SECTION 1


Coil Storage
stored production time: 1.5 month
stored weight : 11,000 tons
input: 88,700 tons
Strip Slitting
output: 84,410 tons
scrap loss
4,290 tons
Slit Coil Storage
stored production time: 1 day
stored weight : 340 tons
input: 84,410 tons
Tube Forming
Tube Welding
Tube Cutting
output: 82,540 tons
scrap loss
1,870 tons
Intermediate Storage
stored production time: 1 day
stored weight : 330 tons

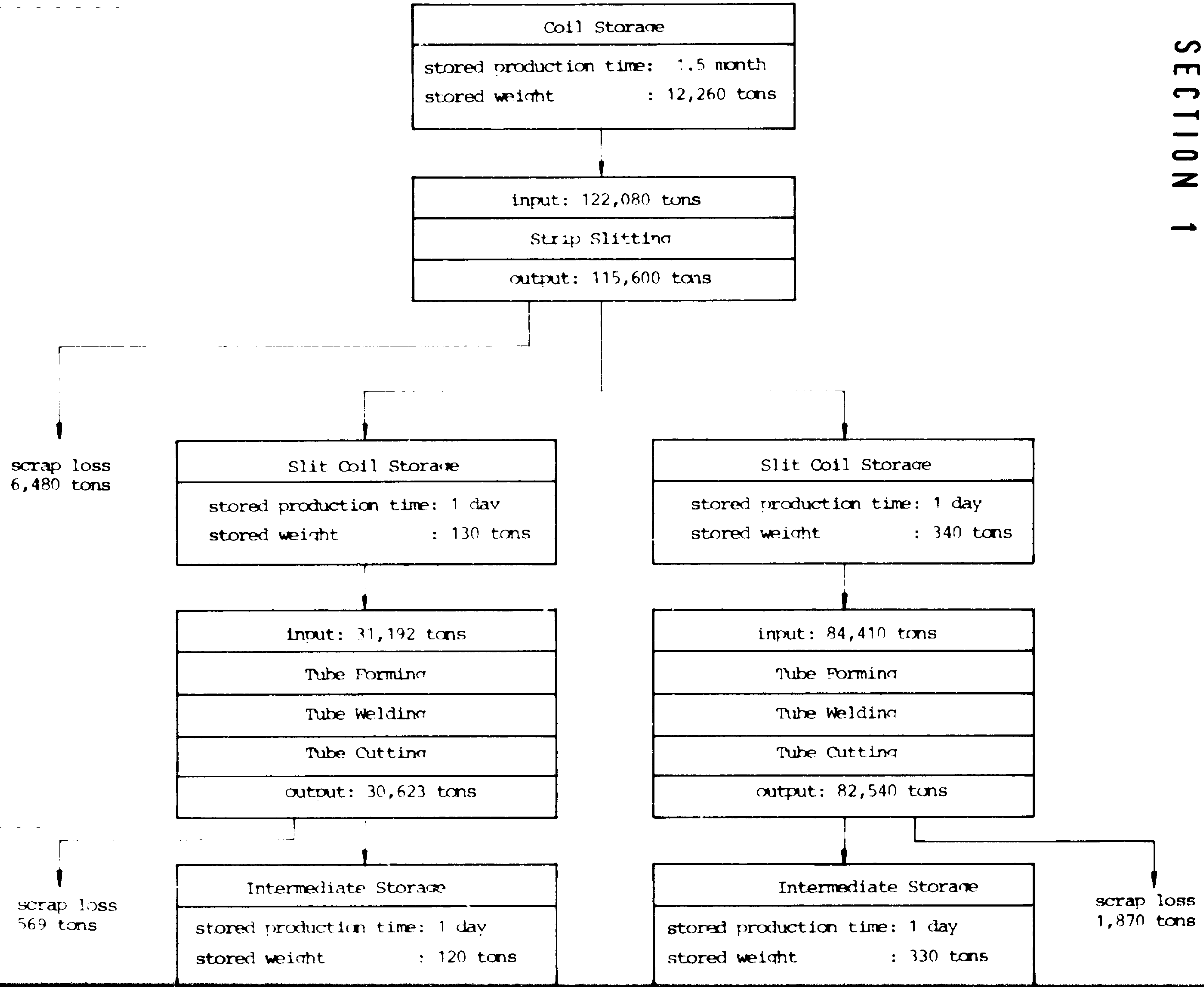

output: 82,540 tons
Intermediate Storage
stored production time: 1 day
stored weight : 330 tons
scrap loss
1,870 tons
input: 82,540 tons
Tube End Facing
Tube Cleaning
Non-Destructive Testing
output: 81,880 tons
Intermediate Storage
stored production time: 1 day
stored weight : 330 tons
scrap loss
660 tons
63,880 tons
Inner Cement Lining
throughput: 18,000 tons
23,120 tons
Bitumen Coating
throughput: 41,120 tons
40,760 tons
Marking
Bundling

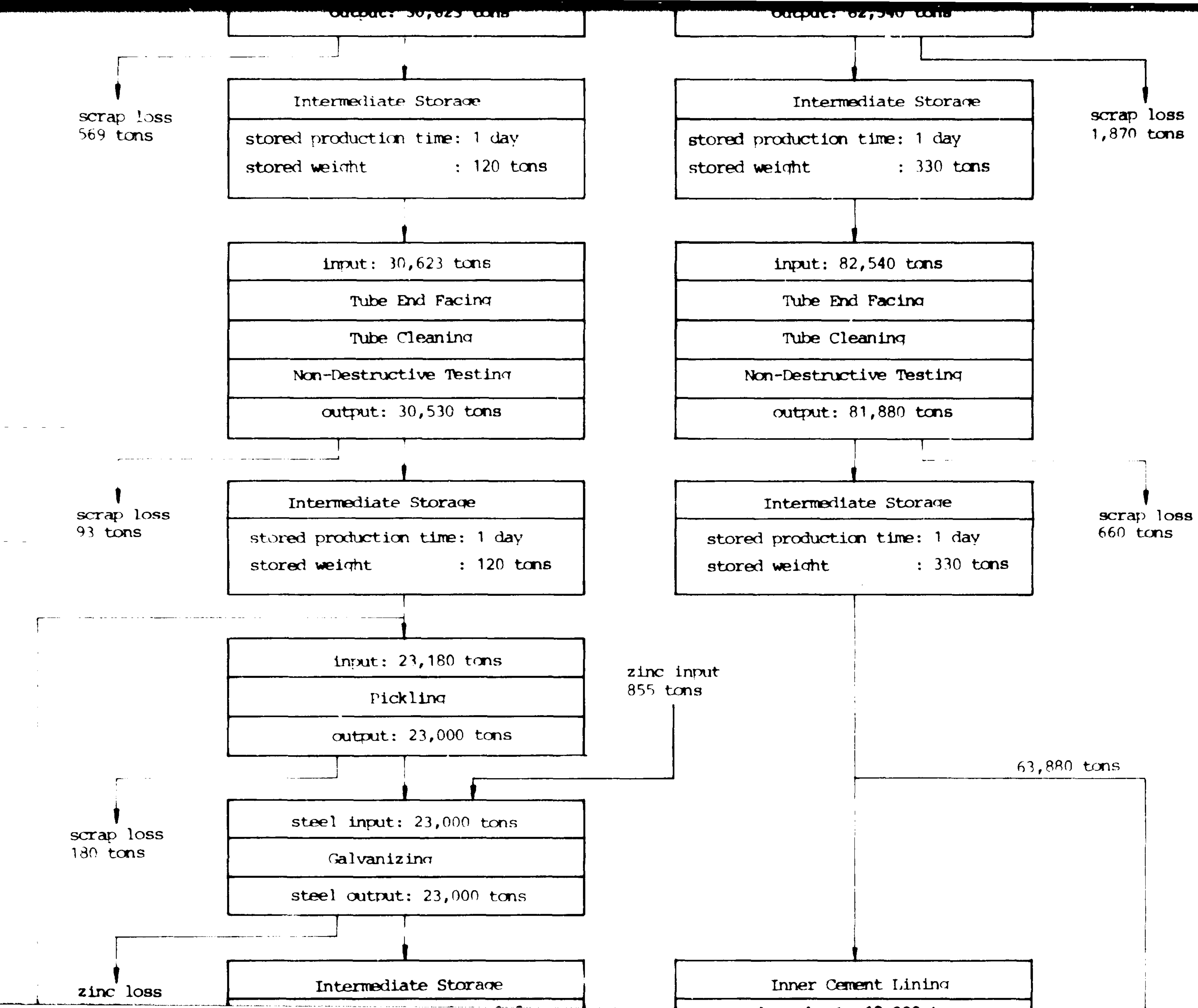


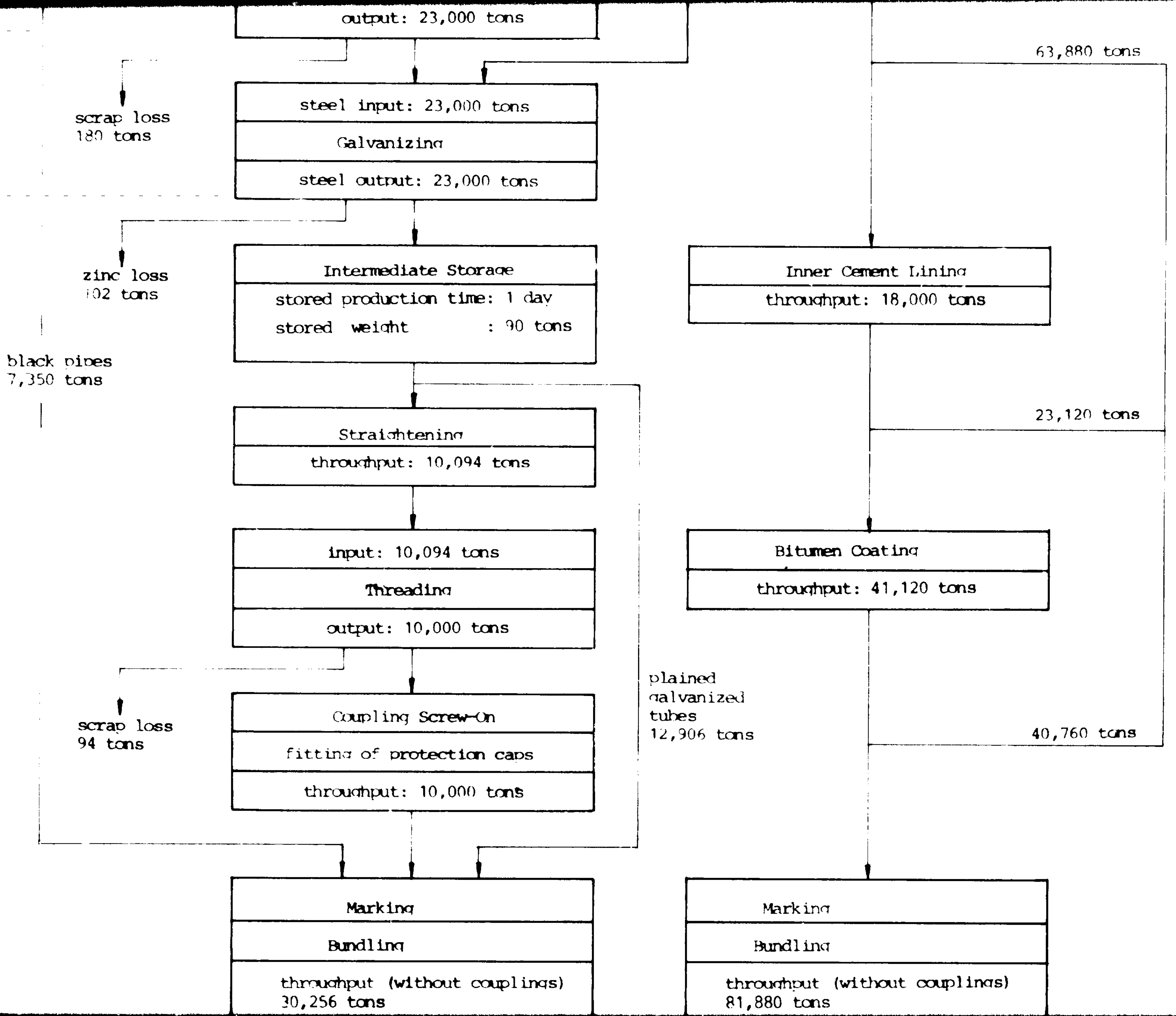
EBE

PRODUCTION PLANT FOR LONGITUDINALLY WELDED STEEL TUBES 6"- 12"
ALTERNATIVE I TABLE Ia
FLOW SHEET

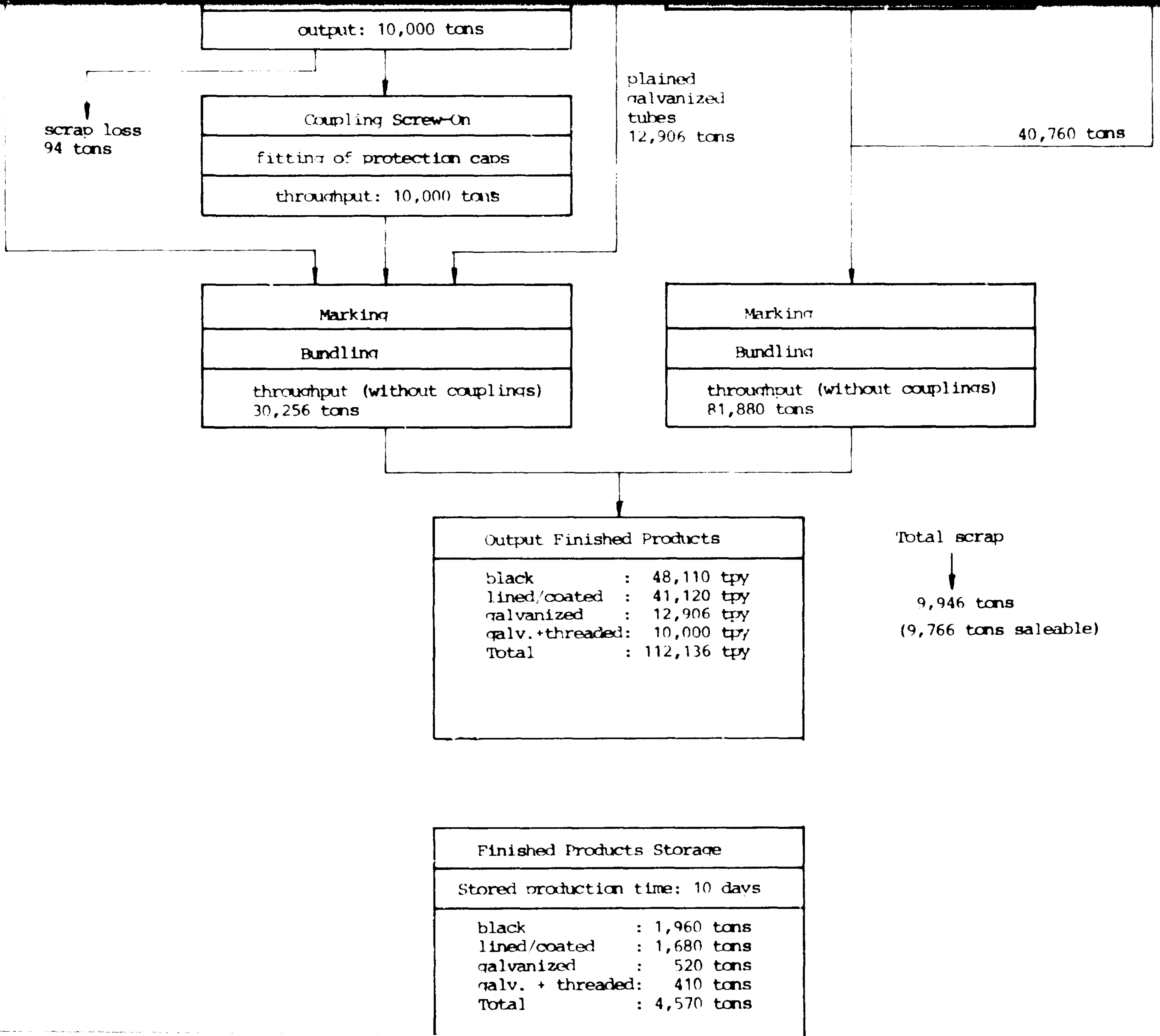
1148-002.03


Coil Storage
stored production time: 1.5 month
stored weight : 12,260 tons
input: 122,080 tons
Strip Slitting
output: 115,600 tons
scrap loss
6,480 tons
Slit Coil Storage
stored production time: 1 day
stored weight : 130 tons
Slit Coil Storage
stored production time: 1 day
stored weight : 340 tons
input: 31,192 tons
Tube Forming
Tube Welding
Tube Cutting
output: 30,623 tons
input: 84,410 tons
Tube Forming
Tube Welding
Tube Cutting
output: 82,540 tons
scrap loss
569 tons
Intermediate Storage
stored production time: 1 day
stored weight : 120 tons
Intermediate Storage
stored production time: 1 day
stored weight : 330 tons
scrap loss
1,870 tons


Intermediate Storage
stored production time: 1 day
stored weight : 120 tons
scrap loss 569 tons
Intermediate Storage
stored production time: 1 day
stored weight : 330 tons
scrap loss 1,870 tons
input: 30,623 tons
Tube End Facing
Tube Cleaning
Non-Destructive Testing
output: 30,530 tons
input: 82,540 tons
Tube End Facing
Tube Cleaning
Non-Destructive Testing
output: 81,880 tons
scrap loss 93 tons
Intermediate Storage
stored production time: 1 day
stored weight : 120 tons
Intermediate Storage
stored production time: 1 day
stored weight : 330 tons
scrap loss 660 tons
input: 23,180 tons
Pickling
output: 23,000 tons
zinc input 855 tons
63,880 tons
scrap loss 180 tons
steel input: 23,000 tons
Galvanizing
steel output: 23,000 tons
zinc loss
Intermediate Storage
Inner Cement Lining


output: 23,000 tons
63,880 tons
scrap loss
180 tons
steel input: 23,000 tons
Galvanizing
steel output: 23,000 tons
zinc loss
102 tons
Intermediate Storage
stored production time: 1 day
stored weight : 90 tons
Inner Cement Lining
throughput: 18,000 tons
black pipes
7,350 tons
23,120 tons
Straightening
throughput: 10,094 tons
input: 10,094 tons
Threading
output: 10,000 tons
Bitumen Coating
throughput: 41,120 tons
plained
galvanized
tubes
12,906 tons
scrap loss
94 tons
Coupling Screw-On
fitting of protection caps
throughput: 10,000 tons
40,760 tons
Marking
Bundling
throughput (without couplings)
30,256 tons
Marking
Bundling
throughput (without couplings)
81,880 tons

SECTION 3



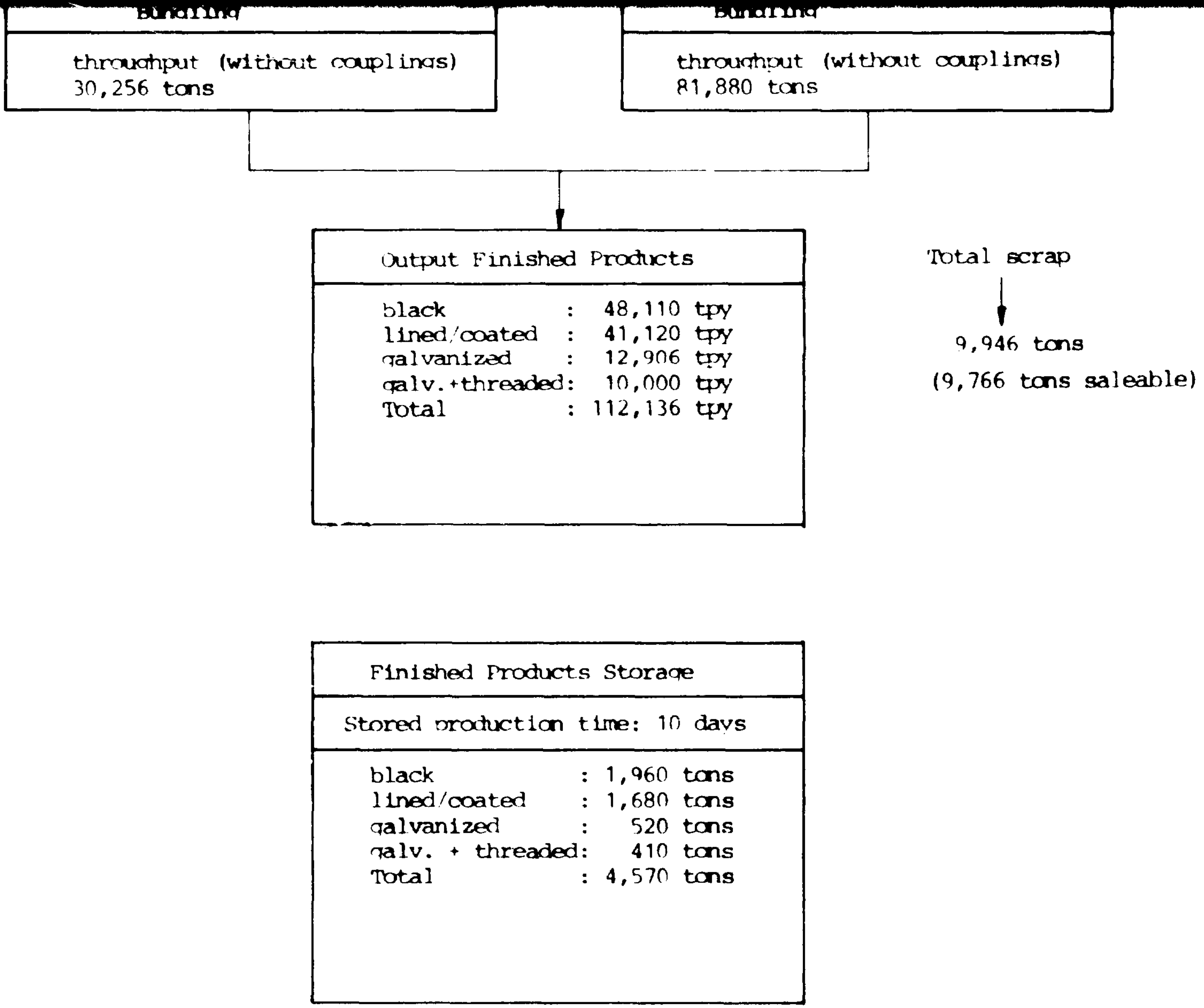
Output Finished Products

black : 48,110 tpy
lined/coated : 41,120 tpy
galvanized : 12,906 tpy
galv.+threaded: 10,000 tpy
Total : 112,136 tpy

Finished Products Storage

Stored production time: 10 days

black : 1,960 tons
lined/coated : 1,680 tons
galvanized : 520 tons
galv. + threaded: 410 tons
Total : 4,570 tons



Bundling

throughput (without couplings)
30,256 tons

Bundling

throughput (without couplings)
81,880 tons

Output Finished Products

black	:	48,110 tpy
lined/coated	:	41,120 tpy
galvanized	:	12,906 tpy
galv.+threaded	:	10,000 tpy
Total	:	112,136 tpy

Total scrap

9,946 tons

(9,766 tons saleable)

Finished Products Storage

Stored production time: 10 days

black	:	1,960 tons
lined/coated	:	1,680 tons
galvanized	:	520 tons
galv. + threaded	:	410 tons
Total	:	4,570 tons

SECTION 5

EBE

PRODUCTION PLANT FOR LONGITUDINALLY WELDED STEEL TUBES ½"-12"
ALTERNATIVE II TABLE I b
FLOW SHEET

1148-002.04

TABLE 2

SUMMARY OF ANNUAL STEEL PIPE DEMAND IN THE RANGE OF 6 INCH TO 12 INCH

		Nominal dia. 300 mm/12 inch				Nominal dia. 250 mm/10 inch				Nominal dia. 200 mm/8 inch			
	Field of Application	black (m/year)	coated lined (m/year)	tube weight (kg/m)	(t/year)	black (m/year)	coated lined (m/year)	tube weight (kg/m)	(t/year)	black (m/year)	coated lined (m/year)	tube weight (kg/m)	(t
2.1	Urban Water Supply	20,000	147,200	43.66	7,300	20,000	7,900	36.69	1,024		154,600	27.20	
2.2	Rural Water Supply												
2.3	Water Supply f.Governm. Bldgs.	2,000		43.66	87	2,000		36.69	73	2,000		27.20	
2.4	Manufact.of Electr.Distr.Posts	178,700		43.66	7,802	12,200		36.69	448	86,700		27.20	
2.5	Irrigation	2,600		34.42	89	1,700		26.29	45		26,700	16.91	
2.6	Ministry of Defence									2,700		27.20	
2.7	Petrochemical Industries Corp.									4,300		27.20	
2.8	Ministry of Mining	1,000	1,000	43.66	87	1,000	1,000	36.69	73	2,000	2,000	27.20	
2.9	Other Users	45,810		43.66	2,000	6,000		36.69	220	36,770		27.20	
		21,580		49.72	1,073	2,700		41.77	113	14,200		33.31	
Total (m/year):		271,690	148,200		18,438	45,600	8,900		1,996	148,670	183,300		
Total (m/year) per dimension:		419,890				54,500				331,970			
Total (t/year):					18,438				1,996				

Nominal dia. 250 mm/10 inch				Nominal dia. 200 mm/8 inch				Nominal dia. 150 mm/6 inch					
black (m/year)	coated lined (m/year)	tube weight (kg/m)	(t/year)	black (m/year)	coated lined (m/year)	tube weight (kg/m)	(t/year)	black (m/year)	coated lined (m/year)	tube weight (kg/m)	(t/year)	Total (m/year)	Total (t/year)
20,000	7,900	36.69	1,024		154,600	27.20	4,205		487,900	19.24	9,387	837,600	21,916
								58,800		19.24	1,131	58,800	1,131
2,000		36.69	73	2,000		27.20	54	2,000	35,000	19.24	712	43,000	926
12,200		36.69	448	86,700		27.20	2,358	1,600		19.24	31	279,200	10,639
1,700		26.29	45		26,700	16.91	451		26,700	12.93	345	57,700	930
				2,700		27.20	73	13,800		19.24	266	16,500	339
				4,300		27.20	117	4,300		19.24	83	8,600	200
1,000	1,000	36.69	73	2,000	2,000	27.20	109	2,000	2,000	19.24	77	12,000	346
6,000		36.69	220	36,770		27.20	1,000	83,160		19.24	1,600	171,740	4,820
2,700		41.77	113	14,200		33.31	473	31,800		25.35	806	70,280	2,465
45,600	8,900		1,996	148,670	183,300		8,840	197,460	551,600		14,438		
54,500				331,970				749,060				1,555,420	
			1,996				8,840				14,438		43,712

TABLE 3

ANNUAL STEEL PIPE DEMAND IN THE RANGE 6 INCH TO 12 INCH BROKEN DOWN INTO BLACK TUBES AND TUBES WITH EXTERNAL AND INTERNAL COATING/LINING FOR INTERNAL DEMAND AND FOR EXPORT

			Internal market demand							Tot
Nominal diameter (inch)	Wall thickness (mm)	Tube weight (kg/m)	black tubes (m/year)	black tubes (tubes/year)	black tubes (t/year)	coated/lined tubes (m/year)	coated/lined tubes (tubes/year)	coated/lined tubes (t/year)	Total (t/year)	black (m/year)
6	3.18	12.93				26,700	2,670	345.2	345.2	
6	4.78	19.24	165,660	16,566	3,187.3	524,900	52,490	10,099.1	13,286.4	310,310
6	6.35	25.35	31,800	3,180	806.1				806.1	59,567
8	3.18	16.91				26,700	2,670	451.5	451.5	
8	5.16	27.20	134,470	13,447	3,657.6	156,600	15,660	4,259.5	7,917.1	251,886
8	6.35	33.31	14,200	1,420	473.0				473.0	26,599
10	3.96	26.29	1,700	170	44.7				44.7	3,184
10	5.56	36.69	41,200	4,120	1,511.6	8,900	890	326.5	1,838.1	77,175
10	6.35	41.77	2,700	270	112.8				112.8	5,058
12	4.37	34.42	2,600	260	89.5				89.5	4,870
12	5.56	43.66	247,510	24,751	10,806.3	148,200	14,820	6,470.4	17,276.7	463,630
12	6.35	49.72	21,580	2,158	1,073.0				1,073.0	40,423
			663,420	66,342	21,761.9	892,000	89,200	21952.2	43,714.1	1,242,702.0

EN DOWN INTO BLACK TUBES AND TUBES WITH EXTERNAL
NAL DEMAND AND FOR EXPORT

market demand				Total output including export						
coated/lined tubes			Total	black tubes			coated/lined tubes			Total
(m/year)	(tubes/year)	(t/year)	(t/year)	(m/year)	(tubes/year)	(t/year)	(m/year)	(tubes/year)	(t/year)	(t/year)
26,700	2,670	345.2	345.2				50,014	5,001	646.7	646.7
524,900	52,490	10,099.1	13,286.4	310,310	31,031	5,970.4	963,230	98,323	18,917.3	24,887.7
			806.1	59,567	5,957	1,510.0				1,510.0
26,700	2,670	451.5	451.5				50,014	5,001	845.7	845.7
156,600	15,660	4,257.5	7,917.1	251,886	25,189	6,851.3	293,339	29,334	7,978.8	14,830.1
			473.0	26,599	2,660	886.0				886.0
			44.7	3,184	318	83.7				83.7
8,900	890	326.5	1,838.1	77,175	7,718	2,831.6	16,671	1,667	611.7	3,443.3
			112.8	5,058	506	211.3				211.3
			89.5	4,870	487	167.6				167.6
148,200	14,820	6,470.4	17,276.7	463,630	46,363	20,242.1	277,605	27,761	12,120.2	32,362.3
			1,073.0	40,423	4,042	2,009.8				2,009.8
892,000	89,200	21952.2	43,714.1	1,242,702.0	124,271.0	40,763.8	1,670,873.0	167,087.0	41,120.4	81,884.2

TABLE 4

PARAMETERS FOR DETERMINATION OF PRODUCTION EQUIPMENT
Production Unit: Strip Slitting Line
Alternative I (6 inch to 12 inch pipe production)

Wall thickness/strip gauge (mm)	Tube nominal diameter (inch)	Outside diameter (mm)	skelp width (mm)	Number of skelps per strip	Theoretical strip/coil width (mm)	Ordered coil width (mm)	Average production end product (t/year)	Average output slitting line (t/year)	Average input slitting line (t/year)	Length of skelp required (m/year)
3.18	6	168.3	516.7	2	1,037.4	1,050	646.2	666	693.0	51,4
4.78	6	168.3	513.7	2	1,027.4	1,050	24,888.9	25,659	26,932.5	1,330,8
6.35	6	168.3	506.8	2	1,017.6	1,050	1.509.8	1,557	1,669.5	61,3
3.18	8	219.1	678.3	1	678.3	690	844.8	871	903.9	51,4
5.16	8	219.1	672.1	1	672.1	690	14,828.1	15,287	16,159.8	561,5
6.35	8	219.1	668.4	1	668.4	690	886.0	913	979.8	27,4
3.96	10	273.0	845.2	1	845.2	860	84.3	87	94.6	3,3
5.56	10	273.0	840.2	1	840.2	860	3,442.9	3,549	3,749.6	96,7
6.35	10	273.0	837.7	1	837.7	860	211.7	218	232.2	5,2
4.37	12	328.8	1,019.2	1	1,019.2	1,030	166.7	172	[illegible].4	4,9
5.56	12	328.8	1,015.5	1	1,015.5	1,030	32,361.0	33,362	34,917.0	752,7
6.35	12	328.8	1,013.0	1	1,013.0	1,030	2009.9	2,072	2,183.6	41,0
Total:							81,880.3	84,412.8	88,700.9	2,988,1

retical p/coil idth mm)	Ordered coil width (mm)	Average production end product (t/year)	Average output slit-ting line (t/year)	Average input slit-ting line (t/year)	Length of skelp required (m/year)	Length of strip required (m/year)	Average slitting speed (m/min.)	Slitting time required (h/year)	Coil weight (tons)	Number of coils required per year	Scrap (t/year)
,037.4	1,050	646.2	666	693.0	51,444	25,722	50	10.7	10.5	66	26.6
,027.4	1,050	24,888.9	25,659	26,932.5	1,330,845	665,423	50	277.3	10.5	2.565	1,273.8
,017.6	1,050	1,509.8	1,557	1,669.5	61,376	30,686	50	12.8	10.5	159	113.0
678.3	690	844.8	871	903.9	51,441	51,441	50	21.4	6.9	131	33.0
672.1	690	14,728.1	15,287	16,159.8	561,598	561,598	50	234.0	6.9	2,342	673.1
668.4	690	886.0	913	979.8	27,413	27,413	50	11.4	6.9	142	66.4
845.2	860	84.3	87	94.6	3,308	3,308	50	1.4	8.6	11	7.7
840.2	860	3,442.9	3,549	3,749.6	96,793	96,793	50	40.3	8.6	436	200.2
837.7	860	211.7	218	232.2	5,225	5,225	50	2.2	8.6	27	14.0
,019.2	1,030	166.7	172	185.4	4,917	4,917	50	2.0	10.3	18	13.5
,015.5	1,030	32,361.0	33,362	34,917.0	752,750	752,750	50	313.6	10.3	3.390	1,555.1
,013.0	1,030	2009.9	2 072	2,183.6	41,032	41,032	50	17.1	10.3	212	111.5
		81,880.3	84,412.8	88,700.9	2,988,143	2,266,310		944.2		9,499	4,288.1

TABLE 4a

PARAMETERS FOR DETERMINATION OF PRODUCTION EQUIPMENT
Production Unit: Strip Slitting Line
Alternative II (1/2 inch through 12 inch pipe production)

Wall thick-ness/strip gauge (mm)	Tube nominal diameter (inch)	Outside diameter (mm)	skelp width (mm)	Number of skelps per strip	Theoretical strip/coil width (mm)	Ordered coil width (mm)	Average production end product (t/year)	Average output slit-ting line (t/year)	Average input slit-ting line (t/year)	Length skelp require (m/year
2.00	1/2	21.0	59.7	18	1,074.6	1,150	2,155.0	2,222	2,392.0	2,363,
2.35	3/4	26.4	75.6	14	1,058.4	1,150	611.0	630	701.5	453,
2.65	3/4	26.6	75.2	14	1,052.8	1,150	1,766.0	1,821	2,024.0	1,167,
2.65	1	33.2	96.0	11	1,056.0	1,120	60.0	62	67.2	30,
2.90	1 1/2	47.8	141.1	8	1,128.8	1,180	260.0	268	295.0	83,
3.25	1	33.4	94.7	11	1,041.7	1,120	3,344.0	3,447	3,763.2	1,424,
3.25	1 1/4	42.2	122.1	9	1,098.9	1,180	1,425.0	1,469	1,604.8	470,
3.25	1 1/2	48.0	140.6	8	1,124.8	1,180	6,138.0	6,328	6,737.8	1,762,
3.65	2	59.8	176.4	6	1,058.4	1,120	3,224.0	3,324	3,584.0	658,
3.65	2 1/2	75.4	225.4	5	1,127.0	1,180	1,510.0	1,557	1,663.8	240,
4.05	3	88.1	264.1	4	1,056.4	1,090	4,318.0	4,452	4,676.1	529,
4.50	4	113.3	341.8	3	1,025.4	1,050	5,445.0	5,613	5,869.5	465,
Subtotal:							30,256.0	31,192	33,378.9	9,650,
3.18	6	168.3	518.7	2	1,037.4	1,050	646.2	666	693.0	51,
4.78	6	168.3	513.7	2	1,027.4	1,050	24,888.9	25,659	26,932.5	1,330,
6.35	6	168.3	508.8	2	1,017.6	1,050	1,509.6	1,557	1,669.5	61,
3.18	8	219.1	678.3	1	678.3	690	844.8	871	903.9	51,
5.16	8	219.1	672.1	1	672.1	690	14,826.1	15,287	16.159.8	561,
6.35	8	219.1	668.4	1	668.4	690	886.0	913	979.8	27,
3.96	10	273.0	845.2	1	845.2	860	84.3	87	94.6	3,
5.56	10	273.0	840.2	1	840.2	860	3,442.9	3,547	3,749.6	96,
6.35	10	273.0	837.7	1	837.7	860	211.7	216	232.2	5,
4.37	12	328.8	1,019.2	1	1,019.2	1,030	166.7	172	185.4	4,
5.56	12	328.8	1,015.5	1	1,015.5	1,030	32,361.0	33,362	34,917.0	752,
6.35	12	328.8	1,013.0	1	1,013.0	1,030	2009.9	2,072	2,183.6	41,
Subtotal:							81,880.3	84,412.8	88,700.9	2,986,
Grandtotal:							112,136.3	115,604.4	122,079.8	12,638,

etical /coil idth m)	Ordered coil width (mm)	Average production end product (t/year)	Average output slitting line (t/year)	Average input slitting line (t/year)	Length of skelp required (m/year)	Length of strip required (m/year)	Average slitting speed (m/min.)	Slitting time required (h/year)	Coil weight (tons)	Number of coils required per year	Scrap (t/year)
074.6	1,150	2,155.0	2,222	2,392.0	2,363,404	131,300	50	109.4	11.5	206	176.4
058.4	1,150	611.0	630	701.5	453,165	32,369	50	27.0	11.5	61	71.6
052.8	1,150	1,766.0	1,821	2,024.0	1,167,051	83,361	50	69.5	11.5	176	203.4
056.0	1,120	60.0	62	67.2	30,950	2,814	50	1.2	11.2	6	5.3
128.8	1,180	260.0	266	295.0	83,489	10,436	50	4.3	11.8	25	27.0
041.7	1,120	3,344.0	3,447	3,763.2	1,424,545	129,504	50	54.0	11.2	336	315.8
098.9	1,180	1,425.0	1,469	1,604.8	470,865	52,318	50	21.8	11.8	136	135.7
124.8	1,180	6,138.0	6,328	6,737.8	1,762,618	220,327	50	91.8	11.8	571	410.0
058.4	1,120	3,224.0	3,324	3,584.0	658,158	109,693	50	45.7	11.2	320	264.3
127.0	1,180	1,510.0	1,557	1,663.8	240,975	48,195	50	20.1	11.8	141	107.1
056.4	1,090	4,318.0	4,452	4,676.1	529,940	132,485	50	55.2	10.9	429	224.6
025.4	1,050	5,445.0	5,613	5,869.5	465,070	155,023	50	64.6	10.5	559	256.1
		30,256.0	31,192	33,378.9	9,650,234	1,107,825		564.6		2,968	2,187.3
037.4	1,050	646.2	666	693.0	51,444	25,722	50	10.7	10.5	66	26.8
027.4	1,050	24,888.9	25,659	26,932.5	1,330,845	665,423	50	277.3	10.5	2,565	1,273.8
017.6	1,050	1,509.8	1,557	1,669.5	61,376	30,688	50	12.8	10.5	159	113.0
678.3	690	844.8	871	903.9	51,441	51,441	50	21.4	6.9	131	33.0
672.1	690	14,828.1	15,287	16,159.8	561,598	561,598	50	234.0	6.9	2,342	873.1
668.4	690	886.0	913	979.8	27,413	27,413	50	11.4	6.9	142	66.4
845.2	860	84.3	87	94.6	3,306	3,306	50	1.4	8.6	11	7.7
840.2	860	[illegible]	3,549	3,749.6	96,793	96,793	50	40.3	8.6	436	200.2
837.7	860	[illegible]	216	232.2	5,225	5,225	50	2.2	8.6	27	14.0
019.2	1,030	166.7	172	185.4	4,917	4,917	50	2.0	10.3	18	13.5
[illegible]	1,030	32,361.0	33,362	34,917.0	752,750	752,750	50	313.6	10.3	3,390	1,555.1
013.0	1,030	2009.9	2,072	2,183.6	41,032	41,032	50	17.1	10.3	212	111.5
		81,880.3	84,412.8	88,700.9	2,988,143	2,266,310		944.2		9,499	4,288.1
		112,136.3	115,604.4	122,079.8	12,638,377	3,374,135		1,508.8		12,467	6,475.4

TABLE 5

PARAMETERS FOR DETERMINATION OF PRODUCTION EQUIPMENT
Production Unit:Tube Welding Plant
Alternative I (6 inch to 12 inch)

Tube Nominal Diameter (inch)	Outside Diameter (mm)	Wall Thickness (mm)	Tube Weight (kg/m)	Average production end product (t/year)	Average output (t/year)	Average input (t/year)	Welding Speed (m/min)	Design Ca pacity pe dimension (ton/hour
6	168.3	3.18	12.93	345	347.8	355.7	39.15	30.374
6	168.3	4.78	19.24	13,287	13,394.2	13,697.9	35.80	41.323
6	168.3	6.35	25.35	806	812.5	830.9	32.44	49.341
8	219.1	3.18	16.91	451	454.6	464.9	34.68	35.184
8	219.1	5.16	27.20	7,916	7,979.6	8,160.6	31.32	51.117
8	219.1	6.35	33.31	473	476.8	487.6	27.97	55.892
10	273.0	3.96	26.29	45	45.4	46.4	27.97	44.113
10	273.0	5.56	36.69	1,838	1,852.8	1,894.8	24.61	54.176
10	273.0	6.35	41.77	113	113.9	116.5	22.37	56.070
12	323.8	4.37	34.42	89	89.7	91.8	19.02	39.273
12	323.8	5.56	43.66	17,276	17,415.3	17,810.3	15.66	41.025
12	323.8	6.35	49.72	1,073	1,081.7	1,106.2	12.30	36.708
				43,712	44,064.5	45,063.8		

Output based on internal market demand

F PRODUCTION EQUIPMENT
Plant
ch)

ess)	Tube Weight (kg/m)	Average production end product (t/year)	Average output (t/year)	Average input (t/year)	Welding Speed (m/min)	Design Capacity per dimension (ton/hour)	(h/year)	Average output (tubes/year)	Average output (t/h)	Avarage output (tubes/h)	Design capacity (tubes/h)	Standard
	12.93	345	347.8	355.7	39.15	30.374	22.9	2,668	0.17	1.30	392	API 5L
	19.24	13,287	13,374.2	13,697.9	35.80	41.323	648.3	69,059	6.55	33.70	358	API 5L
	25.35	806	812.5	830.9	32.44	49.341	32.9	3,179	0.40	1.60	324	API 5L
	16.91	451	454.6	464.9	34.68	35.184	25.8	2,667	0.22	1.30	347	API 5L
	27.20	7,916	7,979.8	8,160.6	31.32	51.117	312.2	29,103	3.90	14.20	313	API 5L
	33.31	473	476.8	487.6	27.97	55.892	17.1	1,420	0.23	0.70	280	API 5L
	26.29	45	45.4	46.4	27.97	44.113	2.1	171	0.02	0.10	280	API 5L
	36.69	1,838	1,852.8	1,894.8	24.61	54.176	68.4	5,010	0.91	2.40	246	API 5L
	41.77	113	113.9	116.5	22.37	56.070	4.1	271	0.06	0.10	224	API 5L
	34.42	89	89.7	91.8	19.02	39.273	4.6	259	0.04	0.10	190	API 5L
	43.66	17,276	17,415.3	17,810.3	15.66	41.025	849.0	39,569	8.51	19.30	157	API 5L
	49.72	1,073	1,081.7	1,106.2	12.30	36.708	58.9	2,158	0.53	1.10	123	API 5L
		43,712	44,064.5	45,063.8			2,046.3	155,534	21.54	75.90		

t demand

TABLE 6

PARAMETERS FOR DETERMINATION OF PRODUCTION EQUIPMENT
Production Unit:Tube Welding Plant
Alternative I (6 inch to 12 inch)

Tube Nominal Diameter (inch)	Outside Diameter (mm)	Wall Thickness (mm)	Tube Weight (kg/m)	Average production end product (t/year)	Average output (t/year)	Average input (t/year)	Welding Speed (m/min)	Design Ca-pacity per dimension (ton/hour)
6	168.3	3.18	12.93	646.2	651.4	666.2	39.15	30.37
6	168.3	4.78	19.24	24,888.9	25,089.6	25,658.7	35.80	41.32
6	168.3	6.35	25.35	1,509.8	1,522.0	1,556.5	32.44	49.34
8	219.1	3.18	16.91	844.8	851.6	870.9	34.68	35.18
8	219.1	5.16	27.20	14,828.1	14,947.7	15,286.7	31.32	51.12
8	219.1	6.35	33.31	886.0	893.1	913.4	27.97	55.89
10	273.0	3.96	26.29	84.3	85.0	86.9	27.97	44.11
10	273.0	5.56	36.69	3,442.9	3,470.7	3,549.4	24.61	54.18
10	273.0	6.35	41.77	211.7	213.4	218.2	22.37	56.07
12	323.8	4.37	34.42	166.7	168.0	171.9	19.02	39.27
12	323.8	5.56	43.66	32,361.0	32,622.0	33,361.9	15.66	41.02
12	323.8	6.35	49.72	2,009.9	2,026.1	2,072.1	12.30	36.71
				81,880.3	82,540.6	84,412.8		

Output based on two-shift (3920 h) operation

ODUCTION EQUIPMENT

Tube Weight (kg/m)	Average production end product (t/year)	Average output (t/year)	Average input (t/year)	Welding Speed (m/min)	Design Capacity per dimension (ton/hour)	(h/year)	Average output (tubes/year)	Average output (t/h)	Average output (tubes/h)	Design capacity (tubes/h)	Standard
12.93	646.2	651.4	666.2	39.15	30.37	42.9	4,998	0.17	1.3	391	API 5L
19.24	24,888.9	25,089.6	25,658.7	35.80	41.32	1,214.4	129,360	6.55	33.7	358	API 5L
25.35	1,509.8	1,522.0	1,556.5	32.44	49.34	61.7	5,956	0.40	1.6	324	API 5L
16.91	844.8	851.6	870.9	34.68	35.18	48.4	4,996	0.22	1.3	347	API 5L
27.20	14,828.1	14,947.7	15,286.7	31.32	51.12	584.8	54,515	3.90	14.2	313	API 5L
33.31	886.0	893.1	913.4	27.97	55.89	32.0	2,660	0.23	0.7	280	API 5L
26.29	84.3	85.0	86.9	27.97	44.11	3.9	321	0.02	0.1	280	API 5L
36.69	3,442.9	3,470.7	3,549.4	24.61	54.13	128.1	9,384	0.91	2.4	246	API 5L
41.77	211.7	213.4	218.2	22.37	56.07	7.6	507	0.06	0.1	224	API 5L
34.42	166.7	168.0	171.9	19.02	39.27	8.6	484	0.04	0.1	190	API 5L
43.66	32,361.0	32,622.0	33,361.9	15.66	41.02	1,590.5	74,120	8.51	19.3	157	API 5L
49.72	2,009.9	2,026.1	2,072.1	12.30	36.71	110.4	4,042	0.53	1.1	123	API 5L
	81,880.3	82,540.6	84,412.8			3.833.3	291,343	21.54	75.9		

operation

TABLE 7

PARAMETERS FOR DETERMINATION OF PRODUCTION EQUIPMENT
Production Unit:Tube Welding Plant
Alternative I (6 inch to 12 inch)

Tube Nominal Diameter (inch)	Outside Diameter (mm)	Wall Thickness (mm)	Tube Weight (kg/m)	Average production end product (t/year)	Average output (t/year)	Average input (t/year)	Welding Speed (m/min)	Design Capacity pe dimension (ton/hour
6	168.3	3.18	12.93	301.2	303.6	310.5	39.15	30.37
6	168.3	4.78	19.24	11,601.9	11,695.5	11,960.7	35.80	41.32
6	168.3	6.35	25.35	703.8	709.5	725.6	32.44	49.34
8	219.1	3.18	16.91	393.8	397.0	406.0	34.68	35.18
8	219.1	5.16	27.20	6,912.1	6,967.8	7,125.9	31.32	51.12
8	219.1	6.35	33.31	413.0	416.3	425.8	27.97	55.89
10	273.0	3.96	26.29	39.3	39.6	40.5	27.97	44.11
10	273.0	5.56	36.69	1,604.9	1,617.8	1,654.5	24.61	54.18
10	273.0	6.35	41.77	98.7	99.5	101.8	22.37	56.07
12	323.8	4.37	34.42	77.7	78.3	80.1	19.02	39.27
12	323.8	5.56	43.66	15,085.0	15,206.7	15,551.5	15.66	41.02
12	323.8	6.35	49.72	936.9	944.5	965.9	12.30	36.71
				38,168.3	38,476.1	39,348.8		

Output destined for export
(difference between 2-shift-operation plant output and internal market demand

PRODUCTION EQUIPMENT
nt
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s Tube Weight (kg/m)	Average production end product (t/year)	Average output (t/year)	Average input (t/year)	Welding Speed (m/min)	Design Capacity per dimension (ton/hour)	(h/year)	Average output (tubes/year)	Average output (t/h)	Average output (tubes/h)	Design capacity (tubes/h)	Standard
12.93	301.2	303.6	310.5	39.15	30.37	20.0	2,329	0.17	1.30	391	API 5L
19.24	11,601.9	11,695.5	11,960.7	35.80	41.32	566.1	60,301	6.55	33.75	358	API 5L
25.35	703.8	709.5	725.6	32.44	49.34	28.8	2,776	0.40	1.55	324	API 5L
16.91	393.8	397.0	406.0	34.68	35.18	22.6	2,329	0.22	1.30	347	API 5L
27.20	6,912.1	6,967.8	7,125.9	31.32	51.12	272.6	25,412	3.90	14.22	313	API 5L
33.31	413.0	416.3	425.8	27.97	55.89	14.9	1,240	0.23	0.69	280	API 5L
26.29	39.3	39.6	40.5	27.97	44.11	1.8	149	0.02	0.08	280	API 5L
36.69	1,604.9	1,617.8	1,654.5	24.61	54.18	59.7	4,374	0.91	2.45	246	API 5L
41.77	98.7	99.5	101.8	22.37	56.07	3.5	236	0.06	0.13	224	API 5L
34.42	77.7	78.3	80.1	19.02	39.27	4.0	226	0.04	0.13	190	API 5L
43.66	15,085.0	15,206.7	15,551.5	15.66	41.02	741.4	34,551	8.51	19.34	157	API 5L
49.72	936.9	944.5	965.9	12.30	36.71	51.5	1,884	0.53	1.05	123	API 5L
	38,168.3	38,476.1	39,348.8			1,786.9	135,807	21.54	76.0		

ation plant output and internal market demand

TABLE 8

PARAMETERS FOR DETERMINATION OF PRODUCTION EQUIPMENT
Production Unit: Tube Welding Plant (1/2 inch to 4 inch)

Tube Nominal Diameter (inch)	Outside Diameter (mm)	Wall Thickness (mm)	Tube Weight (kg/m)	Welding Speed (m/min)	Design Capacity per dimension (ton/hour)	(h/year)	Average production end product (t/year)	Average input (t/year)	Avera outp (t/ye
1/2	21.0	2.00	0.95	80	4.570	681.838	2,155	2,222	2
3/4	26.6	2.65	1.58	80	7.584	336.686	1,766	1,821	1
3/4	26.4	2.35	1.42	90	7.668	115.210	611	630	
1	33.4	3.25	2.44	76	11.126	434.581	3,344	3,447	3
1	33.2	2.65	2.01	85	10.251	8.459	60	62	
1 1/4	42.1	3.25	3.14	64	12.058	170.876	1,425	1,469	1
1 1/2	48.0	3.25	3.61	56	12.130	731.669	6.138	6,328	6
1 1/2	47.8	2.90	3.25	65	12.675	29.665	260	268	
2	59.8	3.65	5.10	48	14.688	317.383	3,224	3,324	3
2 1/2	75.4	3.65	6.51	40	15.624	139.739	1,510	1,557	1
3	88.1	4.05	8.47	36	16.295	341.264	4,318	4,452	4
4	113.3	4.50	12.10	32	23.232	338.886	5,445	5,613	5
						3,646.256	30,256	31,192	30

Output based on assumed market demand

ION EQUIPMENT
/2 inch to 4 inch)

Welding Speed (m/min)	Design Capacity per dimension (ton/hour)	(h/year)	Average production end product (t/year)	Average input (t/year)	Average output (t/year)	Average output (tubes/year)	Average output (t/h)	Average output (tubes/h)	Design capacity (tubes/h)	Standard
80	4.570	681.838	2,155	2,222	2.181	381,863	0.60	104.7	800	B.S. light
80	7.584	336.686	1,766	1,821	1,787	188,544	0.49	51.7	800	B.S. medium
90	7.668	115.210	611	630	618	72,582	0.17	19.9	900	B.S. light
76	11.126	434.581	3,344	3,447	3,385	231,189	0.93	63.4	760	B.S. medium
85	10.251	8.459	60	62	61	5,033	0.02	1.4	850	B.S. light
64	12.058	170.876	1,425	1,469	1,442	76,555	0.40	21.0	640	B.S. medium
56	12.130	731.669	6,138	6,328	6,213	286,824	1.70	78.7	560	B.S. medium
65	12.675	29.665	260	268	263	13,497	0.07	3.7	650	B.S. light
48	14.688	317.383	3,224	3,324	3,263	106,641	0.89	29.2	480	B.S. medium
40	15.624	139.739	1,510	1,557	1,528	39,127	0.42	10.7	400	B.S. medium
36	18.295	341.264	4,318	4,452	4,370	85,998	1.20	23.6	360	B.S. medium
32	23.232	338.886	5,445	5,613	5,511	75,910	1.51	20.8	320	B.S. medium
		3,646.256	30,256	31,192	30,623	1,563,763	8.40	428.8		

TABLE 9

PARAMETERS FOR DETERMINATION OF PRODUCTION EQUIPMENT AND MATERIAL COST ZINC

Production Unit:Tube Galvanizing Plant

Tube Nominal Diameter (inch)	Outside Diameter (mm)	Wall Thickness (mm)	Tube Weight (kg/m)	Demand end prod. (t/year)	Design capacity (t/h)	Design capacity (tubes/h)	Surface area (sqm/ton)	zinc coat (g/sqm)	zinc coat (kg/ton steel)	Zinc yield (88%) (t/year)	Zinc input (100%) (t/year)
1/2	21.1	2.65	1.22	1,856	5	653.1	95.02	450	42.76	79.4	90.2
3/4	26.6	2.65	1.58	1,390	5	527.4	95.24	450	42.86	59.6	67.7
1	33.4	3.25	2.44	2,620	5	341.5	77.64	450	34.94	91.5	104.0
1 1/4	42.1	3.25	3.14	691	5	265.4	77.74	450	34.98	24.2	27.5
1 1/2	48.0	3.25	3.61	5,465	5	230.8	77.89	450	35.05	191.5	217.6
2	59.8	3.65	5.10	2,111	5	163.4	69.18	450	31.13	65.7	74.7
2 1/2	75.4	3.65	6.51	1,432	5	128.0	69.25	450	31.16	44.6	50.7
3	88.1	4.05	8.47	3,565	5	98.4	62.35	450	28.06	100.0	113.6
4	113.3	4.50	12.10	3,775	5	68.9	56.50	450	25.43	96.0	109.1
				22,905						752.5	855.1

Rates used for the cost calculation:

- zinc price : US$ 647.-/ton (Jan.29,1986)
- zinc ash bonus: US$ 216.-/ton

TERIAL COST ZINC

esign pacity bes/h)	Surface area (sqm/ton)	zinc coat (g/sqm)	zinc coat (kg/ton steel)	Zinc yield (88%) (t/year)	Zinc input (100%) (t/year)	Remaining zinc ash (12%) (t/year)	Gross output steel+zinc (t/year)	Zinc input cost (US$/year)	Credit for zinc ash (US$/year)	Total zinc cost (US$/year)
683.1	95.02	450	42.76	79.4	90.2	10.8	1,935.4	58,359	2,333	56,027
527.4	95.24	450	42.86	59.6	67.7	8.1	1,449.6	43,802	1,750	42,052
341.5	77.64	450	34.94	91.5	104.0	12.5	2,711.5	67,288	2,700	64,588
265.4	77.74	450	34.98	24.2	27.5	3.3	715.2	17,793	713	17,080
230.8	77.89	450	35.05	191.5	217.6	26.1	5,656.5	140,787	5,638	135,150
163.4	69.18	450	31.13	65.7	74.7	9.0	2,176.7	48,331	1,944	46,387
128.0	69.25	450	31.16	44.6	50.7	6.1	1,476.6	32,803	1,318	31,485
98.4	62.35	450	28.06	100.0	113.6	13.6	3,665.0	73,499	2,938	70,562
68.9	56.50	450	25.43	96.0	109.1	13.1	3,871.0	70,588	2,830	67,758
				752.5	855.1	102.6	23,657.5	553,250	22,162	531,088

Table 10 Time Utilization of Equipment

Equipment	Utilization Factor % *)	Production Hours per Year *)	Shifts per Day **)	Plant Alt.
Slitting	80 %	944	1	I
	80 %	1,508	1	II
Welding: 0.5" to 4"	70 %	3,646	2	II
4" to 12"	50 %	3,833	2	I, II
Cement Inner Lining 6" to 12"	75 %	4,410	3	I, II
Sand Blasting 6" to 12"	82 %	5,880	3	I, II
Bituminization 6" to 12"	85 %	5,880	3	I, II
Galvanizing 0.5" to 4"	85 %	5,390	3	II

*) considering programme changes, scheduled maintenance and unscheduled break-downs and repairs

**) 1 shift = 1,960 h/year,
2 shifts = 3,920 h/year,
3 shifts = 5,880 h/year

CHAPTER IV

MATERIALS AND INPUTS

Materials and Inputs

All the intermediate, auxiliary, additives and maintenance materials have been calculated and presented in chart form for the two possible plant configurations; the same applies to utilities.

Steel Coils

By far, the major input material for a welded steel pipe plant is flat steel delivered in coil form.

There is an extremely wide range of steel coil qualities and thickness available on the international steel market at varying prices.

The selection of which grade or quality of steel to be used in the pipe plant is pre-determined by the type of pipe to be produced its's diameter and in some instances its ultimate application.

In determining the selection of coils, amounts and setting up the procurement and delivery schedules the major parameters are specifically set out by the plant's scheduled production programme over a given specific future time span and is directly influenced by the known local and/or export sales orders and expectations.

For both, Alternatives I and II a detailed listing of the plant's initial production programme(s) together with the quantities, standards and gauges of input steel required to fulfill the production programme(s) is provided.

Since there are no steel coils produced in Burma it will be necessary for the pipe plant to operate using imported coils. Such coils can be readily purchased from a wide choice of countries and sources including Japan, Korea, Australia, Italy, Germany, England and Brazil.

In processing the coils into pipes there is a scrap or process loss rate of approximately 10% by weight from the original coil weight. Since the production capacity is planned to produce 82,000 tonnes of pipes per annum in the beginning the total tonnage of coils to be imported per year is approx. 90,000 tonnes (Alternative I).

The storage yard and input crane capacities have been set to allow for a maximum individual coil weight of approximately 12 tonnes. The total number of coils to be imported would therefore be 7,500 p.a.

To guard against adverse conditions the plant's storage yard should maintain a coil stock sufficient for 45 days uninterrupted production, approximately 940 coils.

Depending upon which countries the coils are purchased from and the respective transportation times to Burma, detailed procurement and supply programmes have to be closely worked out and adhered too.

It can safely be assumed that from the actual placement of an order to purchase coils until delivery of the first coils to the plant's storage yard will take between 3 and 4 months.

The two methods of coil procurement are either the placement of a single yearly combined order for the entire tonnage or smaller independent orders placed throughout the year.

The combined method has the advantage that the delivery schedule can be negotiated and agreed upon at the time of purchase.

Since the delivery schedule is part of the supply contract shipments could be arranged to be received every 30 days at the plant.

The first delivery would therefore be 7,500 t of reserve stock of working material. The rest of the year's requirements would follow in 11 shipments of 5,250 tonnes each (Alternative I, production 70%).

The main advantages of placing smaller lot coil orders are that there is generally a good chance to get price reductions or discounts at the time of purchase and secondly the orders can be divided among several suppliers and/or countries. This method also allows for more flexibility in plant operations since it allows the manager to alter his production programme by changing input material during the year to meet or take advantage of new, revised or unexpected market conditions.

The critical part of this method is that of the long lead times required from preparing individual purchase orders to actual delivery to plant site; namely 4 to 5 months.

In view of Burma's planned economic system and a review of Burmese procurement practices it can be said that the yearly single combined order procedure will prove to be the most satisfactory mode-of-operation for steel coil purchases and the only one which will ensure uninterrupted operations of the pipe plant.

Auxiliary Materials

Emulsion

Emulsion is a soluble oil used as a lubricant and coolant for the sheet steel as it is fed into the pipe forming and welding machines.

Emulsions consist of water combined with a 3-5 percent addition of either palm, cottonseed, rapeseed or other organic oil stabilized with an amine.

For Alternative I approximately 80 m^3/h are needed to pass through the circuit. The yearly consumption rate is 170 m^3 of oil.

For Alternative II approximately 225 m^3/h are needed for the system with a yearly consumption rate of 280 m^3 of oil.

Such emulsions are available from the local Burmese market.

Hydraulic Oil

Alternative I requires 1,500 kg of hydraulic oil per year for the coil slitting line, the tube line and the tube finishing line.

Alternative II requires 2,000 kg per annum for the slitter, tube line, tube finishing line and coating lines.

Hydraulic oils are available from local market sources.

Lube Oil

Alternative I consumes 1,000 kg/yr,
Alternative II consumes 1,500 kg/yr.

Lube Grease

Alternative I consumes 410 kg/yr,
Alternative II consumes 750 kg/yr.

Water Treatment Chemicals

Alternative I consumes 265 l/yr,
Alternative II consumes 300 l/yr.

Plant Utilities and Energy

Electricity

Alternative I requires 2,200,000 kWh.
Alternative II requires 3,500,000 kWh.

Water

Alternative I consumes 15 m^3/h of water at 6 bar,
Alternative II consumes 22 m^3/h of water at 6 bar.

Compressed air

Alternative I consumes 850 m^3/h of compressed air at 6 bar
Alternative II consumes 2,500 m^3/h of compressed air at 6 bar.

Fuel gas

Alternative I consumes 40 m^3/h,
Alternative II consumes 290 m^3/h.

Galvanizing Process (alternative II)

Zinc

As the main ingredient used in the galvanizing process zinc is required for plant alternative II for coating the smaller diameter pipes.

Since galvanized pipes are the most widely used small diameter pipes for water systems and other applications where a strong rust inhibitor is required the production programme calculates that 22,900 tonnes of the small dia. pipe will be galvanized, consuming 855 tonnes of zinc (incl. losses).

The quality requirement is "Prime Western Zinc" as per DIN 1706; 99.9% zn.

Even though zinc occurs as a natural mineral in Burma the zinc requirements of the plant cannot be covered from local sources since there are no facilities available to convert the zinc concentrate into the high grade refined zinc required for the galvanizing process.

Zinc, like steel coils would therefore have to be purchased on the international metals market and imported into the country. It is delivered in the form of small 25 kg ingots stacked on pallets.

Since the amount of zinc required for the plant is comparatively small, 855 tpy, it should also be purchased on a single yearly order basis and delivered in a single load.

Degreasing Agent

The pipe is thoroughly cleaned by washing in a water solution of caustic soda to remove all traces of oil and grease prior to the pickling process.

The quantity required per annum for the designated production programme is 142 tonnes. The material is locally available in Burma from indigenous sources.

HCl

The pickling solution consists of a dilute (33%) hydrochloric acid solution with an inhibiting agent to remove all rust and mill scale.

The quantities required per annum are 30 kg/t of galvanized pipe, 710 tonnes. HCl is available from local sources within the country.

Lime $Ca(OH)_2$

The spent pickling acid solution is neutralized by the addition of lime to it.

The plant's yearly lime requirements for this application is 6 kg/t or 142 tonnes. Lime is available on the local market.

Flux (Borax)

After emerging from the pickling solution and a fresh clean water bath the pipes are submerged in a flux to protect the cleaned surfaces from rusting in the atmosphere and to neutralize any remaining acid traces.

Borax or similar fluxing agents (zinc ammonium chloride), are available from local sources.

The yearly flux requirement is approximately 100 tonnes.

Internal and External Lining Plant

Part of the larger diameter pipes will be internally lined with cement and/or externally coated with bitumen. Alternative I and II will require 2,260 tonnes of cement, 4,510 t of sand, 4,410 t of bitumen and 835,000 m^2 of cotton tape.

Although cement and cotton tape are available from local sources the bitumen will have to be imported.

Bitumen is available on the international market delivered in 50 kg hard paper drums. Due to the relatively small amount required the purchase would be conducted on a yearly basis for the entire lot to be delivered in a single load.

Prices

Prices of local materials were obtained in Burma.

For steel basic prices were obtained through international steel traders.

For secondary materials and consumables international prices were obtained from various sources and from international market publications.

Schedule 4-1/1 Estimate of production costs: materials and inputs

ESTIMATE OF PRODUCTION COST 100% capacity

Materials and inputs, price basis 1986,

Project component: Large dia. Pipe Plant Alternative I

No.	Quantity per year	Unit	Item Description	Origin Lo-cal	 Foreign	Unit Cost US$	Cost per ye Foreign	 Lo
1.			Raw materials (a)					
	88,705		Steel coils	No	Yes	257	22,825	
	2,260	t	Cement	Yes	No	45	-	10
	4,510	t	Sand	Yes	No	10	-	4
	4,410	t	Bitumen	No	Yes	344	1,517	1
	835,000	m^2	Cotton tape	Yes	No	0.4	-	33
	Subtotal		Raw materials (a)	-	-	-	**24,342**	**49**
2.			Paw materials (b)					
	170	m^3	Emulsion oil	Yes	No	923	-	15
	1,500	kg	Hydraulic oil	Yes	No	0.60	-	
	1,000	kg	Lube oil	Yes	No	1.10	-	
	410	kg	Lube grease	Yes	No	2.20	-	
	lumpsum		Water treatment chemicals	No	Yes	55	14.5	
	Subtotal		Raw materials (b)	-	-	-	**14.5**	**15**
3.			Utilities					
		m^3/hr	Water (6 bar)	Yes	No	included in	electrical	en
		m^3/hr	Compressed air (6 bar)	Yes	No	"	"	"
4.			Energy					
	2,200,000**	kWh	Electricity	Yes	No	0.016	-	3
	140,000	m^3	Fuel gas	Yes	No	0.01		
	Subtotal		Energy	-	-	-	-	3
5.			Spare parts/tools	Yes	Yes	-	**280**	3
6.			Administration (non labour cost)					
	lumpsum		Office supplies	Yes	Yes	-	23	1
	lumpsum		Telecommunication	Yes	No	-	-	2
	lumpsum		Training	Yes	Yes	-	20	1
	Subtotal		Administration (non labour cost)		-	-	43	4
				Total			**24,679.5**	**76**

* Local transportation costs - sales revenue for scrap = 0 ** Installed capacity x 0.6 x

materials and inputs

Alternative I

Origin		Unit Cost US$	Cost per year: 1,000 US$		
Local	Foreign		Foreign	Local	Total
No	Yes	257	22,825	0*	22,825
Yes	No	45	-	101.7	101.7
Yes	No	10	-	45.1	45.1
No	Yes	344	1,517	10	1,527
Yes	No	0.4	-	334	334
-	**-**	**-**	**24,342**	**490.8**	**24,832.8**
Yes	No	923	-	157	157
Yes	No	0.60	-	0.9	0.9
Yes	No	1.10	-	1.1	1.1
Yes	No	2.20	-	0.9	0.9
No	Yes	55	14.5	-	14.5
-	-	-	**14.5**	**159.9**	**174.4**
Yes	No	included in electrical energy costs			
Yes	No	"	"	"	"
Yes	No	0.016	-	35.2	35.2
Yes	No	0.01		1.4	1.4
-	-	-	-	**36.6**	**36.6**
Yes	Yes	-	**280**	**31.5**	**311.5**
labour cost)					
Yes	Yes	-	23	10	33
Yes	No	-	-	24	24
Yes	Yes	-	20	10	30
labour cost)	-	-	43	44	87
Total			**24,679.5**	**762.8**	**25,442.3**

for scrap = 0 ** Installed capacity x 0.6 x production hours

Schedule 4-1/2 Estimate of production costs: materials and inputs

ESTIMATE OF PRODUCTION COST 100% capacity

Materials and inputs price basis 1986

Project component: Large dia. pipe + small dia. pipe plant Alternative II

No.	Quantity/yr	Unit	Item Description	Origin		Unit Cost US$	Cost per year:1	
				Local	Foreign		Foreign	Loc
1.			Raw Materials (a)					
	122,083	t	Steel coils	No	Yes	260	31,742	0
	1,168,750	Pcs.	Threaded sleeves	No	Yes	0.73	854	1
	1,168,750	Pcs.	Plastic caps	Yes	No	0.21	-	244
	2,260	t	Cement	Yes	No	45	-	101
	4,510	t	Sand	Yes	No	10	-	45
	4,410	t	Bitumen	No	Yes	344	1,517	10
	835,000	m^2	Cotton tape	Yes	No	0.4	-	334
	855	t	Zinc	No	Yes	647	553	2
	Subtotal		Raw materials (a)	-	-	-	**34,666**	**737**
2.			Raw Materials (b)					
	142	t	Degreasing agent P3 (caustic soda)	Yes	Yes	891	127	-
	710	Ton	Hydrochloric acid (33%)	Yes	Yes	217	-	154
	100	Ton	Flux (Borax or Zn/ NH_4CI)	Yes	Yes	890	89	-
	142	Ton	Lime $Ca(OH)_2$	Yes	Yes	93	-	13
	280	m^3	Emulsion oil	Yes	Yes	923	-	258
	2,000	kg	Hydraulic oil	Yes	Yes	0.57	-	1.1
	1,500	kg	Lube oil	Yes	Yes	1.14	-	1.7
	750	kg	Lube grease	Yes	Yes	2.28	-	1.7
	lumpsum	1	Water treatment chemicals	No	Yes	55	16.5	-
	Subtotal		Raw materials (b)	-	-	-	**232.5**	**429**

* Local transportation costs - sales revenue for scrap = 0

materials and inputs

. pipe plant Alternative II

Origin		Unit Cost US$	Cost per year:1,000 x US$		
Lo-cal	Foreign		Foreign	Local	Total
No	Yes	260	31,742	0 *	31,742
No	Yes	0.73	854	1	855
Yes	No	0.21	-	244	244
Yes	No	45	-	101.7	101.7
Yes	No	10	-	45.1	45.1
No	Yes	344	1,517	10	1,527
Yes	No	0.4	-	334	334
No	Yes	647	553	2	555
-	**-**	**-**	**34,666**	**737.8**	**35,403.8**
Yes	Yes	891	127	-	127
Yes	Yes	217	-	154	154
Yes	Yes	890	89	-	89
Yes	Yes	93	-	13	13
Yes	Yes	923	-	258	258
Yes	Yes	0.57	-	1.1	1.1
Yes	Yes	1.14	-	1.7	1.7
Yes	Yes	2.28	-	1.7	1.7
No	Yes	55	16.5	-	16.5
-	**-**	**-**	**232.5**	**429.5**	**662**

r scrap = 0

Schedule 4-1/2 Estimate of production costs: materials and inputs

ESTIMATE OF PRODUCTION COST 100% capacity

Materials and inputs price basis 1986

Project component: Large dia. pipe + small dia. pipe plant Alternative II

No.	Quantity/yr	Unit	Item Description	Origin Local	 Foreign	Unit Cost US$	Cost per year: 1 Foreign	 Loca
3.			Utilities					
		m^3/hr	Water (6 bar)	Yes	No	included in electrical ener		
		m^3/hr	Compressed air (6 bar)	Yes	No	"	" "	"
4.			Energy					
	3,500,000	kWh	Electricity	Yes	No	0.016	-	56
	1,000,000	m^3	Fuel gas	Yes	No	0.01	-	10
	Subtotal		Energy	-	-	-	-	**66**
5.			Spare Parts/Tools	Yes	Yes	-	457	31
6.			Administration (non labour cost)					
	lumpsum		Office supplies	Yes	Yes	-	23	11
	lumpsum		Telecommunication	Yes	No	-	-	24
	lumpsum		Training	Yes	yes	-	29	10
	Subtotal		Administration (non labour cost)			-	**52**	**45**
			Total				**34,407.5**	**1,309.3**

materials and inputs

. pipe plant Alternative II

Origin		Unit Cost US$	Cost per year: 1,000 x US$		
Lo-cal	Foreign		Foreign	Local	Total
Yes	No	included in electrical energy costs			
Yes	No	" " " " "			
Yes	No	0.016	-	56	56
Yes	No	0.01	-	10	10
-	-	-	-	**66**	**66**
Yes	Yes	-	457	31	488
abour cost)					
Yes	Yes	-	23	11	34
Yes	No	-	-	24	24
Yes	yes	-	29	10	39
abour cost)		-	**52**	**45**	**97**
			34,407.5	**1,309.3**	**36,716.8**

Schedule 4-2/1 Summary sheet-production cost: materials and inputs

SUMMARY SHEET - PRODUCTION COST

Materials and inputs, price basis 1986 | Alternative I

Project component: Large dia. pipe plant | Production cost x 1,000 US$

No.	Description	Foreign	Local	Total
1.	Raw materials (a)	24,342	490.8	24,832.8
2.	Raw materials (b)	14.5	159.9	174.4
3.	Utilities	included in energy costs		
4.	Energy	-	36.6	36.6
5.	Spare parts / tools	280	31.5	311.5
6.	Administration (non labour costs)	43	44	87
	Total	24,679.5	762.8	25,442.3

Schedule 4-2/2 Summary sheet-production cost: materials and inputs

SUMMARY SHEET - PRODUCTION COST				
	Materials and inputs, price basis 1986		Alternative II	
	Project component Pipe Plant for pipes with dias 1/2"-12"		Production cost x 1,000 US$	
No.	Description	Foreign	Local	Total
1.	Raw materials (a)	34,666	737.8	35,403.8
2.	Raw materials (b)	232.5	429.5	662
3.	Utilities	included in energy costs		
4.	Energy	-	66	66
5.	Spare parts / tools	457	31	488
6.	Administration (non labour costs)	52	45	97
	Total	35,407.5	1,309.3	36,716.8

CHAPTER V

LOCATION AND SITE

GENERAL

Introduction

The purpose of this chapter is to present in detail the investigations conducted in evaluating locations for a suitable site for the welded steel pipe plant. The investigations' guidelines were determined by careful consideration of the criteria contained herein and which entail technical, economic, social and environmental requirements.

Most of the criteria used in the selection of a location for industrial plants of this nature is by its very nature conflicting to some degree. It follows that the emphasis given and the importance attached to individual criteria must therefore in the final anaysis be the result of sound judgement and past experience. Furthermore, the final location must therefore often be something of a compromise to select the site which best fulfills the total requirements.

Criteria for Investigation

The basic criteria for selecting a site for the plant were considered to be the following:

- Sufficient area
- economic access for raw materials to the site
- Availability of electrical power, water, oil and/or gas
- Economic considerations
- Adequate distribution system for the finished products to all parts of the country and abroad.

There are also other factors of lesser importance which must be considered in the final selection of the most suitable site, but the above were chosen as having the highest priority and the most significant influence.

In examining sites the following parameters were considered:

- Location, terrain, topography and soil conditions
- Available ports; their condition and suitability to handle materials for the plant
- Access roads, railroads and waterways
- Utilities
- Manpower availability
- Environmental pollution impact.

Additional requirements were put forward and evaluated by the Consultant during the initial site surveys. These requirements were as follows:

Location with due regard to:

- Any existing master planning of the State Government and/or Local authority
- Rights of way of utilities and existing/future road networks.
- Social effects.

These extra requirements do not in any way clash with the previously stated criteria or main aims.

It is clear that the sites chosen as worthy of further investigation should not include any which were part of, or infringed in any way upon, land already designated for other development under existing long range plans.

Rights of ways of utilities and existing or future road networks were deemed to mean previously granted permission to run natural gas pipelines or roads over any of the sites. It was ascertained that none of the sites were included in development of this kind either now or in the forseeable future.

The effect that a pipe plant would have on the social life of the area was also considered. This included encroachment on agricultural land and established villages as well as the availability of manpower.

Plant Requirements

Land Area

The main facilities of the proposed welded pipe plant which will take up to between 15 and 20% of the land requirement are covered areas and consist of:

- Production facilities
- Auxiliary and storage buildings
- Offices, social amenities etc.

The remainder of the space requirements are taken up by open storage areas, disposal area, roads and parking areas and an allowance for further expansion.

A tentative preliminary layout of the plant to establish the required area is shown in drawings 1148-001.01 and 1148-001.02.

The minimum area requirement is at least 165 metres by 330 metres and is assumed to be of even geometric shape.

Although the plant can tolerate some minor difference in elevation, it is preferable that the production facilities are located on level ground. The main reason for this is that the overhead cranes which operate over the full area of the production facilities require a continuous and unstepped elevation.

For obvious reasons a site which is free from natural flooding is required. Natural hollows and declevities which occured in an otherwise satisfactory site area would obviously have to be filled to prevent retention of rain or flood water. The requirement that the site be free from flooding is therefore important to achieve a saving on initial site preparation work. Further, a low water table level is also preferable but not manditory.

Infrastructure

In common with any major industrial project a minimum level of infrastructure is required and obviously the more services that are readily available at any given location the less the capital investment required for development. Hence an already industrialized location for the site is more favoured than an under developed area. Each type of project requires certain items of infastructure unique to itself. For the pipe manufacturing plant these consist of:

Electrical Power Supply

It is essential for the pipe plant to have a constant and reliable power supply. Depending upon the finally chosen plant configuration the installed electrical capacity will be 1,750 kW for alternative I and 2,600 kW for alternative II at a frequency of 50 Hz.

Burma has a reasonable power supply network. Map 5.05 shows the present situation and proposed extension and the power generating points already in existance.

Fuel Supply

The pipe plant requires a fuel supply for heating of bitumen and in addition for alternative II for the galvanizing furnace and the related heating furnaces. The maximum hourly demand of gas for heating purposes of alternative I will amount to 40 m^3n/hour and for alternative II to 390 m^3n/hour.

The fuel supply can take the form of gas or fuel oil. Gas is the obvious choice as it is a cleaner fuel than oil and is also much easier to handle. However, when the necessary pipeline supply system is not within easy reach of the plant site (resulting in heavy investment costs for pipeline and booster station, etc.) then oil supply with all its encumbent disadvantages (transport by road or rail; installation of handling and storage facilities; added pollution problems) can be substituted.

Water supply

The pipe plant requires a supply of industrial water. Its main uses are:

- Production equipment cooling water
- Toilets
- Wash down

A supply of potable water is also required for personnel use:

- Canteens and/or cooking facilities
- Medical facilities
- Drinking fountains
- Showers

The industrial water is recirculated where possible. Fresh water, properly treated, is then only required as make-up to compensate losses due to

- Evaporation
- Leakage
- Spray losses

The industrial water supply for plant use will generally be closed circuits. Such systems are in the long term more economic than an open system, although initial capital costs may be higher.

Total water demand will vary between 15 m³/hr for alternative I and 22 m³/hr for alternative II. Water demand will increase however, as the production capacity goes up from mainly two to full three shift operation.

The minimum acceptable level for industrial water would be:

Total dissolved solids	max. 1,000 ppm
Cl (Chlorides)	max. 500 ppm
Ca (Calcium)	max. 60 ppm
Lime ($CaCO_3$)	max. 50 ppm
Temperature	max. 35° C

Whilst the potable water analysis would be required to meet WHO standards.

Waste disposal

A suitable means of disposing of liquid effluent will be necessary and also, but to a lesser extent dumps are required for solid waste. Finally an outlet for steel scrap would be advantageous.

Transportation

Suitable means of transportation are required. Any one of road, rail or waterway systems, or best a combination of the three would be acceptable. In general transportation is important in three situations.

- Movement of plant equipment, building materials and construction equipment during the construction period. At this time special problems are often thrown up where a single very large item of equipment has to be brought to the site. Consequently the better and more varied the transport system is the easier it is to solve these problems.

- Movement of locally obtained input materials to site and dispatch of finished products and scrap to local markets. In this case any of the above mentioned alternative will suffice, but where all three are available then this allows for the most economic and/or practical method of transport to be chosen.

- Movement of imported input materials to site and export of finished products to foreign markets. For the pipe plant project this means easy access to suitable port facilities.

Manpower

In evaluating sites for major industrial complexes attention must be given to the indigenous manpower availability and the existing social environmental conditions prevailing in the areas.

To staff the labour force it is preferable that the area can fill these positions from the local population. If the local indigenous population has a sufficient number of industrially skilled personnel or people who can quickly acquire the necessary skills under intense training programs, they will have a more active and positive appreciation of the plant. A second and even more important advantage is that in locations close to existing centers of population much of the support infrastructure required such as housing, schools, shopping facilities and social amenities is already available and well established. Also in developed areas small engineering companies, work shops and services are already established and can often be used to mutual advantage by the planned industrial development.

Pre-Selection of Sites

For the purpose of this study the Industrial Planning Department of the Ministry of No. 1 Industry had pre-selected two sites

Shwedaung (Pegu Division)

Shwedaung is situated on the Rangoon - Prome road; 274 km north of Rangoon and 13 km south of Prome. The actual pre-selected site is 8 km SW of Shwedaung, 1.5 km SW of the village of Mayaman (Shwe Nattaung) Ywama, Insein (Rangoon Division)

Ywama is situated approx. 15 km north of Rangoon, at the Hliang River and adjacent to the NW part of the ring railroad which leads around Rangoon and its suburbs.

SHWEDAUNG

Location and Site

The pre-selected site is SSW of Shwedaung near the small village of Mayaman (Shwe Nattaung).

The area south and west of Shwedaung is generally flat. In the middle of this plain is a chain of low-lying hills. The pre-selected plant site is located on a slightly elevated area at the foot of the hills, about 50 m above the plain.

The site is presently covered with light scrub (which disturbs the free clear view). The area is cut by several gullies caused by erosion and appears to be generally sloping towards the plain. The soil appears to be clay, silt, sand and gravel of "recent origin".

The area would require site clearance and extensive levelling (cutting of tops, filling of gullies and general levelling of the slope).

Due to the lack of better information the soil test results of the Shwedaung textile factory can be taken for information. Soil bearing capacity there is approx. 1 kg/cm². At the pre-selected site, soil properties should be similar. We do not expect that piling will be necessary. However, to ascertain this assumption a sub-soil survey must be made before tendering. This survey must include investigations for subsoil water in order to define location, size and depth of future wells for the water supply of the proposed plant.

In order to find a favourable location within the pre-selected area a geodetical survey with partial bush clearing will also be essential. This must be made before the sub-soil survey.

Since the property is in the possession of the Government there would be no real estate charges for the usage of the land.

For housing of company staff sufficient additional area is available.

Climate

The climate at Shwedaung is similar to that at Rangoon. However, maximum temperatures are slightly higher, minimum temperatures are slightly lower and also precipitation is lower.

Climate information for Shwedaung and Rangoon and Mandalay is shown in the annexed tables.(Shwedaung is located approx. half way between Rangoon and Mandalay)

Main Utilities and Energy

Electric

As part of the national grid the Electric Power Corporation (E.P.C.) has a turbine driven power station 3 km north of Shwedaung.

The plant has three (3) gas turbines

3 x 18.45 MW = 55.35 MW

At present the actual output is 20 to 25 MW, peak 30 MW produced by two turbines.

Main users are (source EPC):

Kyaw Zwa Fertilizer Plant	17 MW
Shwedaung Spinning and Weaving Plant	2 MW
Pumping Irrigation (future)	4 MW
Shwedaung Textile Finishing (future)	2-3 MW

For power transmission to Rangoon a 132 kV line is available and a 230 kW transmission line is under construction.

Our field team was informed that the power supply was reliable and that power was available for the proposed pipe plant. To supply electricity to the pre-selected site 11.5 km of 11 kV overhead line will be needed and 11 kV switch gear at the Shwedaung power station.

Gas

Fuel is needed for bitumen coating of pipe in plant alternative I and in addition for galvanizing and related heating furnaces for plant alternative II. The most ideal fuel for this purpose is natural gas. We were informed that it is planned to also bring other industries to the pre-selected site. For this reason the proximity of gas wells should be utilized and gas be taken as fuel, for both alternatives.

Gas is gathered from producing wells south of Shwedaung 11 km from the power plant and 7 km from the pre-selected site at a well head pressure of 600 to 700 p.s.i. The power plant is supplied by a 10" gas pipe line through a 400 p.s.i. reducing station.

To supply natural gas to the pre-selected site a 7 km gas pipe line is needed along with a reducing and metering station.

The gas has a calorific value of 900 Btu/cu.ft.

Water

The Shwedaung textile mill receives its water supply from the Irrawaddy river. The water has to be purified and pumped from the river to the textile mill.

Our field team noticed a lot of wells in the low land around the village of Mayaman all of which had a high water level (approx. 2 m below ground).

We therefore assume that the plant can receive its water from wells. Wells should be drilled in the low land at the foot of the hills close to the plant site. This will reduce cost of pumping and purification treatment and will avoid the cost of constructing a water intake building and 10 km of water line (from plant to the Irrawaddy).

The sub-soil investigation (mentioned before), which will be made before tendering, must also include investigations on location, quantity and quality of sub-soil water.

Drilling of at least two (2) wells and water treatment is included in the cost of the plant, although wells will be outside the plant's fence.

For connection of these wells to the pre-selected plant site a 6" pipe line is needed, assumed length 350 m

Waste Disposal

Water and Sewage

After treating the spent process waters and sewage to meet internationally acceptable purification norms the waste waters can be discharged directly into one of the small streams near the pre-selected plant site. Connecting open ditches are assumed to have a length of 1,500 m.

Solid Waste

The proposed plant generates general industrial and social refuse, which must be disposed of by burning and dumping into allocated tips.

The major waste product of such a plant is top grade steel scrap from the slitting and welding line. The scrap is collected and transported for sale to the steel melt shop at Ywama, Insein where it is considered as a high quality furnace charging material.

Plant alternative I also generates cement and mortar fragments from the internal lining process. This can be used as landfill material.

Plant alternative II generates in addition wastes from the pickling, galvanizing and neutralization process.

Emissions

Since the major fuel source for the heating furnaces would be a sweet natural gas there would be only very minute emissions from the plant. It is not expected that the emissions would require any type of treatment prior to discharge into the atmosphere.

Transport Facilities

Railway

The Burmese railway system is based on a 1000 mm gauge. The country's railway network consists of a main NS running line traversing almost the entire length of the country. It starts in the north at Myitkyina, approx. 600 km north of Mandalay. At Mandalay there are several branch lines to Namtu and Lashio in the central east and Yen and Myingyan in the central western part of the country. The line continues on down to Rangoon and farther south to Ye.

A separate single track line which runs between Rangoon and Prome passes within 300 m of the Ywama steel mill. (Ywama steel mill will receive steel scrap from the proposed pipe plant) and passes (20 km south of Prome) within 20 km of the pre-selected "Shwedaung" site.

This line has branches to the western region of the country as far as Kyangin and to the southwest as far down as Bassein.

Waggons have a capacity of 18 and 30 tonnes.

The 1985 "Report to the Pyithu Hluttaw" gives the following information for the 1984/85 status of Burma Railways Corporation:

Steam locomotives	123
Diesel locomotives	223
Carriages	1,251
Waggons	8,402
Stations	479
Track miles	2,774

The rail network offers a possibility of transport from Prome to Rangoon harbour and to the major centers of the country and this for raw materials as well as for finished pipe products. All efforts, administrative and technical, must be made to make full use of this ideal means of transport.

It will not be economically justifiable to build a branch railroad to the pre-selected site (cost for this will be in the range of US$ 4,000,000.-). Prome should be used as railroad terminal and transport between Prome and the plant would be by truck.

Cost of railway transport are:
Source: Burma Railways Corporation (February, 1986)

Rangoon to Prome	259 km
Siding per waggon and day	K 250.-
per 1000 kg (K 1.30 per 100 viss)	K 47.16
per waggon of 30 t capacity	K 1,437.-

For rail transport the trans-shipment facilities at Prome must be improved and a new 25 t mobile crane must be bought.

Roads

Burma has an extensive road network which connects all important places in the country. Main roads are generally without potholes but often very uneven and not of uniform width. There are no by-pass roads; roads pass through villages and towns.

The road between Shwedaung and Rangoon can be used by vehicles with a total weight up to 10 tonnes (Several bridges are marked accordingly). This is not sufficient for transport of raw material to the proposed plant. Steel coils have a weight of up to 12 tonnes per piece. Transport of this kind is however possible between Shwedaung and Prome, but this road should be improved.

The road between Shwedaung and Mayaman (6.5 km) is designed only for light traffic. It is only 2 meters wide and badly asphalted. The road crosses approx. 10 water channels/streams. This road must be built new tc meet the requirements of the proposed pipe plant.

Between Mayaman and the pre-selected plant site is a track (1.5 km) which leads through hilly terrain. This track must also be replaced by a new road.

Daily hire cost for road vehicles are as follows:

Truck 3 t capacity	K/day 250.-
Truck 10 t capacity	K/day 750.-
Truck 40 t capacity	K/day 1,775.-

Water Transport

All imports and exports to and from the proposed pipe plant will go through Rangoon harbour. This refers to

- plant equipment bought abroad
- raw materials (sheet coils, bitumen and for plant alternative II also zinc)
- finished products (pipe) for export.

The heavy port crane at Rangoon port has a nominal lifting capacity of 40 tonnes. This capacity is however, limited to 25 tonnes. The crane can be used for sheet coils (12 tonnes). For unloading and loading of other materials which weigh less several other cranes are available.

Transport between Rangoon harbour and the proposed plant can be by rail, road or barge.

The pre-selected plant site is 10 km from the Irrawaddy River and 21 km from Prome, the nearest existing river station.

Raw material (12 tonnes sheet coils) are too heavy for trans-shipment at Prome. Only finished products (pipe) can be loaded there on river boats.

Considering the cost of hired boats (K/day 1,800.-for a boat with 150 tonnes capacity) river transport only for finished products will in general not be feasible.

Housing of Personnel

The pre-selected site is located far away from any major community (8 km from Shwedaung and 21 km from Prome).
The surrounding area is purely agricultural. The closest industry is the new textile mills at Shwedaung and the Shwedaung power plant.

It will not be possible to hire a substantial part of the work force from persons at present living in the vicinity of the plant.

Top and middle class management comming from other places will find difficulties living near the plant; their children will have school problems and their working wives will not easily find good jobs at this location.

To cope with these problems it will be essential that the plant will have excellent housing facilities for all management levels and for other key personnel.

Bus services for personnel and their facilities must be organized.

We propose that the following facilities would be necessary:

	Area per Buildg. m^2	No. of Buildgs. Plant Alternative I	II
guest house, club	300	1	1
nursery, youth centre	180	1	1
houses for management	110	7	7
houses for middle management	90	8	10
houses for specialists	60	10	20

Manpower

It will not be possible to recruit personnel in the immediate vicinity of the proposed plant site.

The nearest place for recruitment will be Shwedaung. As Shwedaung is not an industrial town only untrained personnel can be expected from there.

Trained personnel and personnel with basic knowledge in steel processing will come mainly from Rangoon.

To attract these personnel the proposed plan must offer very good housing facilities and other social amenities.

Shwedaung

Proposed plant site

YWAMA, INSEIN

Location and Site

The pre-selected site is an open space situated at the NW corner of the steel mill and is bounded on the NE by the Rangoon-Prome and the Rangoon ring railroad lines, on the SW and NW by a laterite road and a permanent dike fronting along the Hlaing River. The location is situated 16 km upstream from the Rangoon harbour and 20 km by road.

The site is completely flat. It is rectangular in shape; the long axis being 550 m and the short axis is 200 m.

The site is reported to be free from flooding. The actual site survey will probably indicate that some minor earth fillings and soil exchange are necessary during site preparation.

The site, like most other locations in the general vicinity, can be geologically classified as Irrawaddian Deposits.

The soil testing and sub-surface investigations together with the experience gained from constructing the steel mill indicate that for the production halls and the heavy equipment concrete piling will be required. These would be concrete piles 350 x 350 mm, 16 m long with a load capacity of 50 t/pile. The soil bearing capacity for light buildings and structures is 0.5 kg/cm^2 and piling would not be required.

The Research and Soil Testing Laboratories, Construction Corporation. Kamakyi Road, Thuwunna conducted a sub-surface investigation at the steel mill site in May 1984 (see table 5.16)

Although the data is quite extensive it is recommended that additional subsoil investigations should be undertaken at the exact site prior to start of civil design. These investigations should include tests for quality and quantity of subsoil water. The information as presented is sufficient, however, for tendering purposes.

The site is free of major fauna so there is no need for tree or bush clearing.

Since the property is in the possession of the Government there would be no real estate charges for the use of the land.

North of the proposed construction site further land can be made available for housing of company staff.

Climate

The climate is a tropical rain (monsoon) climate without cool season. January is the coolest month with an average min. temperature of 18.3°C. The dry season is so short that the soil humidity gained during the rainy months permits the growth of tropical rain forest.

Main Utilities

Electric

As part of the Rangoon grid the Electric Power Corporation (E.P.C.) has a turbine driven powerstation at Ywama with the following installed power capacities:

Oil fired steam turbines	3 x 10 MW =	30 MW
Gas turbines	2 x 18 MW =	36 MW
		66 MW

The power plant is located approx. 900 m from the pre-selected pipe plant site. It presently supplies the steel mill via an underground cable and a 11 kV overhead line. At present the steel mill supply voltage is being changed to 33 kV and for this purpose two (2) 15 MVA transformers (33/11 kV) are being installed. After the extension work at the mill is completed it will have a connected load of 20 MW.

It is envisaged that this substation would also supply the pipe mill by extending the 11 kV switchgear. Information from field indicates that the electrical supply is reliable and sufficient for the proposed pipe plant.

The power line from the steel mill's substation to the proposed pipe plant should be approx. 500 m long (200 m underground cable, 300 m overhead line).

Gas

Fuel is needed for bitumen coating of pipe for plant alternative I and in addition for the plant alternative II for galvanizing and related heating furnaces. The ideal type of fuel is natural gas.

Gas is gathered from producing wells in the delta area. A gas station is located a few kilometers north of Ywama. From there a 6" and a 10" gas pipeline extends parallel to the Ywama site along the NW and SW borders. The E.P.C. power station is supplied by the 10" line through a 400 p.s.i. reducing station. The 6" line supplies the existing steel plant through a 75 p.s.i. reducing station.

The field team was informed that the 6" line has sufficient capacity to also feed the pipe plant.

The gas has a calorific value of 900 Btu/cu.ft. Field reports indicate that the gas supply is reliable.

Water

The steel mill receives its water supply from 3 gravel packed 12" tube wells. Each well is equipped with a 114 m^3/hr (25,000 gal/hr) capacity turbine pump. The mill presently operates 2 wells at 60 to 80% pump capacity. The 3rd well will be put into production with completion of the renovation programme and the start-up of the new facilities.

If a sufficient reserve capacity is still available the pipe plant could draw its water needs from this same source requiring approx. 350 m of pipeline to be laid. If not, a new tube well could be sunk in the immediate vicinity of the pipe plant.

Water samples taken from a tube well situated at the Bran Oil Mill, Ywama approx. 4 km distant from the site have the following analysis:

Sample Water Analysis

RESULT

Sample No.		382/85-36
Total Solids	(p.p.m.)	135.00
Dissolved Solids	"	125.00
Temporary Hardness as $CaCO_3$		"
Permanent Hardness as $CaCO_3$		"
Total Hardness as $CaCO_3$	"	50.00
Alkalinity as $CaCO_3$	"	58.00
Calcium as Ca	"	9.80
Magnesium as Mg	"	6.60
Potassium as K	"	5.00
Sodium as Na	"	25.00
Chloride as Cl	"	13.20
Sulphates as SO_4	"	2.00
Soluble Iron as Fe	"	0.35

Soluble Silica as SiO_2	"	15.00
Sediment	"	10.00
Carbon Dioxide as CO_2	"	0.00
Lead Content as Pb	"	N.D.
Turbidity	"	smaller 20
Oxygen Consumed	"	1.20
Arsenic as As	"	N.D.
Dissolved Oxygen	"	6.80
True Color	(Pt. Unit)	5.00
Taste and Odour		Pleasant
pH Value		7.15

p.p.m. = parts per million.
N.D. = Not Detected

Method/Equipment used: Standard methods for the examination of water and sewage. 8th Edition. (A.P.H.A.).

It can be assumed that the water analysis from the above location would be quite similar to Ywama due to their close proximity and similar geology.

The analysis results indicate that such well water could be used in the pipe plant without any great treatment outlays.

Before tendering the raw water quality from the wells of the steel plant must be analysed. Further information will be obtained from the subsoil investigation.

Waste Disposal

Water and Sewage

After treating the spent process waters and sewage to meet internationally acceptable purification norms the waste waters can be discharged directly into the adjacent Hlaing River. At the plant site the river is approx. 1000 m wide and has a surface flow speed of 10 km/hr during the dry season and at least double that during the wet season.

Solid Waste

The proposed plant generates general industrial and social refuse, which must be disposed of by burning and dumping into allocated tips.

The major waste product of such a plant is top grade steel scrap from the slitting and welding line. The scrap is collected and sold to the near-by steel melt shop where it is considered as a high quality furnace charging material.

Plant alternative I also generates hard cement and mortar fragments from the internal lining process. This can be used as landfill material.

Plant alternative II generates in addition wastes from the pickling, galvanizing and neutralization process.

Emissions

Since the major fuel source for the heating furnaces would be a sweet natural gas there would be only very minute emissions from the plant. It is not expected that the emissions would require any type of treatment prior to discharge into the atmosphere.

Transport Facilities

Railway

The Burmese railway system is based on a 1000 mm gauge. The country's railway network consists of a main NS running line traversing almost the entire length of the country. Itstarts in the north at Myitkyina, approx. 600 km north of

Mandalay. At Mandalay there are several branchlines to Namtu and Lashio in the central east and Yen and Myingyan in the central western part of the country. The line continues on down to Rangoon and farther south to Ye.

A separate single track line which runs between Rangoon and Prome passes within 300 m of the pre-selected Ywama site. This line has branches to the western region of the country as far as Kyangin and to the southwest as far down as Bassein. It has side spurs off to the existing steel mill. At the Ywama area the line is part of the ring railroad which leads around Rangoon and to the Rangoon port area.

Waggons have a capacity of 18 and 30 tonnes.

The 1985 "Report to the Pyithu Hluttaw" gives the following information for the 1984/85 status of Burma Railways Corporation:

Steam locomotives	123
Diesel locomotives	223
Carriages	1,251
Waggons	8,402
Stations	479
Track miles	2,774

The rail network offers an ideal mode of transport to Rangoon harbour and to the major centers of the country and this for raw materials as well as for finished pipe products. In addition the Rangoon ring railroad, of which the railroad line at the plant is a part, is a convenient means of transport for personnel.

The Ywama steel mill at present does not make use of rail transport although the plant is connected to the network.

We think however that the railroad is the ideal mode of transportation for

- raw materials
- finished products
- personnel

All efforts - administrative and technical - must be made to make full use of this ideal means of transport. The proposed pipe plant must have a railroad connection.

Cost of railway transport are:
(Source: Burma Railways Corporation, February 1986)

Rangoon harbour to Ywama, Insein	32 km
Siding per waggon and day	K 250
per 1000 kg (K 1.30 per 100 viss)	K 7.96
per waggon of 30 t capacity	K 243

Roads

Burma has an extensive road network which connects all important places in the country. The roads around Rangoon are generally without potholes but often uneven and not of uniform width. There are no by-pass roads; roads pass through villages and towns. Traffic around Rangoon and Insein is dense. Loads up to 45 tonnes have been transported by road between Rangoon and Ywama. Daily hire cost for road vehicles are as follows:

Truck, 3 t capacity	K/day 250.-
Truck, 10 t capacity	K/day 750.-
Truck, 40 t capacity	K/day 1,775.-

Transport per tonne Rangoon harbour to Ywama K/t 18.25

Bearing in mind the above situation we recommend to use road traffic for the needs of the proposed plant as little as possible. The location close to river and railroad are an advantage of this location, which must be utilized.

For certain urgent transportation of goods and persons the road connection of the pre-selected site is however indispensable.

The road network surrounding the plant is sufficient for this purpose. The connection of the pre-selected site to this network will make it necessary to improve the existing laterite road between the pre-selected site and the main road (900 m).

Furthermore a new road should be built to the steel plant jetty (150 m).

Water Transport

All import and exports to and from the proposed pipe plant will go through Rangoon harbour. This refers to

- plant equipment bought abroad
- raw materials (sheet coils, bitumen and for plant alternative II also zinc.)
- finished products (pipe) for export.

The heavy port crane at Rangoon port has a nominal lifting capacity of 40 tonnes. This capacity is however, limited to 25 tonnes. The crane can be used for sheet coils (12 tonnes). For unloading and loading of other materials which weigh less several other cranes are available.

Transport between Rangoon harbour and the proposed plant can be by rail, road or barge.

The pre-selected plant site is located at the Hlaing River. The river is navigable and connects the site with Rangoon and its harbour.

The nearby concrete pipe mill uses the river for transport of cement. The Ywama steel mill makes no use of river transport. The steel mill has however a jetty for a capacity of 5 tonnes.

For transport of raw materials (coils) the proposed pipe plant would need a jetty with a capacity of 25 tonnes. The jetty of the steel plant can however be used for transport of finished pipe.

According to information from the Inland Water Transport Corporation the hiring charge of a barge with 150 tonnes capacity is K/day 1,800.-.

In future water transport might become feasible if a heavy landing jetty is built jointly with the steel plant and one or two boats are also acquired and run jointly.

At present we recommend to use, whenever feasible, the steel plant jetty for transport of finished goods. The needs of the proposed pipe plant alone do not justify construction of a new heavy jetty and acquisition of a 25 tonnes crane.

Housing of Personnel

The pre-selected location Ywama is part of the town of Insein. It is located immediately at the Rangoon ring railroad.

In Insein we find industry, agriculture and housing areas with schools (e.g. Government Technical Institute).

The work force for the proposed plant can be hired in Insein and in other communities along the ring rail-road. Special company housing will only be needed for top and middle management. Housing for this category will ensure that the company can recruit top people and that these persons are available for the company in emergencies at short notice and can also be contacted outside normal working hours.

We propose that 13 houses and a guest house will be built in a common compound. This is for both cases, plant alternative I and alternative II. The houses should be built at an early stage so that they will be available already during construction and commissioning period for the personnel of the contractor.

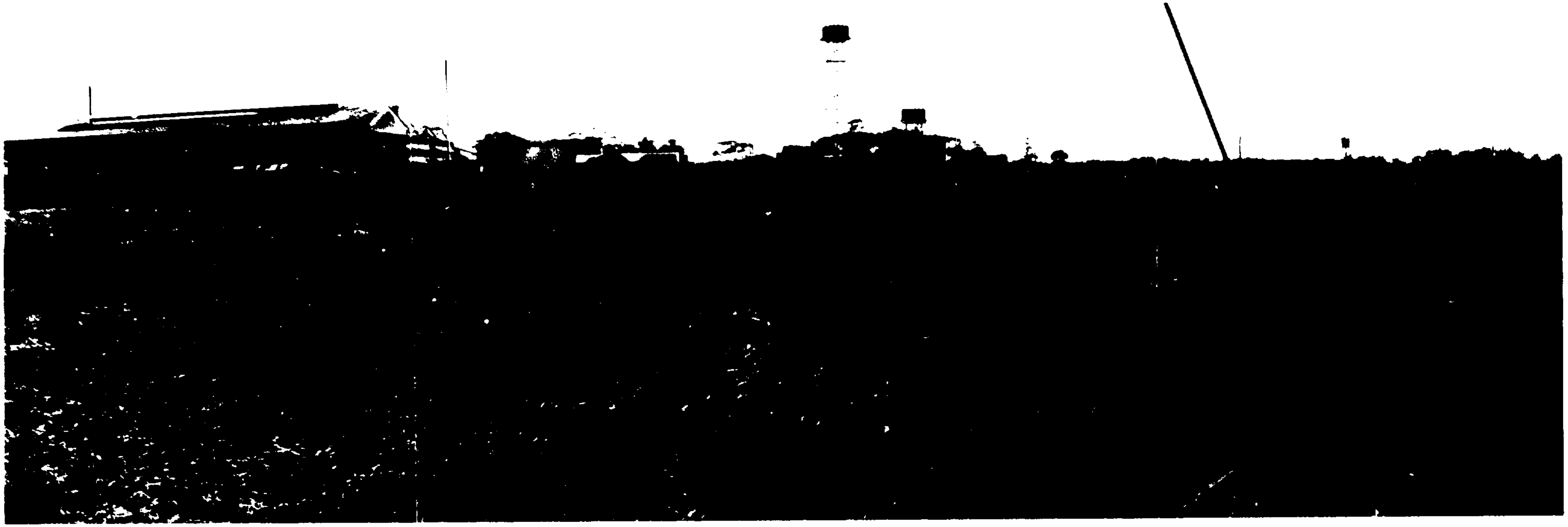
Manpower

Ywama/Insein is located in a densely populated area. The capital Ranggon and its industrial suburbs can easily be reached by road or by train.

Industry and people used to working in industry are at Insein and in the entire region. From there it will easily be possible to recruit personnel for all levels, who will need a minimum of additional training.

An additional advantage of this location is the neighbourhood of the Ywama Steel Mill. New personnel for the proposed pipe plant can be trained there; good young personnel from the steel mill can be transfered to the pipe plant to take higher positions due to their previous experience.

At a certain stage an administrative and technical connection of the two steel based manufacturing plants may be possible. Such a connection would increase productivity and reduce unproductive cost.



Ywama - Insein

Foreground - proposed plant site. Left background - Ywama-Steel Mill

Viewed from NORTH-EAST

Ywama - Insein

River back adjacent proposed plant site and Ywama-Steel Mill
Viewed from NORTH

CONCLUSION

The previous subchapters show a clear advantage in favour of the pre-selected location Ywama, Insein.

Investment for Infrastructure

Investment costs for infrastructure for plant alternative I are:

	million US$ local		foreign	=	total
Shwedaung	4.2	+	1.2	=	5.4
Ywama	0.8	+	0.1	=	0.9

Transport

Despite large investments for infrastructure the Shwedaung site will still have several disadvantages: It will have no direct railroad connection and it can never have a direct access to the river.

The proposed plant will depend on imported raw materials (sheet coils, bitumen, zinc) and will depend on export of a substantial part of its production. Both imported raw materials and exports of pipe will be through Rangoon sea harbour. Also inland sales will have its center at Rangoon.

Cost of transport of raw materials from Rangoon harbour to plant site and cost of transport of finished pipe back to Rangoon harbour are as follows:

		K per tonne
by railroad Rangoon harbour to Prome		
1 day siding, 18 t wagon		
K 250 x 1/18		13.89
transport per tonne		47.16
transshipment at Prome		6.--
by road Prome - plant site		
K 750/10/4		18.75
Rangoon harbour to Shwedaung plant site	K/t	85.80
	US$/t	11.07

		K per tonne
by railroad Rangoon harbour to plant site		
1 day siding, 18 t wagon		
K 250 x 1/18		13.89
transport per tonne		7.96
Rangoon harbour to Ywama plant site	K/t	21.85
	US$/t	2.82

This means that exported pipe from Shwedaung will be more expensive per tonne by
2(11.07-2.82) = US$/t 16.50

The same refers to pipe locally sold in Rangoon region.

Manpower

The higher infrastructure cost for Shwedaung only considers additional housing for specialised labour. The lower grades of labour will however, have to come from Shwedaung -Prome. For them a longer training time on the job must be expected which will result in lower productivity and higher technical assistance cost during the first year of operation.

Energy

Our site team was informed that at both sites sufficient energy (electricity, gas) was available.

However, it must be stated that Shwedaung is closer to gas fields, which are the original source of energy. Building the plant at Shwedaung would mean no additional load on the gas and electricity supply of Rangoon. But this would be the only advantage of the Shwedaung site.

Cost of Construction

It can be expected that foundations at Shwedaung site will need no piling, which will reduce investment cost. However, Shwedaung will also have extra cost compared with Ywama. These extra costs will be for levelling the site. Labour cost for construction at Shwedaung will be lower. But as cost of construction materials are higher total cost of civil works will be 5% to 10% higher at Shwedaung.

In total it can be said that cost of civil works will be the same at both sites.

Cost of equipment and structural steel will however be higher due to additional cost for transport from Rangoon harbour.

Summary

Considering the clear advantages of the pre-selected Ywama site further investigation, layouts and cost analysis were made only for this loaction.

Annex

MAP LEGEND

TABLE 5.01

●	Pre-selected Site Locations
(A)	Shwedaung - Pegu Division
(B)	Ywama, Insein -Rangoon Division

⚒	Coal
▲	Oil
⏢	Shale Oil
△	Gas
—•—	Pipeline
Ⓢb	Antimony
Pb	Lead
Ⓔ	Precious Stones
Fe	Iron
Au	Gold
HE	Semi-precious stones
Cu	Copper
Mn	Manganese
Mo	Molybdenum
Ni	Nickel
Sa	Salt
Ag	Silver
Ⓤ	Uranium
Ⓦ	Tungsten
Zn	Zinc
Sn	Tin

🏭	Oil-Refinery
🏭	Steel-Melting Shop
E	Non Ferrous-Melting Shop
C	Chemical Industry
H	Wood Industry
N	Food Industry
Nz	Sugar Factory
P	Paper production
T	Textile Industry
Z	Cement factory
⊠	Water Power-Station
⚡	Thermal Power-Station

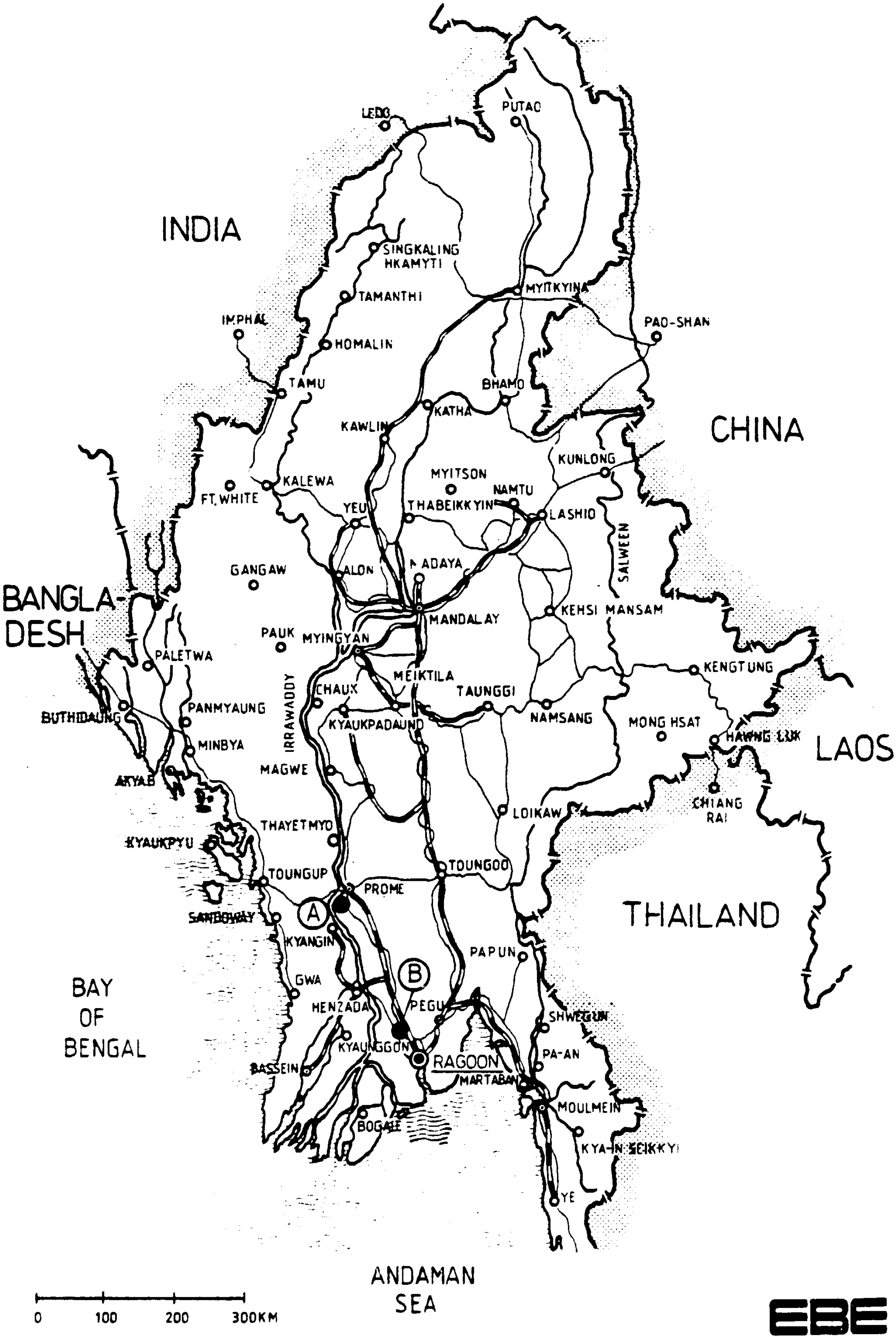
⊙	Cities with more than 100.000 population
○	Cities
▬	Railways
—	Roads

~	River
┴┴┴	Canal
←⚓	Start of navigable channel
⚓	Seaport
✈	Airport (international)
✈	Airport (national)

SOCIALIST REPUBLIC OF THE UNION OF BURMA

MAJOR TOWNS

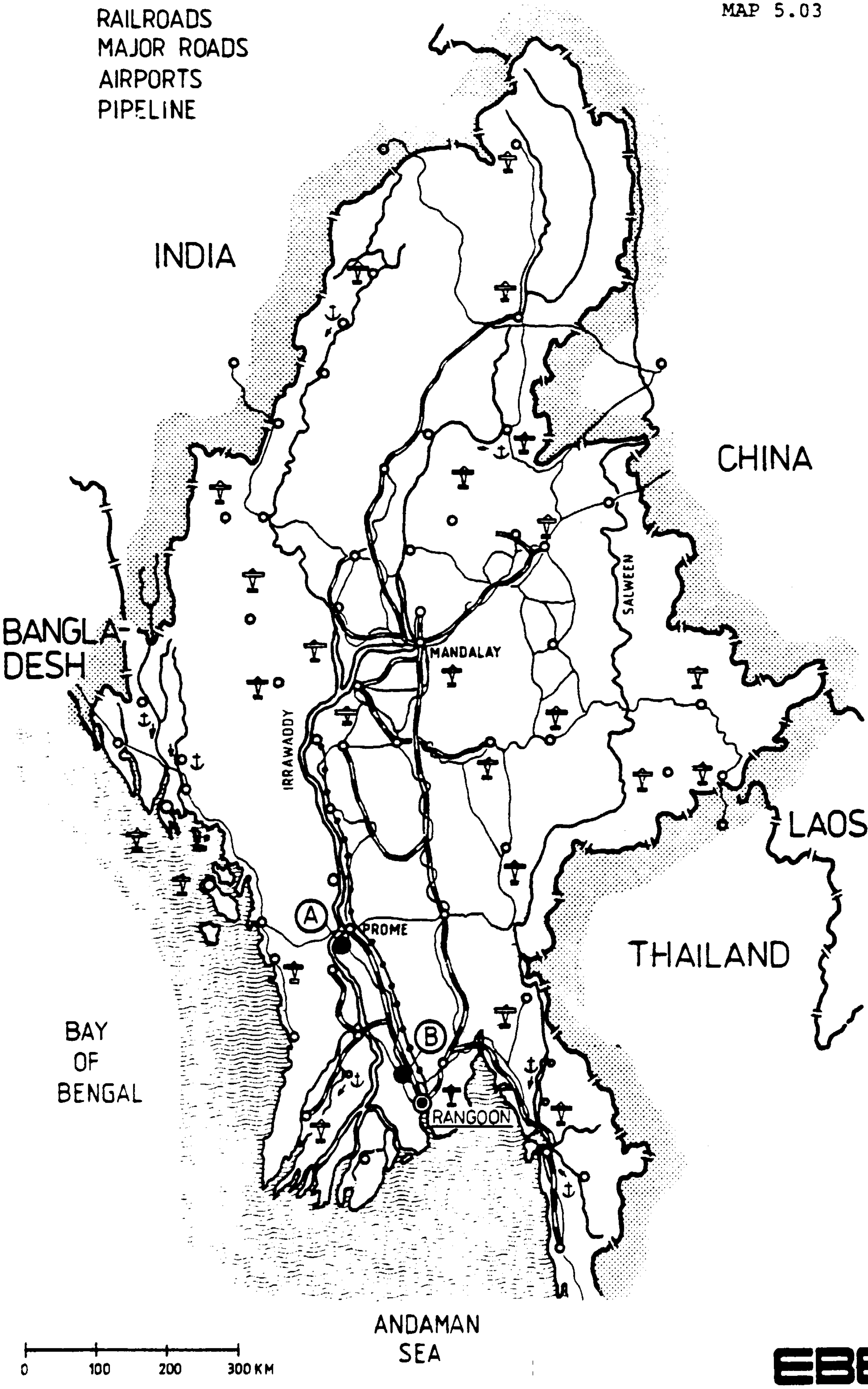
MAP 5.02



SOCIALIST REPUBLIC OF THE UNION OF BURMA

RIVERS
RAILROADS
MAJOR ROADS
AIRPORTS
PIPELINE

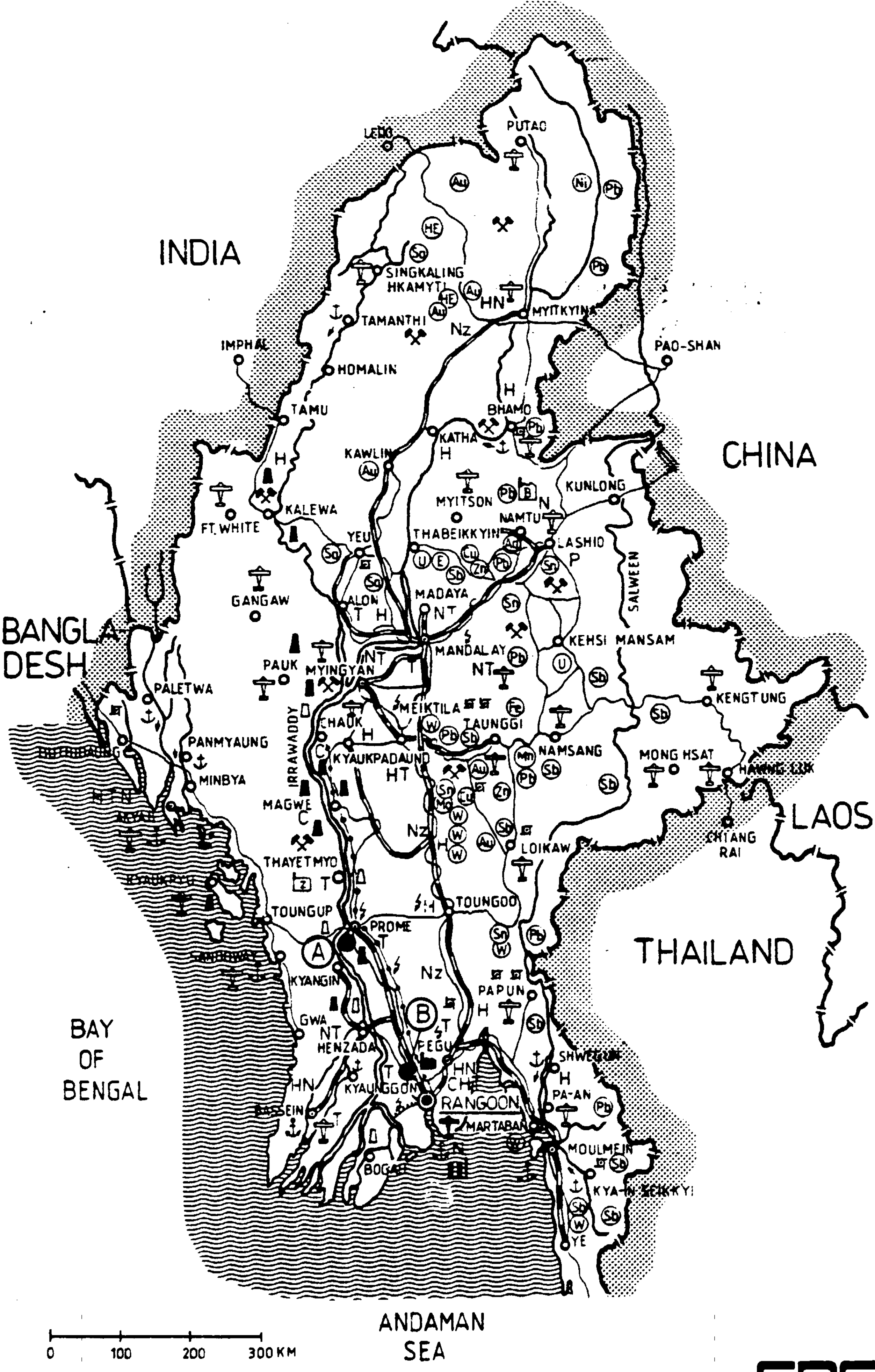
MAP 5.03



SOCIALIST REPUBLIC OF THE UNION OF BURMA

NATURAL RESOURCES

MAP 5.04



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ELECTRIC TRANSMISSION GRID

MAP 5.05

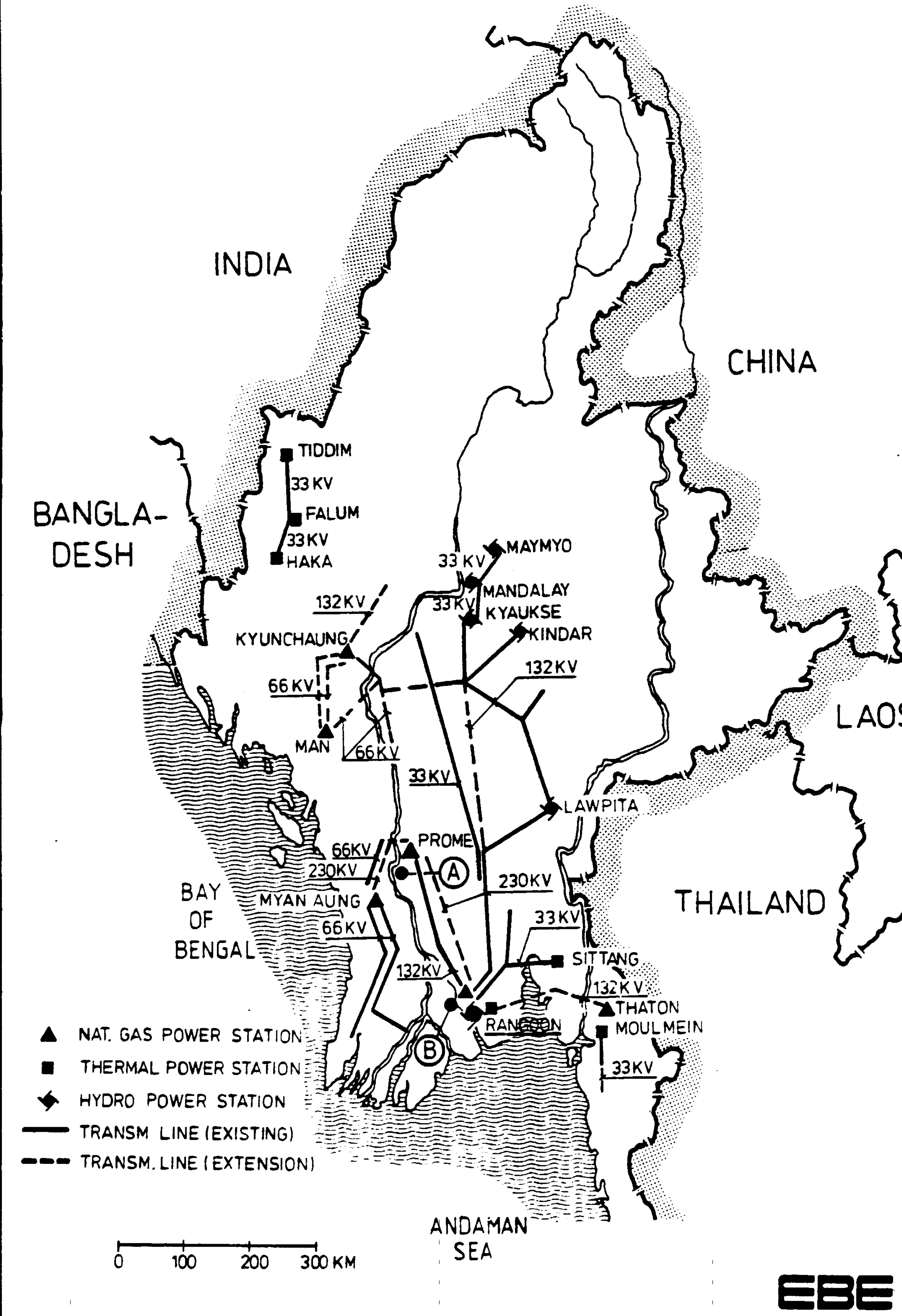

TABLE 5.06

Fuel Analysis

Natural Gas Fuel

Methane	96.4 to 98.80%
Ethane	0.93 to trodes
Propane	0.98 "
Iso-butane	0.97 "
Normal Butane	0.54 "
Pentane	0.10 "
Specific Gravity	0.6105 to 0.5476
Calorific Value (B tu/Cu.ft)	900

Heavy Petrolium Fuel Oil

Specific Gravity	0.9168
Water and Sedimentation (% Wt)	0.7 & 2.3
Pour Point	126° F
Setting Point	128° F
Flash Point	300° F
Calorific Value	18700 Btu/lb
Carbon Residue	2.25%
Viscosity (Red Wood Viscometer)	280 See/60 ml (91° C)

SOURCE: PREFEASIBILITY STUDY REPORT ON CEMENT MILL RENOVATION (THAYET) PROJECT. CERAMIC INDUSTRIES CORPORATION, APRIL 1983

Data confirmed by: Industrial Planning Department
Min. of No. 1 Industry.

TABLE 5.07

UNIT PRICES
ELECTRIC POWER CORPORATION, RANGOON

1. GENERAL PURPOSE:	1 to 100 Units a month 45 pyas per unit. 101 to 400 Units a month 42 pyas per unit. All over 400 Units a month 40 pyas per unit.
2. DOMESTIC POWER:	1 to 50 Units a month 29 pyas per unit All over 50 Units a month 19 pyas per unit.
3. SMALL POWER:	1 to 100 Units a month 29 pyas per unit. 101 to 300 Units a month 24 pyas per unit. All over 300 Units a months 21 pyas per unit.
4. INDUSTRIAL:	First 40 Units per K.W. of maximum demand per month. (Minimum of 50 K.W) 21 pyas per unit. Next 2,000 Units a month 19 pyas per unit Next 10,000 Units a month 16 pyas per unit. Next 30,000 Units a month 14 pyas per unit. All over Units a month 12 pyas per unit.

TABLE 5.07 (cont.)

5. COMMERCIAL:	First 40 Units per K.W. of maximum demand per month. Next 2,000 Units a month 24 pyas per unit. Next 10,000 Units a month 18 pyas per unit. Next 30,000 Units a month 16 pyas per unit. All over Units a month 14 pyas per unit.
6. STREET LIGHT:	40 to 50 Watt at K.6/50 per lamp per month. 60 to 75 Watt at K.12/-per lamp per month. 100 to 160 Watt at K.15/-per lamp per month. 160 to 265 Watt at K.21/-per lamp per month. 265 to 450 Watt at K.28/-per lamp per month. K.5/-less for over and above 1,000 lamps.
7. TEMPORARY LIGHTING:	For metered connections same as General purpose.

SOURCE: Renovation for Plastic Facotry No. (2). Project Planning
Data confirmed by: Industrial Planning Department, Min. of No. 1 Industry.

TABLE 5.08

UNIT PRICES
ELECTRIC POWER CORPORATION DISTRICTS
(Other than Rangoon)

1. General Purpose:	1 to 100 Units a month 48 pyas per unit. 101 to 400 Units a month 42 pyas per unit. All over 400 Units a month 40 pyas per unit.
2. SMALL POWER:	1 to 100 Units a month 29 pyas per unit. 101 to 300 Units a month 24 pyas per unit. All over 300 Units a month 21 pyas per unit.
3. INDUSTRIAL: (Minimum of 2,000 Units)	1 to 200 Units a month 29 pyas per unit. 201 to 2,000 Units a month 24 pyas per unit. All over 2,000 Units a month 19 pyas per unit.
4. BULK: (Minimum of 500 Units)	1 to 500 Units a month 54 pyas per unit. 501 to 5,000 Units a month 44 pyas per unit. All over 5,000 Units a month 34 pyas per unit.
5. STREET LIGHT:	The 25 Watt lamp at K.4/-per month. The 40 Watt lamp at K.5/-per month. Every additional 10 Watt K.-/50 per month.

Mercury lamp 80 Watt at K.12/-per month.
Every additional 10 Watt K.1/-per month.
Fluorescent lamp every additional 10 Watt K.-/75 per month.

6. SPECIAL: One 25 Watt lamp at K.3/-per month.

7. FLAT: One 40 Watt lamp at K.5/-per month.
Every additional 10 Watt K./50 per month.

8. TEMPORARY: For metered connection same as General purpose.
For point connection one 40 Watt at K.1/- per point per night and every additional 10 Watt K.-/25 pyas per night.

SOURCE: Renovation for Plastic Factory No.(2).
Project Planning Course No. (4).
Dated, 9th August 1983.

Confirmed by: Industrial Planning Department
Ministry of No. 1 Industry.

TABLE 5.09

UNIT PRICES OF OILS AND NATURAL GAS

Description	Unit Price per gal.
	K
Petroleum Oil	3.50
Diesel Oil	2.60
Kerosene Oil	2.50
Furnace Oil	2.00
Brake Oil	44.60
Gear Oil	32.45
Engine Oil	44.60
Hydraulic Oil	22.30

SOURCE: Ministry of No. 1 Industry,
Industrial Planning Department
Plastic Factory No. (2) Renovation Project
Proposal, Dated, 9th August 1983.

Natural gas supplied at factory fence incl.
metering and pressure reduction.
K 2.10 per 1000 cb.ft.

SOURCE: Electrical Power Corporation

Confirmed by: Industrial Planning Department
Ministry of No. 1 Industry.

TABLE 5.10

Climate of Shwedaung, Pegu Division

Temperature (during 1971 - 1985).

Monthly Mean Temaperature.
Maximum 33.4° C (April 1973)
Minimum 21.5° C (January 1974)

Mean daily Maximum Temperature.
Maximum 40° C (April 1978)
Highest Maximum Recorded Temperature.
44.0° C (24th April 1973)

Mean Daily Minimum Temperature.
Minimum 12.3° C (February 1983).
Lowest Minimum 9.6° C (February 1972)

Humidity

Maximum 87.0% (August 1984) at (9:30 h)
89% C (August 1977) at (18:30 h)
Minimum 53% (February 1980) at (9:30 h)
28% (March 1983) at (18:30 h)

Rainfall

Maximum 88.7 Inches (1973)
Minimum 28.67 Inches (1979)

Evaporations

Average Daily Evaporation for 1984
Maximum 14.1 (22nd July 1984)
Minimum 0.3 (15th July 1984)

TABLE 5.10 (cont.)

Wind Velocity

No. of days of Wind from -

at 9:30 - 59 SW April (1974)

at 18:30 - 58 SW (November 1974)

Monthly Mean Wind Velocity from 1971 to 1974)

Maximum - 4 mph April

Minimum - 2.2 mph October

SOURCE: Industrial Planning Department
Ministry of No. 1 Industry.

TABLE 5.11

Location: **Mandalay, BURMA**

21°59'N/96°06'E Height a.s.l. 77 m

		J	F	M	A	M	J	J	A	S	O	N	D	Year	*
Average Temperature	in °C	20.3	23.1	27.5	31.7	31.4	29.7	29.7	29.2	28.6	27.2	24.2	20.3	26.9	20
Average Max. Temperature	in °C	27.8	31.1	36.1	38.3	36.7	33.9	33.9	33.3	32.8	31.7	29.4	26.7	32.8	20
Average Min. Tempeature	in °C	12.8	15.0	18.9	25.0	26.1	25.6	25.6	25.0	24.4	22.8	18.9	13.9	21.1	20
Absol. Max. Temperature	in °C	32.8	37.2	42.2	43.3	43.9	41.7	41.1	38.3	39.4	38.9	36.7	32.2	43.9	20
Absol. Min. Temperature	in °C	7.2	8.3	12.2	17.8	20.6	20.0	22.2	21.7	20.6	16.7	13.3	6.7	6.7	20
Relative Humidity	in %	66	54	42	44	60	71	72	78	79	81	79	74	67	6
Precipitation	in mm	3	3	5	30	147	160	69	104	137	109	51	10	828	20
Max. Precipitation 24 h	in mm	18	18	20	58	135	107	135	89	79	99	99	38	135	20
Days with Precipitation	2.5 mm	1	1	1	2	8	7	6	8	9	7	3	1	54	20
Potential Evaporation	in mm	44	68	147	179	193	180	183	173	157	143	87	45	1599	50

* Duration of measurements in years

Source: University of Trier (West Germany) 1980 - Handbook of Selected Climatical Stations of the World

Location: **Rangoon, BURMA**

16°46'N/96°11'E Height a.s.l. 5 m

		J	F	M	A	M	J	J	A	S	O	N	D	Year	*
Average Temperature	in °C	25.0	26.4	28.6	30.3	29.2	27.2	27.5	27.5	27.8	27.8	27.0	25.3	27.5	60
Average Max. Temperature	in °C	31.7	33.3	35.6	36.1	33.3	30.0	29.4	29.4	30.0	31.1	31.1	31.1	31.7	60
Average Min. Temperature	in °C	18.3	19.4	21.7	24.4	25.0	24.4	24.4	24.4	24.4	24.4	22.8	19.4	22.8	60
Absol. Max. Temperature	in °C	37.8	38.3	39.4	41.1	40.6	36.7	33.9	33.9	34.4	35.0	35.0	35.6	41.1	60
Absol. Min. Temperature	in °C	12.8	13.3	16.1	20.0	20.6	21.7	21.1	20.0	22.2	21.7	16.1	12.8	12.8	60
Relative Humidity	in %	62	62	64	68	78	86	89	89	87	80	76	68	76	8
Precipitation	in mm	3	5	8	51	307	480	582	528	394	180	69	10	2617	60
Max. Precipitation 24 h	in mm	74	48	41	361	231	152	140	135	132	135	150	101	361	60
Days with Precipitation	2.5 mm	1	1	1	2	14	23	26	25	20	10	3	1	127	60
Potential Evaporation	in mm	108	123	158	172	176	156	157	151	145	147	132	110	1735	60

* Duration of measurements in years

Source: University of Trier (West Germany) 1980 - Handbook of Selected Climatical Stations of the World

TABLE 5.12

TABLE 5.13

YWAMA - INSEIN, BURMA

Monthly Rainfall (inches)

Year	1971	1972	1973	1974	1975	1976	1977	1978	1979
Jan.	0.00	0.00	0.00	0.00	4.30	0.00	0.98	0.08	0.00
Feb.	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.87	0.00
Mar.	0.00	0.00	1.57	1.42	0.00	0.00	0.00	0.00	0.00
Apr.	0.00	2.48	0.00	2.09	0.00	1.42	0.43	0.00	1.38
May	7.11	5.86	15.71	16.30	10.56	26.24	8.27	15.67	11.33
June	31.02	18.71	14.61	25.91	19.92	14.76	12.52	14.33	21.33
July	16.79	22.28	22.84	25.20	14.61	17.28	23.27	15.00	16.65
Aug.	24.17	22.56	20.12	24.57	29.80	23.81	27.01	26.97	22.83
Sept.	9.13	7.87	14.92	16.66	16.34	24.37	11.10	13.54	10.74
Oct.	7.72	2.60	11.22	11.06	6.54	7.40	5.43	5.67	4.96
Nov.	1.54	4.84	7.91	5.20	0.10	0.20	0.00	0.28	0.00
Dec.	0.00	0.35	0.00	0.00	0.00	0.24	0.65	0.00	0.00
Annual Total	97.48	87.55	108.90	128.41	102.17	114.72	89.72	92.61	89.22

SOURCE: Ministry of No. 1 Industry.
Steel Mill Renovation Project Ywama - Insein 1981

TABLE 5.14

YWAMA - INSEIN, BURMA

Monthly Mean Wind Velocity (In Miles per Hour)

Year	1971	1972	1973	1974	1975	1976
Jan.	3.4	3.2	2.7	2.8	$\frac{3.7}{2.8}$	$\frac{2.2}{1.8}$
Feb.	2.8	3.8	3.5	2.8	3.6	$\frac{3.0}{2.4}$
Mar.	3.3	3.8	3.9	3.9	$\frac{2.6}{3.9}$	$\frac{2.4}{5.3}$
Apr.	4.1	4.2	6.3	5.0	4.3	$\frac{3.6}{6.2}$
May	4.2	5.3	3.9	3.8	4.8	$\frac{3.5}{3.5}$
June	4.3	4.1	3.5	3.6	$\frac{3.2}{3.6}$	$\frac{3.5}{4.1}$
July	3.8	6.5	3.0	3.4	4.4	$\frac{4.0}{3.4}$
Aug.	5.3	5.0	3.0	4.1	3.0	$\frac{3.7}{3.9}$
Sept.	3.8	4.2	2.7	3.3	2.4	$\frac{4.2}{3.5}$
Oct.	3.5	2.3	2.6	2.6	2.3	$\frac{3.1}{1.1}$
Nov.	3.3	2.7	4.0	2.8	2.5	$\frac{5.6}{1.6}$
Dec.	4.1	3.1	2.9	3.6	2.3	$\frac{4.6}{1.4}$

SOURCE: Ministry of No. 1 Industry
Steel Mill Renovation Project Ywama - Insein 1981

TABLE 5.15

YWAMA - INSEIN, Burma

Water Analysis Report of Hlaing River

1.	Tubridity	Present
2.	Colour	Brown /Musty)
3.	Odour	Earthly smell
4.	Taste	Sweetish
5.	Suspended solid	350.0 P.P.M.
6.	PH 6.4 "	
7.	Dissolved solid	172.0 "
8.	Ash on dissolved solid	67.1 "
9.	Total alkalinity	48.8 "
10.	Total chloride	10.8 "
11.	Total hardness	83.4 "
12.	Temporary hardness	48.8 "
13.	Permanent hardness	34.6 "

Analysis on Dissolved Solid

(a)	Loss on ignition	104.9 P.P.M.
(b)	SiO_2	10.5 "
(c)	Fe_2O_3	5.0 "
(d)	Al_2O_3	12.0 "
(e)	CaO 10.0 "	
(f)	MgO 24.6 "	

SOURCE: Ministry of No. 1 Industry
Steel Mill Renovation Project Ywama - Insein 1981

TABLE 5.16: YWAMA STEEL MILL; SOIL TEST (example)

NATURAL MOISTURE CONTENT, WET & DRY DENSITIES & UNCONFINED COMPRESSIVE STRENGTH TEST

JOB: STEEL MILL EXTENSION, YWAMA, INSEIN NEW WIRE PROCESSING SIT

SAMPLE NO. SHELBY OD.2 1/4" ID.2.0"	'SPLIT OD.2.0" ID.1 1/3"	'Depth (Ft)	SOIL DESCRIPTION	PENETRATION RESISTANCE (BLOW/Ft)	MOISTURE CONTENT (%)	DEN (Lbs WET
1	-	0- 2	Yellowish Brown SAND & SILT, tr: Clay	8	13.0	
2	-	2- 4	Reddish Brown SILT & CLAY, tr: Sand	6	38.6	115.
3	-	4- 6	- do -	10	35.6	121.
4	-	6- 8	Bluish Gray SILT & CLAY, tr: Sand, tr: Decomposed Wood	13	45.0	115.
5	-	8-10	- do -	7	40.1	120.
6	-	10-12	Bluish Gray Sandy & Clayey SILT with Decomposed Wood.	6	44.1	125.
7	-	12-14	Bluish Gray Clayey SILT, tr: Sand, tr DW	6	39.0	119.
8	-	14-16	Yellowish Brown Sandy & Clayey SILT.	7	23.0	131.
9	-	16-18	- do -	7	22.0	
10	-	18-20	- do -	7	25.2	120.
11	-	20-22	- do -	8	24.0	121.
12	-	25-27	- do -	8	26.3	128.
13	-	30-32	Reddish Brown Silty SAND some Clay.	10	28.2	119.
14	-	35-37	- do -	9	28.5	122.
15	-	40-42	Yellowish Brown Silty SAND, tr: Clay.	25	24.3	133.
16	-	45-47	- do -	38	24.4	
17	-	50-52	Yellowish Brown Silty SAND.	41	19.2	
18	-	55-57	- do -	47	17.0	
19	-	60-62	- do -	53	20.2	
20	-	65-67	- do -	56	11.5	
-	1	70-71 1/2	Yellowish Brown SAND some Silt some fine Gravel.	66	8.3	Spli
-	2	75-76 1/2	- do -	68	7.8	
-	3	80-80 1/2	- do -	80	7.2	
-	4	85-86 1/2	- do -	100	7.5	
-	5	90-91 1/2	- do -	125	7.6	

SOURCE: Research & Soil Testing Laboratories, Thuwunna, May 1983 mple)

& UNCONFINED COMPRESSIVE STRENGTH TEST

NEW WIRE PROCESSING SITE BORE HOLE NO: (1)

CRIPTION	PENETRATION RESISTANCE (BLOW/Ft)	MOISTURE CONTENT (%)	DENSITIES (Lbs/cu.ft)' WET	Dry	U.C.S. STRESS (Lbs/sq.ft)	STRAIN (%)
SAND & SILT, tr: Clay	8	13.0	Sample		Disturbed	
LT & CLAY, tr: Sand	6	38.6	115.2	84.0	1720	12.5
do -	10	35.6	121.2	89.1	2050	15.0
& CLAY, tr: Sand, ood	13	45.0	115.5	79.5	1960	20.0
do -	7	40.1	120.3	86.0	1420	10.0
y & Clayey SILT Wood.	6	44.1	125.0	86.8	740	18.75
ey SILT, tr: Sand, tr DW	6	39.0	119.0	85.5	Disturbed	
Sandy & Clayey SILT.	7	23.0	131.0	106.3	1210	20.0
do -	7	22.0	Sample		Disturbed	
do -	7	25.2	120.4	96.1	950	15.0
do -	8	24.0	121.0	97.5	760	17.5
do -	8	26.3	128.1	101.4	1360	15.0
lty SAND some Clay.	10	28.2	119.5	93.2	1300	11.25
do -	9	28.5	122.0	95.0	1345	11.25
Silty SAND, tr: Clay.	25	24.3	133.0	106.5	Disturbed	
do -	38	24.4	Sample		Disturbed	
Silty SAND.	41	19.2		- do -		
do -	47	17.0		- do -		
do -	53	20.2		- do -		
do -	56	11.5		- do -		
SAND some Silt	66	8.3	Split Spoon Sample Disturbed			
do -	68	7.8		- do -		
do -	80	7.2		- do -		
do -	100	7.5		- do -		
do -	125	7.6		- do -		

Thuwunna, May 1983

5.17/1 ESTIMATE OF INVESTMENT COST FOR WELDED STEEL PIPE PLANT, BURMA
INFRASTRUCTURE (outside of factory fence)
LOCATION: SHWEDAUNG, PLANT ALTERNATIVE I, US $ 1.- = K 7.75 = DM

No.	Quan-tity	Unit	item description	Unit cost local US $	Unit cost foreign US $	local US $
1	1	pc.	11 kV switch gear	2,000	17,500	2,000
2	11,600	m	11 kV transmission line	12.24	21.98	142,000
3	7,000	m	dia 6" gas pipe line	20	70	140,000
4	1	pc.	reducing and metering station	5,000	30,000	5,000
5	350	m	dia. 6" water pipe line	15	30	5,250
6	1,000	m	open ditch, 1-2 m deep	5	-	7,000
7	500	m	open ditch, 2-3 m deep	7	-	3,500
8	lumpsum	-	improvement of railroad loading facilities at Prome	lumpsum		50,000
9	15	km	road improvements (asphalt) Prome - Shwedaung	6,500	6,500	97,500
10	8	km	new asphalt road Shwedaung - plant	58,500	6,500	468,000
11	8	km	earthworks for new road	100,000	-	800,000
12	10	pc.	small bridges/culverts	50,000	-	500,000
13	lumpsum	-	contingencies	-	-	144,750
	Subtotal		Site development	-	-	2,365,000
14	1	pc.	guest house, club	100,000	-	100,000
15	1	pc.	nursery, youth centre	50,000	-	50,000
16	7	pc.	110 m² houses	32,000	-	224,000
17	8	pc.	90 m² houses	22,000	-	176,000
18	10	pc.	60 m² houses	12,500	-	125,000
19	16,000	m²	land development etc.	10	-	160,000
	Subtotal		company housing	-	-	835,000
20			Total			3,200,000
21	7% geodetical surveying, soil tests, engineering					308,700
	15% supervision by Metal Industries Corporation					661,500
22	Total cost for plant alternative I					4,170,200

D STEEL PIPE PLANT, BURMA

nce)

T ALTERNATIVE I, US $ 1.- = K 7.75 = DM 2.40

	Unit cost		Cost		
	local US $	foreign US $	local US $	foreign US $	total US $
	2,000	17,500	2,000	17,500	19,500
ine	12.24	21.98	142,000	255,000	397,000
	20	70	140,000	490,000	630,000
g					
	5,000	30,000	5,000	30,000	35,000
ine	15	30	5,250	10,500	15,750
ep	5	-	7,000	-	7,000
ep	7	-	3,500	-	3,500
oad t Prome	lumpsum		50,000	200,000	250,000
sphalt)					
	6,500	6,500	97,500	97,500	195,000
	58,500	6,500	468,000	52,000	520,000
oad	100,000	-	800,000	-	800,000
ts	50,000	-	500,000	-	500,000
	-	-	144,750	57,500	202,250
	-	-	2,365,000	1,210,000	3,575,000
	100,000	-	100,000	-	100,000
e	50,000	-	50,000	-	50,000
	32,000	-	224,000	-	224,000
	22,000	-	176,000	-	176,000
	12,500	-	125,000	-	125,000
	10	-	160,000	-	160,000
	-	-	835,000	-	835,000
			3,200,000	1,210,000	4,410,000
ngineering			308,700	-	308,700
rporation			661,500	-	661,500
			4,170,200	1,210,000	5,380,200

5.17/2 ESTIMATE OF INVESTMENT COST FOR WELDED STEEL PIPE PLANT, BURMA
INFRASTRUCTURE (outside of factory fence)
LOCATION: SHWEDAUNG, PLANT ALTERNATIVE II, US $ 1.- = K 7.75

No.	Quantity	Unit	item description	Unit cost local US $	Unit cost foreign US $	local US $
1	same as 5.17/1		site development			2,365,000
2	same as 5.17/1		company housing			835,000
			items additional for plant alternative II			
3	2	pc.	90 m² houses	22,000	-	44,000
4	10	pc.	60 m² houses	12,500	-	125,000
5	3,100	-	additional land development etc.	10.-	-	31,000
6	Subtotal		company housing	-	-	1,035,000
	Total			-	-	3,400,000
	7% geodetical surveying, soil tests, engineering					322,700
	15% supervision by Metal Industries Corporation					691,500
	Grand Total: cost for plant alternative II					4,414,200

ED STEEL PIPE PLANT, BURMA
ence)
LANT ALTERNATIVE II, US $ 1.- = K 7.75 = DM 2.40

	Unit cost		Cost		
	local US $	foreign US $	local US $	foreign US $	total US $
			2,365,000	1,210,000	3,575,000
			835,000	-	835,000
r plant					
	22,000	-	44,000	-	44,000
	12,500	-	125,000	-	125,000
elopment					
	10.-	-	31,000	-	31,000
	-	-	1,035,000	-	1,035,000
	-	-	3,400,000	1 [illegible] 000	4,610,000
engineering			322,700	-	322,700
Corporation			691,500	-	691,500
ive II			4,414,200	1,210,000	5,624,200

5.18 ESTIMATE OF INVESTMENT COST FOR WELDED STEEL PIPE PLANT, BURMA
INFRASTRUCTURE (outside of factory fence)
LOCATION: YWAMA, PLANT ALTERNATIVE I OR II, US $ 1.- = K 7.

No.	Quantity	Unit	item description	Unit cost		
				local US $	foreign US $	local US $
1	1	pc.	11 kV switchgear	2,000	17,500	2,000
2	200	m	11 kV underground cable	9.-	47.50	1,800
3	300	m	11 kV overhead line	13,33	24.-	4,000
4	100	m	dia. 6" gas pipe line	20.-	70.-	2,000
5	1	pc.	metering station	5,000	10,000	5,000
6	350	m	dia. 6" water pipe line	15.-	30.-	5,250
7	350	m	canal 2-3 m deep	35.-	-	12,250
8	300	m	railroad with switch	140.-	200.-	42,000
9	900	m	concrete surface to existing laterite road	45.-	-	40,500
10	150	m	new concrete road	55.-	-	8,250
11	lumpsum	-	contingencies	lumpsum		30,950
12	Subtotal		site development			154,000
13	1	pc.	guest house (150 m²)	50,000	-	50,000
14	7	pc.	110 m² houses	32,000	-	224,000
15	6	pc.	90 m² houses	22,000	-	132,000
16	10,000	m²	land development etc.	10.-	-	100,000
17	Subtotal		company housing			506,000
18			Total			660,000
19	7% Geodetical surveying, soil tests, engineering					55,300
	15% for supervision by Metal Industries Corporation					118,500
20	Grand Total: Cost for plant alternative I or II					833,800

D STEEL PIPE PLANT, BURMA

nce)

ALTERNATIVE I OR II, US $ 1.- = K 7.75 = DM 2.40

	Unit cost		Cost		
	local US $	foreign US $	local US $	foreign US $	total US $
	2,000	17,500	2,000	17,500	19,500
ble	9.-	47.50	1,800	9,500	11,300
	13,33	24.-	4,000	7,200	11,200
e	20.-	70.-	2,000	7,000	9,000
	5,000	10,000	5,000	10,000	15,000
ine	15.-	30.-	5,250	10,500	15,750
	35.-	-	12,250	-	12,250
	140.-	200.-	42,000	60,000	102,000
existing					
	45.-	-	40,500	-	40,500
	55.-	-	8,250	-	8,250
	lumpsum		30,950	8,300	39,250
			154,000	130,000	284,000
	50,000	-	50,000	-	50,000
	32,000	-	224,000	-	224,000
	22,000	-	132,000	-	132,000
.	10.-	-	100,000	-	100,000
			506,000	-	506,000
			660,000	130,000	790,000
engineering			55,300	-	55,300
es Corporation			118,500	-	118,500
ve I or II			833,800	130,000	963,800

CHAPTER VI

PROJECT ENGINEERING

INTRODUCTION

Basic Technological Concept

The project technological concept was developed in accordance with the known market demands for welded steel pipes versus the types of equipment available for producing said pipes.

Since the production capacities of even the smallest pipe welding line surpasses the total inland water pipe requirements for Burma, the study also took into consideration other municipal and industrial customers as well as the potential for exporting a part of the production.

The majority of pipes used in water related projects have diameters ranging from 1/2" through 12". These sizes can be produced on 2 separate welding lines. The first produces pipes with diameters between 1/2" to 4" and the second line produces pipes having diameters between 6" to 12".

The study's field findings indicated that the majority of the 1/2" to 4" pipes required for water related projects would most probably be made of plastic. The 6" to 12" diameters would be made in steel.

The first alternative for the basic plant concept is therefore a pipe welding line capable of producing pipe having diameters between 6" and 12". The drawings corresponding to alternative I clearly show the main equipment items, auxiliaries and plant support facilities.

Since the larger sized pipe used for water applications are generally coated, the layout also takes into account for internal cement lining and external bitumen coat and wrap facilities.

The list of equipment for alternative I as contained herein is sufficiently detailed to calculate an accurate price estimate as well as to present a detailed understanding of the plant's operations.

The study recognized the fact that even if a pipe plant was built to produce pipes having diameters between 6" -12" it would still be necessary to import the 1/2" to 4" steel pipes for those applications where plastic could not be considered.

Although the market for such pipes might presently be somewhat limited in Burma it is obvious that considerable quantities of these pipes could be used in other industries providing they were locally available.

Alternative II therefore is a plant layout designed to produce pipes from 1/2" to 12".

In addition to its own main equipment items it takes full advantage of all the equipment, utilities, auxiliaries, infrastructures and related plant facilities included under alternative I.

The list of equipment shown under alternative II is therefore a combination of that specifically required for alternative I plus the additional equipment required to produce the smaller range of pipes.

Technology

The technology required for producing welded steel pipes is based on well established principles linked directly to the equipment.

Even though neither the know-how or equipment is covered by patents there are relatively few firms with the specialized knowledge and expertise to manufacture such equipment. No separate acquisition of technology is therefore required for a pipe plant. The production know-how to operate and maintain such a plant will have to be obtained through intensive training programmes during the erection and commissioning periods in Burma under the guidance of a team of experts.

Process Flow

The technology and processing equipment for manufacturing "longitudinal-seam-welded tubing" has improved considerably during recent years. These improvements have extended the range of available ERW-tubular products from small diameters and thin walls to pipes having diameters up to 12 inches with thicker walls.

The process for making pipes entails the continuous forming of cold steel strip into an open seam tube in a series of forming stands.

The open seam edges are then welded together by a "High Frequency" (HF) method.

The rolls of the forming stands are designed in accordance with the diameter and wall thickness of the desired pipe product. The figure No. I shows the schematic representation of the sequence of the process by which flat strip is converted into a finished pipe on a modern ERW forming mill.

In order to obtain an accurately formed slit tube, it is necessary to preselect a certain distance between the individual forming stands. In theory the forming rolls should be as close together as possible so that the open seam tube is formed with the maximum possible degree of uniformity. For design reasons however, the minimum distance from stand to stand is normally larger than actually required, since the size and load capacity of the forming mill has to be rated for the maximum pipe diameter in each respective case.

Conversion of strip to pipe is essentially a question of practical experience.

A welded pipe mill producing pipes has to fulfill certain requirements to ensure the weld quality, particularly with regards to

- perfect wave-free forming
- accurate positioning of the strip edges during welding
- accurate weld bead trimming
- weld power control
- change system for changing pipe sizes

The Plant-Layout(s) shown in the study provide suitable designs to ensure reliable production.

This study examines two alternative layouts for the manufacturing of tubes.

- Alternative I:
  Production of tubes 6" - 12" dia.

- Alternative II
  Production of tubes 1/2" - 12" dia

The sequence of the main equipment items and operations used in the fabrication of pipes is as follows:

For Alternative I:

Slitting Line	- raw material, wide width coils cut to strip the width of which will be equal to the circumference of the tubing to be welded.
Tube Production Line	- strip preparation and forming mill for converting the incoming strip into an open seam tube. Welding and sizing the tube into 6"-12" diam. pipe, cutting of tube-strand into the required lengths.
Finshing Area	- the lines are divided into finishing sections:
for black tubes (plain-end)	- facing equipment
for inner-lining	- cementation of the inner surface of the tubes.
for outer coating	- sandblasting and bituminization of outer surface of tubes

For Alternative II:

Alternative II contains all of the equipment required for alternative I plus a second tube production line and additional finishing facilities

Slitting Line	- as for alternative I
Tube production line	- as for alternative I plus a second mill to manufacture pipe, by the same technique, in the pipe range 1/2" - 4" diam.
Finishing Area	- as for alternative I plus
for black tubes (plain-end)	- extra facing equipment
for galvanized tubes (plain-end)	- pickling and galvanizing of tube surfaces
for galvanized tubes (threaded-end)	- pickling and galvanizing of tube surfaces straightening of tubes, both-end threading with one socket and one plastic caps.

General Requirements

The production of tubes with longitudinally welded seams is based on the supply of strip coils (hot and cold rolled) of the specified material. The size of the coils, particularly their length, is limited by the capacities of the relevant strip mill. The strip should meet the following requirements:

the material should possess good welding properties;

the material should be free from rolling defects and, depending on how it is made, contain the minimum possible amount of segregation;

the strip should have a smooth surface with as little scale as possible;

the strip should be straight (i. e. have no "camber");

the strip should be stress-free.

The width and thickness tolerances for steel strip should at least come up to the values specified in DIN 10 16. The amount of curvature in the strip should not exceed 1 to 2 °/°°, i. e. it must not be more than 1 to 2 mm per metre of strip.

In actual practice, strip invariably contains certain flaws which result partly from the manufacturing process and partly from handling. The majority of the above-mentioned requirements must be met to a high degree if flawless tubes are to be produced, otherwise, considerable difficulties may be experienced in the production stage or, later on, during inspection. It is particularly important that any dimensional variations and "camber" present in the strip does not exceed the maximum permissible value.

The requirements for strip-preparation before forming is, that the edges of the strip should be metallically clean and sharp prior to welding. In the case of strip with "natural" edges, this requirement can be met by the edges being trimmed prior to coiling. It is also possible to produce the strip required for welding by slitting wide strip. This eliminates the need for subsequent edge trimming if care is taken to prevent the strip edges from being damaged after they have left the slitting line.

Analyses:

No specific steel composition has been laid down for the manufacture of gas and water pipes for commercial steel tubes. The use of steel within the following composition range is however recommended:

C = 0.06 - 0.18 %
Mn = 0.2 - 0.8 %
S + P = 0.08 %
Si = 0.2 %

In high-frequency welding the composition of the material plays a much less important role, but the composition given above for commercial tubes should be roughly followed.

Welded tubes are frequently manufactured from hot rolled strip. This type of strip is covered with oxide layers which are formed during rolling and coiling the hot material in the strip mill and during subsequent cooling.

In high-frequency welding, scale on the strip surface does not impair the weld, but welding defects may be caused by scale entering between the strip edges. For this reason, the strip surface should be free of rough scale.

Pipe Standards

The more important standards for welded pipes are summarized below. They cover threaded gas and water pipes, black or galvanized, or also GI pipes, as well as boiler tubes, line pipes, structural tubing with plain ends.

As far as the manufacture of threaded pipes is concerned, most countries nowadays use the British and German specifications standardised by ISO (International Organisation for Standardisation). Included are:

B. S. 1387 (Class A) corresponding to ISO Light II.

DIN 2440 corresponding to B. S. 1387 (Class B) which is equivalent to ISO Medium.

DIN 2441 corresponding to B. S. 1387 (Class C) equivalent to ISO Heavy.

The appropriate socket standards are listed in DIN 2986 corresponding to ISO R7.

For boiler pipes, line pipes and structural tubing, see DIN 2458.

The standards sheets can be obtained from Beuth-Verlag GmbH, D-1000 Berlin 15 and D-5000 Köln, FRG (also in English).

Prices

Equipment prices have been compiled from quotations given by plant manufacturers for similar equipment and adjusted by EBE to suit the Burma project. Prices for local services and civil work were based upon information received from sources in Burma.

PRODUCTION EQUIPMENT - ALTERNATIVE I

Due to the complexity of most of the equipment employed in a pipe plant it is assumed that a major proportion of the mechanical, electrical and instrumentation will have to be imported.

The following is an itemized breakdown of the various equipment units which make up Alternative I.

STRIP SLITTING LINE

Technical data

material	hot rolled or cold rolled steel
U.T.S.	max. 50 kp/mm²
strip width	max. 1200 mm
strip thickness	max. 6.5 mm min. 2.0 mm
coil inside diameter	approx. 600 mm
coil outside diameter	approx. 1900 mm
coil weight	max. 12 tons
recoiler inside diameter	approx. 500 mm
threading speed	step I 15 - 40 m/min. step II 15 - 70 m/min.
main drives	DC-motors, thyristor-controlled
auxiliary drives	AC-motors and AC-gearmotors

Slitting capacity

slitter arbor diam.	200 mm
strip width	min. 50 mm

Width of the side trimmed scrap:
max. 30 mm each side
min. 2 x strip thickness of each side.

Thickness	U.T.S.	Number of cuts	
mm	kp/mm²	40 m/min.	70 m/min.
5.5	50	6	
4.5	50	7	
4.0	50	9	
3.5	50	11	9
3.0	50		14
2.5	50		19
2.0	50		25

The number of cuts is valid for symetrical distribution over the whole width of the strip.

Description of the Slitting Line:

- Entry Coil Car

  The hydraulically traversed coil car is equipped with a hydraulic hoist and a vee type cradle. It is traversed by a floor mounted hydraulic cylinder.

- Uncoiler

  The uncoiler is designed as a mandrel expanding drum type for taking up the coils from both sides.

The shafts of the expanding mandrels are set in two antifriction bearing housings.

The drums are actuated by rotating hydraulic cylinders.

The motion of the retractable expanding mandrels is limited by discs.

- Side Register Control

The automatic side register control unit is used in conjunction with the strip aligning cylinders of the uncoiler to move the uncoiler to permit unwinding a coil on centre, to obtain a small and symetrical side trimmed scrap and to avoid interruption of the scrap strip.

- Peeler (Coil opening device)

It is a hydraulically actuated peeler, arranged to open a coil on the uncoiler mandrel and assist in feeding the lead end of the strip to the pinch rolls of the flattener.

- Flattener

This is a 5 roller type flattener with 2 entry pinch rolls.

An additional hydraulically operated quick opening device for the 2 top levelling rolls facilitates the feeding operation.

- Crop Shear

This is a hydraulically operated down-cut crop shear with a fixed bottom knife and a movable top knife actuated by hydraulic cylinder.

- Entry Pinch Rolls

  The pinch rolls carried in pivoting frames are opened and closed by hydraulic cylinder.

  The top roll is driven by AC-gearmotor.

- Slitter

  The slitter slits the strip to a pre-determined width. It is powered by DC-motor. The arbors are mounted in one fixed and one movable housing which is traversed by a power screw gearmotor.

- Interchangeable Slitter Assembly

  consisting of interchangeable slitting frame with slitting housings, including two slitting arbors and central arbor adjustment, quick couplings, motor-driven housing take-off device.

- Scrap Chopper

  Consists of special steel fixed and rotating knives. The knives are interchangeable.

- Loop Pit Installation

  The loop pit is set in the middle of the machinery. There are feeding roll assemblies located on both sides of the pit with a movable table. The pit is covered.

- Strip Brake

  The brake is driven by AC-motor and hydraulically operated. The strip brake is equipped with separator rolls, a suppressor roll and a turn around roll at the exit side. The top pinch roll and the brake is equipped with an hydraulic quick opening device.

- Recoiler

The recoiler is an overhung expanding drum type complete with coil stripper mechanism. The drum is expanded by a rotating hydraulic cylinder mounted at the end of the drum spindle.

The fixed part of the drum contains an automatic gripper which grips the strands when the drum is expanded regardless of strip thickness.

The mandrel is driven by DC-motor with braking over a reduction gear drive.

- Delivery Coil Car

The coil car is a hydraulically traversed box type, complete with hydraulic hoist and a vee type cradle.

- Tables

Tables which are covered with synthetic plastic are set up between the equipment. The tables support the strip and the side strip.

- Central Hydraulic System

There is a central hydraulic oil system to supply the cylinders and all hydraulic equipment of the slitting machinery.

- Electrical Equipment

The electric drives consist of DC-motors for main drives and AC-motors and AC-gearmotors for auxilliary drives.

The complete switching equipment is installed in a totally closed switchgear cubicle and the completely wired control pulpits are equipped with all necessary operating equipment.

TUBE WELDING PLANT FOR 6" - 12" PIPE

Technical data:

tube diameter	6" - 12"
tube length	6 - 12 m
tube specification	British Standard/ DIN/API 5 L
strip dimension	350 - 1,000 mm wide
standard thickness	2.0 - 6.5 mm
material	hot or cold rolled slit steel strip
tensile strength	to DIN 1544 or better
coil inside diamter	500 mm
welding speed	0 - 40 m/min. (accord. Prod. Mix/HF Generator)

Strip Preparation Line

Technical data

Strip condition:		free of grease and oil
Yield point max.:		400 N/mm^2 to DIN 1544
Tensile strength:		550 N/mm^2
Material:		low carbon steel
Max. feed in speed:		160 m/min.
Min. jogging/threading speed:		8 m/min.
Capacity of coil magazine:		3 coils
max. coil weight	approx.	12,000 kg
coil o.d.	approx.	1,000 - 1,800 mm
coil i.d.	approx.	500 - mm
coil width	approx.	450 - 1,000 mm

- Coil Magazine

The coil magazine is a horizontal ramp with steel side walls which can be adjusted to actual coil width by a rack and pinion drive. The side walls also have slots for the C-hook of the crane which loads the coils.

- Coil Hoisting Table

The coil peeler reduces the total coil handling cycle by preparing the incoming coil for straightening while the previous coil is being uncoiled.

The coil hoisting table receives a coil from the coil magazine. Cutting (breaking open) the securing straps of the coil, if necessary, is done by the changeable peeler knife.

The hoist table automatically centers the coil for easy feed onto the uncoiler heads. The hydraulically actuated peeler then opens the coil from the top and assists in feeding the lead end of the coil. The peeler is provided with a replacable tool blade and a breaking roll device to straighten and prepare the lead end of the coil for feeding the strip.

By this arrangement the lead end of the coil is already in position to enter the strip flattener after the tail end of the the running coil has passed.

The lateral walls for coil guiding are adjustable to accommodate various coil diameters and widths.

- Uncoiler

The uncoiler is of the expanding mandrel type.

The mandrel expansion movements are hydraulically operated and controlled from the central hydraulic system. The shaft of the uncoiler is driven by a D.C. motor and brake. A mechanical stand-still brake is also provided. The mandrel D.C. drive is reversible so it is possible to recoil the strip.

- Strip leveller

Equipment:

Welded machine frame
Pinch rolls

Flattening rolls
Main drive gearbox with universal shafts for
bottom and top roll drive
Hydraulic equipment
Electrical equipment

The pinch rolls on the leveller entry side are integrated in the leveller. The top roll is hydraulically operated. The 5-roll leveller flattens the strip, i.e. removes the coil set at tail and leading strip ends for good aligning during cropping and welding.

Strip guides are located between the rolls.

- Strip shear and end welder

  Equipment:

  Machine frame
  Strip centering devices
  Portal clamping devices
  welding device (handoperated)
  Strip end shear
  Weld gap selector crosses
  Hydraulic equipment
  Electrical equipment

  The cropped ends are moved into position and clamped in the exact welding position. The gap can be preset in relation to the thickness of strip to be welded.

- Central hydraulic station

  Equipment:

Hydraulic pump
Oil tank
Oil filter
Solenoid valves
Oil-heat exchanger
Electrical equipment

The hydraulic station is a separate unit and feeds all strip preparation line hydraulic equipment. Each machine unit can be controlled from a special separate control stand.

- Strip Preparation Drives

  Powered by DC-drives which are protected according to IP 23 S forced cooled by a built-on fan with filter.

- Switchboard system MAS-design

  consisting of:

  - Main-circuit-breaker, with necessary control voltage supplies

  - VERITRON-compact converters for DC-motors

  - Several feeders as follows:

    - Hydraulic station
    - Uncoiler
    - Strip shear and end welder
    - feeders for control valves

  - All necessary contactors, control units, control switches, meters, pilot lamps

- Control pulpits or boxes are provided for the following sections
  1. Uncoiler
  2. Strip leveller
  3. Strip shear and end welder
- Transformer-rectifier for hand-welding

Forming Mill

Technical Data:

break down stands	3 Nos., driven top and bottom rolls
idler stands	2 Nos. between Nos. 1-2 and 2-3 break down stands
idler stands	2 Nos. between Nos. 3 and 4 horizontal stands
horizontal stands	4 Nos. driven top and bottom rolls
idler stands	between stands 4-5 and 5-6

Top and bottom rolls height adjustable by screw down spindles.

The top rolls are also adjustable in the axial direction.

Equipment:

Inlet table
7 horizontal driven stands
6 vertical idler stands
Gear boxes
Universal shafts with quick couplings
Machine bed prepared for interchangeable stands/plates
Piping for coolant
Electrical equipment

An adjustable strip guiding device with idling rollers is arranged in front of the first forming stand.

The forming mill gradually forms the flat strip into a slit tube by passing 7 horizontal roll stands and 6 adjustable vertical idler roll stands.

The roller chukes are water and dustproof. The stands are easily removable for changes of forming roll when switching to other pipe dimensions.

The vertical adjustment of the horizontal rolls is made by a central screw-down arrangement for the top roll shafts. The top rolls can also be adjusted in cross direction to the mill centre line.

The 6 adjustable vertical idler roll stands which are mounted between the horizontal driven roll stands are equipped with central adjustment.

The piping for soluble oil distribution is integrated in the steel-frame of the machine.

All horizontal roller shafts are driven by DC-motor over worm-gear boxes.

All gears are totally closed and emersed in an oil bath. Universal joint shafts are positioned between gear boxes and roller shafts.

Welding Table

Technical Data:

number of welding rolls, exchangeable
1 system with two rolls
1 system with three rolls
1 system with five rolls

Equipment:

Welding table:
Base frame
Frame plate with roll assembly
Changing plate with roll assembly
Piping for coolant

The welding table consists of a squeeze roll stand assembly especially designed for the necessities of the HF-welding method. The squeeze rolls are adjustable in horizontal and vertical direction as well as individually in accordance with the pipe diameter.

- Outside weld bead trimmer

  Technical data:

  Double tool holder type
  Quick release by air cylinder

Size range	125 - 325 mm
Guiding rolls	two bottom rolls and one top roll

Equipment:

tool heads
scarf winder
support rollers
follower rollers
screw down adjustment
frame
pneumatic equipment
hydraulic equipment

Two complete units to remove the outside weld bead are arranged in tandem to be used selectively. A fast lifting device actuated by air-cylinders is provided to prevent tool breakage in case the main mill drive is cut off

- Pull out stand

Technical data

size range	125 - 325 mm o.d.
Nos of rolls	4 = 2 top/bottom + 2 side rolls
drive	separate DC-motor

Equipment:

Stands
Shafts
Shaft bearings etc.
Interchangeable sub-base

A driven pull out and shaping stand, with DC-motor drive is positioned behind the bead trimmer. The construction of the roll stand is of the same design as a stand for the sizing mill. The stand is equipped with an interchangeable sub-base plate.

- Water coooling section

Technical Data

Size range	125 - 325 mm o.d.
Length	about 2 x 5 m
Water inlet pressure	3-6 bar

Equipment:

Cooling system for fully immersed pipe
Shut-off valve
Overflow outlet

Any remaining heat from the welding process is removed by passing the pipe through a water bath.

The cooling section is a welded steel box construction with two steel plates arranged in a 'V' position below the pipe and with a 3-4 mm slot at the V-bottom for water inlet over the whole length.

The overflow water outlet is situated at the welded pipe inlet side to effect better cooling by a counter-flow effect.

Sizing Mill

Technical data

Size range	6" - 12" o.d.
Nos of rolls	4 = 2 top/bottom + 2 side rolls

Drives	by separate DC motors
Nos of stands (horizontal)	4
Nos of stands (idler)	3

Equipment:

Stands
Shafts
Shaft bearings etc.
Interchangeable sub-base plate

The sizing mill is equipped with four 4-roll driven stands and three idler non-driven roll stands. The idler roll stands are positioned between the four 4-roll stands. The pocket rolls of the stands are adjustable.

The top and bottom rolls are equipped with sealed central screw down vertical adjusters. The top rolls have lateral axial adjustment.

The front stands are easily removable from the machine base to change from one roller dimension to another.

The idler rolls between the 4-roll stands, are equipped with vertical adjusters and with central movement of the shafts.

The machine base is equipped with interchangeable base-plates on which the roll stands and the idler rolls are positioned. It is possible to remove the complete unit and build up another set of stands already prepared for the next dimension run on separate base plates.

Turk's Head

Technical data

Size range	125 - 325 o.d. and shapes corresponding to the mother pipe
Nos of rolls	4 (each head)
vertical adjustment	
horizontal adjustment	
rotary adjustment	+/- 20°

Equipment

Turk's head housing
Vertical and horizontal adjustment plate
Electrical equipment

The Turk's head housings, each equipped with 2 vertical and 2 horizontal non-driven rolls, are arranged behind the sizing mill. All rolls are individually adjustable in the horizontal and vertical directions. The complete roll system can be turned around the tube axis to keep shapes free of distortion. All motions are motor driven.

The machine base of the Turk's head is equipped with interchangeable sub-base plates for size change-over procedure.

Tube Mill Drives

- DC-motors for forming and sizing section

- DC-motor for saw carriage

- Type of protection for all DC-drives IP 23 S forced cooled by a built-on fan with filter

Switch-Board System

consisting of:

- main-circuit-breaker, hand driven with undervoltage release and instantaneous overcurrent release incuding all necessary control voltage supplies

- VERITRON-compact converters (forming and sizing section)

- Various feeders as follows:

  - Hydraulic station, Flying shear
  - Heater for Hydraulic station
  - Cutting device
  - Hydraulic station
  - Run out table
  - several feeders for control valves
  - various required auxiliary drives
  - pump motors for main and reserve pump
  - pump motor for oil-to-water heat exchanger

- All necessary contactors, control units, control switches, meters, pilot lamps etc. are arranged in the cubicles and control desks for controlling, regulating, monitoring, indicating and operating. The cubicles and control desks are internally completely wired to terminal blocks.

- Control desks or boxes are provided for the following sections

1. Weld section - main control desk
2. Flying shear - control stand with computer

- DC-motor for pull-out stand

rated armature voltage: 400 V

- VERITRON compact converter
  for pull-out stand
  in anti-parallel, circulating current-free
  connection for four quadrant operation
  with supplementary circuit board, including ramp
  function unit, monitoring for speed controller,
  under voltage and zero r.p.m.

Travelling Rotary Cutting Machine

Technical data

tube length approx.	6 - 12 m
tube length tolerances	+/- 5 mm fault quote
Nos of discs	3
type of drive	AC-3 phase motor
cutting head speed regulation	static frequency converter
long travel drive	DC-motor rack and pinion and electronic length measuring unit with impulse generator

Equipment

Machine body with two guide rails.

Travelling carriage gear rack with DC-motor drive.

Carriage consisting of:

2 stretching devices with
1 rotating cutting outfit with 3 cutting discs
1 cable drag chain
1 lubrication unit for the cutter
1 complete hydraulic system consisting of:
pumps, valves, tank, filter, heating element,
cooling element, complete hydraulic line
installation.

The travelling cut-off unit cuts the ready made endless tube into the required commercial lengths. The saw carriage traverses on hardened rails. It is equipped with 4 track wheels and is driven by a DC-motor through a pinion and gear rack. The DC-motor is located on the saw track side.

The saw-carriage is supplied with two double stretching devices one cutting device with 3 rotating cutting discs and a substitute quick driven saw unit for production of square and rectangular tubes.

The complete operating movement cycles i.e. the travelling as well as stretching and cutting movements are automatically controlled and guided by a computer.

The hydraulic unit is located behind the course and connected by cable drag chain.

The tank is equiped with a heating as well as a cooling system, including pumps and drive-motor.

The control panel for operating all electrical magnet valves, adjusting valves and indicators is situated on the front side.

Outlet Conveyor

The conveyor length approx. 18 m, moves the cut tubes to the discharge roller table. Pipe can be hydraulically discharged either to the left or to the right side.

The conveyor is equiped with a heavy end bumper and hydraulic shock absorber.

- HF-Generator 400 kW

Technical Data

Output power:

0 kW to 400 kW continuous rating
6000 kVA at 1500 V to ground
380 KHz nominal frequency
Optimized for wide coil/tube radial clearance

Electrical supply:

740 kVA at 0.86 power factor. 50/60 Hz.
380 / 420 / 460 / 520 / 600 Volts tappings.
1113 / 1008 / 920 / 815 / 756 / 706 Amps at above Volts
Standby Power - 15 kVA
110/220/240 Volts for Cyberscan and lighting.

Water supply for HF-Generator-cooling

Equipment:

Oscillator and output busbar.
Solid state power pack with SCR controller.
Closed circuit water cooler
Remote control panel

Cyberscan Micro3 data management system
Work coil and impeder for one dimension.

High frequency sections are lined with aluminium to give lowest radiation.
Lifting eyes are provided for ease of installation

Features:

Thyristor (SCR) stabilised power control from 0 to 100 %

Single ceramic oscillator tube with a life up to 20,000 hrs

Water cooled ceramic tank capacitors with silicone rubber condensation protection

Unconditional stability with no anti-parasitic components

Remote control matching system for optimum efficiency

Automatic speed/power control

Water flow and temperature protection

Pressurized oscillator cabinet to exclude contamination

High speed circuit breakers on all circuits and single phase protection on fans and pump

CYBERSCAN process monitor and fault indicator fitted as standard equipment

No external output transformer required

Automatic temperature control on heat exchanger

FINISHING EQUIPMENT

In general all pipes are finished as:
a) plain-end black pipes
b) plain-end black pipes with bitumen coating of outer surface

c) plain-end pipes with inner lining
d) plain-end pipes with cement inner lining and bituminous coating of outer surface.

General equipment

- Pipe-end facing and bevelling units
- Cement inner lining centrifugal units
- Sandblasting units
- Bitumen coating devices
- Storage, transport and handling equipment.

Description of Finishing equipment

Pipe welding lines with monthly production rates of more than 1000 tonnes normally require automatic finishing installations.

Handling of pipes from one machine to another will be done by roller table/cross transfer grids/travelling crane and lifting equipment.

Pipe-end Facing and Bevelling Unit

for deburring, facing and chamfering both pipe ends.

Facing Machine (6" - 12")

Capacity : 6" - 12"
Pipe Length : 6 - 12 m
Pipe Standard : BS/DIN

Equipment: consists of interlinked units

- Pipe storage for charging the machines
- two single spindle facing units

- two transfer/roller tables and grids
- electrical equipment
- hydraulic/pneumatic equipment
- necessary tools/accessories
- coolant unit

Machine data

Spindle height above floor	1200 mm
Spindle speeds, infinitely variable	100 - 2200 rpm
Spindle stroke	50 mm

Electrical data

Electrical equipment is wired in accordance with the applicable standards for Metalworking Machine Tools. Standard Voltage is 380 V, 3 phase, 50 Hz, A.C. Motor protection as per IP 44.

Motors	Spindle drive	- 2 pcs
	Lifting arm drive	- 2 pcs
	Conveyor drive	- 2 pcs
	Coolant pump	- 2 pcs
	Total power required	approx. 75 kW

Pneumatic data

Design and installation as per International Standards, operating pressure 5 - 6 bar, consumption of compressed air approx. 40000 ltr/h, at max. production; supply by external unit.

Production data

Based on
- 100 % plant utilization
- pipe material of good machineability
- straightened pipe stock,
- square cut pipe ends
- machining stroke, 7 or 9 mm, depending on pipe size
- 12 m pipe length

The following approximate production can be achieved:

	Production	
Pipe nom. size	Machining stroke	pipes/h both ends finished HSS Tools
5"	7 mm	450
6"	7 mm	300
8"	9 mm	250
10"	9 mm	200
12"	9 mm	150

Cement Inner Lining Plant

Technical data

Tube Dimension: 6" - 12 " dia.
Pipe length : 6 - 12 m
Pipe Standard: BS/DIN

Capacity (of two machines)

diam.	No. tubes/h	Lining thickness
6"	14	6 mm
8"	12	7 mm
10"	11	7.5 mm
12"	10	8.0 mm

Pipe inner surface:	Free from dirt, weld scale, rust, oil and grease	
Total surface for lining:	6"	121,500 m²
	8"	80,350 m²
	10"	35,550 m²
	12"	157,200 m²
Consumption of cement mix:	6"	729 m³
	8"	563 m³
	10"	267 m³
	12"	1,260 m³
Lining factor:	14 - 3 kg/m²	
Loss factor:	20 %	
	Cement mix used	5,640 t/y
	Cement mix lost.	1,130 t/y

Equipment:

On the assumption that 50 % of the total production will be cement lined (i.e. 20,560 t/y) two centrifuges will be required and must operate on a 3 shift system.

- Pipe storage for charging the machines
- two centrifugal innerlining units
- two transfer table and storage grids
- electrical equipment
- cement-mix charging equipment
- water pumping system
- waste/recycling system

The Cement inner lining plant can inner line water-pipes in accordance to German/British Standards with the necessary layer thicknesses in relation to the pipe dia.

The pipes are connected and clamped onto the rotating machine system. The cement-mix spray-nozzle head then moves into the pipe whilst it is in rotation. The spray-nozzle head then moves along the total length of tube (forward-backward).
The finished tubes are finally carefully moved off the machine to drying area grid.

Bitumen Coating Plant

An amount of approx. 41,000 t/y of tube is coated with bituminous material. The coating-thickness has to be in accordance with the relevant international standards i.e. AWWA. The equipment is able to produce the ranges of coating-thickness as required.

Before coating the tubes they must first undergo a special surface sand-blast pre-treatment.

Sandblast-cleaning of surface can be done in automatic sandblast cabinets, or manually. Whereas however 2 automatic cabinets will suffice 14 hand operated ones would be required.
Use of only two automatic sandblasting cabinets however will require a three-shift operation.

Sandblasting Units (two machines)

Technical data

Tube diam. :	6" - 12"
Pipe Length :	6 - 12 m
Pipe Standard :	BS/DIN
Capacity max : (of two machines) :	140 m^2/h (outer surface of tube) the working-capacity of the units is independent of tube diameter.
utilization factor :	82 %

Equipment: consists of interlinked units

- Transfer table/grid charged by cross-transfer car
- roller table for charging/discharging blast cabinets
- blast cabinets with turbine wheel blast equipment and tube turning drive
- collecting table with pre-heating equipment to prepare tube surface for coating.

The pipe to be sand blasted passes through one of two automatic sand blasting cabinets where they are cleaned by blasting them with recycled steel shot. From the cleaning cabinets the pipe passes over a dispatch grid onto the collection grid which is fitted with heating elements to pre-heat the pipe prior to coating. The pipe is then charged direct to the coating unit over a roller table.

<u>Bituminization Platform</u> (two platforms)

Technical data

Tube diam. :	6" - 12" dia	
Pipe Length :	6 - 12 m	
Pipe standards :	BS/DIN	
Capacity :	6" - 18 tubes/h	
	12" - 10 tubes/h	
Utilization factor:	6"	90 %
	8"	82 %
	10"	79 %
	12"	83 %
Consumption of cotton strip:		2,766,000 m (x 0.3 m wide)
Coating factor:		5 kg/m²
Consumption of bitumen:		4,410 t/y
Loss factor:		5 %
		Bitumen used 4,200 t/y
		Bitumen loss 210 t/y

Equipment: consists of interlinked units

- transfer table/grid/roller table for charging the working platform
- platform for wrapping the pipe with cotton strips
- platform for coating the surface of tubes
- transfer table for drying the tubes with water cooling equipment (spraying nozzles)
- collection grid with control area.

PRODUCTION EQUIPMENT ALTERNATIVE II

Alternative II is designed to produce a range of pipe diameters from 1/2" - 12" with in addition to bitumin coated and/or cement lined pipe a range of galvanized pipe. The alternative I layout was so designed to allow alternative II to be added at a later date. To this end much of the internal infratsructure (installed for alternative I) is also suitable for alternative II. The major differences are a second tube welding plant to specifically produce small sized pipe, a galvanizing line to galvanize part of the production and added equipment (threading machine etc.) in the finishing area.

The following is an itemized breakdown of the additional equipment units required to make up alternative II.

TUBE WELDING PLANT FOR 1/2" - 4" PIPE

Technical data:

tube diameter	1/2" - 4"
tube length	6 - 7 m
tube specification	British Standard/DIN
strip dimension	50 - 380 mm wide
wall thickness	2.0 - 4.5 mm

material	hot or cold rolled slit steel strip
tensile strength	approx. 40 kg/mm²
coil inside diamter	500 mm
welding speed	0 - 90 m/min. (accord. Prod. Mix)

<u>Strip Preparation Line</u>

Technical data

Strip condition:	free of grease and oil
Yield point max.:	400 N/mm² to DIN 1544
Tensile strength:	550 N/mm²
Material:	low carbon steel
Max. feed in speed:	160 m/min.
Min. jogging/threading speed:	8 m/min.
Capacity of coil magazine:	3 coils

max. coil weight	approx.	12,000 kg
coil o.d.	approx.	1,000 - 1,800 mm
coil i.d.	approx.	500 - mm
coil width	approx	45 - 350 mm

Equipment

The equipment for the strip preparation line consists of:

- Coil magazine
- Coil hoisting table
- Uncoiler
- Strip leveller
- Strip shear and end welder
- Central hydraulic station
- Electric equipment

The general description for each of the above items of equipment are as per the same items in alternative I.

Spiral Looper

A spiral looper is installed between the strip preparation line and the forming mill. The looper acts as a strip accumulator which allows the strip feed to stop whilst a new strip is automatically welded to the tail of the strip being formed without interruption of the forming process.

The Looper consists of:

a) Entry pinch roll driven by AC-motor with brake

The strip is transported in a vertical position into the looper.

b) Spiral Looper

with a 5.0 m diameter turn-table which is driven by DC-motor, infinitely variable.
The turn-table is equipped with rollers to lead the strip.

The material is loaded into the looper after butt welding is finished.

c) Exit Pinch Roll

In the center of the turn-table there is an exit pinch roll with feeding rolls. The feeding rolls transport the strip from the center to the tube mill.

The advantage of the spiral looper is:

a) continuous production of the tube mill

b) storage of sufficient material for continuous production with reduced area.

c) positioning the strip preparation in line with the tube mill or at any angle depending on desired layout.

Forming Mill

Technical data:

break down stands	3 Nos., driven top and bottom rolls
idler stands	2 Nos. between Nos. 1-2 and 2-3 break down stands
idler stands	2 Nos. between Nos. 3 and 4 horizontal stands
horizontal stands	4 Nos. driven top and bottom rolls
idler stands	between stands 4-5 and 5-6

Top and bottom rolls height adjustable by screw down spindles.

The top rolls are also adjustable in the axial direction.

Equipment:

The equipment general description is as per the forming mill equipment in alternative I.

Welding Table

Technical data

number of welding rolls exchangeable
1 system with two rolls
1 system with three rolls
1 system with five rolls

- Outside Weld Bead Trimmer

Technical data:

Double tool holder type

Size range	125 - 325 mm
Guiding rolls	two bottom rolls and one top roll

Pull Out Stand

Technical data

size range	125 - 325 mm o.d.
Nos of rolls	4 = 2 top/bottom + 2 side rolls
drive	separate DC-motor

Water Coooling Section

Technical data

Size range	125 - 325 mm o.d.
Length	about 2 x 5 m
Water inlet pressure	3-6 bar

Sizing Mill

Technical data

Size range	125 - 325 mm o.d.
Nos of rolls	4 = 2 top/bottom + 2 side rolls
Drives	by separate DC motors
Nos of stands (horizontal)	4
Nos of stands (idler)	3

The description of the equipment is as per the sizing mill in alternative I.

Turk's Head

Technical data

Size range	125 - 325 o.d. and shapes corresponding to the mother pipe
Nos of rolls	4 (each head)

vertical adjustment	
horizontal adjustment	
rotary adjustment	+/- 20°

The desription of the equipment is as per the Turk's head in alternative I.

Tube Mill Drives

- DC-motors for forming and sizing section

- DC-motor for saw carriage

- Type of protection for all DC-drives IP 23 S
  forced cooled by a built-on fan with filter

Switch Board System (MAS-design)

The description of the equipment is as per the switch board in alternative I.

Travelling Rotary Cutting Machine

Technical data

tube length	approx.	6 - 12 m
tube length tolerances		+/- 5 mm fault quote
Nos of discs		3
type of drive		AC-3 phase motor
cutting head speed regulation		static frequency converter

long travel drive	DC-motor rack and pinion and electronic length measuring unit with impulse generator

The description of the equipment is as per the cutting unit in alternative I.

Outlet Conveyor

See the description for the outlet conveyor alternative I.

HF-Generator 250 kW

Technical data

Output power:

0 kW to 25 kW continuous rating
Optimized for wide coil/tube radial clearance

Electrical supply:

300 kVA at 0.86 power factor. 50/60 Hz.
380 / 420 / 460 / 520 / 600 Volts tappings.
Standby Power - 15 kVA
110/220/240 Volts for Cyberscan and lighting.

Water supply for HF-Generator-cooling

For description of equipment see HF-Generator alternative I.

FINISHING EQUIPMENT

In general all pipes are finished as:

a) plain-end-black pipes
b) plain-end galvanized pipes
c) thread-end galvanized pipes

General Equipment

- Pipe-end facing and bevelling units
- Pickling and galvanizing equipment
- Straightening unit
- Threading units
- Socket screw-on unit
- Cap press-on unit

Handling of pipes from one machine to another will be done by roller table/cross transfer grids/travelling crane and lifting equipment.

Pipe-end Facing and Bevelling Unit

for deburring, facing and chamfering both pipe ends.

Facing Machine (1/2" - 4")

Capacity	: 1/2" - 4"
Pipe Length	: 6 - 12 m
Pipe Standard	: BS/DIN

Equipment: consists of interlinked units

- Pipe storage for charging the machines
- two single spindle type facing units
- two transfer/roller tables and grids
- electrical equipment
- hydraulic/pneumatic equipment
- necessary tools/accessories
- coolant unit

Machine data

Spindle height above floor	1200 mm
Spindle speeds, infinitely variable	100 - 2200 rpm
Spindle stroke	50 mm

Electrical data

Electrical equipment is wired in accordance with the applicable standards for Metalworking Machine Tools. Standards Voltage is 380 V, 3 phase, 50 Hz, A.C.
Motor protection as per IP 44.

Motors	Spindle drive	- 2 pcs
	Lifting arm drive	- 2 pcs
	Conveyor drive	- 2 pcs
	Coolant pump	- 2 pcs

Total power required
approx.55 kW

Pneumatic data

Design and istallation as per International Standards, operating pressure 5 - 6 bar, consumption of compressed air approx. 40000 ltr/h, at max. production; supply by external unit.

Production data

Based on
- 100 % plant utilization
- pipe material of good machineability
- straightened pipe stock,
- square cut pipe ends

- machining stroke, 7 or 9 mm, depending on pipe size
- 12 m pipe length

The following approximate production can be achieved:

	Production	
Pipe nom. size	Machining stroke	pipes/h both ends finished HSS Tools
1/2"	3 mm	1,500
3/4"	3 mm	1,400
1"	5 mm	1,100
1 1/2"	5 mm	700
2"	5 mm	550
3"	7 mm	400
4"	7 mm	350

Galvanizing

Capacity : 1/2" - 4"
Pipe Length : 5 - 7 m
Prod. Output approx. : 25,000 t/y
approx. : 1,100 tubes/hour (depending on dia. of pipe)

Equipment consists of interlinked units:

- pickling line
- intermediate collection/charging table
- feeding roller table
- drying furnace
- galvanizing furace
- extracting machine
- blow-out and cooling device

Pickling Line

The pickling plant consists of a series of treatment baths:

- degreasing bath

dimensions:	approx.	length	7.0 m
		width	1.2 m
		depth	1.3 m

  tank protected inside and outside.

- rinsing bath I

dimensions:	length	7.0 m
	width	1.2 m
	depth	1.3 m

  tank protected inside and outside.

- HCL-pickling tanks

dimensions:	length	7.0 m
	width	1.2 m
	depth	1.5 m

  tanks are protected with an inner rubber lining under a layer of acid-proof bricks with a protective coat of paint on the outside.

- rinsing bath II

dimensions:	length	7.0 m
	width	1.2 m
	depth	1.3 m

  tank protection: inner lining and layer of acid-proof bricks.

- post rinsing bath

  dimension:

length	7.0	m
width	1.2	m
depth	1.3	m

  tank protection: inner lining.

- fluxing agent bath

  dimension:

length	7.0	m
width	1.2	m
depth	1.3	m

  tank protection: inner lining with the necessary insulation.

- drip table in a steel frame construction.

  - necessary supporting bricks, acid-proof tiles and tile bedding material required for the chemical treatment and the drying furnace.

Furnace

- drying furnace (light oil heating or gas)

inside effective width:	7.0 m	approx.
inside effective length:	8.0 m	approx.

consisting of:

- single pipe feeding device,
- complete double sheet-metal casing,
- necessary refractory material for the furnace bottom and the exhaust gas duct,
- chain guide bars,
- chain wheels and chain strands,
- chain drive with brake gear motor,

- circulating fans,
- flame jet tubes,
- burners with regulating units,
- combustion air fan with motor,
- exhaust gas slide/stack.

Galvanizing furnace (light oil heating or gas)

consisting of:

- necessary refractory materials, shaped brick and plates
- necessary insulating bricks,
- combustion chambers,
- complete sheet casing with anchoring and furnace roof,
- circulator, with motor,
- exhaust gas slide/stack,
- burners with regulating units,
- combustion air fan with motor,
- double oil-pump unit,
- tube for thermocouple elements
- zinc vat

inside dimensions: length: 8.0 m
width: 1.2 m
depth: 2.8 m

Switch and control equipment for the galvanizing and drying furnaces

consisting of:

- switch-cabinet
- temperature regulators (for galvanizing and for the drying furnace),
- temperature recorder,
- burner control system,
- necessary servo-drives,
- control pulpit
- exhaust gas chimney

diameter: 500 mm approx.
height: 13,000 mm approx.

- dipping and zinc vapour suction
- extracting equipment (handoperated)
- quenching equipment

Auxiliary and Secondary Equipment

- steam generator
- exhaust gas chimney
- pump installation and bath heating plant
- acid-resistant flow heater for heating the bath's
- electrical equipment
- Pollution control equipment
- Zinc vapour suction and cleaning cyclone

Dedusting plant for the pipe blow-out device

- complete multi cyclone filter plant for the galvanizing furnace,
- suction fan,
- the necessary suction lines from the zinc dust collecting tank to the cyclone and to the chimney,

Fluxing agent cleaning unit

Neutralization plant for the concentrate treatment

- lime milk treatment unit with stirrer, circulating pump, automatic water extraction,

- HCL Storage tank for fresh acid - 50 m^3
- charging pump
- HCL tank for old acid - 50 m^3

Straightening Unit

Pipe diam.	1/2" - 4"
Pipe length	5 - 7 m
Pipe Standard	BS/DIN

Equipment consists of interlinked units:

- charging table
- straightening machine
- roller table

Machine Data

Minimum diameter of tube		21.3 mm (1/2")	
Maximum diameter of tube		114.3 mm (4")	
Minimum wall-thickness		2.0 mm	
Maximum wall-thickness		5.0 mm	
Tube lengths		4 - 8 meters	
Tube standard		DIN/BS	
Yield strength		max. 45 kp/mm²	
Straightening speed in 3 steps		70 - 90 - 140 m/min	
Driving power N		2 x 30	kW-AC
Driving speed n	approx.	1500	RPM

General Technical Description:

Equipment:

- feeding rack
- entry channel
- entry pinch roll
- straightening machine
- exit pinch roll
- exit channel
- collecting trough

The straightening machine is equipped with 3 upper and 3 lower diagonally arranged rolls. The rolls are mounted in the top part and bottom part of the machine. The top and bottom parts are connected together by rods and intermediate sections. All rolls are acessible from the front-side.

During the straightening procedure the tubes are straightened by vertical adjustment of the middle pair of rolls. The upper rolls can be individually hand adjusted in the vertical direction to the respective diameter of the material.

- Feed Rack

The feed rack for receiving the pipes is designed for pipe lengths up to 8.0 m max.

- Entry Channel

An entry pinch roll is situated between the entry channel and straightening machine for guiding pipes into the straightening rolls. The upper roll is idle and is actuated by an air cylinder.

- Exit Pinch Roll

- Exit Channel

The exit pinch roll consists of a built-on upper roll, vertically adjustable, as well as a fixed mounted lower roll.

The straightened pipe leaving the machine enters into a "V" shaped delivery groove. The out-going pipe may revolve either clockwise or counter-clockwise, depending on the arrangement of the straightening machine. To be in harmony with the actual sense of pipe revolution, the "V" is inclined either to the right or the left.

When the tail end of the pipe has left the last pair of straightening rolls it is gripped by a pair of rolls which extract it completely from the machine and the pipe then rolls from the "V" groove down into a trough arranged alongside the channel.

The exit channel for max. tube length of 8.0 m consists of:

angle-shaped groove with lining,
adjusting device.

Electrical Equipment

suitable in design for connection to 380 V,
3-phase, 50 cycles AC comprising as follows:

1 three-phase AC-motor
for the drive of the upper straightening rolls.

1 three-phase AC-motor
for the entry pinch roll.

1 AC-geared motor, 3-phase
N = 3 kW
n2= 200 Rpm

Threading/Socket Screw-on/ Cap Press-on Units

Capacity	:	1/2" - 4"
Pipe length	:	5 - 7 m
Pipe Standard	:	BS/DIN

Equipment consists of interlinked units for double-end threading with socket screw-on (one end only) machine and

- 2 threading machines
- feeding charging grid
- transfer table/pipe collection table

- 1 Socket screw-on unit with automatic charging device
- transfer table

- 2 Cap press-on units with automatic cap charging device
- dispatch table

Threading Unit

Machine data

Spindle dia., front bearing	118 mm
Spindle sleeve O.D.	230 mm
Spindle height above floor	1000 mm
Spindle speed, infinitely variable	35 - 800 rpm

Electric data

Motors	Spindle drive	- 2 pcs
	Conveyor drive	- 2 pcs
	Coolant pump	- 2 pcs
	Transformer	- 2 pcs

Total power required approx. 54.0 kW

Pneumatic data

design and installation as per International Standards, operating pressure 5 - 6 bar, consumption of compressed air approx. 40,000 ltr/h at max. production, supply by external unit provided at site.

Production data

based on

- 100 % plant utilization
- pipe materials of good machineability,

- straightening pipe stock,
- use of Tangential Chaser Die Heads
- 6 m pipe length

The following approxiamate production can be achieved:

Pipe nom. size	Production: DIN/BS, pipes/h
1/2"	1,450
3/4"	1,125
1"	1,000
1 1/4"	790
1 1/2"	680
2"	550
2 1/2"	440
3"	365
4"	200

Automatic Socket Screw-on Equipment

for automatic application of a socket to one end of each pipe (hand tight screw-on).

Capacity

Pipe N.D.	1/2" - 4"
Pipe Length	3 - 6 meters
Socket Standards	DIN/BS

Equipment:

- Single spindle screw-on machine
- Transfer table

- Line equipment
  with one screw-on unit for
  single end coupling screw-on

- 1 screw-on machine,
- 1 transfer table,
- eletrical equipment,
- pneumatic installation,
- double reversible roller way,
- tools and accessories

for linking with foregoing threading line

Machine data

Spindle dia., front bearing	95 mm
Spindle height above floor	1000 mm
Spindle speed, infinitely variable	120 - 1800 rpm

Electric data

Motors	Main drive	- 1 pc
	Conveyor drive	- 1 pc
	Coupling feeder	- 1 pc
	Transformer	- 1 pc

Total power required approx. 16 kW

Pneumatic data

design and installation as per International Standards, operating presure 5 - 6 bar, consumption of compressed air approx. 15,000 ltr/h at max. production.

Production data

based on

- 100 % plant utilization
- straight pipe stock
- 6 m pipe stock length

The following production can be achieved approximately:

Pipe/Coupling nom. size	Pipes/h - cpl. at one end
1/2"	1,450
3/3"	1,125
1"	1,000
1,1/4"	790
1,1/2"	680
2"	550
2,1/2"	440
3"	365
4"	200

Above production represents the maximum as achievable with foregoing threading machinery.

Automatic Cap Fitting Installation

for automatic application of plastic thread protectors to one pipe end; machinery is compatable with the threading and coupling lines.

Capacity

Pipe N.D.	1/2" - 4"
Pipe Length	3 - 6 meters

Protecting caps:

Plastic of rigid design and uniform geometry.

Consisting of the following interlinked Units:

1 Fitting Unit
1 Transfer Table

Equipment:

- 1 pressing-on unit,
- transfer table with
- pneumatic installation
- plastic cap feeder device

Technical data

Capacity Range

Pipe nom. size	1/2" - 4"
Pipe length - as standard	4.5 - 7.5 m
Pipe standards	DIN/BS
Protector caps	Rigid Plastic

Machine data

Machine Centerline above floor	approx. 1000 mm

Electrical data

Motors	Lifting arm drive	- 1 pc
	Conveyor drive	- 1 pc
	Transformer	- 1 pc

Total power required approx. 8 kW

Pneumatic Data

Design and installation as per International Standards, operating pressure 5 -6 bar, consumption of compressed air approx. 25,000 ltr/h at max. production.

Production data

based on

- 100 % plant utilization
- straight pipe stock
- pipe stock chamfered at outer diameter,
- plastic caps of rigid material,
- plastic caps of uniform geometry,
- 6 m pipe length

The following production can be achieved approximately:

Pipe nom. size	Pipes/h - cap at one end
1/2"	1,450
3/4"	1,125
1"	1,000
1.1/4"	790
1.1/2"	680
2"	550
2.1/2"	440
3"	365
4"	200

Above production represents the maximum as achievable with foregoing threading machinery.

AUXILIARY EQUIPMENT AND SYSTEMS (Alternative I and II)

The following general description covers the primary auxiliary plant areas and equiment which are necessary to cover the specific requirements of the plant units.

Workshop

The workshop facilities and equipment are designed for maintenance and repair work for the specific production/utility and auxiliary equipment. The most suitable arrangement is to use a main workshop for mechanical and electrical repair and small maintenance centers situated near by the production lines.
The ranges of basic equipment for repair and maintenance should include

- heavy duty standard lathe (also used for treatment of the bigger forming-rolls from the production lines.)
- universal milling machine (table size) with necessary tool sets.
- shaping machine with standard equipment/tools.
- radial drilling machine (capacity up to 32 mm).
- column drilling machine (capacity up to 32 mm).
- electrical hack-saw (approx. 300 mm dia).
- universal round grinding machine (approx. 500 mm dia) with standard equipment and spare wheels.
- universal profile/grinding machine (approx. 500 mm dia).
- key-way slotting machine (standard type).
- welding machines (movable) approx. 50-400 Amp.
- Gas welding equipment with accessories.
- pipe bending equipment (approx. 2 1/2").

- straightening plate (approx. 1000 x 1500 mm).
- threading machine for max. 2 1/2" (metric/inch dies).
- double grinder stand (approx. 300 mm dia).

- general equipment and fittings:
  - tool cabinets/shelves
  - work benches
  - hand drilling equipment
  - hand grinding equipment
  - tools
  - safety equipment
  - workshop consumables

Storage

- tool store (for storage and maintenance of special tools etc.)
- material store
  - consumables
  - spare parts
  - wear + tear materials

Cranes

All cranes are designed and manufactured in accordance with the relevant technical standards (DIN -BS - AS and/or national safety standards). They are also designed to meet the production requirements as well as the maintenance requirements.

All cranes are equipped with contact-control systems. Cranes with operator's cab are controlled by a master switch. Floor controlled cranes are equipped with a pendant push-button control unit running along crane bridge.

Hoist motions of cranes are of compact electric hoist-type, i.e. the rope drum, gearbox, motor and brake are an integral unit.

Rubber buffers to limit travel path of crane and trolley and crane operator cabs are included.

Laboratory

A laboratory for quality control for both raw materials and finished products, is required for physical and chemical tests. Mainly metallographic tests are the basis for checking the quality level of materials and products. The range of basic equipment for pre-testing raw materials and finished products consists of:

- Sample preparation equipment:
    - grinding machine
    - polishing machine
    - cleaning machine

- Non-destructive test equipment
    - ultrasonic
    - microscope

- Destructive test equipment:
    - hydraulic press
    - tensile test machine
    - hardness testing machine

- Chemical test equipment for wet analysis of steel and other materials necessary for production such as zinc, bitumen, cement, water, acid etc.

Mobile equipment/vehicle weigh bridge

In accordance with the actual material flow transportation of products and other materials outside the production areas will be handled by mobile equipment at floor-level.

The mobile equipment covers the transport of:

- finished tubes (internal transportation)
- waste material and scrap
- consumables/spare parts/ tools
- workshop services for repair

Equipment consists of:

- one mobile crane: 5 t
- one heavy duty tractor approx. 25 t traction
- two heavy duty platform trailers: Load approx. 20 t
- one forklift, lifting capacity approx. 1.5 t
- several handcarts/lifting devices
- several containers and boxes
- vehicle weigh bridge: weighing-capacity, 30 t (with printer-system)

Electrical Supply System

All the following equipment will be located in the Electrical Station.

The incoming 11 kV will be distributed in the switchgear with one incoming and two outgoing feeders for two low voltage transformers 1000 KVA (1600 KVA for alternative II). The consumption metering will be integrated in the incoming feeder cubicle.

The oil-immersed transformers will be naturally cooled and will be placed in separate pens.

In addition to the 11 kV-switchgear, the low-voltage distributions for both transformers will be located in the switchgear room. Each distribution consists of one incoming feeder and a minimum of 12 outgoing feeders with various ratings.

The cables from the low-voltage distributions to the consumers will enter the production building via a pipe-duct under the road and then distributed within the building via cable-trays in the steel structure. Cables to other buildings will be buried in cable-trenches along roads.

For grounding purposes foundation reinforcement bars including those of piles will have welded connections and be connected to the steel structure and equipment.

Lighting

The production building will be illuminated with 400 W mercury vapour lamps and 58 W-twin fluorescent tubes. Some of the fluorescent lamps, located at exits and main transport/walkways will be equipped with NICD batteries to illuminate escape routes during power black outs. The auxiliary buildings will be illuminated with fluorescent lamps.

A street illumination has not been provided, therefore all buildings will have some external light fittings.

A telephone system with 15 extensions, located in various offices within the production and auxiliary buildings will be provided. In addition a further 10 handsets will be installed to increase the number of subscribers by parallel connections.

Water System

Fresh Water

The fresh water required for supply of the plant will be taken from a new water well, which also has an interconnection to the existing water wells at YWAMA-Steel Mill so ensuring continuous water supply for the whole plant.

The incoming fresh water is first passed through a gravel filter and then split into to streams. One stream, service and make-up water passes directly to the consumers whilst the second stream goes for treatment prior to its use as potable water.

Potable Water

The available well water will be further treated to potable water quality in accordance with the WHO (World Health Organization) specification. The required water quantity will be stored in a hydrophor tank after chlorination and prior to distribution to the consumers.

Service and Make-up water

One pump group is provided for the service and make-up water supply. As the water demand will vary, the pump group will be of a sufficient number of pumps to enable an economic matching of the delivery rate to the actual requirements.

The consumers of service water are:

- Tube welding line
- Tube finishing line
- Cement lining
- Bitumen coating

Each of the above have individual water circuits and water is required only to make-up water losses due to evaporation and spray/spillage.

Fire Protection

A fire fighting water system is not provided.

For fire protection, a suitable number of portable fire extinguishers, filled with dry powder, will be placed at suitable locations within the plant.

The electric stations will be protected by means of CO_2 fire extinguishers. Moreover, it is assumed that in case of fires, the public fire fighting brigade will be called upon for help.

Compressed Air System

Two compressed air package units will be provided for the various compressed air users in the plant. The package unit consists of two air compressors, one in operation and one as standby, and one buffer vessel so dimensioned that for the different users air with sufficient pressure and quantity is always available.

A pressure controller starts and shuts down the compressors automatically. Changing over from the operating compressor to standby compressor is done manually. The consumers within the pipe welding plant and for utility purposes are fed through a completely equipped pipeline net at a pressure of 6-7 bar.

The produced quantity of one compressor (screw type) is approx. 850 m^3n/h for alternative I and approx. 2500 m^3n/h for alternative II.

Fuel Gas System

The required fuel gas for the tube welding plant will be taken via pipeline from outside the plant limits.

Inside the plant limit will be a small pressure reducing and metering station only, with the pipe network to the consumers. The incoming pressure is approx. 5.3 bar, this pressure will be reduced to approx. 3 bar.

The required quantity of Fuel gas is approx. 40 m^3n/h for alternative I and approx. 390 m^3n/h for alternative II.

Raw Material Storage (Raw Coils)

The production programme covers a range of products as shown below:

- black tubes (plain-end)
- black tubes with cement inner lining
- tubes only with coating of outer surface
- tubes with cement inner lining and bituminous coating of outer surface
- tubes galvanized (plain-end)
- tubes galvanized (thread-end)
- hollow shapes/square/oval etc.
- construction tubes

The major input material for the complete variety of these products is hot or cold rolled coils with the dimensions:

outer dia:	max 1,800 mm
inner dia:	approx. 600 mm
width:	max. 1,200 mm
weight:	max. 12,000 kg

To guarantee a continuous sequence of production, raw material has to be stored for a maximum period of approx. 6 weeks.

Alternative I

slit coils, total	: 84,412 t/year
slitting scrap approx.	: 4,288 t/year
total coils	: 88,700 t/year

Throughput : $\frac{88,700}{12}$

No. of coils, approx. : 7,400 coils/year

Storage capacity for 1.5 months : 925 coils

required floor space : 2 m²/coil (one coil layer system)

total space required : 1,850 m²

Alternative II

slit coils, total : 115,600 t/year

slitting scrap approx. : 6,480 t/year

Total coils : 122,080 t/year

Throughput : $\frac{122,080}{12}$

No. of coils, approx. : 10,173 coils/year

Storage capacity for 1.5 months : 1,270 coils

Surface pressure of storage area : approx. 5.5 t/m²

The extent of the storage area depends on the maximum pressure of soil (5.5 t/m²). These conditions stipulate a "one-coil layer system" only for the area.

A gantry-crane is installed for handling raw material coils within the storage area and charging the coil ramp.

<u>Intermediate Storage</u> (Slit Coils)

Alternative I

Coil weight : max. 11,650 kg

production : 84,412 t/year

working days : 245 d/year

daily production : $\frac{84,412}{245} = 345$ t

Necessary storage capacity : two days production

approx. : 690 t

approx. : 60 coils

required floor space : 2 m^2/coils

total space occupied (required) : 120 m^2

Alternative II

Coil weight : max. 11,650 kg

production : 115,600 t/year

working days : 245 d/year

daily production : $\frac{115,600}{245}$

= 470 t

Necessary storage capacity : two days production

approx. : 940 t

approx. : 80 coils

required floor space : 2 m^2/coils

total space occupied (required) : 160 m^2

surface pressure of storage area : approx. 5.5 t/m^2

Storage "Semi-finished product"

Alternative I

production : 84,412 t/year

weld/form. scrap : 1,872 t/year

semifinished tubes, total : 82,540 t/year

working days : 245 d/year

daily throughput : $\frac{82,540}{245}$

= 337 t/day (tubes)

necessary storage capacity : two days production
required floor space : approx. 300 m^2 (with hurdles)

Alternative II

production : 115,604 t/year
weld/form. scrap : 2,411 t/year
semifinished tubes, total : 113,163 t/year
working days : 245 d/year
daily throughput : $\frac{113,163}{245}$
= 460 t/day (tubes)

necessary storage capacity : two days production
required floor space : approx. 450 m^2 (with hurdles)

Surface pressure of storage area : approx. 1.7 t/m^2

At this point the total production is divided into

Alternative I

- finished black tubes (ready for sale)
- semi-finished tubes for further treatment.

Both products are stored in the area "storage black tubes".

In accordance with the valid product-mix the following amount of total production is distributed in:

a) finished black tubes (plain-end) : 40,760 t/year
b) finished tubes for further treatment: 41,120 t/year

The group "a" will be stored for sale outside of the black tube storage in the open air storage.

Handling procedure

- dispatch of material be travelling-crane from inside to outside of the storage bay.
  Crane runway pass to outdoor area for loading the floor operated trailer.
  A mobile-crane will handle the product in the open-air storage.

The group "b" is moved from the black tube storage by cross transfer car to the charging grids of cement inner lining and/or bitumen coating plants.

Alternative II

- finished black tubes (ready for sale)
- semi-finished tubes for further treatment.

In accordance with the valid product-mix the following amount of total production is distributed in:

a) finished black tubes (plain-end) : 48,110 t/year
b) finished tubes for further treatment : 64,300 t/year

The group "a" will be stored for sale. The handling procedure being the same as alternative I.

The group "b" is moved from the black tube storage by cross transfer car to the charging for cement line and/or bitumen coating or to the pickling line.

Scrap Disposal

As shown in the material flow sheet the following process-scrap material occurs.

	Alt. I	Alt. II
- slitting line	4,290 t/y	6,480 t/y
- strip preparation/welding line	1,870 t/y	2,439 t/y
- facing threading units	660 t/y	847 t/y
total	6,820 t/y	9,766 t/y

At each scrap generating point the scrap will be collected in special containers. The scrap containers are transported by travelling-crane to the outdoor areas of the different production bays.
To avoid intermediate storage, the containers will be picked up by trailers and directly transported to the nearby steel mill.

	Alt. I	Alt. II
working days	245 d/y	245 d/y
total throughput	6,820 t	9,766 t
total scrap	28 t/d	40 t/d

Emulsion Unit

A basin with pump and a paper and magnetic absorber is situated near the production line for collecting the emulsion which is used in the forming and sizing mill, pinch rolls and impeders.

Automatic zinc ash reclaiming plant (Alternative II only)

General

Under normal circumstances efficiency for consumption of zinc can only reach a maximum of 45 % (i.e. 55 % losses in the form of hard zinc, zinc ash and vapour). However, by use of a reclamation plant it is possible to increase zinc usage efficiency up to between 88 and 90 %.

Plant equipment

The equipment consists of:

- Portable zinc ash container
- Automatic worm conveyor system
- Hammer mill
- Vibrator
- Filter case with separating channel, filtering compartments and exhaust ventilator.
- Distilling furnace

Mode of operation

Zinc recovery is normally done batchwise at 2 to 3 monthly intervals depending upon the throughput of the galvanizing bath and cast into ingots ready for direct charging into the distilling furnace. Zinc ash is first crushed and filtered to remove elemental zinc (the ash must be disposed of) which is added with the hard zinc to the furnace. The gas fired furnace vaporizes the zinc which is then recooled in a condensing retort to produce recuparated zinc of 99 % purity. The furnace has a capacity of about 450 kg of waste per charge.

Civil Engineering Works (alternative I and II)

Site Preparation and Development

The pre-selected site at Ywama, Insein is flat. It appears to be high enough to be drained into the neighbouring Hlaing River. The final site survey might show that some filling and/or soil exchange (removal of mud and replacement by good soil) might be needed.

Site preparation (works within factory fence) will include
- fencing
- storm water drainage
- soil improvement

Site development (works outside factory fence) are described under chapter 5.

Masonry Buildings

From the subsoil information available from Ywama steel mill we assume that masonry buildings can have shallow footings with a maximum soil pressure of 0.5 kg/cm².

Masonry buildings will have reinforced concrete strip foundations. Walls will be of red brick with reinforced concrete frames and tie beams. Floors will be concrete. Roof construction will be of local wood construction; roof covering corrugated galvanized steel sheet.

Rooms will have suspended ceilings with fluorescent lamps. Walls will be plastered and painted. Floors will have cement screed and floor paint. Toilets and laboratories will have special ceramic tiles and/or painting for floors and walls.

Laboratories, management offices and conference rooms will have window unit airconditioners; other offices, change rooms, mess rooms etc. will have ceiling fans; toilets and shower rooms will have exhaust fans.

Masonry buildings especially the administration building, amenity building and gate house should be built as early as possible.

The above description covers the following masonry buildings:

- Administration Building

  The administration building will have all necessary office facilities with toilets for technical and commercial management and staff.

  Built-up area:
  Alternative I and II: width 10 m, length 40 m; 400 m²

- Amenity Building

  The amenity building has lockers, showers, toilets and a general mess room (without cooking equipment)

  Built-up area:
  Alternative I: width 10 m, length 40 m; 400 m²
  Alternative II: width 10 m, length 56 m; 560 m²

- Quality Control Center and First Aid Station

  The quality control center includes office facilities with toilets and laboratories for quality control, a first aid room and a car port for an ambulance car.

  Built-up area: width 10 m, length 20 m; 200 m²

- Gate House

  In the gate house includes entrance and exit control facilities for personnel (time control) and goods (weighing scale for trucks), an office for security personnel and toilets.

  Built-up area:
  Alternative I and II: width 4 m, length 12 m; 48 m²

- Electrical Station

  The electrical station contains 2 pens for oil cooled naturally ventilated transformers, a switch gear room with forced ventilation, a spare parts storage with electronic repair shop (airconditioned), and a general electrics repair shop.

  Built-up area:
  Alternative I and II: width 5.5 m, length 21 m; 116 m^2

The following buildings will be without suspended ceilings and plastering. They will be partly without side walls and without painting.

- Pump House

  The pump house houses pumps, water chlorination equipment and a hydrophor tank for potable water.

  Built-up area:
  Alternative I and II: width 5.5 m, length 6 m; 33 m^2

- Motor Pool

  The motor pool is a large car port for maintenance of motor vehicles.

  Built-up area:
  Alternative I and II: width 6 m, length 10 m; 60 m^2

- Water Cooling Station

  The water cooling station houses chilling equipment for the pipe welding machine.

Built-up area:
Alternative I: width 6 m, length 10 m; 60 m^2
Alternative II: width 10 m, length 10 m, 100 m^2

- Storage for Consumables (lubricants, gas bottles etc.)

The storage is a paved, fenced area with a sun/rain roof.

Built-up area:
Alternative I and II: width 6 m, length 15 m; 90 m^2

- Compressed Air Station

The station houses air compressors and buffer vessels.
Built-up area:
Alternative I and II: width 10 m, length 10 m; 100 m^2

Gas Station

The gas station houses gas metering equipment and valves.

Built-up area:
Alternative I and II: width 2 m, length 3 m; 6 m^2

Production Halls

- Structural Steel Halls

All production buildings will be of structural steel. Designs for these buildings will be made abroad and also material will come from abroad. Manufacture, transport and erection will be local.

The buildings will have pile foundations. To reduce the number of piles required the spacing of frames will be as wide as 12 m. (18 m in one case for production reasons).

The halls will have runways for overhead cranes. Roof and wall cladding will be in corrugated sheets. In general wall cladding will be above 2.5 m only. The lower 2.5 m be open to allow free access and ventilation. The roof will have rain-proof openings to improve natural ventilation.

The built-up area of structural steel halls is:

Alternative I:	7,600 m^2
Alternative II:	11,760 m^2

- Concrete Floors

Structural steel halls and production areas outside the halls will receive reinforced concrete floors.

- Foundations for Equipment

All equipment will have reinforced concrete foundations. These foundations are calculated without piling.

- Foundation for Gantry Crane

For foundation of the gantry crane a gravel bed and sleepers are provided.

Outdoor Works (within factory fence)

- Roads

Roads will generally be 6 m wide. Main roads will be concrete. Parking areas and roads at the storage areas will be built of laterite.

- Railroad

  There will be 190 m of railroad track within the factory fence.

- Stormwater Drainage

  The stormwater drainage built during site preparation will be extended to suit all needs of the proposed plant.

- Sewage and Waste Water Disposal

  Sewage will be cleaned in septic tanks and then led into the stormwater drainage system. Waste water from production will after cleaning also be led into the stormwater drainage.

- Storage Areas

  Storage areas will be reinforced with laterite and drained. In addition wooden sleepers will be provided.

- Utility Supply

  For water supply a well will be drilled. Trenches will be provided for water, electricity, gas and telephone distribution lines.

<u>Company Housing</u>

- Company housing for alternative I and II will include a guest house (150 m^2), 7 houses of 110 m^2 each and 6 houses of 90 m^2 each as detailed in chapter 5. These facilities should be built as early as possible.

Schedule 6-2/1 Estimate of investment cost: equipment

ESTIMATE OF INVESTMENT COST

EQUIPMENT

Project component: Pipe plant, dia 6"-12" Alternative I
Production equipment,

Description	Investment Cost 1000 x US $		
	Foreign	Local	Total
Coil slitting line	1,088	57	1,145
Tube welding line	2,858	317	3,175
Roller tables/grids	85	9	94
Facing machine	417		417
Non destructive testing equipment	175		175
Road weigh bridge	42		42
Tube hurdles	21	42	63
Sand blasting machine	115		115
Bitumizing machine	63		63
Cement inner lining machine	1,170	130	1,300
Sub-total production equipment f.o.b.	6,034	555	6,589

Schedule 6-2/2 Estimate of investment cost: equipment

ESTIMATE OF INVESTMENT COST

EQUIPMENT

Project component: Pipe plant, dia 6"-12" Alternative I

Auxiliary equipment

Description	Investment Cost 1000 x US $		
	Foreign	Local	Total
Electrical transformer	25		25
H.V. Switch gear	50		50
L.V. Switch gear	60		60
Lighting	60		60
Telecommunication	15		15
Electrical installation material and cables	25		25
Waste water treatment/water treatment equip.	210		210
Compressed air station	115		115
Fuel gas station and piping etc.	27		27
Cranes	288		288
Mobile equipment	40		40
Total auxiliary equipment f.o.b.	915		915

Schedule 6-2/3 Estimate of investment cost: equipment

ESTIMATE OF INVESTMENT COST

EQUIPMENT

Project component: Pipe plant, dia 6"-12" Alternative I
Service equipment

Description	Investment Cost 1000 x US $		
	Foreign	Local	Total
Mechanical workshop	52	2.5	54.5
Electrical workshop	10	0.5	10.5
Stores (spare parts etc.)	10	12	22
Laboratory	15		15
Fire fighting equipment	39		39
Sub-total service equipment f.o.b.	126	15	141

Schedule 6-2/4 Estimate of investment cost: equipment

ESTIMATE OF INVESTMENT COST

EQUIPMENT

Project component: Pipe plant, dia 6"-12" Alternative I
Spare parts and tools

Description	Investment Cost 1000 x US $		
	Foreign	Local	Total
Additional tools	417		417
Spare parts	170		170
Wear and tear parts	230		230
Sub-total Spare parts and tools f.o.b.	817		817

Spare parts and tools are estimated for the first two (2) years of operation.

Schedule 6-2/5 Estimate of investment cost: equipment

ESTIMATE OF INVESTMENT COST

EQUIPMENT

Project component: Pipe plant, dia 6"-12" Alternative I

Additional costs

Description	Investment Cost 1000 x US $		
	Foreign	Local	Total
Transport to nearest port (CIF)	495	-	495
Local transportation		4	4
Erection of production equipment	265	60	325
Sub-total additional costs	760	64	824

Schedule 6.3 Summary - investment cost: equipment

SUMMARY SHEET - INVESTMENT COST

EQUIPMENT

Project component: Alternative I

Description		Investment Cost 1000 x US $		
		Foreign	Local	Total
Production equipment		6,034	555	6,589
Auxiliary equipment	*)	915		915
Service equipment	*)	126	15	141
Spare parts and tools		817		817
Additional costs	*)	760	64	824
Total		8,652	634	9,286

*) the costs include vehicles and sundry equipment (which should be replaced after 5 years) as follows:

Foreign	Local	Total
90	10	100

Schedule 6-2/1 Estimate of investment cost: equipment

ESTIMATE OF INVESTMENT COST

EQUIPMENT

Project component: pipe plant, dia 1/2"-12" Alternative II
Production equipment

Description	Investment Cost 1000 x US $		
	Foreign	Local	Total
Coil slitting line	1,088	57	1,145
Tube welding line	4,330	482	4,812
Roller tables/grids	136		136
Facing machine	682		682
Non-destructive testing equipment	375		375
Straightening machine	175		175
Threading machine	281		281
Socket screw on machine	138		138
Pipe end cap fitting machine	104		104
Road Weighbridge	42		42
Tube hurdles	40	75	115
Pickling plant	500	152	652
Galvanizing plant	1,210		1,210
Zinc recovery plant	66		66
Neutralization plant	125		125
Sand blasting machine	115		115
Bitumizing machine	63		63
Cement inner lining machine	1,170	130	1,300
Sub-total production equipment f.o.b.	10,640	896	11,536

Schedule 6-2/2 Estimate of investment cost: equipment

ESTIMATE OF INVESTMENT COST

EQUIPMENT

Project component: pipe plant, dia 1/2"-12" Alternative II

Auxiliary equipment

Description	Investment Cost 1000 x US $		
	Foreign	Local	Total
Electrical transformer	33		33
H.V. Switch gear	50		50
L.V. Switch gear	65		65
Lighting	65		65
Telecommunication	15		15
Electrical installation material and costs	30		30
Waste water treatment/water treatment equip.	268		268
Compressed air station	135		135
Fuel gas station and piping etc.	35		35
Cranes	344		344
Mobile equipment	52		52
Total auxiliary equipment f.o.b.	1,092		1,092

Schedule 6-2/3 Estimate of investment cost: equipment

ESTIMATE OF INVESTMENT COST

EQUIPMENT

Project component: pipe plant, dia 1/2"-12" Alternative II
Service equipment

Description	Investment Cost 1000 x US $		
	Foreign	Local	Total
Mechanical workshop	84	4	88
Electrical workshop	10	1	11
Stores (spare parts etc.)	14	17	31
Laboratory		20	20
Fire fighting equipment	44		44
Sub-total service equipment f.o.b.	172	22	194

Schedule 6-2/4 Estimate of investment cost: equipment

ESTIMATE OF INVESTMENT COST

EQUIPMENT

Project component: pipe plant, dia 1/2"-12"   Alternative II

Spare parts and tools

Description	Investment Cost 1000 x US $		
	Foreign	Local	Total
Additional tools	567		567
Spare parts	278		278
Wear and tear parts	376		376
Sub-total spare parts and tools f.o.b.	1,221		1,221

Spare parts and tools are estimated for the first two (2) years of operation.

Schedule 6-2/5 Estimate of investment cost: equipment

ESTIMATE OF INVESTMENT COST

EQUIPMENT

Project component: pipe plant, dia 1/2"-12" Alternative II

Additional costs

Description	Investment Cost 1000 x US $		
	Foreign	Local	Total
Transport to nearest port (CIF)	739	-	739
Local transportation		7	7
Erection of production equipment	420	90	510
Sub-total additional costs	1,159	97	1,256

Schedule 6.3 Summary - investment cost: equipment

SUMMARY SHEET - INVESTMENT COST

EQUIPMENT

Project component:		Alternative II		
Description		Investment Cost 1000 x US $		
		Foreign	Local	Total
Production equipment		10,640	896	11,536
Auxiliary equipment	*)	1,092		1,092
Service equipment	*)	172	22	194
Spare parts and tools		1,221		1,221
Additional costs	*)	1,159	97	1,256
Total		14,28'	1,015	15,299,

*) the costs include vehicles and sundry equipment (which should be replaced after 5 years) as follows:

Foreign	Local	Total
100	10	110

Schedule 6 - 4/1 - Estimate of investment cost: civil engineering works

ESTIMATE OF INVESTMENT COST
CIVIL ENGINEERING WORKS
LOCATION: YWAMA PLANT ALTERNATIVE I, US \$ 1.- = K 7.75 = DM 2.40

No.	Quantity	Unit	Item description	Unit cost		Cost	
				local US \$	foreign US \$	local US \$	fore U
			SITE PREPARATION AND DEVELOPMENT				
1	1,000	m	factory fencing	20	-	20,000	-
			drainage ditches:				
2	800	m	0.5 - 1 m deep	2	-	1,600	-
3	250	m	1 - 2 m deep	2.50	-	625	-
4	250	m	2 - 2.5 m deep	3.50	-	875	-
5	lumpsum		soil fill/exchange	lumpsum		6,900	-
6	see chapter 5		site development	see chapter 5		154,000	130,
sub-total site preparation and development					-	184,000	130,
			MASONRY BUILDINGS				
7	400	m^2	administration building	350	lumpsum	140,000	20,0
8	400	m^2	amenity building	350	"	140,000	2,0
9	200	m^2	quality control center and first aid station	350	"	70.000	4,0
10	48	m^2	gate house	350	"	16,300	3,0
11	116	m^2	electrical station	400	"	46,400	3,0
12	33	m^2	pump house	280	-	9,240	-
13	60	m^2	motor pool	260	-	15,600	-
14	[illegible]	m^2	water cooling station	280	-	16,800	-
15	90	m^2	storage for consumables	250	-	22,500	-
16	100	m^2	compressed air station	280	-	28,000	-
17	lumpsum		other buildings	lumpsum		24,660	5,0
sub-total masonry buildings				-	-	530,000	37,0

: civil engineering works

ATIVE I, US $ 1.- = K 7.75 = DM 2.40

	Unit cost local US $	 foreign US $	Cost local US $	 foreign US $	 total US $
EVELOPMENT					
	20	-	20,000	-	20,000
	2	-	1,600	-	1,600
	2.50	-	625	-	625
	3.50	-	875	-	875
	lumpsum		6,900	-	6,900
	see chapter 5		154,000	130,000	284,000
		-	184,000	130,000	314,000
	350	lumpsum	140,000	20,000	160,000
	350	"	140,000	2,000	142,000
	350	"	70,000	4,000	74,000
	350	"	16,800	3,000	19,800
	400	"	46,400	3,000	49,400
	280	-	9,240	-	9,240
	260	-	15,600	-	15,600
	280	-	16,800	-	16,800
	250	-	22,500	-	22,500
	280	-	28,000	-	28,000
	lumpsum		24,660	5,000	29,660
	-	-	530,000	37,000	567,000

Schedule 6 - 4/1 (cont.) - Estimate of investment cost: civil engineering works

ESTIMATE OF INVESTMENT COST
CIVIL ENGINEERING WORKS (cont.)
LOCATION: YWAMA PLANT ALTERNATIVE I US $ 1.- = K 7.75 = DM 2.40

No.	Quantity	Unit	Item description	Unit Cost		Cost	
				local US $	foreign US $	local US $	foreign US $
			PRODUCTION HALLS				
1	150	pc	piles f. struct. steel halls	1100	-	165,000	-
2	250	m^3	concrete for pile heads	200	-	50,000	-
3	7,600	m^2	structural steel halls	30	55	228,000	418,000
4	6,000	m^2	concrete floor	30	-	180,000	-
5	900	m^3	foundation etc. f. equipment	220	-	198,000	-
6	280	m	foundation for gantry crane	20	-	5,600	-
sub-total production halls				-	-	826,600	418,000
			OUTDOOR WORKS				
7	7,250	m^2	concrete roads	7.20	-	52,200	-
8	3,300	m^2	laterite roads	3.60	-	11,880	-
9	190	m	railroad	25	95	4,750	18,050
10	lumpsum		extension stormwater drainage	lumpsum	-	10,000	-
11	lumpsum		sewage and waste water disposal	lumpsum	-	20,000	-
12	1,350	m^2	storage area for sheet coils	5	-	6,750	-
13	5,800	m^2	storage area for pipes	2	-	11,600	-
14	lumpsum		utility supply	lumpsum		6,000	-
sub-total outdoor works				-	-	123,180	18,050
15	see chapter 5		company housing	see chapter 5		506,000	-

ent cost: civil engineering works

IVE I US $ 1.- = K 7.75 = DM 2.40

	Unit Cost		Cost		
	local US $	foreign US $	local US $	foreign US $	total US $
halls	1100	-	165,000	-	165,000
s	200	-	50,000	-	50,000
	30	55	228,000	418,000	646,000
	30	-	180,000	-	180,000
ipment	220	-	198,000	-	198,000
rane	20	-	5,600	-	5,600
	-	-	826,600	418,000	1,244,600
	7.20	-	52,200	-	52,200
	3.60	-	11,880	-	11,880
	25	95	4,750	18,050	22,800
ainage	lumpsum	-	10,000	-	10,000
	lumpsum	-	20,000	-	20,000
coils	5	-	6,750	-	6,750
	2	-	11,600	-	11,600
	lumpsum		6,000	-	6,000
	-	-	123,180	18,050	141,230
	see chapter 5		506,000	-	506,000

Schedule 6 - 5/1 - Summary sheet - investment cost: civil engineering works

ESTIMATE OF INVESTMENT COST
CIVIL ENGINEERING WORKS
SUMMARY SHEET
LOCATION: YWAMA PLANT ALTERNATIVE I

Item description	Cost local US$	 foreign US$	 total US $
Site Preparation + Development	184,000	130,000	314,000
Masonry Buildings *)	530,000	37,000	567,000
Production Halls *)	826,500	418,000	1,244,600
Outdoor Works	123,180	18,050	141,230
Company Housing *)	506,000	-	506,000
Contingencies approx. 2.5%	60,220	16,950	77,170
Total Civil Engineering Works	2,230,000	620,000	2,850,000

*) the costs include furniture and airconditioning equipment (which should be replaced after 5 years) as follows:

local US$	foreign US$	total US$
35,000	37,000	72,000

Schedule 6 - 6/1 - Estimate of production cost: civil engineering works

ESTIMATE OF PRODUCTION COST
CIVIL ENGINEERING WORKS - MAINTENANCE
LOCATION: YWAMA PLANT ALTERNATIVE I

No.	Item description	Value of Works			Annual Maintenance			
		local	foreign	total	local		foreig	
		US$	US$	US$	%	US$/y	%	U
1	Site Preparation + Development	184,000	130,000	314,000	4%	7,400	2%	2,
2	Masonry Buildings	530,000	37,000	567,000	2%	10,600*)	4%	1,
3	Production Halls	826,600	418,000	1,244,600	1%	8,300*)	1%	4,
4	Outdoor Works	123,180	18,050	146,390	3%	3,700*)	1%	
5	Company Housing	506,000	-	506,000	-	- **)	-	
6	Contingencies	60,220	16,950	70,010	1%	600*)	4%	
	Totals for Alternative I	2,230,000	620,000	2,850,000	(1.4%)	30,600	(1.5%)	9,

*) materials only, work done by plant personnel
**) maintenance cost born by rent paid by tennants

t: civil engineering works

ALTERNATIVE I

ks		Annual Maintenance				
n	total	local		foreign		total
	US$	%	US$/y	%	US$/y	US$/y
0	314,000	4%	7,400	2%	2,600	10,000
0	567,000	2%	10,600*)	4%	1,400*)	12,000
0	1,244,600	1%	8,300*)	1%	4,200*)	12,500
0	146,390	3%	3,700*)	1%	200*)	3,900
	506,000	-	- **)	-	-	- **)
0	70,010	1%	600*)	4%	700*)	1,300
0	2,850,000	(1.4%)	30,600	(1.5%)	9,100	39,700

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Schedule 6 - 4/2 - Estimate of investment cost: civil engineering works

ESTIMATE OF INVESTMENT COST

CIVIL ENGINEERING WORKS

LOCATION: YWAMA PLANT ALTERNATIVE II, US $ 1.- = K 7.75 = DM 2.40

No.	Quantity	Unit	Item description	Unit cost local US $	Unit cost foreign US $	Cost local US $	Cost foreig US $
			SITE PREPARATION AND DEVELOPMENT				
1	1,000	m	factory fencing	20	-	20,000	-
			drainage ditches:				
2	800	m	0.5 - 1 m deep	2	-	1,600	-
3	250	m	1 - 2 m deep	2.50	-	625	-
4	250	m	2 - 2.5 m deep	3.50	-	875	-
5	lumpsum		soil fill/exchange	lumpsum		6,900	-
6	see chapter 5		site development	see chapter 5		154,000	130,000
sub-total site preparation and development					-	184,000	130,000
			MASONRY BUILDINGS				
7	400	m²	administration building	350	lumpsum	140,000	20,000
8	560	m²	amenity building	350	"	196,000	3,000
9	200	m²	quality control center and first aid station	350	"	70,000	4,000
10	48	m²	gate house	350	"	16,800	3,000
11	116	m²	electrical station	400	"	46,400	3,000
12	33	m²	pump house	280	-	9,240	-
13	60	m²	motor pool	260	-	15,600	-
14	100	m²	water cooling station	280	-	28,000	-
15	90	m²	storage for consumables	250	-	22,500	-
16	100	m²	compressed air station	280	-	28,000	-
17	lumpsum		other buildings	lumpsum		24,660	5,000
sub-total masonry buildings				-	-	597,200	38,000

st: civil engineering works

RNATIVE II, US $ 1.- = K 7.75 = DM 2.40

	Unit cost		Cost		
	local US $	foreign US $	local US $	foreign US $	total US $
DEVELOPMENT					
	20	-	20,000	-	20,000
	2	-	1,600	-	1,600
	2.50	-	625	-	625
	3.50	-	875	-	875
	lumpsum		6,900	-	6,900
	see chapter 5		154,000	130,000	284,000
		-	184,000	130,000	314,000
ng	350	lumpsum	140,000	20,000	160,000
	350	"	196,000	3,000	199,000
r					
	350	"	70,000	4,000	74,000
	350	"	16,800	3,000	19,800
	400	"	46,400	3,000	49,400
	280	-	9,240	-	9,240
	260	-	15,600	-	15,600
	280	-	28,000	-	28,000
es	250	-	22,500	-	22,500
n	280	-	28,000	-	28,000
	lumpsum		24,660	5,000	29,660
	-	-	597,200	38,000	635,200

Schedule 6 - 4/2 (cont.) - Estimate of investment cost: civil engineering works

ESTIMATE OF INVESTMENT COST
CIVIL ENGINEERING WORKS (cont.)
LOCATION: YWAMA PLANT ALTERNATIVE II US $ 1.- = K 7.75 = DM 2.40

No.	Quantity	Unit	Item description	Unit Cost local US $	Unit Cost foreign US $	Cost local US $	Cost foreign US $
			PRODUCTION HALLS				
1	240	pc	piles f. struct. steel halls	1100	-	264,000	-
2	400	m^3	concrete for pile heads	200	-	80,000	-
3	11,755	m^2	structural steel halls	30	52	352,650	611,260
4	9,300	m^2	concrete floor	30	-	279,000	-
5	1,400	m^3	foundation etc. f. equipment	220	-	308,000	-
6	280	m	foundation for gantry crane	20	-	5,600	-
sub-total production halls				-	-	1,289,250	611,260
			OUTDOOR WORKS				
7	7,400	m^2	concrete roads	7.20	-	53,280	-
8	3,500	m^2	laterite roads	3.60	-	12,600	-
9	200	m	railroad	25	95	5,000	19,000
10	lumpsum		extension stormwater drainage	lumpsum	-	10,000	-
11	lumpsum		sewage and waste water disposal	lumpsum	-	20,000	-
12	1,350	m^2	storage area for sheet coils	5	-	6,750	-
13	6,900	m^2	storage area for pipes	2	-	13,800	-
14	lumpsum		utility supply	lumpsum		6,000	-
sub-total outdoor works				-	-	127,430	19,000
15	see chapter 5		company housing	see chapter 5		506,000	-

tment cost: civil engineering works

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ALTERNATIVE II US $ 1.- = K 7.75 = DM 2.40

	Unit Cost		Cost		
	local US $	foreign US $	local US $	foreign US $	total US $
ei halls	1100	-	264,000	-	264,000
ads	200	-	80,000	-	80,000
ls	30	52	352,650	611,260	963,910
	30	-	279,000	-	279,000
quipment	220	-	308,000	-	308,000
y crane	20	-	5,600	-	5,600
	-	-	1,289,250	611,260	1,900,510
	7.20	-	53,280	-	53,280
	3.60	-	12,600	-	12,600
	25	95	5,000	19,000	24,000
drainage	lumpsum	-	10,000	-	10,000
er	lumpsum	-	20,000	-	20,000
et coils	5	-	6,750	-	6,750
es	2	-	13,800	-	13,800
	lumpsum		6,000	-	6,000
	-	-	127,430	19,000	146,430
	see chapter 5		506,000	-	506,000

Schedule 6 - 5/2 - Summary sheet - investment cost: civil engineering works

ESTIMATE OF INVESTMENT COST
CIVIL ENGINEERING WORKS
SUMMARY SHEET
LOCATION: YWAMA PLANT ALTERNATIVE II

Item description	Cost local US$	foreign US$	total US$
Site Preparation + Development	184,000	130,000	314,000
Masonry Buildings *)	597/200	38,000	635,200
Production Halls *)	1,289,250	611,260	1,900,510
Outdoor Works	127,430	19,000	146,430
Company Housing *)	506,000	-	506,000
Contingencies approx. 2.5%	66,120	21,740	87,860
Total Civil Works	2,770,000	820,000	3,590,000

*) the costs include furniture and airconditioning equipment (which should be replaced after 5 years) as follows:

local US$	foreign US$	total US$
40,000	38,000	78,000

Schedule 6 - 6/2 - Estimate of production cost: civil engineering works

ESTIMATE OF PRODUCTION COST
CIVIL ENGINEERING WORKS - MAINTENANCE
LOCATION: YWAMA PLANT ALTERNATIVE II

No.	Item description	Value of Works			Annual Maintenance			
		local	foreign	total	local		foreign	
		US$	US$	US$	%	US$/y	%	US
1	Site Preparation + Development	184,000	130,000	314,000	4%	7,400	2%	2,
2	Masonry Buildings	597,200	38,000	635,200	2%	12,000*)	4%	1,
3	Production Halls	1,289,250	611,260	1,900,510	1%	12,900*)	1%	6,
4	Outdoor Works	127,430	19,000	146,430	3%	3,800*)	1%	
5	Company Housing	506,000	-	506,000	-	- **)	-	
6	Contingencies	66,120	21,740	87,860	1%	700*)	4%	
	Totals for Alternative II	2,770,000	820,000	3,590,000	(1.3%)	36,800	(1.4%)	11,

*) materials only, work done by plant personnel

**) maintenance cost born by rent paid by tennants t: civil engineering works

ALTERNATIVE II

ks		Annual Maintenance				
n	total	local		foreign		total
	US$	%	US$/y	%	US$/y	US$/y
0	314,000	4%	7,400	2%	2,600	10,000
0	635,200	2%	12,000*)	4%	1,500*)	13,500
0	1,900,510	1%	12,900*)	1%	6,100*)	19,000
0	146,430	3%	3,800*)	1%	200*)	4,000
	506,000	-	- **)	-	-	- **)
0	87,860	1%	700*)	4%	900*)	1,600
0	3,590,000	(1.3%)	36,800	(1.4%)	11,300	48,100

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Annex

General survey plan welded steel pipe plant

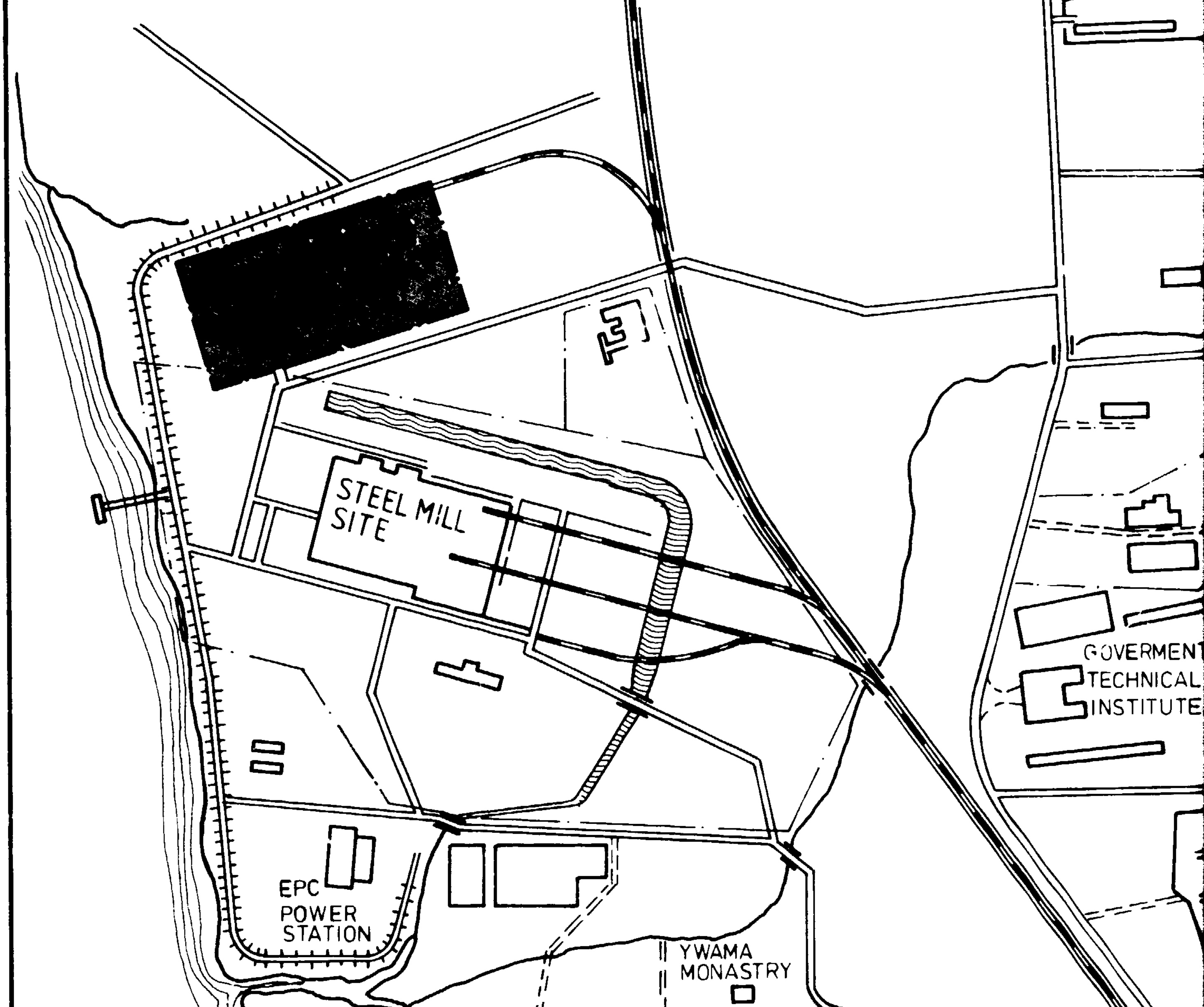
Welded steel pipe plant layout - Alternative I.
Welded steel pipe plant layout - Alternative II.
Welded steel pipe plant, detailed - Alternative I.
Welded steel pipe plant, detailed - Alternative II.

Schematic representation of pipe forming mill

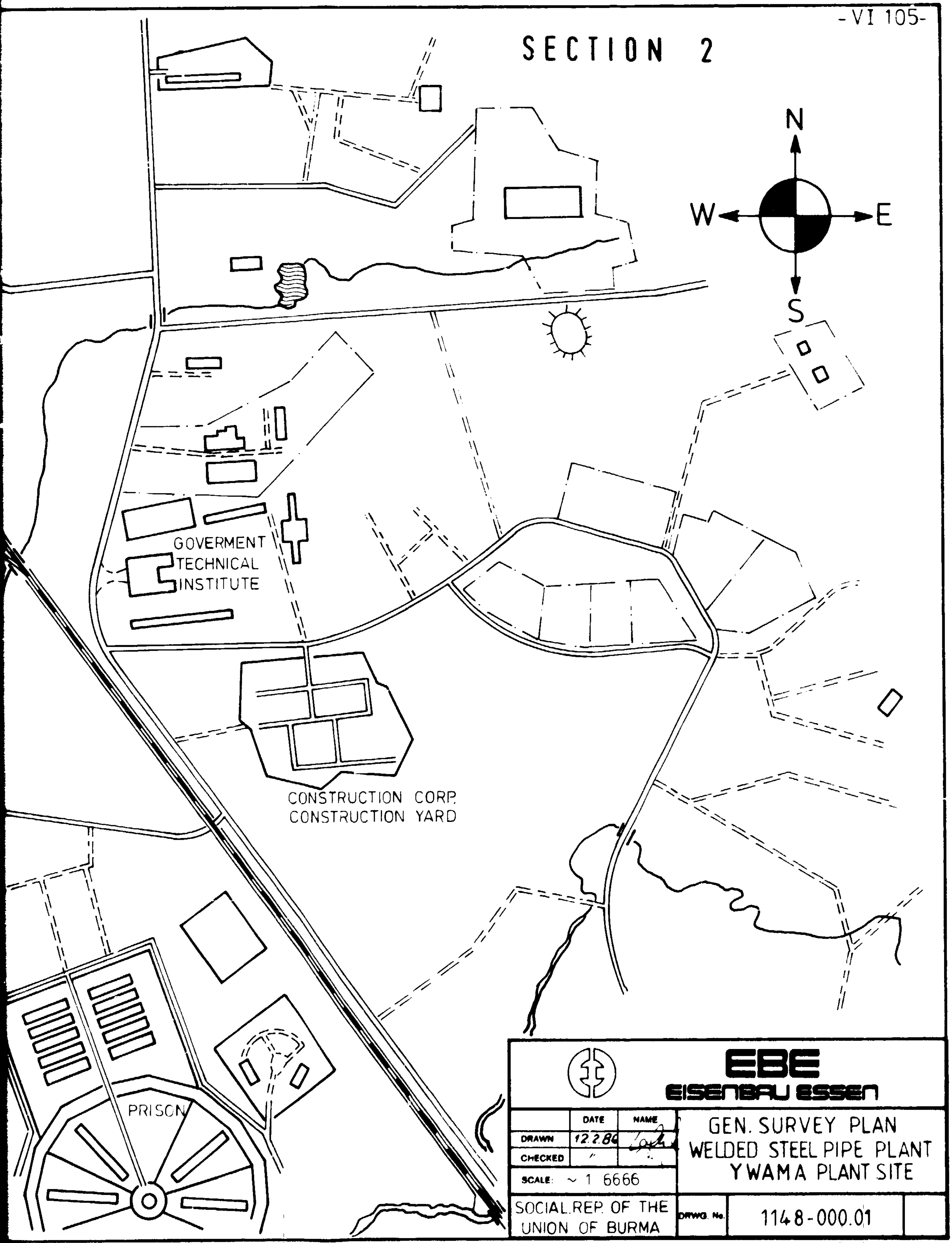
Crane List - Alternative I.
Crane List - Alternative II.

Block diagram water system - Alternative I.
Block diagram water system - Alternative II.
Block diagram compressed air system - Alternative I.
Block diagram compressed air system - Alternative II.
Block diagram fuel gas system - Alternative I.
Block diagram fuel gas system - Alternative I.

SECTION 1


STEEL MILL SITE
GOVERMENT TECHNICAL INSTITUTE
EPC POWER STATION
YWAMA MONASTRY
HLAING RIVER
BRAN OIL FACTORY
PRISON

SECTION 2



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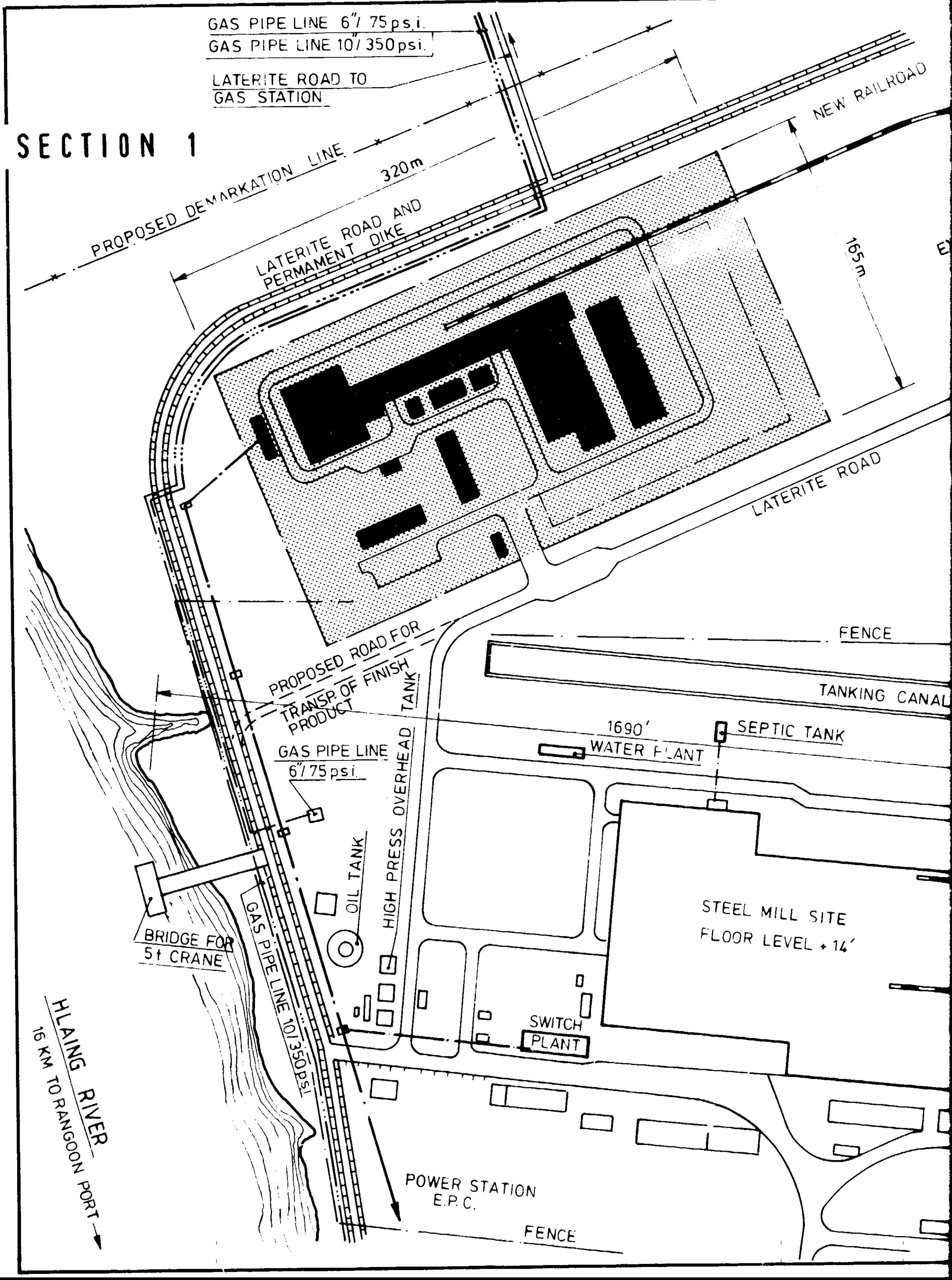
GEN. SURVEY PLAN
WELDED STEEL PIPE PLANT
YWAMA PLANT SITE

SOCIAL.REP. OF THE
UNION OF BURMA

DRWG. No. 1148-000.01

SECTION 1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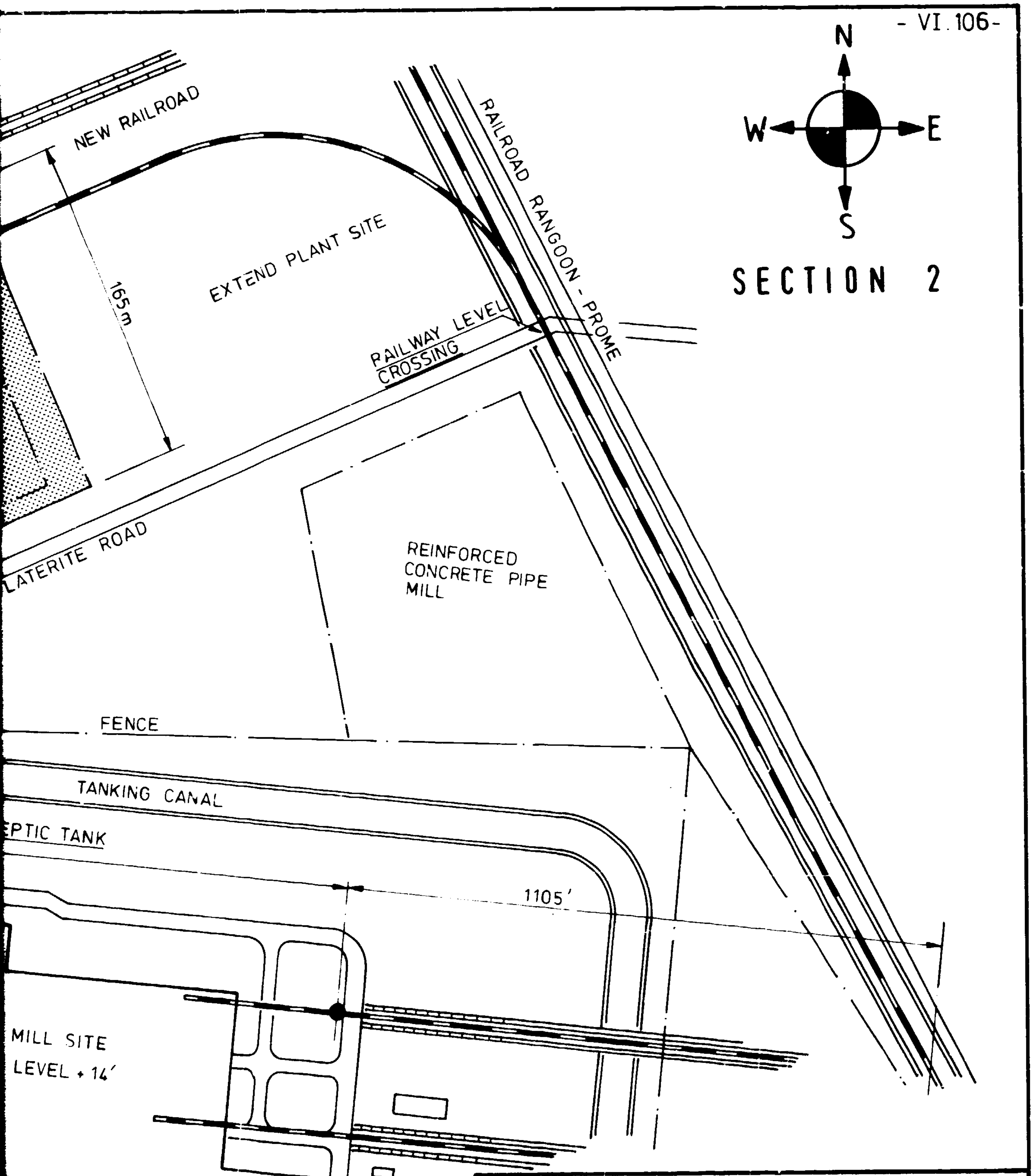
GAS PIPE LINE 10/ 350 psi.
LATERITE ROAD TO GAS STATION
NEW RAILROAD
PROPOSED DEMARKATION LINE
320m
LATERITE ROAD AND PERMAMENT DIKE
165m
EX
LATERITE ROAD
FENCE
TANKING CANAL
PROPOSED ROAD FOR TRANSP. OF FINISH PRODUCT
HIGH PRESS OVERHEAD TANK
1690'
SEPTIC TANK
WATER PLANT
GAS PIPE LINE 6"/75 psi.
OIL TANK
STEEL MILL SITE
FLOOR LEVEL + 14'
BRIDGE FOR 5t CRANE
GAS PIPE LINE 10/350psi.
SWITCH PLANT
HLAING RIVER
16 KM TO RANGOON PORT
POWER STATION E.P.C.
FENCE



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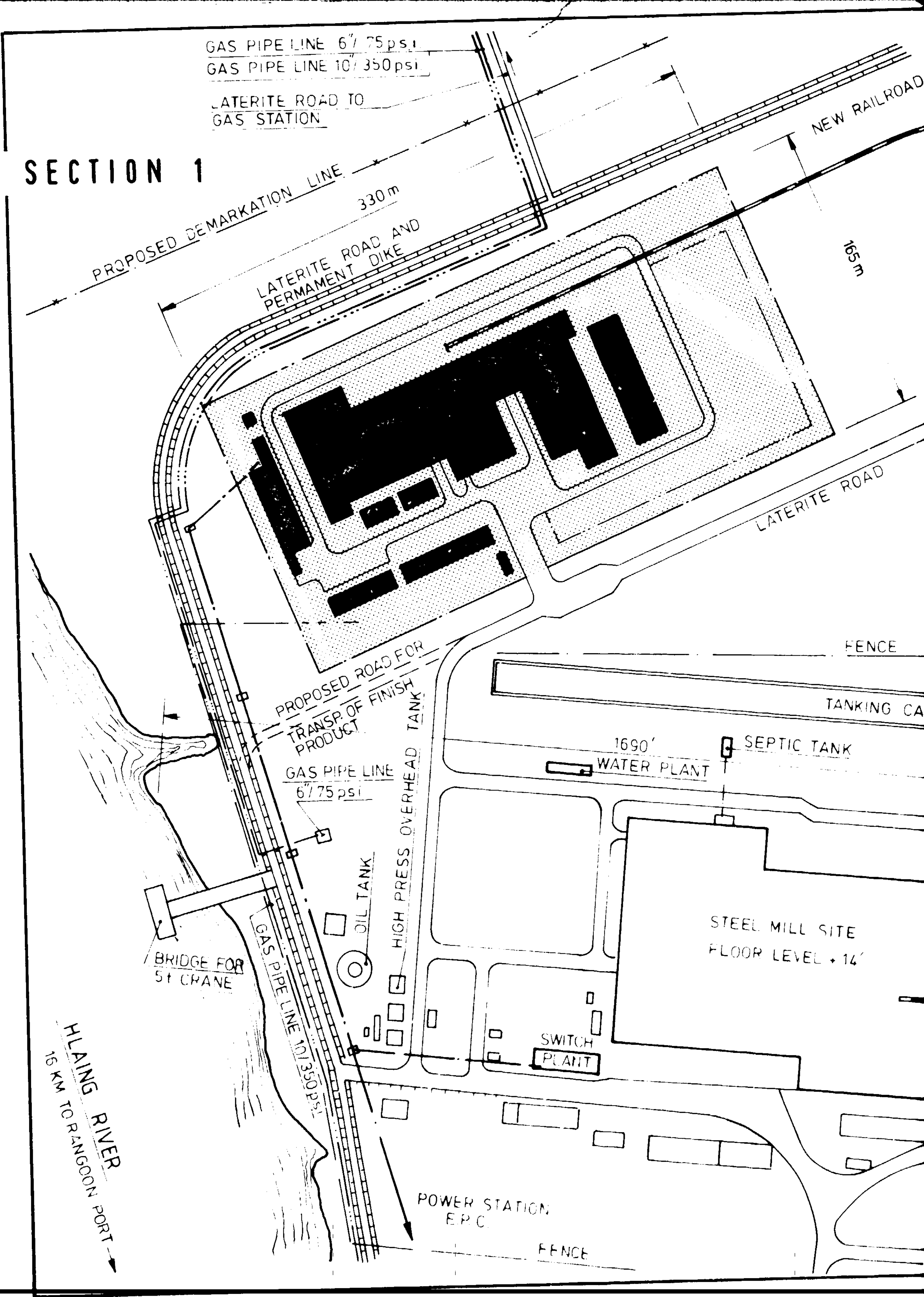
WELDED STEEL PIPE PLANT
ALTERNATIVE I
YWAMA / INSEIN

SOCIALIST REPUBLIC OF
THE UNION OF BURMA

DRWG. No. 1148-000.02

SECTION 1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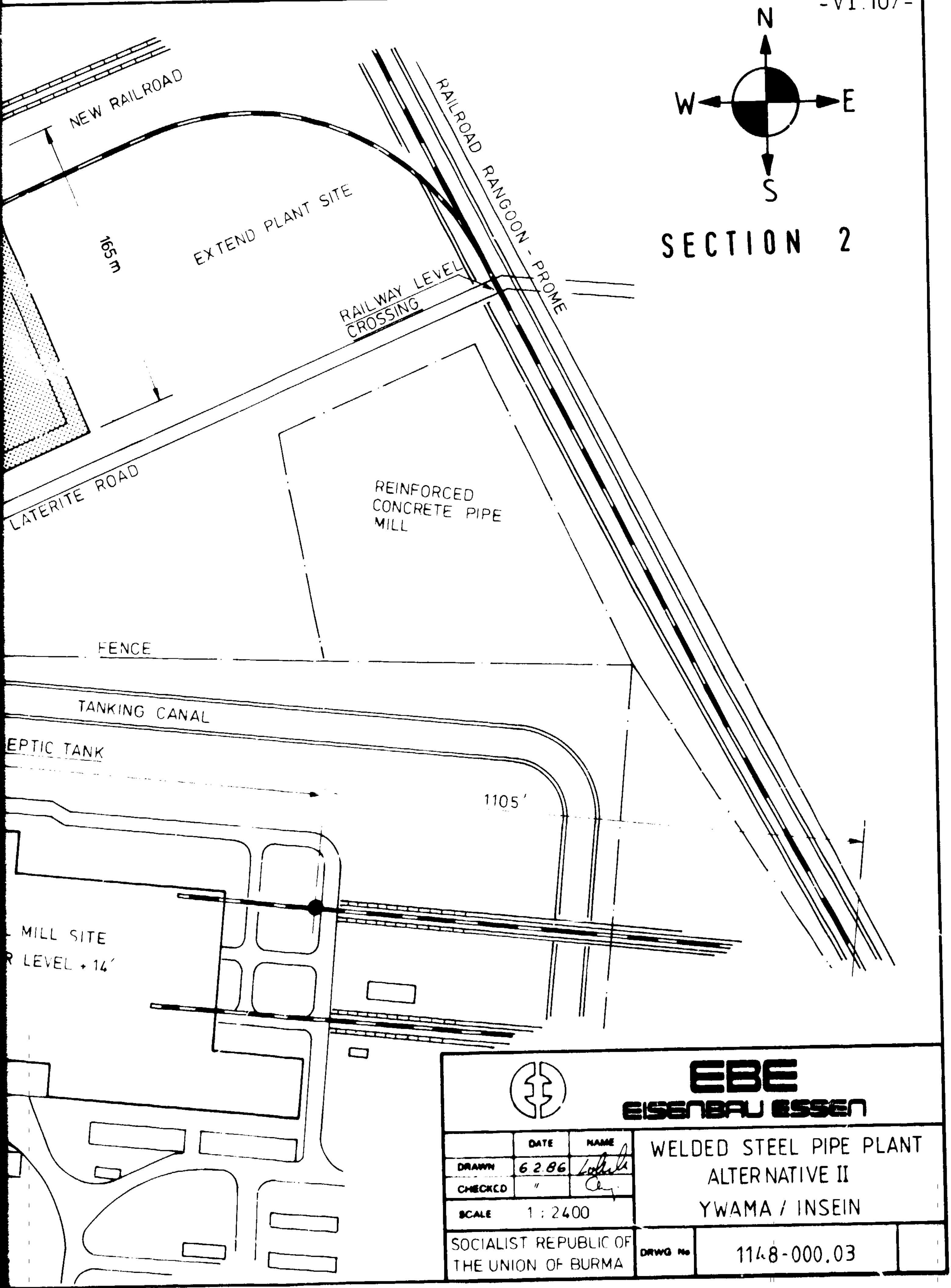
GAS PIPE LINE 10"/350psi
LATERITE ROAD TO GAS STATION
NEW RAILROAD
PROPOSED DEMARKATION LINE
330 m
LATERITE ROAD AND PERMAMENT DIKE
165 m
LATERITE ROAD
FENCE
PROPOSED ROAD FOR TRANSP. OF FINISH PRODUCT
TANKING CA
1690'
SEPTIC TANK
WATER PLANT
GAS PIPE LINE 6"/75psi
HIGH PRESS OVERHEAD TANK
OIL TANK
STEEL MILL SITE
FLOOR LEVEL + 14'
BRIDGE FOR 5t CRANE
GAS PIPE LINE 10"/350psi
SWITCH PLANT
HLAING RIVER
16 KM TO RANGOON PORT
POWER STATION E.P.C.
FENCE

SECTION 2



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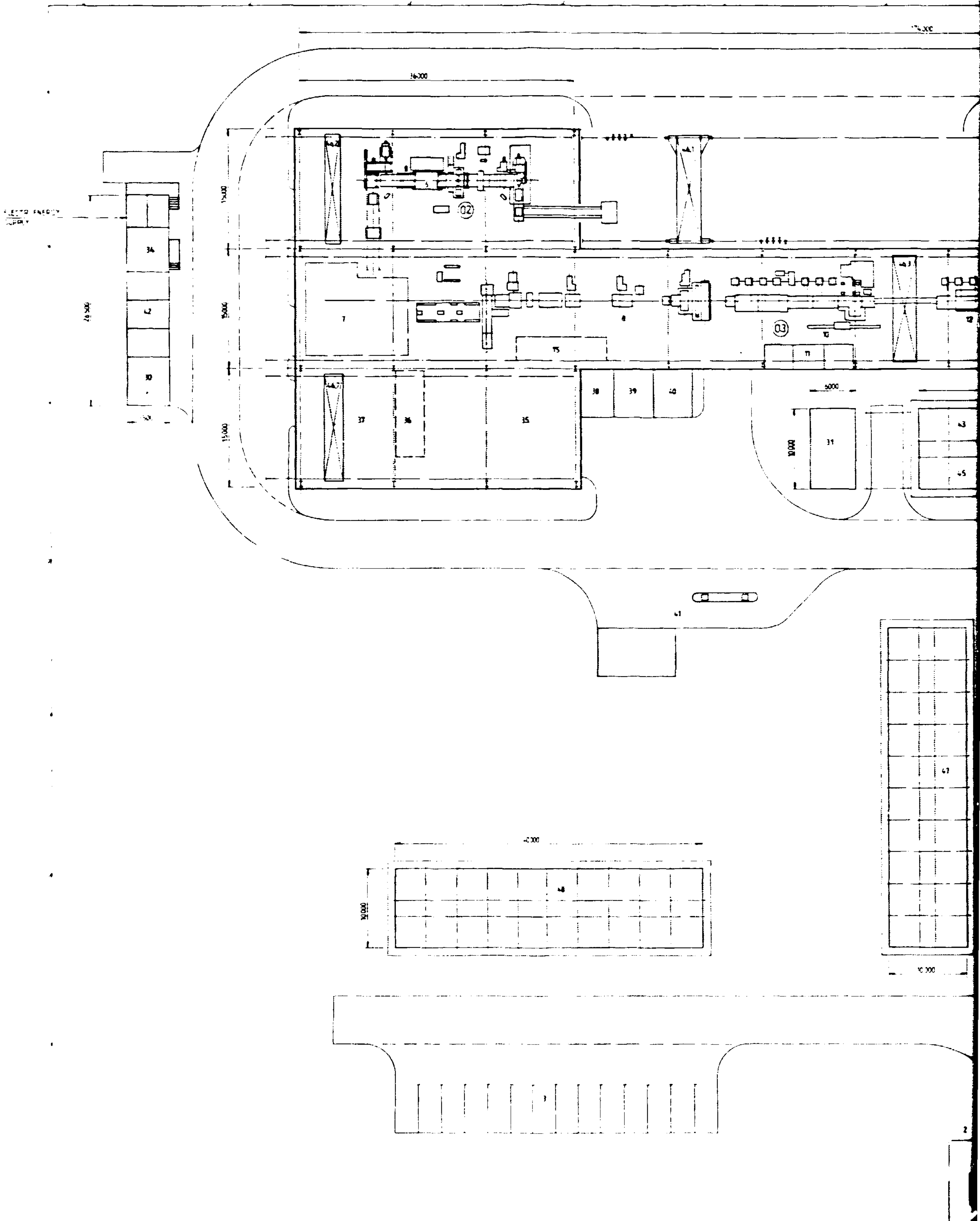
WELDED STEEL PIPE PLANT
ALTERNATIVE II
YWAMA / INSEIN

SOCIALIST REPUBLIC OF
THE UNION OF BURMA

DRWG No 1148-000.03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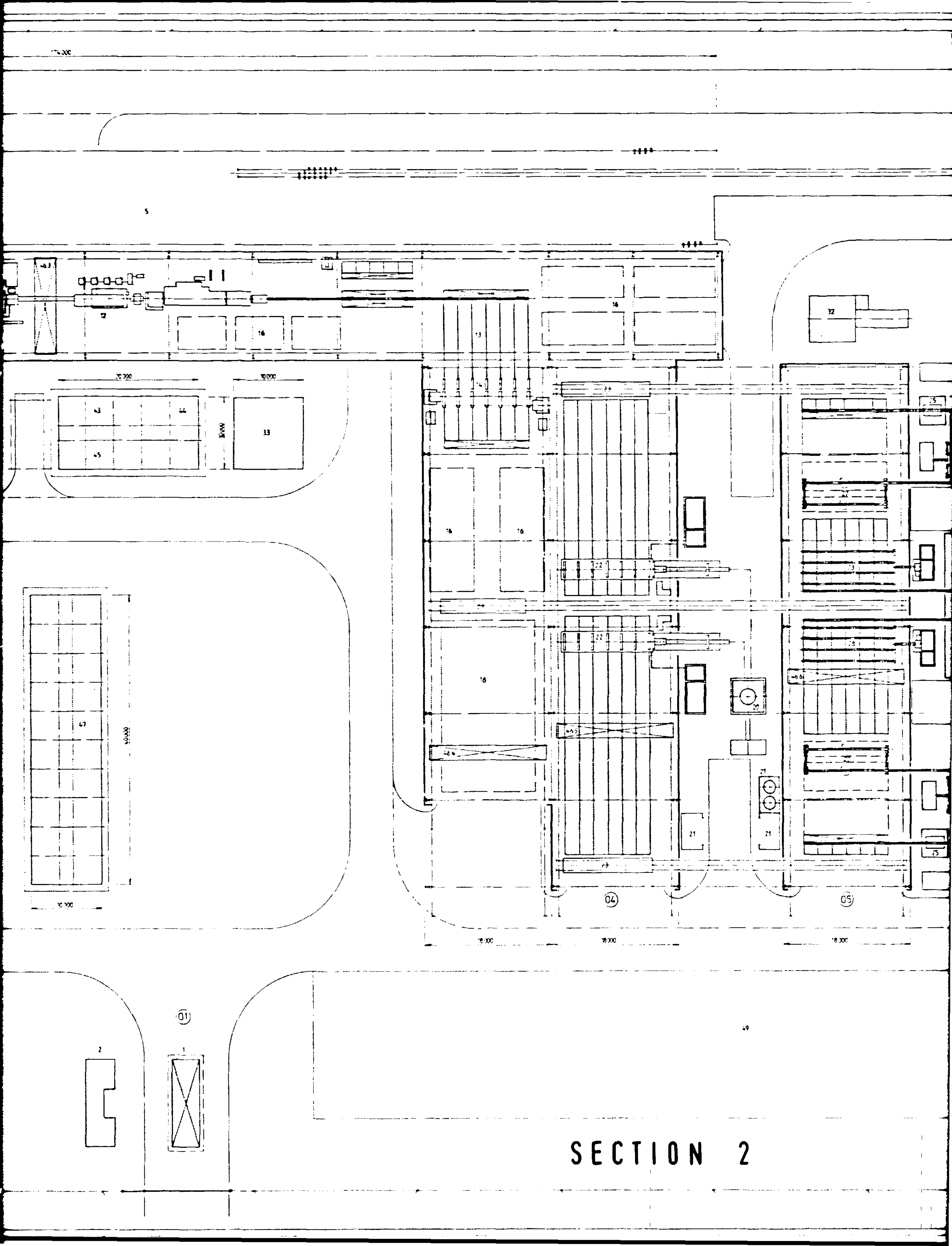
SECTION 1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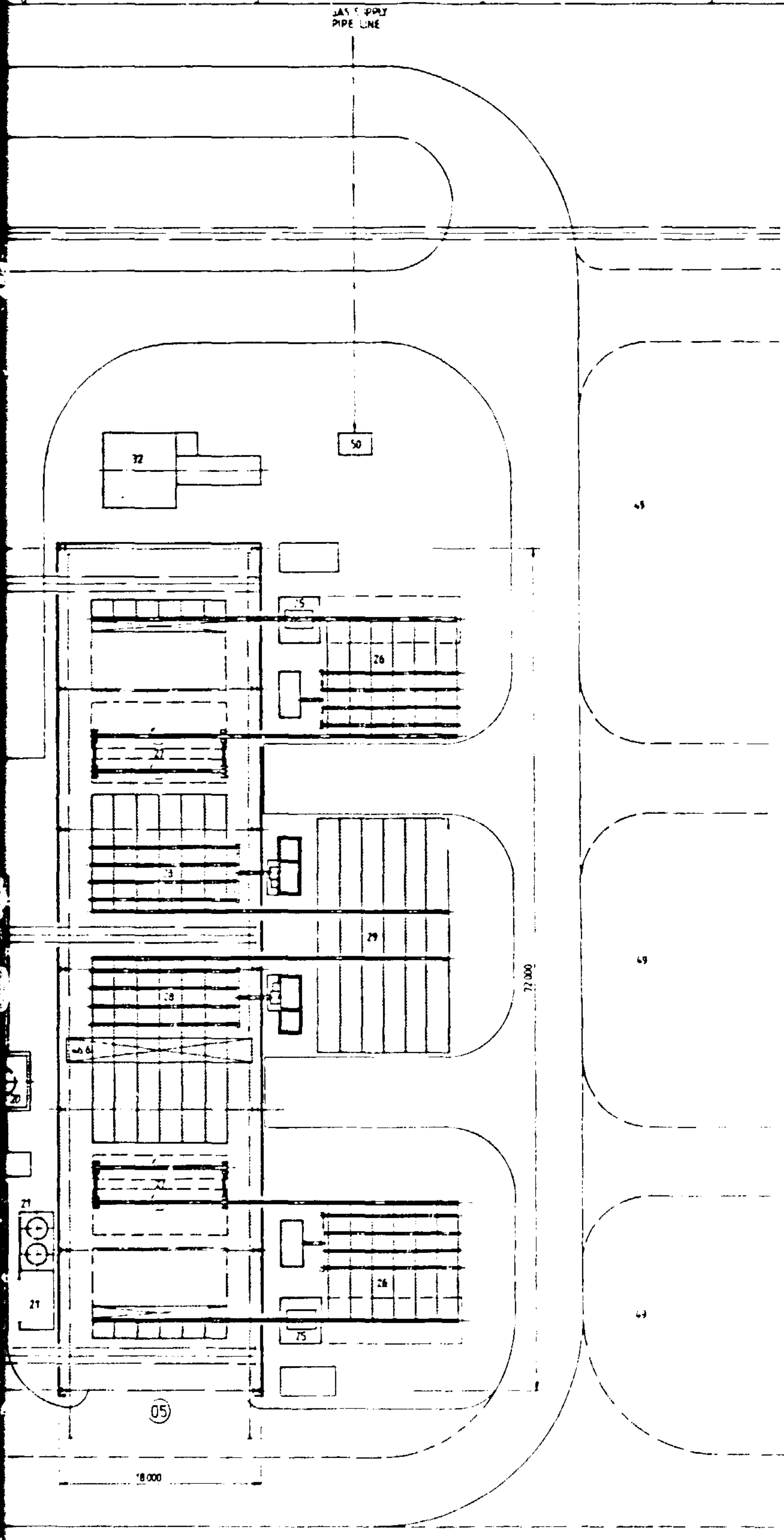
SECTION 2



LEGEND

(01) PLANT AREA ENTRANCE
1 Vehicle Weigh Bridge
2 Gate House / Security
3 Parking Area

(02) SLITTING LINE / STRIP-PREPARATION
5 Raw Material Coil Storage
6 Coil Slitting Line with cross transfer car
7 Slitted Coils / Strip Storage
8 Strip Preparation Area

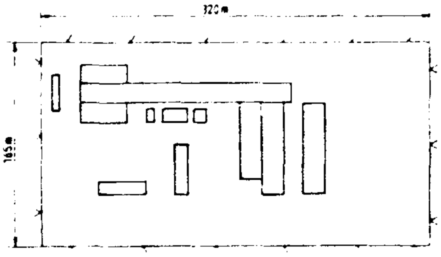
(03) PIPE PRODUCTION AREA
10 Tube Welding / Forming Line
11 Production Offices
12 Tube Sizing Line / Flying Cutting Shear
13 Tube Transfer Table
14 Pipe End Facing Machine
15 Tube Mill Tool Area
16 Tube Intermediate Storage (black tubes)

(04) INNER LINING CEMENTATION PLANT
20 Cement / Sand Mixing Plant
21 Cement / Sand Storages
22 Centrifugal Inner Lining Machines
23 Tube Bundle Cross Transfer Cars

(05) BITUMEN COATING PLANT
25 Sand Blasting Machines
26 Tube Collection / Preheating Table
27 Bitumen Coating Device
28 Tube Collection / Cooling Table
29 Tube Collection and Delivery Table

(06) UTILITIES
30 Pump House
31 Water Cooling Station
32 Settling Pond
33 Compressed Air Station
34 Electr. Main Station

(07) AUXILIERIES
35 Mechan. Workshop
36 Tool Storage
37 Spare Part Storage
38 Material Storage
39 Gas Bottle Store
40 Lube Oil / Grease
41 Motor Pool / Petrol Gas Station
42 Electr. Workshop / Store
43 Laboratory
44 Quality Control Center
45 First Aid Station
46 Cranes
46.1 Gantry Crane 15 t
46.2 Production Crane 10 t
46.3 Production Crane 10 t
46.4 Production Crane 5 t
46.5 Production Crane 5 t
46.6 Production Crane 5 t
46.7 Workshop Crane 5 t
47 Amenity Building
48 Administration Building
49 Finished Product Storage
50 Gas Station



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INDEX	DATE	COMMENTS	NAME

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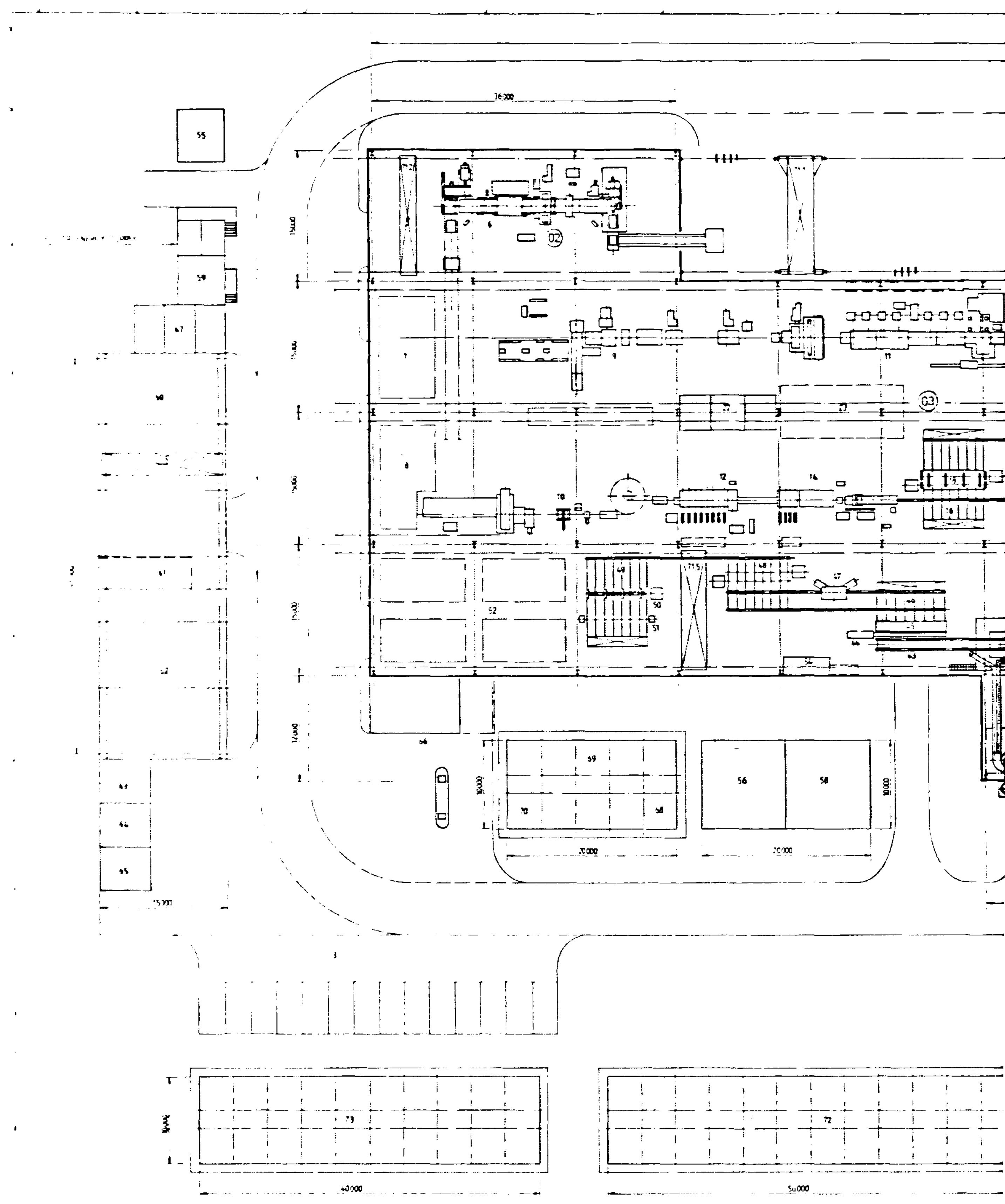
SCALE		

WELDED STEEL PIPE PLANT
LAYOUT-PLAN VIEW
ALTERNATIVE I

SOCIALIST REPUBLIC OF
THE UNION OF BURMA

DRAWING No 1148-00101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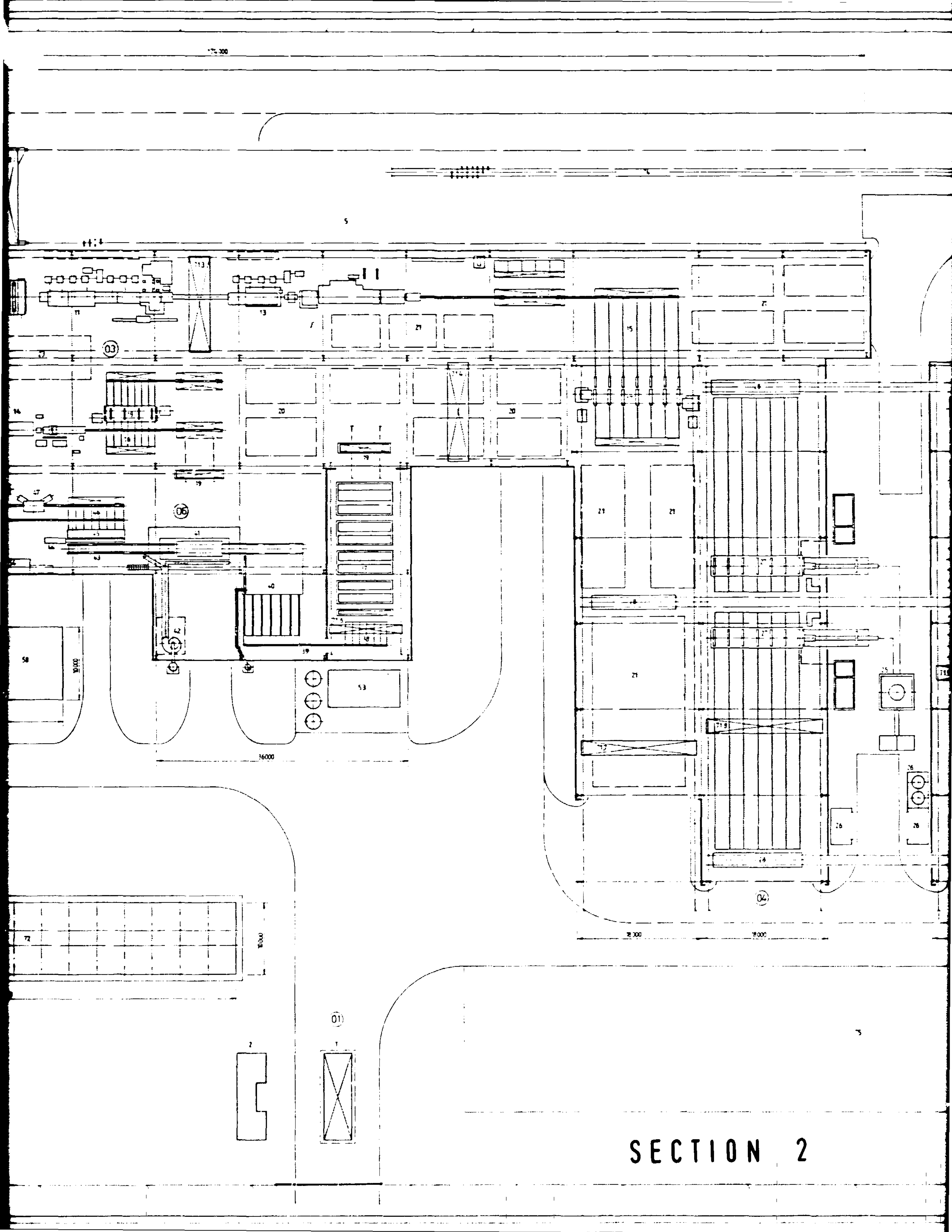
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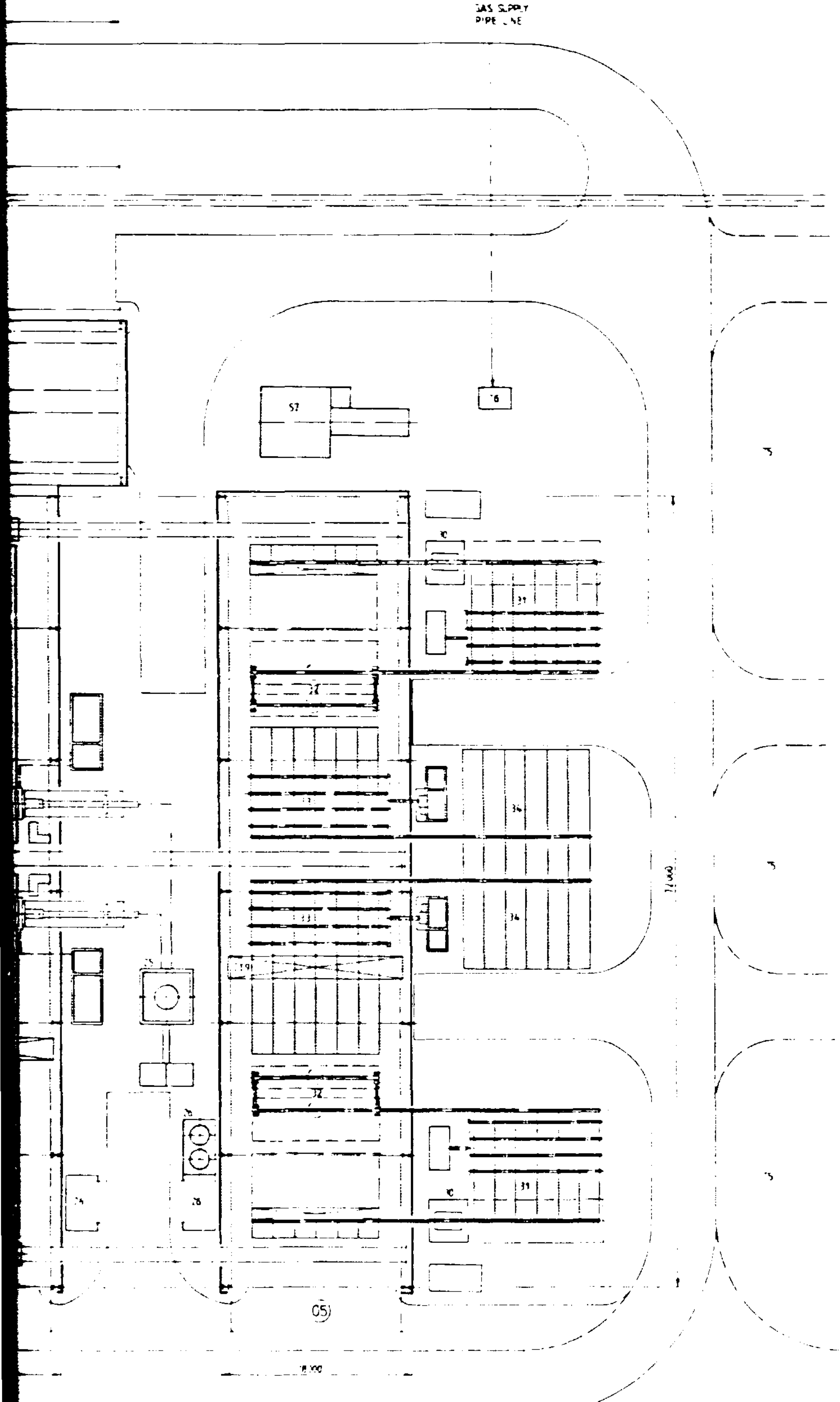


LEGEND

(01) PLANT AREA ENTRANCE
- 1 Vehicle Weigh Bridge
- 2 Gate House Security
- 3 Parking Area

(02) SLITTING LINE / STRIP PREPARATION
- 5 Raw Material Coil Storage
- 6 Coil Slitting Line with cross transfer car
- 7 Slitted Coils Strip Storage Line 6" - 12"
- 8 Slitted Coils Strip Storage Line 1/2" - 4"
- 9 Strip Preparation Area Line 6" - 12"
- 10 Strip Preparation Area Line 1/2" - 4"

(03) PIPE PRODUCTION AREA
- 11 Tube Welding Line 6" - 12"
- 12 Tube Welding Line 1/2" - 4"
- 13 Tube Sizing Line 6" - 12"
- 14 Tube Sizing Line 1/2" - 4"
- 15 Tube Transfer Table 6" - 12"
- 16 Tube Transfer Table 1/2" - 4"
- 17 Facing unit 6" - 12"
- 18 Facing Unit 1/2" - 4"
- 19 Bundle Cross Transfer Car For Tubes 1/2" - 4"
- 20 Storage Area (Black Tubes 1/2" - 4")
- 21 Storage Area (Black Tubes 6" - 12")
- 22 Production Offices
- 23 Tube Mill Tool Area

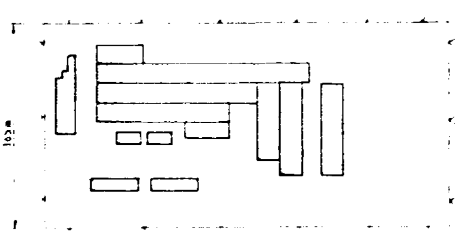
(04) INNER LINING CEMENTATION PLANT
- 25 Cement Sand Mixing Plant
- 26 Cement / Sand Storages
- 27 Centrifugal Inner Lining Machines
- 28 Tube Bundle Cross Transfer Cars

(05) BITUMEN COATING PLANT
- 30 Sand Blasting Machines
- 31 Tube Collection Preheating Table
- 32 Bitumen Coating Device
- 33 Tube Collection Cooling Table
- 34 Tube Collection and Delivery Table

(06) PICKLING / GALVANIZATION PLANT
- 37 Pickling Bath's
- 38 Collecting Grid
- 39 Transfer Roller Table
- 40 Drying Furnace with Stack
- 41 Galvanization Furnace
- 42 Zinc-dust Cyclone
- 43 Tube Pull-out Device
- 44 Tube Blow-out Device
- 45 Tube Cooling Chamber
- 46 Transfer Table
- 47 Straightening Machine
- 48 Threading Unit
- 49 Collecting Table
- 50 Socket Screw-on Unit
- 51 Cap Press-on Unit
- 52 Storage Finished Product 1/2" - 4"
- 53 Neutralisation Acid Storage
- 54 Control Pulpit

(07) UTILITIES
- 55 Pump House
- 56 Water Cooling Station
- 57 Settling Pond
- 58 Compressed Air Station
- 59 Electr. Main Station

(08) AUXILIERIES
- 60 Mechan. Workshop
- 61 Tool Storage
- 62 Spare Part Storage
- 63 Material Storage
- 64 Gas Bottle Store
- 65 Lube Oil Grease
- 66 Motor Pool / Petrol Gas Station
- 67 Electr. Workshop / Store
- 68 Laboratory
- 69 Quality Control Center
- 70 First Aid Station
- 71 Cranes
  - 71.1 Gantry Crane 15 t
  - 71.2 Service Crane 10 t
  - 71.3 Production Crane 10 t (Line 6" - 12")
  - 71.4 Production Crane 5 t (Line 1/2" - 4")
  - 71.5 Production Crane Finish Area 1/2" - 4" 5 t
  - 71.6 Production Crane Pickling Plant 1/2" - 4" 5 t
  - 71.7 Production Crane Tube Storage 6" - 12" 5 t
  - 71.8 Production Crane Tube Cement Lining 6"-12" 5 t
  - 71.9 Production Crane Tube Bitum. Coating 6"-12" 5 t
  - 71.10 Workshop Crane 5 t
- 72 Amenity Building
- 73 Administration Building
- 74 Railroad Transport
- 75 Finished Product Storage
- 76 Gas Station



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SECTION 3

REV. DATE COMMENTS NAME

EBE
EISENBAU ESSEN

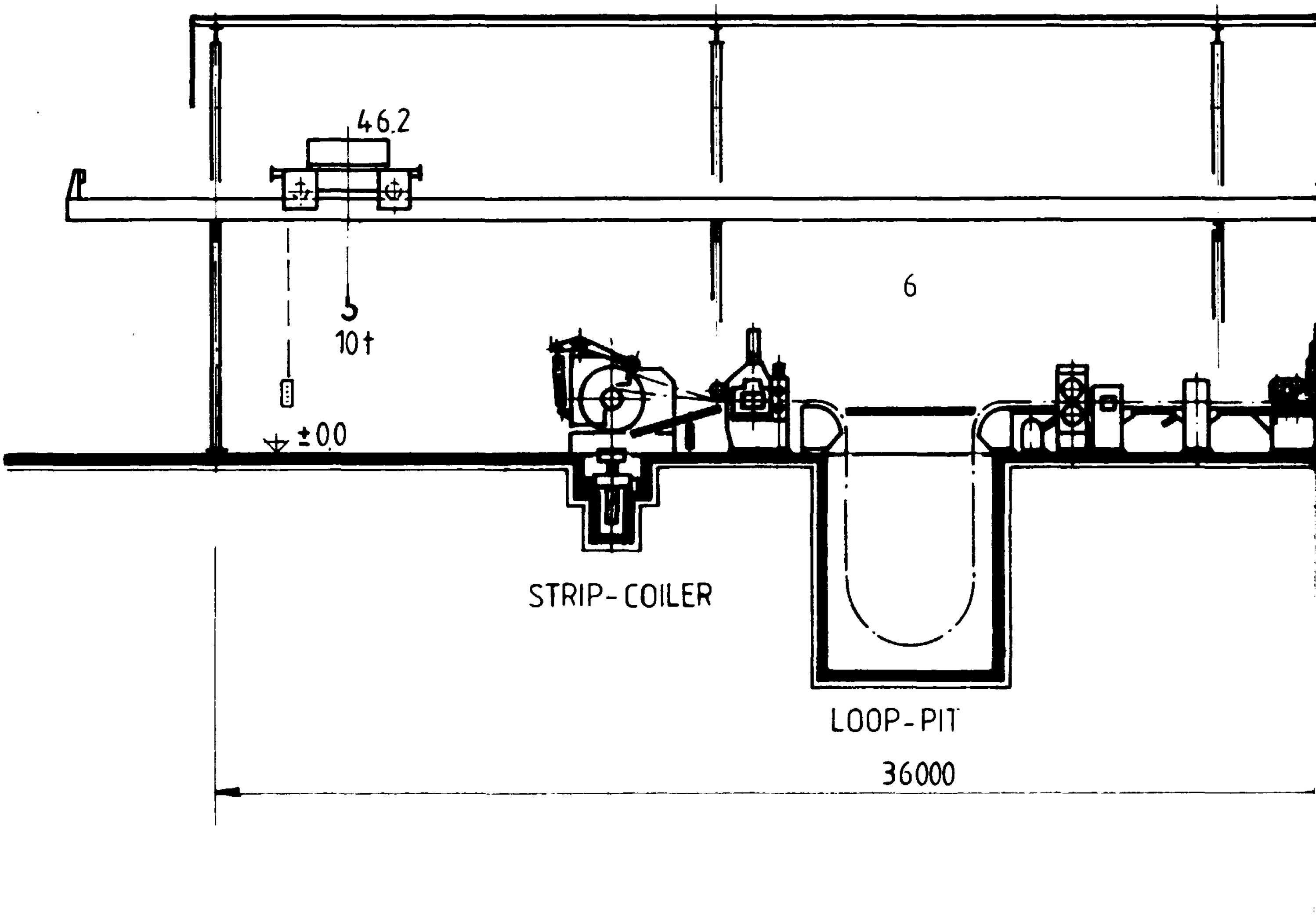
DRAWN DATE NAME
CHECKED
SCALE

WELDED STEEL PIPE PLANT
LAYOUT-PLAN VIEW
ALTERNATIVE II

SOCIALIST REPUBLIC OF
THE UNION OF BURMA

DRAWING No 1148-00102

SECTION 1



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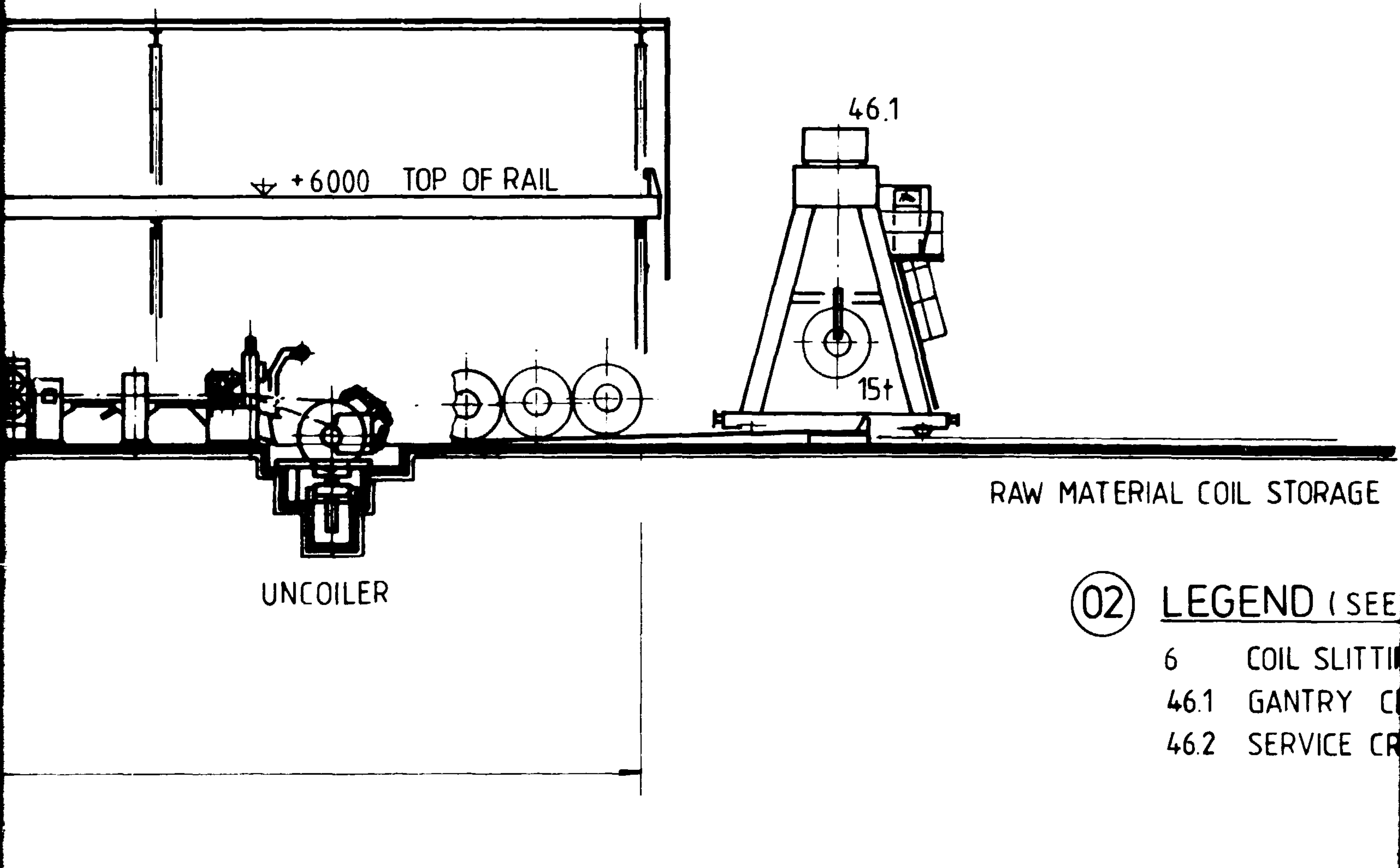

(02) LEGEND (SEE

6	COIL SLITTI
46.1	GANTRY C
46.2	SERVICE CR

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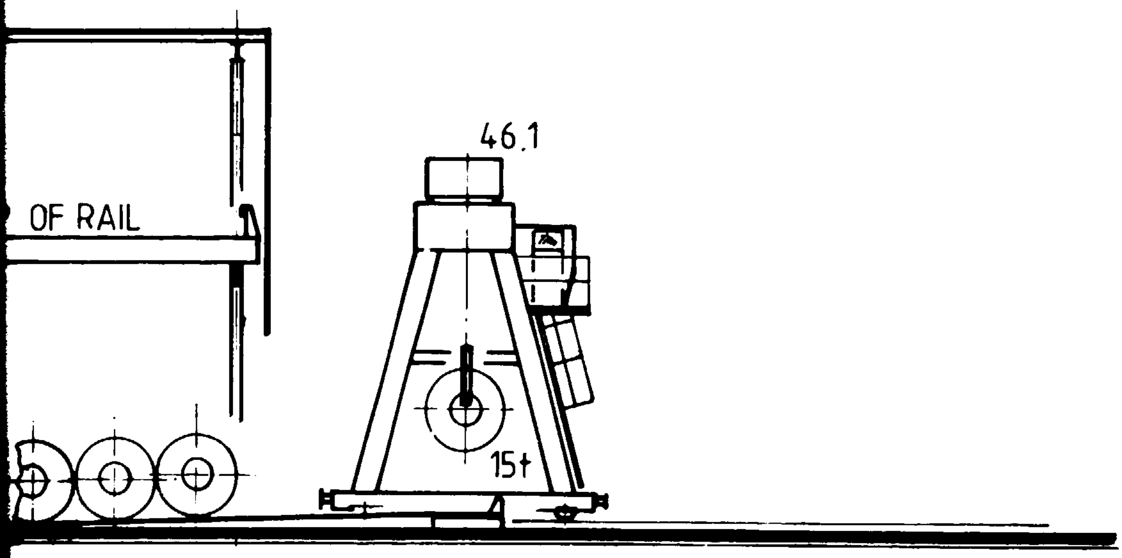
SOCIAL.REPUBLIC OF
THE UNION OF BURMA

SECTION 3



RAW MATERIAL COIL STORAGE

(02) LEGEND (SEE DRWG. No 1148-001.01)

6	COIL SLITTING LINE
46.1	GANTRY CRANE 15t
46.2	SERVICE CRANE 10t

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EISENBAU ESSEN

	DATE	NAME
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CHECKED	" "	
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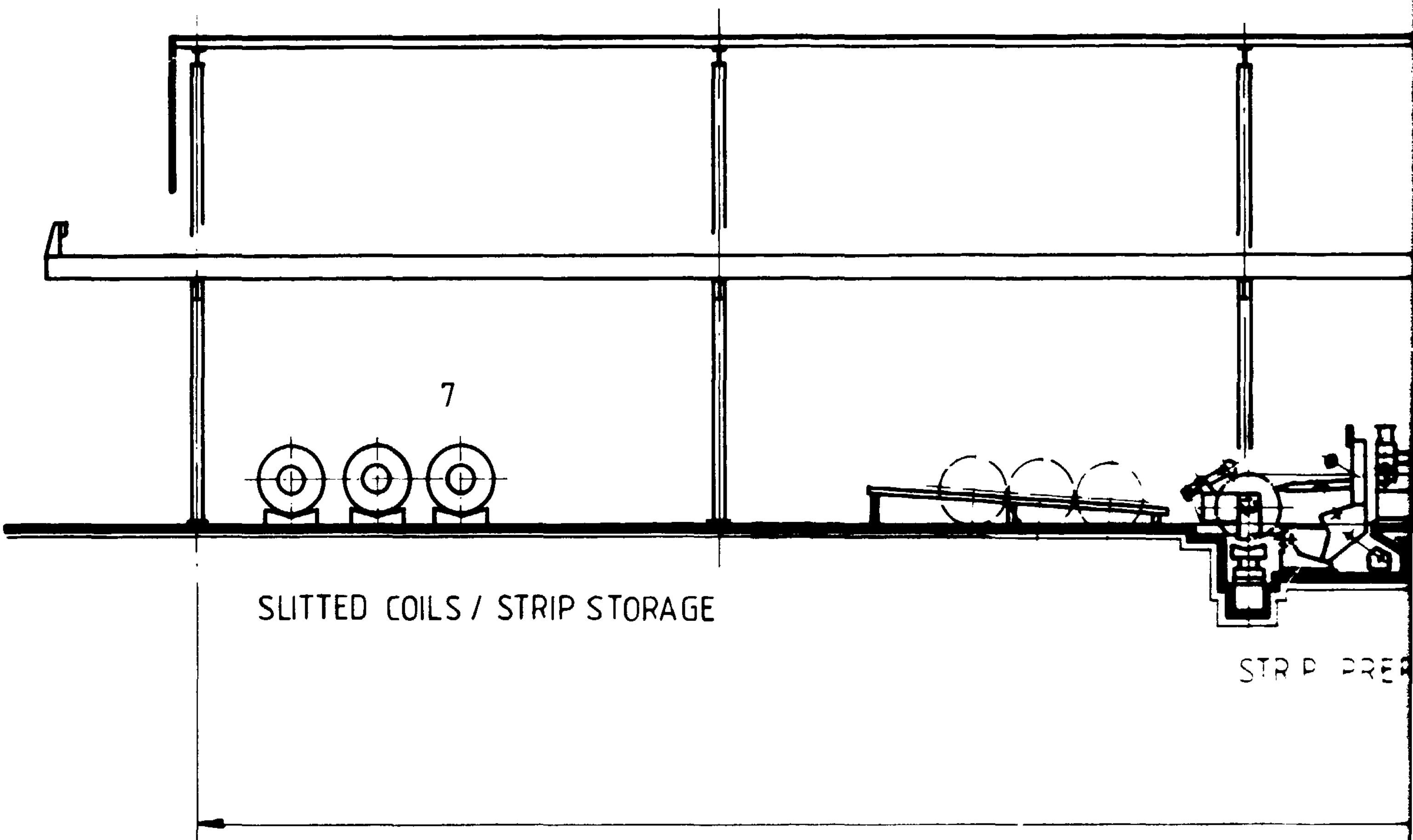
SLITTING LINE
ALTERNATIVE I

SOCIAL REPUBLIC OF
THE UNION OF BURMA

DRWG. No. 1148-001.03

SECTION 1



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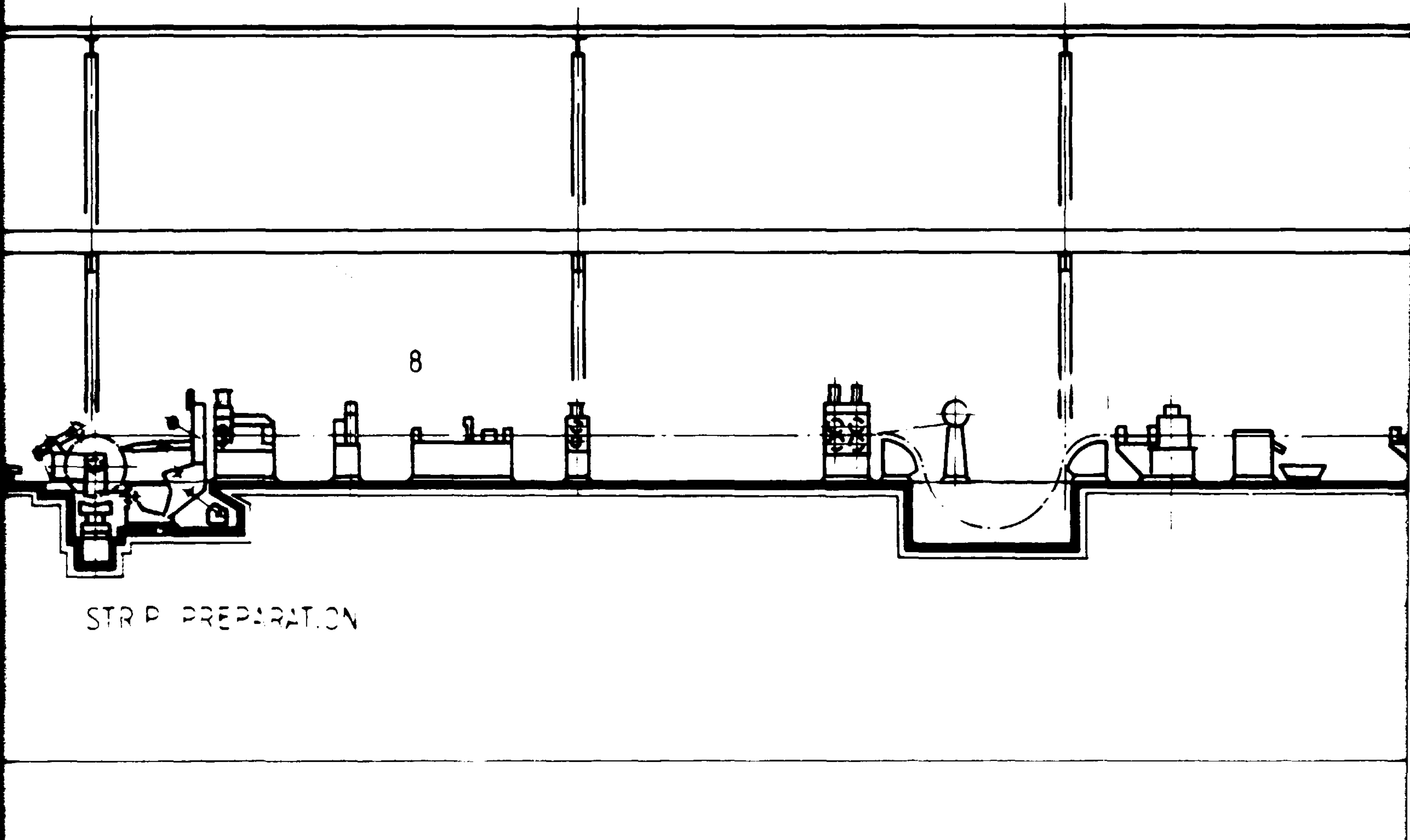
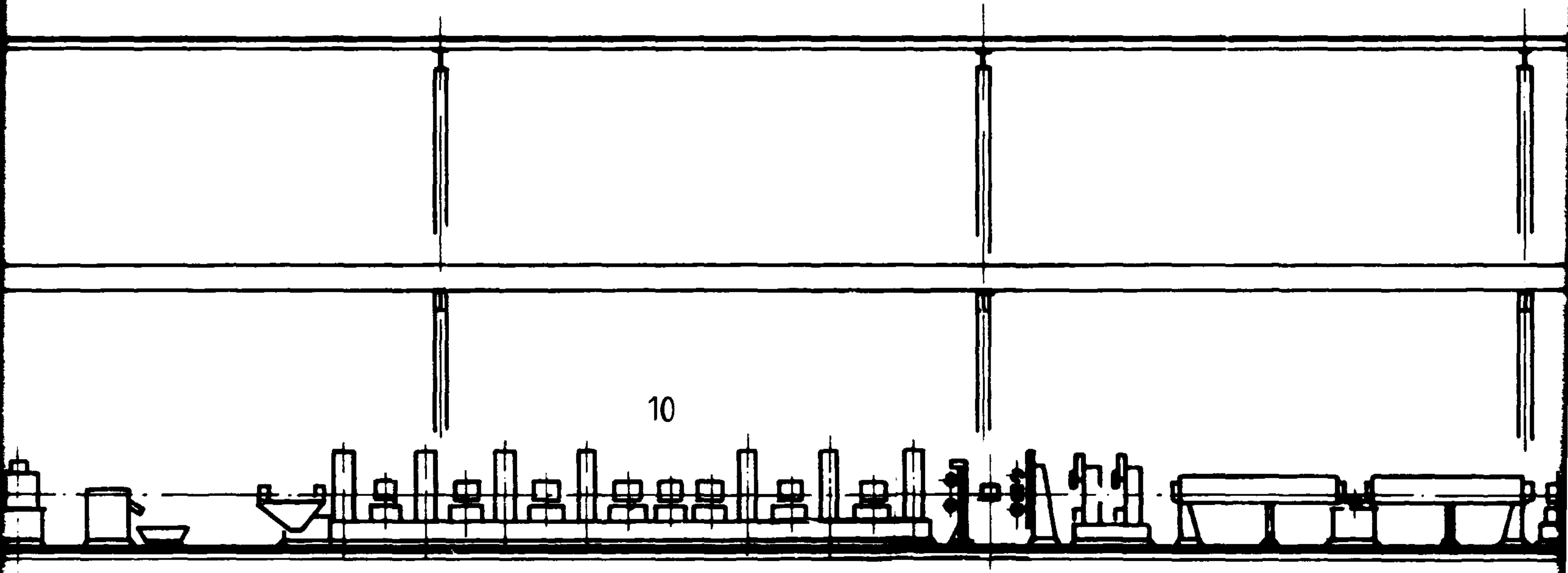


STRIP PREPARATION

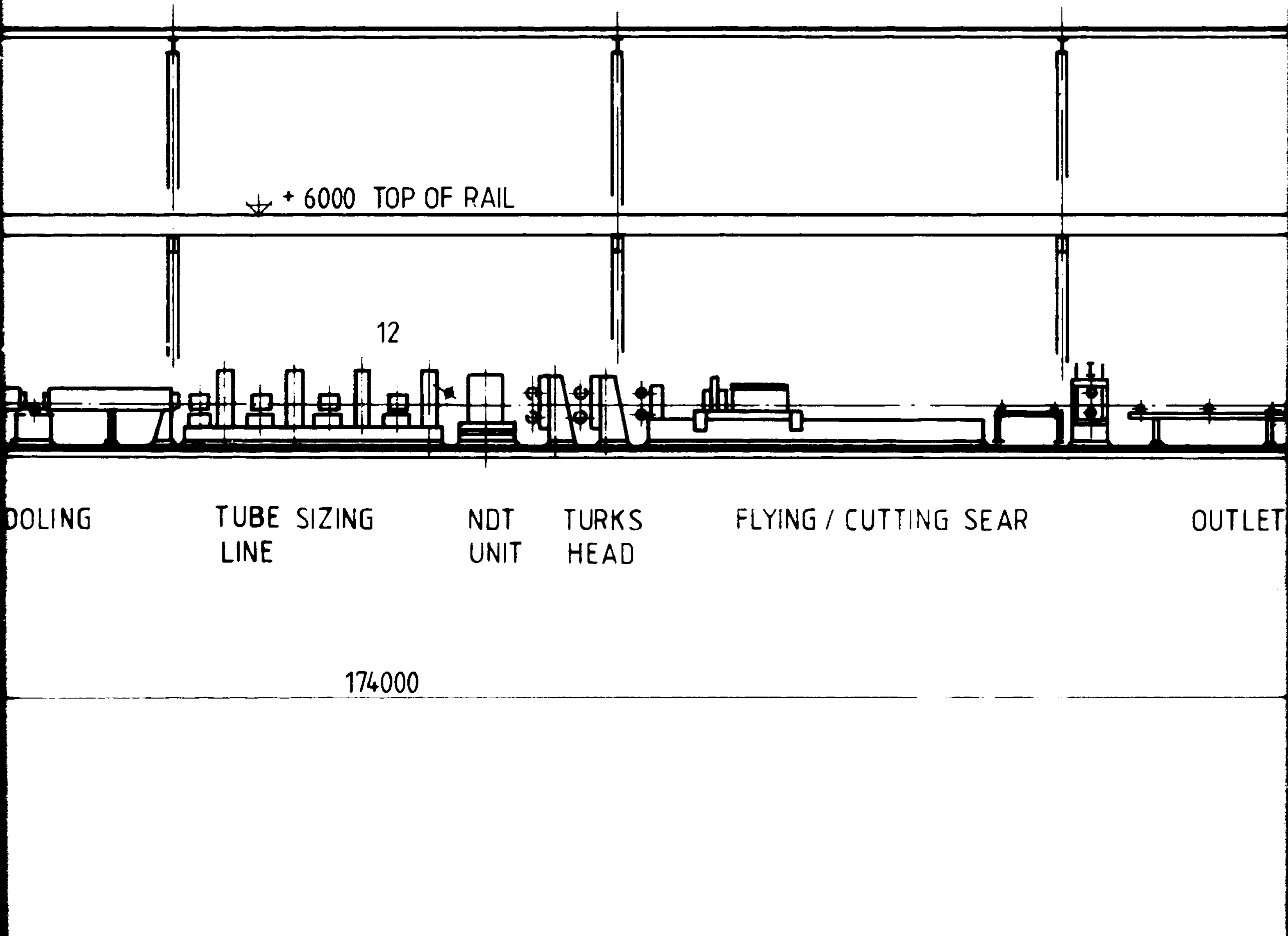
SECTION 3



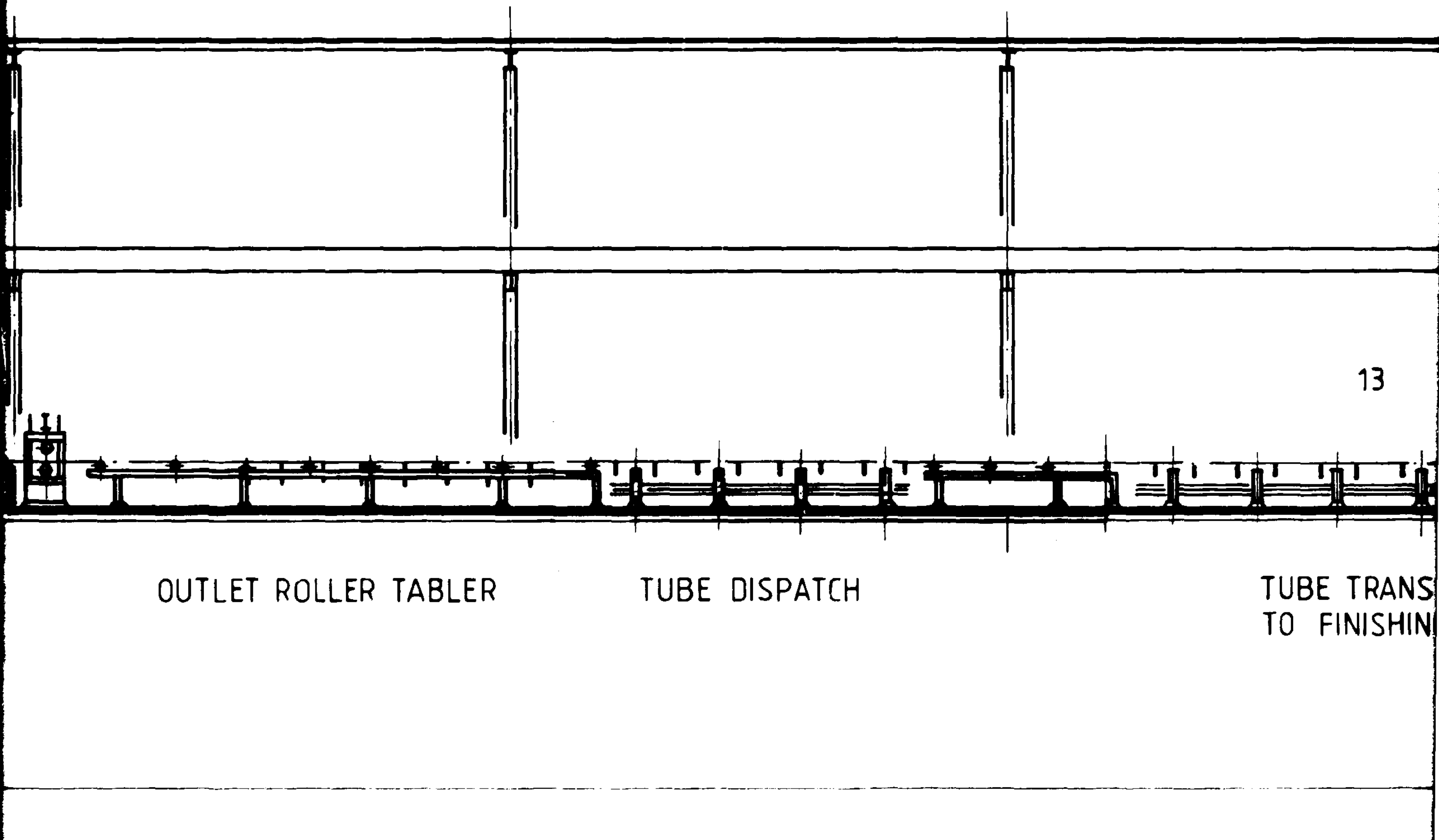
FORMING / WELDING

TUBE-STRAND COOLING

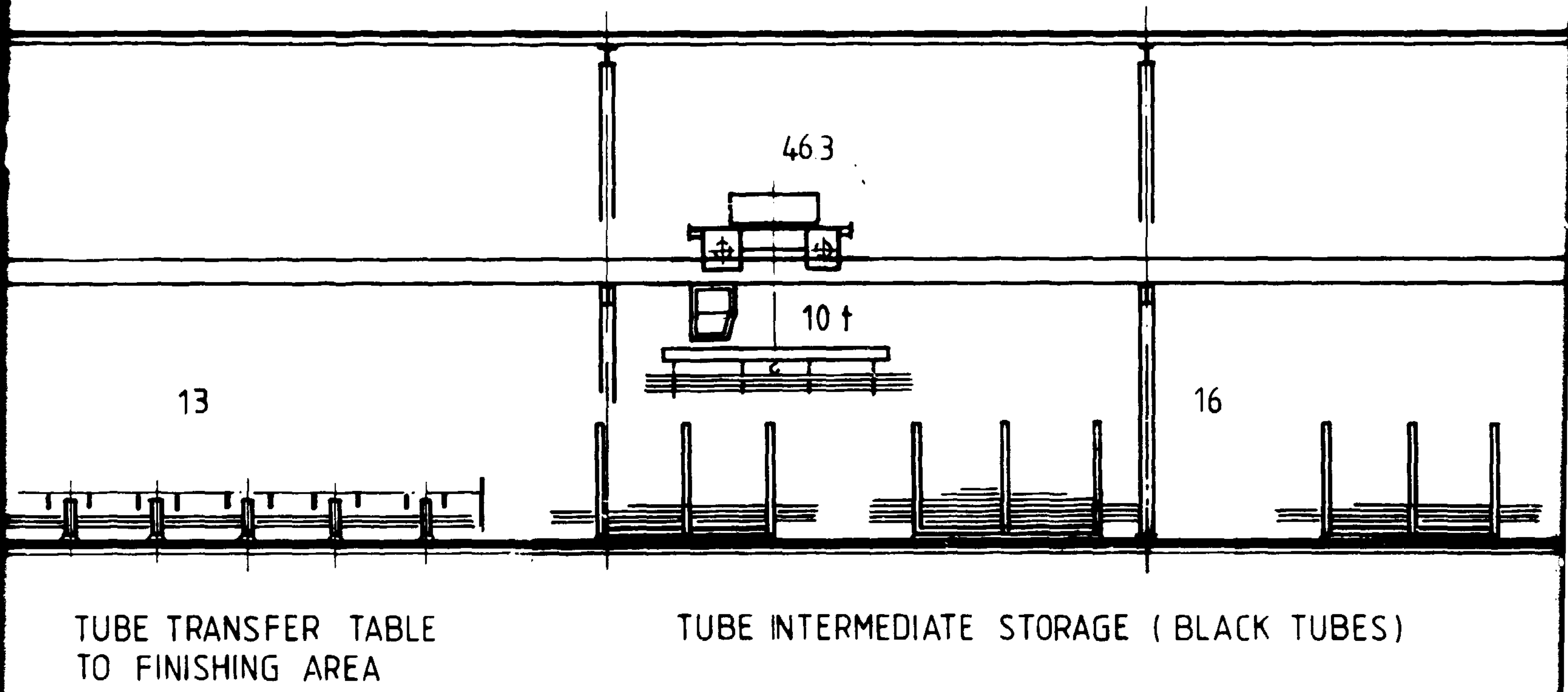
SECTION 4


+ 6000 TOP OF RAIL
12
OOLING
TUBE SIZING
LINE
NDT
UNIT
TURKS
HEAD
FLYING / CUTTING SEAR
OUTLET
174000

SECTION 5


13
OUTLET ROLLER TABLER
TUBE DISPATCH
TUBE TRANS
TO FINISHIN

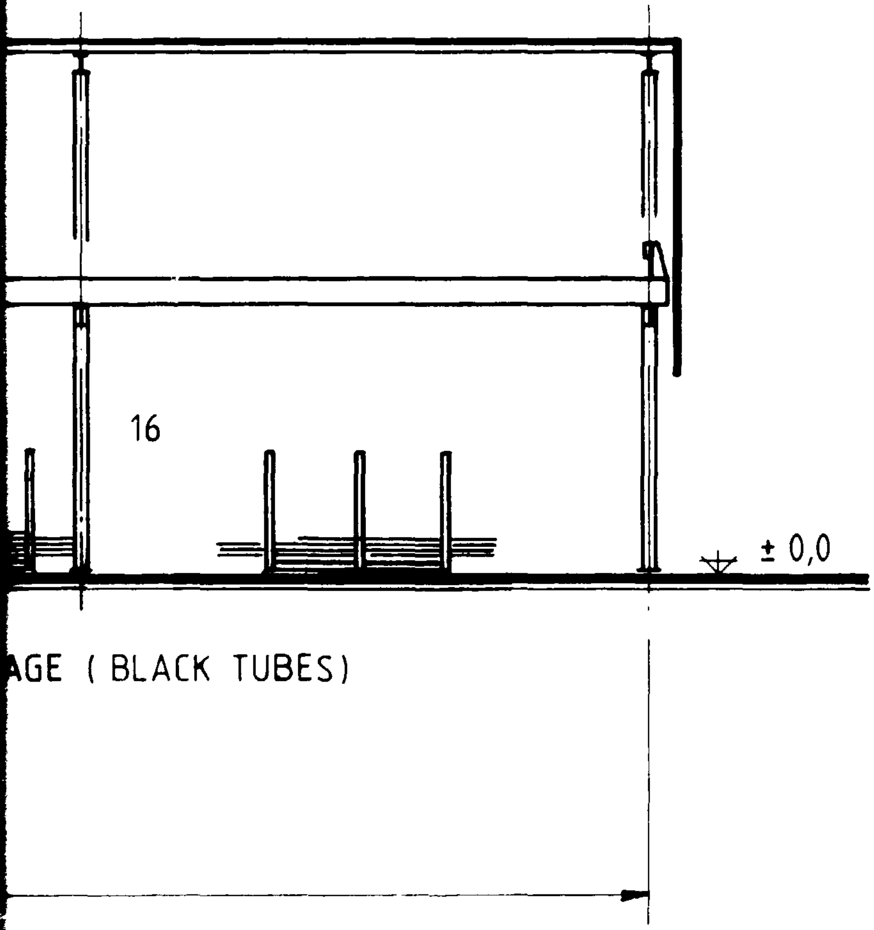
SECTION 6


46.3
10 t
13
16
TUBE TRANSFER TABLE TO FINISHING AREA
TUBE INTERMEDIATE STORAGE (BLACK TUBES)

SECTION 7

(03) LEGEND (SEE DRWG. No. 1148-000.01)

7	SLITTED COILS / STRIP STORAGE
8	STRIP PREPARATION AREA
10	TUBE WELDING / FORMING LINE
12	TUBE SIZING LINE / FLYING CUTTING SHEAR
13	TUBE TRANSFER TABLE
16	TUBE INTERMEDIATE STORAGE (BLACK TUBES)
46,3	PRODUCTION CRANE 10t



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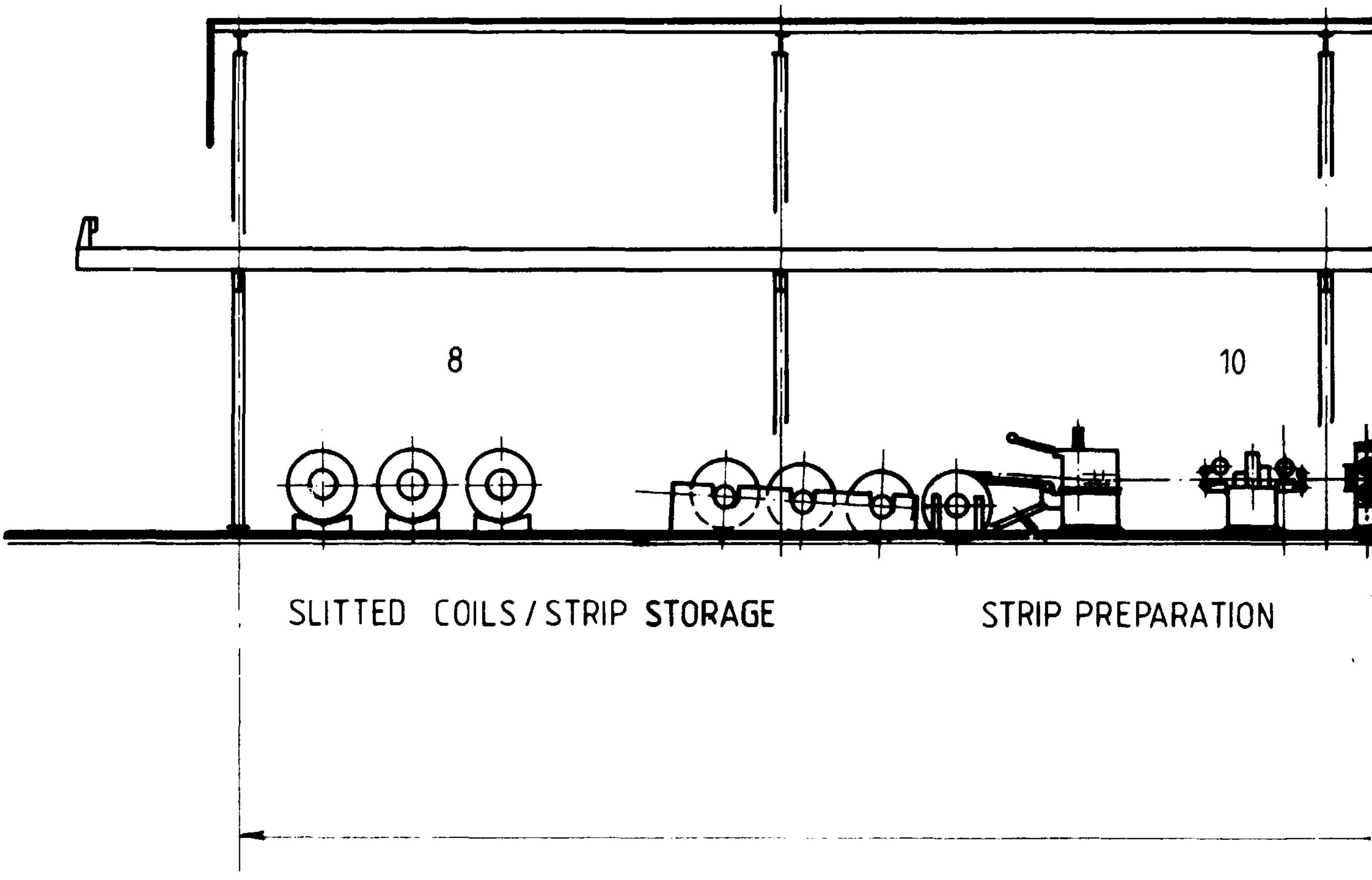
PIPE PRODUCTION AREA
6" ÷ 12"
ALTERNATIVE I

SOCIAL. REPUBLIC OF
THE UNION OF BURMA

DRWG. No. 1148-001.04

SECTION 1



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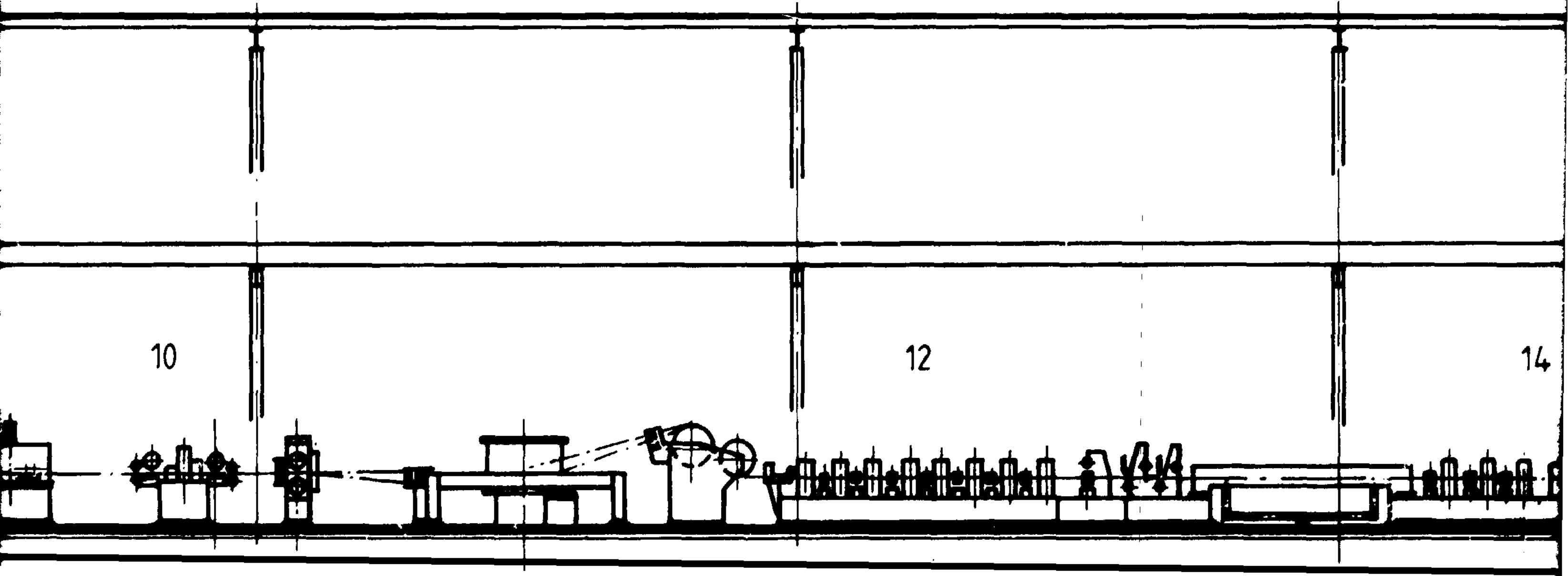
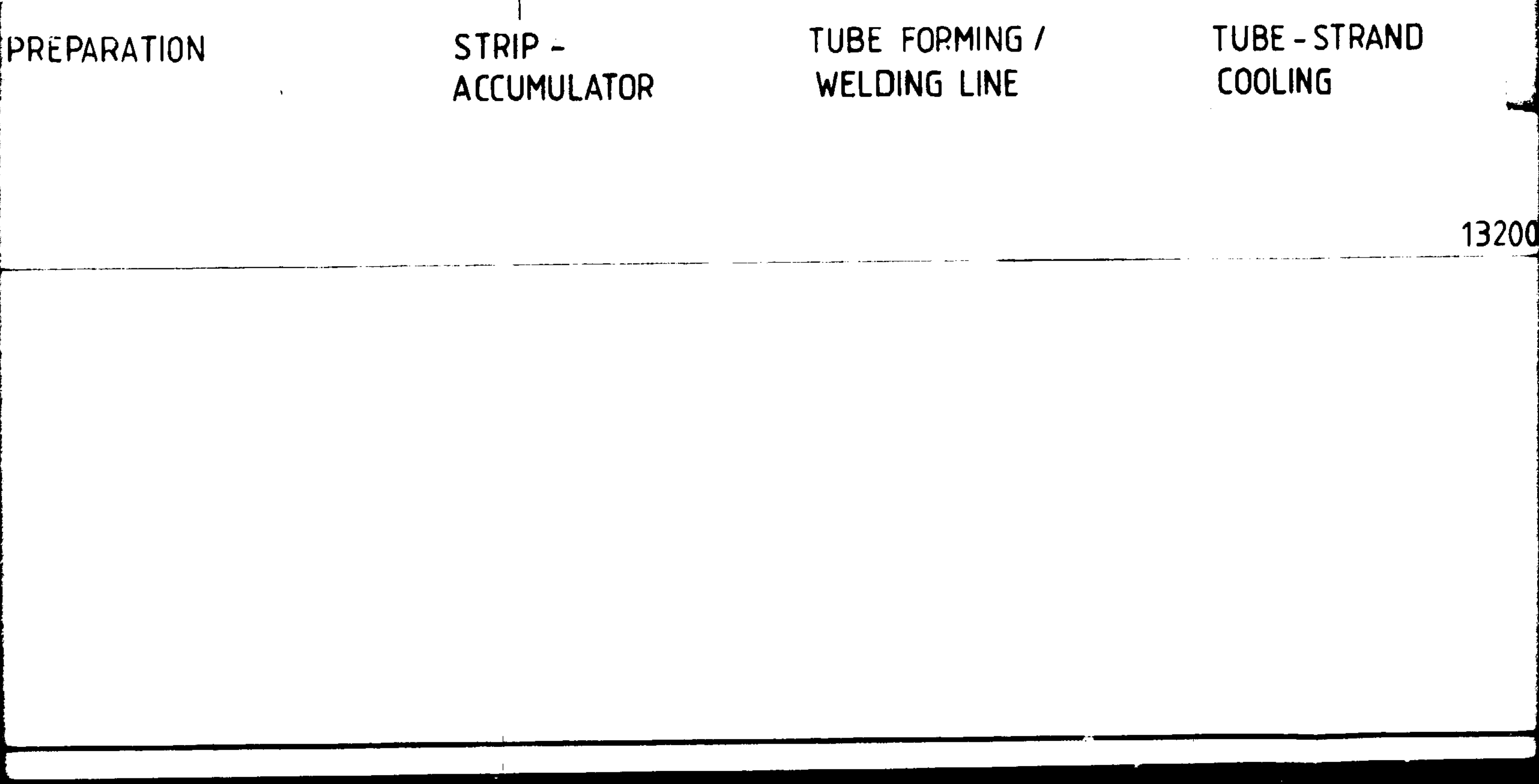
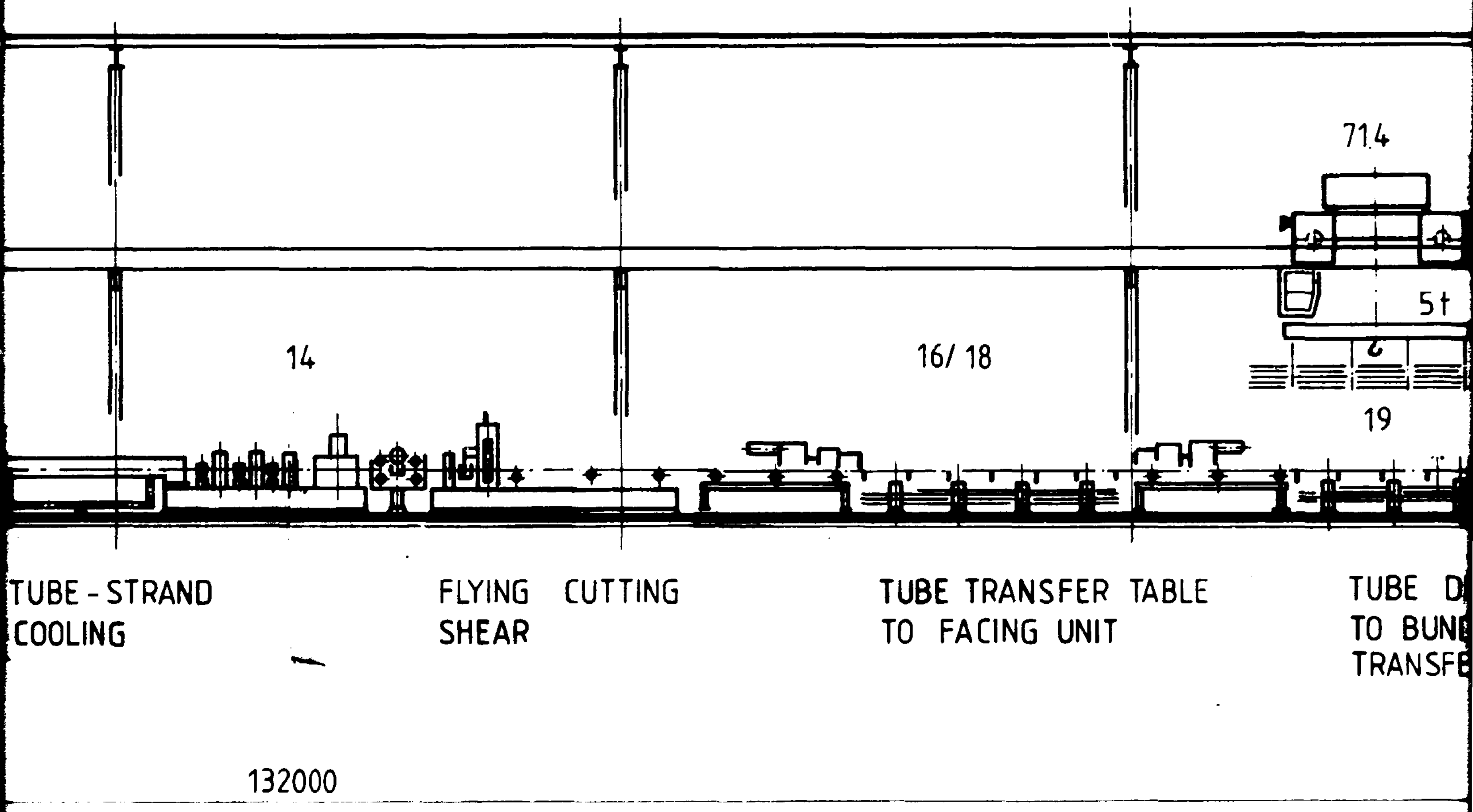



PREPARATION
STRIP - ACCUMULATOR
TUBE FORMING / WELDING LINE
TUBE - STRAND COOLING
13200

SECTION 3


71.4
5t
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TUBE - STRAND COOLING
FLYING CUTTING SHEAR
TUBE TRANSFER TABLE TO FACING UNIT
TUBE D
TO BUN
TRANSFE
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SECTION 4

(03) L

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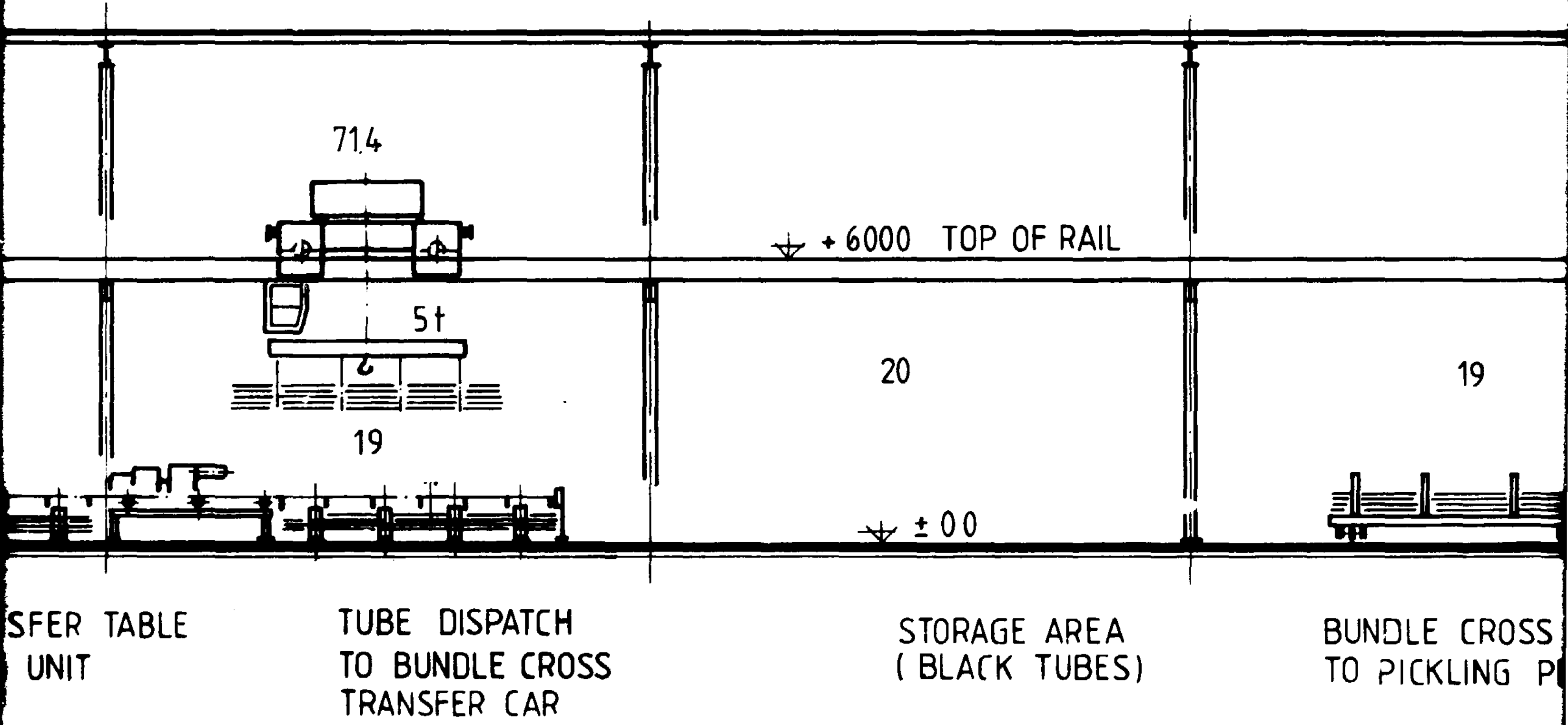
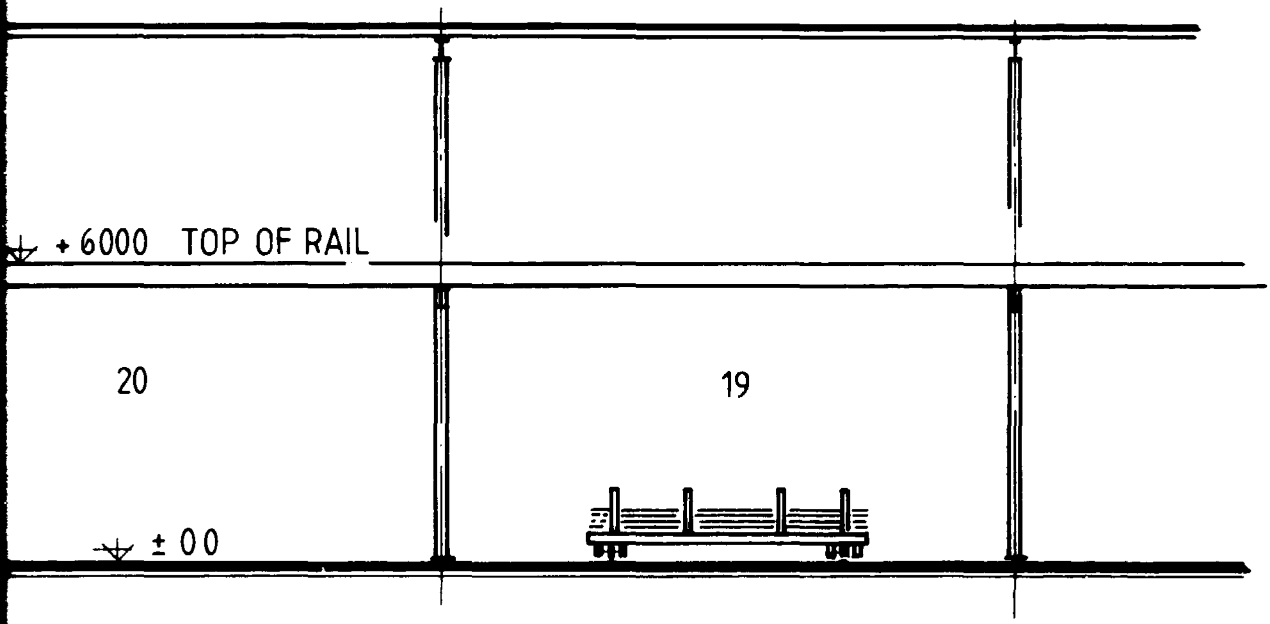


③ LEGEND (SEE DRWG. No. 1148-001.02)

8	SLITTED COILS / STRIP STORAGE
10	STRIP PREPARATION AREA
12	TUBE WELDING LINE
14	TUBE SIZING LINE
16	TUBE TRANSFER TABLE
18	FACING UNIT
19	BUNDLE CROSS TRANSFER CAR
20	STORAGE AREA (BLACK TUBES)
71.4	PRODUCTION CRANE 5 t

SECTION 5



STORAGE AREA
(BLACK TUBES)

BUNDLE CROSS TRANSFER CAR
TO PICKLING PLANT

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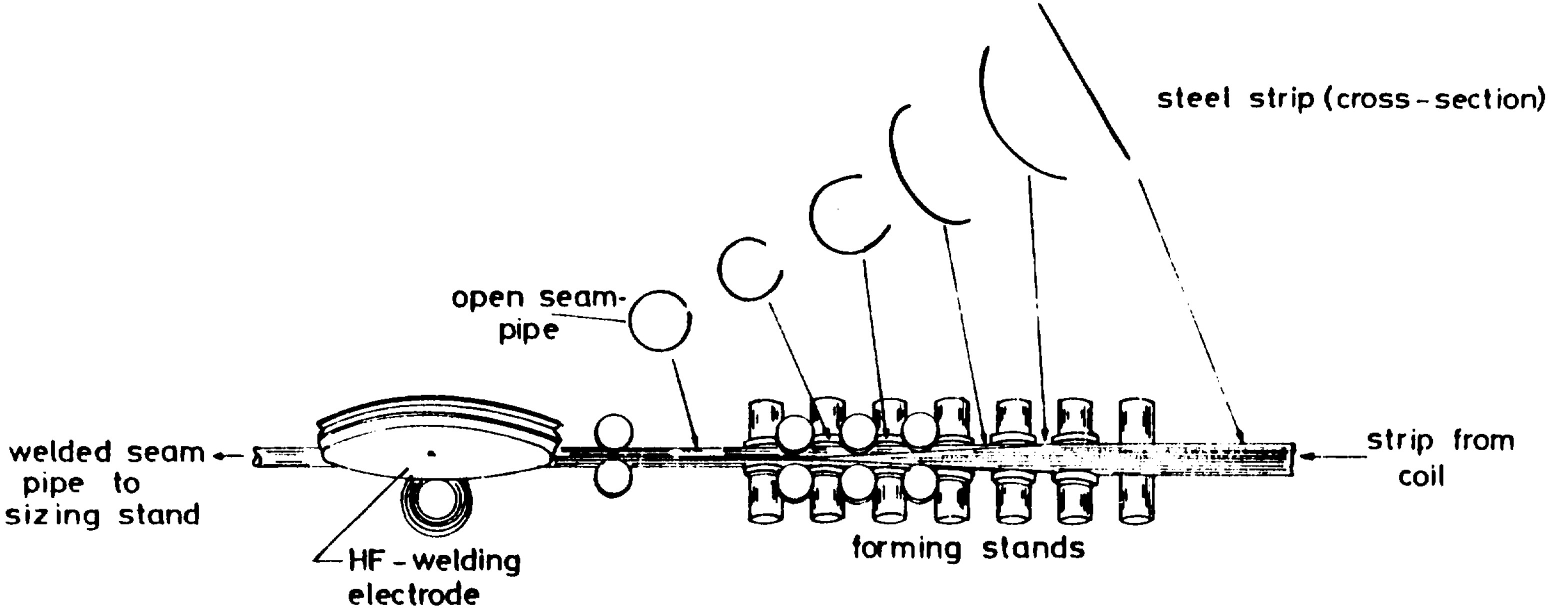
PIPE PRODUCTION AREA
1/2" ÷ 4"
ALTERNATIVE II

SOCIAL REPUBLIC OF
THE UNION OF BURMA

DRWG. No. 1148-001.05

SCHEMATIC REPRESENSATION OF SEQUECE OF OPERATION - STEPS



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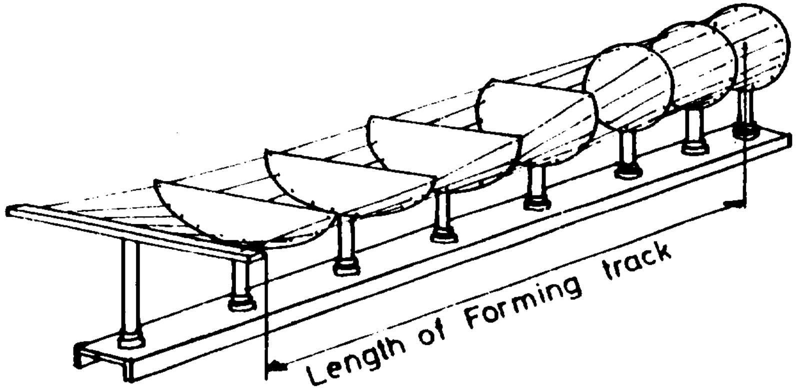
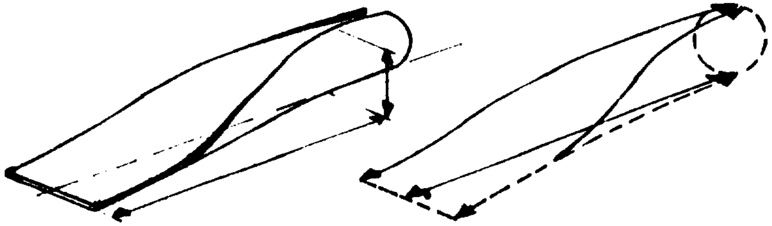


Transion from Strip to open-seam Tube



EBE

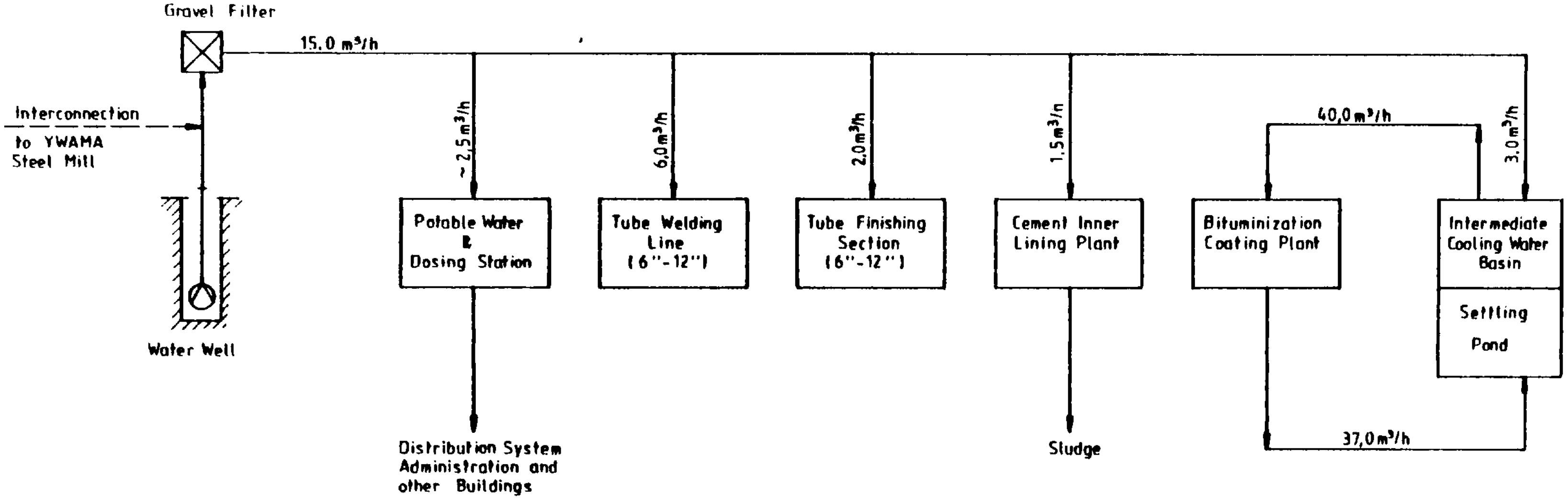
CRANE LIST: Pipe Welding Plant 6" - 12"

Layout No.	Quantity	Location Duty	Span mm	Height Crane Runway mm	Main Hoist approx.			Auxiliary Hoist approx.			Travel Speed approx.		Special Require
					Capa-city t	Lifting Height mm	Speed m/min.	Cap. t	Lift'g Height mm	Speed m/min.	Crane m/min.	Trolley m/min.	
46.1	1	Raw Material Coil Storage	15.000	rail track	15	6.000	10/1	-	-	-	120/60	30	Gantry Crane Motorized swivel C-hook
46.2	1	Slitting Line Service Crane	12.000	6.000	10	4.500	6/0.6	-	-	-	60/6	25	Floor-operated
46.3	1	Production Line 6" - 12"	12.000	6.000	10	5.000	6/0.6	-	-	-	120/60	30	Cabine-operated
46.4 46.5	2	Finishing Line Storage / Cementation 6" - 12"	12.000	6.000	5	5.000	6/0.6	-	-	-	120/60	25	Cabine-operated
46.6	1	Finishing Line Bituminization	12.000	6.000	5	5.000	6/0.6	-	-	-	120/60	25	Cabine-operated
46.7	1	Workshop / Spare Part Storage	12.000	6.000	5	4.500	5/0.5	-	-	-	40/4	15	Floor-operated
-	1	Open-Air Storage Finished Product	-	Floor-operated	5	4.500	-	-	-	-	Diesel-Engine	-	Mobile Auto-Crane

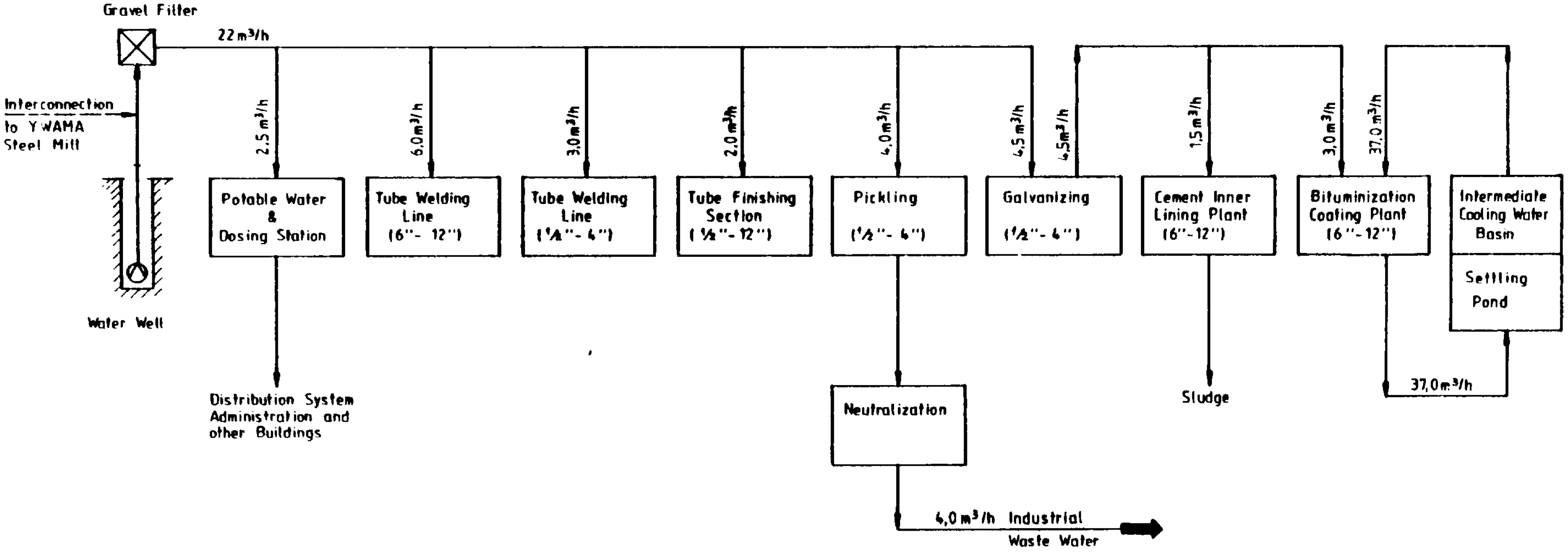
EBE

CRANE LIST: Pipe Welding Plant 1/2" - 12"

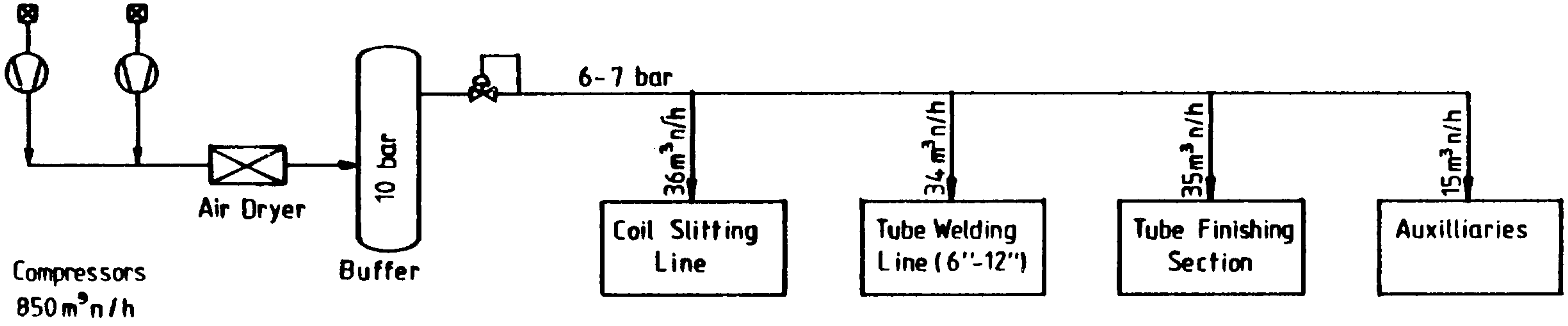
Layout No.	Quantity	Location Duty	Span mm	Height Crane Runway mm	Main Hoist approx.			Auxiliary Hoist approx.			Travel Speed approx.		Special Require
					Capa-city t	Lifting Height mm	Speed m/min.	Cap. t	Lift'g Height mm	Speed m/min.	Crane m/min.	Trolley m/min.	
71.1	1	Raw Material Coil Storage	15.000	rail track	15	6.000	10/1	-	-	-	120/60	30	Gantry Crane motorized swivel C-hook
71.2	1	Slitting Line Service Crane	12.000	6.000	10	4.500	6/0.6	-	-	-	60/6	25	Floor-operated
71.3	1	Production Line 6" - 12"	12.000	6.000	10	5.000	6/0.6	-	-	-	120/60	30	Cabine-operated
71.4	1	Production Line 1/2" - 4"	12.000	6.000	5	4.500	6/0.6	-	-	-	120/60	30	Cabine-operated
71.5	1	Finishing Line 1/2" - 4"	12.000	6.000	5	5.000	6/0.6	-	-	-	120/60	25	Cabine-operated
71.6	1	Pickling Line Bundle Transport	10.000	5.000	5	4.500	5/0.5	-	-	-	40/4	15	Floor-operated
71.7 71.8	2	Finishing Line Storage/Cementation 6" - 12"	12.000	6.000	5	5.000	6/0.6	-	-	-	120/60	25	Cabine-operated
71.9	1	Finishing Line Bituminization 6" - 12"	12.000	6.000	5	5.000	6/0.6	-	-	-	120/60	25	Cabine-operated
71.10	1	Workshop/ Spare Part Storage	12.000	6.000	5	4.500	5/0.5	-	-	-	40/4	15	Floor-operated
-	1	Open-Air Storages Finished Product	-	floor-operated	5	4.500	-	-	-	-	Diesel-Engine	-	Mobile Auto-Crane



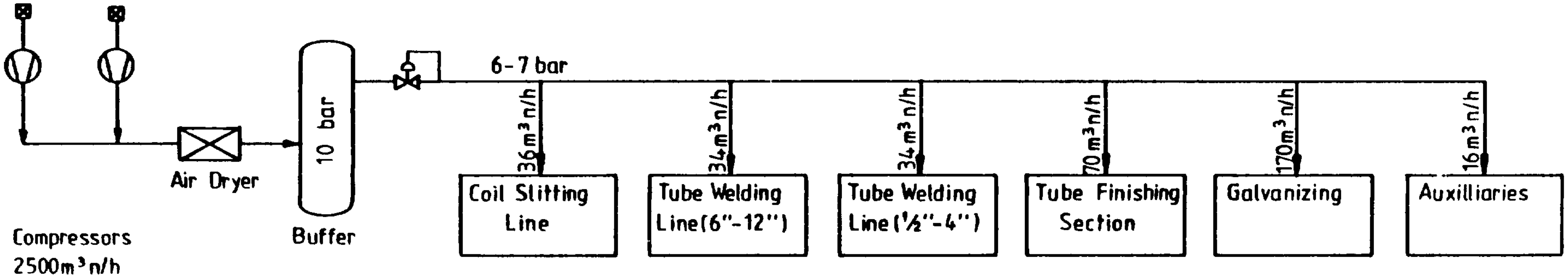
BLOCK DIAGRAM
Water System
Plant Alternative I



BLOCK DIAGRAM
Water System
Plant Alternative II



BLOCK DIAGRAM
Compressed Air System
Plant Alternative I



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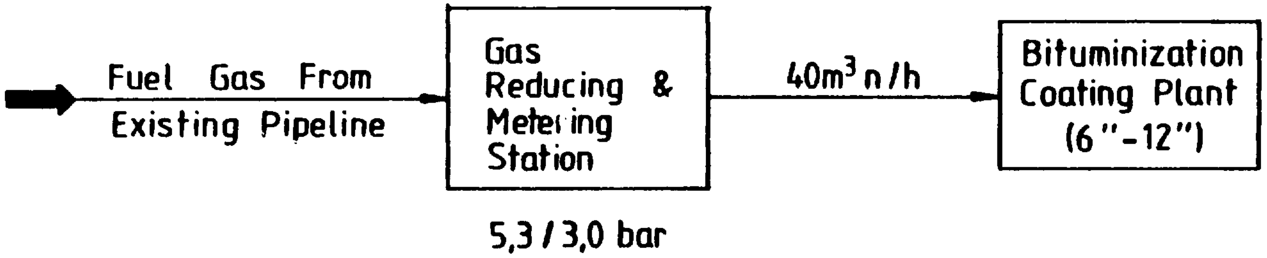
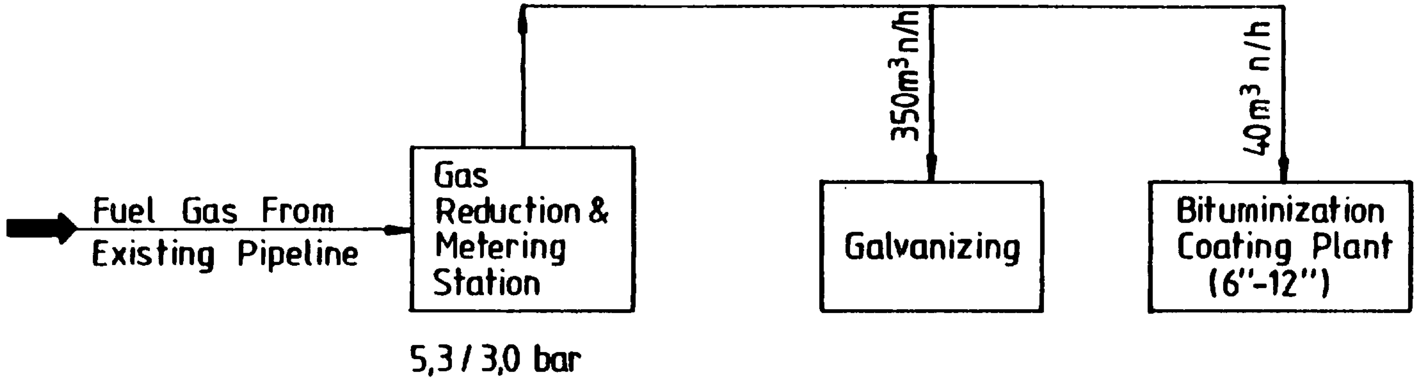
Compressed Air System
Plant Alternative II



BLOCK DIAGRAM
Fuel Gas System
Plant Alternative I



BLOCK DIAGRAM
Fuel Gas System
Plant Alternative II

15766 (2)

The United Nations Industrial Development Organization, Vienna
Executing Agency for UNDP

Feasibility Study on a Welded Steel Pipe Plant in the Socialist Republic of the Union of Burma

Project DP/BUR/80/015
UNIDO Contract No. 85/107

PART II

EISENBAU ESSEN GMBH
Essen, West Germany

July 1986

The United Nations Industrial Development Organization, Vienna
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Feasibility Study on a Welded Steel Pipe Plant in the Socialist Republic of the Union of Burma

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PART II

EISENBAU ESSEN GMBH
Essen, West Germany

July 1986

TABLE OF CONTENTS

CHAPTER VII

PLANT ORGANIZATION
AND
OVERHEAD COSTS

Introduction

In order to calculate the overhead costs for producing welded steel pipe from imported coils the plant and operations has been divided into individual cost centers.

The production cost centers comprise the following units:

Alternative I

- Slitting line
- Large diameter pipe production line
- Coating and lining lines

Alternative II

- Slitting line
- Large and small diamter pipe production lines
- Coating and lining lines

Due to the social system prevailing in the country the costs for such social service items as health service, employee transport, canteen, employee, etc. have been included in the study as investment costs.

The same is true for plant management costs including administration and production workshops. The maintenance, upkeep and utility costs for these items are listed separately under administration overhead costs.

Costs for material stores, spares, tools, etc. are also included under investment overhead costs.

For Alternative I the factory and administrative overhead costs are shown in tables 7/1/1, 7/2/1 and 7/3/1 respectively and for Alternative II tables 7/1/2, 7/2/2 and 7/3/2.

SECTION 1

Table 7/1/1 Distribution of Manpower Costs Alternative I

Department	Unit	General Manager	Deputy G.M.	Assist. Factory Manager	Head of Division	Foreman	Assist. Foreman	Branch Clerk	Firs Opera
Salary cost per person	US $/y	2,580	2,124	1,740	1164	984	852	768	6
Administration									
Number of persons	No.	1	1	2	9	-	-	5	-
Subtotal: salary cost	US $/y	2,580	2,124	3,480	10,476	-	-	3,840	-
General Factory Services									
Number of persons	No.	-	1	2	5	12	4	1	50
Subtotal: salary cost	US $/y	-	2,124	3,480	5,820	11,808	3,408	768	32,4
Slitting									
Number of persons	No.	-	-	-	-	1	-	-	1
Subtotal: salary cost	US $/y	-	-	-	-	984	-	-	648
Pipe Making									
Number of persons	No.	-	-	-	2	4	-	-	7
Subtotal: salary cost	US $/y	-	-	-	2,328	3,936	-	-	4,5
Coating/Lining									
Number of persons	No.	-	-	-	-	6	-	-	15
Subtotal: salary cost	US $/y	-	-	-	-	5,904	-	-	9,7
Totals									
Number of persons	No.	1	2	4	16	23	4	6	73
Total: salary cost	US $/y	2,580	4,248	6,960	18,624	22,632	3,408	4,608	47,3

SECTION 2

Alternative I

Head of Division	Foreman	Assist. Foreman	Branch Clerk	First Operator	Upper Division Clerk	Second Operator	Lower Division Clerk	Helper	Total
1164	984	852	768	648	576	516	420	336	-
9	-	-	5	-	12	-	7	4	41
10,476	-	-	3,840	-	6,912	-	2,940	1,344	33,696
5	12	4	1	50	3	12	-	45	135
5,820	11,808	3,408	768	32,400	1,728	6,192	-	15,120	82,848
-	1	-	-	1	-	-	-	3	5
-	984	-	-	648	-	-	-	1,008	2.640
2	4	-	-	7	-	3	-	15	31
2,328	3,936	-	-	4,536	-	1,548	-	5,040	17,388
-	6	-	-	15	-	12	-	27	60
-	5,904	-	-	9,720	-	6,192	-	9,072	30,888
16	23	4	6	73	15	27	7	94	272
18,624	22,632	3,408	4,608	47,304	8,640	13,932	2,940	31,584	167,460

Table 7/2/1

Factory Overheads		Alternative I
		US $ / year
Salaries and Wages (incl. benefits and social security) of manpower and employees not directly involved in production		82,848
Auxiliary materials		2,007,800
Factory supplies		485,900
Utilities		35,000
Repair and maintenance (contractual)		none
Effluent disposal		no fees
Total	US $/year	2,611,548,--

Table 7/3/1

Administration Overheads		Alternative I
		US $ / year
Wages and salaries (incl. benefits and social security)		33,696
Office supplies		7,000
Utilities		1,600
Telecommunication		10,000
Engineering costs (contractual)		none
Rents		none
Insurances (property)		not considered
Taxes (property)		not considered
Total	US $/year	52,296,--

SECTION 1

Table 7/1/2 Distribution of Manpower Costs Alternative II

Department	Unit	General Manager	Deputy G.M.	Assist. Factory Manager	Head of Division	Foreman	Assist. Foreman	Branch Clerk	First Operato
Salary cost per person	US $/y	2,580	2,124	1,740	1,164	984	852	768	648
Administration									
Number of persons	No.	1	1	2	9	-	-	5	-
Subtotal: salary cost	US $/y	2,580	2,124	3,480	10,476	-	-	3,840	-
General Factory Services									
Number of persons	No.	-	1	2	5	12	4	1	62
Subtotal: salary cost	US $/y	-	2,124	3,480	5,820	11,808	3,408	768	40,176
Slitting									
Number of persons	No.	-	-	-	-	1	-	-	1
Subtotal: salary cost	US $/y	-	-	-	-	984	-	-	648
Pipe Making									
Number of persons	No.	-	-	-	2	6	-	-	19
Subtotal: salary cost	US $/y	-	-	-	2,328	5,904	-	-	12,312
Coating/Lining/Galvan.									
Number of persons	No.	-	-	-	-	9	-	-	18
Subtotal: salary cost	US $/y	-	-	-	-	8,856	-	-	11,664
Totals									
Number of persons	No.	1	2	4	16	28	4	6	100
Total: salary cost	US $/y	2,580	4,248	6,960	18,624	27,552	3,408	4,608	64,800

Alternative II

Head of Division	Foreman	Assist. Foreman	Branch Clerk	First Operator	Upper Division Clerk	Second Operator	Lower Division Clerk	Helper	Total
1,164	984	852	768	648	576	516	420	336	-
9	-	-	5	-	12	-	7	4	41
10,476	-	-	3,840	-	6,912	-	2,940	1,344	33,696
5	12	4	1	62	3	13	-	61	164
5,820	11,808	3,408	768	40,176	1,728	6,708	-	20,496	96,516
-	1	-	-	1	-	-	-	3	5
-	984	-	-	648	-	-	-	1,008	2,640
2	6	-	-	19	-	11	-	30	68
2,328	5,904	-	-	12,312	-	5,676	-	10,080	36,300
-	9	-	-	18	-	15	-	36	78
-	8,856	-	-	11,664	-	7,740	-	12,096	40,356
16	28	4	6	100	15	39	7	134	356
18,624	27,552	3,408	4,608	64,800	8,640	20,124	2,940	45,024	209,508

Table 7/2/2

Factory Overheads		Alternative II
		US $ / year
Salaries and Wages (incl. benefits and social security) of manpower and employees not directly involved in production		96,516
Auxiliary materials		2,945,800
Factory supplies		767,000
Utilities		64,000
Repair and maintenance (contractual)		none
Effluent disposal		no fees
Total	US $/year	3,873,316

Table 7/3/2

Administrative Overheads		Alternative II
		US $ / year
Wages and salaries (incl. benefits and social security		33,696
Office supplies		7,000
Utilities		2,000
Telecommunication		10,000
Engineering costs (contractual)		none
Rents		none
Insurances (property)		not considered
Taxes (property)		not considered
Total	US $/year	52,696

CHAPTER VIII

MANPOWER

Manpower

It is to be assumed that from the very inception of a project having the magnitude and importance to the national economy as the welded steel pipe plant that the Government would form its own project team to liaise with and assist the general contractor with the design and detailed engineering of the plant. Their activities and major contributions would be mainly concerned with the local and site related conditions and activities.

Although such work is important to the project the Study does not take into consideration the manpower requirements or expenditures for this work. The reason for this decision is that it is also entirely possible that the Government will decide not to form such a team.

Manpower requirements, pre-production phase

The section of this chapter entitled "manpower requirement - operational phase" lists the managerial staff positions together with those of the key supervisiors and foremen. It also states when these individuals should be assigned to or recruited for the project.

The following is the estimated starting dates for the different staff positions during the pre-production phase.

Technical

General Manager	6 months prior to start up			
Deputy General Manger	22	"	"	"
Assistant Factory Manager, Production	18	"	"	"
Assistant Factory Manager, Maintenance	14	"	"	"
Head of Welding Division	8	"	"	"
Head of Finishing Division	6	"	"	"
Head of Quality Control Division	2	"	"	"

Head of Mechanical Division, Maintenance	8 months prior to startup
Head of Electrical Division, Maintenance	10 " " "
Head of Planning Division	2 " " "
Foremen, all disciplines	
Alternative I (25)	1 " " "
Alternative II (28)	1 " " "
Equipment operators	
Alternative I (16)	1 " " "
Alternative II (19)	1 " " "
Commercial	
Deputy General Manger, Planning	6 months prior to startup
Assistant Planning Manager, Financial	6 " " "
Assistant Planning Manger, Administration	6 " " "
Head of Accounts	6 " " "
Head of Procurement	6 " " "
Head of Administration	6 " " "

Table 8.3 Pre-operational salary costs

Wage catagory	No. of Workers	Salary/ mo. US$	Man-months	Total salary costs (US$)
General Manager	1	215	6	1,290
Deputy G.M.	2	177	28	4,956
Assistant Factory Manager	4	145	44	6,380
Head of Division	9	97	54	5,238
Foreman:				
Alternative I	25	82	25	2,050
Alternative II	28	82	28	2,296
Operator:				
Alternative I	16	54	16	864
Alternative II	19	54	19	1,026
Total cost Alternative I				20,778
Total cost Alternative II				21,186

Manpower requirements - operational phase

Table 8-1 is the detailed manpower manning table applicable to the manning requirements for operating and managing during the operational phase of the welded steel pipe plant, Alternative I.

It also gives title designations for the various job categories and duties as well as the reporting chain of command.

The numbers of operational and management personnel shown are in accordance to the established production programme and operating capacity as set out in the study. This is based upon the presumption that individual plant units will have different operating schedules and therefore manned either on a 1, 2 or 3 shift basis. In general, it can be assumed that the managerial, administrative and commercial activities are concentrated on a 1 shift basis where the operational and supervisory duties are spread over a 2 or 3 shift basis.

The study findings indicate that there is a ready number of qualified personnel available who are capable of being trained to successfully manage, supervise and operate the plant.

Of major importance are the managerial and supervisory positions which have to be filled. A primary source of such personnel, especially technical, could be the Ywama steel mill. In over 20 years of operation a cadre of technically qualified managers and supervisors have gained invaluable on-the-job-training (OJT) and hands-on experience in the steel industry.

Since the steel mill is government owned as would be the pipe plant there should be no undue difficulty in transferring personnel from the mill to the plant. In fact, due to the rather limited promotional postings within the Burmese steel industry such a transfer programme would enable a considerable number of capable but somewhat junior individuals to move up and take on more senior positions and thus responsibilities in the new pipe plant.

The managerial and supervisory personnel selected for these new assignments should be transferred over to the pipe project in sufficient time to enable them to participate as early as possible in the detailed engineering and construction phase relative to their particular discipline or speciality.

Phased plant secondment and recruitment

The following are the technical personnel and their approximate starting dates for staffing the managerial and supervisory positions:

General Manager

The GM will have overall control of all aspects of the pipe plant; technical and administrative. As such he must take up his duties well before start-up to ensure that all of his organization systems are set up and can come into operation in parrallel with commissioning and consequent operation. It is not necessary that he should be as involved with plant design as is the DGMP.

The GM should have a degree in engineering or business administration and have had at least 10 years professional experience in management at a senior level in large scale industry.

Deputy General Manager, Production

Since the DGMP will ultimately have total technical responsibility for all aspects of the plant and its operations it is necessary that he should be familar with the plant in its entirity. It is therefore imperative that he be seconded to the project during the design phase.

The DGMP should have a degree in engineering or related science. He should also have a minimum of 10 years professional experience with at least 3 years in management and planning.

Assistant Factory Manager, Production

The AFMP is directly responsible for plant production and production related functions. For this reason he should be assigned to the project team early in the design phase to ensure he has an in-depth knowledge of the design and equipment capacities, plant layout, utilities and related infrastructures as well as the overall operating philosophy.

The AFMP should have a degree in engineering or related science. He should have a minimum of 5 years professional experience and preferably some in management and planning.

Assistant Factory Manager, Maintenance

The AFMM will require an intimate knowledge of the plant's equipment and utilities.

It would therefore be advantageous to have him assigned to the project team when the equipment specifications and spare parts lists are being drawn-up. Under no circumstances should he be assigned to the project later than the start of installing the first utilities at site.

The AFMM should have a degree in either mechanical or electrical engineering. It would also be advantageous if he had completed a craft or training programme sometime in his career. He should also have a minimum of 5 years practical experience and preferably some in management and planning.

Head of Welding Division

The HWD should be available from the start of receipt of the welding machines(s) at site. He should closely monitor the equipment installation and assist in the actual start-up and commissioning work.

Head of Finishing Division

The HFD should be on the job from the start of receipt of the finishing equipment at site. He should monitor the equipment installation and assist in the actual start-up and commissioning work.

Head of Quality Control Division

The HQCD should be employed on the project shortly prior to the plant start-up and commissioning work.

These division heads should have university degrees in engineering or related sciences. They should also have a minimum of 1 year practical experience in industry: preferably in a line position.

Head of Mechanical Division, Maintenance

The HMD should be available from the beginning of mechanical installation.

He should have a degree in mechanical engineering and at least 1 year industrial experience preferably in a line position. It would be advantageous if he had also completed a craft or trade course, such as welding.

Head of Electrical Division, Maintenance

The HED should be available from the beginning of electrical installation.

He should have a degree in electrical engineering and at least 1 year industrial experience preferably in a line position. It would be advantageous if he had also completed a crafts or trade course or gained other practical experience in instruments and controls.

Head of Planning Division

The HPD would join the plant staff during the later phases of construction. His duties would be to establish and implement, together with other senior members of the staff, the operational, production, hiring and procurements plans and procedures.

He should have a degree in engineering or one of the related sciences and a minimum of 1 year industrial experience. This experience should preferably have been related to planning or control functions.

In lieu of the engineering or science degree qualification Heads of Divisions may have a diploma from the Government Technical Institute (G.T.I. diploma) together with at least 5 years relevant industrial experience.

Foremen (Technician Grade 10)

All foremen, operations and maintenance, should be staff members and be present during plant start-up and commissioning work.

Foremen should possess a diploma from the Government Technical Institute (G.T.I. Diploma) together with at least 1 year practical industrial experience. As far as possible their position in the plant should reflect their past experience.

In lieu of the G.T.I. diploma foremen may possess a certificate from a Technical High School (T.H.S. Certificate) providing they also have a minimum of 5 years practical industrial experience.

Technicians (Machine operators and maintenance personnel)

Machine and equipment operators and maintenance personnel should be employed shortly before start-up to enable them to obtain orientation and preliminary OJT during the commissioning period.

Assistant plant foremen have the Technician Grade 8 with the 1st equipment operator classified as Grade 6 and 2nd operator as Grade 4.

Maintenance personnel would have the same classifications in accordance to their specific job responsibilities.

Foreign experts

To ensure smooth implementation and on-going production of high quality pipe products it is imperative that a team of highly qualified and experienced pipe plant personnel supervise the initial production phase and at the same time conduct an intensive OJT programme for the local work force.

The technical experts envisaged for this work would each have one or more indigenous counterparts who would ultimately take over the work in their own accord.

It is envisaged that the following foreign experts will be required beginning with the start-up and commissioning phase.

Two (2) Welding Division Specialists

It is the duty of these specialists to ensure the indigenous Head of Welding Division, his assistant and at least 4 foremen are trained to correctly operate all the equipment and facilities associated with the welding line.

Their tour would be for approximately 3 months after commissioning for alternative I and 5 months for alternative II.

Two (2) Finishing Division Specialists

The duties of these specialists is to train the Head of Finishing Division together with his assistant and 4 foremen to be able to correctly use the finishing equipment and auxiliaries.

The training programme and assignment tour would be for approximately 3 months after commissioning.

Two (2) Quality Control Specialists

The qaulity control specialist will establish a programme of quality control norms, standards and implementation and control and reporting procedures. At the same time he will act as training instructor for the Head of Quality Control Division, his assistant and 2 foremen.

His assignment tour would be for approximately 6 months after commissioning.

Three (3) Pipe Mill Maintenance Specialists

2 Mechanical
1 Electrical-instrument

It is the responsibility of these specialists to ensure proper maintenance is carried out on the plant until they can train at least 4 local personnel for each discipline.

It would also be the responsibility of one of the mechanical specialists, with input from his electrical colleague to establish and instigate plant-wide preventative and on-going maintenance procedures and schedules.

It will be the responsibility of all 3 specialists to ensure that their local trainees understand the importance of these procedures and schedules and that plant maintenance is regularly conducted in strict accordance to them.

Their assignments would be for approximately 6 months after commissioning.

Table 8-2 is the detailed manpower manning programme applicable for Alternative II.

In both alternatives the managerial and supervisory personnel remains the same.

Additional foremen will be required however, for operating the small diameter pipe welding machine and the pickling and galvanizing lines in Alternative II.

The only additional foreign specialists required would be:

Two (2) Pickling and Galvanizing Specialists
It is their responsibility to train at least 4 foremen for operating these facilities.

It is estimated that 3 months will be required for the complete start-up and commissioning programme for Alternative I and 1 welding line.

Since it is assumed that the installation supervisors would install the 2nd machine under Alterntive II the same foreign welding specialists would be used for instructing indigenous foremen in its use. This would be done by simply extending their tour by 2 months.

Alternative I requires	
a foreign specialist input of	45 man months
at an average cost of	450,000 US$
US$ 10,000/man month	

Alternative II requires	
a foreign specialist input of	55 man months
at an average cot of	550,000 US$
US$ 10,000/man month	

If the project is implementated on a turn-key basis the above foreign experts services should be included as part of the contract.

If any other form of project implementation is conducted the services should be contracted for under a single "Technical Know-How" contract.

Training

It is envisaged that all the technical managerial and supervisory personnel will require a brief theoretical introduction programme followed by intense OJT.

Due to the qualifications set for the General Manager, Deputy General Manager and Assistant Factory Managers it is assumed that a 2 week orientation seminar should suffice. Where applicable this would then be followed up by having the individual closely monitor the installation of the equipment relating to his specific job responsibilities. The durations here are shown under the heading preproduction phase.

Heads of Divisions and foremen would first be given a 1 month theoretical introductory course in production and finishing of pipe. The divisional heads would then monitor the installation of their particular pices of equipment. This familarization and monitoring period would start from the time the equipment was received on site.

The theoretical orientation programme for foremen would start approximately 1 month prior to start-up and commissioning.

With the exception of the General Manager and the Deputy General Manager all other managerial and supervisory personnel would participate in the start-up and commissioning programme.

During the initial 3 months of operations the supervisors would be subjected to actual on-line responsibilities and work procedures. During this same period of time the individual equipment and machine operators would be trained.

Since no orientation or general training programme is required for the commercial positions most of these persons can be taken on the staff shortly before start-up.

The following is a description of the main commercial and administrative positions.

Deputy General Manager, Operational Planning

The DGMOP is in charge of all the commercial, administrative and planning activities related to the plant and its operations.

Since certain commercial activities will have to be transacted before the plant can go into operation, such as purchase of steel coils and other input materials. The DGMOP will have to be on staff at least 6 months prior to start-up.

He should have a degree in either business administration, economics or related subjects and at least 10 years professional experience with at least 3 years in a senior managerial or planning position.

Assistant Planning Manager, Financial

The APMF reports directly to the Deputy General Manager, Operational Planning. His responsibilities include managing the activities of the accounting and book keeping departments, payrolls and employee benefits.

He should possess a degree in business administration or economics with a major in accounting together with at least 5 years professional experience and preferably some in financial management and planning.

Since there will be a considerable amount of international procurement to be executed prior to plant start-up the APMF should be on staff 6 months before start-up.

Assistant Planning Manager, Administration

The APMA reports directly to the Deputy General Manager, Operational Planning. His responsibility include sale, procurement planning, plant administration and personnel.

He should have a degree in business administration or related subject and at least 5 years commercial experience.

Since procurement of various input materials has to be completed prior to start-up he should be on staff 6 months before start-up. Other work to be done during this period is setting up employee social affairs programmes, employment procedures, etc.

Head of Accounts

The HA works as the chief accountant directly under the Assistant Planning Manger, Finance.

He should have a degree in business administration, with an emphasis in accounting and a minimum of 1 year professional experience.

In lieu of the degree the HA could possess a diploma in accounting from a recognized commercial institute and have at least 5 years experience as an accountant or chief book keeper.

The HA should also be on staff 6 months prior to start-up.

Head of Procurement

The HP is responsible for preparing and placing orders for local as well as international procurement. He will also be in charge of plant stores as well as expediting of stocks and materials into the plant.

He should have a degree in business administration or related with at least 1 years experience in procurement planning.

The HP should be on staff 6 months prior to start-up.

Head of Administration

The HA is responsible for all the general administrative activities not specifically assigned under another department head.

His qualifications are a business or management degree with a minimum of 1 year commercial or managerial experience.

The HA should be on staff 6 months prior to start-up.

Head of Personnel

The HP is responsible for recruiting and hiring personnel and administering employee social affairs and benefits.

He should have a college degree with at least 1 year personnel or social benefits experience.

The HP should be on staff 6 months prior to start-up for employee recruitments.

In lieu of the degree requirements for the Head of Procurement, Head of Administration and Head of Personnel candidates for these positions may also possess a diploma or certificate from a recognized commercial institute and have at least 5 years professional experience.

Head of Sales

The HS is responsible for ensuring finished product sales, timely deliveries, customer relations and production programme planning.

He should have a technical degree to be able to assist the customers in product selections and applications and at least 1 year professional experience.

In lieu of the technical degree the HS may have a diploma from the Government Technical Institute, (G.T.I. diploma) together with 5 years relevant industrial and commercial experience.

He should be on staff shortly prior to start-up.

Administrative Assistants and Clerks

The various administrative assistants and clerks would be given the classifications Branch Clerk grade 7, Upper Division Clerk, grade 6 and Lower Division Clerk, grade 4 depending on their specific job responsibilities.

SECTION 1

Schedule 8-1/1 Manning Table - labour

MANNING TABLE - TECHNICAL ALTERNATIVE I		Wage catagories (no. of workers)							
Function	Shift	Deputy G.M.	Assist. Factory Manager	Head of Division	Foreman	Assist Foreman	Branch Clerk	First Operator	Se Op to
Production management	I	1	1	1	1		1		
	II								
	III								
Maintenance management	I		1		1				
	II								
	III								
Planning	I			1		1			
	II								
	III								
Slitting line	I				1			1	
	II								
	III								
Welding line	I			1	1			2	
	II				1			2	
	III								
Finishing line	I			1	1			1	
	II				1			1	
	III							1	
Surface coating line	I				2			5	
	II				2			5	
	III				2			5	
Quality control	I			1		1		2	
	II							1	
	III							1	
Utilities & transportation	I				1			10	
	II				1			8	
	III							8	
Maintenance	I			2	4	2		12	
	II				2			6	
	III				2			2	
Total Labour		1	2	7	23	4	1	73	2

Note: All wage catagories considered to be for local workers

SECTION 2

atagories (no. of workers)

Head of Division	Foreman	Assist Foreman	Branch Clerk	First Operator	Second Operator	Upper Division Clerk	Lower Division Clerk	Helper	Total
1	1		1			1			6
	1					1			3
1		1							2
	1			1				3	5
1	1			2				4	8
	1			2				4	7
1	1			1	1			3	7
	1			1	1			2	5
				1	1			2	4
	2			5	4			9	20
	2			5	4			9	20
	2			5	4			9	20
1		1		2				2	6
				1				2	3
				1				1	2
	1			10	5			10	26
	1			8	4			10	23
				8	3			6	17
2	4	2		12		1		8	29
	2			6				4	12
	2			2				2	6
7	23	4	1	73	27	3		90	231

local workers

SECTION 1

Schedule 8-1/2 Manning Table - labour

MANNING TABLE - TECHNICAL
ALTERNATIVE II

Wage catagories (no. of workers)

Function	Shift	Deputy G.M.	Assist. Factory Manager	Head of Division	Foreman	Assist Foreman	Branch Clerk	First Operator	Se Op to
Production management	I	1	1	1	1		1		
	II								
	III								
Maintenance management	I		1		1				
	II								
	III								
Planning	I			1		1			
	II								
	III								
Slitting line	I				1			1	
	II								
	III								
Welding line	I			1	2			4	
	II				2			4	
	III								
Finishing line	I			1	1			4	
	II				1			4	
	III							3	
Surface coating line	I				3			6	
	II				3			6	
	III				3			6	
Quality control	I			1		1		3	
	II							2	
	III							1	
Utilities & transportation	I				1			15	
	II				1			12	
	III							9	
Maintenance	I			2	4	2		12	
	II				2			6	
	III				2			2	
Total Labour		1	2	7	28	4	1	100	3

Note: All wage catagories considered to be for local workers

SECTION 2

atagories (no. of workers)

Head of Division	Foreman	Assist Foreman	Branch Clerk	First Operator	Second Operator	Upper Division Clerk	Lower Division Clerk	Helper	Total
1	1		1			1			6
	1					1			3
1		1							2
	1			1				3	5
1	2			4				8	15
	2			4				8	14
1	1			4	4			5	15
	1			4	4			5	14
				3	3			4	10
	3			6	5			12	26
	3			6	5			12	26
	3			6	5			12	26
1		1		3				4	9
				2				3	5
				1				1	2
	1			15	5			14	35
	1			12	4			11	28
				9	4			9	22
2	4	2		12		1		11	32
	2			6				6	14
	2			2				2	6
7	28	4	1	100	39	3		130	315

local workers

SECTION 1

Schedule 8-2/1 Estimate of production costs: wages

ESTIMATE OF PRODUCTION COSTS - WAGES
ALTERNATIVE I Wage catagories (no. of workers)

Function	General Manager	Deputy G.M.	Assist. Factory Manager	Head of Division	Foreman	Assist Foreman	Branch Clerk	First Operator	U D s C
Administration management	1	1	2	4			2		
Production management		1	1	1	1		1		
Maintenance management			1		1				
Planning				1		1			
Slitting line					1			1	
Welding line				1	2			4	
Finishing line				1	2			3	
Surface coating line					6			15	
Quality control				1		1		4	
Utilities and transportation					2			26	
Maintenance				2	8	2		20	
Book-keeping				1			1		
Purchasing				1					
Sales				1					
Office administration				1			1		
Personnel				1			1		
Total workers	1	2	4	16	23	4	6	73	
Basic salary/month (US$)	174	142	116	74	59	49	46	35	
Allowances (incl. soc. security payment) (US$)	17	15	13	12	14	14	11	13	
Total amount/month incl. additional amount (12.5%) (US$)	215	177	145	97	82	71	64	54	
Salary/yr (US$)	2580	2124	1740	1164	984	852	768	648	5
Total salary costs/yr (US$)	2580	4248	6960	18624	22632	3408	4608	47304	86

wages

atagories (no. of workers)

Head of Division	Foreman	Assist Foreman	Branch Clerk	First Operator	Upper Division Clerk	Second Operator	Lower Division Clerk	Helper	Total
4			2		2				12
1	1		1		1				6
	1				1				3
1		1							2
	1			1				3	5
1	2			4				8	15
1	2			3		3		7	16
	6			15		12		27	60
1		1		4				5	11
	2			26		12		26	66
2	8	2		20	1			14	47
1			1		2				4
1					1				2
1					1			2	4
1			1		3		5	1	11
1			1		3		2	1	8
16	23	4	6	73	15	27	7	94	272
74	59	49	46	35	32	25	21	14	
12	14	14	11	13	11	13	10	11	
97	82	71	64	54	48	43	35	28	
1164	984	852	768	648	576	516	420	336	
8624	22632	3408	4608	47304	8640	13932	2940	31584	167,460

SECTION 1

Schedule 8-2/2 Estimate of production costs: wages

ESTIMATE OF PRODUCTION COSTS - WAGES
ALTERNATIVE II Wage catagories (no. of workers)

Function	General Manager	Deputy G.M.	Assist. Factory Manager	Head of Division	Foreman	Assist Foreman	Branch Clerk	First Operator	Uppe Divi sion Cler
Administration management	1	1	2	4			2		2
Production management		1	1	1	1		1		1
Maintenance management			1		1				1
Planning				1		1			
Slitting line					1			1	
Welding line				1	4			8	
Finishing line				1	2			11	
Surface coating line					9			18	
Quality control				1		1		6	
Utilities and transportation					2			36	
Maintenance				2	8	2		20	1
Book-keeping				1			1		2
Purchase				1					1
Sales				1					1
Office administration				1			1		3
Personnel				1			1		3
Total workers	1	2	4	16	28	4	6	100	15
Basic salary/month (US$)	174	142	116	74	59	49	46	35	32
Allowances (incl. soc. security payment) (US$)	17	15	13	12	14	14	11	13	11
Total amount/month incl. additional amount (12.5%) (US$)	215	177	145	97	82	71	64	54	48
Salary/yr (US$)	2580	2124	1740	1164	984	852	768	648	576
Total salary costs/ yr (US$)	2580	4248	6960	18624	27552	3408	4608	64800	8640

SECTION 2

: wages

catagories (no. of workers)

t. ry er	Head of Division	Foreman	Assist Foreman	Branch Clerk	First Operator	Upper Division Clerk	Second Operator	Lower Division Clerk	Helper	Total
	4			2		2				12
	1	1		1		1				6
		1				1				3
	1		1							2
		1			1				3	5
	1	4			8				16	29
	1	2			11		11		14	39
		9			18		15		36	78
	1		1		6				8	16
		2			36		13		34	85
	2	8	2		20	1			19	52
	1			1		2				4
	1					1				2
	1					1			2	4
	1			1		3		5	1	11
	1			1		3		2	1	8
	16	28	4	6	100	15	39	7	134	356
	74	59	49	46	35	32	25	21	14	
	12	14	14	11	13	11	13	10	11	
	97	82	71	64	54	48	43	35	28	
	1164	984	852	768	648	576	516	420	336	
	18624	27552	3408	4608	64800	8640	20124	2940	45024	209,508

SECTION 1

Schedule 8-3 Manning Table - Staff

Department Administration

Alternative I & II Wage catagories (No. of workers)

Function	General Manager	Deputy G.M. Comm.	Assistant Factory Manager	Head of Division	Branch Clerk	Upper Division Clerk	L D s C
Administration management	1	1	2	4	2	2	
Book-keeping				1	1	2	
Purchase				1		1	
Sales				1		1	
Office administration				1	1	3	
Personnel				1	1	3	
Total Staff	1	1	2	9	5	12	

Note 1: All wage catagories considered to be for local workers

Note 2: All personnel work on the day shift

(No. of workers)

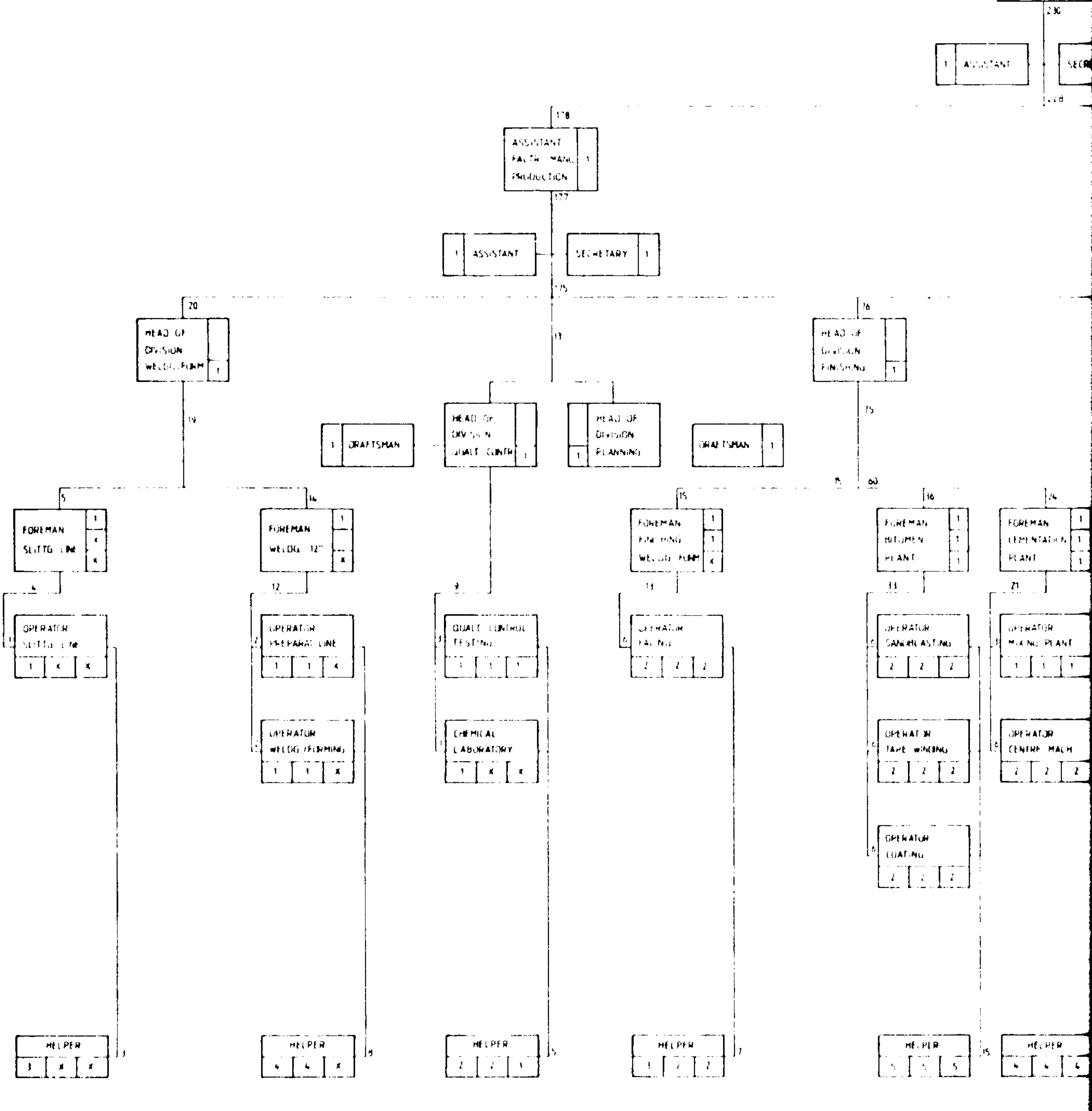
Assistant Factory Manager	Head of Division	Branch Clerk	Upper Division Clerk	Lower Division Clerk	Helper	Total
2	4	2	2			12
	1	1	2			4
	1		1			2
	1		1		2	4
	1	1	3	5	1	11
	1	1	3	2	1	8
2	9	5	12	7	4	41

Annex

Organization chart	Alternative I
Organization chart	Alternative II

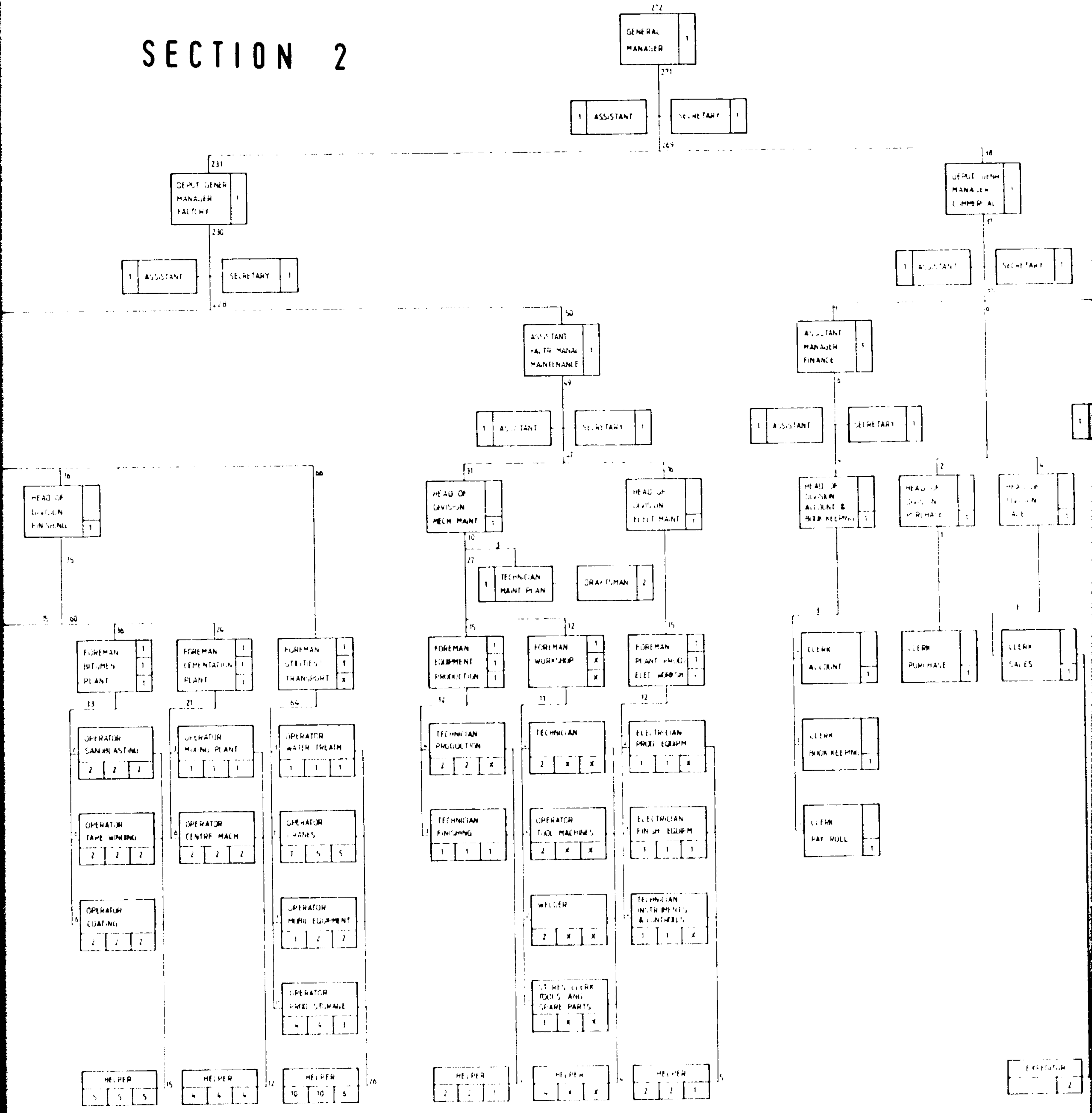
ORGANIZATION CHAR

SECTION 1

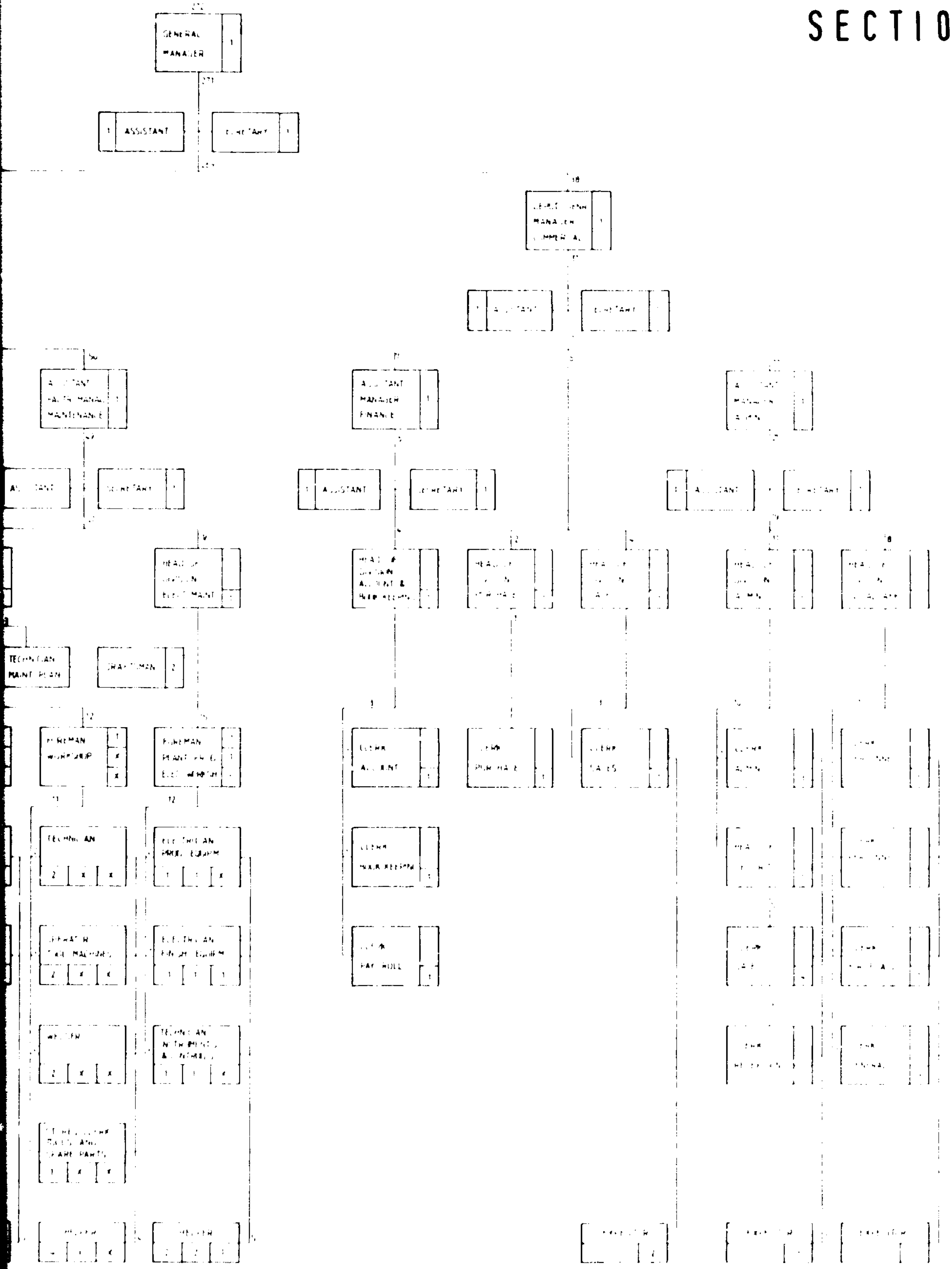


ORGANIZATION CHART - ALTERNATIVE I

SECTION 2



SECTION 3



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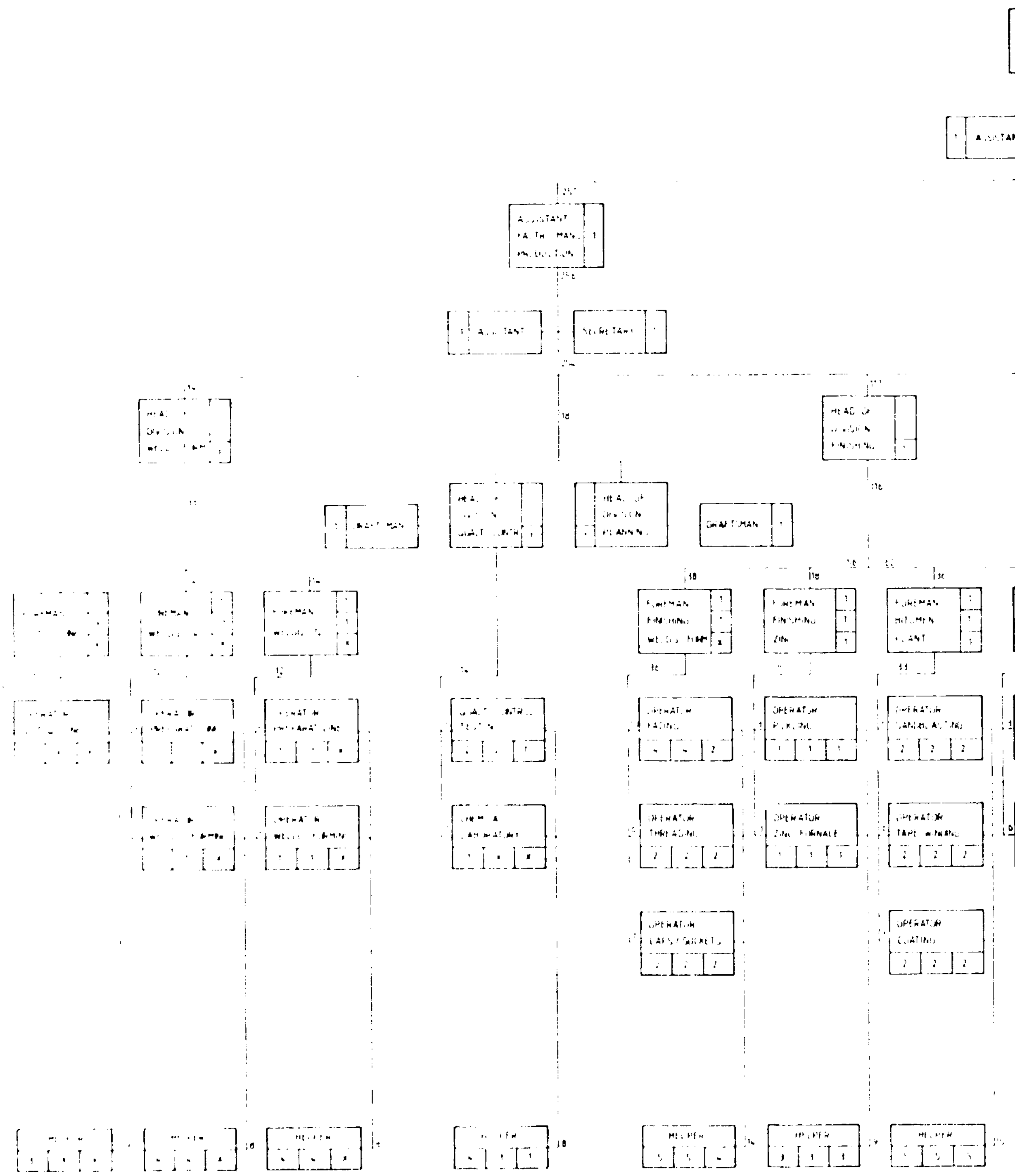
WELDED STEEL PIPE PLANT
ORGANIZATION CHART
ALTERNATIVE I

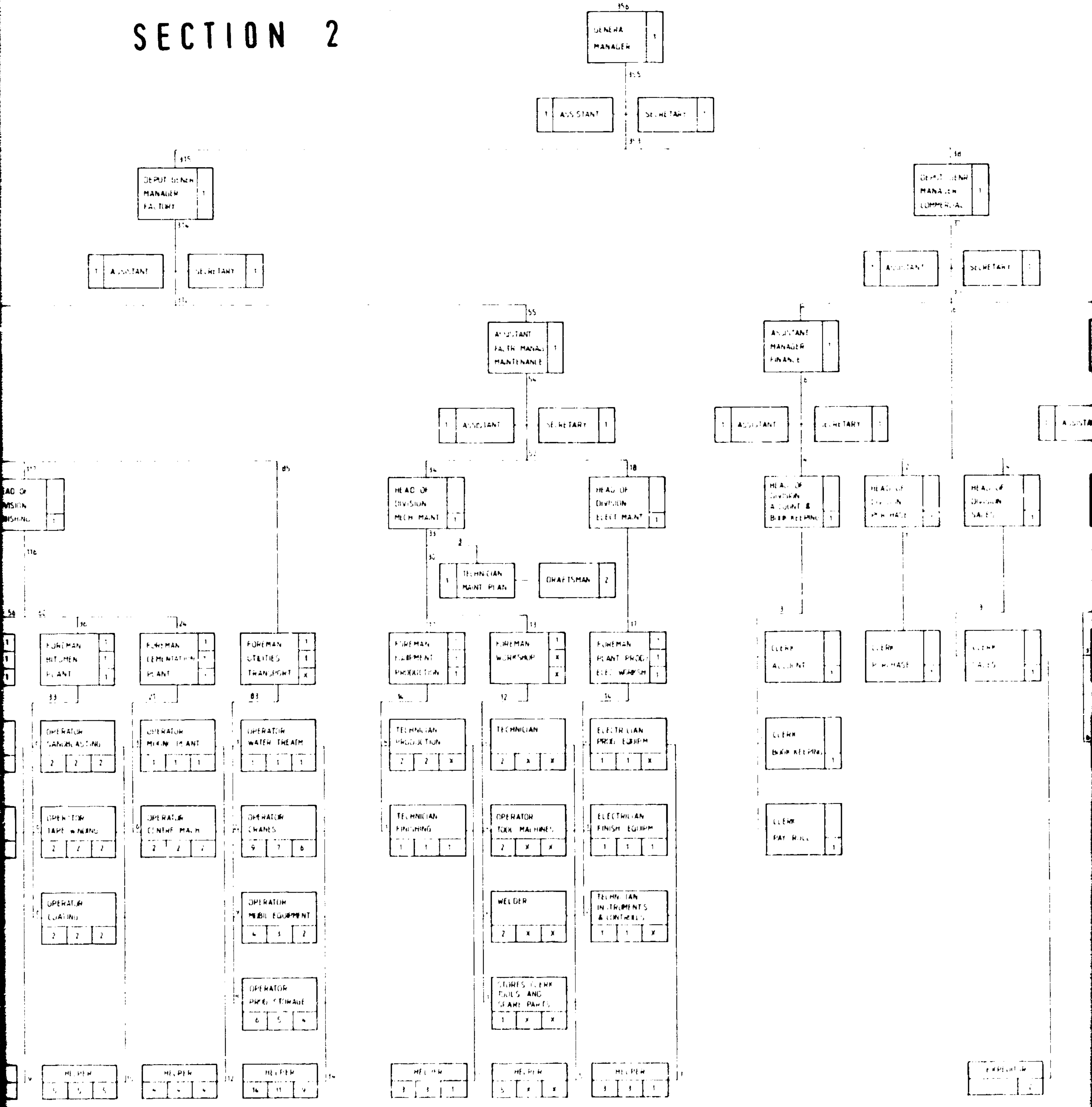
SECTION 1

ORGANIZ

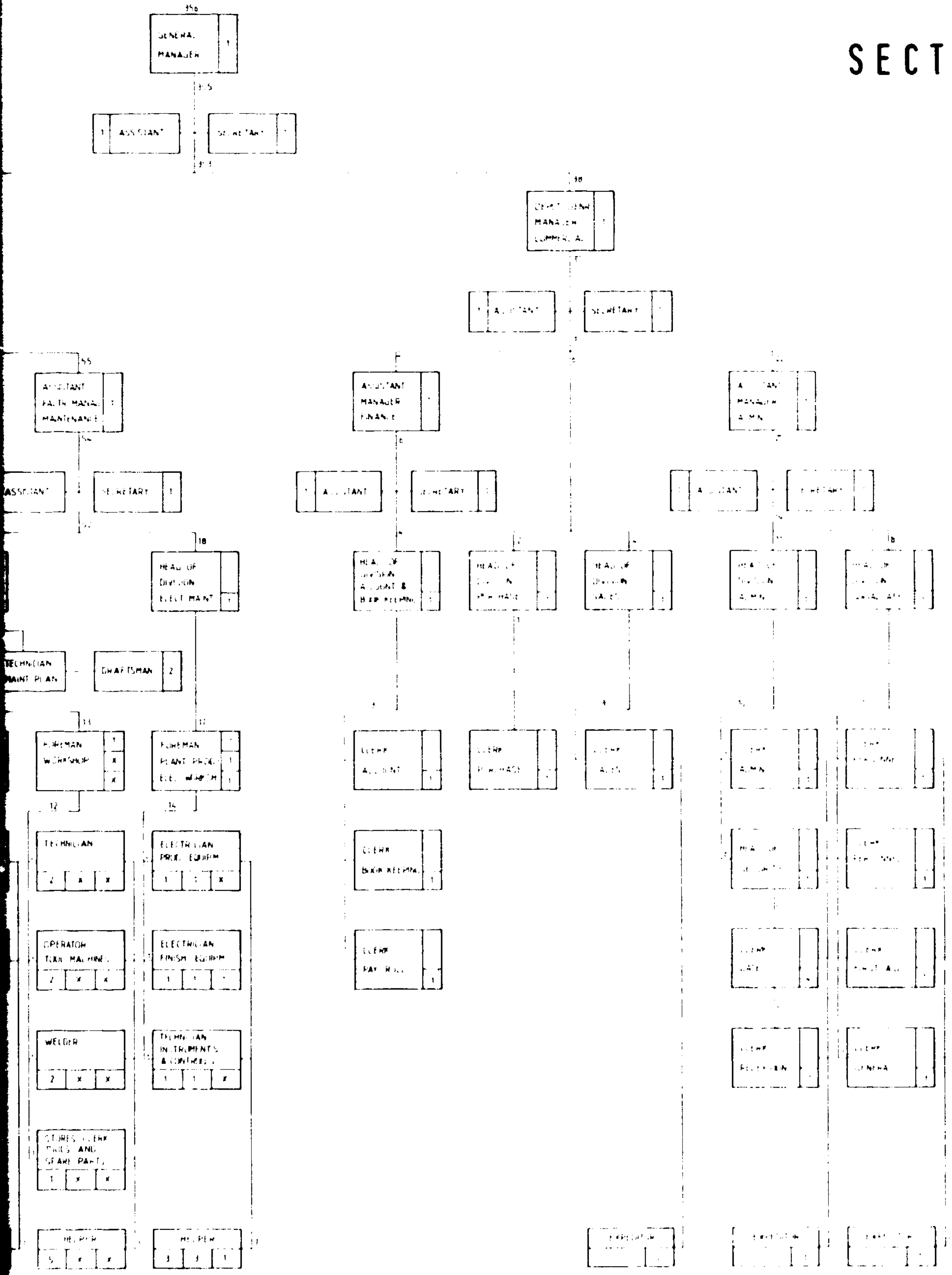


ORGANIZATION CHART - ALTERNATIVE II

SECTION 2



SECTION 3



EISENBAU ESSEN

1986

WELDED STEEL PIPE PLANT
ORGANIZATION CHART
ALTERNATIVE II

CHAPTER IX

IMPLEMENTATION SCHEDULING

Project Schedule

As part of this chapter a project schedule bar chart with work item number has been developed together with detailed activity lists relative to both alternatives. Due to the complexity of the project, complete network diagrams, for both alternatives were also completed.

A slight deviation to normal network layouts was made insofar as no actual starting date is given. The time schedule therefore simply indicates pending project activities and milestones as occurring so many days/months after project inception.

The time-distance sequential print-out relationship used for computer controlled project scheduling has been sacrificed for convenience of presentation. Since the CPM printouts constitute such a vast amount of printout material they have not been included in the Study, these are, however, available to the client upon request.

In analysing the network activities in relation to durations allocated for their completions it can be noted that although some activity durations appear rather short there is sufficient total float to complete the project as projected. Also, civil activities as shown do not take into consideration any delays that may be caused due to monsoon rains. It will be the responsibility of the construction manager to schedule the implementation of this work at the best time to avoid any such delays.

From the establishment of project implementation management to plant start-up and commissiong of the welded steel pipe plant requires a total project duration of 30 calendar months for alternative I and 31 months for alternative II.

As detailed in the chart there is a time duration of 11 months from project inception to start of civil works. The work during this time includes appointing engineers, preparing specifications and naming of general contractor for project execution.

Civil works for the various plant units will commence in the 11th month and continue until the 25th month at which time the majority of the plant's equipment will also be installed.

During basic engineering the possibility to realise certain civil works at an early stage must be investigated (company housing, administration, etc.).

The various production units will be commissioned and put into operations starting in the 26th month together with various infrastructural units.

Alternative I will be ready for production starting in the 30th month and alternative II starting in the 31st month.

Cost estimates for project implementation

The project implementation costs are pre-production costs which are to be capitalized and are broken down into their relevant components and shown in Schedule 9, estimate of investment cost: project implementation.

SECTION 1

Table 9/1 - Estimate of investment cost: project implementation

ESTIMATE OF INVESTMENT COST - PROJECT IMPLEMENTATION

ALTERNATIVE I

No.	Quantity	Unit *)	Item description	Unit Cost		
				local US$	foreign US$	local US$
1			Management of project implementation			
1a	-	-	Salaries and wages of managerial staff			
	15	m/m	foreign experts in field	1,000	9,000	15,0
	15	m/m	foreign experts in home office	-	7,000	-
	100	m/m	Burmese management	150	-	15,0
1b	-	-	Rent and operation of offices, motor cars, living quarters (company offices and company housing)	-	-	15,0
1c	-	-	Travel and communication expenses	-	-	5,0
1d	-	-	Duties and taxes during implementation period	-	-	-
			Sub total 1	-	-	50,0
2			Detail engineering, tendering			
2a	-	-	Salaries and wages of planning staff			
	57.5	m/m	foreign experts	-	6,000	-
	200	m/m	Burmese personnel	150	-	30,0
2b	-	-	Rent and operation of offices, motor cars, living quarters	-	-	20,0
2c	-	-	Travel and communication expenses	-	-	20,0
2d	-	-	Consultant fees: Know-how	-	-	-
2e	-	-	Site and laboratory tests	included under chapter VI		
			Sub total 2	-	-	70,0
3			Supervision, coordination of construction, installation and start-up			
3a	1,800	m/m	Salaries and wages of site staff (incl.overheads)	150	-	270,0
3b	35	m/m	Foreign experts	1,000	9,000	35,0
3c	-	-	Rents (company offices and company housing) incl. cars	-	-	25,0
3d	-	-	Materials, supplies and utilities for start-up and commissioning	-	-	10,0
			Sub total 3	-	-	340,0

ct implementation

TATION

*) m/m = man months

	Unit Cost		Cost		
	local	foreign	local	foreign	total
	US$	US$	US$	US$	US$
mentation					
erial staff					
	1,000	9,000	15,000	135,000	150,000
ice	-	7,000	-	105,000	105,000
	150	-	15,000	-	15,000
es, motor cars, fices and	-	-	15,000	-	15,000
penses	-	-	5,000	10,000	15,000
lementation period	-	-	-	-	-
	-	-	50,000	250,000	300,000
ng					
ing staff					
	-	6,000	-	345,000	345,000
	150	-	30,000	-	30,000
es, motor cars,					
	-	-	20,000	-	20,000
penses	-	-	20,000	10,000	30,000
	-	-	-	100,000	100,000
	included under chapter VI				
	-	-	70,000	455,000	525,000
construction,					
taff					
	150	-	270,000	-	270,000
	1,000	9,000	35,000	315,000	350,000
ompany housing)					
	-	-	25,000	-	25,000
ities for start-	-	-	10,000	85,000	95,000
	-	-	340,000	400,000	740,000

SECTION 1

Table 9/1 (cont.) - Estimate of investment cost: project implementation

ESTIMATE OF INVESTMENT COST - PROJECT IMPLEMENTATION

ALTERNATIVE I

No.	Quantity	Unit *)	Item description	Unit Cost		
				local US$	foreign US$	local US$
4			Build-up of administration, recruitment and training of staff and labour			
4a	-	-	Salaries and wages of administrative staff	-	-	includ
4b	7	m/m	Salaries and wages of training staff incl. travel and substistance payments	1,000	9,000	7,00
4c	-	-	Salaries and wages of recruited staff and labour (from date of recruitment to production start-up)	see table 8.3		21,00
4d	-	-	Rents, motor cars, living quarters, etc.	-	-	20,00
			Sub total 4	-	-	48,00
5			Arrangements for supplies			
5a	-	-	Salaries and wages of purchasing staff	-		incl
5b	-	-	Communications	-	-	5,00
			Sub total 5	-		5,00
6			Arrangements for marketing			
6a	-		Salaries and wages for sales and marketing staff	-	-	includ
6b	1	m/m	Training of sales personnel	1,000	9,000	1,00
6c	-	-	Travel and communications	-	-	2,00
			Sub total 6	-	-	3,00
7			Preliminary and capital-issue expenses (total) 20,000,000 x 70% x 0.5%	-	-	-
			Total investment cost for project implementation			516,00

t: project implementation

TATION

*) m/m = man months

	Unit Cost		Cost		
	local US$	foreign US$	local US$	foreign US$	total US$
recruitment					
abour					
istrative staff	-	-	included in "4c"		
ing staff incl. ments	1,000	9,000	7,000	63,000	70,000
ited staff and tment to	see table 8.3		21,000	-	21,000
uarters, etc.	-	-	20,000	-	20,000
	-	-	48,000	63,000	111,000
asing staff	-		included in "4c"		
	-	-	5,000	-	5,000
	-		5,000	-	5,000
and marketing	-	-	included in "4c"		
	1,000	9,000	1,000	9,000	10,000
	-	-	2,000	7,000	9,000
	-	-	3,000	16,000	19,000
e expenses (total)	-	-	-	70,000	70,000
oject implementation			516,000	1,254,000	1,770,000

SECTION 1

Table 9/2 - Estimate of investment cost: project implementation

ESTIMATE OF INVESTMENT COST - PROJECT IMPLEMENTATION

ALTERNATIVE II

No.	Quantity	Unit *)	Item description	Unit Cost local US$	Unit Cost foreign US$	loca US$
1			Management of project implementation			
1a	-	-	Salaries and wages of managerial staff			
	17	m/m	foreign experts in field	1,000	9,000	17,
	17	m/m	foreign experts in home office	-	7,000	-
	120	m/m	Burmese management	150	-	18,
1b	-	-	Rent and operation of offices, motor cars, living quarters (company offices and company housing)	-	-	18,
1c	-	-	Travel and communication expenses	-	-	8,
1d	-	-	Duties and taxes during implementation period	-	-	-
			Sub total 1	-	-	61,
2			Detail engineering, tendering			
2a	-	-	Salaries and wages of planning staff			
	90	m/m	foreign experts	-	6,000	-
	250	m/m	Burmese personnel	150	-	37,
2b	-	-	Rent and operation of offices, motor cars, living quarters	-	-	25,
2c	-	-	Travel and communication expenses	-	-	25,
2d	-	-	Consultant fees: Know-how	-	-	-
2e	-	-	Site and laboratory tests	included under chapter VI		
			Sub total 2	-	-	88,
3			Supervision, coordination of construction, installation and start-up			
3a	2,200	m/m	Salaries and wages of site staff (incl.overheads)	150	-	330,
3b	43	m/m	Foreign experts	1,000	9,000	43,
3c	-	-	Rents (company offices and company housing) incl. cars	-	-	36,
3d	-	-	Materials, supplies and utilities for start-up and commissioning	-	-	15,
			Sub total 3	-	-	424,

ect implementation

NTATION

*) m/m = man months

	Unit Cost		Cost		
	local US$	foreign US$	local US$	foreign US$	total US$
ementation					
gerial staff					
	1,000	9,000	17,000	153,000	170,000
fice	-	7,000	-	119,000	119,000
	150	-	18,000	-	18,000
ces, motor cars, ffices and	-	-	18,000	-	18,000
xpenses	-	-	8,000	12,000	20,000
plementation period	-	-	-	-	-
	-	-	61,000	284,000	345,000
ing					
ning staff					
	-	6,000	-	540,000	540,000
	150	-	37,500	-	37,500
ces, motor cars,					
	-	-	25,000	-	25,000
xpenses	-	-	25,500	28,000	53,500
	-	-	-	130,000	130,000
	included under chapter VI				
	-	-	88,000	698,000	786,000
of construction,					
staff					
	150	-	330,000	-	330,000
	1,000	9,000	43,000	387,000	430,000
company housing)					
	-	-	36,000	-	36,000
ilities for start-	-	-	15,000	150,000	165,000
	-	-	424,000	537,000	961,000

SECTION 1

Table 9/2 (cont.) - Estimate of investment cost: project implementation

ESTIMATE OF INVESTMENT COST - PROJECT IMPLEMENTATION

ALTERNATIVE II

No.	Quan-tity	Unit *)	Item description	Unit Cost local US$	Unit Cost foreign US$	local US$
4			Build-up of administration, recruitment and training of staff and labour			
4a	-	-	Salaries and wages of administrative staff	-	-	includ
4b	10	m/m	Salaries and wages of training staff incl. travel and substistance payments	1,000	9,000	10,00
4c	-	-	Salaries and wages of recruited staff and labour (from date of recruitment to production start-up)	see table 8.3		21,50
4d	-	-	Rents, motor cars, living quarters, etc.	-	-	28,50
			Sub total 4	-	-	60,00
5			Arrangements for supplies			
5a	-	-	Salaries and wages of purchasing staff	-		inclu
5b	-	-	Communications	-	-	7,00
			Sub total 5	-		7,00
6			Arrangements for marketing			
6a	-		Salaries and wages for sales and marketing staff	-	-	inclu
6b	1	m/m	Training of sales personnel	1,000	9,000	1,00
6c	-	-	Travel and communications	-	-	2,00
			Sub total 6	-	-	3,00
7			Preliminary and capital-issue expenses (total) 30,000,000 x 70% x 0.5%	-	-	-
			Total investment cost for project implementation			643,00

t: project implementation

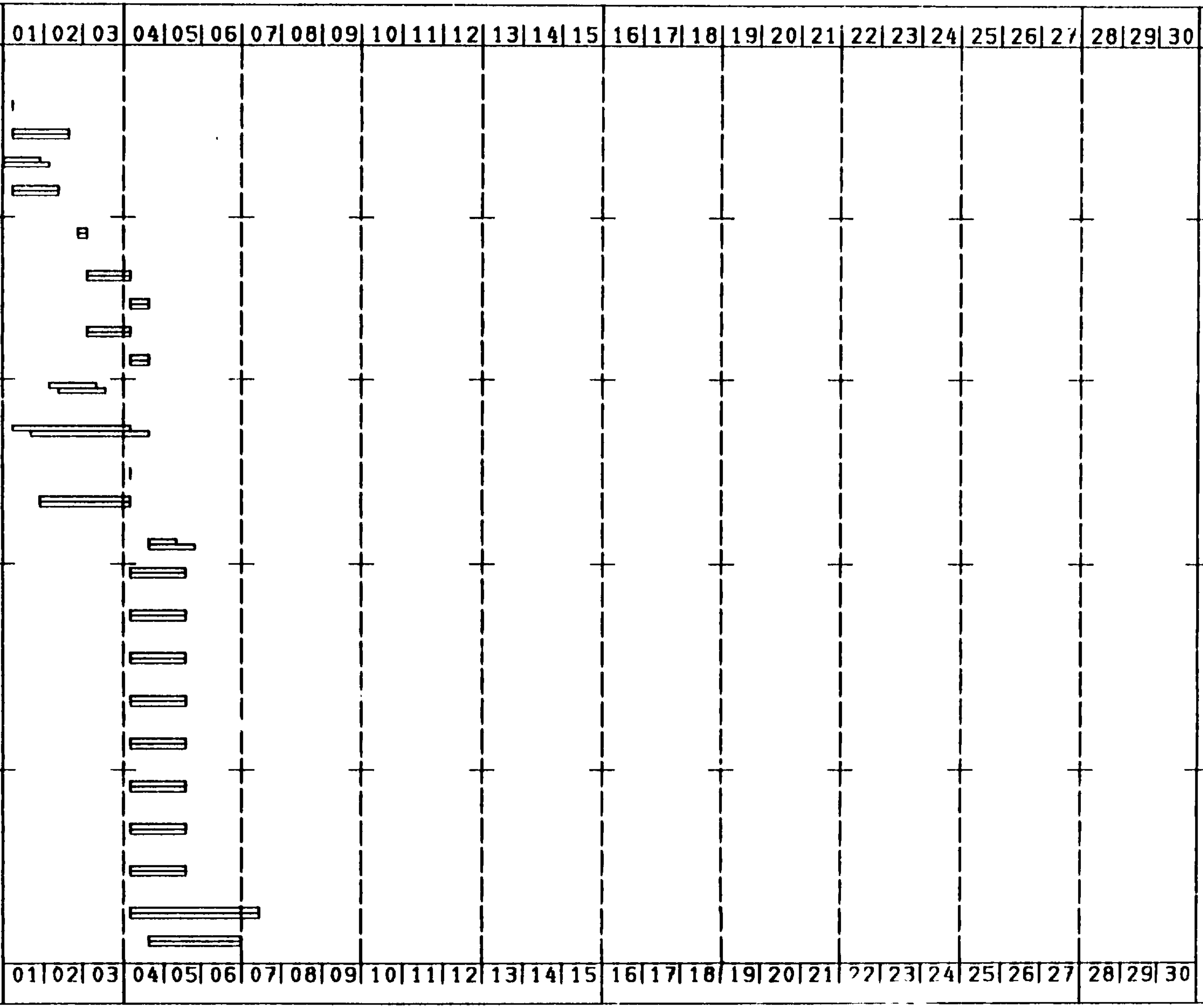
TATION

*) m/m = man months

	Unit Cost		Cost		
	local	foreign	local	foreign	total
	US$	US$	US$	US$	US$
recruitment abour					
istrative staff	-	-	included in "4c"		
ing staff incl. ments	1,000	9,000	10,000	90,000	100,000
ited staff and tment to	see table 8.3		21,500	-	21,500
uarters, etc.	-	-	28,500	-	28,500
	-	-	60,000	90,000	150,000
asing staff	-		included in "4c"		
	-	-	7,000	-	7,000
	-		7,000	-	7,000
s and marketing	-	-	included in "4c"		
	1,000	9,000	1,000	9,000	10,000
	-	-	2,000	7,000	9,000
	-	-	3,000	16,000	19,000
ue expenses (total)	-	-	-	105,000	105,000
oject implementation			643,000	1,730,000	2,373,000

ANNEX

Gantt chart	Alternative I
Gantt chart	Alternative II
Time schedule	Alternative I
Time schedule	Alternative II



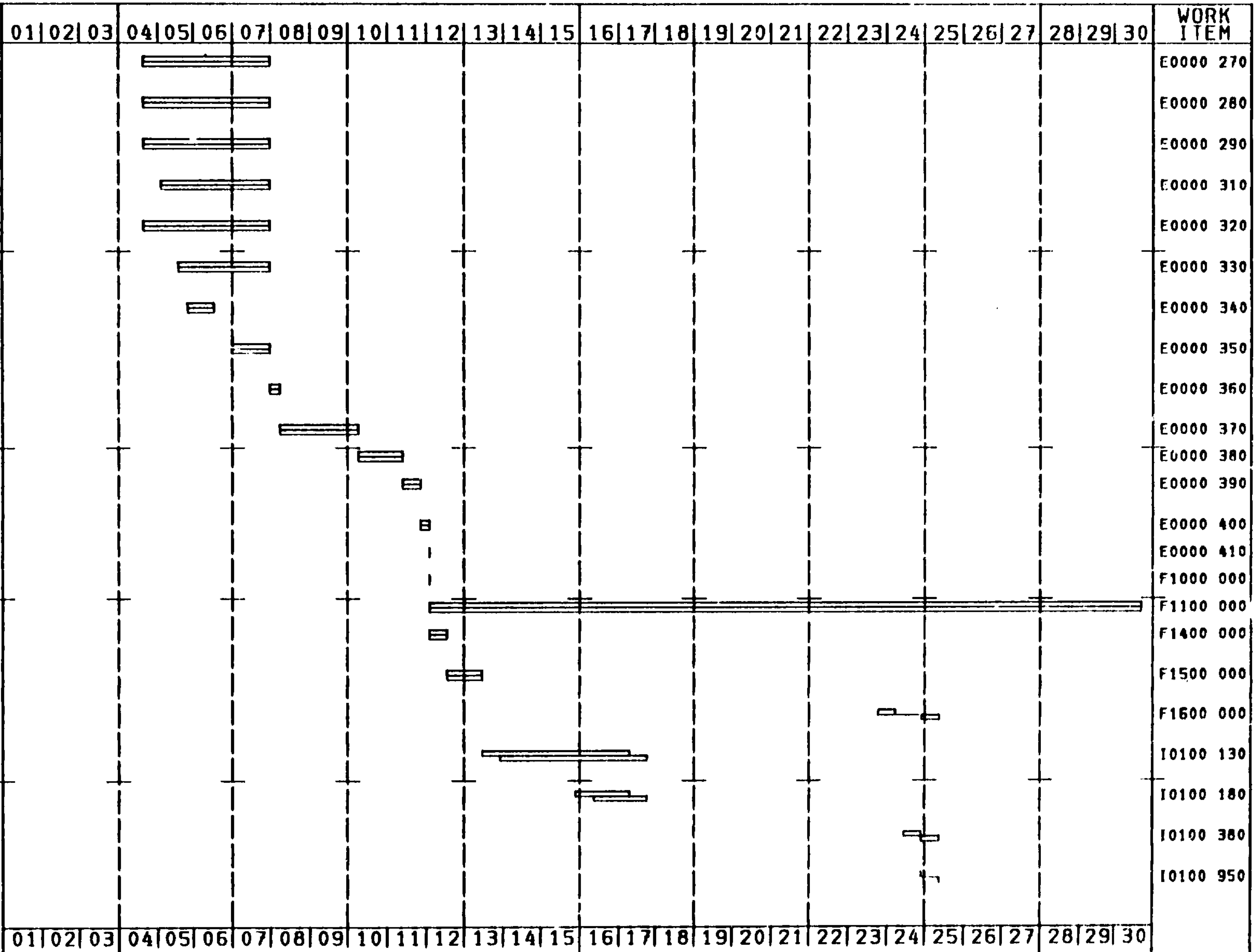
WORK ITEM	DESCRIPTION	WORK ITEM
E0000 010	NOMINATION OF ENGINEERING - CONSULTANT BY THE OWNER	E0000 010
E0000 020	COMING INTO FORCE OF CONTRACT	E0000 020
E0000 030	ELABORATION OF PROJECT SCHEDULE	E0000 030
E0000 040	PROCUREMENT OF PLANT SITE	E0000 040
E0000 050	SPECIFICATION FOR GEODETICAL & SUBSOIL SURVEY	E0000 050
E0000 060	CONTRACT FOR GEODETICAL SURVEY & SOIL FIELD WORK	E0000 060
E0000 070	EXECUTION OF FIELD WORK	E0000 070
E0000 080	FINAL REPORT & MAPS	E0000 080
E0000 090	SUPERVISION OF FIELD WORK	E0000 090
E0000 100	COMPILE FINAL INFRASTRUCT. DATA	E0000 100
E0000 110	COLLECT THE PREVAILING LOCAL STANDARDS & REGULATIONS	E0000 110
E0000 120	BASIC & ARCHITECTURAL DESIGN FOR TENDER PURPOSES	E0000 120
E0000 130	START OF TENDER ENGINEERING	E0000 130
E0000 140	CLASSIFICATION SYSTEM FOR PLANT EQUIPMENT	E0000 140
E0000 150	BIDDING INSTRUCTIONS	E0000 150
E0000 160	GENERAL TECHNICAL SPECIFICATION - KNOW HOW TRANSFER	E0000 160
E0000 170	GENERAL TECHNICAL SPECIFICATION - DESCRIPTION OF LOCATION	E0000 170
E0000 180	GENERAL TECHNICAL SPECIFICATION - STANDARDS & REGULATIONS	E0000 180
E0000 190	GENERAL TECHNICAL SPECIFICATION - SEE / LAND / AIR TRANSPORT	E0000 190
E0000 210	GENERAL TECHNICAL SPECIFICATION - PROJECT / [illegible] CONTROL	E0000 210
E0000 220	GENERAL TECHNICAL SPECIFICATION - DOCUMENTATION	E0000 220
E0000 230	GENERAL TECHNICAL SPECIFICATION - PRODUCT. & MATERIAL FLOW	E0000 230
E0000 240	GENERAL TECHNICAL SPECIFICATION - POLLUTION & HEALTH REGULAT	E0000 240
E0000 250	GENERAL COMMERCIAL CONDITIONS	E0000 250
E0000 260	SPECIAL TECHNICAL SPECIFICATION - LAYOUTS & TENDER DRAWINGS	E0000 260

STATUS DATED 03/03/86
RUN DATE 03/03/86
DEPT.: PROJECT CONTROL P1148

ENGINEERING / CONSULTANT EISENBAU ESSEN GMBH
ON BEHALF OF U N I D O FOR
BURMESE MINISTRY OF NO. 1 INDUSTRY

GANTT-CHART FOR FOR THE IMPLEMENTATION OF A
WELDED STEEL PIPE PLANT / BURMA
ALTERNATIVE OF DESIGN I

WORK ITEM	DESCRIPTION
E0000 270	SPECIAL TECHNICAL SPECIFICATION - MATERIAL & ENERGY BALANCE
E0000 280	SPECIAL TECHNICAL SPECIFICATION - MECHANICAL EQUIPMENT
E0000 290	SPECIAL TECHNICAL SPECIFICATION - ELECTRICAL EQUIPMENT
E0000 310	SPECIAL TECHNICAL SPECIFICATION - UTILITIES / PIPING
E0000 320	SPECIAL TECHNICAL SPECIFICATION - CIVIL WORK & STEEL STRUCT.
E0000 330	SPECIAL TECHNICAL SPECIFICATION - AUXILIARY EQUIPMENT
E0000 340	QUESTIONAIRES FOR PREQUALIFICAT. OF TURNKEY BIDDERS
E0000 350	PREQUALIFICATION OF TURNKEY BIDDERS
E0000 360	PRINTING & DISTRIBUTION OF THE TENDER DOCUMENTS
E0000 370	TURNKEY BIDDING PERIOD
E0000 380	EVALUATION OF TURNKEY BIDS
E0000 390	NEGOTATIONS WITH THE TURNKEY BIDDERS
E0000 400	TURNKEY CONTRACT DOCUMENTS
E0000 410	START OF SITE MANAGEMENT
F1000 000	START OF CONTRACTUAL WORK
F1100 000	SUPERVISION OF SITE WORK
F1400 000	CONNECTION OF ELECTRICAL POWER & WATER FOR SITE WORK
F1500 000	SITE INSTALLATION & PROV. CONNCT OF ELEC. POWER & WAT
F1600 000	CONNECTION OF ELECTRICAL POWER & UTILITIES
I0100 130	GATE HOUSE & WEIGHING BRIDGE CONSTRUCTION OF BUILDING
I0100 180	GATE HOUSE & WEIGHING BRIDGE FINISHING WORK
I0100 380	GATE HOUSE & WEIGHING BRIDGE INSTALLATION OF EQUIPMENT
I0100 950	GATE HOUSE & WEIGHING BRIDGE TRIAL RUNS & COMMISSIONING

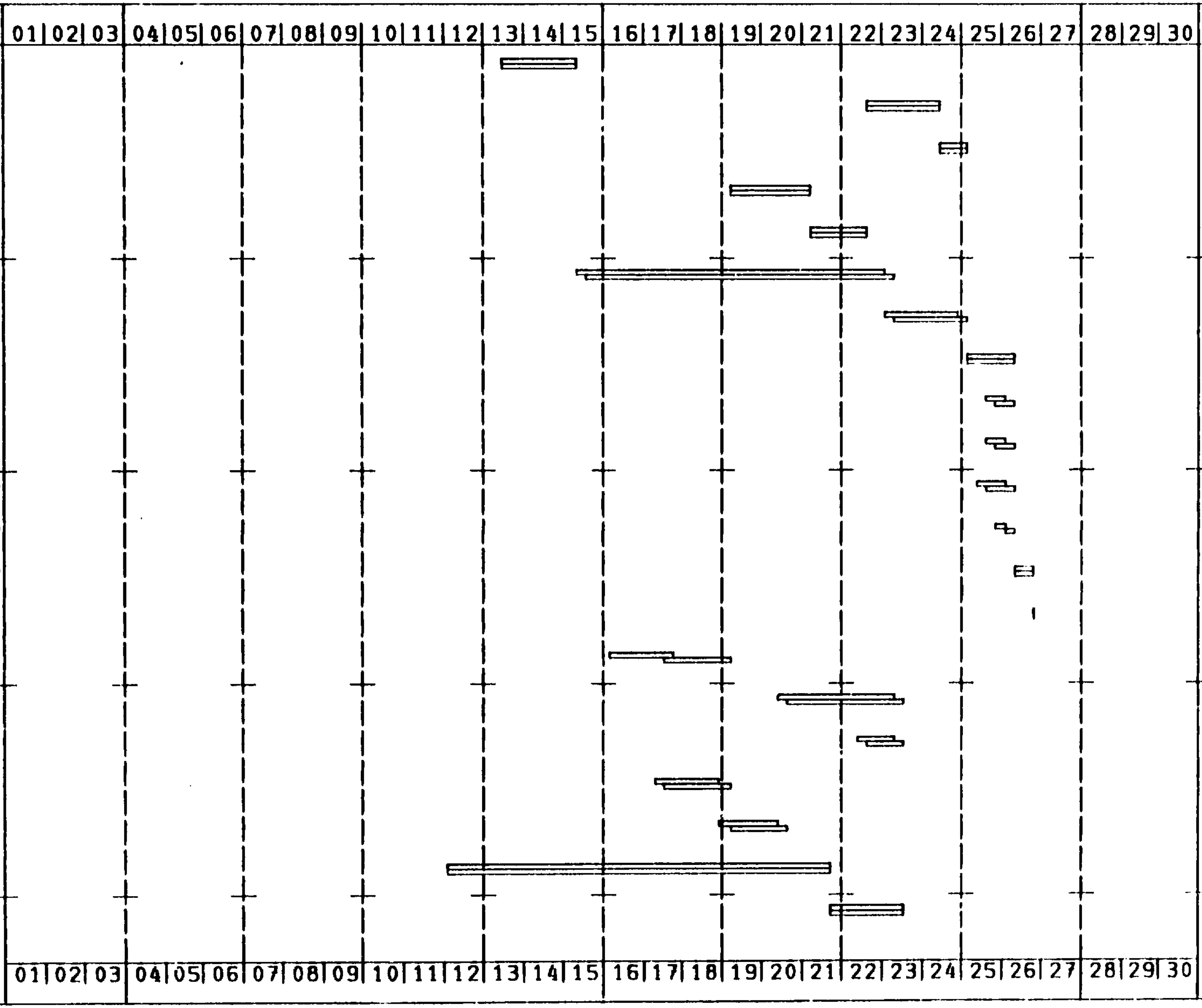


STATUS DATED 03/03/86
RUN DATE 03/03/86
DEPT.: PROJECT CONTROL P1148

ENGINEERING / CONSULTANT EISENBAU ESSEN GMBH
ON BEHALF OF U N I D O FOR
BURMESE MINISTRY OF NO. 1 INDUSTRY

GANTT-CHART FOR FOR THE IMPLEMENTATION OF A
WELDED STEEL PIPE PLANT / BURMA
ALTERNATIVE OF DESIGN I

WORK ITEM	DESCRIPTION	WORK ITEM
10200 110	SLITTING LINE /STRIP PREPARATION FOUNDATIONS FOR BUILDING	10200 110
10200 120	SLITTING LINE /STRIP PREPARATION FOUND.F.EQUIP.& FLOOR SLABS	10200 120
10200 180	SLITTING LINE /STRIP PREPARATION FINISHING WORK	10200 180
10200 210	SLITTING LINE /STRIP PREPARATION MANUFACT. OF STEEL STRUCTURE	10200 210
10200 250	SLITTING LINE /STRIP PREPARATION ERECTION OF STEEL STRUCTURE	10200 250
10200 310	SLITTING LINE /STRIP PREPARATION FABRICATION OF EQUIPMENT	10200 310
10200 350	SLITTING LINE /STRIP PREPARATION SHIPMENT OF EQUIPMENT	10200 350
10200 380	SLITTING LINE /STRIP PREPARATION INSTALLATION OF EQUIPMENT	10200 380
10200 480	SLITTING LINE /STRIP PREPARATION ELECTRICAL INSTALLATION	10200 480
10200 580	SLITTING LINE /STRIP PREPARATION PIPING & UTILITY DISTRIBUTN.	10200 580
10200 680	SLITTING LINE /STRIP PREPARATION INSTALLATION OF AUX. EQUIPM.	10200 680
10200 700	SLITTING LINE /STRIP PREPARATION FINISHING WORK	10200 700
10200 950	SLITTING LINE /STRIP PREPARATION TRIAL RUNS & COMMISSIONING	10200 950
10200 990	SLITTING LINE /STRIP PREPARATION START OF PRODUCTION	10200 990
10300 110	PIPE PRODUCTION AREA FOUNDATIONS FOR BUILDING	10300 110
10300 120	PIPE PRODUCTION AREA FOUND.F.EQUIP.& FLOOR SLABS	10300 120
10300 180	PIPE PRODUCTION AREA FINISHING WORK	10300 180
10300 210	PIPE PRODUCTION AREA MANUFACT. OF STEEL STRUCTURE	10300 210
10300 250	PIPE PRODUCTION AREA ERECTION OF STEEL STRUCTURE	10300 250
10300 310	PIPE PRODUCTION AREA FABRICATION OF EQUIPMENT	10300 310
10300 350	PIPE PRODUCTION AREA SHIPMENT OF EQUIPMENT	10300 350



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ENGINEERING / CONSULTANT EISENBAU ESSEN GMBH
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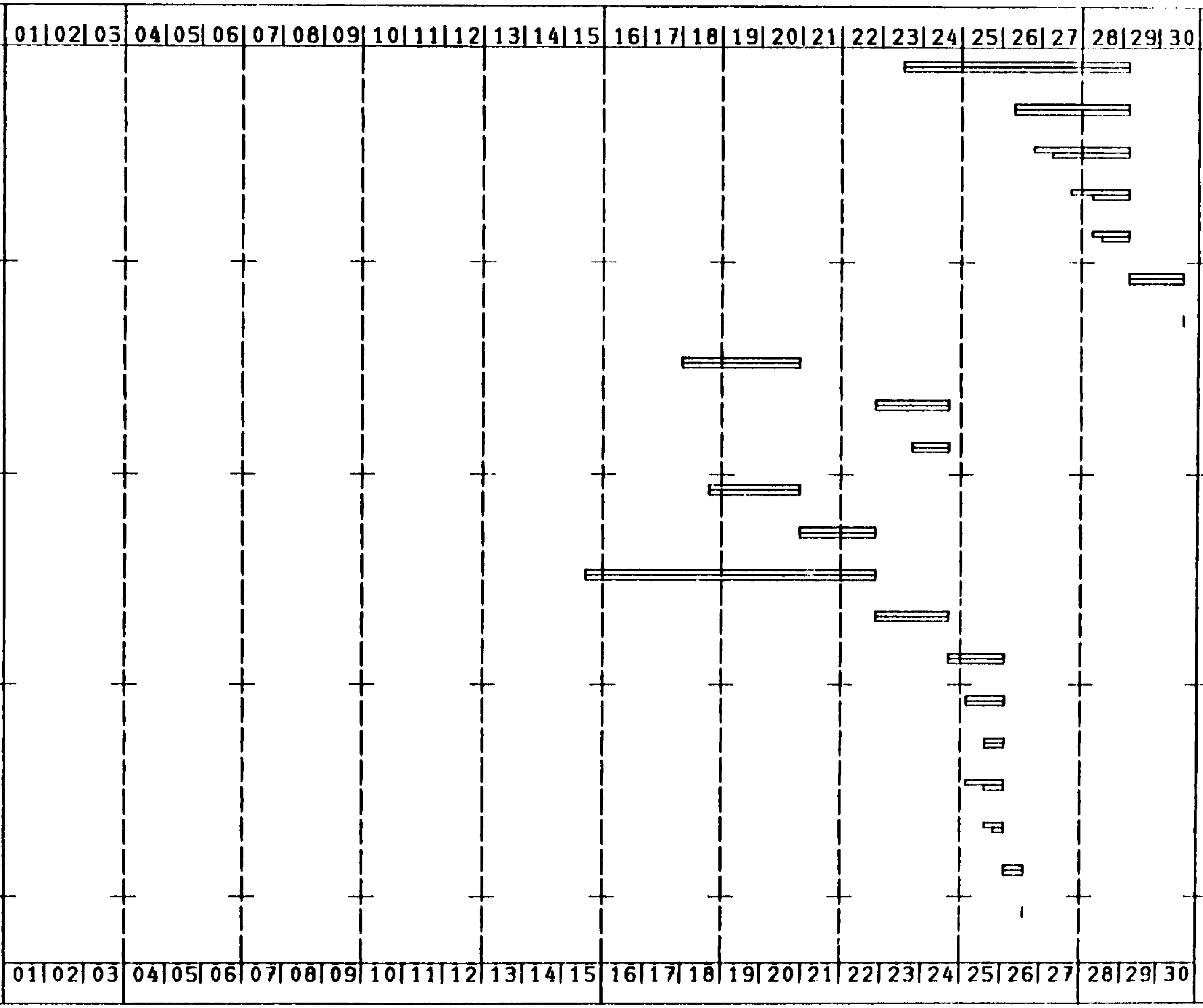
BURMESE MINISTRY OF NO. 1 INDUSTRY

GANTT-CHART FOR FOR THE IMPLEMENTATION OF A
WELDED STEEL PIPE PLANT / BURMA
ALTERNATIVE OF DESIGN I

WORK ITEM	DESCRIPTION	WORK ITEM
10300 380	PIPE PRODUCTION AREA INSTALLATION OF EQUIPMENT	10300 380
10300 480	PIPE PRODUCTION AREA ELECTRICAL INSTALLATION	10300 480
10300 580	PIPE PRODUCTION AREA PIPING & UTILITY DISTRIBUTN.	10300 580
10300 680	PIPE PRODUCTION AREA INSTALLATION OF AUX. EQUIPM.	10300 680
10300 700	PIPE PRODUCTION AREA FINISHING WORK	10300 700
10300 950	PIPE PRODUCTION AREA TRIAL RUNS & COMMISSIONING	10300 950
10300 990	PIPE PRODUCTION AREA START OF PRODUCTION	10300 990
10500 110	PIPE FINISHING AREA / STORAGES FOUNDATIONS FOR BUILDING	10500 110
10500 120	PIPE FINISHING AREA / STORAGES FOUND.F.EQUIP.& FLOOR SLABS	10500 120
10500 180	PIPE FINISHING AREA / STORAGES FINISHING WORK	10500 180
10500 210	PIPE FINISHING AREA / STORAGES MANUFACT. OF STEEL STRUCTURE	10500 210
10500 250	PIPE FINISHING AREA / STORAGES ERECTION OF STEEL STRUCTURE	10500 250
10500 310	PIPE FINISHING AREA / STORAGES FABRICATION OF EQUIPMENT	10500 310
10500 350	PIPE FINISHING AREA / STORAGES SHIPMENT OF EQUIPMENT	10500 350
10500 380	PIPE FINISHING AREA / STORAGES INSTALLATION OF EQUIPMENT	10500 380
10500 480	PIPE FINISHING AREA / STORAGES ELECTRICAL INSTALLATION	10500 480
10500 580	PIPE FINISHING AREA / STORAGES PIPING & UTILITY DISTRIBUTN.	10500 580
10500 680	PIPE FINISHING AREA / STORAGES INSTALLATION OF AUX. EQUIPM.	10500 680
10500 700	PIPE FINISHING AREA / STORAGES FINISHING WORK	10500 700
10500 950	PIPE FINISHING AREA / STORAGES TRIAL RUNS & COMMISSIONING	10500 950
10500 990	PIPE FINISHING AREA / STORAGES START OF PRODUCTION	10500 990



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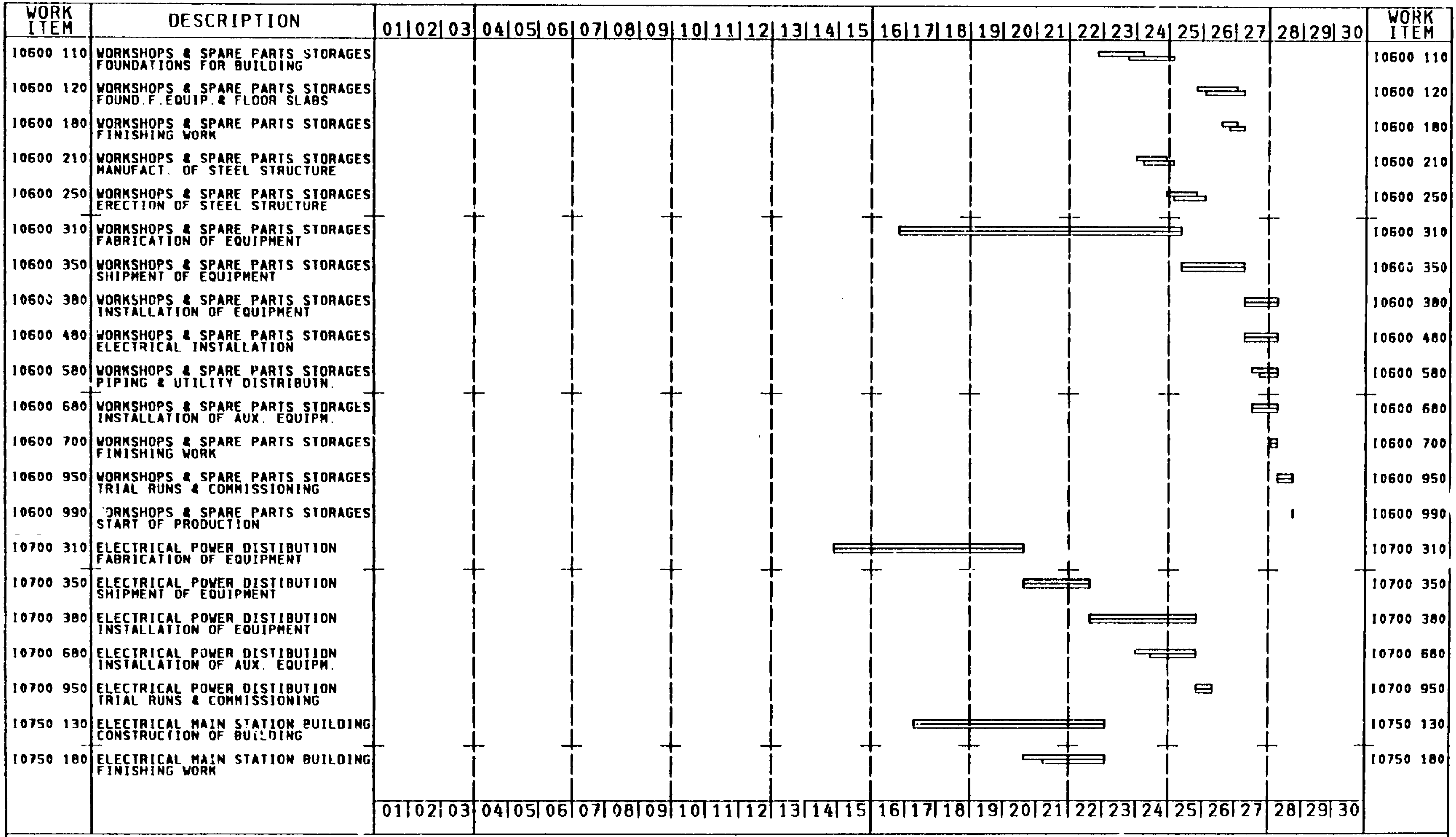

WORK ITEM	DESCRIPTION	WORK ITEM
10600 110	WORKSHOPS & SPARE PARTS STORAGES FOUNDATIONS FOR BUILDING	10600 110
10600 120	WORKSHOPS & SPARE PARTS STORAGES FOUND.F.EQUIP.& FLOOR SLABS	10600 120
10600 180	WORKSHOPS & SPARE PARTS STORAGES FINISHING WORK	10600 180
10600 210	WORKSHOPS & SPARE PARTS STORAGES MANUFACT. OF STEEL STRUCTURE	10600 210
10600 250	WORKSHOPS & SPARE PARTS STORAGES ERECTION OF STEEL STRUCTURE	10600 250
10600 310	WORKSHOPS & SPARE PARTS STORAGES FABRICATION OF EQUIPMENT	10600 310
10600 350	WORKSHOPS & SPARE PARTS STORAGES SHIPMENT OF EQUIPMENT	10600 350
10600 380	WORKSHOPS & SPARE PARTS STORAGES INSTALLATION OF EQUIPMENT	10600 380
10600 480	WORKSHOPS & SPARE PARTS STORAGES ELECTRICAL INSTALLATION	10600 480
10600 580	WORKSHOPS & SPARE PARTS STORAGES PIPING & UTILITY DISTRIBUTN.	10600 580
10600 680	WORKSHOPS & SPARE PARTS STORAGES INSTALLATION OF AUX. EQUIPM.	10600 680
10600 700	WORKSHOPS & SPARE PARTS STORAGES FINISHING WORK	10600 700
10600 950	WORKSHOPS & SPARE PARTS STORAGES TRIAL RUNS & COMMISSIONING	10600 950
10600 990	WORKSHOPS & SPARE PARTS STORAGES START OF PRODUCTION	10600 990
10700 310	ELECTRICAL POWER DISTIBUTION FABRICATION OF EQUIPMENT	10700 310
10700 350	ELECTRICAL POWER DISTIBUTION SHIPMENT OF EQUIPMENT	10700 350
10700 380	ELECTRICAL POWER DISTIBUTION INSTALLATION OF EQUIPMENT	10700 380
10700 680	ELECTRICAL POWER DISTIBUTION INSTALLATION OF AUX. EQUIPM.	10700 680
10700 950	ELECTRICAL POWER DISTIBUTION TRIAL RUNS & COMMISSIONING	10700 950
10750 130	ELECTRICAL MAIN STATION BUILDING CONSTRUCTION OF BUILDING	10750 130
10750 180	ELECTRICAL MAIN STATION BUILDING FINISHING WORK	10750 180

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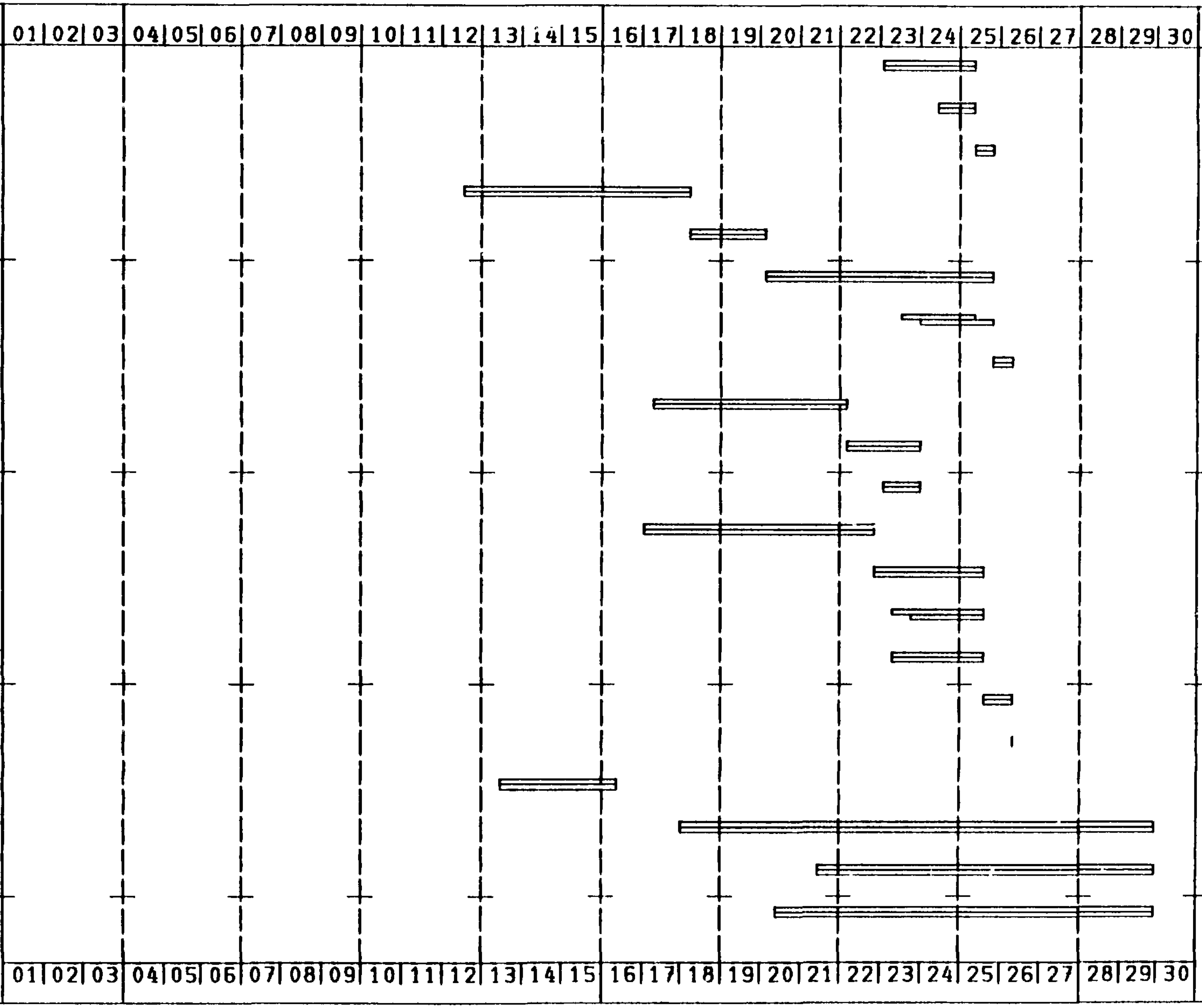
WORK ITEM	DESCRIPTION	WORK ITEM
I0750 380	ELECTRICAL MAIN STATION BUILDING INSTALLATION OF EQUIPMENT	I0750 380
I0750 680	ELECTRICAL MAIN STATION BUILDING INSTALLATION OF AUX. EQUIPM.	I0750 680
I0750 950	ELECTRICAL MAIN STATION BUILDING TRIAL RUNS & COMMISSIONING	I0750 950
I0900 310	AUXILIARY & UTILITIES DISTRIBUT. FABRICATION OF EQUIPMENT	I0900 310
I0900 350	AUXILIARY & UTILITIES DISTRIBUT. SHIPMENT OF EQUIPMENT	I0900 350
I0900 380	AUXILIARY & UTILITIES DISTRIBUT. INSTALLATION OF EQUIPMENT	I0900 380
I0900 700	AUXILIARY & UTILITIES DISTRIBUT. FINISHING WORK	I0900 700
I0900 950	AUXILIARY & UTILITIES DISTRIBUT. TRIAL RUNS & COMMISSIONING	I0900 950
I0950 140	WATER TREATM. PLANT & MOTOR POOL CONSTRUCTION / EXEC. OF WORK	I0950 140
I0950 380	WATER TREATM. PLANT & MOTOR POOL INSTALLATION OF EQUIPMENT	I0950 380
I0950 700	WATER TREATM. PLANT & MOTOR POOL FINISHING WORK	I0950 700
I1000 130	MAIN ADMINISTRATION BUILDING CONSTRUCTION OF BUILDING	I1000 130
I1000 180	MAIN ADMINISTRATION BUILDING FINISHING WORK	I1000 180
I1000 380	MAIN ADMINISTRATION BUILDING INSTALLATION OF EQUIPMENT	I1000 380
I1000 480	MAIN ADMINISTRATION BUILDING ELECTRICAL INSTALLATION	I1000 480
I1000 800	MAIN ADMINISTRATION BUILDING PLACING OF OUTFIT	I1000 800
I1000 950	MAIN ADMINISTRATION BUILDING TRIAL RUNS & COMMISSIONING	I1000 950
I1100 100	INTERNAL INFRASTRUCTURE BOUNDARY WALL & MAIN-GATE	I1100 100
I1100 140	INTERNAL INFRASTRUCTURE CONSTRUCTION / EIEC. OF WORK	I1100 140
I1100 200	INTERNAL INFRASTRUCTURE ROADS & PLACES	I1100 200
I1100 300	INTERNAL INFRASTRUCTURE DRAINAGE SYSTEM	I1100 300



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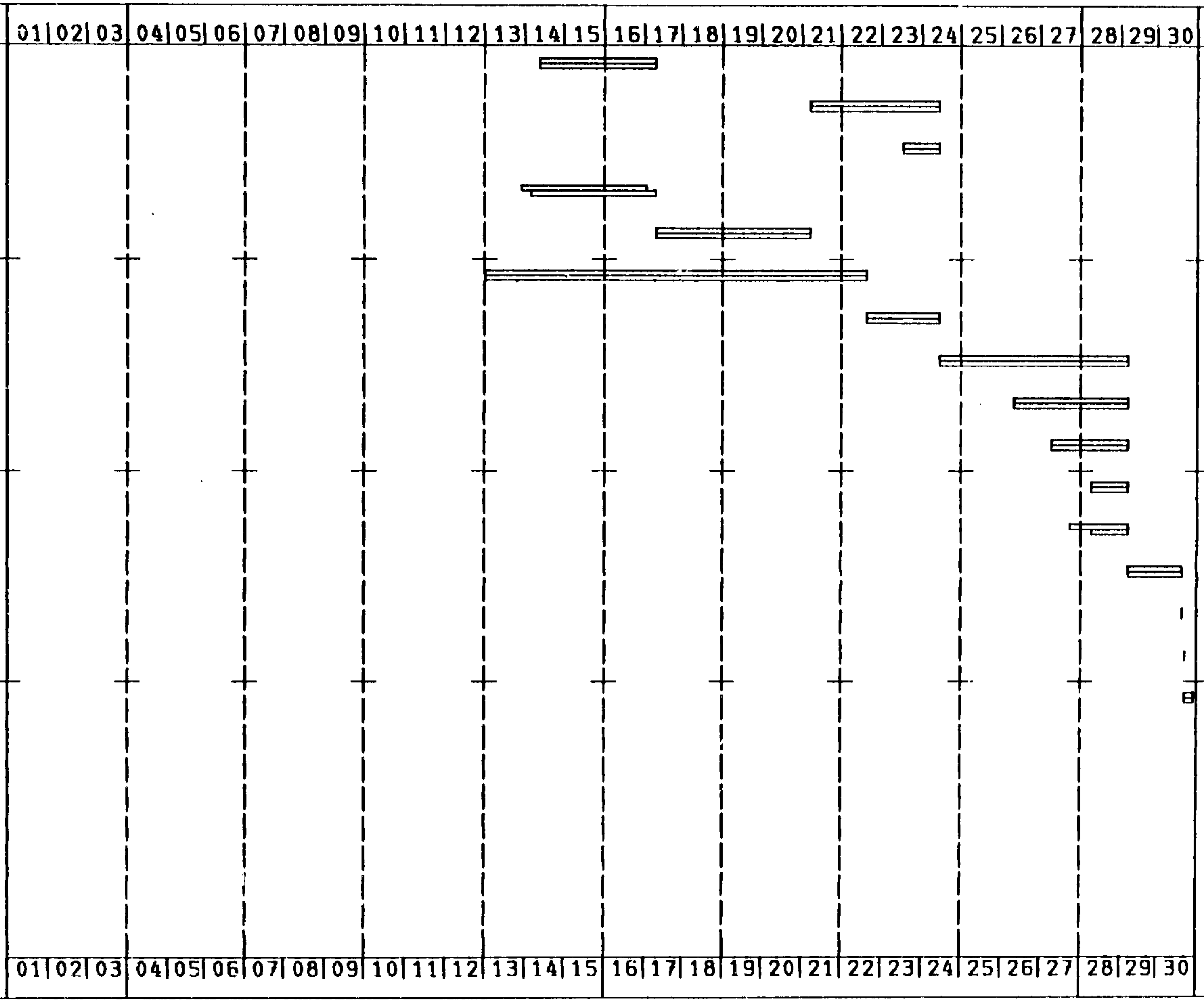
WORK ITEM	DESCRIPTION
11200 110	LINING & COATING PLANT / STORES FOUNDATIONS FOR BUILDING
11200 120	LINING & COATING PLANT / STORES FOUND.F.EQUIP.& FLOOR SLABS
11200 180	LINING & COATING PLANT / STORES FINISHING WORK
11200 210	LINING & COATING PLANT / STORES MANUFACT. OF STEEL STRUCTURE
11200 250	LINING & COATING PLANT / STORES ERECTION OF STEEL STRUCTURE
11200 310	LINING & COATING PLANT / STORES FABRICATION OF EQUIPMENT
11200 350	LINING & COATING PLANT / STORES SHIPMENT OF EQUIPMENT
11200 380	LINING & COATING PLANT / STORES INSTALLATION OF EQUIPMENT
11200 480	LINING & COATING PLANT / STORES ELECTRICAL INSTALLATION
11200 580	LINING & COATING PLANT / STORES PIPING & UTILITY DISTRIBUTN.
11200 680	LINING & COATING PLANT / STORES INSTALLATION OF AUX. EQUIPM.
11200 700	LINING & COATING PLANT / STORES FINISHING WORK
11200 950	LINING & COATING PLANT / STORES TRIAL RUNS & COMMISSIONING
11200 990	LINING & COATING PLANT / STORES START OF PRODUCTION
19000 000	TAKING OVER & ACCEPTANCE OF THE PLANT
19900 000	START OF PRODUCTION OF THE COMPLETE PLANT



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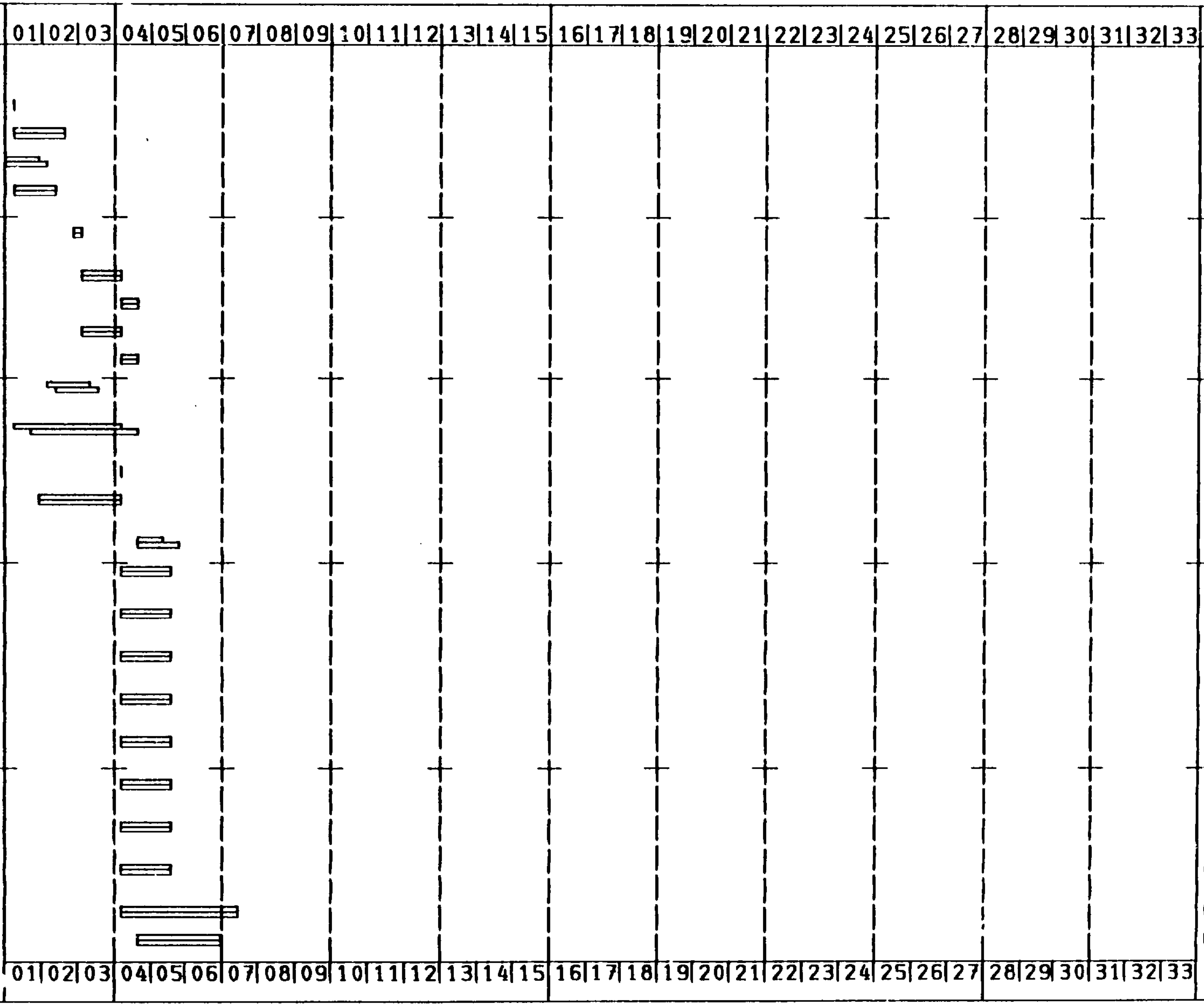
WORK ITEM	DESCRIPTION	WORK ITEM
E0000 010	NOMINATION OF ENGINEERING - CONSULTANT BY THE OWNER	E0000 010
E0000 020	COMING INTO FORCE OF CONTRACT	E0000 020
E0000 030	ELABORATION OF PROJECT SCHEDULE	E0000 030
E0000 040	PROCUREMENT OF PLANT SITE	E0000 040
E0000 050	SPECIFICATION FOR GEODETICAL & SUBSOIL SURVEY	E0000 050
E0000 060	CONTRACT FOR GEODETICAL SURVEY & SOIL FIELD WORK	E0000 060
E0000 070	EXECUTION OF FIELD WORK	E0000 070
E0000 080	FINAL REPORT & MAPS	E0000 080
E0000 090	SUPERVISION OF FIELD WORK	E0000 090
E0000 100	COMPILE FINAL INFRASTRUCT. DATA	E0000 100
E0000 110	COLLECT THE PREVAILING LOCAL STANDARDS & REGULATIONS	E0000 110
E0000 120	BASIC & ARCHITECTURAL DESIGN FOR TENDER PURPOSES	E0000 120
E0000 130	START OF TENDER ENGINEERING	E0000 130
E0000 140	CLASSIFICATION SYSTEM FOR PLANT EQUIPMENT	E0000 140
E0000 150	BIDDING INSTRUCTIONS	E0000 150
E0000 160	GENERAL TECHNICAL SPECIFICATION - KNOW HOW TRANSFER	E0000 160
E0000 170	GENERAL TECHNICAL SPECIFICATION - DESCRIPTION OF LOCATION	E0000 170
E0000 180	GENERAL TECHNICAL SPECIFICATION - STANDARDS & REGULATIONS	E0000 180
E0000 190	GENERAL TECHNICAL SPECIFICATION - SEE / LAND / AIR TRANSPORT	E0000 190
E000C 210	GENERAL TECHNICAL SPECIFICATION - PROJECT / TIME CONTROL	E0000 210
E0000 220	GENERAL TECHNICAL SPECIFICATION - DOCUMENTATION	E0000 220
E0000 230	GENERAL TECHNICAL SPECIFICATION - PRODUCT. & MATERIAL FLOW	E0000 230
E0000 240	GENERAL TECHNICAL SPECIFICATION - POLLUTION & HEALTH REGULAT	E0000 240
E0000 250	GENERAL COMMERCIAL CONDITIONS	E0000 250
E0000 260	SPECIAL TECHNICAL SPECIFICATION - LAYOUTS & TENDER DRAWINGS	E0000 260



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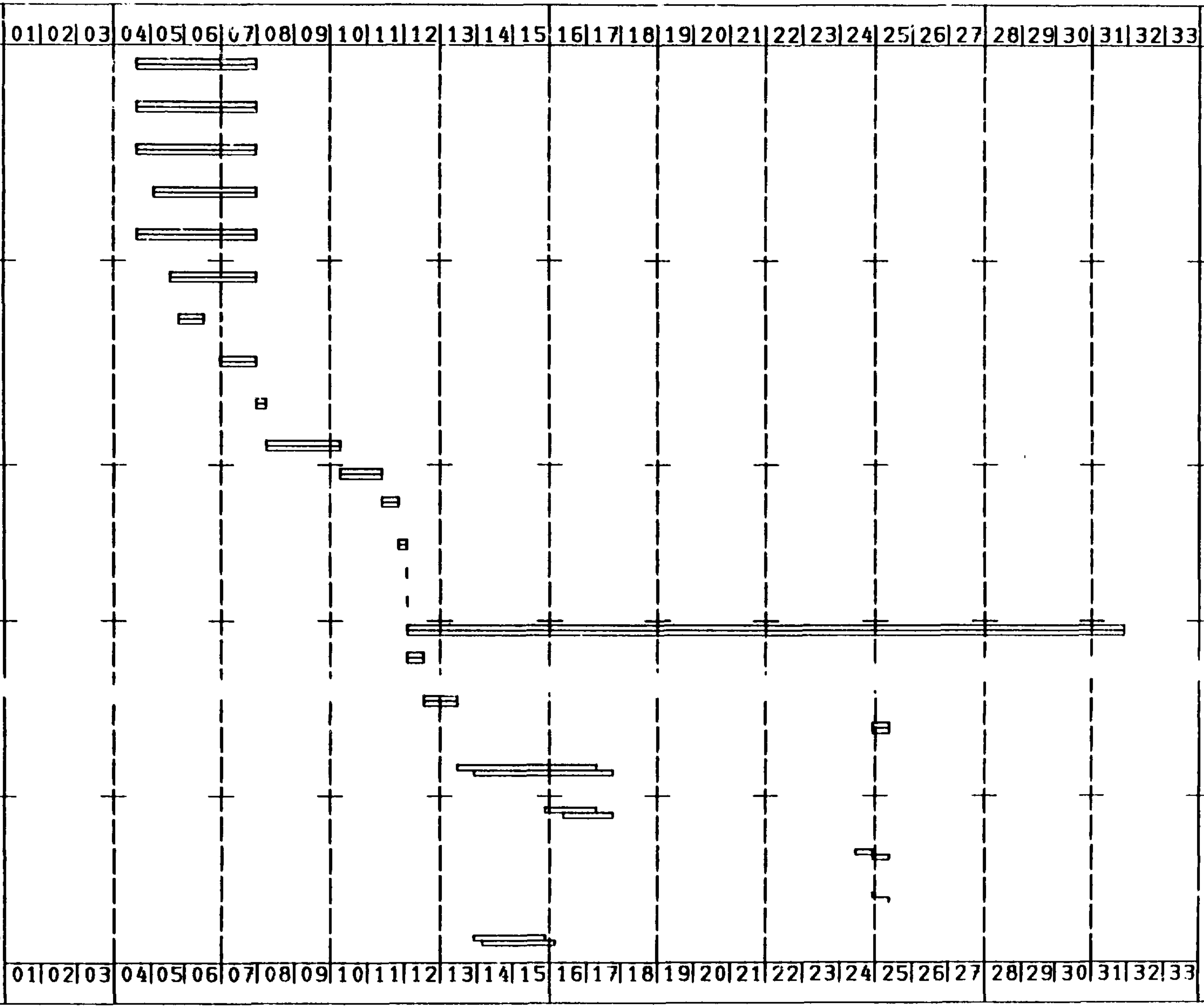
ALTERNATIVE OF DESIGN II

WORK ITEM	DESCRIPTION	WORK ITEM
0000 270	SPECIAL TECHNICAL SPECIFICATION - MATERIAL & ENERGY BALANCE	E0000 270
E0000 280	SPECIAL TECHNICAL SPECIFICATION - MECHANICAL EQUIPMENT	E0000 280
E0000 290	SPECIAL TECHNICAL SPECIFICATION - ELECTRICAL EQUIPMENT	E0000 290
E0000 310	SPECIAL TECHNICAL SPECIFICATION - UTILITIES / PIPING	E0000 310
E0000 320	SPECIAL TECHNICAL SPECIFICATION - CIVIL WORK & STEEL STRUCT.	E0000 320
E0000 330	SPECIAL TECHNICAL SPECIFICATION - AUXILIARY EQUIPMENT	E0000 330
E0000 340	QUESTIONAIRES FOR PREQUALIFICAT. OF TURNKEY BIDDERS	E0000 340
E0000 350	PREQUALIFICATION OF TURNKEY BIDDERS	E0000 350
E0000 360	PRINTING & DISTRIBUTION OF THE TENDER DOCUMENTS	E0000 360
E0000 370	TURNKEY BIDDING PERIOD	E0000 370
E0000 380	EVALUATION OF TURNKEY BIDS	E0000 380
E0000 390	NEGOTIATIONS WITH THE TURNKEY BIDDERS	E0000 390
E0000 400	TURNKEY CONTRACT DOCUMENTS	E0000 400
E0000 410	START OF SITE MANAGEMENT	E0000 410
F1000 000	START OF CONTRACTUAL WORK	F1000 000
F1100 000	SUPERVISION OF SITE WORK	F1100 000
F1400 000	CONNECTION OF ELECTRICAL POWER & WATER FOR SITE WORK	F1400 000
F1500 000	SITE INSTALLATION	F1500 000
F1600 000	CONNECTION OF ELECTRICAL POWER & UTILITIES	F1600 000
I0100 130	GATE HOUSE & WEIGHING BRIDGE CONSTRUCTION OF BUILDING	I0100 130
I0100 180	GATE HOUSE & WEIGHING BRIDGE FINISHING WORK	I0100 180
I0100 380	GATE HOUSE & WEIGHING BRIDGE INSTALLATION OF EQUIPMENT	I0100 380
I0100 950	GATE HOUSE & WEIGHING BRIDGE TRIAL RUNS & COMMISSIONING	I0100 950
I0200 110	SLITTING LINE /STRIP PREPARATION FOUNDATIONS FOR BUILDING	I0200 110



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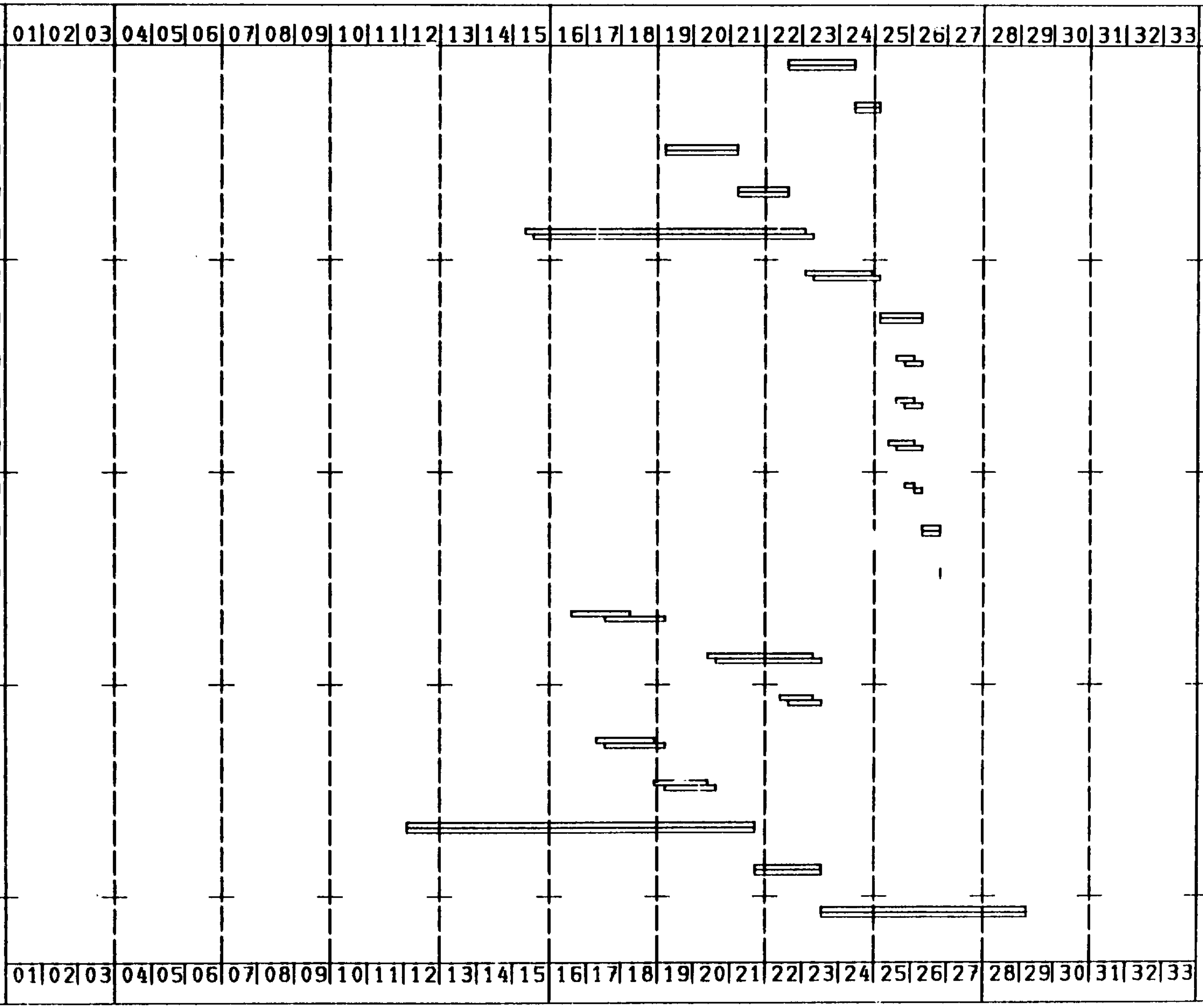
WORK ITEM	DESCRIPTION	WORK ITEM
10200 120	SLITTING LINE /STRIP PREPARATION FOUND.F.EQUIP.& FLOOR SLABS	10200 120
10200 180	SLITTING LINE /STRIP PREPARATION FINISHING WORK	10200 180
10200 210	SLITTING LINE /STRIP PREPARATION MANUFACT. OF STEEL STRUCTURE	10200 210
10200 250	SLITTING LINE /STRIP PREPARATION ERECTION OF STEEL STRUCTURE	10200 250
10200 310	SLITTING LINE /STRIP PREPARATION FABRICATION OF EQUIPMENT	10200 310
10200 350	SLITTING LINE /STRIP PREPARATION SHIPMENT OF EQUIPMENT	10200 350
10200 380	SLITTING LINE /STRIP PREPARATION INSTALLATION OF EQUIPMENT	10200 380
10200 480	SLITTING LINE /STRIP PREPARATION ELECTRICAL INSTALLATION	10200 480
10200 580	SLITTING LINE /STRIP PREPARATION PIPING & UTILITY DISTRIBUTN.	10200 580
10200 680	SLITTING LINE /STRIP PREPARATION INSTALLATION OF AUX. EQUIPM.	10200 680
10200 700	SLITTING LINE /STRIP PREPARATION FINISHING WORK	10200 700
10200 950	SLITTING LINE /STRIP PREPARATION TRIAL RUNS & COMMISSIONING	10200 950
10200 990	SLITTING LINE /STRIP PREPARATION START OF PRODUCTION	10200 990
10300 110	PIPE PRODUCTION AREA FOUNDATIONS FOR BUILDING	10300 110
10300 120	PIPE PRODUCTION AREA FOUND.F.EQUIP.& FLOOR SLABS	10300 120
10300 180	PIPE PRODUCTION AREA FINISHING WORK	10300 180
10300 210	PIPE PRODUCTION AREA MANUFACT. OF STEEL STRUCTURE	10300 210
10300 250	PIPE PRODUCTION AREA ERECTION OF STEEL STRUCTURE	10300 250
10300 310	PIPE PRODUCTION AREA FABRICATION OF EQUIPMENT	10300 310
10300 350	PIPE PRODUCTION AREA SHIPMENT OF EQUIPMENT	10300 350
10300 380	PIPE PRODUCTION AREA INSTALLATION OF EQUIPMENT	10300 380



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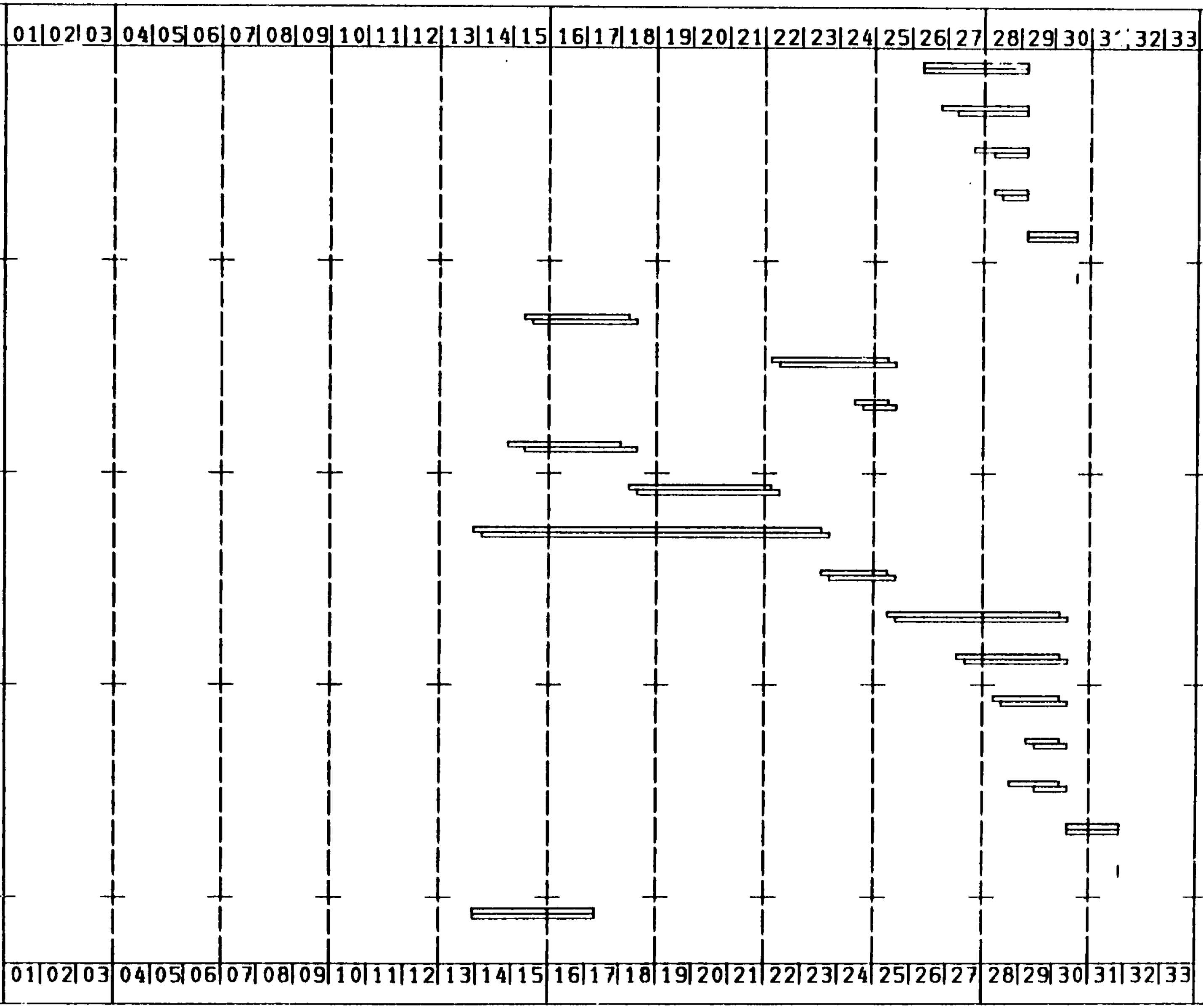
WORK ITEM	DESCRIPTION	WORK ITEM
10300 480	PIPE PRODUCTION AREA ELECTRICAL INSTALLATION	10300 480
10300 580	PIPE PRODUCTION AREA PIPING & UTILITY DISTRIBUTN.	10300 580
10300 680	PIPE PRODUCTION AREA INSTALLATION OF AUX. EQUIPM.	1030r
10300 700	PIPE PRODUCTION AREA FINISHING WORK	1030 ,0
10300 950	PIPE PRODUCTION AREA TRIAL RUNS & COMMISSIONING	10300 950
10300 990	PIPE PRODUCTION AREA START OF PRODUCTION	10300 990
10400 110	PIPE PICKLING AREA FOUNDATIONS FOR BUILDING	10400 110
10400 120	PIPE PICKLING AREA FOUND.F.EQUIP.& FLOOR SLABS	10400 120
10400 180	PIPE PICKLING AREA FINISHING WORK	10400 180
10400 210	PIPE PICKLING AREA MANUFACT. OF STEEL STRUCTURE	10400 210
10400 250	PIPE PICKLING AREA ERECTION OF STEEL STRUCTURE	10400 250
10400 310	PIPE PICKLING AREA FABRICATION OF EQUIPMENT	10400 310
10400 350	PIPE PICKLING AREA SHIPMENT OF EQUIPMENT	10400 350
10400 380	PIPE PICKLING AREA INSTALLATION OF EQUIPMENT	10400 380
10400 480	PIPE PICKLING AREA ELECTRICAL INSTALLATION	10400 480
10400 580	PIPE PICKLING AREA PIPING & UTILITY DISTRIBUTN.	10400 580
10400 680	PIPE PICKLING AREA INSTALLATION OF AUX. EQUIPM.	10400 680
10400 700	PIPE PICKLING AREA FINISHING WORK	10400 700
10400 950	PIPE PICKLING AREA TRIAL RUNS & COMMISSIONING	10400 950
10400 990	PIPE PICKLING AREA START OF PRODUCTION	10400 990
10450 110	GALVANIZATION AREA FOUNDATIONS FOR BUILDING	10450 110



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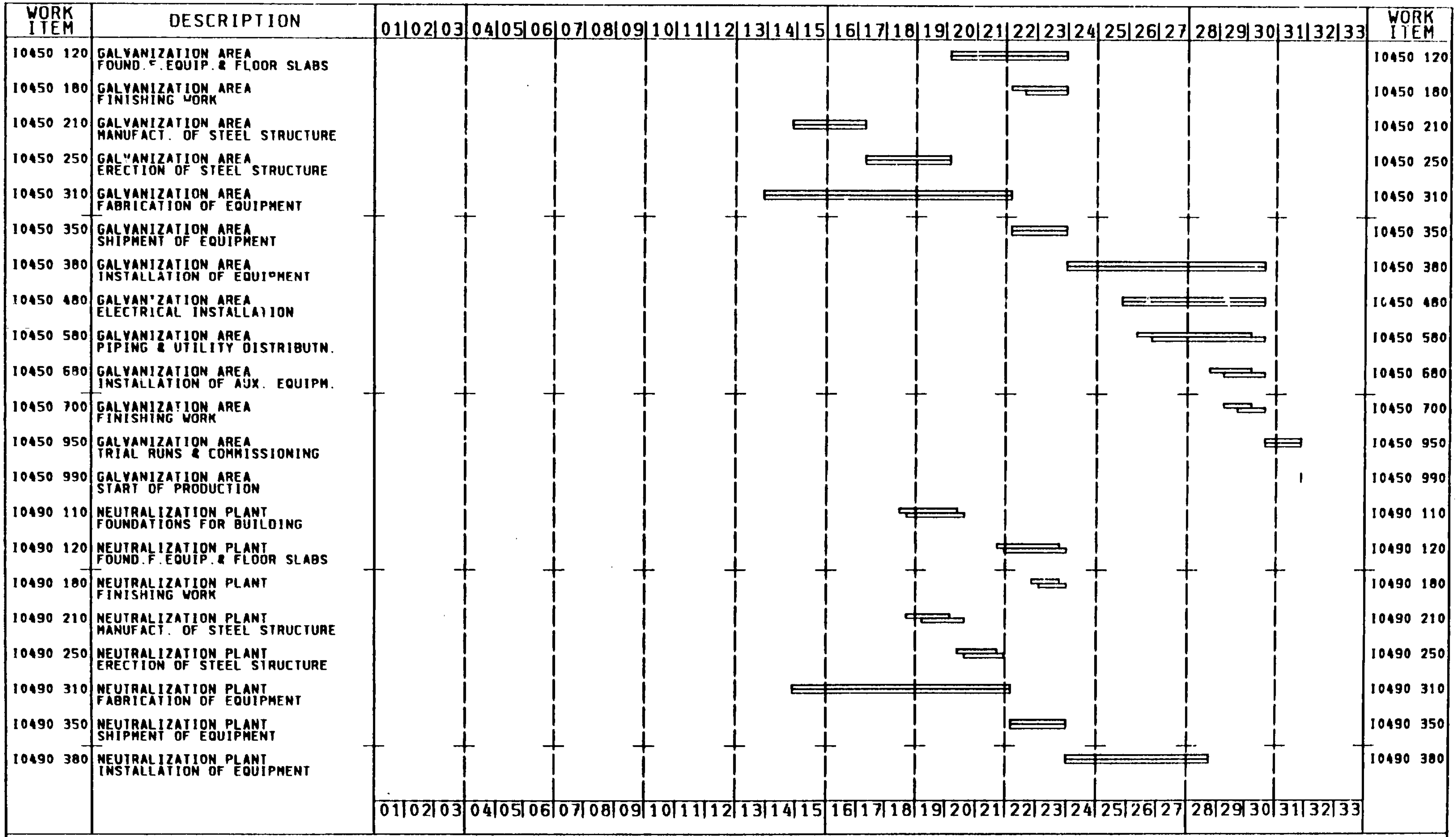

WORK ITEM	DESCRIPTION
10450 120	GALVANIZATION AREA FOUND.F.EQUIP.& FLOOR SLABS
10450 180	GALVANIZATION AREA FINISHING WORK
10450 210	GALVANIZATION AREA MANUFACT. OF STEEL STRUCTURE
10450 250	GALVANIZATION AREA ERECTION OF STEEL STRUCTURE
10450 310	GALVANIZATION AREA FABRICATION OF EQUIPMENT
10450 350	GALVANIZATION AREA SHIPMENT OF EQUIPMENT
10450 380	GALVANIZATION AREA INSTALLATION OF EQUIPMENT
10450 480	GALVANIZATION AREA ELECTRICAL INSTALLATION
10450 580	GALVANIZATION AREA PIPING & UTILITY DISTRIBUTN.
10450 680	GALVANIZATION AREA INSTALLATION OF AUX. EQUIPM.
10450 700	GALVANIZATION AREA FINISHING WORK
10450 950	GALVANIZATION AREA TRIAL RUNS & COMMISSIONING
10450 990	GALVANIZATION AREA START OF PRODUCTION
10490 110	NEUTRALIZATION PLANT FOUNDATIONS FOR BUILDING
10490 120	NEUTRALIZATION PLANT FOUND.F.EQUIP.& FLOOR SLABS
10490 180	NEUTRALIZATION PLANT FINISHING WORK
10490 210	NEUTRALIZATION PLANT MANUFACT. OF STEEL STRUCTURE
10490 250	NEUTRALIZATION PLANT ERECTION OF STEEL STRUCTURE
10490 310	NEUTRALIZATION PLANT FABRICATION OF EQUIPMENT
10490 350	NEUTRALIZATION PLANT SHIPMENT OF EQUIPMENT
10490 380	NEUTRALIZATION PLANT INSTALLATION OF EQUIPMENT

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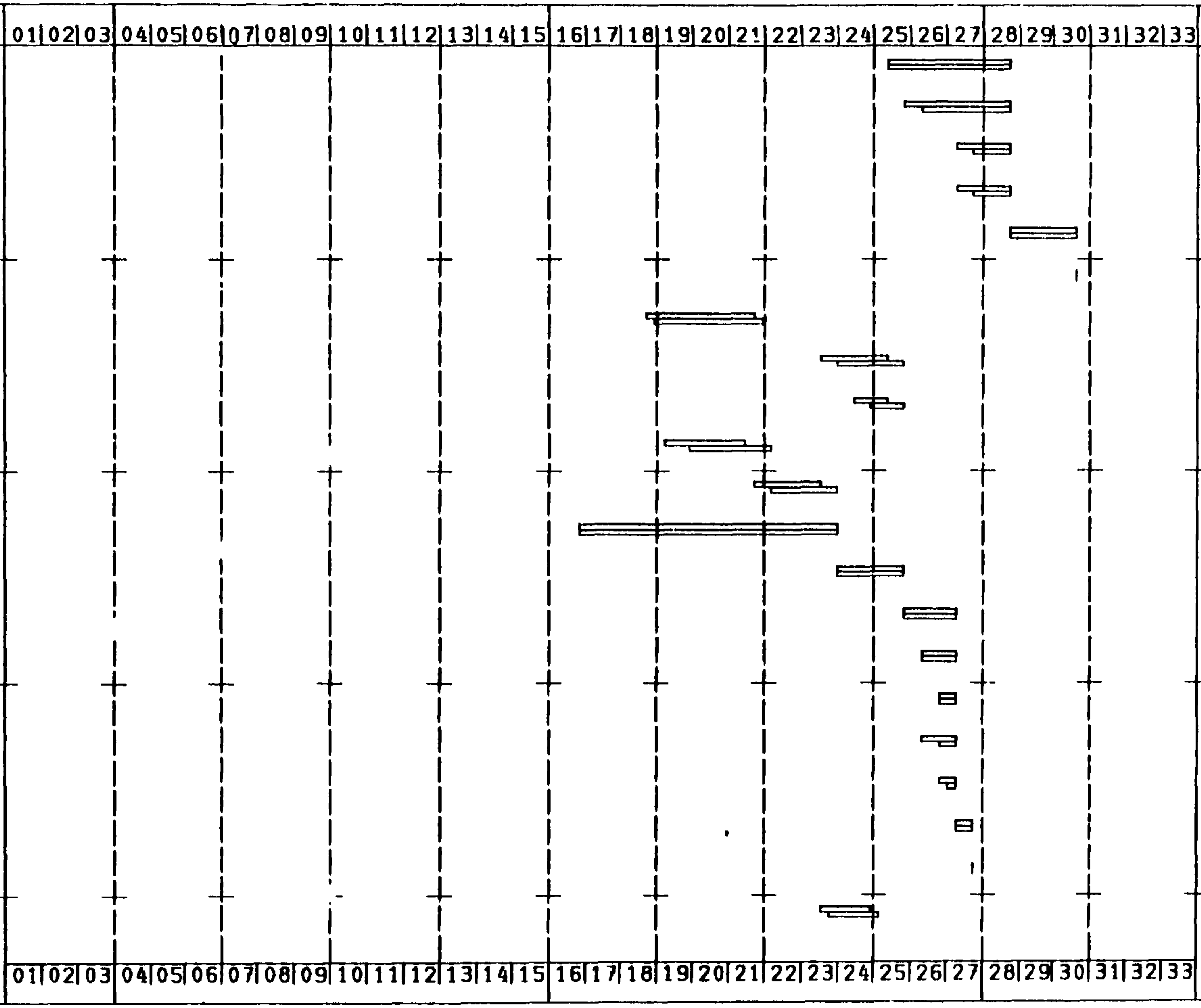
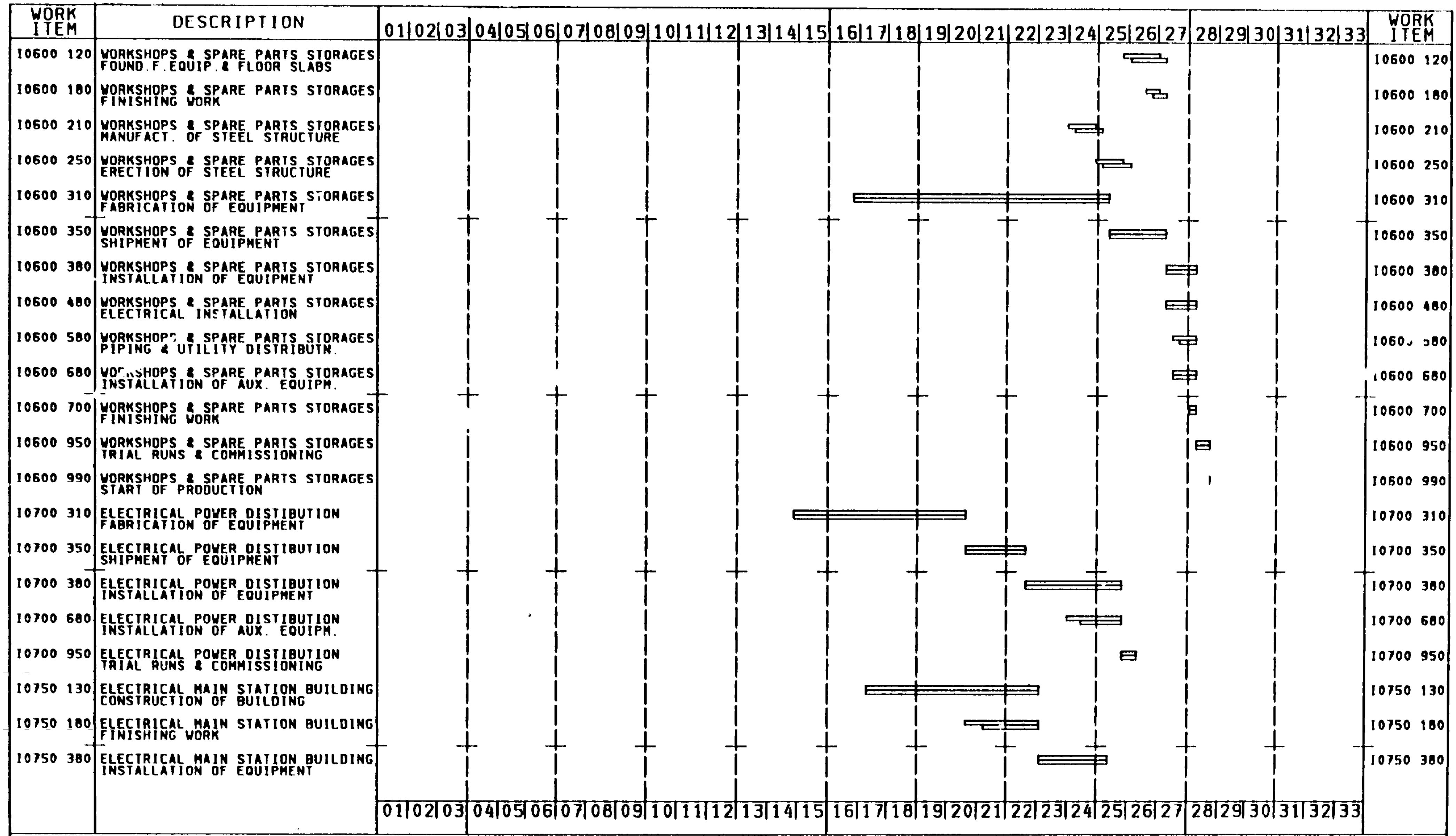
WORK ITEM	DESCRIPTION	WORK ITEM
10490 480	NEUTRALIZATION PLANT ELECTRICAL INSTALLATION	10490 480
10490 580	NEUTRALIZATION PLANT PIPING & UTILITY DISTRIBUTN.	10490 580
10490 680	NEUTRALIZATION PLANT INSTALLATION OF AUX. EQUIPM.	10490 680
10490 700	NEUTRALIZATION PLANT FINISHING WORK	10490 700
10490 950	NEUTRALIZATION PLANT TRIAL RUNS & COMMISSIONING	10490 950
10490 990	NEUTRALIZATION PLANT START OF PRODUCTION	10490 990
10500 110	PIPE FINISHING AREA / STORAGES FOUNDATIONS FOR BUILDING	10500 110
10500 120	PIPE FINISHING AREA / STORAGES FOUND.F.EQUIP.& FLOOR SLABS	10500 120
10500 180	PIPE FINISHING AREA / STORAGES FINISHING WORK	10500 180
10500 210	PIPE FINISHING AREA / STORAGES MANUFACT. OF STEEL STRUCTURE	10500 210
10500 250	PIPE FINISHING AREA / STORAGES ERECTION OF STEEL STRUCTURE	10500 250
10500 310	PIPE FINISHING AREA / STORAGES FABRICATION OF EQUIPMENT	10500 310
10500 350	PIPE FINISHING AREA / STORAGES SHIPMENT OF EQUIPMENT	10500 350
10500 380	PIPE FINISHING AREA / STORAGES INSTALLATION OF EQUIPMENT	10500 380
10500 480	PIPE FINISHING AREA / STORAGES ELECTRICAL INSTALLATION	10500 480
10500 580	PIPE FINISHING AREA / STORAGES PIPING & UTILITY DISTRIBUTN.	10500 580
10500 680	PIPE FINISHING AREA / STORAGES INSTALLATION OF AUX. EQUIPM.	10500 680
10500 700	PIPE FINISHING AREA / STORAGES FINISHING WORK	10500 700
10500 950	PIPE FINISHING AREA / STORAGES TRIAL RUNS & COMMISSIONING	10500 950
10500 990	PIPE FINISHING AREA / STORAGES START OF PRODUCTION	10500 990
10600 110	WORKSHOPS & SPARE PARTS STORAGES FOUNDATIONS FOR BUILDING	10600 110



STATUS DATED 04/03/86
RUN DATE 04/03/86
DEPT.: PROJECT CONTROL P1148

ENGINEERING / CONSULTANT EISENBAU ESSEN GMBH
ON BEHALF OF U N I D O FOR
BURMESE MINISTRY OF NO. 1 INDUSTRY

GANTT-CHART FOR FOR THE IMPLEMENTATION OF A
WELDED STEEL PIPE PLANT / BURMA
ALTERNATIVE OF DESIGN II



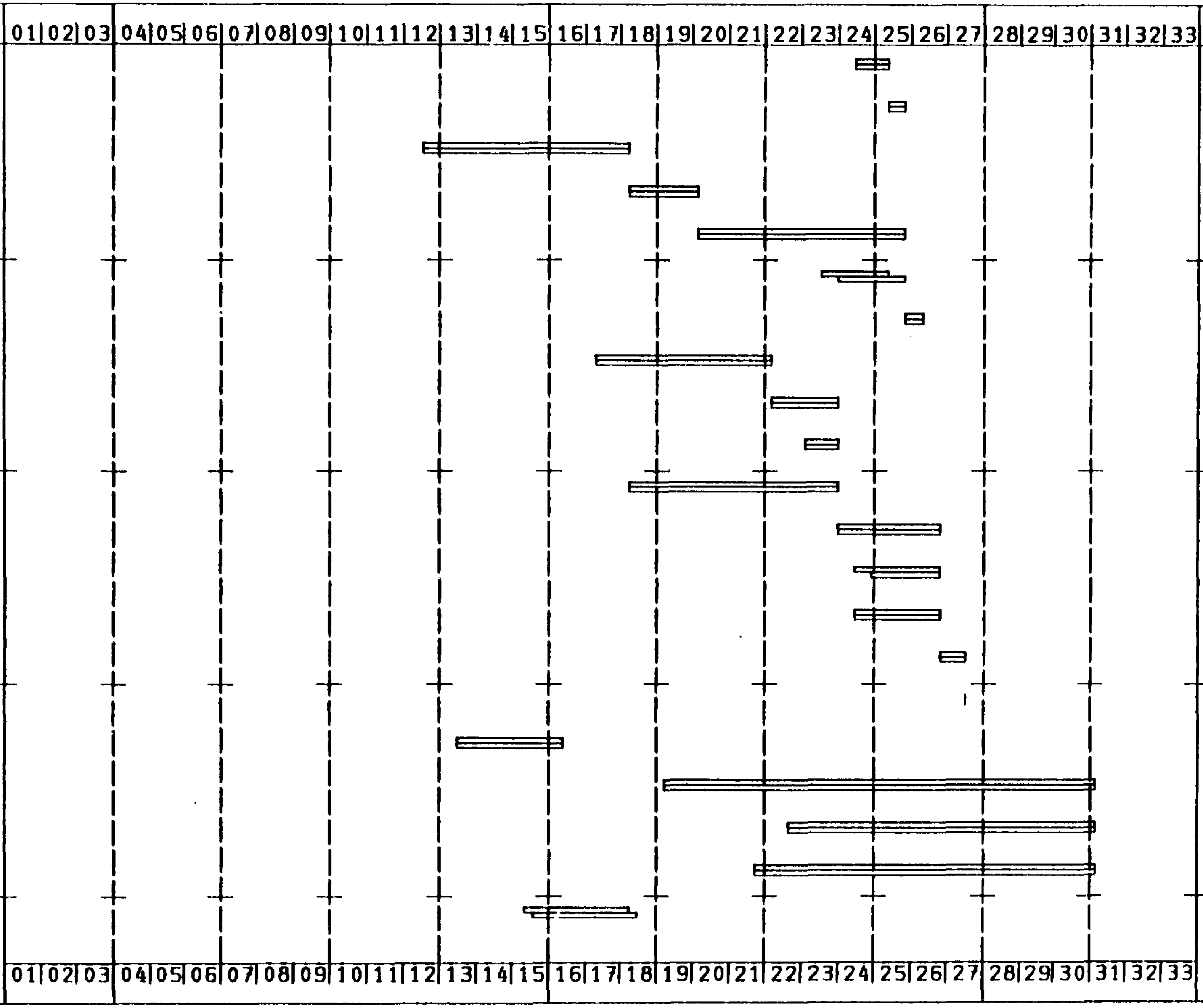
WORK ITEM	DESCRIPTION
10600 120	WORKSHOPS & SPARE PARTS STORAGES FOUND.F.EQUIP.& FLOOR SLABS
10600 180	WORKSHOPS & SPARE PARTS STORAGES FINISHING WORK
10600 210	WORKSHOPS & SPARE PARTS STORAGES MANUFACT. OF STEEL STRUCTURE
10600 250	WORKSHOPS & SPARE PARTS STORAGES ERECTION OF STEEL STRUCTURE
10600 310	WORKSHOPS & SPARE PARTS STORAGES FABRICATION OF EQUIPMENT
10600 350	WORKSHOPS & SPARE PARTS STORAGES SHIPMENT OF EQUIPMENT
10600 380	WORKSHOPS & SPARE PARTS STORAGES INSTALLATION OF EQUIPMENT
10600 480	WORKSHOPS & SPARE PARTS STORAGES ELECTRICAL INSTALLATION
10600 580	WORKSHOPS & SPARE PARTS STORAGES PIPING & UTILITY DISTRIBUTN.
10600 680	WORKSHOPS & SPARE PARTS STORAGES INSTALLATION OF AUX. EQUIPM.
10600 700	WORKSHOPS & SPARE PARTS STORAGES FINISHING WORK
10600 950	WORKSHOPS & SPARE PARTS STORAGES TRIAL RUNS & COMMISSIONING
10600 990	WORKSHOPS & SPARE PARTS STORAGES START OF PRODUCTION
10700 310	ELECTRICAL POWER DISTIBUTION FABRICATION OF EQUIPMENT
10700 350	ELECTRICAL POWER DISTIBUTION SHIPMENT OF EQUIPMENT
10700 380	ELECTRICAL POWER DISTIBUTION INSTALLATION OF EQUIPMENT
10700 680	ELECTRICAL POWER DISTIBUTION INSTALLATION OF AUX. EQUIPM.
10700 950	ELECTRICAL POWER DISTIBUTION TRIAL RUNS & COMMISSIONING
10750 130	ELECTRICAL MAIN STATION BUILDING CONSTRUCTION OF BUILDING
10750 180	ELECTRICAL MAIN STATION BUILDING FINISHING WORK
10750 380	ELECTRICAL MAIN STATION BUILDING INSTALLATION OF EQUIPMENT

STATUS DATED 03/03/86
RUN DATE 03/03/86
DEPT.: PROJECT CONTROL P1148

ENGINEERING / CONSULTANT EISENBAU ESSEN GMBH
ON BEHALF OF UNIDO FOR
BURMESE MINISTRY OF NO. 1 INDUSTRY

GANTT-CHART FOR FOR THE IMPLEMENTATION OF A
WELDED STEEL PIPE PLANT / BURMA
ALTERNATIVE OF DESIGN II

WORK ITEM	DESCRIPTION	WORK ITEM
I0750 680	ELECTRICAL MAIN STATION BUILDING INSTALLATION OF AUX. EQUIPM.	I0750 680
I0750 950	ELECTRICAL MAIN STATION BUILDING TRIAL RUNS & COMMISSIONING	I0750 950
I0900 310	AUXILIARY & UTILITIES DISTRIBUT. FABRICATION OF EQUIPMENT	I0900 310
I0900 350	AUXILIARY & UTILITIES DISTRIBUT. SHIPMENT OF EQUIPMENT	I0900 350
I0900 380	AUXILIARY & UTILITIES DISTRIBUT. INSTALLATION OF EQUIPMENT	I0900 380
I0900 700	AUXILIARY & UTILITIES DISTRIBUT. FINISHING WORK	I0900 700
I0900 950	AUXILIARY & UTILITIES DISTRIBUT. TRIAL RUNS & COMMISSIONING	I0900 950
I0950 140	WATER TREATM. PLANT & MOTOR POOL CONSTRUCTION / EXEC. OF WORK	I0950 140
I0950 380	WATER TREATM. PLANT & MOTOR POOL INSTALLATION OF EQUIPMENT	I0950 380
I0950 700	WATER TREATM. PLANT & MOTOR POOL FINISHING WORK	I0950 700
I1000 130	MAIN ADMINISTRATION BUILDING CONSTRUCTION OF BUILDING	I1000 130
I1000 180	MAIN ADMINISTRATION BUILDING FINISHING WORK	I1000 180
I1000 380	MAIN ADMINISTRATION BUILDING INSTALLATION OF EQUIPMENT	I1000 380
I1000 480	MAIN ADMINISTRATION BUILDING ELECTRICAL INSTALLATION	I1000 480
I1000 800	MAIN ADMINISTRATION BUILDING PLACING OF OUTFIT	I1000 800
I1000 950	MAIN ADMINISTRATION BUILDING TRIAL RUNS & COMMISSIONING	I1000 950
I1100 100	INTERNAL INFRASTRUCTURE BOUNDARY WALL & MAIN-GATE	I1100 100
I1100 140	INTERNAL INFRASTRUCTURE CONSTRUCTION / EIEC. OF WORK	I1100 140
I1100 200	INTERNAL INFRASTRUCTURE ROADS & PLACES	I1100 200
I1100 300	INTERNAL INFRASTRUCTURE DRAINAGE SYSTEM	I1100 300
I1200 110	LINING & COATING PLANT / STORES FOUNDATIONS FOR BUILD.."S	I1200 110



STATUS DATED 03/03/86
RUN DATE 03/03/86
DEPT.: PROJECT CONTROL P1148

ENGINEERING / CONSULTANT EISENBAU ESSEN GMBH
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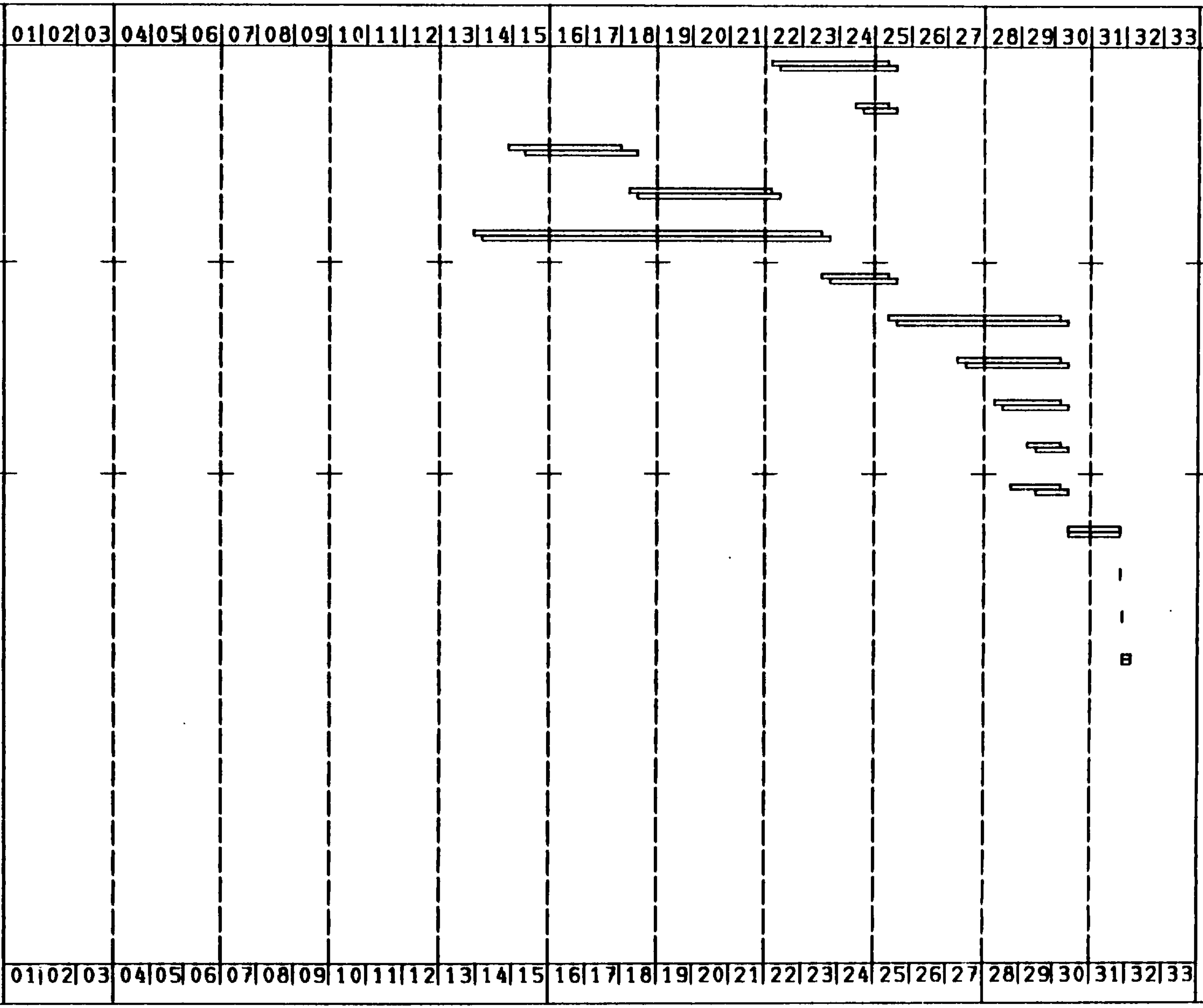
ALTERNATIVE OF DESIGN II



WORK ITEM	DESCRIPTION	WORK ITEM
I1200 120	LINING & COATING PLANT / STORES FOUND.F.EQUIP.& FLOOR SLABS	I1200 120
I1200 180	LINING & COATING PLANT / STORES FINISHING WORK	I1200 180
I1200 210	LINING & COATING PLANT / STORES MANUFACT. OF STEEL STRUCTURE	I1200 210
I1200 250	LINING & COATING PLANT / STORES ERECTION OF STEEL STRUCTURE	I1200 250
I1200 310	LINING & COATING PLANT / STORES FABRICATION OF EQUIPMENT	I1200 310
I1200 350	LINING & COATING PLANT / STORES SHIPMENT OF EQUIPMENT	I1200 350
I1200 380	LINING & COATING PLANT / STORES INSTALLATION OF EQUIPMENT	I1200 380
I1200 480	LINING & COATING PLANT / STORES ELECTRICAL INSTALLATION	I1200 480
I1200 580	LINING & COATING PLANT / STORES PIPING & UTILITY DISTRIBUTN.	I1200 580
I1200 680	LINING & COATING PLANT / STORES INSTALLATION OF AUX. EQUIPM.	1200 680
I1200 700	LINING & COATING PLANT / STORES FINISHING WORK	I1200 700
I1200 950	LINING & COATING PLANT / STORES TRIAL RUNS & COMMISSIONING	I1200 950
I1200 990	LINING & COATING PLANT / STORES START OF PRODUCTION	I1200 990
I9000 000	TAKE OVER & ACCEPTANCE OF THE PLANT	I9000 000
I9900 000	START OF PRODUCTION OF THE COMPLETE PLANT	I9900 000

STATUS DATED 03/03/86
RUN DATE 03/03/86
DEPT.: PROJECT CONTROL P1148

ENGINEERING / CONSULTANT EISENBAU ESSEN GMBH
ON BEHALF OF U N I D O FOR
BURMESE MINISTRY OF NO. 1 INDUSTRY

GANTT-CHART FOR FOR THE IMPLEMENTATION OF A
WELDED STEEL PIPE PLANT / BURMA
ALTERNATIVE OF DESIGN II

ACTIVITY TIME STATUS REPORT

NETWORK TIME SHEDULE FOR THE IMPLENTATION OF A BURMA
SUBNET WELDED STEEL PIPE PLANT / BURMA ALTERNATIVE I BURMA1
RUN DATE 03MAR86

WORK ITEM	ORG COD	DESCRIPTION	DURAT.	START EXPECTED	END EXPECTED	SLACK START	SLACK END	START LATEST	END LATEST	SCHEDULE DATE	DEPT.
E0000010		NOMINATION OF ENGINEERING - CONSULTANT BY THE OWNER	0.0	01/10/86	01/10/86	.0	.0	01/10/86	01/10/86		
E0000020		COMING INTO FORCE OF CONTRACT	0.0	08/10/86	08/10/86	.0	.0	08/10/86	08/10/86		
E0000030		ELABORATION OF PROJECT SCHEDULE	30.0	08/10/86	20/11/86	.0	.0	08/10/86	20/11/86		
E0000040		PROCUREMENT OF PLANT SITE	20.0	01/10/86	29/10/86	.0	5.0	01/10/86	05/11/86		
E0000050		SPECIFICATION FOR GEODETICAL & SUBSOIL SURVEY	25.0	08/10/86	12/11/86	.0	.0	08/10/86	12/11/86		
E0000060		CONTRACT FOR GEODETICAL SURVEY & SOIL FIELD WORK	5.0	27/11/86	04/12/86	.0	.0	27/11/86	04/12/86		
E0000070		EXECUTION OF FIELD WORK	20.0	04/12/86	06/01/87	.0	.0	04/12/86	06/01/87		
E0000080		FINAL REPORT & MAPS	10.0	06/01/87	20/01/87	.0	.0	06/01/87	20/01/87		
E0000090		SUPERVISION OF FIELD WORK	20.0	04/12/86	06/01/87	.0	.0	04/12/86	06/01/87		
E0000100		COMPILE FINAL INFRASTRUCT. DATA	10.0	06/01/87	20/01/87	.0	.0	06/01/87	20/01/87		
E0000110		COLLECT THE PREVAILING LOCAL STANDARDS & REGULATIONS	25.0	05/11/86	11/12/86	5.0	5.0	12/11/86	18/12/86		
E0000120		BASIC & ARCHITECTURAL DESIGN FOR TENDER PURPOSES	60.0	08/10/86	06/01/87	10.0	10.0	22/10/86	20/01/87		
E0000130		START OF TENDER ENGINEERING	0.0	06/01/87	06/01/87	.0	.0	06/01/87	06/01/87		
E0000140		CLASSIFICATION SYSTEM FOR PLANT EQUIPMENT	45.0	29/10/86	06/01/87	.0	.0	29/10/86	06/01/87		
E0000150		BIDDING INSTRUCTIONS	15.0	20/01/87	10/02/87	.0	10.0	20/01/87	24/02/87		
E0000160		GENERAL TECHNICAL SPECIFICATION - KNOW HOW TRANSFER	30.0	06/01/87	17/02/87	.0	.0	06/01/87	17/02/87		
E0000170		GENERAL TECHNICAL SPECIFICATION - DESCRIPTION OF LOCATION	30.0	06/01/87	17/02/87	.0	.0	06/01/87	17/02/87		
E0000180		GENERAL TECHNICAL SPECIFICATION - STANDARDS & REGULATIONS	30.0	06/01/87	17/02/87	.0	.0	06/01/87	17/02/87		
E0000190		GENERAL TECHNICAL SPECIFICATION - SEE / LAND / AIR TRANSPORT	30.0	06/01/87	17/02/87	.0	.0	06/01/87	17/02/87		
E0000210		GENERAL TECHNICAL SPECIFICATION - PROJECT / TIME CONTROL	30.0	06/01/87	17/02/87	.0	.0	06/01/87	17/02/87		
E0000220		GENERAL TECHNICAL SPECIFICATION - DOCUMENIATION	30.0	06/01/87	17/02/87	.0	.0	06/01/87	17/02/87		
E0000230		GENERAL TECHNICAL SPECIFICATION - PRODUCT. & MATERIAL FLOW	30.0	06/01/87	17/02/87	.0	.0	06/01/87	17/02/87		
E0000240		GENERAL TECHNICAL SPECIFICATION - POLLUTION & HEALTH REGULAT	30.0	06/01/87	17/02/87	.0	.0	06/01/87	17/02/87		
E0000250		GENERAL COMMERCIAL CONDITIONS	70.0	06/01/87	14/04/87	.0	.0	06/01/87	14/04/87		
E0000260		SPECIAL TECHNICAL SPECIFICATION - LAYOUTS & TENDER DRAWINGS	50.0	20/01/87	31/03/87	.0	.0	20/01/87	31/03/87		
E0000270		SPECIAL TECHNICAL SPECIFICATION - MATERIAL & ENERGY BALANCE	70.0	20/01/87	30/04/87	.0	.0	20/01/87	30/04/87		
E0000280		SPECIAL TECHNICAL SPECIFICATION - MECHANICAL EQUIPMENT	70.0	20/01/87	30/04/87	.0	.0	20/01/87	30/04/87		
E0000290		SPECIAL TECHNICAL SPECIFICATION - ELECTRICAL EQUIPMENT	70.0	20/01/87	30/04/87	.0	.0	20/01/87	30/04/67		
E0000310		SPECIAL TECHNICAL SPECIFICATION - UTILITIES / PIPING	60.0	03/02/87	30/04/87	.0	.0	03/02/87	30/04/87		

ACTIVITY TIME STATUS REPORT

NETWORK TIME SHEDULE FOR THE IMPLENTATION OF A BURMA
SUBNET WELDED STEEL PIPE PLANT / BURMA ALTERNATIVE I BURMA1

RUN DATE 03MAR86

WORK ITEM	ORG COD	DESCRIPTION	DURAT.	START EXPECTED	END EXPECTED	SLACK START	SLACK END	START LATEST	END LATEST	SCHEDULE DATE	DEPT.
E0000320		SPECIAL TECHNICAL SPECIFICATION - CIVIL WORK & STEEL STRUCT.	70.0	20/01/87	30/04/87	.0	.0	20/01/87	30/04/87		
E0000330		SPECIAL TECHNICAL SPECIFICATION - AUXILIARY EQUIPMENT	50.0	17/02/87	30/04/87	.0	.0	17/02/87	30/04/87		
E0000340		QUESTIONAIRES FOR PREQUALIFICAT. OF TURNKEY BIDDERS	15.0	24/02/87	17/03/87	.0	.0	24/02/87	17/03/87		
E0000350		PREQUALIFICATION OF TURNKEY BIDDERS	20.0	31/03/87	30/04/87	.0	.0	31/03/87	30/04/87		
E0000360		PRINTING & DISTRIBUTION OF THE TENDER DOCUMENTS	5.0	30/04/87	08/05/87	.0	.0	30/04/87	08/05/87		
E0000370		TURNKEY BIDDING PERIOD	40.0	08/05/87	09/07/87	.0	.0	08/05/87	09/07/87		
E0000380		EVALUATION OF TURNKEY BIDS	25.0	09/07/87	13/08/87	.0	.0	09/07/87	13/08/87		
E0000390		NEGOTATIONS WITH THE TURNKEY BIDDERS	10.0	13/08/87	27/08/87	.0	.0	13/08/87	27/08/87		
E0000400		TURNKEY CONTRACT DOCUMENTS	5.0	27/08/87	03/09/87	.0	.0	27/08/87	03/09/87		
E0000410		START OF SITE MANAGEMENT	0.0	03/09/87	03/09/87	.0	.0	03/09/87	03/09/87		
F1000000		START OF CONTRACTUAL WORK	0.0	03/09/87	03/09/87	.0	.0	03/09/87	03/09/87		
F1100000		SUPERVISION OF SITE WORK	392.0	03/09/87	22/03/89	.0	.0	03/09/87	22/03/89		
F1400000		CONNECTION OF ELECTRICAL POWER & WATER FOR SITE WORK	10.0	03/09/87	17/09/87	.0	.0	03/09/87	17/09/87		
F1500000		SITE INSTALLATION & PROV. CONNCT OF ELEC. POWER & WAT	20.0	17/09/87	15/10/87	.0	.0	17/09/87	15/10/87		
F1600000		CONNECTION OF ELECTRICAL POWER & UTILITIES	10.0	24/08/88	07/09/88	25.0	25.0	28/09/88	12/10/88		
I0100130		GATE HOUSE & WEIGHING BRIDGE CONSTRUCTION OF BUILDING	80.0	15/10/87	09/02/88	10.0	10.0	29/10/87	23/02/88		
I0100180		GATE HOUSE & WEIGHING BRIDGE FINISHING WORK	30.0	28/12/87	09/02/88	10.0	10.0	12/01/88	23/02/88		
I0100380		GATE HOUSE & WEIGHING BRIDGE INSTALLATION OF EQUIPMENT	10.0	14/09/88	28/09/88	10.0	10.0	28/09/88	12/10/88		
I0100950		GATE HOUSE & WEIGHING BRIDGE TRIAL RUNS & COMMISSIONING	0.0	28/09/88	28/09/88	10.0	10.0	12/10/88	12/10/88		
I0200110		SLITTING LINE /STRIP PREPARATION FOUNDATIONS FOR BUILDING	40.0	15/10/87	11/12/87	.0	.0	15/10/87	11/12/87		
I0200120		SLITTING LINE /STRIP PREPARATION FOUND.F.EQUIP.& FLOOR SLABS	40.0	20/07/88	14/09/88	.0	.0	20/07/88	14/09/88		
I0200180		SLITTING LINE /STRIP PREPARATION FINISHING WORK	15.0	14/09/88	05/10/88	.0	.0	14/09/88	05/10/88		
I0200210		SLITTING LINE /STRIP PREPARATION MANUFACT. OF STEEL STRUCTURE	40.0	07/04/88	07/06/88	.0	.0	07/04/88	07/06/88		
I0200250		SLITTING LINE /STRIP PREPARATION ERECTION OF STEEL STRUCTURE	30.0	07/06/88	20/07/88	.0	.0	07/06/88	20/07/88		
I0200310		SLITTING LINE /STRIP PREPARATION FABRICATION OF EQUIPMENT	160.0	11/12/87	03/08/88	5.0	5.0	18/12/87	10/08/88		
I0200350		SLITTING LINE /STRIP PREPARATION SHIPMENT OF EQUIPMENT	40.0	03/08/88	28/09/88	5.0	5.0	10/08/88	05/10/88		
I0200380		SLITTING LINE /STRIP PREPARATION INSTALLATION OF EQUIPMENT	25.0	05/10/88	10/11/88	.0	.0	05/10/88	10/11/88		
I0200480		SLITTING LINE /STRIP PREPARATION ELECTRICAL INSTALLATION	10.0	19/10/88	03/11/88	5.0	5.0	26/10/88	10/11/88		
I0200580		SLITTING LINE /STRIP PREPARATION PIPING & UTILITY DISTRIBUTN.	10.0	19/10/88	03/11/88	5.0	5.0	26/10/88	10/11/88		

ACTIVITY TIME STATUS REPORT

NETWORK TIME SHEDULE FOR THE IMPLENTATION OF A BURMA
SUBNET WELDED STEEL PIPE PLANT / BURMA ALTERNATIVE I BURMA1

RUN DATE 03MAR86

WORK ITEM	ORG COD	DESCRIPTION	DURAT.	START EXPECTED	END EXPECTED	SLACK START	SLACK END	START LATEST	END LATEST	SCHEDULE DATE	DEPT.
I0200680		SLITTING LINE /STRIP PREPARATION INSTALLATION OF AUX. EQUIPM.	15.0	12/10/88	03/11/88	5.0	5.0	19/10/88	10/11/88		
I0200700		SLITTING LINE /STRIP PREPARATION FINISHING WORK	5.0	26/10/88	03/11/88	5.0	5.0	03/11/88	10/11/88		
I0200950		SLITTING LINE /STRIP PREPARATION TRIAL RUNS & COMMISSIONING	10.0	10/11/88	25/11/88	.0	.0	10/11/88	25/11/88		
I0200990		SLITTING LINE /STRIP PREPARATION START OF PRODUCTION	0.0	25/11/88	25/11/88	.0	.0	25/11/88	25/11/88		
I0300110		PIPE PRODUCTION AREA FOUNDATIONS FOR BUILDING	35.0	05/01/88	23/02/88	30.0	30.0	16/02/88	07/04/88		
I0300120		PIPE PRODUCTION AREA FOUND.F.EQUIP.& FLOOR SLABS	60.0	13/05/88	10/08/88	5.0	5.0	20/05/88	17/08/88		
I0300180		PIPE PRODUCTION AREA FINISHING WORK	20.0	13/07/88	10/08/88	5.0	5.0	20/07/88	17/08/88		
I0300210		PIPE PRODUCTION AREA MANUFACT. OF STEEL STRUCTURE	35.0	09/02/88	29/03/88	5.0	5.0	16/02/88	07/04/88		
I0300250		PIPE PRODUCTION AREA ERECTION OF STEEL STRUCTURE	30.0	29/03/88	13/05/88	5.0	5.0	07/04/88	20/05/88		
I0300310		PIPE PRODUCTION AREA FABRICATION OF EQUIPMENT	200.0	03/09/87	22/06/88	.0	.0	03/09/87	22/06/88		
I0300350		PIPE PRODUCTION AREA SHIPMENT OF EQUIPMENT	40.0	22/06/88	17/08/88	.0	.0	22/06/88	17/08/88		
I0300380		PIPE PRODUCTION AREA INSTALLATION OF EQUIPMENT	120.0	17/08/88	06/02/89	.0	.0	17/08/88	06/02/89		
I0300480		PIPE PRODUCTION AREA ELECTRICAL INSTALLATION	60.0	10/11/88	06/02/89	.0	.0	10/11/88	06/02/89		
I0300580		PIPE PRODUCTION AREA PIPING & UTILITY DISTRIBUTN.	40.0	25/11/88	06/02/89	10.0	.0	09/12/88	06/02/89		
I0300680		PIPE PRODUCTION AREA INSTALLATION OF AUX. EQUIPM.	20.0	23/12/88	06/02/89	10.0	.0	09/01/89	06/02/89		
I0300700		PIPE PRODUCTION AREA FINISHING WORK	15.0	09/01/89	06/02/89	5.0	.0	16/01/89	06/02/89		
I0300950		PIPE PRODUCTION AREA TRIAL RUNS & COMMISSIONING	30.0	06/02/89	20/03/89	.0	.0	06/02/89	20/03/89		
I0300990		PIPE PRODUCTION AREA START OF PRODUCTION	0.0	20/03/89	20/03/89	.0	.0	20/03/89	20/03/89		
I0500110		PIPE FINISHING AREA / STORAGES FOUNDATIONS FOR BUILDING	60.0	01/03/88	30/05/88	.0	.0	01/03/88	30/05/88		
I0500120		PIPE FINISHING AREA / STORAGES FOUND.F.EQUIP.& FLOOR SLABS	40.0	27/07/88	21/09/88	.0	.0	27/07/88	21/09/88		
I0500180		PIPE FINISHING AREA / STORAGES FINISHING WORK	20.0	24/08/88	21/09/88	.0	.0	24/08/88	21/09/88		
I0500210		PIPE FINISHING AREA / STORAGES MANUFACT. OF STEEL STRUCTURE	45.0	22/03/88	30/05/88	.0	.0	22/03/88	30/05/88		
I0500250		PIPE FINISHING AREA / STORAGES ERECTION OF STEEL STRUCTURE	40.0	30/05/88	27/07/88	.0	.0	30/05/88	27/07/88		
I0500310		PIPE FINISHING AREA / STORAGES FABRICATION OF EQUIPMENT	150.0	18/12/87	27/07/88	.0	.0	18/12/87	27/07/88		
I0500350		PIPE FINISHING AREA / STORAGES SHIPMENT OF EQUIPMENT	40.0	27/07/88	21/09/88	.0	.0	27/07/88	21/09/88		
I0500380		PIPE FINISHING AREA / STORAGES INSTALLATION OF EQUIPMENT	30.0	21/09/88	03/11/88	.0	.0	21/09/88	03/11/88		
I0500480		PIPE FINISHING AREA / STORAGES ELECTRICAL INSTALLATION	20.0	05/10/88	03/11/88	.0	.0	05/10/88	03/11/88		
I0500580		PIPE FINISHING AREA / STORAGES PIPING & UTILITY DISTRIBUTN.	10.0	19/10/88	03/11/88	.0	.0	19/10/88	03/11/88		
I0500680		PIPE FINISHING AREA / STORAGES INSTALLATION OF AUX. EQUIPM.	10.0	05/10/88	03/11/88	10.0	.0	19/10/88	03/11/88		

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                                          ACTIVITY TIME STATUS REPORT                                                             PAGE     4

NETWORK                              TIME SHEDULE FOR THE IMPLENTATION OF A           BURMA
SUBNET                          WELDED STEEL PIPE PLANT / BURMA    ALTERNATIVE I      BURMA1                                 RUN DATE 03MAR86

  WORK     ORG      DESCRIPTION                            DURAT.    START          END        SLACK     SLACK      START          END        SCHEDULE     DEPT.
  ITEM     COD                                                      EXPECTED      EXPECTED     START      END       LATEST        LATEST        DATE

I0500700        PIPE FINISHING AREA / STORAGES           5.0    19/10/88      03/11/88      5.0        .0      26/10/88      03/11/88
                FINISHING WORK
I0500950        PIPE FINISHING AREA / STORAGES          10.0    03/11/88      18/11/88       .0        .0      03/11/88      18/11/88
                TRIAL RUNS & COMMISSIONING
I0500990        PIPE FINISHING AREA / STORAGES           0.0    18/11/88      18/11/88       .0        .0      18/11/88      18/11/88
                START OF PRODUCTION
I0600110        WORKSHOPS & SPARE PARTS STORAGES        30.0    27/07/88      07/09/88     20.0      20.0      24/08/88      05/10/88
                FOUNDATIONS FOR BUILDING
I0600120        WORKSHOPS & SPARE PARTS STORAGES        25.0    26/10/88      02/12/88      5.0       5.0      03/11/88      09/12/88
                FOUND.F.EQUIP.& FLOOR SLABS
I0600180        WORKSHOPS & SPARE PARTS STORAGES        10.0    18/11/88      02/12/88      5.0       5.0      25/11/88      09/12/88
                FINISHING WORK
I0600210        WORKSHOPS & SPARE PARTS STORAGES        20.0    31/08/88      28/09/88      5.0       5.0      07/09/88      05/10/88
                MANUFACT. OF STEEL STRUCTURE
I0600250        WORKSHOPS & SPARE PARTS STORAGES        20.0    28/09/88      26/10/88      5.0       5.0      05/10/88      03/11/88
                ERECTION OF STEEL STRUCTURE
I0600310        WORKSHOPS & SPARE PARTS STORAGES       180.0    26/01/88      12/10/88       .0        .0      26/01/88      12/10/88
                FABRICATION OF EQUIPMENT
I0600350        WORKSHOPS & SPARE PARTS STORAGES        40.0    12/10/88      09/12/88       .0        .0      12/10/88      09/12/88
                SHIPMENT OF EQUIPMENT
I0600380        WORKSHOPS & SPARE PARTS STORAGES        20.0    09/12/88      09/01/89       .0        .0      09/12/88      09/01/89
                INSTALLATION OF EQUIPMENT
I0600480        WORKSHOPS & SPARE PARTS STORAGES        20.0    09/12/88      09/01/89       .0        .0      09/12/88      09/01/89
                ELECTRICAL INSTALLATION
I0600580        WORKSHOPS & SPARE PARTS STORAGES        10.0    16/12/88      09/01/89      5.0        .0      23/12/88      09/01/89
                PIPING & UTILITY DISTRIBUTN.
I0600680        WORKSHOPS & SPARE PARTS STORAGES        15.0    16/12/88      09/01/89       .0        .0      16/12/88      09/01/89
                INSTALLATION OF AUX. EQUIPM.
I0600700        WORKSHOPS & SPARE PARTS STORAGES         5.0    02/01/89      09/01/89       .0        .0      02/01/89      09/01/89
                FINISHING WORK
I0600950        WORKSHOPS & SPARE PARTS STORAGES        10.0    09/01/89      23/01/89       .0        .0      09/01/89      23/01/89
                TRIAL RUNS & COMMISSIONING
I0600990        WORKSHOPS & SPARE PARTS STORAGES         0.0    23/01/89      23/01/89       .0        .0      23/01/89      23/01/89
                START OF PRODUCTION
I0700310        ELECTRICAL POWER DISTIBUTION           120.0    27/11/87      20/05/88       .0        .0      27/11/87      20/05/88
                FABRICATION OF EQUIPMENT
I0700350        ELECTRICAL POWER DISTIBUTION            40.0    20/05/88      20/07/88       .0        .0      20/05/88      20/07/88
                SHIPMENT OF EQUIPMENT
I0700380        ELECTRICAL POWER DISTIBUTION            70.0    20/07/88      26/10/88       .0        .0      20/07/88      26/10/88
                INSTALLATION OF EQUIPMENT
I0700680        ELECTRICAL POWER DISTIBUTION            30.0    31/08/88      26/10/88     10.0        .0      14/09/88      26/10/88
                INSTALLATION OF AUX. EQUIPM.
I0700950        ELECTRICAL POWER DISTIBUTION            10.0    26/10/88      10/11/88       .0        .0      26/10/88      10/11/88
                TRIAL RUNS & COMMISSIONING
I0750130        ELECTRICAL MAIN STATION BUILDING       120.0    09/02/88      03/08/88       .0        .0      09/02/88      03/08/88
                CONSTRUCTION OF BUILDING
I0750180        ELECTRICAL MAIN STATION BUILDING        40.0    20/05/88      03/08/88     10.0        .0      07/06/88      03/08/88
                FINISHING WORK
I0750380        ELECTRICAL MAIN STATION BUILDING        50.0    03/08/88      12/10/88       .0        .0      03/08/88      12/10/88
                INSTALLATION OF EQUIPMENT
I0750680        ELECTRICAL MAIN STATION BUILDING        20.0    14/09/88      12/10/88       .0        .0      14/09/88      12/10/88
                INSTALLATION OF AUX. EQUIPM.
I0750950        ELECTRICAL MAIN STATION BUILDING        10.0    12/10/88      26/10/88       .0        .0      12/10/88      26/10/88
                TRIAL RUNS & COMMISSIONING
I0900310        AUXILIARY & UTILITIES DISTRIBUT.       120.0    17/09/87      08/03/88       .0        .0      17/09/87      08/03/88
                FABRICATION OF EQUIPMENT
I0900350        AUXILIARY & UTILITIES DISTRIBUT.        40.0    08/03/88      05/05/88       .0        .0      08/03/88      05/05/88
                SHIPMENT OF EQUIPMENT
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NETWORK                     TIME SHEDULE FOR THE IMPLENTATION OF A          BURMA
SUBNET               WELDED STEEL PIPE PLANT / BURMA   ALTERNATIVE I        BURMA1                                         RUN DATE 03MAR86

 WORK     ORG     DESCRIPTION                    DURAT.   START       END      SLACK    SLACK     START        END       SCHEDULE   DEPT.
 ITEM     COD                                            EXPECTED   EXPECTED   START     END      LATEST      LATEST       DATE

I0900380      AUXILIARY & UTILITIES DISTRIBUT.  120.0  05/05/88   26/10/88      .0       .0    05/05/88    26/10/88
              INSTALLATION OF EQUIPMENT
I0900700      AUXILIARY & UTILITIES DISTRIBUT.   40.0  17/08/88   12/10/88    10.0     10.0    31/08/88    26/10/88
              FINISHING WORK
I0900950      AUXILIARY & UTILITIES DISTRIBUT.   10.0  26/10/88   10/11/88      .0       .0    26/10/88    10/11/88
              TRIAL RUNS & COMMISSIONING
I0950140      WATER TREATM. PLANT & MOTOR POOL  100.0  09/02/88   06/07/88      .0       .0    09/02/88    06/07/88
              CONSTRUCTION / EXEC. OF WORK
I0950380      WATER TREATM. PLANT & MOTOR POOL   40.0  06/07/88   31/08/88      .0       .0    06/07/88    31/08/88
              INSTALLATION OF EQUIPMENT
I0950700      WATER TREATM. PLANT & MOTOR POOL   20.0  03/08/88   31/08/88      .0       .0    03/08/88    31/08/88
              FINISHING WORK
I1000130      MAIN ADMINISTRATION BUILDING      120.0  02/02/88   27/07/88      .0       .0    02/02/88    27/07/88
              CONSTRUCTION OF BUILDING
I1000180      MAIN ADMINISTRATION BUILDING       60.0  27/07/88   19/10/88      .0       .0    27/07/88    19/10/88
              FINISHING WORK
I1000380      MAIN ADMINISTRATION BUILDING       40.0  10/08/88   19/10/88    10.0       .0    24/08/88    19/10/88
              INSTALLATION OF EQUIPMENT
I1000480      MAIN ADMINISTRATION BUILDING       50.0  10/08/88   19/10/88      .0       .0    10/08/88    19/10/88
              ELECTRICAL INSTALLATION
I1000800      MAIN ADMINISTRATION BUILDING       15.0  19/10/88   10/11/88      .0       .0    19/10/88    10/11/88
              PLACING OF OUTFIT
I1000950      MAIN ADMINISTRATION BUILDING        0.0  10/11/88   10/11/88      .0       .0    10/11/88    10/11/88
              TRIAL RUNS & COMMISSIONING
I1100100      INTERNAL INFRASTRUCTURE            60.0  15/10/87   12/01/88      .0       .0    15/10/87    12/01/88
              BOUNDARY WALL & MAIN-GATE
I1100140      INTERNAL INFRASTRUCTURE           250.0  01/03/88   27/02/89      .0       .0    01/03/88    27/02/89
              CONSTRUCTION / EXEC. OF WORK
I1100200      INTERNAL INFRASTRUCTURE           180.0  14/06/88   27/02/89      .0       .0    14/06/88    27/02/89
              ROADS & PLACES
I1100300      INTERNAL INFRASTRUCTURE           200.0  13/05/88   27/02/89      .0       .0    13/05/88    27/02/89
              DRAINAGE SYSTEM
I1200110      LINING & COATING PLANT / STORES    60.0  12/11/87   09/02/88      .0       .0    12/11/87    09/02/88
              FOUNDATIONS FOR BUILDING
I1200120      LINING & COATING PLANT / STORES    70.0  07/06/88   14/09/88      .0       .0    07/06/88    14/09/88
              FOUND.F.EQUIP.& FLOOR SLABS
I1200180      LINING & COATING PLANT / STORES    20.0  17/08/88   14/09/88      .0       .0    17/08/98    14/09/88
              FINISHING WORK
I1200210      LINING & COATING PLANT / STORES    65.0  29/10/87   02/02/88     5.0      5.0    05/11/87    09/02/88
              MANUFACT. OF STEEL STRUCTURE
I1200250      LINING & COATING PLANT / STORES    80.0  09/02/88   07/06/88      .0       .0    09/02/88    07/06/88
              ERECTION OF STEEL STRUCTURE
I1200310      LINING & COATING PLANT / STORES   200.0  01/10/87   20/07/88      .0       .0    01/10/87    20/07/88
              FABRICATION OF EQUIPMENT
I1200350      LINING & COATING PLANT / STORES    40.0  20/07/88   14/09/88      .0       .0    20/07/88    14/09/88
              SHIPMENT OF EQUIPMENT
I1200380      LINING & COATING PLANT / STORES   100.0  14/09/88   06/02/89      .0       .0    14/09/88    06/02/89
              INSTALLATION OF EQUIPMENT
I1200480      LINING & COATING PLANT / STORES    60.0  10/11/88   06/02/89      .0       .0    10/11/88    06/02/89
              ELECTRICAL INSTALLATION
I1200580      LINING & COATING PLANT / STORES    40.0  09/12/88   06/02/89      .0       .0    09/12/88    06/02/89
              PIPING & UTILITY DISTRIBUTN.
I1200680      LINING & COATING PLANT / STORES    20.0  09/01/89   06/02/89      .0       .0    09/01/89    06/02/89
              INSTALLATION OF AUX. EQUIPM.
I1200700      LINING & COATING PLANT / STORES    20.0  23/12/88   06/02/89    10.0       .0    09/01/89    06/02/89
              FINISHING WORK
I1200950      LINING & COATING PLANT / STORES    30.0  06/02/89   20/03/89      .0       .0    06/02/89    20/03/89
              TRIAL RUNS & COMMISSIONING
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                                        ACTIVITY TIME STATUS REPORT                                                                PAGE     6

      NETWORK                             TIME SHEDULE FOR THE IMPLENTATION OF A          BURMA
      SUBNET                          WELDED STEEL PIPE PLANT / BURMA   ALTERNATIVE I     BURMA1                                  RUN DATE 03MAR86

        WORK    ORG     DESCRIPTION                     DURAT.   START       END       SLACK   SLACK     START       END      SCHEDULE   DEPT.
  - - - - ITEM  COD                                            EXPECTED    EXPECTED    START    END     LATEST      LATEST      DATE

      I1200990      LINING & COATING PLANT / STORES      0.0  20/03/89    20/03/89      .0      .0    20/03/89    20/03/89
                    START OF PRODUCTION
      I9000000      TAKING OVER & ACCEPTANCE OF THE      0.0  22/03/89    22/03/89      .0      .0    22/03/89    22/03/89
                    PLANT
      I9900000      START OF PRODUCTION OF THE           3.0  22/03/89    29/03/89      .0      .0    22/03/89    29/03/89
                    COMPLETE PLANT
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ACTIVITY TIME STATUS REPORT

NETWORK TIME SHEDULE FOR THE IMPLENTATION OF A BURMA
SUBNET WELDED STEEL PIPE PLANT / BURMA ALTERNATIVE II BURMA2

RUN DATE 03MAR86

WORK ITEM	ORG COD	DESCRIPTION	DURAT.	START EXPECTED	END EXPECTED	SLACK START	SLACK END	START LATEST	END LATEST	SCHEDULE DATE	DEPT.
E0000010		NOMINATION OF ENGINEERING - CONSULTANT BY THE OWNER	0.0	01/10/86	01/10/86	.0	.0	01/10/86	01/10/86		
E0000020		COMING INTO FORCE OF CONTRACT	0.0	08/10/86	08/10/86	.0	.0	08/10/86	08/10/86		
E0000030		ELABORATION OF PROJECT SCHEDULE	30.0	08/10/86	20/11/86	.0	.0	08/10/86	20/11/86		
E0000040		PROCUREMENT OF PLANT SITE	20.0	01/10/86	29/10/86	.0	5.0	01/10/86	05/11/86		
E0000050		SPECIFICATION FOR GEODETICAL & SUBSOIL SURVEY	25.0	08/10/86	12/11/86	.0	.0	08/10/86	12/11/86		
E0000060		CONTRACT FOR GEODETICAL SURVEY & SOIL FIELD WORK	5.0	27/11/86	04/12/86	.0	.0	27/11/86	04/12/86		
E0000070		EXECUTION OF FIELD WORK	20.0	04/12/86	06/01/87	.0	.0	04/12/86	06/01/87		
E0000080		FINAL REPORT & MAPS	10.0	06/01/87	20/01/87	.0	.0	06/01/87	20/01/87		
E0000090		SUPERVISION OF FIELD WORK	20.0	04/12/86	06/01/87	.0	.0	04/12/86	06/01/87		
E0000100		COMPILE FINAL INFRASTRUCT. DATA	10.0	06/01/87	20/01/87	.0	.0	06/01/87	20/01/87		
E0000110		COLLECT THE PREVAILING LOCAL STANDARDS & REGULATIONS	25.0	05/11/86	11/12/86	5.0	5.0	12/11/86	18/12/86		
E0000120		BASIC & ARCHITECTURAL DESIGN FOR TENDER PURPOSES	60.0	08/10/86	06/01/87	10.0	10.0	22/10/86	20/01/87		
E0000130		START OF TENDER ENGINEERING	0.0	06/01/87	06/01/87	.0	.0	06/01/87	06/01/87		
E0000140		CLASSIFICATION SYSTEM FOR PLANT EQUIPMENT	45.0	29/10/86	06/01/87	.0	.0	29/10/86	06/01/87		
E0000150		BIDDING INSTRUCTIONS	15.0	20/01/87	10/02/87	.0	10.0	20/01/87	24/02/87		
E0000160		GENERAL TECHNICAL SPECIFICATION - KNOW HOW TRANSFER	30.0	06/01/87	17/02/87	.0	.0	06/01/87	17/02/87		
E0000170		GENERAL TECHNICAL SPECIFICATION - DESCRIPTION OF LOCATION	30.0	06/01/87	17/02/87	.0	.0	06/01/87	17/02/87		
E0000180		GENERAL TECHNICAL SPECIFICATION - STANDARDS & REGULATIONS	30.0	06/01/87	17/02/87	.0	.0	06/01/87	17/02/87		
E0000190		GENERAL TECHNICAL SPECIFICATION - SEE / LAND / AIR TRANSPORT	30.0	06/01/87	17/02/87	.0	.0	06/01/87	17/02/87		
E0000210		GENERAL TECHNICAL SPECIFICATION - PROJECT / TIME CONTROL	30.0	06/01/87	17/02/87	.0	.0	06/01/87	17/02/87		
E0000220		GENERAL TECHNICAL SPECIFICATION - DOCUMENTATION	30.0	06/01/87	17/02/87	.0	.0	06/01/87	17/02/87		
E0000230		GENERAL TECHNICAL SPECIFICATION - PRODUCT. & MATERIAL FLOW	30.0	06/01/87	17/02/87	.0	.0	06/01/87	17/02/87		
E0000240		GENERAL TECHNICAL SPECIFICATION - POLLUTION & HEALTH REGULAT	30.0	06/01/87	17/02/87	.0	.0	06/01/87	17/02/87		
E0000250		GENERAL COMMERCIAL CONDITIONS	70.0	06/01/87	14/04/87	.0	.0	06/01/87	14/04/87		
E0000260		SPECIAL TECHNICAL SPECIFICATION - LAYOUTS & TENDER DRAWINGS	50.0	20/01/87	31/03/87	.0	.0	20/01/87	31/03/87		
E0000270		SPECIAL TECHNICAL SPECIFICATION - MATERIAL & ENERGY BALANCE	70.0	20/01/87	30/04/87	.0	.0	20/01/87	30/04/87		
E0000280		SPECIAL TECHNICAL SPECIFICATION - MECHANICAL EQUIPMENT	70.0	20/01/87	30/04/87	.0	.0	20/01/87	30/04/87		
E0000290		SPECIAL TECHNICAL SPECIFICATION - ELECTRICAL EQUIPMENT	70.0	20/01/87	30/04/87	.0	.0	20/01/87	30/04/87		
E0000310		SPECIAL TECHNICAL SPECIFICATION - UTILITIES / PIPING	60.0	03/02/87	30/04/87	.0	.0	03/02/87	30/04/87		

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                                     ACTIVITY TIME STATUS REPORT                                                    PAGE     2

NETWORK                           TIME SHEDULE FOR THE IMPLENTATION OF A        BURMA
SUBNET                        WELDED STEEL PIPE PLANT / BURMA   ALTERNATIVE II   BURMA2                               RUN DATE 03MAR86

  WORK     ORG    DESCRIPTION                       DURAT.    START        END       SLACK     SLACK      START        END      SCHEDULE    DEPT.
  ITEM     COD                                              EXPECTED    EXPECTED     START      END      LATEST      LATEST      DATE

E0000320      SPECIAL TECHNICAL SPECIFICATION      70.0  20/01/87    30/04/87       .0        .0     20/01/87    30/04/87
              - CIVIL WORK & STEEL STRUCT.
E0000330      SPECIAL TECHNICAL SPECIFICATION      50.0  17/02/87    30/04/87       .0        .0     17/02/87    30/04/87
              - AUXILIARY EQUIPMENT
E0000340      QUESTIONAIRES FOR PREQUALIFICAT.     15.0  24/02/87    17/03/87       .0        .0     24/02/87    17/03/87
              OF TURNKEY BIDDERS
E0000350      PREQUALIFICATION OF TURNKEY          20.0  31/03/87    30/04/87       .0        .0     31/03/87    30/04/87
              BIDDERS
E0000360      PRINTING & DISTRIBUTION OF THE        5.0  30/04/87    08/05/87       .0        .0     30/04/87    08/05/87
              TENDER DOCUMENTS
E0000370      TURNKEY BIDDING PERIOD               40.0  08/05/87    09/07/87       .0        .0     08/05/87    09/07/87

E0000380      EVALUATION OF TURNKEY BIDS           25.0  09/07/87    13/08/87       .0        .0     09/07/87    13/08/87

E0000390      NEGOTIATIONS WITH THE TURNKEY        10.0  13/08/87    27/08/87       .0        .0     13/08/87    27/08/87
              BIDDERS
E0000400      TURNKEY CONTRACT DOCUMENTS            5.0  27/08/87    03/09/87       .0        .0     27/08/87    03/09/87

E0000410      START OF SITE MANAGEMENT              0.0  03/09/87    03/09/87       .0        .0     03/09/87    03/09/87

F1000000      START OF CONTRACTUAL WORK             0.0  03/09/87    03/09/87       .0        .0     03/09/87    03/09/87

F1100000      SUPERVISION OF SITE WORK            417.0  03/09/87    28/04/89       .0        .0     03/09/87    28/04/89

F1400000      CONNECTION OF ELECTRICAL POWER       10.0  03/09/87    17/09/87       .0        .0     03/09/87    17/09/87
              & WATER FOR SITE WORK
F1500000      SITE INSTALLATION                    20.0  17/09/87    15/10/87       .0        .0     17/09/87    15/10/87

F1600000      CONNECTION OF ELECTRICAL POWER &     10.0  28/09/88    12/10/88       .0        .0     28/09/88    12/10/88
              UTILITIES
I0100130      GATE HOUSE & WEIGHING BRIDGE         80.0  15/10/87    09/02/88     10.0      10.0     29/10/87    23/02/88
              CONSTRUCTION OF BUILDING
I0100180      GATE HOUSE & WEIGHING BRIDGE         30.0  28/12/87    09/02/88     10.0      10.0     12/01/88    23/02/88
              FINISHING WORK
I0100380      GATE HOUSE & WEIGHING BRIDGE         10.0  14/09/88    28/09/88     10.0      10.0     28/09/88    12/10/88
              INSTALLATION OF EQUIPMENT
I0100950      GATE HOUSE & WEIGHING BRIDGE          0.0  28/09/88    28/09/88     10.0      10.0     12/10/88    12/10/88
              TRIAL RUNS & COMMISSIONING
I0200110      SLITTING LINE /STRIP PREPARATION     40.0  29/10/87    28/12/87      5.0       5.0     05/11/87    05/01/88
              FOUNDATIONS FOR BUILDING
    0120      SLITTING LINE /STRIP PREPARATION     40.0  20/07/88    14/09/88       .0        .0     20/07/88    14/09/88
              FOUND.F.EQUIP.& FLOOR SLABS
      80      SLITTING LINE /STRIP PREPARATION     15.0  14/09/88    05/10/88       .0        .0     14/09/88    05/10/88
              FINISHING WORK
I0200210      SLITTING LINE /STRIP PREPARATION     40.0  07/04/88    07/06/88       .0        .0     07/04/88    07/06/88
              MANUFACT. OF STEEL STRUCTURE
I0200250      SLITTING LINE /STRIP PREPARATION     30.0  07/06/88    20/07/88       .0        .0     07/06/88    20/07/88
              ERECTION OF STEEL STRUCTURE
I0200310      SLITTING LINE /STRIP PREPARATION    160.0  11/12/87    03/08/88      5.0       5.0     18/12/87    10/08/88
              FABRICATION OF EQUIPMENT
I0200350      SLITTING LINE /STRIP PREPARATION     40.0  03/08/88    28/09/88      5.0       5.0     10/08/88    05/10/88
              SHIPMENT OF EQUIPMENT
I0200380      SLITTING LINE /STRIP PREPARATION     25.0  05/10/88    10/11/88       .0        .0     05/10/88    10/11/88
              INSTALLATION OF EQUIPMENT
I0200480      SLITTING LINE /STRIP PREPARATION     10.0  19/10/88    03/11/88      5.0       5.0     26/10/88    10/11/88
              ELECTRICAL INSTALLATION
I0200580      SLITTING LINE /STRIP PREPARATION     10.0  19/10/88    03/11/88      5.0       5.0     26/10/88    10/11/88
              PIPING & UTILITY DISTRIBUTN.
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ACTIVITY TIME STATUS REPORT

NETWORK TIME SHEDULE FOR THE IMPLENTATION OF A BURMA
SUBNET WELDED STEEL PIPE PLANT / BURMA ALTERNATIVE II BURMA2

RUN DATE 03MAR86

WORK ITEM	ORG COD	DESCRIPTION	DURAT.	START EXPECTED	END EXPECTED	SLACK START	SLACK END	START LATEST	END LATEST	SCHEDULE DATE	DEPT.
10200680		SLITTING LINE /STRIP PREPARATION INSTALLATION OF AUX. EQUIPM.	15.0	12/10/88	03/11/88	5.0	5.0	19/10/88	10/11/88		
10200700		SLITTING LINE /STRIP PREPARATION FINISHING WORK	5.0	26/10/88	03/11/88	5.0	5.0	03/11/88	10/11/88		
10200950		SLITTING LINE /STRIP PREPARATION TRIAL RUNS & COMMISSIONING	10.0	10/11/88	25/11/88	.0	.0	10/11/88	25/11/88		
10200990		SLITTING LINE /STRIP PREPARATION START OF PRODUCTION	0.0	25/11/88	25/11/88	.0	.0	25/11/88	25/11/88		
10300110		PIPE PRODUCTION AREA FOUNDATIONS FOR BUILDING	35.0	19/01/88	08/03/88	20.0	20.0	16/02/88	07/04/88		
10300120		PIPE PRODUCTION AREA FOUND.F.EQUIP.& FLOOR SLABS	60.0	13/05/88	10/08/88	5.0	5.0	20/05/88	17/08/88		
10300180		PIPE PRODUCTION AREA FINISHING WORK	20.0	13/07/88	10/08/88	5.0	5.0	20/07/88	17/08/88		
10300210		PIPE PRODUCTION AREA MANUFACT. OF STEEL STRUCTURE	35.0	09/02/88	29/03/88	5.0	5.0	16/02/88	07/04/88		
10300250		PIPE PRODUCTION AREA ERECTION OF STEEL STRUCTURE	30.0	29/03/88	13/05/88	5.0	5.0	07/04/88	20/05/88		
10300310		PIPE PRODUCTION AREA FABRICATION OF EQUIPMENT	200.0	03/09/87	22/06/88	.0	.0	03/09/87	22/06/88		
10300350		PIPE PRODUCTION AREA SHIPMENT OF EQUIPMENT	40.0	22/06/88	17/08/88	.0	.0	22/06/88	17/08/88		
10300380		PIPE PRODUCTION AREA INSTALLATION OF EQUIPMENT	120.0	17/08/88	06/02/89	.0	.0	17/08/88	06/02/89		
10300480		PIPE PRODUCTION AREA ELECTRICAL INSTALLATION	60.0	10/11/88	06/02/89	.0	.0	10/11/88	06/02/89		
10300580		PIPE PRODUCTION AREA PIPING & UTILITY DISTRIBUTN.	40.0	25/11/88	06/02/89	10.0	.0	09/12/88	06/02/89		
10300680		PIPE PRODUCTION AREA INSTALLATION OF AUX. EQUIPM.	20.0	23/12/88	06/02/89	10.0	.0	09/01/89	06/02/89		
10300700		PIPE PRODUCTION AREA FINISHING WORK	15.0	09/01/89	06/02/89	5.0	.0	16/01/89	06/02/89		
10300950		PIPE PRODUCTION AREA TRIAL RUNS & COMMISSIONING	30.0	06/02/89	20/03/89	.0	.0	06/02/89	20/03/89		
10300990		PIPE PRODUCTION AREA START OF PRODUCTION	0.0	20/03/89	20/03/89	.0	.0	20/03/89	20/03/89		
10400110		PIPE PICKLING AREA FOUNDATIONS FOR BUILDING	60.0	11/12/87	08/03/88	5.0	5.0	18/12/87	15/03/88		
10400120		PIPE PICKLING AREA FOUND.F.EQUIP.& FLOOR SLABS	70.0	06/07/88	12/10/88	5.0	5.0	13/07/88	19/10/88		
10400180		PIPE PICKLING AREA FINISHING WORK	20.0	14/09/88	12/10/88	5.0	5.0	21/09/88	19/10/88		
10400210		PIPE PICKLING AREA MANUFACT. OF STEEL STRUCTURE	65.0	27/11/87	01/03/88	10.0	10.0	11/12/87	15/03/88		
10400250		PIPE PICKLING AREA ERECTION OF STEEL STRUCTURE	80.0	08/03/88	06/07/88	5.0	5.0	15/03/88	13/07/88		
10400310		PIPE PICKLING AREA FABRICATION OF EQUIPMENT	200.0	29/10/87	17/08/88	5.0	5.0	05/11/87	24/08/88		
10400350		PIPE PICKLING AREA SHIPMENT OF EQUIPMENT	40.0	17/08/88	12/10/88	5.0	5.0	24/08/88	19/10/88		
10400380		PIPE PICKLING AREA INSTALLATION OF EQUIPMENT	100.0	12/10/88	06/03/89	5.0	5.0	19/10/88	13/03/89		
10400480		PIPE PICKLING AREA ELECTRICAL INSTALLATION	60.0	09/12/88	06/03/89	5.0	5.0	16/12/88	13/03/89		
10400580		PIPE PICKLING AREA PIPING & UTILITY DISTRIBUTN.	40.0	09/01/89	06/03/89	5.0	5.0	16/01/89	13/03/89		
10400680		PIPE PICKLING AREA INSTALLATION OF AUX. EQUIPM.	20.0	06/02/89	06/03/89	5.0	5.0	13/02/89	13/03/89		

ACTIVITY TIME STATUS REPORT

NETWORK TIME SHEDULE FOR THE IMPLENTATION OF A BURMA
SUBNET WELDED STEEL PIPE PLANT / BURMA ALTERNATIVE II BURMA2

RUN DATE 03MAR86

WORK ITEM	ORG COD	DESCRIPTION	DURAT.	START EXPECTED	END EXPECTED	SLACK START	SLACK END	START LATEST	END LATEST	SCHEDULE DATE	DEPT.
I0400700		PIPE PICKLING AREA FINISHING WORK	20.0	23/01/89	06/03/89	15.0	5.0	13/02/89	13/03/89		
I0400950		PIPE PICKLING AREA TRIAL RUNS & COMMISSIONING	30.0	13/03/89	26/04/89	.0	.0	13/03/89	26/04/89		
I040095[illegible]		PIPE PICKLING AREA START OF PRODUCTION	0.0	26/04/89	26/04/89	.0	.0	26/04/89	26/04/89		
I0450110		GALVANIZATION AREA FOUNDATIONS FOR BUILDING	70.0	29/10/87	09/02/88	.0	.0	29/10/87	09/02/88		
I0450120		GALVANIZATION AREA FOUND.F.EQUIP.& FLOOR SLABS	80.0	05/05/88	31/08/88	.0	.0	05/05/88	31/08/88		
I0450180		GALVANIZATION AREA FINISHING WORK	30.0	06/07/88	31/08/88	10.0	.0	20/07/88	31/08/88		
I0450210		GALVANIZATION AREA MANUFACT. OF STEEL STRUCTURE	50.0	27/11/87	09/02/88	.0	.0	27/11/87	09/02/88		
I0450250		GALVANIZATION AREA ERECTION OF STEEL STRUCTURE	60.0	09/02/88	05/05/88	.0	.0	09/02/88	05/05/88		
I0450310		GALVANIZATION AREA FABRICATION OF EQUIPMENT	170.0	29/10/87	06/07/88	.0	.0	29/10/87	06/07/88		
I0450350		GALVANIZATION AREA SHIPMENT OF EQUIPMENT	40.0	06/07/88	31/08/88	.0	.0	06/07/88	31/08/88		
I0450380		GALVANIZATION AREA INSTALLATION OF EQUIPMENT	140.0	31/08/88	20/03/89	.0	.0	31/08/88	20/03/89		
I0450480		GALVANIZATION AREA ELECTRICAL INSTALLATION	100.0	26/10/88	20/03/89	.0	.0	26/10/88	20/03/89		
I0450580		GALVANIZATION AREA PIPING & UTILITY DISTRIBUTN.	80.0	10/11/88	06/03/89	10.0	10.0	25/11/88	20/03/89		
I0450680		GALVANIZATION AREA INSTALLATION OF AUX. EQUIPM.	30.0	23/01/89	06/03/89	10.0	10.0	06/02/89	20/03/89		
I0450700		GALVANIZATION AREA FINISHING WORK	20.0	06/02/89	06/03/89	10.0	10.0	20/02/89	20/03/89		
I0450950		GALVANIZATION AREA TRIAL RUNS & COMMISSIONING	25.0	20/03/89	26/04/89	.0	.0	20/03/89	26/04/89		
I0450990		GALVANIZATION AREA START OF PRODUCTION	0.0	26/04/89	26/04/89	.0	.0	26/04/89	26/04/89		
I0490110		NEUTRALIZATION PLANT FOUNDATIONS FOR BUILDING	40.0	15/03/88	13/05/88	5.0	5.0	22/03/88	20/05/88		
I0490120		NEUTRALIZATION PLANT FOUND.F.EQUIP.& FLOOR SLABS	45.0	22/06/88	24/08/88	5.0	5.0	29/06/88	31/08/88		
I0490180		NEUTRALIZATION PLANT FINISHING WORK	20.0	27/07/88	24/08/88	5.0	5.0	03/08/88	31/08/88		
I0490210		NEUTRALIZATION PLANT MANUFACT. OF STEEL STRUCTURE	30.0	22/03/88	05/05/88	10.0	10.0	07/04/88	20/05/88		
I0490250		NEUTRALIZATION PLANT ERECTION OF STEEL STRUCTURE	25.0	13/05/88	22/06/88	5.0	5.0	20/05/88	29/06/88		
I0490310		NEUTRALIZATION PLANT FABRICATION OF EQUIPMENT	150.0	27/11/87	06/07/88	.0	.0	27/11/87	06/07/88		
I0490350		NEUTRALIZATION PLANT SHIPMENT OF EQUIPMENT	40.0	06/07/88	31/08/88	.0	.0	06/07/88	31/08/88		
I0490380		NEUTRALIZATION PLANT INSTALLATION OF EQUIPMENT	100.0	31/08/88	23/01/89	.0	.0	31/08/88	23/01/89		
I0490480		NEUTRALIZATION PLANT ELECTRICAL INSTALLATION	70.0	12/10/88	23/01/89	.0	.0	12/10/88	23/01/89		
I0490580		NEUTRALIZATION PLANT PIPING & UTILITY DISTRIBUTN.	50.0	26/10/88	23/01/89	10.0	.0	10/11/88	23/01/89		
I0490680		NEUTRALIZATION PLANT INSTALLATION OF AUX. EQUIPM.	20.0	09/12/88	23/01/89	10.0	.0	23/12/88	23/01/89		
I0490700		NEUTRALIZATION PLANT FINISHING WORK	20.0	09/12/88	23/01/89	10.0	.0	23/12/88	23/01/89		

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                                              ACTIVITY TIME STATUS REPORT                                                                        PAGE     5

NETWORK                                   TIME SHEDULE FOR THE IMPLENTATION OF A          BURMA
SUBNET                               WELDED STEEL PIPE PLANT / BURMA    ALTERNATIVE II    BURMA2                                          RUN DATE 03MAR86

   WORK      ORG      DESCRIPTION                          DURAT.   START          END        SLACK     SLACK      START         END        SCHEDULE      DEPT.
   ITEM      COD                                                    EXPECTED       EXPECTED   START     END        LATEST        LATEST       DATE

I0490950          NEUTRALIZATION PLANT                      40.0   23/01/89      20/03/89      .0        .0      23/01/89      20/03/89
                  TRIAL RUNS & COMMISSIONING
I0490990          NEUTRALIZATION PLANT                       0.0   20/03/89      20/03/89      .0        .0      20/03/89      20/03/89
                  START OF PRODUCTION
I0500110          PIPE FINISHING AREA / STORAGES            60.0   22/03/88      22/06/88     5.0       5.0      29/03/88      29/06/88
                  FOUNDATIONS FOR BUILDING
I0500120          PIPE FINISHING AREA / STORAGES            40.0   17/08/88      12/10/88    10.0      10.0      31/08/88      26/10/88
                  FOUND.F.EQUIP.& FLOOR SLABS
I0500180          PIPE FINISHING AREA / STORAGES            20.0   14/09/88      12/10/88    10.0      10.0      28/09/88      26/10/88
                  FINISHING WORK
I0500210          PIPE FINISHING AREA / STORAGES            45.0   07/04/88      14/06/88    15.0      15.0      28/04/88      06/07/88
                  MANUFACT. OF STEEL STRUCTURE
I0500250          PIPE FINISHING AREA / STORAGES            40.0   22/06/88      17/08/88    10.0      10.0      06/07/88      31/08/88
                  ERECTION OF STEEL STRUCTURE
I0500310          PIPE FINISHING AREA / STORAGES           150.0   26/01/88      31/08/88      .0        .0      26/01/88      31/08/88
                  FABRICATION OF EQUIPMENT
I0500350          PIPE FINISHING AREA / STORAGES            40.0   31/08/88      26/10/88      .0        .0      31/08/88      26/10/88
                  SHIPMENT OF EQUIPMENT
I0500380          PIPE FINISHING AREA / STORAGES            30.0   26/10/88      09/12/88      .0        .0      26/10/88      09/12/88
                  INSTALLATION OF EQUIPMENT
I0500480          PIPE FINISHING AREA / STORAGES            20.0   10/11/88      09/12/88      .0        .0      10/11/88      09/12/88
                  ELECTRICAL INSTALLATION
I0500580          PIPE FINISHING AREA / STORAGES            10.0   25/11/88      09/12/88      .0        .0      25/11/88      09/12/88
                  PIPING & UTILITY DISTRIBUTN.
I0500680          PIPE FINISHING AREA / STORAGES            10.0   10/11/88      09/12/88    10.0        .0      25/11/88      09/12/88
                  INSTALLATION OF AUX. EQUIPM.
I0500700          PIPE FINISHING AREA / STORAGES             5.0   25/11/88      09/12/88     5.0        .0      02/12/88      09/12/88
                  FINISHING WORK
I0500950          PIPE FINISHING AREA / STORAGES            10.0   09/12/88      23/12/88      .0        .0      09/12/88      23/12/88
                  TRIAL RUNS & COMMISSIONING
I0500990          PIPE FINISHING AREA / STORAGES             0.0   23/12/88      23/12/88      .0        .0      23/12/88      23/12/88
                  START OF PRODUCTION
I0600110          WORKSHOPS & SPARE PARTS STORAGES          30.0   17/08/88      28/09/88     5.0       5.0      24/08/88      05/10/88
                  FOUNDATIONS FOR BUILDING
I0600120          WORKSHOPS & SPARE PARTS STORAGES          25.0   26/10/88      02/12/88     5.0       5.0      03/11/88      09/12/88
                  FOUND.F.EQUIP.& FLOOR SLABS
I0600180          WORKSHOPS & SPARE PARTS STORAGES          10.0   18/11/88      02/12/88     5.0       5.0      25/11/88      09/12/88
                  FINISHING WORK
I0600210          WORKSHOPS & SPARE PARTS STORAGES          20.0   31/08/88      28/09/88     5.0       5.0      07/09/88      05/10/88
                  MANUFACT. OF STEEL STRUCTURE
I0600250          WORKSHOPS & SPARE PARTS STORAGES          20.0   28/09/88      26/10/88     5.0       5.0      05/10/88      03/11/88
                  ERECTION OF STEEL STRUCTURE
I0600310          WORKSHOPS & SPARE PARTS STORAGES         180.0   26/01/88      12/10/88      .0        .0      26/01/88      12/10/88
                  FABRICATION OF EQUIPMENT
I0600350          WORKSHOPS & SPARE PARTS STORAGES          40.0   12/10/88      09/12/88      .0        .0      12/10/88      09/12/88
                  SHIPMENT OF EQUIPMENT
I0600380          WORKSHOPS & SPARE PARTS STORAGES          20.0   09/12/88      09/01/89      .0        .0      09/12/88      09/01/89
                  INSTALLATION OF EQUIPMENT
I0600480          WORKSHOPS & SPARE PARTS STORAGES          20.0   09/12/88      09/01/89      .0        .0      09/12/88      09/01/89
                  ELECTRICAL INSTALLATION
I0600580          WORKSHOPS & SPARE PARTS STORAGES          10.0   16/12/88      09/01/89     5.0        .0      23/12/88      09/01/89
                  PIPING & UTILITY DISTRIBUTN.
I0600680          WORKSHOPS & SPARE PARTS STORAGES          15.0   16/12/88      09/01/89      .0        .0      16/12/88      09/01/89
                  INSTALLATION OF AUX. EQUIPM.
I0600700          WORKSHOPS & SPARE PARTS STORAGES           5.0   02/01/89      09/01/89      .0        .0      02/01/89      09/01/89
                  FINISHING WORK
I0600950          WORKSHOPS & SPARE PARTS STORAGES          10.0   09/01/89      23/01/89      .0        .0      09/01/89      23/01/89
                  TRIAL RUNS & COMMISSIONING
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                                        ACTIVITY TIME STATUS REPORT                                                              PAGE     6

NETWORK                          TIME SHEDULE FOR THE IMPLENTATION OF A         BURMA
SUBNET                       WELDED STEEL PIPE PLANT / BURMA   ALTERNATIVE II    BURMA2                                   RUN DATE 03MAR86

   WORK    ORG     DESCRIPTION                          DURAT.   START        END       SLACK     SLACK     START         END      SCHEDULE     DEPT.
   ITEM    COD                                                 EXPECTED    EXPECTED    START      END      LATEST       LATEST      DATE

I0600990        WORKSHOPS & SPARE PARTS STORAGES    0.0   23/01/89    23/01/89      .0        .0     23/01/89     23/01/89
                START OF PRODUCTION
I0700310        ELECTRICAL POWER DISTIBUTION      120.0   27/11/87    20/05/88      .0        .0     27/11/87     20/05/88
                FABRICATION OF EQUIPMENT
I0700350        ELECTRICAL POWER DISTIBUTION       40.0   20/05/88    20/07/88      .0        .0     20/05/88     20/07/88
                SHIPMENT OF EQUIPMENT
I0700380        ELECTRICAL POWER DISTIBUTION       70.0   20/07/88    26/10/88      .0        .0     20/07/88     26/10/88
                INSTALLATION OF EQUIPMENT
I0700680        ELECTRICAL POWER DISTIBUTION       30.0   31/08/88    26/10/88    10.0        .0     14/09/88     26/10/88
                INSTALLATION OF AUX. EQUIPM.
I0700950        ELECTRICAL POWER DISTIBUTION       10.0   26/10/88    10/11/88      .0        .0     26/10/88     10/11/88
                TRIAL RUNS & COMMISSIONING
I0750130        ELECTRICAL MAIN STATION BUILDING 120.0   09/02/88    03/08/88      .0        .0     09/02/88     03/08/88
                CONSTRUCTION OF BUILDING
I0750180        ELECTRICAL MAIN STATION BUILDING  40.0   20/05/88    03/08/88    10.0        .0     07/06/88     03/08/88
                FINISHING WORK
I0750380        ELECTRICAL MAIN STATION BUILDING  50.0   03/08/88    12/10/88      .0        .0     03/08/88     12/10/88
                INSTALLATION OF EQUIPMENT
I0750680        ELECTRICAL MAIN STATION BUILDING  20.0   14/09/88    12/10/88      .0        .0     14/09/88     12/10/88
                INSTALLATION OF AUX. EQUIPM.
I0750950        ELECTRICAL MAIN STATION BUILDING  10.0   12/10/88    26/10/88      .0        .0     12/10/88     26/10/88
                TRIAL RUNS & COMMISSIONING
I0900310        AUXILIARY & UTILITIES DISTRIBUT. 120.0   17/09/87    08/03/88      .0        .0     17/09/87     08/03/88
                FABRICATION OF EQUIPMENT
I0900350        AUXILIARY & UTILITIES DISTRIBUT.  40.0   08/03/88    05/05/88      .0        .0     08/03/88     05/05/88
                SHIPMENT OF EQUIPMENT
I0900380        AUXILIARY & UTILITIES DISTRIBUT. 120.0   05/05/88    26/10/88      .0        .0     05/05/88     26/10/88
                INSTALLATION OF EQUIPMENT
I0900700        AUXILIARY & UTILITIES DISTRIBUT.  40.0   17/08/88    12/10/88    10.0      10.0     31/08/88     26/10/88
                FINISHING WORK
I0900950        AUXILIARY & UTILITIES DISTRIBUT.  10.0   26/10/88    10/11/88      .0        .0     26/10/88     10/11/88
                TRIAL RUNS & COMMISSIONING
I0950140        WATER TREATM. PLANT & MOTOR POOL 100.0   09/02/88    06/07/88      .0        .0     09/02/88     06/07/88
                CONSTRUCTION / EXEC. OF WORK
I0950380        WATER TREATM. PLANT & MOTOR POOL  40.0   06/07/88    31/08/88      .0        .0     06/07/88     31/08/88
                INSTALLATION OF EQUIPMENT
I0950700        WATER TREATM. PLANT & MOTOR POOL  20.0   03/08/88    31/08/88      .0        .0     03/08/88     31/08/88
                FINISHING WORK
I1000130        MAIN ADMINISTRATION BUILDING     120.0   08/03/88    31/06/88      .0        .0     08/03/88     31/08/88
                CONSTRUCTION OF BUILDING
I1000180        MAIN ADMINISTRATION BUILDING      60.0   31/08/88    25/11/88      .0        .0     31/08/88     25/11/88
                FINISHING WORK
I1000380        MAIN ADMINISTRATION BUILDING      40.0   14/09/88    25/11/88    10.0        .0     28/09/88     25/11/88
                INSTALLATION OF EQUIPMENT
I1000480        MAIN ADMINISTRATION BUILDING      50.0   14/09/88    25/11/88      .0        .0     14/09/88     25/11/88
                ELECTRICAL INSTALLATION
I1000800        MAIN ADMINISTRATION BUILDING      15.0   25/11/88    16/12/88      .0        .0     25/11/88     16/12/88
                PLACING OF OUTFIT
I1000950        MAIN ADMINISTRATION BUILDING       0.0   16/12/88    16/12/88      .0        .0     16/12/88     16/12/88
                TRIAL RUNS & COMMISSIONING
I1100100        INTERNAL INFRASTRUCTURE           60.0   15/10/87    12/01/88      .0        .0     15/10/87     12/01/88
                BOUNDARY WALL & MAIN-GATE
I1100140        INTERNAL INFRASTRUCTURE          250.0   07/04/88    05/04/89      .0        .0     07/04/88     05/04/89
                CONSTRUCTION / EXEC. OF WORK
I1100200        INTERNAL INFRASTRUCTURE          180.0   20/07/88    05/04/89      .0        .0     20/07/88     05/04/89
                ROADS & PLACES
I1100300        INTERNAL INFRASTRUCTURE          200.0   22/06/88    05/04/89      .0        .0     22/06/88     05/04/89
                DRAINAGE SYSTEM
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                              ACTIVITY TIME STATUS REPORT                                                                   PAGE     7

NETWORK                            TIME SHEDULE FOR THE IMPLENTATION OF A          BURMA
SUBNET                         WELDED STEEL PIPE PLANT / BURMA   ALTERNATIVE II    BURMA2                                   RUN DATE 03MAR86

  WORK     ORG    DESCRIPTION                    DURAT.   START       END        SLACK    SLACK      START       END       SCHEDULE    DEPT.
  ITEM     COD                                          EXPECTED    EXPECTED    START     END      LATEST     LATEST       DATE

I1200110         LINING & COATING PLANT / STORES   60.0  11/12/87    08/03/88     5.0      5.0    18/12/87    15/03/88
                 FOUNDATIONS FOR BUILDING
I1200120         LINING & COATING PLANT / STORES   70.0  06/07/88    12/10/88     5.0      5.0    13/07/88    19/10/88
                 FOUND.F.EQUIP.& FLOOR SLABS
I1200180         LINING & COATING PLANT / STORES   20.0  14/09/88    12/10/88     5.0      5.0    21/09/88    19/10/88
                 FINISHING WORK
I1200210         LINING & COATING PLANT / STORES   65.0  27/11/87    01/03/88    10.0     10.0    11/12/87    15/03/88
                 MANUFACT. OF STEEL STRUCTURE
I1200250         LINING & COATING PLANT / STORES   80.0  08/03/88    06/07/88     5.0      5.0    15/03/88    13/07/88
                 ERECTION OF STEEL STRUCTURE
I1200310         LINING & COATING PLANT / STORES  200.0  29/10/87    17/08/88     5.0      5.0    05/11/87    24/08/88
                 FABRICATION OF EQUIPMENT
I1200350         LINING & COATING PLANT / STORES   40.0  17/08/88    12/10/88     5.0      5.0    24/08/88    19/10/88
                 SHIPMENT OF EQUIPMENT
I1200380         LINING & COATING PLANT / STORES  100.0  12/10/88    06/03/89     5.0      5.0    19/10/88    13/03/89
                 INSTALLATION OF EQUIPMENT
I1200480         LINING & COATING PLANT / STORES   60.0  09/12/88    06/03/89     5.0      5.0    16/12/88    13/03/89
                 ELECTRICAL INSTALLATION
I1200580         LINING & COATING PLANT / STORES   40.0  09/01/89    06/03/89     5.0      5.0    16/01/89    13/03/89
                 PIPING & UTILITY DISTRIBUTN.
I1200680         LINING & COATING PLANT / STORES   20.0  06/02/89    06/03/89     5.0      5.0    13/02/89    13/03/89
                 INSTALLATION OF AUX. EQUIPM.
I1200700         LINING & COATING PLANT / STORES   20.0  23/01/89    06/03/89    15.0      5.0    13/02/89    13/03/89
                 FINISHING WORK
I1200950         LINING & COATING PLANT / STORES   30.0  13/03/89    26/04/89      .0       .0    13/03/89    26/04/89
                 TRIAL RUNS & COMMISSIONING
I1200990         LINING & COATING PLANT / STORES    0.0  26/04/89    26/04/89      .0       .0    26/04/89    26/04/89
                 START OF PRODUCTION
I9000000         TAKE OVER & ACCEPTANCE OF THE      0.0  28/04/89    28/04/89      .0       .0    28/04/89    28/04/89
                 PLANT
I9900000         START OF PRODUCTION OF THE         3.0  28/04/89    05/05/89      .0       .0    28/04/89    05/05/89
                 COMPLETE PLANT
```

CHAPTER X

FINANCIAL AND ECONOMIC EVALUATION

Introduction

This chapter contains the feasibility calculations for the proposed plant.

The basic parameters for the method of financial calculation are:

Rates of currency exchange: US$ 1.- = K 7.75 = DM 2.40

Financing: 30% equity; 70% commercial loan

The equity covers all payments in local currency and the first foreign currency payments during the construction period.

It is assumed that the plant would be completed within 2.5 years and the project costs are calculated accordingly with actual production starting as follows:

year	1990	1991	1992	1993	etc.	2004
capacity	70%	80%	100%	100%		100%

The year 1992 is the first year of full production. During this year a major portion of the earnings are still needed to supplement the working capital. The lower outputs achieved during the initial 2 years is taken into account in all calculations such as annual turnover and operating costs.

The lifetime of such a project in Burma can be expected to be 25 to 35 years. Nevertheless to be on the safe side feasibility calculations were limited to 15 production years (1990 to 2004) and no salvage value was considered.

The operating expenses are calculated on the basis of 1986 prices and from thereon increased by an inflation rate of 3% per annum; the investment is calculated as expected for ordering in 1988.

All prices and costs have been split up into local and foreign cost. Taxes and duties within Burma were not considered.

The results of these considerations provide the answer to the most important question of the feasibility study:
Is it commercially feasible to produce welded steel pipe products in Burma, or is it more economical to import such pipe from abroad?

Explanation of the Calculation Methods

The calculations for Alternative I and II have been conducted on the basis of full production capacity. Full production capacity implies two shift operation of the welding line(s). Coating, lining and galvanizing are run on three shifts to avoid investment for additional plant. Introduction of a full third shift could be done but this is not common procedure under normal conditions for similar plants in developing countries. The full third shift should therefore be considered as an additional reserve for the future. Alternative I and IA have identical plant, however in Alternative IA the plant is run at half capacity (reduced production hours).

Since the comparison is made under international conditions it is advisable to use an inflation rate in order to arrive at realistic results. For this reason sales revenue, costs, etc. have been increased by an inflation factor of 3%/year throughout the feasibility calculation.

In the event the production rate is reduced due to either the market demand in Burma or the inability to export as much as indicated in the study it is necessary to analyse the breakeven production rate to assertain the minimum production rate necessary to cover the plant's fixed costs. The breakeven production rate decreases with the repayment of loans. For plant Alternative I it is below 50% already in the first year and drastically drops down to 7-8% when all loans are payed back.

The cost parameters have been analysed separately within the sensitivity analysis.

Both the feasibility and the sensitivity analysis calculations indicate the range of results and the Study's feasibility recommendations.

Basic Parameters

Computer calculations

For computer calculations the following programmes were used:

COMFAR 2.0 (UNIDO)
MICROSOFT MULTIPLAN (SPREAD SHEET) 1.20

Prices

All prices for investments are based on fixed prices estimated for the year 1988.

Prices used for operating costs and sales revenue are first calculated as of 1986. During the feasibility calculations they are multiplied with an inflation factor.

During the last years the inflation rate for relevant products and materials as calculated in European currencies was between 3% and 6% p.a. Annex 10.4 shows inflation rates of typical project related products in West Germany.

Although West Germany is an industrial country with an extremely low inflation, these tables indicate inflation rates around 4% p.a. over the last five years for welded tubes (main sales product of the proposed plant), hot strip (main input material of the proposed plant) and machinery products.

The higher the added value the higher the inflation rate because the increment rate for salaries and capital expenditures has been greater than that of raw materials and simple semi-finished products.

It is expected that the inflationary tendency for the near future will be more moderate than during the past years.

The calculations for this Study were therefore based on a somewhat more moderate inflation rate of 3% p.a.

Project Cost

Project costs are subdivided into:

- Pre-production capital expenditures
- Initial fixed investment costs
- Working capital

Replacement investments are provided in 1995 and 2000. Current investments are provided every year to cover the influence of inflation on the working capital.

Pre-production capital expenditures include costs for preparatory investigations, engineering, recruitment and training of plant manpower, establishment of the plant's organization and loan fees (capital issue expenditure) to be paid until start of production.

Initial fixed investment costs are the costs for civil engineering works and equipment with tools and spares including related costs for transport and installation.

Working capital covers:

- Accounts receivable calculated on the basis of operating costs. Within Burma all pipes will be bought by government agencies which are expected to settle their accounts immediately. Exports will be paid upon shipment. The minimum coverage was therefore provided for 20 days.

- Inventory for which a minimum coverage of 45 days is provided.

- Work in progress and stored finished products for which the minimum coverage is 8 and 15 days respectively.

No provision is made for energy (natural gas), which is paid retrospectively, and for spares, for which a two years' stock is provided with initial investment.

Accounts payable, which would reduce the required working capital, are only a very small portion of the total and as such also not considered in the working capital.

Sources of Financing

The financial calculations assume a split in the financial structure of the project as 30% equity and 70% in medium to long term loans.

Alternative I

1000 x US$

Source	foreign	local	total
Equity	2,570	3,370	5,940
Loan	13,860	-	13,860
Total Funds	16,430	3,370	19,800

Alternative II

1000 x US$

Source	foreign	local	total
Equity	4,400	4,450	8,850
Loan	20,650	-	20,650
Total Funds	25,050	4,450	29,500

Equity

The equity will cover all local currency expenditure and the first foreign currency expenditures.

The equity portion of the project would be provided by the Government as required in local and foreign currency. In view of the foreign currency restraints prevailing in Burma the most advantageous method for securing the equity foreign portion would be a long term government-to-government economic grant or development loan.

The Study conducted confidential interviews regarding the applicability of this method. It can be said that there are very good possibilities for Burma to receive such grants from European as well as Asian sources. The main hinderence in this approach is the long lead times required between the actual presentation of a project to the responsible authorities and the time the grant/loan is actually made available for the project.

A quicker approach is to obtain the required financing through one of the multinational institutions which provide financing for industries in developing countries.

Since many of these funds are primarily concerned with infrastructural and agricultural projects a good case can be presented for the pipe plant project. This results from the fact that the majority of pipes produced for local consumption will be for greatly improving the country's overall infrastructure by providing safe and reliable potable water systems to all the population and by contributing to the expansion of the country's electrification systems. Further, it will also improve agriculture by providing distribution pipes and water well casings for expanding the irrigation networks.

The Study's findings indicate that there are a number of such multinational sources quite interested in discussing such grants and loans for Burma. The terms and conditions for the provision of funds on soft terms can only be established through negotiations between the respective parties and only after a thorough examination of the Study's findings.

It is therefore recommended that an approach should be made to these various financial institutions as soon as the Government decides to proceed with the project.

Loan

Loan(s) will cover the second part of foreign exchange needed for fixed assets and the initial working capital requirements. It is quite realistic to assume that the outstanding 70% of the project can be financed from the same sources as the equity portion.

Another approach is that the required funding be included in a general bilateral credit or tied credit agreement at the government-to-government level. Although such agreements are generally part of long term national policies and aid programmes the Study observed sufficient indications that such credit agreements can over a period of time be achieved.

It is recommended that this approach also be initiated but due to the time element the implementation of the welded steel pipe plant should not be made contingent upon conclusion of such bilateral credit sources.

The Study also investigated funding possibilities through commercial banking sources in Europe and Asia. In all instances the replies were positive in regards to providing a suitable financial package to Burma for the project.

Since this is the most easily available source of financing, mainly due to the time element, the feasibility calculations for the plant were conducted on the basis of using a normal commercial loan for 70% of the total project costs at an interest rate of 8.5% on a medium term basis.

Medium term capital is also available to Burma for the entire foreign equipment purchase portion of the project through supplier credits. This constitutes approximately 50% of the total project costs and would be payable in 7 years after start-up of operations. The interest rate on this type of arrangement could possibly be somewhat less than a straight commercial loan. This of course would provide a positive contribution to the overall commercial viability of the pipe plant.

Since the Study concludes that a variety of international loans are available to Burma to execute the project the financial package will probably be made up of loans-grants from several sources. The actual constellation of the package can only be developed however, after the Government has given its official authorization to go ahead with the construction of a welded steel pipe plant.

Financing Proposal for Project Implementation

The goals of establishing a realistic financing proposal for the project included the following:

- achieve a financing package of 70% of the total investment costs
- cover the financing of the imported machinery and equipment to be paid in foreign currency.
- create the necessary liquidity from the very beginning
- secure a balanced cash flow during construction period
- make the project self-liquidating

The financing proposal provides for a combination of a buyer's loan and a free-market-roll-over-loan and will cover 70% of the total investment of the implementation of the plant.

Providing that the contractor who engineers and supplies the plant is a European or Asian company, it is possible to arrange for a buyer's loan (export credit to be covered by the European or Asian Export Credit Insurance Companies) at terms to be negotiated and concluded between purchaser/borrower and a consortium of international banks and for a free-market-roll-over-loan to be negotiated and concluded between purchaser/borrower and an international bank or consortium of banks either in Europe or Asia.

Financing Conditions (Interest Rate, Grace Period, Repayment Period etc.)

A. Buyer's Loan (Export Credit)

- Borrower/Guarantor:
  MIC (Metal Industries Corporation) as purchaser, credit to be guaranteed by the Government of Burma represented by the Ministry of Finance.

- Amount of Credit:
  The export credit will cover approx. 85% of the partial contract value for supplies and services of foreign origin.

- Currency of Credit:
  The credit shall be denominated in the currency according to the currency of the supply and service contract.

- Drawdowns of the Credit:
  The credit will be drawn according to the progress of works respectively in accordance with the payment schedule as stipulated in the supply and service contract to be concluded between the purchaser and the contractor.

- Repayment of the Credit:
  Repayment of the credit amount will be effected within a period of 7 (seven) years by 14 (fourteen) consecutive semi-annual instalments, first of which falling due 6 (six) months after readiness for operation, at the latest 3 (three) years after effectiveness of the supply and service contract.

  For reasons of simplification the Study assumed that the repayment of the credit will be effected in annual instalments.

- Lifetime of the Credit:
  Totally 10 (ten) years, under the assumption that the draw-down period will be 2 (two) years, period of grace 1 (one) year and the payback time will be 7 (seven) years.

- Interest Rate:
  The interest rate shall be in accordance with the actual rates of the respective banking rate, for example AKA, Ausfuhrkredit-Gesellschaft mbH, Frankfurt am Main, (AKA is a German Banking Consortium incorporated by the leading German commercial banks). The rate prevailing for the time being is 8.5% p.a. fixed.

  Interest will be calculated on the effective drawdowns during construction period and on the outstanding balances during repayment period and are payable semi-annually in arrears.

  Above interest rate is excluding the usual management, commitment and handling fee and expenses.

- Fees:
  A management fee of 0.5% flat on the principal of the credit will certainly be charged. This fee will be payable upon signing the credit agreement.

  A commitment fee of 0.5% p.a. calculated on the undrawn amount of credit will be payable in advance.

  Such fees are subject to market conditions and may be negotiable.

- Export Credit Insurance:
  The above-mentioned financing terms are subject to the final approval of the respective Export Insurance Company.

B. Free-Market-Roll-Over-Loans

- Borrower/Guarantor:
  MIC as purchaser, loan to be guaranteed by the Government of Burma represented by the Ministry of Finance.

- Amount of Loan:
  The loan will cover
  - approx. 15% of supplies and services of foreign origin
  - parts of the Burmese portion

- Currency of Loan:
  The loan shall be denominated in the currency according to the currency of the supply and service contract.

- Drawdowns of the Loan:
  The loan will be drawn according to the progress of works respectively in accordance with the payment schedule as stipulated in the supply and service contract to be concluded between the purchaser and the contractor.

- Repayment of the Loan:
  After a grace period of approx. 3 (three) years, repayment has to be effected within 6 (six) to 7 (seven) years by equal consecutive semi-annual instalments first of which falls due 3.5 (three and a half) years after signing of the loan agreement.

- Lifetime of Loan:
  The duration of loan will be 6 (six) to 7 (seven) years plus a grace period of 3 (three) years, however, total loan period 10 (ten) years from signing of the loan agreement.

- Interest Rate:
  The interest rate shall be in accordance with the valid spread, above the variable 3 (three) or 6 (six) months Interbank-Offered-Rate (IBOR). On this basis the interest rate prevailing for the time being is approx. 8.5% p.a.

  Interest is to be calculated on the outstanding balance.

- Fees:
  A management fee of approx. 0.5% flat on the principle of the loan will be charged. This fee will be payable upon signing the loan agreement.

  A commitment fee of 0.25 to 0.5% p.a. calculated on the undrawn amount of loan will be payable in advance.

  Such fees are subject to market conditions and may be negotiable.

C. Local Loan

Local loans are available to the MIC at the following rates:

5% p.a. for investments
8% p.a. for current expenditure

Loan Assumptions for Feasibility Calculations

For reasons of simplification the Study assumes the following conditions for one loan in foreign currency:

Amount	70% of total investment
Interest rate	8.5% p.a.

Initial fees	0.5 % flat
Draw-down period	2 years
Period of grace	1 year
Pay-back period (7 equal annual payments)	7 years

Feasibility Calculations

The annexed tables show the feasibility calculation for the Alternatives of the project.

The results for plant Alternative II are not as good as those for Alternative I. The reason is the low market price of the galvanized pipes in the diameter range 1/2" to 4". This production has a negative result and reduces the total profitability of Alternative II. The market price for these pipes suffers from the competition of plastic pipes. Small diameter plastic pipe is cheap to produce and offers in many cases at least the same service as galvanized pipe. The weak result of Alternative II is the more remarkable as this larger Alternative profits from the advantage of scale and uses many facilities identical with Alternative I for the additional production of small galvanized pipe.

Considering the results we conclude that at present it is not profitable to build a pipe plant which would include galvanized steel pipes in the diameter range 1/2" to 4" (Alternative II). Production of small pipes would depend almost totally on export and would also reduce the profitability of the plant.

However, the implementation of Alternative I is a profitable venture as shown in the feasibility calculations and the extracts given hereafter. For this reason further analysis concentrates only on Alternative I.

Rate of Discount, Used to Determine the NPV (Net Present Value)

Burma is a capital borrower and its absorptive capacity is greater than its possibility of borrowing capital from other countries or international institutions. This statement, however, must be regarded in connection with the Government's intention not to increase the indebtedness of its country unnecessarily.

In consideration of these facts the feasibility study for project evaluation determines the NPV as a factor in deciding the viability of such a project and uses a rate of discount of 10% p.a. which as it is slightly above the rate of interest on the capital market prevailing on long term loans for Burma (approx. 8.5% p.a.) is well on the safe side for such economic evaluation.

Break-Even Analysis

Break-even analysis is based on cash-flow and determines the break-even point (BEP); the production rate at which sales revenues equal all production costs (= fixed costs plus variable costs).

The calculation assumes that variable production costs as well as sales revenue vary in proportion with the sales volume, while fixed cost stay constant.

It is obvious that this assumption is not correct anymore if the production rate varies greatly. If production is reduced as far as 50% also "fixed costs" will be reduced. In this case labour and sales costs will be reduced to suit the changed requirements; many parts of the plant will work on one shift less (2 shifts instead of 3, 1 shift instead of 2) and the sales organization for exports will be ommitted. (see Alternative IA)

At break-even point the sales revenue covers all cost including repayment of loans and payment of interest - the cash surplus in the period however is zero (0).

The equation to determine the BEP is

$$BEP = \frac{\text{Fixed costs}}{\text{Sales revenue - Variable costs}}$$

Fixed costs are:

- all labour costs
- maintenance civil and emmissions disposal
- administration (no labour) costs
- sales and distribution costs
- cost of finance
- repayment of loans

Variable costs are:

- all raw materials' costs
- energy costs
- costs of tools and spare parts

The calculation shows excellent results regarding break-even point:

Year	BEP Alternative I	BEP Alternative IA
1990	49 %	84 %
1993	35 %	60 %
1997	8 %	9 %

Sensitivity Analysis

Sensitivity analysis considers the economic results of the project in case cost factors will change in future.

The Study's calculation analyses the resulting changes in the "break-even point" and in the annual "cash surplus".

Calculations were made for variation of the main cost factors influencing the financial viability:

- sales revenue
- costs of raw materials
- investment costs(costs of finance + repayment of loans)

The results are shown in the annexed computer tables and in graphs. The graphs show the results for the year 1993 - the fourth year of production in the middle of the pay-back period of the loan.

National Net Value Added

The contribution of the project to the national income of Burma is indicated by its net value added. The net value consists of two major components

- salaries and wages
- social surplus

The net value added is equal to gross value added minus investment. The national net value added considers only the national contribution of the project.

For the calculations of this Study the "national net value added" is calculated for a production period of fifteen (15) years; only local salaries and wages are considered; social surplus is the cash surplus as shown in the COMFAR tables (taxes, duties etc. are not considered).

General

It must be noted that the results do not consider any taxes. The low wages prevailing in Burma also contribute to the economy of the project.

In addition the favourable results for Alternative I and IA are also enhanced by the relatively high sales revenues for pipes coated with bitumen and lined with cement.

In the event the production rate is reduced or the production mix altered to produce a larger percentage of black pipes the favourable profits are immediately reduced. The main problem being the relatively low added value on finished product (black pipe) versus input materials.

Sales prices for tube and pipe products are presently 50 % more expensive in Europe than in the Far East. Due to the location of the proposed plant the Far East figures have been used in the Study. It is entirely possible however, that these figures will eventually be closer to those of Europe. In such event the plant would prove to be even more feasible than the Study indicates.

Plant Alternative IA

The break-even point analysis for Alternative I shows that the break-even production rate is always below 50%, i.e. less than the local market demand (which is 53 % of total production of Alternative I).

For this reason the feasibility of the project is also calculated for an Alternative, IA, which has half the rated capacity of Alternative I (1/2 x 81,883 tpy). The main characteristics of this Alternative IA are:

Production 40,942 tpy = 100 %

1990	1991	1992		2004
90 %	100 %	100 %	etc.	100 %

Sales Revenue (1990/100 %): local currency only

$33\ 157\ 060 \times 1/2 \times 1.03^4$ = US$ 18,660,000

Sources of Financing

Source	foreign	local	total
		1000 US$	
Equity	2,120	3,370	5,490
Loan	12,810	-	12,810
Total Funds	14,930	3,370	18,300

Pre-production expenditure and fixed investment for Alternative IA are the same as for Alternative I. However a reduction of funds is possible due to reduced working capital requirements.

The results of the calcultions for Alternative IA prove that the plant can be run profitably at half its capacity serving only the needs of Burma's national market. Also in the case of Alternative IA it will still be more economical to produce the pipes needed in Burma than to import them from abroad.

Summary

The results of the feasibility calculation show clearly the viability of the production of large diameter (dia. 6" to 12") steel pipe. They show also that it is at present not feasible to produce small diameter (dia. 1/2" to 4") steel pipe - not even in combination with large diameter pipe.

The large diameter steel pipe plant is calculated for an annual production of 81,880 tonnes (Alternative I); main equipment is used during two (2) shifts. With about half its production the plant covers the total national demand and provides the other half for export. The exports earn the foreign exchange needed to pay back foreign loans and provide part of the foreign exchange necessary to import raw materials.

A second option has also been considered which is identical to Alternative I except it is evaluated on a production rate of 40,940 tonnes; main welding line operating on one (1) shift (Alternative IA). This production rate would cover approx. 94% of the local market and generate foreign exchange savings well in excess of that required to compensate for the total cost of the foreign loan.

The main raw material for production of welded steel pipe is coiled sheet. At present Burma has no production facilities for this material. Hot strip mills and cold rolling mills to produce sheet coils have production capacities of 500,000 to 1,500,000 tpy. This is above the present steel demand of Burma and above the country's melting capacity for steel. For this reason we expect that such facilities will not be available in Burma in the near future and the Study assumes that sheet coil for pipe production will be imported.

The necessity to import almost all raw materials - which constitute the main part of the factory cost - naturally is a burden for the project.

It should however be considered that Alternative IA, which produces for the local market only and earns no foreign exchange, effects substantial foreign exchange savings. These foreign exchange savings compensate for the cost of the foreign loan (interest and repayment) and give over the fifteen production years considered an additional total saving of US$ 68.1 millions.

Due to a slightly higher sales volume on the national market, foreign exchange savings of Alternative I will even be slightly higher. But in addition to these savings Alternative I will earn through exports, foreign exchange.

These earnings will over fifteen production years total US$ 67.4 millions. This means that the exports of Alternative I will not only earn the foreign exchange needed to pay for the foreign portion of the investment but will also pay for a substantial part of the foreign cost of raw materials for pipe used in Burma.

Alternative I shows excellent economical results. The plant can be run at low production rates and is not sensitive against unfavourable variations in the cost factors.

In fact the plant is still profitable when run at half its capacity and servicing only the national market.

In summary it can be stated that the plant for large diameter steel pipe is a very viable project promising good profit and being not sensitive to adverse developments that may occur in the future; such as low capacity utilization and/or unfavourable changes in cost factors. The plant will reduce the foreign currency outlays needed for the import of pipe and has in addition the ability to earn foreign currency through exports.

Apart from its own viability the project will be an important contribution to the social and industrial development of Burma.

During the first fifteen (15) years of production its National Net Value Added will be between 105.7 (Alt. I) and 38.9 (Alt. IA) million US $.

The cost of production of steel pipe in Burma will be cheaper than that of imported pipe. This will reduce the cost of drinking water supply and sanitation programmes.

Locally produced steel pipe will support the country's irrigation programmes and will thus secure a steady rise in food production for local consumption and for export.

The ready availability of locally produced pipe and its universal possibilities of utilization will give industrial development in Burma a great incentive. Pipe can be used for distribution systems for gases and liquids as well as for structural purposes. Pipe can be used to build the towers for electrical transmission lines and in this way help to improve the country's infrastructure.

At the proposed location Ywama the plant will ideally fit to the existing steel plant. This already existing basis of a steel industry would be an immense help for the start-up of the plant (e.g. personnel exchange and training) and for its operation (e.g. sharing of facilities and equipment for repair and maintenance and sharing of utilities in emergencies).

The pipe plant will bring new technical know-how to Burma not only in connection with its own activities (pipe production) but also with the technologies connected with utilization of pipe. Accordingly the advent of this project will not only create new industrial jobs within the proposed plant but will also create new jobs in pipe related industries and even in agriculture.

The following is a summary of the annexed computer calculations.

Project Cost in 1000 US$

Item	Alt. I	Alt. IA	Alt. II
Land	provided free by the Government		
Site development	314	314	314
Civil works	2,536	2,536	3,276
Plant machinery	9,286	9,286	15,299
Fixed investment	12,136	12,136	18,889
Pre-production exp.	2,396	2,414	3,283
Working capital	5,000	3,500	7,300
Initial investment	19,532	18,050	29,472
Cash	268	250	28
Total project cost	19,800	18,300	29,500

Sources of Funds in Million US$

Source	Alt. I	Alt. IA	Alt. II
Equity 30 %	5.94	5.49	8.85
Loan 70 %	13.86	12.81	20.65
Total 100 %	19.80	18.30	29.50
Foreign portion	82.9 %	81.6 %	84.9 %

Annual Cash Surplus

Year	Year of Production	Alt. I mio. US$	Alt. IA mio US$	Alt. II mio. US $
1990	1st	1.876	0.577	0.511
1993	4th	6.004	1.810	4.950
1997	8th	9.744	4.797	10.020

Return on Equity (R.O.E., Cash Surplus)

Year	Year of Production	Alt. I %	Alt. IA %	Alt. II %
1990	1st	32 %	9 %	6 %
1993	4th	101 %	30 %	56 %
1997	8th	164 %	81 %	113 %

Return on Investment (R.O.I., Cash Surplus)

Year	Year of Production	Alt. I %	Alt. IA %	Alt. II %
1990	1st	9 %	3 %	2 %
1993	4th	30 %	9 %	17 %
1997	8th	49 %	24 %	34 %

Internal Rate of Return on Total Investment 1987-2004

	Alt. I	Alt. IA	Alt. II
Net present value at 10% in mio US$	40.1	14.8	34.0
Internal rate of return (I.R.R.)	37 %	23 %	26 %

Pay-Back Period

	Alt.I	Alt. IA
Production Years	4	8

Break-Even (Cash Surplus) Production

Year	Year of Production	Alt. I %	Alt. IA %
1990	1st	49 %	84 %
1993	4th	35 %	60 %
1997	8th	7.5 %	8.8 %

National Net Value Added (NNVA)

		Alt. I	Alt. IA
NNVA, 1990-2004	mio US$	105.7	38.9
Investment,	mio US$	19.8	18.3

Alternative I

Foreign Exchange Savings (through sales on the local market) and Foreign Exchange Earnings (through exports) - interest and repayments of foreign loan deducted - in Million US$

Year	Foreign Exchange Savings	Foreign Exchange Earnings
1990	1.7	1.4
1993	3.9	3.4
1997	6.0	5.3
Total 1990-2004	77.2	67.4

Alternative IA

Foreign Exchange Savings (through sales on the local market) - interest and repayments of foreign loan deducted -in Million US$

Year	Foreign Exchange Savings
1990	1.4
1993	2.6
1997	5.7
Total 1990-2004	68.1

ANNEXES

ANNEX

10.1	Computer calculations for Alternative I
10.2	Computer calculations for Alternative IA
10.3	Computer calculations for Alternative II
10.4	Index of Producer's Prices

ANNEX 10.1 Computer Calculation for Alternative I

Input Tables (COMFAR)

Output Schedules (COMFAR)

Break-even and Sensitivity Analysis (MULTIPLAN)

Graph: Sensitivity of Break-even Point

Tab: BURMA1 : Text Variables

-- COMFAR 2.0 - UNIDO IO/FEAS, Vienna -----

Project Name:	Pipe Plant, Burma: Alternative I
Date:	June 1986
Name of Alternative:	81,883 tpy, Pipe Diameter from 6" to 12"
Accounting currency:	thousands of U.S. Dollars
Name of Product (A):	Welded Steel Pipe

Tab: BURMA1 : General Variables

-- COMFAR 2.0 - UNIDO IO/FEAS, Vienna -----

Multiplier to compute foreign into accounting currency: 1.000

Multiplier to compute local into accounting currency: 1.000

Construction phase: 3 year(s), planned half-yearly

Interest rate for computation of future values in % p.a.: 3.000

Percent rate for CF-Discounting: 10.000

Tab BURMA1 : Source of finance - foreign funds

--- COMFAR 2.0 - UNIDO IO/FEAS, Vienna -----

```
Equity - D: first disbursement in year 1

Equity - F: not specified

Subsidies : not specified

Loan A:     first disbursement in period 1
            Amortization:     constant principal
                              lasting for 7 year(s)
                              paying yearly rates
            Period of grace:  1 year(s)
            Interests payable: 8.5 % for year 1 through 10

Loan B:     not specified

Loan C:     not specified

Overdraft:  not specified
```

Tab: BURMA1 : Source of finance - local funds
--- COMFAR 2.0 - UNIDO IO/FEAS, Vienna -----

Equity - O: first disbursement in year 1

Equity - F: not specified

Subsidies : not specified

Loan A: not specified

Loan B: not specified

Loan C: not specified

Overdraft: not specified

Tabl BURMA1 : Subtable **Initial Fixed Investment - foreign**

-- COMFAR 2.0 - UNIDO IO/FEAS, Vienna -----

Col	1	2	3	4	5	6	7
	Deprec- %	Type of de	Scrap - %	Depreciati	Amount- P1	Amount- P2	Amount- P3
L 1 Land..........................	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 2 Site preparation and developme	5.00	1.00	0.00	20.00	30.00	100.00	0.00
L 3 Structures and civil (a)......	5.00	1.00	0.00	20.00	0.00	0.00	143.00
L 4 Structures and civil (b)......	20.00	1.00	0.00	5.00	0.00	0.00	37.00
L 5 Incorporated fixed assets,-(a)	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 6 Incorporaed fixed assets,-(b)	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 7 Incorporated fixed assets,-(c)	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 8 Plant machinery and equipm-(a)	10.00	1.00	0.00	10.00	0.00	0.00	0.00
L 9 Plant machinery and equipm-(b)	20.00	1.00	0.00	5.00	0.00	0.00	0.00
L 10 Auxiliary and service faciliti	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 11 Pre-production expenditures...	10.00	1.00	0.00	10.00	40.00	400.00	300.00
L 12 Inventory, working capital....	0.00	1.00	0.00	0.00	0.00	0.00	0.00

Tabl BURMA1 : Subtable **Initial Fixed Investment - local**

-- COMFAR 2.0 - UNIDO IO/FEAS, Vienna -----

Col	1	2	3	4	5	6	7
	Deprec- %	Type of de	Scrap - %	Depreciati	Amount- P1	Amount- P2	Amount- P3
L 13 Land..........................	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 14 Site preparation and developme	5.00	1.00	0.00	20.00	42.00	50.00	92.00
L 15 Structures and civil (a)......	5.00	1.00	0.00	20.00	0.00	0.00	331.00
L 16 Structures and civil (b)......	20.00	1.00	0.00	5.00	0.00	0.00	35.00
L 17 Incorporated fixed assets,-(a)	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 18 Incorporated fixed assets,-(b)	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 19 Incorporated fixed assets,-(c)	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 20 Plant machinery and equipm-(a)	10.00	1.00	0.00	10.00	0.00	0.00	0.00
L 21 Plant machinery and equipm-(b)	20.00	1.00	0.00	5.00	0.00	0.00	0.00
L 22 Auxiliary and service faciliti	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 23 Pre-production expenditures...	10.00	1.00	0.00	10.00	44.00	80.00	103.00
L 24 Inventory, working capital....	0.00	1.00	0.00	0.00	0.00	0.00	0.00

Tabi BURMA1 : Subtable Initial Fixed Investment - foreign

-- COMFAR 2.0 - UNIDO IO/FEAS, Vienna -----

8	9	10	11	12	13	14	15	16	17	18
Amount- P4	Amount- P5	Amount- P6	Amount- P7	Amount- P8	Not used	Not used	Not used	Not used	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
310.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2759.00	2759.00	2756.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	376.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
370.00	74.00	70.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	5000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tabi BURMA1 : Subtable Initial Fixed Investment - local

-- COMFAR 2.0 - UNIDO IO/FEAS, Vienna -----

8	9	10	11	12	13	14	15	16	17	18
Amount- P4	Amount- P5	Amount- P6	Amount- P7	Amount- P8	Not used	Not used	Not used	Not used	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
560.00	560.00	560.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
203.00	203.00	204.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	24.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
103.00	103.00	103.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

```
Tabi BURMA1 : Subtable Current Fixed Investment - foreign
------------------------------------------------------------------------------------- COMFAR 2.0  -  UNIDO IO/FEAS, Vienna -----
Col                                    1           2           3           4           5           6           7

                                 Deprec-n %  Depreciati  Scrap -  %  Depreciati  Amount- Y1  Amount- Y2  Amount- Y3
L  25 Land.........................    0.00        1.00        0.00        0.00        0.00        0.00        0.00
L  26 Site preparation and developme   0.00        1.00        0.00        0.00        0.00        0.00        0.00
L  27 Structures and civil (a)......   0.00        1.00        0.00        0.00        0.00        0.00        0.00
L  28 Structures and civil (b)......  20.00        1.00        0.00        5.00        0.00        0.00        0.00
L  29 Incorporated fixed assets,-(a)   0.00        1.00        0.00        0.00        0.00        0.00        0.00
L  30 Incorporated fixed assets,-(b)   0.00        1.00        0.00        0.00        0.00        0.00        0.00
L  31 Incorporated fixed assets,-(c)   0.00        1.00        0.00        0.00        0.00        0.00        0.00
L  32 Plant machinery and equipm-(a)   0.00        1.00        0.00        0.00        0.00        0.00        0.00
L  33 Plant machinery and equipm-(b)  20.00        1.00       10.00        5.00        0.00        0.00        0.00
L  34 Auxiliary and service faciliti   0.00        1.00        0.00        0.00        0.00        0.00        0.00
L  35 Pre-production expenditures...   0.00        1.00        0.00        0.00        0.00        0.00        0.00
L  36 Inventory, working capital....   0.00        1.00        0.00        0.00    -5000.00        0.00        0.00

Tabi BURMA1 : Subtable Current Fixed Investment - local
------------------------------------------------------------------------------------- COMFAR 2.0  -  UNIDO IO/FEAS, Vienna -----
Col                                    1           2           3           4           5           6           7

                                 Deprec-n %  Depreciati  Scrap -  %  Depreciati  Amount- Y1  Amount- Y2  Amount- Y3
L  37 Land.........................    0.00        1.00        0.00        0.00        0.00        0.00        0.00
L  38 Site preparation and developme   0.00        1.00        0.00        0.00        0.00        0.00        0.00
L  39 Structures and civil (a)......   0.00        1.00        0.00        0.00        0.00        0.00        0.00
L  40 Structures and civil (b)......  20.00        1.00        0.00        5.00        0.00        0.00        0.00
L  41 Incorporated fixed assets,-(a)   0.00        1.00        0.00        0.00        0.00        0.00        0.00
L  42 Incorporated fixed assets,-(b)   0.00        1.00        0.00        0.00        0.00        0.00        0.00
L  43 Incorporated fixed assets,-(c)   0.00        1.00        0.00        0.00        0.00        0.00        0.00
L  44 Plant machinery and equipm-(a)   0.00        1.00        0.00        0.00        0.00        0.00        0.00
L  45 Plant machinery and equipm-(b)  20.00        1.00       10.00        5.00        0.00        0.00        0.00
L  46 Auxiliary and service faciliti   0.00        1.00        0.00        0.00        0.00        0.00        0.00
L  47 Pre-production expenditures...   0.00        1.00        0.00        0.00        0.00        0.00        0.00
L  48 Inventory, working capital....   0.00        1.00        0.00        0.00        0.00        0.00        0.00
```

Tabl BURMA1 : Subtable Current Fixed Investment - foreign

COMFAR 2.0 - UNIDO IO/FEAS, Vienna

8 Amount- Y4	9 Amount- Y5	10 Amount- Y6	11 Amount- Y7	12 Amount- Y8	13 Amount- Y9	14 Amount-Y10	15 Amount-Y11	16 Amount-Y12	17 Amount-Y13	18 Amount-Y14
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	43.00	0.00	0.00	0.00	0.00	50.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	104.00	0.00	0.00	0.00	0.00	121.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tabl BURMA1 : Subtable Current Fixed Investment - local

COMFAR 2.0 - UNIDO IO/FEAS, Vienna

8 Amount- Y4	9 Amount- Y5	10 Amount- Y6	11 Amount- Y7	12 Amount- Y8	13 Amount- Y9	14 Amount-Y10	15 Amount-Y11	16 Amount-Y12	17 Amount-Y13	18 Amount-Y14
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	41.00	0.00	0.00	0.00	0.00	47.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	12.00	0.00	0.00	0.00	0.00	13.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

```
Tabl BURMA1 : Subtable Production Costs - foreign
------------------------------------------------------------------------------- COMFAR 2.0  -  UNIDO IO/FEAS, Vienna -----
Col
                                          1           2           3           4           5           6           7

                                   Inflator %  Adjust- Y1  Adjust- Y2  Adjust- Y3  Adjust- Y4  Adjust- Y5  Adjust- Y6
L  52 Raw material, annual cost (a).    3.00    19178.00    21918.00    27397.00    27397.00    27397.00    27397.00
L  53 Raw material, annual cost (b).    3.00       11.00       13.00       16.00       16.00       16.00       16.00
L  54 Utilities, annual cost........    0.00        0.00        0.00        0.00        0.00        0.00        0.00
L  55 Energy, annual cost......... .    0.00        0.00        0.00        0.00        0.00        0.00        0.00
L  56 Labour (direct), annual cost..    3.00      456.00        0.00        0.00        0.00        0.00        0.00
L  57 Maintenance, annual cost......    3.00       10.00       10.00       10.00       10.00       10.00       10.00
L  58 Spares, annual cost...........    3.00      221.00      252.00      315.00      315.00      315.00      315.00
L  59 Factory overheads, annual cost    0.00        0.00        0.00        0.00        0.00        0.00        0.00
L  60 Administration, labour cost...    0.00        0.00        0.00        0.00        0.00        0.00        0.00
L  61 Administration, non-labour cos    3.00       48.00       48.00       48.00       48.00       48.00       48.00
L  62 Marketing, labour cost.....       0.00        0.00        0.00        0.00        0.00        0.00        0.00
L  63 Marketing, non-labour cost        3.00      180.00      180.00      180.00      180.00      180.00      180.00
```

```
Tabl BURMA1 : Subtable Production Costs - local
------------------------------------------------------------------------------- COMFAR 2.0  -  UNIDO IO/FEAS, Vienna -----
Col
                                          1           2           3           4           5           6           7

                                   Inflator %  Adjust- Y1  Adjust- Y2  Adjust- Y3  Adjust- Y4  Adjust- Y5  Adjust- Y6
L  82 Raw material, annual cost (a).    3.00      387.00      442.00      552.00      552.00      552.00      552.00
L  83 Raw material, annual cost (b).    3.00      126.00      144.00      180.00      180.00      180.00      180.00
L  84 Utilities, annual cost........    0.00        0.00        0.00        0.00        0.00        0.00        0.00
L  85 Energy, annual cost ..........    3.00       29.00       33.00       41.00       41.00       41.00       41.00
L  86 Labour (direct), annual cost..    3.00      240.00      189.00      189.00      189.00      189.00      189.00
L  87 Maintenance, annual cost......    3.00       37.00       37.00       37.00       37.00       37.00       37.00
L  88 Spares, annual cost...........    3.00       25.00       28.00       36.00       36.00       36.00       36.00
L  89 Factory overheads, annual cost    0.00        0.00        0.00        0.00        0.00        0.00        0.00
L  90 Administration, labour cost...    0.00        0.00        0.00        0.00        0.00        0.00        0.00
L  91 Administration, non-labour cos    3.00       58.00       58.00       58.00       58.00       58.00       58.00
L  92 Marketing, labour cost........    0.00        0.00        0.00        0.00        0.00        0.00        0.00
L  93 Marketing, non-labour cost....    3.00      135.00      135.00      135.00      135.00      135.00      135.00
```

```
Tabi BURMA1 : Subtable Production Program and Sales - foreign
----------------------------------------------------------------------------------------- COMFAR 2.0 - UNIDO IO/FEAS, Vienna -----
Col                                       1          2          3          4          5          6          7

                                   Not used  Quanti- Y1 Quanti- Y2 Quanti- Y3 Quanti- Y4 Quanti- Y5 Quanti- Y6
L 110 Yearly production, export - A    0.00       0.70       0.80       1.00       1.00       1.00       1.00

                                   Inflat- %  1st  year 2nd  year  3rd  year 4th  year  5th  year  6th  year
L 111 Unit price, export product  A.   3.00   17396.00   17396.00   17396.00   17396.00   17396.00   17396.00
L 112 Sales tax, export product  A..   0.00       0.00       0.00       0.00       0.00       0.00       0.00
L 113 Other direct variable cost- A    0.00       0.00       0.00       0.00       0.00       0.00       0.00
L 114 Direct non-variable cost, - A    0.00       0.00       0.00       0.00       0.00       0.00       0.00
L 115 Labour included in direct - A    0.00       0.00       0.00       0.00       0.00       0.00       0.00
```

```
Tabi BURMA1 : Subtable Production Program and Sales - local
---------------------------------------------------------------------------------------- COMFAR 2.0 - UNIDO IO/FEAS, Vienna -----
Col                                       1          2          3          4          5          6          7

                                    ference  Quanti- Y1 Quanti- Y2 Quanti- Y3 Quanti- Y4 Quanti- Y5 Quanti- Y6
L 146 Yearly production, local p- A    2.00       0.70       0.80       1.00       1.00       1.00       1.00

                                   Inflat- %  1st  year 2nd  year  3rd  year 4th  year  5th  year  6th  year
L 147 Unit price, local product  A..   3.00   19923.00   19923.00   19923.00   19923.00   19923.00   19923.00
L 148 Sales tax, local product  A...   0.00       0.00       0.00       0.00       0.00       0.00       0.00
L 149 Other direct variable cost- A    0.00       0.00       0.00       0.00       0.00       0.00       0.00
L 150 Direct non-variable cost, - A    0.00       0.00       0.00       0.00       0.00       0.00       0.00
L 151 Labour included in direct - A    0.00       0.00       0.00       0.00       0.00       0.00       0.00
```

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Tabi BURMA1 : Subtable Working Capital Requirements - f/l
------------------------------------------------------------------------------- COMFAR 2.0  -  UNIDO IO/FEAS, Vienna -----
Col                                             1          2          3          4          5          6          7

                                          Covera- F  Covera- L  Covera- F  Covera- L   Not used   Not used   Not used
L 182 Accounts receivable C1/C2; cas          20.00      20.00       3.75       3.75       1.00       1.00       1.00

                                          Covera- F  Covera- L   not used   not used   Not used   Not used   Not used
L 183 Inventory, raw material (a)...          45.00      45.00       1.00       1.00       1.00       1.00       1.00
L 184 Inventory, raw material (b)...          45.00      45.00       1.00       1.00       1.00       1.00       1.00
L 185 Inventory, utilities..........           0.00       0.00       1.00       1.00       1.00       1.00       1.00
L 186 Inventory, energy.............           0.00       0.00       1.00       1.00       1.00       1.00       1.00
L 187 Inventory, spare parts........           0.00       0.00       1.00       1.00       1.00       1.00       1.00
L 188 Inventory, work-in-progress...           7.50       7.50       1.00       1.00       1.00       1.00       1.00
L 189 Inventory, finished products..          15.00      15.00       1.00       1.00       1.00       1.00       1.00
L 190 Accounts payable..............           0.00       0.00       1.00       1.00       1.00       1.00       1.00
```

```
Tabi BURMA1 : Subtable Source of Finance - foreign
---------------------------------------------------------------------------------------- COMFAR 2.0  -  UNIDO IO/FEAS, Vienna -----
Col                                      1           2           3           4           5           6           7

                                 1st  disbu  2nd  disbu  3rd  disbu  4th  disbu  5th  disbu  6th  disbu  7th  disbu
L 191 Equity-O  (ordinary shares)...     70.00      500.00      480.00     1520.00        0.00        0.00        0.00
L 192 Equity-P  (preference shares).      0.00        0.00        0.00        0.00        0.00        0.00        0.00
L 193 Subsidies, grants.............      0.00        0.00        0.00        0.00        0.00        0.00        0.00
L 194 Loan A, foreign (AF)..........      0.00        0.00        0.00     1980.00     3380.00     8500.00        0.00
L 195 Loan B, foreign (BF)..........      0.00        0.00        0.00        0.00        0.00        0.00        0.00
L 196 Loan C, foreign (CF)..........      0.00        0.00        0.00        0.00        0.00        0.00        0.00
L 197 Overdraft during production...      0.00        0.00        0.00        0.00        0.00        0.00        0.00
```

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Tabi BURMA1 : Subtable Source of Finance - local
---------------------------------------------------------------------------------------- COMFAR 2.0  -  UNIDO IO/FEAS, Vienna -----
Col                                      1           2           3           4           5           6           7

                                 1st  disbu  2nd  disbu  3rd  disbu  4th  disbu  5th  disbu  6th  disbu  7th  disbu
L 198 Equity-O  (ordinary shares)...     86.00      130.00      561.00      856.00      880.00      857.00        0.00
L 199 Equity-P  (preference shares).      0.00        0.00        0.00        0.00        0.00        0.00        0.00
L 200 Subsidies, grants.............      0.00        0.00        0.00        0.00        0.00        0.00        0.00
L 201 Loan A, local (AL)............      0.00        0.00        0.00        0.00        0.00        0.00        0.00
L 202 Loan B, local (BL)............      0.00        0.00        0.00        0.00        0.00        0.00        0.00
L 203 Loan C, local (CL)............      0.00        0.00        0.00        0.00        0.00        0.00        0.00
L 204 Overdraft during production...      0.00        0.00        0.00        0.00        0.00        0.00        0.00
```

COMFAR © 2.0 UNIDO

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------------------------------------------------------------------------------ COMFAR 2.0  -  UNIDO IO/FEAS, Vienna -----

                         Pipe Plant, Burma: Alternative I
                         June 1986
                         81,883 tpy, Pipe Diameter from 6" to 12"

                         3 year(s) of construction, 15 years of production
                         currency conversion rates:
                               foreign currency 1 unit =      1.0000 units accounting currency
                               local   currency 1 unit =      1.0000 units accounting currency
                         accounting currency:     thousands of U.S. Dollars
-------------------------------------------------------------------------------------------------------------------------
                         Total initial investment during construction phase

                               fixed   assets:      14532.47              76.604 % foreign
                               current assets:       5000.00             100.000 % foreign
                               total   assets:      19532.47              82.593 % foreign

-------------------------------------------------------------------------------------------------------------------------
                         Source of funds during construction phase

                              equity & grants:       5940.00              43.266 % foreign
                              foreign  loans :      13860.00
                              local    loans :          0.00
                              total    funds :      19800.00              82.980 % foreign

-------------------------------------------------------------------------------------------------------------------------
                         Cashflow from operations

                              Year:                        1              4              8
                              operating costs:      21141.00       31901.07       35904.93
                              depreciation   :       1361.55        1361.55        1307.15
                              interest       :       1178.10         673.20           0.00
                              ------------------ ------------  ------------   ------------
                              production costs      23680.65       33935.82       37212.08
                              thereof foreign          94.62 %        95.35 %        95.31 %
                              total sales    :      26123.30       40779.48       45897.66

                              gross income   :       2442.65        6843.66        8685.57
                              net   income   :       2442.65        6843.66        8685.57
                              cash balance   :       1876.13        6004.01        9743.76
                              net cashflow   :       5034.23        8657.21        9743.76


                              Net Present Value    at:  10.00 % =       40149.84
                              Internal Rate of Return:  36.65 %
                              Return on equity1:        59.55 %
                              Return on equity2:        51.46 %

-------------------------------------------------------------------------------------------------------------------------
                         Index of Schedules produced by COMFAR

                         Total initial investment               Cashflow Tables
                         Total investment during production     Projected Balance
                         Total production costs                 Net income statement
                         Working Capital requirements           Source of finance
```

Total Initial Investment in thousands of U.S. Dollars

Year	1987.1	1987.2	1988.1	1988.2	1989.1	1989.2
Fixed investuent costs						
Land, site preparation, development	72.00	150.00	92.00	0.00	0.00	0.00
Buildings and civil works	0.00	0.00	546.00	870.00	560.00	560.00
Auxiliary and service facilities	0.00	0.00	0.00	0.00	0.00	0.00
Incorporated fixed assets	0.00	0.00	0.00	0.00	0.00	0.00
Plant machinery and equipment	0.00	0.00	0.00	2962.00	3362.00	2962.00
Total fixed investuent costs	72.00	150.00	638.00	3832.00	3922.00	3522.00
Pre-production capital expenditures.	84.00	480.00	403.00	515.08	332.98	581.42
Net working capital	0.00	0.00	0.00	0.00	0.00	5000.00
Total initial investment costs	156.00	630.00	1041.00	4347.08	4254.98	9103.42
Of it foreign, in %	44.87	79.37	46.11	80.08	79.08	90.48

Pipe Plant, Burma: Alternative I --- June 1986

COMFAR 2.0 UNIDO

COMFAR 2.0 - UNIDO IO/FEAS, Vienna

Total Current Investment in thousands of U.S. Dollars

Year	1990	1991	1992	1993	1994	1995
Fixed investment costs						
Land, site preparation, development	0.00	0.00	0.00	0.00	0.00	0.00
Buildings and civil works	0.00	0.00	0.00	0.00	0.00	84.00
Auxiliary and service facilities	0.00	0.00	0.00	0.00	0.00	0.00
Incorporated fixed assets	0.00	0.00	0.00	0.00	0.00	0.00
Plant, machinery and equipment	0.00	0.00	0.00	0.00	0.00	116.00
Total fixed investment costs	0.00	0.00	0.00	0.00	0.00	200.00
Preproduction capitals expenditures.	0.00	0.00	0.00	0.00	0.00	0.00
Working capital	-51.93	791.07	1634.08	221.20	227.83	234.67
Total current investment costs	-51.93	791.07	1634.08	221.20	227.83	434.67
Of it foreign, %	96.35	97.75	97.20	96.69	96.69	86.02

Pipe Plant, Burma: Alternative I --- June 1986

COMFAR 2.0 - UNIDO IO/FEAS, Vienna

Total Current Investment in thousands of U.S. Dollars

Year	1996	1997	1998	1999	2000	2001
Fixed investment costs						
Land, site preparation, development	0.00	0.00	0.00	0.00	0.00	0.00
Buildings and civil works	0.00	0.00	0.00	0.00	97.00	0.00
Auxiliary and service facilities	0.00	0.00	0.00	0.00	0.00	0.00
Incorporated fixed assets	0.00	0.00	0.00	0.00	0.00	0.00
Plant, machinery and equipment	0.00	0.00	0.00	0.00	134.00	0.00
Total fixed investment costs	0.00	0.00	0.00	0.00	231.00	0.00
Preproduction capitals expenditures.	0.00	0.00	0.00	0.00	0.00	0.00
Working capital	241.71	248.96	256.43	264.12	272.05	280.20
Total current investment costs	241.71	248.96	256.43	264.12	503.05	280.20
Of it foreign, %	96.69	96.69	96.69	96.69	86.28	96.69

Pipe Plant, Burma: Alternative I --- June 1986

COMFAR 2.0 UNIDO

COMFAR 2.0 - UNIDO IO/FEAS, Vienna

Total Current Investment in thousands of U.S. Dollars

Year	2002	2003	2004
Fixed investment costs			
Land, site preparation, development	0.00	0.00	0.00
Buildings and civil works	0.00	0.00	0.00
Auxiliary and service facilities .	0.00	0.00	0.00
Incorporated fixed assets	0.00	0.00	0.00
Plant, machinery and equipment . .	0.00	0.00	0.00
Total fixed investment costs	0.00	0.00	0.00
Preproduction capitals expenditures.	0.00	0.00	0.00
Working capital	288.61	297.27	306.19
Total current investment costs . . .	288.61	297.27	306.19
Of it foreign, %	96.69	96.69	96.69

Pipe Plant, Burma: Alternative I --- June 1986

COMFAR 2.0 UNIDO

COMFAR 2.0 - UNIDO IO/FEAS, Vienna

Total Production Costs in thousands of U.S. Dollars

Year	1990	1991	1992	1993	1994	1995
% of nom. capacity (single product).	70.00	80.00	100.00	100.00	100.00	100.00
Raw material 1	19565.00	23030.86	29651.09	30540.63	31456.84	32400.55
Other raw materials	137.00	161.71	207.94	214.17	220.60	227.22
Utilities	0.00	0.00	0.00	0.00	0.00	0.00
Energy	29.00	33.99	43.50	44.80	46.15	47.53
Labour, direct	696.00	194.67	200.51	206.53	212.72	219.10
Repair, maintenance	47.00	48.41	49.86	51.36	52.90	54.49
Spares	246.00	288.40	372.38	383.55	395.05	406.91
Factory overheads	0.00	0.00	0.00	0.00	0.00	0.00
Factory costs	20720.00	23757.98	30525.28	31441.03	32384.26	33355.79
Administrative overheads	106.00	109.18	112.46	115.83	119.30	122.88
Indir. costs, sales and distribution	315.00	324.45	334.18	344.21	354.54	365.17
Direct costs, sales and distrbution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation	1361.55	1361.55	1361.55	1361.55	1361.55	1267.15
Financial costs	1178.10	1009.80	841.50	673.20	504.90	336.60
Total production costs	23680.65	26562.96	33174.96	33935.82	34724.55	35447.59
Costs per unit (single product) .	16914.75	16601.85	16587.48	16967.91	17362.27	17723.80
Of it foreign, %	94.62	94.98	95.36	95.35	95.34	95.35
Of it variable,%	0.00	0.00	0.00	0.00	0.00	0.00
Total labour	696.00	194.67	200.51	206.53	212.72	219.10

Pipe Plant, Burma: Alternative I --- June 1986

COMFAR 2.0 UNIDO

COMFAR 2.0 - UNIDO IO/FEAS, Vienna

Total Production Costs in thousands of U.S. Dollars

Year	1996	1997	1998	1999	2000	2001
% of nom. capacity (single product).	100.00	100.00	100.00	100.00	100.00	100.00
Raw material 1	33372.56	34373.74	35404.95	36467.10	37561.11	38687.95
Other raw materials	234.03	241.06	248.29	255.74	263.41	271.31
Utilities	0.00	0.00	0.00	0.00	0.00	0.00
Energy	48.96	50.42	51.94	53.50	55.10	56.75
Labour, direct	225.68	232.45	239.42	246.60	254.00	261.62
Repair, maintenance	56.12	57.80	59.54	61.32	63.16	65.06
Spares	419.11	431.69	444.64	457.98	471.71	485.87
Factory overheads	0.00	0.00	0.00	0.00	0.00	0.00
Factory costs	34356.46	35387.15	36448.77	37542.23	38668.50	39828.56
Administrative overheads	126.57	130.37	134.28	138.31	142.46	146.73
Indir. costs, sales and distribution	376.13	387.41	399.03	411.00	423.33	436.03
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation	1307.15	1307.15	1307.15	1307.15	167.30	185.10
Financial costs	168.30	0.00	0.00	0.00	0.00	0.00
Total production costs	36334.61	37212.08	38289.23	39398.69	39401.59	40596.43
Costs per unit (single product)	18167.30	18606.04	19144.61	19699.35	19700.79	20298.21
Of it foreign, %	95.32	95.31	95.32	95.34	95.51	95.51
Of it variable,%	0.00	0.00	0.00	0.00	0.00	0.00
Total abour	225.68	232.45	239.42	246.60	254.00	261.62

Pipe Plant, Burma: Alternative I --- June 1986

COMFAR 2.0 UNIDO

COMFAR 2.0 - UNIDO IO/FEAS, Vienna

Total Production Costs in thousands of U.S. Dollars

Year	2002	2003	2004
% of nom. capacity (single product).	100.00	100.00	100.00
Raw material 1	39848.58	41044.04	42275.36
Other raw materials	279.45	287.83	296.47
Utilities	0.00	0.00	0.00
Energy	58.46	60.21	62.02
Labour, direct	269.47	277.55	285.88
Repair, maintenance	67.01	69.02	71.09
Spares	500.44	515.46	530.92
Factory overheads	0.00	0.00	0.00
Factory costs	41023.41	42254.11	43521.73
Administrative overheads	151.13	155.66	160.33
Indir. costs, sales and distribution	449.11	462.59	476.47
Direct costs, sales and distribution	0.00	0.00	0.00
Depreciation	185.10	185.10	185.10
Financial costs	0.00	0.00	0.00
Total production costs	41808.75	43057.46	44343.63
Costs per unit (single product) .	20904.38	21528.73	22171.82
Of it foreign, %	95.52	95.53	95.54
Of it variable,%	0.00	0.00	0.00
Total labour	269.47	277.55	285.88

Pipe Plant, Burma: Alternative I --- June 1986

COMFAR 2.0 UNIDO

-- COMFAR 2.0 - UNIDO IO/FEAS, Vienna -----

Net Working Capital in thousands of U.S. Dollars

Year			1990	1991	1992	1993	1994
Coverage	mdc	coto					
Current assets &							
Accounts receivable . . .	20	18.0	1174.50	1343.98	1720.66	1772.28	1825.45
Inventory and materials .	45	8.0	2462.75	2899.06	3732.38	3844.35	3959.68
Energy	0	---	0.00	0.00	0.00	0.00	0.00
Spares	0	---	0.00	0.00	0.00	0.00	0.00
Work in progress	8	48.0	431.67	494.96	635.94	655.02	674.67
Finished products . . .	15	24.0	867.75	994.46	1276.57	1314.87	1354.32
Cash in hand	4	96.0	11.41	6.67	7.66	7.89	8.12
Total current assets			4948.07	5739.14	7373.21	7594.41	7822.24
Current liabilities and Accounts payable	0	---	0.00	0.00	0.00	0.00	0.00
Net working capital			4948.07	5739.14	7373.21	7594.41	7822.24
Increase in working capital			-51.93	791.07	1634.08	221.20	227.83
Net working capital, local			180.65	198.48	244.18	251.50	259.05
Net working capital, foreign			4767.42	5540.66	7129.04	7342.91	7563.20

Note: mdc = minimum days of coverage ; coto = coefficient of turnover .

Pipe Plant, Burma: Alternative I --- June 1986

-- COMFAR 2.0 - UNIDO IO/FEAS, Vienna -----

Net Working Capital in thousands of U.S. Dollars

Year			1995	1996	1997	1998	1999
Coverage	mdc	coto					
Current assets &							
Accounts receivable . . .	20	18.0	1880.21	1936.62	1994.72	2054.56	2116.20
Inventory and materials .	45	8.0	4078.47	4200.82	4326.85	4456.66	4590.35
Energy	0	---	0.00	0.00	0.00	0.00	0.00
Spares	0	---	0.00	0.00	0.00	0.00	0.00
Work in progress	8	48.0	694.91	715.76	737.23	759.35	782.13
Finished products . . .	15	24.0	1394.94	1436.79	1479.90	1524.29	1570.02
Cash in hand	4	96.0	8.37	8.62	8.88	9.14	9.42
Total current assets			8056.91	8298.62	8547.58	8804.00	9068.12
Current liabilities and Accounts payable	0	---	0.00	0.00	0.00	0.00	0.00
Net working capital			8056.91	8298.62	8547.58	8804.00	9068.12
Increase in working capital			234.67	241.71	248.96	256.43	264.12
Net working capital, local			266.82	274.82	283.07	291.56	300.31
Net working capital, foreign			7790.09	8023.79	8264.51	8512.44	8767.82

Note: mdc = minimum days of coverage ; coto = coefficient of turnover .

Pipe Plant, Burma: Alternative I --- June 1986

Net Working Capital in thousands of U.S. Dollars

Year			2000	2001	2002	2003	2004
Coverage	mdc	coto					
Current assets &							
Accounts receivable	20	18.0	2179.68	2245.07	2312.43	2381.80	2453.25
Inventory and materials	45	8.0	4728.07	4869.91	5016.00	5166.48	5321.48
Energy	0	---	0.00	0.00	0.00	0.00	0.00
Spares	0	---	0.00	0.00	0.00	0.00	0.00
Work in progress	8	48.0	805.59	829.76	854.65	880.29	906.70
Finished products	15	24.0	1617.12	1665.64	1715.61	1767.07	1820.09
Cash in hand	4	96.0	9.70	9.99	10.29	10.60	10.92
Total current assets			9340.17	9620.37	9908.98	10206.25	10512.44
Current liabilities and							
Accounts payable	0	---	0.00	0.00	0.00	0.00	0.00
Net working capital			9340.17	9620.37	9908.98	10206.25	10512.44
Increase in working capital			272.04	280.20	288.61	297.27	306.19
Net working capital, local			309.32	318.59	328.15	338.00	348.14
Net working capital, foreign			9030.85	9301.78	9580.83	9868.25	10164.30

Note: mdc = minimum days of coverage ; coto = coefficient of turnover .

Source of Finance, construction in thousands of U.S. Dollars

Year	1987.1	1987.2	1988.1	1988.2	1989.1	1989.2
Equity, ordinary ..	156.00	630.00	1041.00	2376.00	880.00	857.00
Equity, preference.	0.00	0.00	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, foreign .	0.00	0.00	0.00	1980.00	3380.00	8500.00
Loan B, foreign..	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00	0.00	0.00
Total loan	0.00	0.00	0.00	1980.00	3380.00	8500.00
Current liabilities	0.00	0.00	0.00	0.00	9.00	0.00
Bank overdraft	0.00	0.00	0.00	0.00	0.00	0.00
Total funds	156.00	630.00	1041.00	4356.00	4260.00	9357.00

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--------------------------------------------------------------------------------- COMFAR 2.0  -  UNIDO IO/FEAS, Vienna -----

Source of Finance, production in  thousands of U.S. Dollars

Year ..............         1990-96

Equity, ordinary ..            0.00
Equity, preference.            0.00
Subsidies, grants .            0.00

  Loan A, foreign .        -1980.00
  Loan B, foreign..            0.00
  Loan C, foreign .            0.00
  Loan A, local....            0.00
  Loan B, local....            0.00
  Loan C, local....            0.00
                     --------------
Total loan ........        -1980.00

Current liabilitie.            0.00
Bank overdraft ....            0.00
                     --------------
Total funds .......        -1980.00
-------------------------------------------------------------------------------------------------------------------------------
                                                                       Pipe Plant, Burma: Alternative I --- June 1986
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Cashflow Tables, construction in thousands of U.S. Dollars

Year	1987.1	1987.2	1988.1	1988.2	1989.1	1989.2
Total cash inflow . .	156.00	630.00	1041.00	4356.00	4260.00	9357.00
Financial resources .	156.00	630.00	1041.00	4356.00	4260.00	9357.00
Sales, net of tax . .	0.00	0.00	0.00	0.00	0.00	0.00
Total cash outflow . .	156.00	630.00	1041.00	4347.08	4254.98	9103.42
Total assets	156.00	630.00	1041.00	4305.00	4099.00	8695.00
Operating costs . . .	0.00	0.00	0.00	0.00	0.00	0.00
Cost of finance . . .	0.00	0.00	0.00	42.08	155.98	408.42
Repayment	0.00	0.00	0.00	0.00	0.00	0.00
Corporate tax . . .	0.00	0.00	0.00	0.00	0.00	0.00
Dividends paid . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus (deficit) .	0.00	0.00	0.00	8.92	5.02	253.58
Cumulated cash balance	0.00	0.00	0.00	8.92	13.95	267.52
Influ, local	86.00	130.00	561.00	856.00	880.00	857.00
Outflow, local	86.00	130.00	561.00	866.00	890.00	867.00
Surplus (deficit) .	0.00	0.00	0.00	-10.00	-10.00	-10.00
Influ, foreign . . .	70.00	500.00	480.00	3500.00	3380.00	8500.00
Outflow, foreign . . .	70.00	500.00	480.00	3481.07	3364.98	8236.42
Surplus (deficit) .	0.00	0.00	0.00	18.93	15.02	263.58
Net cashflow	-156.00	-630.00	-1041.00	-4305.00	-4099.00	-8695.00
Cumulated net cashflow	-156.00	-786.00	-1827.00	-6132.00	-10231.00	-18926.00

COMFAR 2.0 - UNIDO IO/FEAS, Vienna

Cashflow tables, production in thousands of U.S. Dollars

Year	1990	1991	1992	1993	1994	1995
Total cash inflow . .	26123.30	30750.86	39591.73	40779.48	42002.86	43262.94
Financial resources .	0.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax . .	26123.30	30750.86	39591.73	40779.48	42002.86	43262.94
Total cash outflow . .	24247.17	27972.48	35427.49	34775.46	35570.83	36595.11
Total assets	-51.93	791.07	1634.08	221.20	227.83	434.67
Operating costs . . .	21141.00	24191.61	30971.92	31901.07	32858.10	33843.84
Cost of finance . . .	1178.10	1009.80	841.50	673.20	504.90	336.60
Repayment	1980.00	1980.00	1980.00	1980.00	1980.00	1980.00
Corporate tax . . .	0.00	0.00	0.00	0.00	0.00	0.00
Dividends paid . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus (deficit) .	1876.13	2778.38	4164.23	6004.01	6432.03	6667.83
Cumulated cash balance	2143.65	4922.03	9086.27	15090.28	21522.30	28190.13
Inflow, local	13946.10	16416.55	21136.31	21770.40	22423.51	23096.21
Outflow, local	1217.65	1115.81	1348.48	1349.19	1389.67	1484.36
Surplus (deficit) .	12728.44	15300.74	19787.83	20421.21	21033.84	21611.85
Inflow, foreign . . .	12177.20	14334.30	18455.42	19009.08	19579.35	20166.73
Outflow, foreign . . .	23029.52	26856.67	34079.01	33426.27	34181.16	35110.75
Surplus (deficit) .	-10852.32	-12522.36	-15623.60	-14417.20	-14601.81	-14944.03
Net cashflow	5034.23	5768.18	6985.74	8657.21	8916.93	8984.43
Cumulated net cashflow	-13891.77	-8123.59	-1137.86	7519.35	16436.28	25420.71

Pipe Plant, Burma: Alternative I --- June 1986

COMFAR 2.0 UNIDO

COMFAR 2.0 - UNIDO IO/FEAS, Vienna

Cashflow tables, production in thousands of U.S. Dollars

Year	1996	1997	1998	1999	2000	2001
Total cash inflow . .	44560.83	45897.66	47274.59	48692.82	50153.61	51658.21
Financial resources .	0.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax . .	44560.83	45897.66	47274.59	48692.82	50153.61	51658.21
Total cash outflow . .	37249.16	36153.89	37238.52	38355.66	39737.33	40691.52
Total assets	241.71	248.96	256.43	264.12	503.04	280.20
Operating costs . . .	34859.16	35904.93	36982.09	38091.54	39234.29	40411.32
Cost of finance . . .	168.30	0.00	0.00	0.00	0.00	0.00
Repayment	1980.00	0.00	0.00	0.00	0.00	0.00
Corporate tax . . .	0.00	0.90	0.00	0.00	0.00	0.00
Dividends paid . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus (deficit) .	7311.66	9743.77	10036.07	10337.16	10416.28	10966.69
Cumulated cash balance	35501.80	45245.56	55281.63	65618.79	76035.06	87001.75
Inflow local	23789.10	24502.77	25237.86	25994.99	26774.84	27578.09
Outflow, local	1474.30	1518.53	1564.09	1611.01	1719.34	1709.12
Surplus (deficit) .	22314.80	22984.24	23673.77	24383.98	25055.50	25868.96
Inflow, foreign . . .	20771.73	21394.88	22036.73	22697.83	23378.77	24080.13
Outflow, foreign . . .	35774.87	34635.36	35674.43	36744.65	38018.00	38982.40
Surplus (deficit) .	-15003.14	-13240.48	-13637.70	-14046.82	-14639.23	-14902.28
Net cashflow	9459.96	9743.77	10036.07	10337.16	10416.28	10966.69
Cumulated net cashflow	34880.67	44624.44	54660.51	64997.66	75413.94	86380.63

Pipe Plant, Burma: Alternative I --- June 1986

Cashflow tables, production in thousands of U.S. Dollars

Year	2002	2003	2004
Total cash inflow . .	53207.95	54804.20	56448.32
Financial resources .	0.00	0.00	0.00
Sales, net of tax . .	53207.95	54804.20	56448.32
Total cash outflow . .	41912.26	43169.63	44464.72
Total assets	288.61	297.27	306.19
Operating costs . . .	41623.65	42872.36	44158.53
Cost of finance . . .	0.00	0.00	0.00
Repayment	0.00	0.00	0.00
Corporate tax . . .	0.00	0.00	0.00
Dividends paid . . .	0.00	0.00	0.00
Surplus (deficit) .	11295.69	11634.57	11983.60
Cumulated cash balance	98297.44	109932.00	121915.60
Inflow, local	28405.43	29257.59	30135.31
Outflow, local	1760.39	1813.20	1867.66
Surplus (deficit) .	26645.04	27444.39	28267.71
Inflow, foreign . . .	24802.53	25546.61	26313.00
Outflow, foreign . . .	40151.88	41356.43	42597.12
Surplus (deficit) .	-15349.35	-15809.82	-16284.12
Net cashflow	11295.69	11634.57	11983.60
Cumulated net cashflow	97676.31	109310.90	121294.50

Cashflow Discounting:

```
a) Return on Equity 1:
        Net  present  value ..............  41414.34  at      10.00 %
        Internal Rate of Return  (IRRE1) ..     59.55 %
b) Return on Equity 2:
        Net  present  value ..............  39727.11  at      10.00 %
        Internal Rate of Return  (IRRE2) ..     51.46 %
c) Internal Rate of Return on total investment:
        Net  present  value ..............  40149.84  at      10.00 %
        Internal Rate of Return  ( IRR ) ..     36.65 %
Equity 1 = Total equity paid : Net income
Equity 2 = Initial equity paid : Net cash return
```

COMFAR 2.0 UNIDO

COMFAR 2.0 - UNIDO ID/FEAS, Vienna

Net Income Statement in thousands of U.S. Dollars

Year	1990	1991	1992	1993	1994
Total sales, incl. sales tax	26123.30	30750.86	39591.73	40779.48	42002.86
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin	26123.30	30750.86	39591.73	40779.48	42002.86
As % of total sales	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	22502.55	25553.16	32333.46	33262.62	34219.65
Operational margin	3620.75	5197.70	7258.27	7516.86	7783.21
As % of total sales	13.86	16.90	18.33	18.43	18.53
Cost of finance	1178.10	1009.80	841.50	673.20	504.90
Gross profit	2442.65	4187.90	6416.77	6843.66	7278.32
Allowances	0.00	0.00	0.00	0.00	0.00
Taxable profit	2442.65	4187.90	6416.77	6843.66	7278.32
Tax	0.00	0.00	0.00	0.00	0.00
Net profit	2442.65	4187.90	6416.77	6843.66	7278.32
Dividends paid	0.00	0.00	0.00	0.00	0.00
Undistributed profit	2442.65	4187.90	6416.77	6843.66	7278.32
Accumulated undistributed profit . . .	2442.65	6630.55	13047.32	19890.98	27169.29
Gross profit, % of total sales	9.35	13.62	16.21	16.78	17.33
Net profit, % of total sales	9.35	13.62	16.21	16.78	17.33
ROE, Net profit, % of equity	41.12	70.50	108.03	115.21	122.53
ROI, Net profit+interest, % of invest.	19.18	26.43	34.08	34.93	35.79

Pipe Plant, Burma: Alternative I --- June 1986

COMFAR 2.0 UNIDO

COMFAR 2.0 - UNIDO IO/FEAS, Vienna

Net Income Statement in thousands of U.S. Dollars

Year	1995	1996	1997	1998	1999
Total sales, incl. sales tax	43262.94	44560.83	45897.66	47274.59	48692.82
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin	43262.94	44560.83	45897.66	47274.59	48692.82
As % of total sales	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	35110.99	36166.31	37212.08	38289.23	39398.69
Operational margin	8151.95	8394.52	8685.57	8985.36	9294.13
As % of total sales	18.84	18.84	18.92	19.01	19.09
Cost of finance	336.60	168.30	0.00	0.00	0.00
Gross profit	7815.35	8226.22	8685.57	8985.36	9294.13
Allowances	0.00	0.00	0.00	0.00	0.00
Taxable profit	7815.35	8226.22	8685.57	8985.36	9294.13
Tax	0.00	0.00	0.00	0.00	0.00
Net profit	7815.35	8226.22	8685.57	8985.36	9294.13
Dividends paid	0.00	0.00	0.00	0.00	0.00
Undistributed profit	7815.35	8226.22	8685.57	8985.36	9294.13
Accumulated undistributed profit	34984.64	43210.86	51896.44	60881.79	70175.92
Gross profit, % of total sales	18.06	18.46	18.92	19.01	19.09
Net profit, % of total sales	18.06	18.46	18.92	19.01	19.09
ROE, Net profit, % of equity	131.57	138.49	146.22	151.27	156.47
ROI, Net profit+interest, % of invest.	36.75	37.43	38.31	39.19	40.07

Pipe Plant, Burma: Alternative I --- June 1986

COMFAR 2.0 UNIDO

COMFAR 2.0 - UNIDO IO/FEAS, Vienna

Net Income Statement in thousands of U.S. Dollars

Year	2000	2001	2002	2003	2004
Total sales, incl. sales tax	50153.61	51658.21	53207.95	54804.20	56448.32
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin	50153.61	51658.21	53207.95	54804.20	56448.32
As % of total sales	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	39401.59	40596.42	41808.76	43057.46	44343.63
Operational margin	10752.02	11061.79	11399.20	11746.73	12104.68
As % of total sales	21.44	21.41	21.42	21.43	21.44
Cost of finance	0.00	0.00	0.00	0.00	0.00
Gross profit	10752.02	11061.79	11399.20	11746.73	12104.68
Allowances	0.00	0.00	0.00	0.00	0.00
Taxable profit	10752.02	11061.79	11399.20	11746.73	12104.68
Tax	0.00	0.00	0.00	0.00	0.00
Net profit	10752.02	11061.79	11399.20	11746.73	12104.68
Dividends paid	0.00	0.00	0.00	0.00	0.00
Undistributed profit	10752.02	11061.79	11399.20	11746.73	12104.68
Accumulated undistributed profit	80927.94	91989.73	103388.90	115135.70	127240.30
Gross profit, % of total sales	21.44	21.41	21.42	21.43	21.44
Net profit, % of total sales	21.44	21.41	21.42	21.43	21.44
ROE, Net profit, % of equity	181.01	186.23	191.91	197.76	203.78
ROI, Net profit+interest, % of invest.	45.37	46.13	46.98	47.82	48.67

Pipe Plant, Burma: Alternative I --- June 1986

COMFAR 2.0 UNIDO

COMFAR 2.0 - UNIDO IO/FEAS, Vienna

Projected Balance Sheets, construction in thousands of U.S. Dollars

Year	1987.1	1987.2	1988.1	1988.2	1989.1	1989.2
Total assets	156.00	786.00	1827.00	6183.00	10443.00	19800.00
Fixed assets, net of depreciation	0.00	156.00	786.00	1827.00	6174.08	10429.05
Construction in progress	156.00	630.00	1041.00	4347.08	4254.98	4103.42
Current assets	0.00	0.00	0.00	0.00	0.00	5000.00
Cash, bank	0.00	0.00	0.00	0.00	0.00	0.00
Cash surplus, finance available	0.00	0.00	0.00	8.92	13.95	267.52
Loss carried forward	0.00	0.00	0.00	0.00	0.00	0.00
Loss	0.00	0.00	0.00	0.00	0.00	0.00
Total liabilities	156.00	786.00	1827.00	6183.00	10443.00	19800.00
Equity capital	156.00	786.00	1827.00	4203.00	5083.00	5940.00
Reserves, retained profit	0.00	0.00	0.00	0.00	0.00	0.00
Profit	0.00	0.00	0.00	0.00	0.00	0.00
Long and medium term debt	0.00	0.00	0.00	1980.00	5360.00	13860.00
Current liabilities	0.00	0.00	0.00	0.00	0.00	0.00
Bank overdraft, finance required.	0.00	0.00	0.00	0.00	0.00	0.00
Total debt	0.00	0.00	0.00	1980.00	5360.00	13860.00
Equity, % of liabilities	100.00	100.00	100.00	67.98	48.67	30.00

Pipe Plant, Burma: Alternative I --- June 1986

COMFAR 2.0 UNIDO

COMFAR 2.0 - UNIDO IO/FEAS, Vienna

Projected Balance Sheets, Production in thousands of U.S. Dollars

Year	1990	1991	1992	1993	1994	1995
Total assets	20262.65	22470.55	26907.32	31770.98	37069.29	42904.64
Fixed assets, net of depreciation	13170.93	11809.38	10447.83	9086.29	7724.74	6457.59
Construction in progress	0.00	0.00	0.00	0.00	0.00	200.00
Current assets	4936.67	5732.46	7365.56	7586.52	7814.12	8048.54
Cash, bank	11.41	6.67	7.66	7.89	8.12	8.37
Cash surplus, finance available	2143.65	4922.03	9086.27	15090.28	21522.31	28190.14
Loss carried forward	0.00	0.00	0.00	0.00	0.00	0.00
Loss	0.00	0.00	0.00	0.00	0.00	0.00
Total liabilities	20262.65	22470.55	26907.32	31770.98	37069.29	42904.64
Equity capital	5940.00	5940.00	5940.00	5940.00	5940.00	5940.00
Reserves, retained profit	0.00	2442.65	6630.55	13047.32	19890.98	27169.29
Profit	2442.65	4187.90	6416.77	6843.66	7278.32	7815.35
Long and medium term debt	11880.00	9900.00	7920.00	5940.00	3960.00	1980.00
Current liabilities	0.00	0.00	0.00	0.00	0.00	0.00
Bank overdraft, finance required.	0.00	0.00	0.00	0.00	0.00	0.00
Total debt	11880.00	9900.00	7920.00	5940.00	3960.00	1980.00
Equity, % of liabilities	29.32	26.43	22.08	18.70	16.02	13.84

Pipe Plant, Burma: Alternative I --- June 1986

COMFAR 2.0 - UNIDO IO/FEAS, Vienna

Projected Balance Sheets, Production in thousands of U.S. Dollars

Year	1996	1997	1998	1999	2000	2001
Total assets	49150.86	57836.44	66821.80	76115.92	86867.94	97929.73
Fixed assets, net of depreciation	5350.45	4043.30	2736.15	1429.00	1261.70	1307.60
Construction in progress	0.00	0.00	0.00	0.00	231.00	0.00
Current assets	8290.00	8538.70	8794.86	9058.70	9330.46	9610.38
Cash, bank	8.62	8.88	9.14	9.42	9.70	9.99
Cash surplus, finance available	35501.80	45245.56	55281.64	65618.80	76035.07	87001.77
Loss carried forward	0.00	0.00	0.00	0.00	0.00	0.00
Loss	0.00	0.00	0.00	0.00	0.00	0.00
Total liabilities	49150.86	57836.44	66821.80	76115.92	86867.94	97929.73
Equity capital	5940.00	5940.00	5940.00	5940.00	5940.00	5940.00
Reserves, retained profit	34984.64	43210.86	51896.44	60881.79	70175.92	80927.94
Profit	8226.22	8685.57	8985.36	9294.13	10752.02	11061.79
Long and medium term debt	0.00	0.00	0.00	0.00	0.00	0.00
Current liabilities	0.00	0.00	0.00	0.00	0.00	0.00
Bank overdraft, finance required.	0.00	0.00	0.00	0.00	0.00	0.00
Total debt	0.00	0.00	0.00	0.00	0.00	0.00
Equity, % of liabilities	12.09	10.27	8.89	7.80	6.84	6.07

Pipe Plant, Burma: Alternative I --- June 1986

Projected Balance Sheets, Production in thousands of U.S. Dollars

Year	2002	2003	2004
Total assets	109328.90	121075.70	133180.30
Fixed assets, net of depreciation	1122.50	937.40	752.30
Construction in progress	0.00	0.00	0.00
Current assets	9898.69	10195.65	10501.52
Cash, bank	10.29	10.60	10.92
Cash surplus, finance available	98297.45	109932.00	121915.60
Loss carried forward	0.00	0.00	0.00
Loss	0.00	0.00	0.00
Total liabilities	109328.90	121075.70	133180.30
Equity capital	5940.00	5940.00	5940.00
Reserves, retained profit	91989.73	103388.90	115135.70
Profit	11399.20	11746.73	12104.68
Long and medium term debt	0.00	0.00	0.00
Current liabilities	0.00	0.00	0.00
Bank overdraft, finance required.	0.00	0.00	0.00
Total debt	0.00	0.00	0.00
Equity, % of liabilities	5.43	4.91	4.46

SECTION 1

PIPE PLANT, BURMA JUNE 1986, ALTERNATIVE I

BREAK-EVEN AND SENSITIVITY ANALYSIS, NATIONAL NET VALUE ADDED, INFLATION CONSIDERED: 3% p.a.

		YEAR:	1987	1988	1989	1990	1991	1992	1993
			CONSTRUCTION PHASE						
PRODUCTION RATE						70%	80%	100%	100%
SALES VOLUME (TONNES)						57,316	65,504	81,880	81,880
SALES, NET OF TAX		(A)	0	0	0	26,123	30,751	39,592	40,779
RAW MATERIAL I	variable cost					19,564	23,030	29,651	30,541
OTHER RAW MATERIALS	variable cost					137	162	208	214
ENERGY	variable cost					29	34	44	45
LABOUR local	fixed cost					240	195	201	207
LABOUR foreign	fixed cost					456	0	0	0
MAINT. (CIV.) EMM.DISP.	fixed cost					47	48	50	51
SPARES	variable cost					246	289	372	384
ADMIN. (NON LABOUR)	fixed cost					106	109	112	116
SALES and DISTRIBUTION	fixed cost					315	324	334	344
TOTAL ASSETS			786	5,388	13,358	-52	791	1,634	221
COST OF FINANCE	fixed cost					1,178	1,010	842	673
REPAYMENT	fixed cost					1,980	1,980	1,980	1,980
TOTAL CASH OUTFLOW		(B)	786	5,388	13,358	24,246	27,972	35,428	34,776
SURPLUS (DEFICIT)		(A-B)	-786	-5,388	-13,358	1,877	2,779	4,164	6,004
SURPLUS (DEFICIT) ACCUM.			-786	-6,174	-19,532	-17,655	-14,876	-10,712	-4,708
ROI (CASH SURPLUS)						9.5%	14.0%	21.0%	30.3%
ROE (CASH SURPLUS)						31.6%	46.8%	70.1%	101.1%
BREAK-EVEN ANALYSIS									
TOTAL FIXED COSTS		F				4,322	3,667	3,519	3,371
TOTAL VARI. COSTS (at 100%)		V				28,537	29,393	30,275	31,183
SALES, NET OF TAX (at 100%)		P				37,319	38,439	39,592	40,779
BEP (BREAK-EVEN POINT)		F/(P-V)				49.2%	40.5%	37.8%	35.1%
SENSITIVITY ANALYSIS									
RAW MAT's at +10%:	BEP					72.4%	59.7%	55.6%	51.7%
	SURPLUS					1,697	1,689	1,178	2,928
RAW MAT's at -10%:	BEP					37.3%	30.7%	28.6%	26.6%
	SURPLUS					7,326	7,487	7,150	9,079
SALES at +10%:	BEP					34.5%	28.4%	26.5%	24.7%
	SURPLUS					8,244	8,432	8,123	10,082
SALES at -10%:	BEP					85.6%	70.5%	65.7%	61.1%
	SURPLUS					780	744	205	1,926
INVESTM. at +10%:	BEP					52.8%	43.8%	40.8%	37.9%
	SURPLUS					4,196	4,289	3,382	5,739
INVESTM. at -10%:	BEP					45.6%	37.2%	34.7%	32.4%
	SURPLUS					4,828	4,837	4,446	6,269
NATIONAL NET VALUE ADDED									
NAT. VALUE ADDED (=LABOUR LOC.+SURPLUS)						2,117	2,973	4,365	6,210
NAT. NET VALUE ADD.(=ACC.N.V.A.- INVESTM.)						105,701			

SECTION 2

INFLATION CONSIDERED: 3% p.a.   CURRENCY: 1000 U.S. Dollars

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
04	81,880	81,880	81,880	81,880	81,880	81,880	81,880	81,880	81,880	81,880	81,880	81,880	81,880
0,751	39,592	40,779	42,003	43,263	44,561	45,898	47,275	48,693	50,154	51,658	53,208	54,804	56,448
3,030	29,651	30,541	31,457	32,401	33,373	34,374	35,405	36,467	37,561	38,688	39,849	41,044	42,275
162	208	214	221	227	234	241	248	256	263	271	279	288	296
34	44	45	46	48	49	50	52	53	55	57	58	60	62
195	201	207	213	219	226	232	239	247	254	262	269	278	286
0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	50	51	53	55	56	58	60	61	63	65	67	69	71
289	372	384	395	407	419	432	445	458	472	486	500	515	531
109	112	116	119	123	127	130	134	138	142	147	151	156	160
324	334	344	355	365	376	387	399	411	423	436	449	463	476
791	1,634	221	228	435	242	249	256	246	503	280	289	297	306
1,010	842	673	505	337	168	0	0	0	0	0	0	0	0
1,980	1,980	1,980	1,980	1,980	1,980	0	0	0	0	0	0	0	0
7,972	35,428	34,776	35,571	36,595	37,249	36,154	37,239	38,338	39,737	40,692	41,912	43,170	44,465
2,779	4,164	6,004	6,432	6,668	7,312	9,744	10,036	10,355	10,416	10,967	11,296	11,635	11,984
4,876	-10,712	-4,708	1,724	8,392	15,704	25,447	35,483	45,838	56,255	67,221	78,517	90,151	102,135
14.0%	21.0%	30.3%	32.5%	33.7%	36.9%	49.2%	50.7%	52.3%	52.6%	55.4%	57.0%	58.8%	60.5%
46.8%	70.1%	101.1%	108.3%	112.3%	123.1%	164.0%	169.0%	174.3%	175.4%	184.6%	190.2%	195.9%	201.7%
3,667	3,519	3,371	3,224	3,078	2,933	808	872	857	883	909	937	965	994
9,393	30,275	31,183	32,119	33,082	34,075	35,097	36,150	37,234	38,351	39,502	40,687	41,908	43,165
8,439	39,592	40,779	42,003	43,263	44,561	45,898	47,275	48,693	50,154	51,658	53,208	54,804	56,448
40.5%	37.8%	35.1%	32.6%	30.2%	28.0%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%
59.7%	55.6%	51.7%	48.0%	44.5%	41.2%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%
1,689	1,176	2,926	3,264	3,405	3,951	6,282	6,471	6,633	6,634	7,071	7,283	7,501	7,726
30.7%	28.6%	26.6%	24.7%	22.9%	21.2%	5.7%	5.7%	5.7%	5.7%	5.7%	5.7%	5.7%	5.7%
7,487	7,150	9,079	9,600	9,931	10,672	13,205	13,601	14,027	14,195	14,865	15,308	15,768	16,241
28.4%	26.5%	24.7%	22.9%	21.2%	19.6%	5.3%	5.3%	5.3%	5.3%	5.3%	5.3%	5.3%	5.3%
8,432	8,123	10,082	10,632	10,994	11,768	14,333	14,763	15,224	15,432	16,132	16,616	17,115	17,628
70.5%	65.7%	61.1%	56.7%	52.6%	48.6%	13.0%	13.0%	13.0%	13.0%	13.0%	13.0%	13.0%	13.0%
744	205	1,926	2,232	2,341	2,856	5,154	5,309	5,485	5,401	5,809	5,975	6,154	6,339
43.8%	40.8%	37.9%	35.1%	32.5%	30.0%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%
4,289	3,882	5,739	6,184	6,436	7,097	9,744	10,036	10,355	10,416	10,967	11,296	11,635	11,984
37.2%	34.7%	32.4%	30.1%	28.0%	25.9%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%
4,887	4,446	6,269	6,630	6,899	7,526	9,744	10,036	10,355	10,416	10,967	11,296	11,635	11,984
2,973	4,365	6,210	6,645	6,987	7,537	9,976	10,275	10,602	10,670	11,228	11,565	11,912	12,269

PIPE PLANT BURRA: ALTERNATIVE I

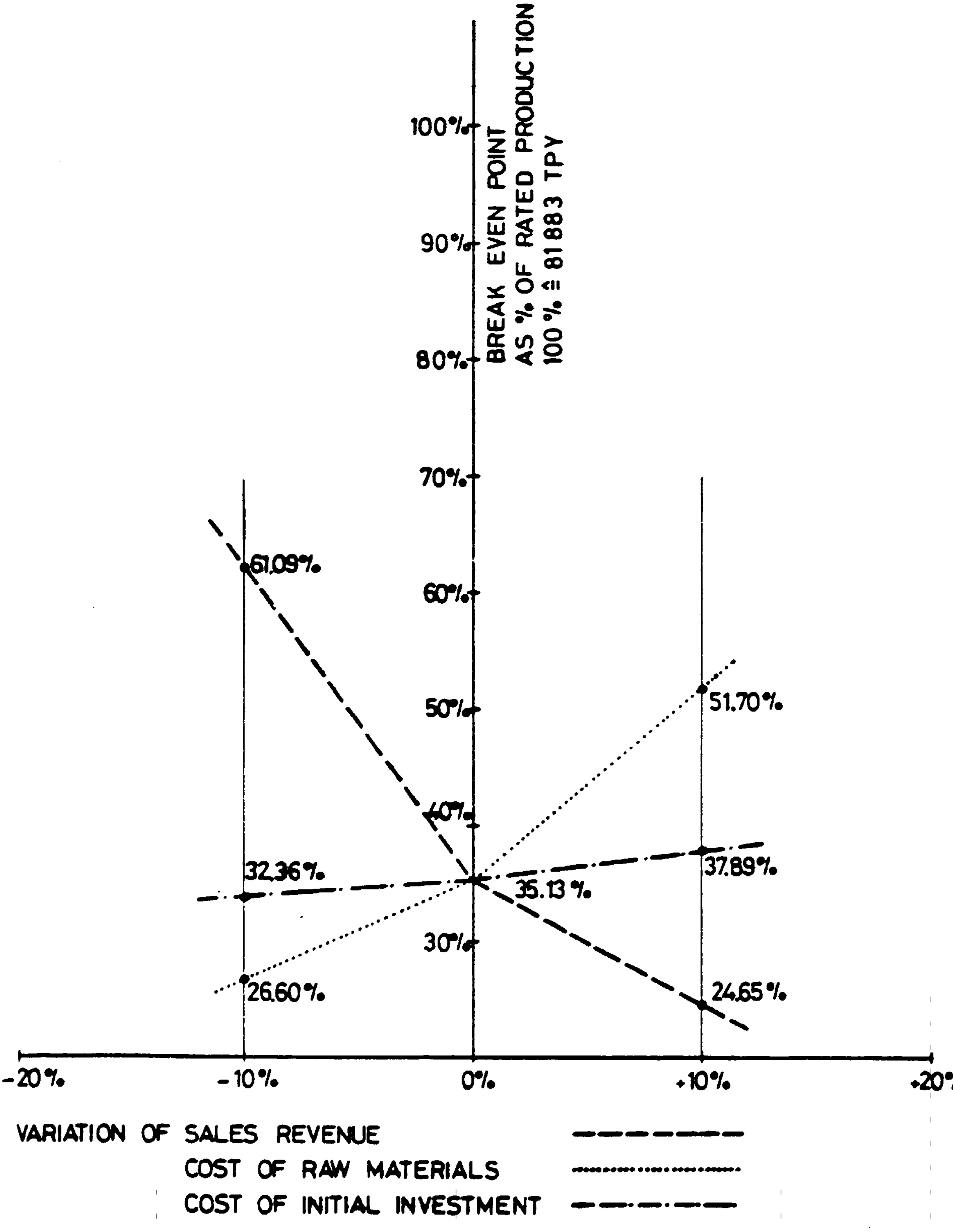
FOREIGN EXCHANGE EARNING THROUGH EXPORTS AND FOREIGN EXCHANGE SAVING THROUGH LOCAL MARKET
EXPORTS = 46.61% LOCAL SALES = 53.39% OF TOTAL PRODUCTION

all values in 1000 U.S. Dollars

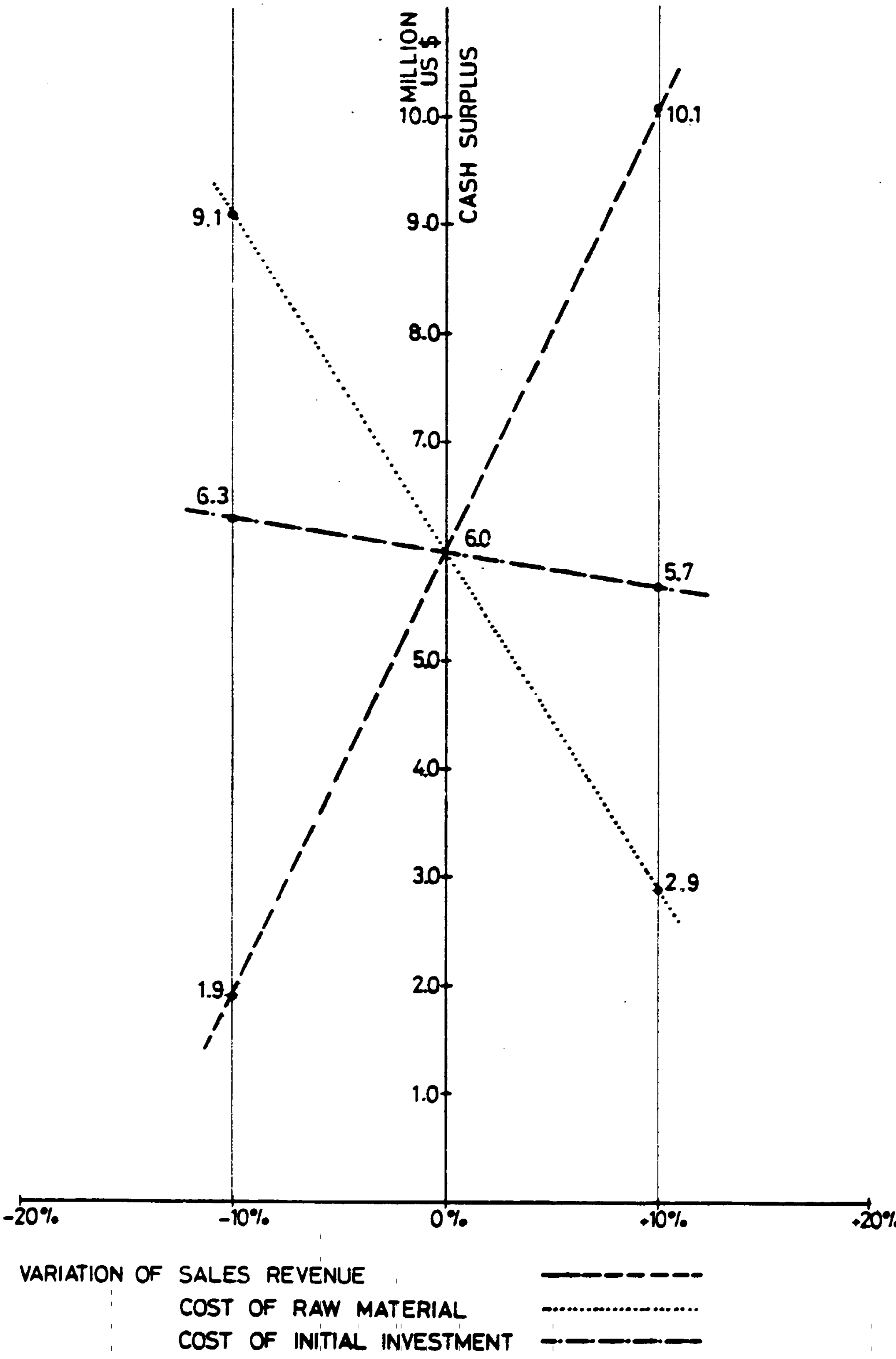
YEAR	FOREIGN EXCHANGE INFLOW	100% OF FOREIGN EXCHANGE OUTFLOW	46.61% OF FOREIGN EXCHANGE OUTFLOW	FOREIGN EXCHANGE EARNING	ACCUM. FOREIGN EXCHANGE EARNING	LOCAL EXCHANGE INFLOW *)	53.39% OF FOREIGN EXCHANGE OUTFLOW	FOREIGN EXCHANGE SAVING	ACCUM. FOREIGN EXCHANGE SAVING
1	2	3	4	5=2-4	6=SUM5	7	8	9=7-8	10=SUM9
1,990	12,177	23,030	10,734	1,443	1,443	13,946	12,295	1,651	1,651
1,991	14,334	26,857	12,518	1,816	3,260	16,417	14,339	2,078	3,728
1,992	18,455	34,079	15,884	2,571	5,831	21,136	18,195	2,942	6,670
1,993	19,009	33,426	15,580	3,429	9,260	21,770	17,846	3,924	10,594
1,994	19,579	34,181	15,932	3,648	12,907	22,424	18,249	4,174	14,768
1,995	20,167	35,111	16,365	3,802	16,709	23,096	18,746	4,351	19,119
1,996	20,772	35,775	16,675	4,097	20,806	23,789	19,100	4,689	23,808
1,997	21,395	34,635	16,144	5,251	26,057	24,503	18,492	6,011	29,819
1,998	22,037	35,674	16,628	5,409	31,466	25,238	19,047	6,191	36,010
1,999	22,698	36,745	17,127	5,571	37,037	25,995	19,618	6,377	42,387
2,000	23,379	38,018	17,720	5,659	42,696	26,775	20,298	6,477	48,864
2,001	24,080	38,982	18,170	5,910	48,606	27,578	20,813	6,765	55,629
2,002	24,803	40,152	18,715	6,088	54,694	28,405	21,437	6,968	62,598
2,003	25,547	41,356	19,276	6,270	60,965	29,258	22,080	7,177	69,775
2,004	26,313	42,597	19,855	6,458	67,423	30,135	22,743	7,393	77,168

*) EQUAL TO VALUE OF PIPE SOLD LOCALLY

PLANT ALTERNATIVE I , 4th YEAR OF PRODUCTION = 1993
SENSITIVITY OF BREAK EVEN POINT ON CASH SURPLUS



PLANT ALTERNATIVE I , 4th YEAR OF PRODUCTION = 1993
SENSITIVITY OF CASH SURPLUS



ANNEX 10.2 Computer Calculation for Alternative IA

Output Schedules (COMFAR)

Break-even and Sensitivity Analysis (MULTIPLAN)

Graph: Sensitivity of Break-even Point

```
COMFAR 2.0
UNIDO

---------------------------------------------------------------------------- COMFAR 2.0 - UNIDO IO/FEAS, Vienna -----

      Pipe Plant, Burma: Alternative IA
      June 1986
      40,940 tpy, Pipe Diameter from 6" to 12"

      3 year(s) of construction, 15 years of production
      currency conversion rates:
            foreign currency 1 unit =     1.0000 units accounting currency
            local   currency 1 unit =     1.0000 units accounting currency
      accounting currency:    thousands of U.S. Dollars
----------------------------------------------------------------------------------------------------------
      Total initial investment during construction phase

            fixed   assets:     14550.11              76.632 % foreign
            current assets:      3500.00             100.000 % foreign
            total   assets:     18050.11              81.164 % foreign

----------------------------------------------------------------------------------------------------------
      Source of funds during construction phase

           equity & grants:      5490.00              38.616 % foreign
           foreign  loans :     12810.00
           local    loans :         0.00
           total    funds :     18300.00              81.585 % foreign

--  -------------------------------------------------------------------------------------------------------
      Cashflow from operations

           Year:                       1            4            8
           operating costs:     13609.00     16017.19     18027.49
           depreciation   :      1363.31      1363.31      1308.91
           interest       :      1088.85       622.20         0.00
           ---------------  -----------  -----------  -----------
           production costs     16061.16     18002.70     19336.40
           thereof foreign         94.02 %      94.26 %      94.15 %
           total sales    :     16794.00     20390.29     22949.44

           gross income   :       732.84      2387.58      3613.04
           net   income   :       732.84      2387.58      3613.04
           cash balance   :       577.11      1809.97      4797.11
           net cashflow   :      3495.96      4262.17      4797.11


           Net Present Value    at:  10.00 % =       14792.71
           Internal Rate of Return:  23.02 %
           Return on equity1:        33.07 %
           Return on equity2:        29.64 %

--  -------------------------------------------------------------------------------------------------------
      Index of Schedules produced by COMFAR

      Total initial investment                 Cashflow Tables
      Total investment during production       Projected Balance
      Total production costs                   Net income statement
      Working Capital requirements             Source of finance
```

COMFAR 2.0 - UNIDO IO/FEAS, Vienna

Total Initial Investment in thousands of U.S. Dollars

Year	1987.1	1987.2	1988.1	1988.2	1989.1	1989.2
Fixed investment costs						
Land, site preparation, development	72.00	150.00	92.00	0.00	0.00	0.00
Buildings and civil works	0.00	0.00	546.00	870.00	560.00	560.00
Auxiliary and service facilities	0.00	0.00	0.00	0.00	0.00	0.00
Incorporated fixed assets	0.00	0.00	0.00	0.00	0.00	0.00
Plant machinery and equipment	0.00	0.00	0.00	2962.00	3362.00	2962.00
Total fixed investment costs	72.00	150.00	638.00	3832.00	3922.00	3522.00
Pre-production capital expenditures.	84.00	480.00	403.00	524.85	352.95	569.31
Net working capital	0.00	0.00	0.00	0.00	0.00	3500.00
Total initial investment costs	156.00	630.00	1041.00	4356.85	4274.95	7591.31
Of it foreign, in %	44.87	79.37	46.11	80.12	79.18	88.58

Pipe Plant, Burma: Alternative IA --- June 1986

COMFAR 2.0 UNIDO

COMFAR 2.0 - UNIDO IO/FEAS, Vienna

Total Current Investment in thousands of U.S. Dollars

Year	1990	1991	1992	1993	1994	1995
Fixed investment costs						
Land, site preparation, development	0.00	0.00	0.00	0.00	0.00	0.00
Buildings and civil works	0.00	0.00	0.00	0.00	0.00	84.00
Auxiliary and service facilities .	0.00	0.00	0.00	0.00	0.00	0.00
Incorporated fixed assets	0.00	0.00	0.00	0.00	0.00	0.00
Plant, machinery and equipment . .	0.00	0.00	0.00	0.00	0.00	116.00
Total fixed investment costs	0.00	0.00	0.00	0.00	0.00	200.00
Preproduction capitals expenditures.	0.00	0.00	0.00	0.00	0.00	0.00
Working capital	-310.95	400.62	107.69	110.92	114.25	117.68
Total current investment costs . . .	-310.95	400.62	107.69	110.92	114.25	317.68
Of it foreign, %	96.16	97.87	96.35	96.35	96.35	81.97

Pipe Plant, Burma: Alternative IA --- June 1986

COMFAR 2.0 - UNIDO IO/FEAS, Vienna

Total Current Investment in thousands of U.S. Dollars

Year	1996	1997	1998	1999	2000	2001
Fixed investment costs						
Land, site preparation, development	0.00	0.00	0.00	0.00	0.00	0.00
Buildings and civil works	0.00	0.00	0.00	0.00	97.00	0.00
Auxiliary and service facilities .	0.00	0.00	0.00	0.00	0.00	0.00
Incorporated fixed assets	0.00	0.00	0.00	0.00	0.00	0.00
Plant, machinery and equipment . .	0.00	0.00	0.00	0.00	134.00	0.00
Total fixed investment costs	0.00	0.00	0.00	0.00	231.00	0.00
Preproduction capitals expenditures.	0.00	0.00	0.00	0.00	0.00	0.00
Working capital	121.21	124.84	128.59	132.44	136.42	140.51
Total current investment costs . . .	121.21	124.84	128.59	132.44	367.42	140.51
Of it foreign, %	96.35	96.35	96.35	96.35	82.32	96.35

Pipe Plant, Burma: Alternative IA --- June 1986

Total Current Investment in thousands of U.S. Dollars

Year	2002	2003	2004
Fixed investment costs			
Land, site preparation, development	0.00	0.00	0.00
Buildings and civil works	0.00	0.00	0.00
Auxiliary and service facilities .	0.00	0.00	0.00
Incorporated fixed assets	0.00	0.00	0.00
Plant, machinery and equipment . .	0.00	0.00	0.00
Total fixed investment costs	0.00	0.00	0.00
Preproduction capitals expenditures.	0.00	0.00	0.00
Working capital	144.73	149.07	153.54
Total current investment costs . . .	144.73	149.07	153.54
Of it foreign, %	96.35	96.35	96.35

Total Production Costs in thousands of U.S. Dollars

Year	1990	1991	1992	1993	1994	1995
% of nom. capacity (single product).	90.00	100.00	100.00	100.00	100.00	100.00
Raw material 1	12577.00	14394.25	14826.08	15270.86	15728.98	16200.85
Other raw materials	88.00	100.94	103.97	107.09	110.30	113.61
Utilities	0.00	0.00	0.00	0.00	0.00	0.00
Energy	18.00	21.63	22.28	22.95	23.64	24.34
Labour, direct	522.00	146.26	150.65	155.17	159.82	164.62
Repair, maintenance	47.00	48.41	49.86	51.36	52.90	54.49
Spares	158.00	181.28	186.72	192.32	198.09	204.03
Factory overheads	0.00	0.00	0.00	0.00	0.00	0.00
Factory costs	13410.00	14892.77	15339.55	15799.74	16273.73	16761.94
Administrative overheads	80.00	82.40	84.87	87.42	90.04	92.74
Indir. costs, sales and distribution	119.00	122.57	126.25	130.03	133.94	137.95
Direct costs, sales and distrbution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation	1363.31	1363.31	1363.31	1363.31	1363.31	1268.91
Financial costs	1086.85	933.30	777.75	622.20	466.65	311.10
Total production costs	16061.16	17394.35	17691.73	18002.70	18327.67	18572.65
Costs per unit (single product)	8922.87	8697.18	8845.87	9001.35	9163.83	9286.32
Of it foreign, %	94.02	94.33	94.29	94.26	94.23	94.24
Of it variable,%	0.00	0.00	0.00	0.00	0.00	0.00
Total labour	522.00	146.26	150.65	155.17	159.82	164.62

COMFAR 2.0 - UNIDO IO/F543, Vienna

Total Production Costs in thousands of U.S. Dollars

Year	1996	1997	1998	1999	2000	2001
% of nom. capacity (single product).	100.00	100.00	100.00	100.00	100.00	100.00
Raw material 1	16686.88	17187.48	17703.11	18234.20	18781.23	19344.66
Other raw materials	117.02	120.53	124.14	127.87	131.70	135.65
Utilities	0.00	0.00	0.00	0.00	0.00	0.00
Energy	25.08	25.83	26.60	27.40	28.22	29.07
Labour, direct	169.56	174.64	179.88	185.28	190.84	196.56
Repair, maintenance	56.12	57.80	59.54	61.32	63.16	65.06
Spares	210.15	216.46	222.95	229.64	236.53	243.63
Factory overheads	0.00	0.00	0.00	0.00	0.00	0.00
Factory costs	17264.80	17782.74	18316.23	18865.71	19431.69	20014.63
Administrative overheads	95.52	98.39	101.34	104.38	107.51	110.74
Indir. costs, sales and distribution	142.09	146.35	150.75	155.27	159.93	164.72
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation	1308.91	1308.91	1308.91	1308.91	167.30	185.10
Financial costs	155.55	0.00	0.00	0.00	0.00	0.00
Total production costs	18966.88	19336.40	19877.22	20434.27	19866.43	20475.20
Costs per unit (single product) .	9483.44	9668.20	9938.61	10217.14	9933.21	10237.60
Of it foreign, %	94.17	94.15	94.17	94.20	94.47	94.48
Of it variable,%	0.00	0.00	0.00	0.00	0.00	0.00
Total abour	169.56	174.64	179.88	185.28	190.84	196.56

Pipe Plant, Burma: Alternative IA --- June 1986

Total Production Costs in thousands of U.S. Dollars

Year	2002	2003	2004
% of nom. capacity (single product).	100.00	100.00	100.00
Raw material 1	19925.00	20522.75	21138.43
Other raw materials	139.72	143.92	148.23
Utilities	0.00	0.00	0.00
Energy	29.94	30.84	31.76
Labour, direct	202.46	208.53	214.79
Repair, maintenance	67.01	69.02	71.09
Spares	250.93	258.46	266.22
Factory overheads	0.00	0.00	0.00
Factory costs	20615.07	21233.52	21870.53
Administrative overheads	114.06	117.48	121.01
Indir. costs, sales and distribution	169.67	174.76	180.00
Direct costs, sales and distribution	0.00	0.00	0.00
Depreciation	185.10	185.10	185.10
Financial costs	0.00	0.00	0.00
Total production costs	21083.90	21710.86	22356.63
Costs per unit (single product) .	10541.95	10855.43	11178.32
Of it foreign, %	94.49	94.51	94.52
Of it variable,%	0.00	0.00	0.00
Total labour	202.46	208.53	214.79

COMFAR 2.0 - UNIDO ID/FEAS, Vienna

Net Working Capital in thousands of U.S. Dollars

Year			1990	1991	1992	1993	1994
Coverage	mdc	coto					
Current assets &							
Accounts receivable . . .	20	18.0	756.06	838.76	863.93	889.84	916.54
Inventory and materials .	45	8.0	1583.13	1811.90	1866.26	1922.24	1979.91
Energy	0	---	0.00	0.00	0.00	0.00	0.00
Spares	0	---	0.00	0.00	0.00	0.00	0.00
Work in progress	8	48.0	279.38	310.27	319.57	329.16	339.04
Finished products . . .	15	24.0	562.08	623.97	642.68	661.96	681.82
Cash in hand	4	96.0	8.41	4.77	4.92	5.07	5.22
Total current assets			3189.05	3589.67	3697.36	3808.28	3922.53
Current liabilities and							
Accounts payable	0	---	0.00	0.00	0.00	0.00	0.00
Net working capital			3189.05	3589.67	3697.36	3808.28	3922.53
Increase in working capital			-310.95	400.62	107.69	110.92	114.25
Net working capital, local			122.37	130.91	134.83	138.88	143.05
Net working capital, foreign			3066.67	3458.76	3562.52	3669.40	3779.48

Note: mdc = minimum days of coverage ; coto = coefficient of turnover .

Pipe Plant, Burma: Alternative IA --- June 1986

COMFAR 2.0 - UNIDO ID/FEAS, Vienna

Net Working Capital in thousands of U.S. Dollars

Year			1995	1996	1997	1998	1999
Coverage	mdc	coto					
Current assets &							
Accounts receivable . . .	20	18.0	944.04	972.36	1001.53	1031.57	1062.52
Inventory and materials .	45	8.0	2039.31	2100.49	2163.50	2228.41	2295.26
Energy	0	---	0.00	0.00	0.00	0.00	0.00
Spares	0	---	0.00	0.00	0.00	0.00	0.00
Work in progress	8	48.0	349.21	359.68	370.47	381.59	393.04
Finished products . . .	15	24.0	702.28	723.35	745.05	767.40	790.42
Cash in hand	4	96.0	5.37	5.53	5.70	5.87	6.05
Total current assets			4040.20	4161.41	4286.25	4414.84	4547.28
Current liabilities and							
Accounts payable	0	---	0.00	0.00	0.00	0.00	0.00
Net working capital			4040.20	4161.41	4286.25	4414.84	4547.28
Increase in working capital			117.68	121.21	124.84	128.59	132.44
Net working capital, local			147.34	151.76	156.31	161.00	165.83
Net working capital, foreign			3892.87	4009.65	4129.94	4253.84	4381.45

Note: mdc = minimum days of coverage ; coto = coefficient of turnover .

Pipe Plant, Burma: Alternative IA --- June 1986

Net Working Capital in thousands of U.S. Dollars

Year			2000	2001	2002	2003	2004
Coverage	mdc	coto					
Current assets &							
Accounts receivable	20	18.0	1094.40	1127.23	1161.04	1195.88	1231.75
Inventory and materials	45	8.0	2364.12	2435.04	2508.09	2583.33	2660.83
Energy	0	---	0.00	0.00	0.00	0.00	0.00
Spares	0	---	0.00	0.00	0.00	0.00	0.00
Work in progress	8	48.0	404.83	416.97	429.48	442.37	455.64
Finished products	15	24.0	814.13	838.56	863.71	889.63	916.31
Cash in hand	4	96.0	6.23	6.42	6.61	6.81	7.01
Total current assets			4683.70	4824.21	4968.94	5118.01	5271.55
Current liabilities and							
Accounts payable	0	---	0.00	0.00	0.00	0.00	0.00
Net working capital			4683.70	4824.21	4968.94	5118.01	5271.55
Increase in working capital			136.42	140.51	144.73	149.07	153.54
Net working capital, local			170.80	175.93	181.21	186.64	192.24
Net working capital, foreign			4512.90	4648.29	4787.73	4931.37	5079.31

Note: mdc = minimum days of coverage ; coto = coefficient of turnover .

Source of Finance, construction in thousands of U.S. Dollars

Year	1987.1	1987.2	1988.1	1988.2	1989.1	1989.2
Equity, ordinary ..	156.00	630.00	1041.00	1926.00	680.00	857.00
Equity, preference.	0.00	0.00	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, foreign .	0.00	0.00	0.00	2440.00	3400.00	6970.00
Loan B, foreign..	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00	0.00	0.00
Total loan	0.00	0.00	0.00	2440.00	3400.00	6970.00
Current liabilities	0.00	0.00	0.00	0.00	0.00	0.00
Bank overdraft	0.00	0.00	0.00	0.00	0.00	0.00
Total funds	156.00	630.00	1041.00	4366.00	4280.00	7827.00

COMFAR 2.0 - UNIDO IO/FEAS, Vienna

Source of Finance, production in thousands of U.S. Dollars

Year	1990-96
Equity, ordinary ..	0.00
Equity, preference.	0.00
Subsidies, grants .	0.00
Loan A, foreign .	-1830.00
Loan B, foreign..	0.00
Loan C, foreign .	0.00
Loan A, local....	0.00
Loan B, local....	0.00
Loan C, local....	0.00
Total loan	-1830.00
Current liabilities	0.00
Bank overdraft	0.00
Total funds	-1830.00

Pipe Plant, Burma: Alternative IA --- June 1986

Cashflow Tables, construction in thousands of U.S. Dollars

Year	1987.1	1987.2	1988.1	1988.2	1989.1	1989.2
Total cash inflow . .	156.00	630.00	1041.00	4366.00	4280.00	7827.00
Financial resources .	156.00	630.00	1041.00	4366.00	4280.00	7827.00
Sales, net of tax . .	0.00	0.00	0.00	0.00	0.00	0.00
Total cash outflow . .	156.00	630.00	1041.00	4356.85	4274.95	7591.31
Total assets	156.00	630.00	1041.00	4305.00	4099.00	7195.00
Operating costs . . .	0.00	0.00	0.00	0.00	0.00	0.00
Cost of finance . . .	0.00	0.00	0.00	51.85	175.95	396.31
Repayment	0.00	0.00	0.00	0.00	0.00	0.00
Corporate tax . . .	0.00	0.00	0.00	0.00	0.00	0.00
Dividends paid . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus (deficit) .	0.00	0.00	0.00	9.15	5.05	235.69
Cumulated cash balance	0.00	0.00	0.00	9.15	14.20	249.89
Inflow, local	86.00	130.00	561.00	856.00	880.00	857.00
Outflow, local	86.00	130.00	561.00	866.00	890.00	867.00
Surplus (deficit) .	0.00	0.00	0.00	-10.00	-10.00	-10.00
Inflow, foreign . . .	70.00	500.00	480.00	3510.00	3400.00	6970.00
Outflow, foreign . . .	70.00	500.00	480.00	3490.85	3384.95	6724.31
Surplus (deficit) .	0.00	0.00	0.00	19.15	15.05	245.69
Net cashflow	-156.00	-630.00	-1041.00	-4305.00	-4099.00	-7195.00
Cumulated net cashflow	-156.00	-786.00	-1827.00	-6132.00	-10231.00	-17426.00

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COMFAR 2.0 - UNIDO IO/FEAS, Vienna

Cashflow tables, production in thousands of U.S. Dollars

Year	1990	1991	1992	1993	1994	1995
Total cash inflow . .	16794.00	19219.80	19796.39	20390.29	21001.99	21632.05
Financial resources .	0.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax . .	16794.00	19219.80	19796.39	20390.29	21001.99	21632.05
Total cash outflow . .	16216.89	18261.66	18266.11	18580.31	18908.60	19451.41
Total assets	-310.95	400.62	107.69	110.92	114.25	317.68
Operating costs . . .	13609.00	15097.74	15550.67	16017.19	16497.70	16992.64
Cost of finance . . .	1088.85	933.30	777.75	622.20	466.65	311.10
Repayment	1830.00	1830.00	1830.00	1830.00	1830.00	1830.00
Corporate tax . . .	0.00	0.00	0.00	0.00	0.00	0.00
Dividends paid . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus (deficit) .	577.11	958.14	1530.28	1809.97	2093.39	2180.64
Cumulated cash balance	826.99	1785.13	3315.41	5125.38	7218.77	9399.41
Inflow, local	16794.00	19219.80	19796.39	20390.29	21001.99	21632.05
Outflow, local	847.37	759.40	777.32	800.64	824.66	902.40
Surplus (deficit) .	15946.63	18460.39	19019.07	19589.64	20177.33	20729.65
Inflow, foreign . . .	0.00	0.00	0.00	0.00	0.00	0.00
Outflow, foreign . . .	15369.52	17502.26	17488.79	17779.67	18083.94	18549.01
Surplus (deficit) .	-15369.52	-17502.26	-17488.79	-17779.67	-18083.94	-18549.01
Net cashflow	3495.96	3721.44	4138.03	4262.17	4390.04	4321.74
Cumulated net cashflow	-13930.04	-10208.61	-6070.58	-1808.40	2581.64	6903.38

Pipe Plant, Burma: Alternative IA --- June 1986

COMFAR 2.0 - UNIDO ID/FEAS, Vienna

Cashflow tables, production in thousands of U.S. Dollars

Year	1996	1997	1998	1999	2000	2001
Total cash inflow . .	22281.01	22949.44	23637.93	24347.06	25077.48	25829.80
Financial resources .	0.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax . .	22281.01	22949.44	23637.93	24347.06	25077.48	25829.80
Total cash outflow . .	19609.18	18152.33	18696.90	19257.81	20066.54	20430.60
Total assets	121.21	124.84	128.59	132.44	367.42	140.51
Operating costs . . .	17502.42	18027.49	18568.32	19125.36	19699.13	20290.09
Cost of finance . . .	155.55	0.00	0.00	0.00	0.00	0.00
Repayment	1830.00	0.00	0.00	0.00	0.00	0.00
Corporate tax . . .	0.00	0.00	0.00	0.00	0.00	0.00
Dividends paid . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus (deficit) .	2671.84	4797.11	4941.02	5089.26	5010.93	5399.20
Cumulated cash balance	12071.25	16868.36	21809.38	26898.64	31909.57	37308.77
Inflow, local	22281.01	22949.44	23637.93	24347.06	25077.48	25829.80
Outflow, local	874.89	901.13	928.17	956.01	1044.69	1014.23
Surplus (deficit) .	21406.13	22048.31	22709.76	23391.05	24032.79	24815.57
Inflow, foreign . . .	0.00	0.00	0.00	0.00	0.00	0.00
Outflow, foreign . . .	18734.29	17251.20	17768.74	18301.80	19021.86	19416.38
Surplus (deficit) .	-18734.29	-17251.20	-17768.74	-18301.80	-19021.86	-19416.38
Net cashflow	4657.39	4797.11	4941.02	5089.26	5010.93	5399.20
Cumulated net cashflow	11560.76	16357.87	21298.89	26388.15	31399.08	36798.28

Pipe Plant, Burma: Alternative IA --- June 1986

COMFAR 2.0 - UNIDO IO/FEAS, Vienna

Cashflow tables, production in thousands of U.S. Dollars

Year	2002	2003	2004
Total cash inflow . .	26604.69	27402.83	28224.91
Financial resources .	0.00	0.00	0.00
Sales, net of tax . .	26604.69	27402.83	28224.91
Total cash outflow . .	21043.53	21674.83	22325.07
Total assets	144.73	149.07	153.54
Operating costs . . .	20898.80	21525.76	22171.53
Cost of finance . . .	0.00	0.00	0.00
Repayment	0.00	0.00	0.00
Corporate tax . . .	0.00	0.00	0.00
Dividends paid . . .	0.00	0.00	0.00
Surplus (deficit) .	5561.16	5728.00	5899.84
Cumulated cash balance	42869.93	48597.93	54497.77
Inflow, local	26604.69	27402.83	28224.91
Outflow, local	1044.66	1076.00	1108.28
Surplus (deficit) .	25560.03	26326.83	27116.64
Inflow, foreign . . .	0.00	0.00	0.00
Outflow, foreign . . .	19998.87	20598.83	21216.79
Surplus (deficit) .	-19998.87	-20598.83	-21216.79
Net cashflow	5561.16	5728.00	5899.84
Cumulated net cashflow	42359.45	48087.45	53987.29

Pipe Plant, Burma: Alternative IA --- June 1986

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Cashflow Discounting:

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a) Return on Equity 1:
        Net  present  value ..............  14480.70  at      10.00 %
        Internal Rate of Return  (IRRE1) ..     33.07 %
b) Return on Equity 2:
        Net  present  value ..............  14406.16  at      10.00 %
        Internal Rate of Return  (IRRE2) ..     29.64 %
c) Internal Rate of Return on total investment:
        Net  present  value ..............  14792.71  at      10.00 %
        Internal Rate of Return  ( IRR ) ..     23.02 %
Equity 1 = Total equity paid : Net income
Equity 2 = Initial equity paid : Net cash return
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                                                                           Pipe Plant, Burma: Alternative IA --- June 1986
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Net Income Statement in thousands of U.S. Dollars

Year	1990	1991	1992	1993	1994
Total sales, incl. sales tax	16794.00	19219.80	19796.39	20390.29	21001.99
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin	16794.00	19219.80	19796.39	20390.29	21001.99
As % of total sales	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	14972.31	16461.05	16913.98	17380.50	17861.02
Operational margin	1821.69	2758.75	2882.41	3009.78	3140.97
As % of total sales	10.85	14.35	14.56	14.76	14.96
Cost of finance	1088.85	933.30	777.75	622.20	466.65
Gross profit	732.84	1825.45	2104.66	2387.58	2674.32
Allowances	0.00	0.00	0.00	0.00	0.00
Taxable profit	732.84	1825.45	2104.66	2387.58	2674.32
Tax	0.00	0.00	0.00	0.00	0.00
Net profit	732.84	1825.45	2104.66	2387.58	2674.32
Dividends paid	0.00	0.00	0.00	0.00	0.00
Undistributed profit	732.84	1825.45	2104.66	2387.58	2674.32
Accumulated undistributed profit . . .	732.84	2558.29	4662.94	7050.53	9724.85
Gross profit, % of total sales	4.36	9.50	10.63	11.71	12.73
Net profit, % of total sales	4.36	9.50	10.63	11.71	12.73
ROE, Net profit, % of equity	13.35	33.25	38.34	43.49	48.71
ROI, Net profit+interest, % of invest.	10.64	15.75	16.36	16.97	17.60

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COMFAR 2.0 - UNIDO IO/FEAS, Vienna

Net Income Statement in thousands of U.S. Dollars

Year	1995	1996	1997	1998	1999
Total sales, incl. sales tax	21632.05	22281.01	22949.44	23637.93	24347.06
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin	21632.05	22281.01	22949.44	23637.93	24347.06
As % of total sales	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	18261.55	18811.33	19336.40	19877.23	20434.27
Operational margin	3370.50	3469.69	3613.04	3760.70	3912.79
As % of total sales	15.58	15.57	15.74	15.91	16.07
Cost of finance	311.10	155.55	0.00	0.00	0.00
Gross profit	3059.40	3314.13	3613.04	3760.70	3912.79
Allowances	0.00	0.00	0.00	0.00	0.00
Taxable profit	3059.40	3314.13	3613.04	3760.70	3912.79
Tax	0.00	0.00	0.00	0.00	0.00
Net profit	3059.40	3314.13	3613.04	3760.70	3912.79
Dividends paid	0.00	0.00	0.00	0.00	0.00
Undistributed profit	3059.40	3314.13	3613.04	3760.70	3912.79
Accumulated undistributed profit	12784.25	16098.39	19711.43	23472.13	27384.93
Gross profit, % of total sales	14.14	14.87	15.74	15.91	16.07
Net profit, % of total sales	14.14	14.87	15.74	15.91	16.07
ROE, Net profit, % of equity	55.73	60.37	65.81	68.50	71.27
ROI, Net profit+interest, % of invest.	18.55	18.97	19.62	20.28	20.95

Pipe Plant, Burma: Alternative IA --- June 1986

Net Income Statement in thousands of U.S. Dollars

Year	2000	2001	2002	2003	2004
Total sales, incl. sales tax	25077.48	25829.80	26604.69	27402.83	28224.91
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin	25077.48	25829.80	26604.69	27402.83	28224.91
As % of total sales	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	19866.43	20475.19	21083.90	21710.86	22356.63
Operational margin	5211.05	5354.61	5520.79	5691.97	5868.28
As % of total sales	20.78	20.73	20.75	20.77	20.79
Cost of finance	0.00	0.00	0.00	0.00	0.00
Gross profit	5211.05	5354.61	5520.79	5691.97	5868.28
Allowances	0.00	0.00	0.00	0.00	0.00
Taxable profit	5211.05	5354.61	5520.79	5691.97	5868.28
Tax	0.00	0.00	0.00	0.00	0.00
Net profit	5211.05	5354.61	5520.79	5691.97	5868.28
Dividends paid	0.00	0.00	0.00	0.00	0.00
Undistributed profit	5211.05	5354.61	5520.79	5691.97	5868.28
Accumulated undistributed profit	32595.98	37950.58	43471.38	49163.34	55031.63
Gross profit, % of total sales	20.78	20.73	20.75	20.77	20.79
Net profit, % of total sales	20.78	20.73	20.75	20.77	20.79
ROE, Net profit, % of equity	94.92	97.53	100.56	103.68	106.89
ROI, Net profit+interest, % of invest.	27.37	27.92	28.57	29.23	29.90

COMFAR 2.0 - UNIDO IO/FEAS, Vienna

Projected Balance Sheets, construction in thousands of U.S. Dollars

Year	1987.1	1987.2	1988.1	1988.2	1989.1	1989.2
Total assets	156.00	786.00	1827.00	6193.00	10473.00	18300.00
Fixed assets, net of depreciation	0.00	156.00	786.00	1827.00	6183.85	10458.80
Construction in progress	156.00	630.00	1041.00	4356.85	4274.95	4091.31
Current assets	0.00	0.00	0.00	0.00	0.00	3500.00
Cash, bank	0.00	0.00	0.00	0.00	0.00	0.00
Cash surplus, finance available	0.00	0.00	0.00	9.15	14.20	249.89
Loss carried forward	0.00	0.00	0.00	0.00	0.00	0.00
Loss	0.00	0.00	0.00	0.00	0.00	0.00
Total liabilities	156.00	786.00	1827.00	6193.00	10473.00	18300.00
Equity capital	156.00	786.00	1827.00	3753.00	4633.00	5490.00
Reserves, retained profit	0.00	0.00	0.00	0.00	0.00	0.00
Profit	0.00	0.00	0.00	0.00	0.00	0.00
Long and medium term debt	0.00	0.00	0.00	2440.00	5840.00	12810.00
Current liabilities	0.00	0.00	0.00	0.00	0.00	0.00
Bank overdraft, finance required.	0.00	0.00	0.00	0.00	0.00	0.00
Total debt	0.00	0.00	0.00	2440.00	5840.00	12810.00
Equity, % of liabilities	100.00	100.00	100.00	60.60	44.24	30.00

Pipe Plant, Burma: Alternative IA --- June 1986

COMFAR 2.0 UNIDO

COMFAR 2.0 - UNIDO IO/FEAS, Vienna

Projected Balance Sheets, Production in thousands of U.S. Dollars

Year	1990	1991	1992	1993	1994	1995
Total assets	17202.84	17198.29	17472.95	18030.53	18874.85	20104.25
Fixed assets, net of depreciation	13186.80	11823.49	10460.18	9096.87	7733.56	6464.65
Construction in progress	0.00	0.00	0.00	0.00	0.00	200.00
Current assets	3180.64	3584.89	3692.44	3803.21	3917.31	4034.83
Cash, bank	8.41	4.77	4.92	5.07	5.22	5.37
Cash surplus, finance available	826.99	1785.13	3315.41	5125.38	7218.77	9399.40
Loss carried forward	0.00	0.00	0.00	0.00	0.00	0.00
Loss	0.00	0.00	0.00	0.00	0.00	0.00
Total liabilities	17202.84	17198.29	17472.95	18030.53	18874.85	20104.25
Equity capital	5490.00	5490.00	5490.00	5490.00	5490.00	5490.00
Reserves, retained profit	0.00	732.84	2558.29	4662.94	7050.53	9724.85
Profit	732.84	1825.45	2104.66	2387.58	2674.32	3059.40
Long and medium term debt	10980.00	9150.00	7320.00	5490.00	3660.00	1830.00
Current liabilities	0.00	0.00	0.00	0.00	0.00	0.00
Bank overdraft, finance required.	0.00	0.00	0.00	0.00	0.00	0.00
Total debt	10980.00	9150.00	7320.00	5490.00	3660.00	1830.00
Equity, % of liabilities	31.91	31.92	31.42	30.45	29.09	27.31

Pipe Plant, Burma: Alternative IA --- June 1986

COMFAR 2.0 - UNIDO IO/FEAS, Vienna

Projected Balance Sheets, Production in thousands of U.S. Dollars

Year	1996	1997	1998	1999	2000	2001
Total assets	21588.39	25201.43	28962.13	32874.93	38085.98	43440.58
Fixed assets, net of depreciation	5355.74	4046.83	2737.91	1429.00	1261.70	1307.60
Construction in progress	0.00	0.00	0.00	0.00	231.00	0.00
Current assets	4155.87	4280.55	4408.97	4541.23	4677.47	4817.80
Cash, bank	5.53	5.70	5.87	6.05	6.23	6.42
Cash surplus, finance available	12071.24	16868.36	21809.38	26898.64	31909.57	37308.77
Loss carried forward	0.00	0.00	0.00	0.00	0.00	0.00
Loss	0.00	0.00	0.00	0.00	0.00	0.00
Total liabilities	21588.39	25201.43	28962.13	32874.93	38085.98	43440.58
Equity capital	5490.00	5490.00	5490.00	5490.00	5490.00	5490.00
Reserves, retained profit	12784.25	16098.39	19711.43	23472.13	27384.93	32595.98
Profit	3314.13	3613.04	3760.70	3912.79	5211.05	5354.61
Long and medium term debt	0.00	0.00	0.00	0.00	0.00	0.00
Current liabilities	0.00	0.00	0.00	0.00	0.00	0.00
Bank overdraft, finance required.	0.00	0.00	0.00	0.00	0.00	0.00
Total debt	0.00	0.00	0.00	0.00	0.00	0.00
Equity, % of liabilities	25.43	21.78	18.96	16.70	14.41	12.64

Projected Balance Sheets, Production in thousands of U.S. Dollars

Year	2002	2003	2004
Total assets	48961.38	54653.34	60521.63
Fixed assets, net of depreciation	1122.50	937.40	752.30
Construction in progress	0.00	0.00	0.00
Current assets	4962.33	5111.20	5264.53
Cash, bank	6.61	6.81	7.01
Cash surplus, finance available .	42869.93	48597.93	54497.78
Loss carried forward	0.00	0.00	0.00
Loss	0.00	0.00	0.00
Total liabilities	48961.38	54653.34	60521.63
Equity capital	5490.00	5490.00	5490.00
Reserves, retained profit	37950.58	43471.38	49163.34
Profit	5520.79	5691.97	5868.28
Long and medium term debt	0.00	0.00	0.00
Current liabilities	0.00	0.00	0.00
Bank overdraft, finance required.	0.00	0.00	0.00
Total debt	0.00	0.00	0.00
Equity, % of liabilities	11.21	10.05	9.07

PIPE PLANT, BURRA JUNE 1986, ALTERNATIVE IA

BREAK-EVEN AND SENSITIVITY ANALYSIS, NATIONAL NET VALUE ADDED, INFLATION CONSIDERED: 3% p.

		YEAR:	1987	1988	1989	1990	1991	1992	1993
			CONSTRUCTION PHASE						
PRODUCTION RATE						70%	100%	100%	100%
SALES VOLUME (TONNES)						36,346	40,940	40,940	40,940
SALES, NET OF TAX		(A)	0	0	0	16,794	19,220	19,796	20,390
RAW MATERIAL I	variable cost					12,578	14,374	14,826	15,271
OTHER RAW MATERIALS	variable cost					88	101	104	107
ENERGY	variable cost					21	22	22	23
LABOUR local	fixed cost					180	146	151	155
LABOUR foreign	fixed cost					342	0	0	0
MAINT. (CIV.) EMM.DISP.	fixed cost					47	48	50	51
SPARES	variable cost					176	181	187	192
ADMIN. (NON LABOUR)	fixed cost					80	92	95	97
SALES and DISTRIBUTION	fixed cost					119	123	126	130
TOTAL ASSETS			786	5,398	11,866	-311	401	108	111
COST OF FINANCE	fixed cost					1,089	933	778	622
REPAYMENT	fixed cost					1,830	1,830	1,830	1,830
TOTAL CASH OUTFLOW		(B)	786	5,398	11,866	16,239	18,262	18,266	18,580
SURPLUS (DEFICIT)		(A-B)	-786	-5,398	-11,866	555	959	1,530	1,810
SURPLUS (DEFICIT) ACCUM.			-786	-6,184	-18,050	-17,495	-16,536	-15,006	-13,196
ROI (CASH SURPLUS)						2.8%	4.[illegible]%	7.7%	9.1%
ROE (CASH SURPLUS)						9.4%	16.1%	25.8%	30.5%
BREAK-EVEN ANALYSIS									
TOTAL FIXED COSTS	F					3,687	3,163	3,019	2,976
TOTAL VARI. COSTS (at 100%)	V					14,292	14,698	15,139	15,593
SALES, NET OF TAX (at 100%)	P					18,660	19,220	19,796	20,390
BEP (BREAK-EVEN POINT)	F/(P-V)					84.4%	70.0%	64.8%	60.0%
SENSITIVITY ANALYSIS									
RAW MAT's at +10%:	BEP					124.5%	103.0%	95.4%	88.2%
	SURPLUS					-415	-491	37	272
RAW MAT's at -10%:	BEP					63.8%	53.0%	49.1%	45.4%
	SURPLUS					2,400	2,408	3,023	3,348
SALES at +10%:	BEP					59.1%	49.1%	45.5%	42.1%
	SURPLUS					2,856	2,380	3,510	3,849
SALES at -10%:	BEP					147.3%	121.7%	112.8%	104.3%
	SURPLUS					-874	-964	-449	-229
INVESTM. at +10%:	BEP					91.1%	76.1%	70.4%	65.1%
	SURPLUS					700	682	1,269	1,565
INVESTM. at -10%:	BEP					77.7%	63.8%	59.2%	54.8%
	SURPLUS					1,294	1,234	1,791	2,055
NATIONAL NET VALUE ADDED									
NAT. VALUE ADDED (=LABOUR LOC.+SURPLUS)						735	1,104	1,681	1,965
NAT. NET VALUE ADD.(=ACC.N.V.A.- INVESTM.)						38,855			

INFLATION CONSIDERED: 3% p.a. CURRENCY: 1000 U.S. Dollars

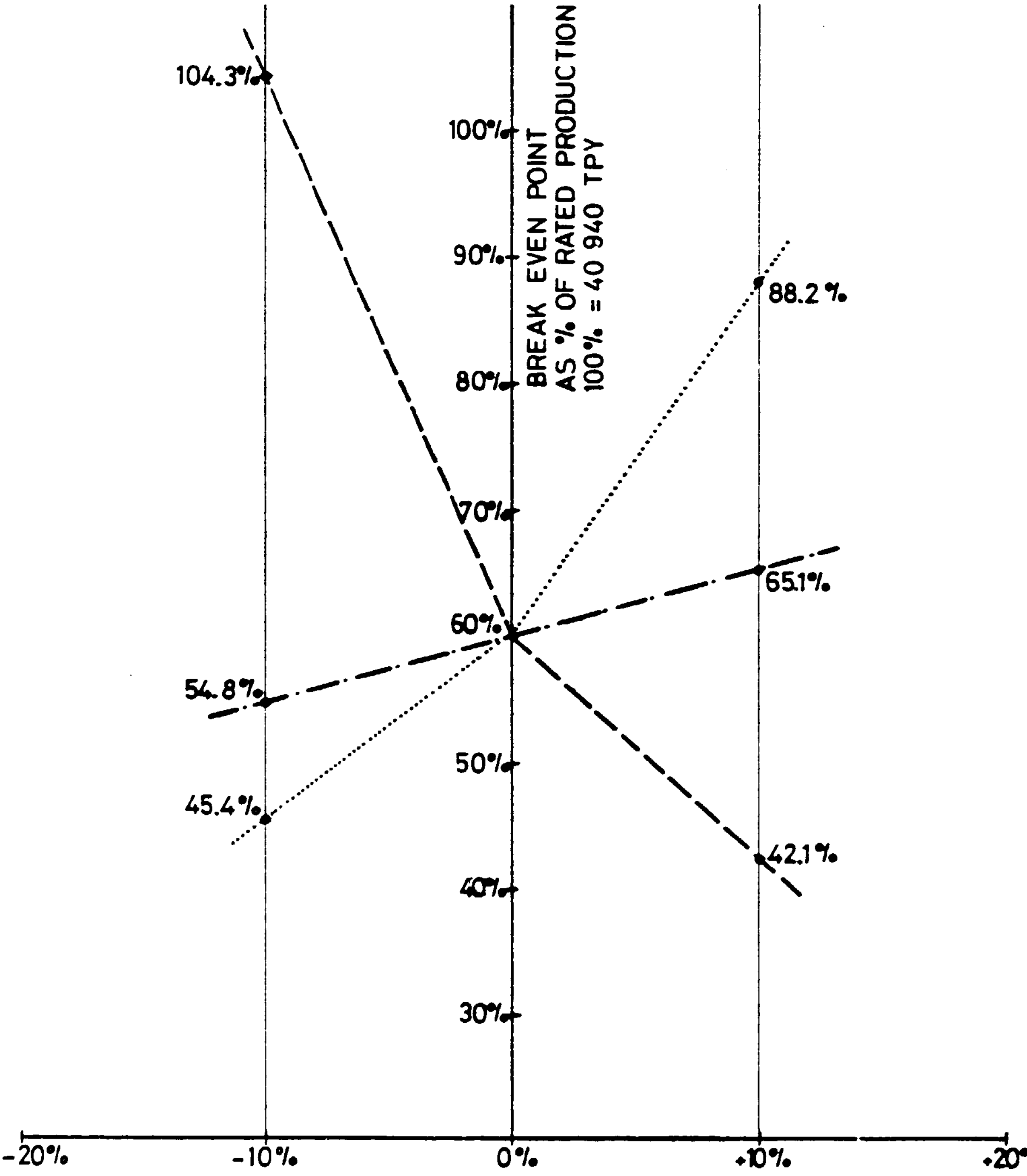
91	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
00%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
940	40,940	40,940	40,940	40,940	40,940	40,940	40,940	40,940	40,940	40,940	40,940	40,940	40,940
19,220	19,796	20,390	21,002	21,632	22,281	22,949	23,638	24,347	25,077	25,830	26,605	27,403	28,225
14,394	14,826	15,271	15,729	16,201	16,687	17,187	17,703	18,234	18,781	19,345	19,925	20,523	21,139
101	104	107	110	114	117	121	124	128	132	136	140	144	148
22	22	23	24	24	25	26	27	27	28	29	30	31	32
146	151	155	160	165	170	175	180	185	191	197	202	209	215
0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	50	51	53	54	56	58	60	61	63	65	67	69	71
181	187	192	198	204	210	216	223	230	237	244	251	258	266
82	85	87	90	93	96	98	101	104	108	111	114	117	121
123	126	130	134	138	142	146	151	155	160	165	170	175	180
401	108	111	114	318	121	125	129	132	367	141	145	149	154
933	778	622	467	311	156	0	0	0	0	0	0	0	0
1,830	1,830	1,830	1,830	1,830	1,830	0	0	0	0	0	0	0	0
18,282	18,266	18,580	18,909	19,451	19,809	18,152	18,697	19,258	20,067	20,431	21,044	21,675	22,325
938	1,530	1,810	2,093	2,181	2,472	4,797	4,941	5,089	5,011	5,399	5,561	5,728	5,900
16,536	-15,006	-13,196	-11,103	-8,922	-6,250	-1,453	3,488	8,577	13,588	18,987	24,548	30,276	36,176
4.9%	7.7%	9.1%	10.6%	11.0%	13.5%	24.2%	25.0%	25.7%	25.3%	27.3%	28.1%	28.7%	29.8%
16.1%	25.8%	30.5%	35.2%	36.7%	45.0%	80.3%	83.2%	85.7%	84.4%	90.9%	93.6%	96.4%	99.3%
3,163	3,019	2,876	2,733	2,591	2,449	477	492	506	521	537	553	570	587
14,698	15,139	15,593	16,061	16,543	17,039	17,550	18,077	18,619	19,178	19,753	20,346	20,956	21,585
19,220	19,796	20,390	21,002	21,632	22,281	22,949	23,638	24,347	25,077	25,830	26,605	27,403	28,225
70.0%	64.8%	60.0%	55.3%	50.9%	46.7%	8.8%	8.8%	8.8%	8.8%	8.8%	8.8%	8.8%	8.8%
103.0%	95.4%	88.2%	81.4%	74.9%	68.8%	13.0%	13.0%	13.0%	13.0%	13.0%	13.0%	13.0%	13.0%
-491	37	272	509	749	991	3,066	3,158	3,253	3,120	3,451	3,555	3,661	3,771
53.0%	49.1%	45.4%	41.9%	38.6%	35.4%	6.7%	6.7%	6.7%	6.7%	6.7%	6.7%	6.7%	6.7%
2,408	3,023	3,348	3,677	3,812	4,352	6,528	6,724	6,925	6,902	7,347	7,568	7,795	8,129
49.1%	45.5%	42.1%	38.8%	35.7%	32.8%	6.2%	6.2%	6.2%	6.2%	6.2%	6.2%	6.2%	6.2%
2,980	3,510	3,849	4,194	4,344	4,900	7,092	7,305	7,524	7,519	7,962	8,222	8,468	8,722
121.7%	112.8%	104.3%	96.2%	88.5%	81.3%	15.4%	15.4%	15.4%	15.4%	15.4%	15.4%	15.4%	15.4%
-964	-449	-229	-7	17	444	2,502	2,577	2,655	2,503	2,815	2,901	2,988	3,077
76.1%	70.4%	65.1%	60.0%	55.1%	50.5%	8.8%	8.8%	8.8%	8.8%	8.8%	8.8%	8.8%	8.8%
682	1,269	1,565	1,864	1,967	2,473	4,797	4,941	5,089	5,011	[illegible]	5,561	5,728	5,900
63.8%	59.2%	54.8%	50.7%	46.7%	42.9%	8.8%	8.8%	8.8%	8.8%	8.8%	8.8%	8.8%	[illegible]
1,234	1,791	2,055	2,323	2,395	2,970	4,797	4,941	5,089	5,011	5,399	5,561	5,723	[illegible]
1,104	1,681	1,965	2,253	2,345	2,841	4,972	5,121	5,275	5,202	5,596	5,764	5,937	[illegible]

PIPE PLANT BURMA: ALTERNATIVE IA

FOREIGN EXCHANGE SAVINGS , in 1000 US Dollar

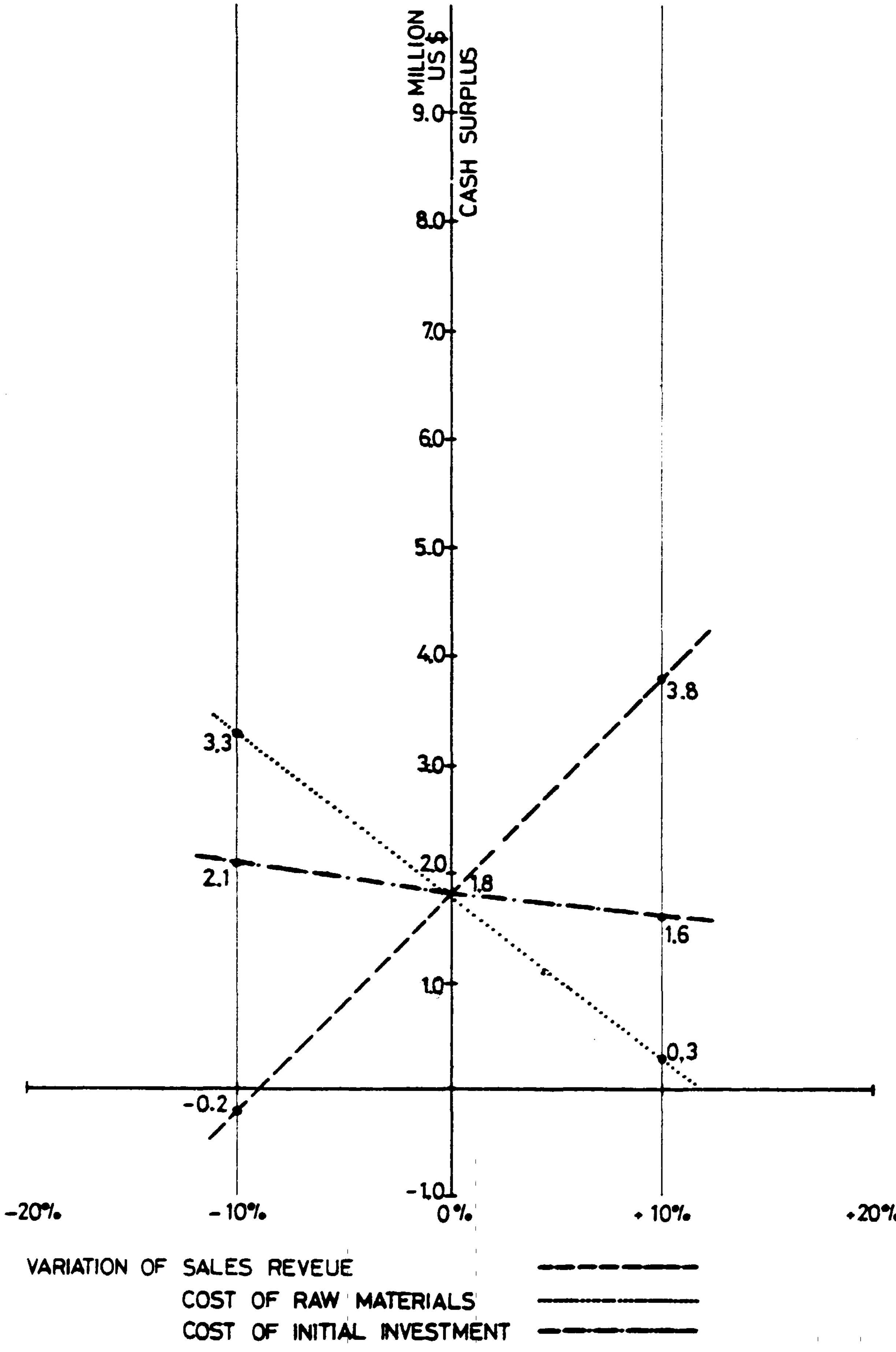
YEAR	VALUE OF PIPE PRODUCED	FOREIGN EXCHANGE OUTFLOW	FOREIGN EXCHANGE SAVINGS	ACCUM. FOREIGN EXCHANGE SAVING
1	2	3	4=2-3	5=SUM4
1,990	16,794	15,370	1,424	1,424
1,991	19,220	17,502	1,718	3,142
1,992	19,796	17,489	2,308	5,450
1,993	20,390	17,780	2,611	8,060
1,994	21,002	18,084	2,918	10,978
1,995	21,632	18,549	3,083	14,061
1,996	22,281	18,734	3,547	17,608
1,997	22,949	17,251	5,698	23,306
1,998	23,638	17,769	5,869	29,175
1,999	24,347	18,302	6,045	35,221
2,000	25,077	19,022	6,056	41,276
2,001	25,830	19,416	6,413	47,690
2,002	26,605	19,999	6,606	54,296
2,003	27,403	20,599	6,804	61,100
2,004	28,245	21,217	7,028	68,128

PLANT ALTERNATIVE IA , 4th YEAR OF PRODUCTION = 1993
SENSITIVITY OF BREAK EVEN POINT ON CASH SURPLUS



VARIATION OF SALES REVENUE ————————
COST OF RAW MATERIALS ·························
COST OF INITIAL INVESTMENT —·—·—·—

PLANT ALTERNATIVE IA , 4th YEAR OF PRODUCTION =1993
SENSITIVITY OF CASH SURPLUS



ANNEX 10.2 Computer Calculations for Alternative II

Output Schedules (COMFAR)

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                                                                    COMFAR
                                                                    2.0   UNIDO
------------------------------------------------------------------------------- COMFAR 2.0  -  UNIDO IO/FEAS, Vienna -----

               Pipe Plant, Burma: Alternative II
               June 1986
               112,139 tpy, Pipe Diameter 1/2" to 12"

               3 year(s) of construction, 15 years of production
               currency conversion rates:
                     foreign currency 1 unit =      1.0000 units accounting currency
                     local   currency 1 unit =      1.0000 units accounting currency
               accounting currency:      thousands of U.S. Dollars
---------------------------------------------------------------------------------------------------------------
               Total  initial  investment  during construction phase

                      fixed   assets:       22172.16                79.939 % foreign
                      current assets:        7300.00               100.000 % foreign
                      total   assets:       29472.16                84.908 % foreign

---------------------------------------------------------------------------------------------------------------
               Source  of  funds  during construction phase

                     equity & grants:        8850.00                49.740 % foreign
                     foreign  loans :       20650.00
                     local    loans :           0.00
                     total    funds :       29500.00                84.922 % foreign

---------------------------------------------------------------------------------------------------------------
               Cashflow  from  operations

                     Year:                     1            4            8
                     operating costs:   30323.00     45969.93     51739.55
                     depreciation   :    2097.72      2097.72      2029.12
                     interest       :    1755.25      1003.00         0.00
                     ---------------- ------------ ------------ ------------
                     production costs   34175.96     49070.64     53768.67
                     thereof foreign       94.40 %      94.99 %      94.93 %
                     total sales    :   35355.60     55191.45     62118.46

                     gross income   :    1179.64      6120.81      8349.79
                     net   income   :    1179.64      6120.81      8349.79
                     cash balance   :     511.20      4949.61     10019.96
                     net cashflow   :    5216.45      8902.61     10019.96


                     Net Present Value    at:  10.00 % =      34035.73
                     Internal Rate of Return:  26.16 %
                     Return on equity1:        41.20 %
                     Return on equity2:        34.17 %

---------------------------------------------------------------------------------------------------------------
               Index  of  Schedules  produced by COMFAR

               Total initial investment              Cashflow Tables
               Total investment during production    Projected Balance
               Total production costs                Net income statement
               Working Capital requirements          Source of finance
```

COMFAR 2.0
UNIDO

COMFAR 2.0 - UNIDO IO/FEAS, Vienna

Total Initial Investment in thousands of U.S. Dollars

Year	1987.1	1987.2	1988.1	1988.2	1989.1	1989.2
Fixed investment costs						
Land, site preparation, development	72.00	150.00	92.00	0.00	0.00	0.00
Buildings and civil works	0.00	0.00	694.00	1162.00	710.00	710.00
Auxiliary and service facilities .	0.00	0.00	0.00	0.00	0.00	0.00
Incorporated fixed assets	0.00	0.00	0.00	0.00	0.00	0.00
Plant machinery and equipment . . .	0.00	0.00	0.00	4930.00	5413.00	4956.00
Total fixed investment costs	72.00	150.00	786.00	6092.00	6123.00	5666.00
Pre-production capital expenditures.	103.00	630.00	535.00	690.25	480.67	844.24
Net working capital	0.00	0.00	0.00	0.00	0.00	7300.00
Total initial investment costs . . .	175.00	780.00	1321.00	6782.25	6603.67	13810.24
Of it foreign, in %	51.43	83.33	48.30	82.82	81.92	91.38

Pipe Plant, Burma: Alternative II --- June 1986

-- COMFAR 2.0 - UNIDO IO/FEAS, Vienna -----

Total Current Investment in thousands of U.S. Dollars

Year	1990	1991	1992	1993	1994	1995
Fixed investment costs						
Land, site preparation, development	0.00	0.00	0.00	0.00	0.00	0.00
Buildings and civil works	0.00	0.00	0.00	0.00	0.00	90.00
Auxiliary and service facilities .	0.00	0.00	0.00	0.00	0.00	0.00
Incorporated fixed assets	0.00	0.00	0.00	0.00	0.00	0.00
Plant, machinery and equipment . .	0.00	0.00	0.00	0.00	0.00	128.00
Total fixed investment costs	0.00	0.00	0.00	0.00	0.00	218.00
Preproduction capitals expenditures.	0.00	0.00	0.00	0.00	0.00	0.00
Working capital	-183.85	1156.11	2358.33	318.92	328.49	338.34
Total current investment costs . . .	-183.85	1156.11	2358.33	318.92	328.49	556.34
Of it foreign, %	95.87	96.97	96.60	96.15	96.15	87.23

Pipe Plant, Burma: Alternative II --- June 1986

-- COMFAR 2.0 - UNIDO IO/FEAS, Vienna -----

Total Current Investment in thousands of U.S. Dollars

Year	1996	1997	1998	1999	2000	2001
Fixed investment costs						
Land, site preparation, development	0.00	0.00	0.00	0.00	0.00	0.00
Buildings and civil works	0.00	0.00	0.00	0.00	105.00	0.00
Auxiliary and service facilities .	0.00	0.00	0.00	0.00	0.00	0.00
Incorporated fixed assets	0.00	0.00	0.00	0.00	0.00	0.00
Plant, machinery and equipment . .	0.00	0.00	0.00	0.00	147.00	0.00
Total fixed investment costs	0.00	0.00	0.00	0.00	252.00	0.00
Preproduction capitals expenditures.	0.00	0.00	0.00	0.00	0.00	0.0
Working capital	348.49	358.94	369.71	380.81	392.23	403.99
Total current investment costs . . .	348.49	358.94	369.71	380.81	644.23	403.99
Of it foreign, %	96.15	96.15	96.15	96.15	87.26	96.15

Pipe Plant, Burma: Alternative II --- June 1986

COMFAR 2.0 UNIDO

CORFAR 2.0 - UNIDO IO/FEAS, Vienna

Total Current Investment in thousands of U.S. Dollars

Year	2002	2003	2004
Fixed investment costs			
Land, site preparation, development	0.00	0.00	0.00
Buildings and civil works	0.00	0.00	0.00
Auxiliary and service facilities .	0.00	0.00	0.00
Incorporated fixed assets	0.00	0.00	0.00
Plant, machinery and equipment . .	0.00	0.00	0.00
Total fixed investment costs	0.00	0.00	0.00
Preproduction capitals expenditures.	0.00	0.00	0.00
Working capital	416.11	428.60	441.46
Total current investment costs . . .	416.11	428.60	441.46
Of it foreign, %	96.15	96.15	96.15

Pipe Plant, Burma: Alternative II --- June 1986

COMFAR 2.0 - UNIDO IO/FEAS, Vienna

Total Production Costs in thousands of U.S. Dollars

Year	1990	1991	1992	1993	1994	1995
% of nom. capacity (single product).	70.00	80.00	100.00	100.00	100.00	100.00
Raw material 1	27893.00	32834.34	42273.68	43541.89	44848.14	46193.59
Other raw materials	521.00	613.88	790.37	814.08	838.50	863.66
Utilities	0.00	0.00	0.00	0.00	0.00	0.00
Energy	52.00	60.77	78.51	80.86	83.29	85.79
Labour, direct	855.00	243.08	250.37	257.88	265.62	273.59
Repair, maintenance	63.00	64.89	66.84	68.84	70.91	73.03
Spares	384.00	452.17	582.43	599.91	617.90	636.44
Factory overheads	0.00	0.00	0.00	0.00	0.00	0.00
Factory costs	29768.00	34269.13	44042.20	45363.46	46724.37	48126.09
Administrative overheads	110.00	113.30	116.70	120.20	123.81	127.52
Indir. costs, sales and distribution	445.00	458.35	472.10	486.26	500.85	515.88
Direct costs, sales and distrbution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation	2097.72	2097.72	2097.72	2097.72	2097.72	1985.52
Financial costs	1755.25	1504.50	1253.75	1003.00	752.25	501.50
Total production costs	34175.97	38443.00	47982.46	49070.64	50198.99	51256.50
Costs per unit (single product) .	24411.41	24026.87	23991.23	24535.32	25099.49	25628.25
Of it foreign, %	94.40	94.68	95.01	94.99	94.97	94.97
Of it variable,%	0.00	0.00	0.00	0.00	0.00	0.00
Total labour	855.00	243.08	250.37	257.88	265.62	273.59

Pipe Plant, Burma: Alternative II --- June 1986

COMFAR 2.0 - UNIDO IO/FEAS, Vienna

Total Production Costs in thousands of U.S. Dollars

Year	1996	1997	1998	1999	2000	2001
% of nom. capacity (single product).	100.00	100.00	100.00	100.00	100.00	100.00
Raw material 1	47579.39	49006.78	50476.98	51991.29	53551.03	55157.55
Other raw materials	889.57	916.26	943.74	972.06	1001.22	1031.25
Utilities	0.00	0.00	0.00	0.00	0.00	0.00
Energy	88.36	91.01	93.74	96.55	99.45	102.43
Labour, direct	281.80	290.25	298.96	307.93	317.16	326.68
Repair, maintenance	75.23	77.48	79.81	82.20	84.67	87.21
Spares	655.53	675.20	695.46	716.32	737.81	759.94
Factory overheads	0.00	0.00	0.00	0.00	0.00	0.00
Factory costs	49569.88	51056.98	52588.69	54166.34	55791.34	57465.07
Administrative overheads	131.35	135.29	139.34	143.53	147.83	152.27
Indir. costs, sales and distribution	531.35	547.29	563.71	580.62	598.04	615.98
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation	2029.12	2029.12	2029.12	2029.12	206.40	226.00
Financial costs	250.75	0.00	0.00	0.00	0.00	0.00
Total production costs	52512.45	53768.67	55320.86	56919.61	56743.61	58459.32
Costs per unit (single product) .	26256.22	26884.34	27660.43	28459.80	28371.81	29229.66
Of it foreign, %	94.94	94.93	94.94	94.95	95.09	95.10
Of it variable,%	0.00	0.00	0.00	0.00	0.00	0.00
Total abour	281.80	290.25	298.96	307.93	317.16	326.68

Pipe Plant, Burma: Alternative II --- June 1986

Total Production Costs in thousands of U.S. Dollars

Year	2002	2003	2004
% of nom. capacity (single product).	100.00	100.00	100.00
Raw material 1	56812.28	58516.64	60272.14
Other raw materials	1062.19	1094.06	1126.88
Utilities	0.00	0.00	0.00
Energy	105.51	108.67	111.93
Labour, direct	336.48	346.57	356.97
Repair, maintenance	89.82	92.52	95.29
Spares	782.74	806.22	830.41
Factory overheads	0.00	0.00	0.00
Factory costs	59189.02	60964.68	62793.63
Administrative overheads	156.83	161.54	166.38
Indir. costs, sales and distribution	634.46	653.50	673.10
Direct costs, sales and distribution	0.00	0.00	0.00
Depreciation	226.00	226.00	226.00
Financial costs	0.00	0.00	0.00
Total production costs	60206.32	62005.72	63859.12
Costs per unit (single product)	30103.16	31002.86	31929.56
Of it foreign, %	95.10	95.11	95.12
Of it variable,%	0.00	0.00	0.00
Total labour	336.48	346.57	356.97

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COMFAR 2.0 - UNIDO IO/FEAS, Vienna

Net Working Capital in thousands of U.S. Dollars

Year			1990	1991	1992	1993	1994
Coverage	mdc	coto					
Current assets &							
Accounts receivable	20	18.0	1684.61	1935.60	2479.50	2553.89	2630.50
Inventory and materials	45	8.0	3551.75	4181.03	5383.01	5544.50	5710.83
Energy	0	---	0.00	0.00	0.00	0.00	0.00
Spares	0	---	0.00	0.00	0.00	0.00	0.00
Work in progress	7	48.0	620.17	713.94	917.55	945.07	973.42
Finished products	15	24.0	1244.92	1432.60	1839.95	1895.15	1952.01
Cash in hand	4	96.0	14.71	9.10	10.59	10.90	11.23
Total current assets			7116.15	8272.27	10630.59	10949.51	11278.00
Current liabilities and							
Accounts payable	0	---	0.00	0.00	0.00	0.00	0.00
Net working capital			7116.15	8272.27	10630.59	10949.51	11278.00
Increase in working capital			-183.85	1156.11	2358.33	318.92	328.49
Net working capital, local			294.07	329.11	409.37	421.66	434.31
Net working capital, foreign			6822.09	7943.16	10221.22	10527.85	10843.69

Note: mdc = minimum days of coverage ; coto = coefficient of turnover .

Pipe Plant, Burma: Alternative II --- June 1986

COMFAR 2.0 - UNIDO IO/FEAS, Vienna

Net Working Capital in thousands of U.S. Dollars

Year			1995	1996	1997	1998	1999
Coverage	mdc	coto					
Current assets &							
Accounts receivable	20	18.0	2709.42	2790.70	2874.42	2960.65	3049.47
Inventory and materials	45	8.0	5882.16	6058.62	6240.38	6427.59	6620.42
Energy	0	---	0.00	0.00	0.00	0.00	0.00
Spares	0	---	0.00	0.00	0.00	0.00	0.00
Work in progress	7	48.0	1002.63	1032.71	1063.69	1095.60	1128.47
Finished products	15	24.0	2010.57	2070.88	2133.01	2197.00	2262.91
Cash in hand	4	96.0	11.57	11.92	12.27	12.64	13.02
Total current assets			11616.33	11964.82	12323.77	12693.48	13074.29
Current liabilities and							
Accounts payable	0	---	0.00	0.00	0.00	0.00	0.00
Net working capital			11616.33	11964.82	12323.77	12693.48	13074.29
Increase in working capital			338.34	348.49	358.94	369.71	380.80
Net working capital, local			447.33	460.75	474.58	488.81	503.48
Net working capital, foreign			11169.00	11504.07	11849.19	12204.67	12570.81

Note: mdc = minimum days of coverage ; coto = coefficient of turnover .

Pipe Plant, Burma: Alternative II --- June 1986

Net Working Capital in thousands of U.S. Dollars

Year	mdc	coto	2000	2001	2002	2003	2004
Coverage	mdc	coto					
Current assets &							
Accounts receivable	20	18.0	3140.96	3235.18	3332.24	3432.21	3535.17
Inventory and materials	45	8.0	6819.03	7023.60	7234.31	7451.34	7674.88
Energy	0	---	0.00	0.00	0.00	0.00	0.00
Spares	0	---	0.00	0.00	0.00	0.00	0.00
Work in progress	7	48.0	1162.32	1197.19	1233.10	1270.10	1308.20
Finished products	15	24.0	2330.80	2400.72	2472.74	2546.93	2623.33
Cash in hand	4	96.0	13.41	13.81	14.23	14.65	15.09
Total current assets			13466.52	13870.51	14286.63	14715.22	15156.68
Current liabilities and							
Accounts payable	0	---	0.00	0.00	0.00	0.00	0.00
Net working capital			13466.52	13870.51	14286.63	14715.22	15156.68
Increase in working capital			392.23	403.99	416.12	428.60	441.46
Net working capital, local			518.58	534.14	550.17	566.67	583.67
Net working capital, foreign			12947.93	13336.37	13736.46	14148.55	14573.01

Note: mdc = minimum days of coverage ; coto = coefficient of turnover .

Source of Finance, construction in thousands of U.S. Dollars

Year	1987.1	1987.2	1988.1	1988.2	1989.1	1989.2
Equity, ordinary ..	175.00	780.00	1321.00	4189.00	1194.00	1191.00
Equity, preference.	0.00	0.00	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, foreign .	0.00	0.00	0.00	2600.00	5420.00	12630.00
Loan B, foreign..	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00	0.00	0.00
Total loan	0.00	0.00	0.00	2600.00	5420.00	12630.00
Current liabilities	0.00	0.00	0.00	0.00	0.00	0.00
Bank overdraft	0.00	0.00	0.00	0.00	0.00	0.00
Total funds	175.00	780.00	1321.00	6789.00	6614.00	13821.00

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Source of Finance, production in thousands of U.S. Dollars

Year	1990-96
Equity, ordinary ..	0.00
Equity, preference.	0.00
Subsidies, grants .	0.00
Loan A, foreign .	-2950.00
Loan B, foreign..	0.00
Loan C, foreign .	0.00
Loan A, local....	0.00
Loan B, local....	0.00
Loan C, local....	0.00
Total loan	-2950.00
Current liabilities	0.00
Bank overdraft	0.00
Total funds	-2950.00

Pipe Plant, Burma: Alternative II --- June 1986

Cashflow Tables, construction in thousands of U.S. Dollars

Year	1987.1	1987.2	1988.1	1988.2	1989.1	1989.2
Total cash inflow . .	175.00	780.00	1321.00	6789.00	6614.00	13821.00
Financial resources .	175.00	780.00	1321.00	6789.00	6614.00	13821.00
Sales, net of tax . .	0.00	0.00	0.00	0.00	0.00	0.00
Total cash outflow . .	175.00	780.00	1321.00	6782.25	6603.67	13810.24
Total assets	175.00	780.00	1321.00	6727.00	6378.00	13201.00
Operating costs . . .	0.00	0.00	0.00	0.00	0.00	0.00
Cost of finance . . .	0.00	0.00	0.00	55.25	225.68	609.24
Repayment	0.00	0.00	0.00	0.00	0.00	0.00
Corporate tax . . .	0.00	0.00	0.00	0.00	0.00	0.00
Dividends paid . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus (deficit) .	0.00	0.00	0.00	6.75	10.33	10.76
Cumulated cash balance	0.00	0.00	0.00	6.75	17.08	27.84
Inflw, local	85.00	130.00	683.00	1165.00	1194.00	1191.00
Outflow, local	85.00	130.00	683.00	1165.00	1194.00	1191.00
Surplus (deficit) .	0.00	0.00	0.00	0.00	0.00	0.00
Inflow, foreign . . .	90.00	650.00	638.00	5624.00	5420.00	12630.00
Outflow, foreign . . .	90.00	650.00	638.00	5617.25	5409.67	12619.24
Surplus (deficit) .	0.00	0.00	0.00	6.75	10.33	10.76
Net cashflow	-175.00	-780.00	-1321.00	-6727.00	-6378.00	-13201.00
Cumulated net cashflow	-175.00	-955.00	-2276.00	-9003.00	-15381.00	-28582.00

Cashflow tables, production in thousands of U.S. Dollars

Year	1990	1991	1992	1993	1994	1995
Total cash inflow . .	35355.60	41618.59	53583.94	55191.45	56847.20	58552.60
Financial resources .	0.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax . .	35355.60	41618.59	53583.94	55191.45	56847.20	58552.60
Total cash outflow . .	34844.41	40451.39	51193.08	50241.85	51379.77	52777.33
Total assets	-133.85	1156.11	2358.33	318.92	328.49	556.34
Operating costs . . .	30323.00	34840.78	44631.00	45969.93	47349.03	48769.49
Cost of finance . . .	1755.25	1504.50	1253.75	1003.00	752.25	501.50
Repayment	2950.00	2950.00	2950.00	2950.00	2950.00	2950.00
Corporate tax . . .	0.00	0.00	0.00	0.00	0.00	0.00
Dividends paid . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus (deficit) .	511.20	1167.20	2390.86	4949.61	5467.43	5775.27
Cumulated cash balance	539.03	1706.23	4097.09	9046.70	14514.13	20289.40
Inflow, local	13946.10	16416.55	21136.31	21770.40	22423.51	23096.21
Outflow, local	1891.07	1763.39	2161.75	2156.21	2220.90	2345.52
Surplus (deficit) .	12055.03	14653.17	18974.56	19614.19	20202.61	20750.69
Inflow, foreign . . .	21409.50	25202.04	32447.63	33421.05	34423.68	35456.39
Outflow, foreign . . .	32953.34	38688.01	49031.33	48085.64	49158.87	50431.81
Surplus (deficit) .	-11543.84	-13485.97	-16583.70	-14664.58	-14735.19	-14975.42
Net cashflow	5216.45	5621.70	6594.61	8902.61	9169.68	9226.77
Cumulated net cashflow	-23365.55	-17743.85	-11149.24	-2246.64	6923.04	16149.81

Cashflow tables, production in thousands of U.S. Dollars

Year	1996	1997	1998	1999	2000	2001
Total cash inflow . .	60309.18	62118.46	63982.01	65901.47	67878.52	69914.88
Financial resources .	0.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax . .	60309.18	62118.46	63982.01	65901.47	67878.52	69914.88
Total cash outflow . .	53781.82	52098.50	53661.46	55271.30	57181.44	58637.31
Total assets	348.49	358.94	369.71	380.80	644.23	403.99
Operating costs . . .	50232.58	51739.56	53291.75	54890.49	56537.21	58233.32
Cost of finance . . .	250.75	0.00	0.00	0.00	0.00	0.00
Repayment	2950.00	0.00	0.00	0.00	0.00	0.00
Corporate tax . . .	0.00	0.00	0.00	0.00	0.00	0.00
Dividends paid . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus (deficit) .	6527.36	10019.96	10320.55	10630.17	10697.07	11277.57
Cumulated cash balance	26816.76	36836.71	47157.26	57787.43	68484.51	79762.08
Inflow local	23789.10	24502.77	25237.86	25994.99	26774.84	27578.09
Outflow, local	2356.15	2426.83	2499.64	2574.63	2718.87	2731.42
Surplus (deficit) .	21432.95	22075.94	22738.21	23420.36	24055.97	24846.66
Inflow, foreign . . .	36520.08	37615.69	38744.16	39906.48	41103.68	42336.79
Outflow, foreign . . .	51425.67	49671.67	51161.82	52696.67	54462.57	55905.89
Surplus (deficit) .	-14905.59	-12055.98	-12417.66	-12790.19	-13358.90	-13569.10
Net cashflow	9728.11	10019.96	10320.55	10630.17	10697.08	11277.57
Cumulated net cashflow	25877.92	35897.88	46218.43	56848.60	67545.67	78823.23

Cashflow tables, production in thousands of U.S. Dollars

Year	2002	2003	2004
Total cash inflow . .	72012.31	74172.68	76397.86
Financial resources .	0.00	0.00	0.00
Sales, net of tax . .	72012.31	74172.68	76397.86
Total cash outflow . .	60396.44	62208.32	64074.57
Total assets	416.12	428.60	441.46
Operating costs . . .	59980.32	61779.72	63633.12
Cost of finance . . .	0.00	0.00	0.00
Repayment	0.00	0.00	0.00
Corporate tax . . .	0.00	0.00	0.00
Dividends paid . . .	0.00	0.00	0.00
Surplus (deficit) .	11615.87	11964.36	12323.29
Cumulated cash balance	91377.95	103342.30	115665.60
Inflow, local	28405.43	29257.59	30135.31
Outflow, local	2813.37	2897.77	2984.70
Surplus (deficit) .	25592.06	26359.82	27150.62
Inflow, foreign . . .	43606.89	44915.09	46262.54
Outflow, foreign . . .	57583.07	59310.55	61089.88
Surplus (deficit) .	-13976.18	-14395.46	-14827.33
Net cashflow	11615.87	11964.37	12323.28
Cumulated net cashflow	90439.11	102403.50	114726.80

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Cashflow Discounting:

a) Return on Equity 1:
        Net  present  value ..............  35747.99  at      10.00 %
        Internal Rate of Return  (IRRE1) ..     41.20 %
b) Return on Equity 2:
        Net  present  value ..............  33697.06  at      10.00 %
        Internal Rate of Return  (IRRE2) ..     34.17 %
c) Internal Rate of Return on total investment:
        Net  present  value ..............  34035.73  at      10.00 %
        Internal Rate of Return  ( IRR ) ..     26.16 %
Equity 1 = Total equity paid : Net income
Equity 2 = Initial equity paid : Net cash return
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                                                                          Pipe Plant, Burma: Alternative II --- June 1986
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Net Income Statement in thousands of U.S. Dollars

Year	1990	1991	1992	1993	1994
Total sales, incl. sales tax	35355.60	41618.59	53583.94	55191.45	56847.20
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin	35355.60	41618.59	53583.94	55191.45	56847.20
As % of total sales	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	32420.71	36938.50	46728.72	48067.64	49446.75
Operational margin	2934.89	4680.10	6855.22	7123.81	7400.45
As % of total sales	8.30	11.25	12.79	12.91	13.02
Cost of finance	1755.25	1504.50	1253.75	1003.00	752.25
Gross profit	1179.64	3175.60	5601.47	6120.81	6648.20
Allowances	0.00	0.00	0.00	0.00	0.00
Taxable profit	1179.64	3175.60	5601.47	6120.81	6648.20
Tax	0.00	0.00	0.00	0.00	0.00
Net profit	1179.64	3175.60	5601.47	6120.81	6648.20
Dividends paid	0.00	0.00	0.00	0.00	0.00
Undistributed profit	1179.64	3175.60	5601.47	6120.81	6648.20
Accumulated undistributed profit . . .	1179.64	4355.23	9956.70	16077.51	22725.71
Gross profit, % of total sales	3.34	7.63	10.45	11.09	11.69
Net profit, % of total sales	3.34	7.63	10.45	11.09	11.69
ROE, Net profit, % of equity	13.33	35.88	63.29	69.16	75.12
ROI, Net profit+interest, % of invest.	10.33	15.84	21.48	22.10	22.73

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Net Income Statement in thousands of U.S. Dollars

Year	1995	1996	1997	1998	1999
Total sales, incl. sales tax	58552.60	60309.18	62118.46	63982.01	65901.47
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin	58552.60	60309.18	62118.46	63982.01	65901.47
As % of total sales	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	50755.01	52261.70	53768.67	55320.86	56919.61
Operational margin	7797.59	8047.48	8349.79	8661.15	8981.86
As % of total sales	13.32	13.34	13.44	13.54	13.63
Cost of finance	501.50	250.75	0.00	0.00	0.00
Gross profit	7296.09	7796.73	8349.79	8661.15	8981.86
Allowances	0.00	0.00	0.00	0.00	0.00
Taxable profit	7296.09	7796.73	8349.79	8661.15	8981.86
Tax	0.00	0.00	0.00	0.00	0.00
Net profit	7296.09	7796.73	8349.79	8661.15	8981.86
Dividends paid	0.00	0.00	0.00	0.00	0.00
Undistributed profit	7296.09	7796.73	8349.79	8661.15	8981.86
Accumulated undistributed profit . . .	30021.80	37818.54	46168.33	54829.48	63811.33
Gross profit, % of total sales	12.46	12.93	13.44	13.54	13.63
Net profit, % of total sales	12.46	12.93	13.44	13.54	13.63
ROE, Net profit, % of equity	82.44	88.10	94.35	97.87	101.49
ROI, Net profit+interest, % of invest.	23.55	24.05	24.69	25.33	25.98

Pipe Plant, Burma: Alternative II --- June 1986

Net Income Statement in thousands of U.S. Dollars

Year	2000	2001	2002	2003	2004
Total sales, incl. sales tax	67878.52	69914.88	72012.31	74172.68	76397.86
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin	67878.52	69914.88	72012.31	74172.68	76397.86
As % of total sales	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	56743.61	58459.32	60206.32	62005.73	63859.12
Operational margin	11134.90	11455.55	11805.99	12166.95	12538.74
As % of total sales	16.40	16.39	16.39	16.40	16.41
Cost of finance	0.00	0.00	0.00	0.00	0.00
Gross profit	11134.90	11455.55	11805.99	12166.95	12538.74
Allowances	0.00	0.00	0.00	0.00	0.00
Taxable profit	11134.90	11455.55	11805.99	12166.95	12538.74
Tax	0.00	0.00	0.00	0.00	0.00
Net profit	11134.90	11455.55	11805.99	12166.95	12538.74
Dividends paid	0.00	0.00	0.00	0.00	0.00
Undistributed profit	11134.90	11455.55	11805.99	12166.95	12538.74
Accumulated undistributed profit	74946.23	86401.79	98207.78	110374.70	122913.50
Gross profit, % of total sales	16.40	16.39	16.39	16.40	16.41
Net profit, % of total sales	16.40	16.39	16.39	16.40	16.41
ROE, Net profit, % of equity	125.82	129.44	133.40	137.48	141.68
ROI, Net profit+interest, % of invest.	31.62	32.16	32.76	33.36	33.97

Pipe Plant, Burma: Alternative II --- June 1986

Projected Balance Sheets, construction in thousands of U.S. Dollars

Year	1987.1	1987.2	1988.1	1988.2	1989.1	1989.2
Total assets	175.00	955.00	2276.00	9065.00	15679.00	29500.00
Fixed assets, net of depreciation	0.00	175.00	955.00	2276.00	9058.25	15661.92
Construction in progress	175.00	780.00	1321.00	6782.25	6603.67	6510.24
Current assets	0.00	0.00	0.00	0.00	0.00	7300.00
Cash, bank	0.00	0.00	0.00	0.00	0.00	0.00
Cash surplus, finance available	0.00	0.00	0.00	6.75	17.08	27.84
Loss carried forward	0.00	0.00	0.00	0.00	0.00	0.00
Loss	0.00	0.00	0.00	0.00	0.00	0.00
Total liabilities	175.00	955.00	2276.00	9065.00	15679.00	29500.00
Equity capital	175.00	955.00	2276.00	6465.00	7659.00	8850.00
Reserves, retained profit	0.00	0.00	0.00	0.00	0.00	0.00
Profit	0.00	0.00	0.00	0.00	0.00	0.00
Long and medium term debt	0.00	0.00	0.00	2600.00	8020.00	20650.00
Current liabilities	0.00	0.00	0.00	0.00	0.00	0.00
Bank overdraft, finance required.	0.00	0.00	0.00	0.00	0.00	0.00
Total debt	0.00	0.00	0.00	2600.00	8020.00	20650.00
Equity, % of liabilities	100.00	100.00	100.00	71.32	48.85	30.00

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Projected Balance Sheets, Production in thousands of U.S. Dollars

Year	1990	1991	1992	1993	1994	1995
Total assets	27729.64	27955.23	30606.70	33777.51	37475.71	41821.80
Fixed assets, net of depreciation	20074.45	17976.73	15879.01	13781.30	11683.58	9698.07
Construction in progress	0.00	0.00	0.00	0.00	0.00	218.00
Current assets	7101.44	8263.17	10620.01	10938.61	11266.76	11604.77
Cash, bank	14.71	9.10	10.59	10.90	11.23	11.57
Cash surplus, finance available	539.04	1706.24	4097.10	9046.71	14514.13	20289.40
Loss carried forward	0.00	0.00	0.00	0.00	0.00	0.00
Loss	0.00	0.00	0.00	0.00	0.00	0.00
Total liabilities	27729.64	27955.23	30606.70	33777.51	37475.71	41821.80
Equity capital	8850.00	8850.00	8850.00	8850.00	8850.00	8850.00
Reserves, retained profit	0.00	1179.64	4355.23	9956.70	16077.51	22725.71
Profit	1179.64	3175.60	5601.47	6120.81	6648.20	7296.09
Long and medium term debt	17700.00	14750.00	11800.00	8850.00	5900.00	2950.00
Current liabilities	0.00	0.00	0.00	0.00	0.00	0.00
Bank overdraft, finance required.	0.00	0.00	0.00	0.00	0.00	0.00
Total debt	17700.00	14750.00	11800.00	8850.00	5900.00	2950.00
Equity, % of liabilities	31.92	31.66	28.92	26.20	23.62	21.16

Pipe Plant, Burma: Alternative II --- June 1986

---------- COMFAR 2.0 - UNIDO IO/FEAS, Vienna -----

Projected Balance Sheets, Production in thousands of U.S. Dollars

Year	1996	1997	1998	1999	2000	2001
Total assets	46668.54	55018.33	63679.48	72661.33	83796.23	95251.79
Fixed assets, net of depreciation	7886.95	5857.83	3828.72	1799.60	1593.20	1619.20
Construction in progress	0.00	0.00	0.00	0.00	252.00	0.00
Current assets	11952.91	12311.50	12680.84	13061.27	13453.11	13856.70
Cash, bank	11.92	12.27	12.64	13.02	13.41	13.81
Cash surplus, finance available	26816.76	36836.73	47157.28	57787.45	68484.52	79762.08
Loss carried forward	0.00	0.00	0.00	0.00	0.00	0.00
Loss	0.00	0.00	0.00	0.00	0.00	0.00
Total liabilities	46668.54	55018.33	63679.48	72661.33	83796.23	95251.79
Equity capital	8850.00	8850.00	8850.00	8850.00	8850.00	8850.00
Reserves, retained profit	30021.80	37818.54	46168.33	54829.48	63811.33	74946.23
Profit	7796.73	8349.79	8661.15	8981.86	11134.90	11455.55
Long and medium term debt	0.00	0.00	0.00	0.00	0.00	0.00
Current liabilities	0.00	0.00	0.00	0.00	0.00	0.00
Bank overdraft, finance required.	0.00	0.00	0.00	0.00	0.00	0.00
Total debt	0.00	0.00	0.00	0.00	0.00	0.00
Equity, % of liabilities	18.96	16.09	13.90	12.[illegible]	10.56	9.29

Pipe Plant [illegible] Alternative II --- June 1986

Projected Balance Sheets, Production in thousands of U.S. Dollars

Year	2002	2003	2004
Total assets	107057.80	119224.70	131763.50
Fixed assets, net of depreciation	1393.20	1167.20	941.20
Construction in progress	0.00	0.00	0.00
Current assets	14272.40	14700.57	15141.59
Cash, bank	14.23	14.65	15.09
Cash surplus, finance available .	91377.95	103342.30	115665.60
Loss carried forward	0.00	0.00	0.00
Loss	0.00	0.00	0.00
Total liabilities	107057.80	119224.70	131763.50
Equity capital	8850.00	8850.00	8850.00
Reserves, retained profit	86401.79	98207.78	110374.70
Profit	11805.99	12166.95	12538.74
Long and medium term debt	0.00	0.00	0.00
Current liabilities	0.00	0.00	0.00
Bank overdraft, finance required.	0.00	0.00	0.00
Total debt	0.00	0.00	0.00
Equity, % of liabilities	8.27	7.42	6.72

ANNEX 10.4	Index of Producer's Prices
Table	Index of Producer's Prices for West Germany
Graph	dto. Hot Strip
Graph	dto. Welded Tubes
Graph	dto. Machinery Products

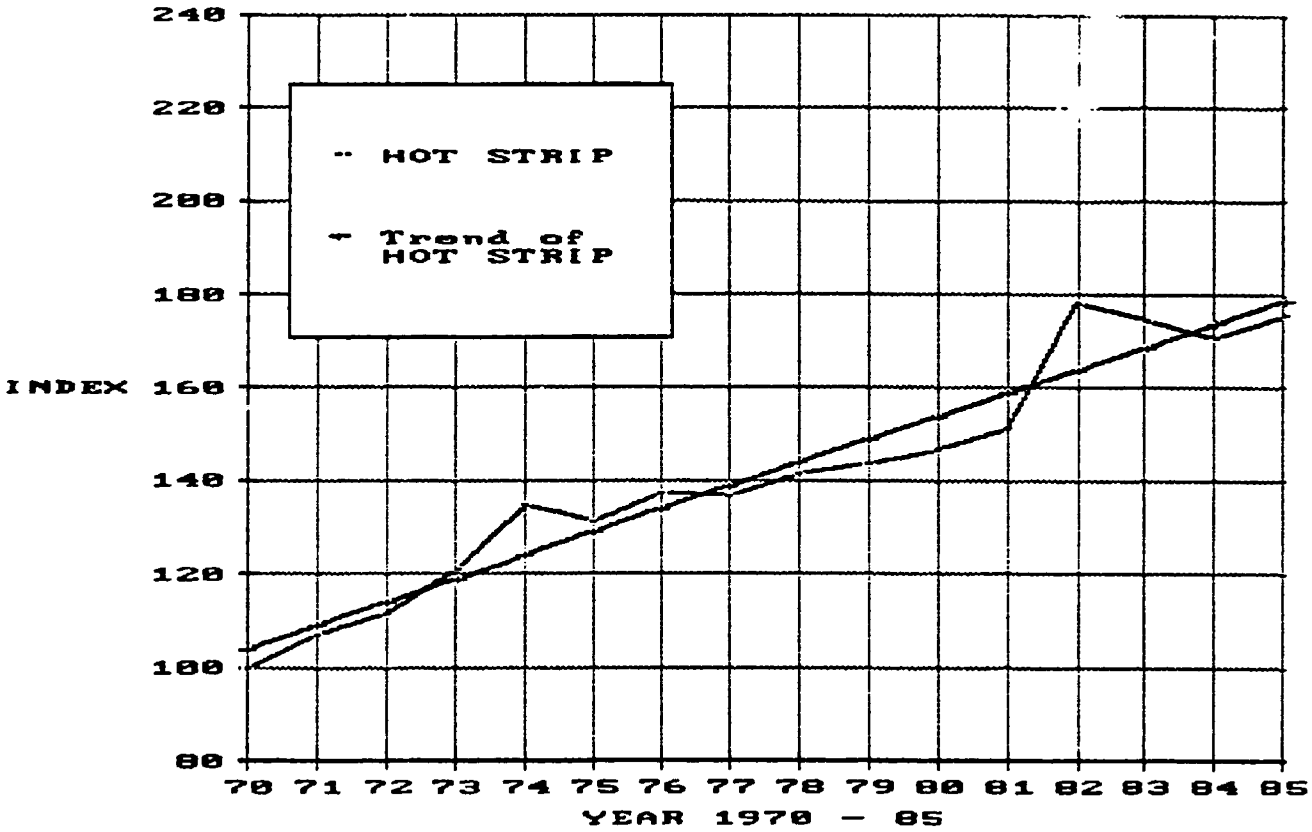
Table

Index of Producer's Prices for West Germany,
Base Currency: German Mark (DM); 1970 = 100
Source: Federal Office of Statistics, Wiesbaden

Year	Hot Strip	Welded Tubes Products	Machinery
1970	100	100	100
1971	106.9	103.1	108.4
1972	111.6	104.4	113.0
1973	121.0	113.4	119.1
1974	134.6	131.2	131.1
1975	131.1	125.1	143.0
1976	137.1	130.2	150.3
1977	136.6	116.4	157.9
1978	141.5	129.1	163.4
1979	143.7	130.4	168.8
1980	146.6	130.5	178.6
1981	151.1	142.0	187.7
1982	178.2	164.4	198.9
1983	174.6	142.0	205.4
1984	170.8	151.3	211.8
1985	175.7	158.0	217.9

Average increase per annum

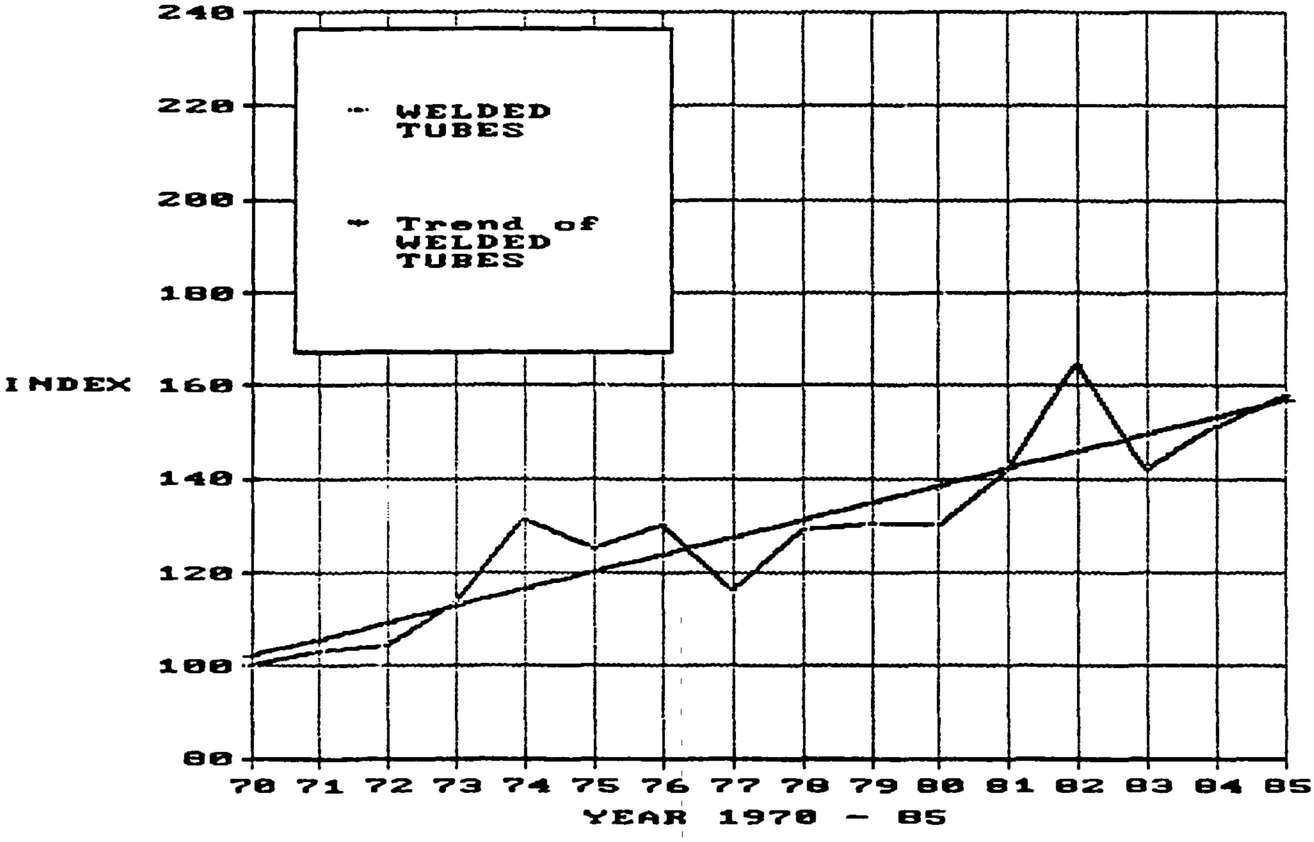
1970-1985	5.1%	3.9%	7.9%
1980-1985	4.0%	4.2%	4.4%



Index of Producer's Prices for West Germany,

Base Currency: German Mark (DM); 1970 = 100

(Source: Federal Office of Statistics, Wiesbaden)



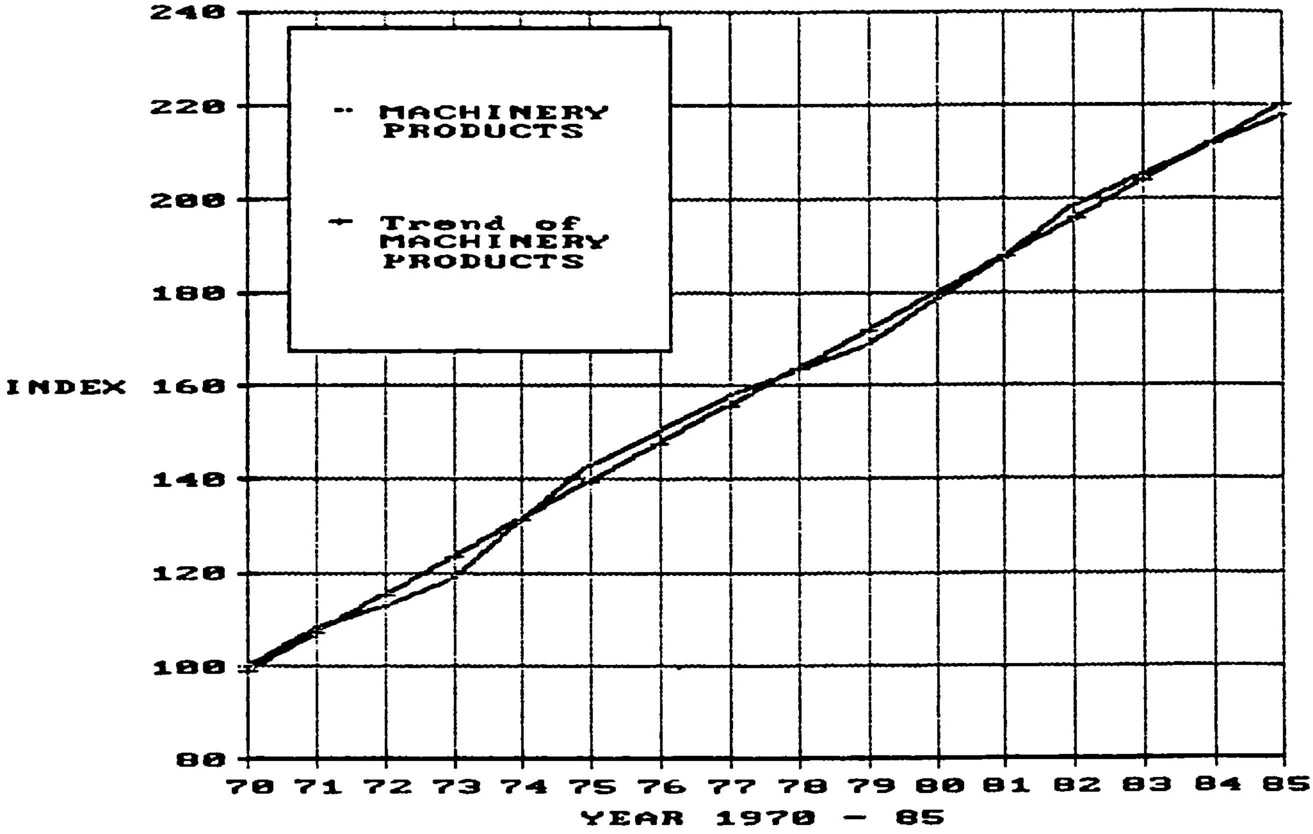
Index of Producer's Prices for West Germany,

Base Currency: German Mark (DM); 1970 = 100

(Source: Federal Office of Statistics, Wiesbaden)

Index data for 1970 - 1975 not available.

Chart data estimated by EBE.



Index of Producer's Prices for West Germany,

Base Currency: German Mark (DM); 1970 = 100

(Source: Federal Office of Statistics, Wiesbaden)