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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

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PROJECT PAK-28

# UNITED NATIONS DEVELOPMENT PROGRAMME/SPECIAL FUND

"PRE—INVESTMENT STUDIES FOR THE PROMOTION OF FERTILIZER AND PETROCHEMICAL INDUSTRIES IN PAKISTAN"

## PROJECT "P"

Pakistan.

# FEASIBILITY STUDY FOR THE PRODUCTION OF POLYESTER FIBER INDUSTRY IN CHITTAGONG 6000 T/Y

PREPARED FOR THE GOVERNMENT

*BY*

T. V. Janakievski, D. Ch. E.

UNIDO—EXPERT

ISLAMABAD—PAKISTAN

MAY, 1971

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PAK-26 PROJECT

UNITED NATIONS DEVELOPMENT PROGRAMME/SPECIAL FUND

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# PROJECT "D"

# FEASIBILITY STUDY FOR THE PROMOTION OF POLYESTER FIBER INDUSTRY IN CHITTAGONG

## 6000 T/Y

PREPARED FOR THE GOVERNMENT
BY
T.V. JANAKIEVSKI, D.CH.E.,
UNIDO-EXPERT

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MAY, 1971.

"This report is presented to the Government Project Representative without prior approval of either the United Nations or the United Nations Development Programme and therefore does not necessarily represent the views of either organization".

# A B S T R A C T

In this Volume a techno-financial evaluation of the Polyester fiber production plant of 6000 t/y in Chittagong has been presented. This is a continuation of Petrochemical (aromatics) Complex Industry which would be supplier of Raw Material for this plant.

This unit would produce:-

5000 t/y Polyester Staple fiber

1000 t/y Polyester filament yarn.

FEASIBILITY STUDY FOR THE PROMOTION OF POLYESTER FIBERS IN
C H I T T A G O N G
600 T/Y

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# SECTION 1

## SUMMARY

### 1.1 History and Background

This Feasibility Study for the promotion of Polyester fiber plants production in Karachi in continuation of the Project A + B (BTX-aromatics and Monomer Complex) which is recommended to be implemented in the scope of Eastern Refinery or Karachi Refineries. Using the p-xylene from the Project A (BTX-aromatics) in the Project B intend to produce TA/DMT 18,000 T/A for the polyester fiber production in both wings:-

1. 12,000 t/y Polyester fibers in West Pakistan located in Karachi.
   9000 t/y - Staple fiber and
   3000 t/y - Filament yarn

2. 6,000 t/y Polyester fibers in East Pakistan located in Chittagong.
   5000 t/y - Staple fiber
   1000 t/y - Filament yarn

The implementation of these projects should be synchronised with the implementation of the basic Project A + B in order to avoid the import of monomers for this production.

### 1.2 Marketing

Based on the present possibility, growing market potential and taking overall economic objectives of Pakistan.

The planned quantity of production anticipated from the proposed complexes are as follows:-

1. West Pakistan plant in Karachi.

   9000 t/y - Steple fibers of different den. from 1-10den. but the majority of production would be between 1 and 4.5 denier (Cotton and Woollen type)
   3000 t/y - Filament yarn a different den.

2. East Pakistan - polyester fiber plant would produce in the first phase the staple fiber only.

6000 t/y staple fibers of different denier will be produced for the cotton industry.

In the second phase after 1980, the plant would be extended to 12000 t/y and the filament yarn production could be included.

1.2.1 Proposed Selling Price

The proposed ex-factory selling price is estimated on base of existing world price, CIF and local condition.

West Pakistan

| | |
|---|---|
| Staple fiber | Rs. 8568.0 ton |
| Filament yarn | Rs.11900.0 ton |

East Pakistan

| | |
|---|---|
| Staple fibers | Rs. 9500.0 ton |
| Filament yarn | Rs.12500.0/ton |

1.3 Facilities and Manufacturing

These two projects which are continuation of the basic production in Projects A + B can be located in Chittagong or Karachi, it also depends on the investment policy of the Government.

The calculation have been made on the basis of 320 days (7680 hours in full operation per year).

The required utilities partially would be produced within the location including steam, cooling water, DM-water etc.

1.4 Financial

Required Investment

The total investment required for this project is estimated as follows:-

| | Local | Foreign | Total |
|---|---|---|---|
| Site and plant costs | 36,101.0 | 36,311.0 | 72,412.0 |
| Development costs | 6,608.0 | 2,200.0 | 9,808.0 |
| Working Capital | 6,875.0 | 3,750.0 | 10,625.0 |
| Total | 49,876.0 | 43,261.0 | 92,845.0 |

It has been estimated that the ratio between loan and equity to be 60:40 and investor supposed to be private party. Equity capital would be provided by investor in the form of shareholders equity. The balance assumed to be long term debt local and foreign. The local long term loan is calculated at 8% interest and for foreign 7%. The long term loan would cover 100% of foreign exchange components required.

The proforma capitalisation would be as shown below:-

| Type of Capital | Local | Foreign | Total |
|---|---|---|---|
| | Rs(000) | | |
| Long term debt | 16,739.0 | 43,261.0 | 60,000.0 |
| Shareholders equity | 32,845.0 | - | 32,845.0 |
| Total | 49,584.0 | 43,261.0 | 92,845.0 |

## 1.5 Estimated Earning and Fund Generated

A summary of the estimated profit, loss and the cash generated for the first six years after start-up is shown in Table 1 below:-

Table 1

Summary of Estimated Earning and Fund Generated
Rs(000)

| Yr. | Net Sales | Cost of Sales | G&A | Operating income | Other income and expens | Net income | | Non cash chgs. | Fund Generated |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Before tax | After tax | | |
| 1 | 51000.0 | 37596.6 | 1266.8 | 12236.0 | 4200.0 | 8036.0 | 8036.0 | 7519.0 | 15555.0 |
| 2 | 57000.0 | 40830.0 | 1266.8 | 14903.2 | 3780.0 | 11123.0 | 11123.0 | 7519.0 | 18642.0 |
| 3 | 60000.0 | 42437.2 | 1266.8 | 16296.2 | 3130.0 | 13166.0 | 13166.0 | 7519.0 | 20685.0 |
| 4 | 60000.0 | 42437.2 | 1266.8 | 16296.2 | 2240.0 | 14055.5 | 14055.5 | 7519.0 | 21574.5 |
| 5 | 60000.0 | 42437.2 | 1266.0 | 16296.2 | 1295.0 | 15001.2 | 15001.2 | 7519.0 | 22520.2 |
| 6 | 60000.0 | 42437.2 | 1266.0 | 16296.2 | 376.0 | 15920.0 | 15920.0 | 7519.0 | 23439.. |

It may be noted that the first two years reflect a reduced sales revenue by utilization of capacity due to normal problems of start-up and efficiency of the staff. However, the plant is expected to operate at capacity after two years.

Break even is computed to be at 50% on a net income basis. On a funds generated basis, which is the level when cash flow equals the amount required for debt retirement the break-even point is about 45% percent of capacity.

1.6 Interest and Debt Service Coverage

The projected coverage of interest on long term debt as well as debt service coverage ratios are as follows:-

Table 2

Interest and Debt Coverage

| Year | Interest Coverage 1) | Debt Service 2) |
|---|---|---|
| 1 | 2.9 | 1.95 |
| 2 | 4.0 | 2.30 |
| 3 | 4.8 | 2.55 |
| 4 | 5.5 | 2.65 |
| 5 | 6.3 | 2.80 |
| 6 | 7.8 | 2.95 |

Note:- 1) Before income taxes.

2) After income taxes.

1.7 Project Balance Sheets

Condensed Balance Sheets estimated for years first and sixth are shown below:-

Table 3

Estimated Balance Sheets
Rs(000)

| | Year 1 | Year 6 |
|---|---|---|
| **Assets** | | |
| Current Assets | | |
| Cash | 5,339.0 | 5,639.2 |
| Receivable (trade) | 7,500.0 | 8,700.0 |
| Inventories | 14,625.0 | 14,625.0 |
| Total current assets | 27,464,0 | 63,445.2 |
| **Liabilities** | | |
| Current liabilities | | |
| Payable (trade) | 5,339.2 | 5,339.2 |
| Long term debt due within one year | 6,000.0 | 6,000.0 |
| Total current liabilities | 11,339.2 | 11,639.0 |
| Long term debt | 48,000.0 | 18,000.0 |
| Shareholders equity | | |
| Capital stock | 32,845.0 | 32,845.0 |
| Net retained earnings after dividends | 8,036.0 | 56,532.0 |
| Total shareholders equity | 40,881.0 | 89,377.0 |
| Total liabilities and equity | 100,220.0 | 119,016.0 |

Cash build-up after providing for debt service and the assumed payment of a dividends to shareholders is substantial.It was assumed that such excess would be invested in Bank Certificates of deposit at five percent. Actually a long portion of this excess cash could be used to retire long-term debt at an accelerated rate, or be invested in additional manufacturing capability which should earn a higher return than five percent.

The estimated return on investment over six year period is summarized below:-

Total Investment

- Annual average 17.3 percent

Shareholders Investment

- Annual average 39.2 percent

The pay back on the total investment will be about 5.8 years about 2.6 years for the original shareholders investment.

Return on investment is shown within the six years after start-up only.

Taking in account that the first 2 years the utilizatio.. of capacity is lower than usual one.

1.8 Economic Feasibility

The overall results of this study indicate that the development of polyester fiber production in both wings is economically feasible. In forming this judgement, consideration has been given to the projected return on investment together with the value of the project to the economy and progress of both wings as summarized hereafter.

1.8.1 **Revenue**

The problem of selling price i.e. revenue of course will be determined by future Government policy, therefore, in the final analysis the price and profit level are matters to be decided by investor, market and Government of Pakistan.

We made assumption of selling price on reasonable level according to the present condition of the market and policy of the Government.

1.8.2 **Foreign Exchange Savings**

The saving in foreign exchange by producing 6000 t/y of these imported raw materials, rather than importing a like quantity will be significant.

We would summerized in Table 4 below:-

Table 4

Saving in Foreign Exchange
Rs(000)

| Year | Rs(000) |
|---|---|
| 1 | 25,994.0 |
| 2 | 30,426.0 |
| 3 | 32,248.0 |
| 4 | 33,049.0 |
| 5 | 32,150.0 |
| 6 | 33,651.0 |

### 1.8.3 Value of the Project to the Economy and Progress of the Country

The implementation of polyester fiber production and further processing in textile industry will give impressive benefit to the economy and development of Pakistan.

As we have mentioned the main stimulation would be the development of Textile Industry on base of synthetic fibers production.

Among the specific benefits

This industry will provide new direct employment for over 500 people and indirect textile industry processing another 1600 people.

- Expenditure of salaries, goods and services relating to the plant will rise the income of areas in which plant is located.
- Implementation of polyester fibers production will give the great impulse to the development of new upto date textile material like other countries in the world.
- Government will be provided with an additional source of taxable revenue.
- Implementation of the new variety of textile material (yarn,cloth) would fill the present vacuum in the market and export possibilities of textile products.

# SECTION 2

# MARKETING

## 2.0 Estimated Market

Estimation of market figures are based on the present and growing market potential in Pakistan and taking into consideration the overall economic objectives prevailing in Pakistan. The implementation of this project should be for the market of West Pakistan except filament yarn which will partially be going to East Pakistan.

Table 5 shows the estimated production in the projected polyester plant in West and East Wing.

Table 5

Projected Polyester Fiber Production

| | West Pakistan t/y | East Pakistan t/y | Total |
|---|---|---|---|
| Polyester fibers | | | |
| - Staple | 9000.0 | 5000.0 | 14000.0 |
| - Filament yarn | 3000.0 | 1000.0 | 4000.0 |
| Total | 12000.0 | 6000.0 | 18000.0 |

This means each wing would have own production of polyester fiber. During the implementation the ratio filament staple could be modified.

The production of 18,000 t/y of polyester fibers different grade would make significant impact in the development of new variety of textile products.

Currently, total world production of synthetic fibers is about 6.5 million tons/annum. The estimated market share and rate of growth of each main categories is:-

| | % of total | % p.a. growth |
|---|---|---|
| Nylon fibers | 38.4 | 15 |
| Polyester fibers | 33.1 | 20-25 |
| Acrylic | 19.5 | 20-25 |
| Other synthetic fibers | 9.0 | |
| Total | 100% | |

2.1 Polyester Fiber Application - Generally

The polyester fibers compete with the other synthetic fibers in nearly all textile markets apparel, households, tire and industrial so that a synthetic fiber producers not making polyester fibers must consider making them or face loss of markets. At present the contribution in various fields and application approximately can be summarised as follows:-

| | |
|---|---|
| - Apparel | 62 percent |
| - Household | 18 ---"--- |
| - Tire cord | 10 ---"--- |
| - Other consumer products | 5 ---"--- |
| - Industrial | 5 ---"--- |
| | 100% |

2.1.1 Polyester Fibers Staple currently accounts for about 65% of total fibers output. The staple is generally combined into polyester/cotton, polyester/wool or polyester/rayon blends to

take advantage of such quantities imported by the polyester as abrasion resistance and wrinkle resistance. In apparel, polyester blends are used in shirts, slacks, skirts, suits and uniforms. Use of polyester staple in tufted carpets has grown rapidly in other household items, polyester blends are used primarily in such items as sheets and curtains.

2.1.2. Polyester Yarn Output Currently accounts for about 25% of total production. Industry sources indicate that yarn production is more profitable to the fiber producer than staple production. Yarn is used mostly in knit apparel particularly textured yarns, and in tire cord. The high strength and resistance to stretch of polyester yarns makes them especially suitable for tires and for such industrial application as hose and belt reinforcement polyester yarn use in carpets was introduced recently.

The growth of polyester/cotton and other durable press textiles has been phenomenal. Probably over 80% of all women shirts are durable press. Other apparel in which durable-press treatments are almost universal are in polyester/cotton and polyester/rayon slacks, skirts, dresses, blouses uniforms, jackets, raincoats and nightwear. Durable press is also making heavy inroad into sheets pillowcases, table cloth and other napery, slip covers, curtains and draperies.

Polyester fibers have grown faster through their use in blends, chiefly with cotton, wool and rayon.

2.1.3 Apparel - the biggest market forpolyester fibers is in apparel, mainly as staple, although filament yarn-especially textured yarn is becoming increasingly importnat. The outstanding characteristics that make polyester fibers so attractive in apparel are ease of care, high strength, high resistance to stretching and shrinking, crisp resilience when wet and dry (meaning fabrics that do not wilt or droop) and the ability to be shaped by heat and to retain heat-set shapes through many washings.

In this category the man, boys, children and women's wear, the polyester fibers contribute about 40% of total synthetic fibers consumption in the following goods:-

- Suits
- Uniform
- Sport jackets
- Overcoat
- Outdoor jacket
- Coat, raining coats
- Outdoor jackets
- Work and uniform shirts
- Dress shirts
- Sport shirts - woven
- Sports shirts - knit
- Underwear - woven
- Underwear - knit
- Nightwear
- Hosiery

The most dynamic application of polyester fibers in apparel has been as staple in polyester/cotton durable press blends. These blends now dominate the dress and woven sports shirt market. Blends with cotton and rayon are widely used in slacks, suits and uniform, rainwear and nightwear are also proving important markets. Polyester/wool blends are widely used in suits of a variety of weights and in separate slacks and sport coats.

Durable press polyester/cotton blends are used in blouses and shirts, dresses, slacks, shirts sports, sports and leisure wear, rainwear and service apparel. Polyester/rayon blend are also penetrating certain of these markets as in skirts and slacks . Polyester/wool blends are used in suits, skirts and slacks. Polyester yarn consumption in women's wear has grown much more rapidly than in men's wear.

2.1.4 Carpets

In appearance, spun staple polyester carpets most closely resembl acrylic carpets but have the higher abrasion resistance of nylon carpets. Continuous filament polyester carpets are similar to nylon continuous filament carpets in such properties as durability and resilience but are perhaps a little less synthetic - like in hand appearance. One of the biggest advantage polyester fibers have in carpets is that "Polyester" is the name that is well known to consumers and has a good reputation. Most industry sources believe that broad-loom carpets will continue to provide a fast-growing market for polyester fibers.

2.1.5 Tire-Cord

The penetration of polyester fibers into the tire-cord market in recent years is remarkable. Polyester fibers are being used predominantly in belted tires, although some are also used in conventional bias-ply tires.

As we have mentioned the polyester fibers have made sharp inroad into many of cotton's markets, most notable in polyester/cotton blends when first introduced, polyester staple was

more costly than even the expensive long-staple varieties of cotton but substantial polyester price cuts have made them comparable in price on a utility basis. In fact, polyester/cotton blends have been selling below the cost of equivalent all-cotton fabrics.

In the developed countries the staple fibers prices have bottomed out because in view of the fact that capacity is growing faster than expected consumption. In Table is shown the trend of polyester fibers price during the last twenty years in U.S.A.

Table 6

Polyester, Nylon prices trend 1961/71
(cents/pound)

| | Regular | | Tire Cord | | Carpet Yarn | | Staple | |
|---|---|---|---|---|---|---|---|---|
| | Nylon | Poly-ester | Nylon | Poly-ester | Nylon | Poly-ester | Nylon | Polyester |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 1961 | 225 | 235 | - | - | - | - | 180 | 180 |
| 1962 | 225 | 235 | - | - | - | - | 180 | 180 |
| 1963 | 225 | 235 | - | - | - | - | 180 | 180 |
| 1964 | 225 | 235 | - | - | - | - | 153 | 180 |
| 1965 | 225 | 235 | - | - | - | - | 153 | 160 |
| 1966 | 190 | 190 | - | - | - | - | 127 | 135 |
| 1967 | 201 | 201 | - | - | - | - | 130 | 141 |
| 1968 | 201 | 201 | - | - | - | - | 130 | 141 |
| 1969 | 201 | 191 | 120 | - | - | - | 130 | 136 |
| 1960 | 201 | 191 | 97 | - | - | - | 130 | 136 |
| 1961 | 201 | 197 | 92 | - | 147 | - | 126 | 124 |
| 1966 | 201 | 182 | 82 | - | 117 | - | 98 | 84 |
| 1966 | 201 | 167 | 82 | 110 | 123 | - | 96 | 84 |
| 1967 | 201 | 167 | 82 | 90 | 123 | - | 98 | 58 |
| 1968 | 201 | 167 | 82 | 90 | 119 | - | 96 | 61 |
| 1969 | 201 | 167 | 82 | 90 | 119 | 135 | 84 | 61 |

Note:-1. Apparel Du Pont's 40 den, 13 filament, type 280; standard multifilament yarn first grade, bobins.

2. Colanese's to denier, 36 filament, type 700 regular tenacity yarn for general textile application, semi dull, bobins.

3. Du Point's 840 den, 140 filament, type 702, tire quality yarn, beams.

4. Midland rose crop; high tenacity yarn, 1300 den. 250 filament, beams.

5. Du Pont's 3700 den, 204 filament, type 845 carpet yarn, tube.

6. 4400 den, bulked continuous filament yarn.

7. 3 den. type 201 staple first grade.

8. 3 den. staple length 1½-1¾ inches.

2.1.6 World Production of Synthetic Fibers

The trend of production of synthetic fibers in the world is shown in Table 7 below:-

Table 7

World Production of Synthetic Fibers
(000) ton/year

| | 1962 | % | 1964 | % | 1966 | % | 1968 | % | 1970 | % |
|---|---|---|---|---|---|---|---|---|---|---|
| Nylon fibers | 740.0 | 55.3 | 902.7 | 53.2 | 1216.8 | 48.9 | 1628.2 | 43.2 | 2493.0 | 38.4 |
| Polyester fibers | 2636.6 | 19.7 | 339.1 | 20.1 | 590.0 | 23.7 | 1078.2 | 28.6 | 2142.7 | 33.1 |
| Acrylic fibers | 211.3 | 15.8 | 300.9 | 17.8 | 458.2 | 18.4 | 738.2 | 19.6 | 1265.0 | 19.5 |
| Other synthetic fibers | 119.5 | 9.2 | 151.8 | 8.9 | 222.7 | 9.0 | 323.6 | 14.7 | 590.0 | 9.0 |
| Total synthetic fibers | 1337.2 | 100.0 | 1694.5 | 100.0 | 2487.7 | 100.0 | 3768.2 | 100.0 | 6490.0 | 100.0 |

Textile Organon June, 1970.

Polyester fibers are actually the fastest growing synthetics in the world and are expected to increase their share of the total market for synthetics from 28% in 1968 to 38-40% in 1975.

Although the other major synthetic fibers have been somewhat limited in the number and kinds of textile applications for which they may be best utilized, polyester appears to be the best "all-round synthetic" textile fiber.

Nylon as the veteran, has over the year been tried in almost every conceivable end use, but today is essentially only a continuous filament fiber. It is well utilized in industrial carpeting and certain knitted apparel areas.

Acrylics on the other hand are essentially only staple fibers. With their wool-like appearance and handle, they have followed the wool types of end uses; floor coverings blankets and other home furnishings and knitted outer wear.

Polyester fibers on the other hand have achieved considerable stature in both staple and continuous filament forms as has been said hitherto;

2.2.0 <u>Situation in Pakistan</u>

<u>Facts about Textile Industry</u>

Textile Industry of Pakistan is the most developed sector of Pakistan's Industrial structure in terms of:-

- Value of fixed assets
- employments.

- value of Production
- foreign exchange earning
- steady progress in development of production and export prospects.

By June 1969 the textile industry had following capacity.

2.2.1 Cotton Industry by 1969-70 was composed of 135 textile mills consisting of the installed 3,906,000 spindles and 37,800 looms. Working capacity; 2700,000 spindles and 31000 looms.

Fourth Five Year Plan (1970-75) estimate increasing of capacity to the following figures:-

- about 2600,000 spindles
- about 50,000 looms.

The per capita availability of cloth for consumption was 12.4 yds. by 1969-70. The projected increase by Fourth Five Year Plan is to 18 yards/per capita. To achieve these figures, about 2610 million yards of cloth will be required to meet the demands of grown population by 1974-75 (about 145 million people) 50% of above is expected to be produced in Mill Sector 50% by private loomers.

Export of cottn fabrics is estimated to grow 500 million yards 1974-75 and yarn to about 300 million lbs.

Fourth Plan targets in production of cotton yarn are assumed as follows:-

| | | |
|---|---|---|
| - East Pakistan | 400 million lbs | (182,000 t/y) by 1974-75. |
| - West Pakistan | 700 " | " (318,000 t/y) by 1974-75 |
| | 1100 million lbs | (500,000 t/y) |

Total target in production of cloth should be:-

| | |
|---|---|
| - for local market | 2,610 million yds. |
| - for export | 500 " " |
| Total | 3,110 million yds. |

The total yarn production should be:-

| | |
|---|---|
| - for production of cloth | 800 million lbs |
| - yarn for export | 300 " " |
| Total | 1100 million lbs |

2.2.2 Woollen Industry - Existing Facts

Woollen compared with cotton industry is a very small sector.

The woollen industry now consist of:-

| | |
|---|---|
| - worsted sector about | 42000 spindles |
| - woollen sector about | 29000 spindles |
| and 800 worsted/woollen looms. | |

Almost the entire existing capacities are located in West Pakistan. The first woollen mill of East Pakistan (Valika) is at present under construction.

The capacity in the field of carpets for machine-made carpets (existing and sanctioned is about for 3 million sq.yards).

On the basis of PICIC Survey the output in 1967-68 is roughly estimated as:-

| | |
|---|---|
| - Yarn | 15 million lbs |
| - Cloth | 8 million yards. |
| - Blankets | 07 million pcs. |
| - Carpet and rugs | 1.5 million sq.yards. |
| - Miscellaneous goods | 2.6 million lbs. |

In the above products the local and imported wool as well as yarn and tops were used.

The annual import of worsted yarn was averaged about 500,000 lbs. and in form of tops 2500,000 lbs.

In addition about 1.5-2.0 million lbs. of superior quality wool is also imported to feed the domestic textile industry.

The total availability of woollen textile has steadily increased and currently placed at about 19-20 millions lbs.(in term of wool).

Pakistan experts wool in quantity about 24 million lbs. (1968) based on the Rs.1.5/pound realising of Rs. 37 million in foreign exchange.

2.2.3 Existing Carpet Industry in Pakistan

Pakistan has been producing hand-knitted carpets both for home consumption and export,Machine made carpets production was first started in 1958 with the establishment of machinery for the production of jute carpet in Chittagong. In 1962 WPIDC started production of woollen carpets in Quaidabad. In 1960 Machine made carpets were first exported from Pakistan.

Pakistan has quite good position for production of carpets both woollen and jute type as all the raw materials required wool, jute and cotton are available.

At present five mechanised units are operating in Pakistan 4 in West Pakistan and 1 unit in East Pakistan. The installed

capacity and production of these units are as follows:-

| | Installed capacity sq.yds. | Current production sq. yds |
|---|---|---|
| Wilton carpets | 675,000 | 350,000 |
| Administer carpets | 220,000 | 165,000 |
| Tufted carpets | 430,000 | 80,000 |
| Total | 1,324,000 | 595,000 |

| | |
|---|---|
| East Pakistan | 80,000 |
| West Pakistan | 1,244,000 |
| | 1,324,000 sq.yds. |

Consumption of carpets inside the country.

| | |
|---|---|
| Machine made woollen | 60% |
| Hand knitted woollen | 30% |
| Machine made jute | 10% |

Pakistan export performance in the field of carpets is very optimistic. The foreign exchange earning is steadily increasing. Till now hand made carpets were mostly exported. With the establishment of machine manufacturing, machine made carpets are gaining importance both for home consumption and for export.

As can be seen from the installed capacity which is 1324,000 sq. yards, but production is less than 50% which shows the lack of selling ability.

Export of carpets from Pakistan in Rs/million

| | 1965/66 | 1966/67 | 1967/68 |
|---|---|---|---|
| Woollen carpets | 13.0 | 26.0 | 31.0 |
| Jute carpets | 2.9 | 6.6 | 2.4 |
| Total | 15.9 | 32.6 | 33.6 |

2.2.4 **Estimated requirements of woollen textiles in Pakistan**

On basis of assessment in PICIC Survey, the trend of consumption of woollen textiles in Pakistan is growing at the rate of 5-7% per annum.On this basis estimated requirements by 1970-75 would be:-

Table 8

Estimated Future Requirements in Woollen Textile in Pakistan

| Year | Total yarn m/lbs | Cloth m/yds | Blankets m/Nos. | Carpets a.Rugs m/sq.yds | Misc products m/lbs | Total raw wool required m/lbs |
|---|---|---|---|---|---|---|
| 1969-70 | 16.9 | 9.0 | 068 | 2.0 | 2.90 | 20.0 |
| 1970-71 | 17.7 | 9.2 | 074 | 2.2 | 2.92 | 21.0 |
| 1971-72 | 18.5 | 9.4 | 0.80 | 2.4 | 2.94 | 22.0 |
| 1972-73 | 19.3 | 9.6 | 096 | 2.6 | 2.96 | 23.0 |
| 1973-74 | 20.1 | 9.8 | 093 | 2.8 | 2.98 | 24.0 |
| 1974-75 | 21.0 | 10.0 | 1.00 | 3.0 | 3.00 | 25.0 |

Sources:- PICIC Survey, 1969.

- In above estimation is included expeted export.

The total requirements of raw wool to meet the above demands would be about 25 million lbs. On the basis of the past pattern of consumption, the industry may require over 6 millions lbs of imported wool (yarn and tops).

Assumption: 1. One lb. of raw wool = 0837 lbs of yarn
2. One lb. of yarn = 1.1 yards of cloth
3. One lb. of yarn = 075 sq.yd. carpet
4. Five lbs of yarn = One blanket.

The current output of raw wool is about 36 million lbs. on the basis of 78% clean content. The produced wool in Pakistan is coarse, with a spinning value of $44_S$ and suitable for production of:-

- Carpets
- Blankets
- Ordinary woollen goods

For worsted industry products demands the better quality wool about $55_S$+ should be imported. A certain quantity of top superior quality of imported wool is used in worsted industry for medium quality of products.

2.3.0 Silk Industry

The silk industry at present is in the stagnate position in term of utilisation of capacity because of very high Government taxes.

The installed total capacity (in the settled and unsettled area) for production of silk fabrics are as follows:-

- 120,000,000 Yards in the settled area with 14000 looms
- 45,000,000 Yards in the unsettled area with 5000 "

165,000,000 19000 looms

In terms of used yarn should be 23 million lbs/yr.

- Production of silk fabrics in 1968 was about 90,000,000 Yards in term of used yarn was 13 million lbs.
- Production in 1969 has droped to 67 million yards of fabrics. In terms of used yarn was 9.580 million lbs.

Pakistan silk industry consumes mostly man-made filament and small qantity of natural silk. Therefore, the raw material for silk industry are as follows:-

- Acetat cellulose filament
  - Produced locally about 2700 t/y
  - Imported 4000 t/y
- Nylon filament (local production) 3900 t/y.
- Imported about 1000 t/y
- Polyester filament (imported) 400-600 t/y.

2.3.1 DMT/Polyester Fibers Market

Polyester fibers are not yet manufacture in Pakistan. Under the present Government policy the Pakistan's Textile Industry imported an insignificant quantity of polyester fiber.

Past consumption figures are listed in Table 9.

Table 9

Consumption of Polyester Fibers 1965-70

| | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 |
|---|---|---|---|---|---|---|
| Staple fibers | 20 | 50 | 30 | 30 | 50 | 80 |
| Filament | 80 | 110 | 50 | 50 | 80 | 90 |
| Blends | 5 | 80 | 15 | 15 | 20 | 35 |
| Effect yarn | 45 | 75 | 105 | 105 | 130 | 200 |
| Total | 150 | 315 | 200 | 200 | 280 | 405 |

Normally the staple fibers is consumed by cotton and woollen industries. Filament and filament yarn are consumed by silk industries.

The landed cost is so extremely high, the mills have so far imported polyester only to a very limited extent. This is understandable, because the polyester fabrics produced in Pakistan face the competition of the local cotton articles as well as of the Japanese fabrics which can be obtained on bonus voucher; both groups are much cheaper. Thus, up to now no continuous production of polyester/cotton fabrics has developed in Pakistan.

2.3.2 Forecast of Consumption Trends

As is shown by the above statements, the actual consumption figures can not be taken as yard stick of the latent demand for polyester fibers.

The all analysis directed us that the potential consumption power in Pakistan conditions are in favour of polyester fibers and in the near future, will gain the leading position. This could be achieved with availability of this fiber. The promotion of domestic production is best solution to remove the hindrance of normal development.

Reference to the World trends of synthetic fibers is the best indication for Pakistan as well as polyester fibers are fastest growing of synthetic fibers, owing their outstanding features in the all textile system (cotton, woollen/worsted and silk).

The properties of fibers can be considered by dividing the various types of fibers into three main groups:-

- high tenacity filament yarn
- medium tenacity filament yarn
- staple fibers.

These groups differ considerably from each other in respect of certain physical properties, but within any one group, the differences are generally only slight, although alternation in denier may affect some characteristics.

Normally polyester filament yarn is produced in the following yarn denier; 25,50,75,100,125,150,250. In the widely used yarn deniers of 50,75,100 and 150 the individual filaments are each of approximately 2 den.

Staple fibers are made in a range of filament denier from 1.5 to 10 in dull lustres. Various types, which may differ appreciably in properties are designed specifically for use on the various spinning system, such as worsted woollen cotton or flax system.

Polyester filament as supplied shrinks approximately 3% in air at temp. of $100^{o}_{C}$ and 10% at $150^{o}C$.

Polyester staple fibers differ from the filament yarn in being heat stablized during manufacture and staple fibre shrinks less than 1% in boiling water etc.

The end uses of polyester fibers have developed largely on basis of these important characteristics, enabling polyester fibers to become one of the most versatile of all modern synthetic fibers.

The introduction of polyester fibers in the blends with natural and other synthetic fibers started nearly twenty years ago. A marvellous customer acceptance during the past years stimulate a rapid growth of polyester blends.

According to certain statistics the production and consumption of various polyester blends in the recent years are as follows:-

| With Cotton | With Wool | With Rayon | Wity Nylon Cotton and acrylic |
|---|---|---|---|
| 42% | 6% | 12% | 10% |

Remnant of 30% is used as 100%

The popularity of these, is based mainly on the excellent wrinkel resistance of polyester fibers and polyester fibers becomes the most popular in wash-and-wear garments. Blends of various proportion are marketed. The most consumed blends are as follows:-

| | |
|---|---|
| 65/35 | Polyester/Cotton |
| 67/33 | -------"------- |
| 25/75 | -------"------- |
| 50/50 | -------"------- |
| 55/45 | Polyester/Rayon |
| 50/50 | Polyester/Acrylic |
| 55/45 | Polyester/Wool etc. |

2.3.3 A Field of Application

Polyester/Cotton Blends are used largely in shirts, slacks, dresses, blouses, rain coat, underwear, jacket, sportswear and uniform.

Polyester/Wool blends are used mostly in men's and women's suiting mate rials.

Polyester/Rayon blends are used in the nearly same products as it is with cotton.

Polyester/Acrylic blends are used in Sweater.

Apparel 100% polyester fibers are used mostly in men's suits.

Polyester fibers made very successfully penetration in textured filament yarn for knitwear ("Cremplene")

Filament of polyester fabrics have found important outlets in curtains, ties, shirts and lingerie.

The best use of polyester fibers in home furnishings other than carpets has been in sheets, pillowcases, sewing thread, conveyor belts, ropes nets, sailcloth awning etc.

The recent inroad very successful is in the tire cord field.

2.3.4 Cotton Industry

Estimated production of cotton yarn by 1974-75 is 1100 million lbs/yr. (500,000 t/y) for this quantity of yarn a

consumption of cotton should be about 1,353 million lbs (615,000 t/y)

| | | |
|---|---|---|
| - West Pakistan | 60% | 4,800 t/y. |
| - East Pakistan | 40% | 3,200 t/y. |
| Total consumption | | 8,000 t/y |

From the total production of cotton yarn of 1100 million lbs (550,000 t/y) is taken about 3% or 33 million lbs/y. of yarn should be produced in form of polyester/cotton blends, as it was described.

Consumption by variety should be estimated as follows:-

| | |
|---|---|
| - for the corase yarn | 2,500 t/y |
| - for the medium | 2,400 t/y. |
| - for fine | 800 t/y. |
| - for super fine | 300 t/y. |
| | 8,000 t/y. |

(22 million lbs/y.)

This quantity would represent about 2% of total consumption of cotton only

2.3.4 Possibilities for the Consumption of Polyester Fiber in Woollen/Worsted Industry in Pakistan.

Analysing the local situation in regard to the consumption of polyester fibers. The position would be followings-

1. Woollen cloth demand by 1974-75 should be about 10 million yds. in term of yarn about 9 million lbs.

The estimated import wool (6 million lbs) is mostly for cloth and knitting yarn and some quantity for blending with domestic wool for cloth industry.

The part of estimated import of superior wool for men's and ladies suiting materials could be replaced by polyester fibers. Polyester/wool blends 55/45 are very popular for the suit material (tropical and normal type) and suitable for the Pakistan climatic conditions.

In the cloth sector 20-25% of polyester/wool blends could be consumed particularly 55/45. It means a consumption of polyester fibers of about 600 t/yr. (by 1974-75).

Since the polyester fibers is not established in Pakistan yet, the consumption could not be on the reasonable level as it is in other developing country.

On other hand Pakistan has a simbolic production of cellulosic fibers (3000 t/y) in the form of rayon filament and no staple fibers. There is not raw materials for economical extension of this production significantly. Therfore, Pakistan should be orientated mostly to the production of synthetic fibers. After well establishment of polyester fibers processing in Textile Industry it is expected the consumption will grow faster.

Estimated production of cotton yarn and cloth by 1974-75 (to the end of the Fourth Five Year Plan) by variety on the basis

of present trend could be assumed as follows:-

Table 10

Production of yarn by variety at 1974-75

| | Total | Less than 21 counts coarse | % of total | 21-34 counts medium | % of total | 35-37 counts fine | % of total |
|---|---|---|---|---|---|---|---|
| Yarn/million lbs | 1100 | 330.0 | 30 | 660.0 | 60 | 110.0 | 10 |

* Fourth Five Year Plan Figures.

Table 11

Production of cloth by variety at 1974-75

| | Total | Coarse cloth | % | Medium | % | Fine | % |
|---|---|---|---|---|---|---|---|
| Cloth/Million Yds. | 3110.0 | 933.0 | 30 | 1866.0 | 60 | 311 | 10 |

Analysing the structure of estimated production of yarn and textiles articles we could see that the variety is not so rich. The consumption of polyester/cotton blends yarn from 21-48 + counts should be estimated about 8,000 t/y.(by 1974-75) staple fibers for both wings market and export.

In the miscellaneous items about 25% could be replaced. In term of polyester fibers about 200 t/y. Therefore, the whole woollen industry by 1974-75 could consume total quantity maximum. of about 800 t/y. of polyester fibers by 1974-75.

It means that about 800 t/y of imported wool would be replaced by polyester wool type fibers. It means about 40% of estimated import of wool by 1974-75 could be replaced by polyester tops and staple.

2.3.5 Silk Industry

The silk industry at present is in the stagnate position in term of utilisation of capacity because of very high Government taxes.

The installed total capacity (in the settled and unsettled area) for production of silk fabrics are as follows:-

- 120,000,000 Yards in the settled area with 14000 looms
- 45,000,000 Yards in the unsettled area with* 5000 "

165,000,000 Yards Total 19000 looms

In terms of used yarn should be 23 million lbs/yr.

- Production of silk fabrics in 1968 was about 90,000,000 Yds. in term of used yarn was 13 million lbs.
- Production in 1969 dropped to the 67 million yards of fabrics. in terms of used yarn was 9.580 million lbs.

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* Unsettled area are north part of the country which are not under direct control of Government tax control.

Pakistan silk industry consumes mostly man-made filament and small quantity of natural silk. Therefore, the raw material for silk industry are as follows:-

- Acetat cellulosic filament
  - Produced locally about 2700 t/y.
  - Imported 4000 t/y.
- Nylon filament (local production) 3000 t/y.
- Polyester filament (imported) 400-600 t/y.

Table 12

Estimated requirement of Polyester and Acrylic Fibers in Textile Industry of Pakistan by 1974-75

| | Consumption t/y 1974-75 | | | |
|---|---|---|---|---|
| | Cotton Industry | Woollen Industry | Filament use Industry | Total |
| Polyester fibers | 8,000.0 | 800.0 | 1,200.0 | 10,000 |
| Acrylic -"- | *100.0 | 585.0 | - | 685 |
| Total | 8,100.0 | 1,385.0 | 1,200.0 | 10,685 |

* Acrylic fibers in cotton system is taken in the simbolic quantity for start with some variety as upholestery, some kind of gabardins and lady winter dresses mostly in West Pakistan.

Tot total consumption of polyester and acrylic fibers could be about 10,685 t/y. and about 8,000 t/y. nylon and 8000 t/y. viscose and acetate rayon.

Therefore, the possible consumption figures by 1974-75 for man- made fibers could be:-

| | |
|---|---|
| - Polyester fibers | 10,000 |
| - Nylon* | 8,000 |
| - Acrylic fibers | 685 |
| - Viscose and acetate rayon filament | 8,000 |
| Total | 26,685 t/y |

On the basis of these estimated figures and expected population by 1974-75 (145 million people), the production figures per capita of man-made fibers should be about 02 kgr/per capita 045 lbs.

Total production of textiles by 1974-75 should be about 3.7 kgr/per capita (8.1 lbs). According to estimated figures the synthetic fibers consumption by textile industry should be about 0.150 kgrs/per capita.

Following the estimated figures for synthetic fibers by 1974-75, the logical trend of consumption (on the basis of long term plan for development of textile industry) of synthetic fibers for the period 1975-80 and further could be predicted.

Table 13

Prediction in consumption of the main synthetic fibers in textile industry by 1980 (polyester, nylon and acrylic)

| | Consumption t/y by 1980 | | | |
|---|---|---|---|---|
| | Cotton Industry | Woollen Industry | Filament use Industry | Total |
| - Polyester | 14,500 | 1,500 | 4,000 | 20,000 |
| - Nylong | 500 | 200 | 16,300 | 17,000 |
| - Acrylic | 500 | 1,000 | - | 1,500 |
| Total | 19,000 | 2,700 | 20,300 | 38,500 |

Table 14

Estimated consumption of Nylon 6 and Polyester fibers in West and East Pakistan

| | 1975 | | 1980 | | |
|---|---|---|---|---|---|
| | East Pakistan t/a | West Pakistan t/a | East Pakistan t/a | West Pakistan t/a | Total 1980 |
| Polyester Fibers | 2500.0 | 5500.0 | 6000 | 12000 | 18000.0 |
| Nylon 6 | 2000.0 | 6000.0 | 5000 | 12000 | 17000.0 |

2.3.6 Price of Polyester Fibers

Table 15

Price Development for Polyester Fibers in bigger producer Countries
$/kg.

| | Filament 100/36 den. in tubes | | | Staple Fiber 3 denier, normal tenacity | | |
|---|---|---|---|---|---|---|
| | West Germany | U. K. | U.S.A. | West Germany | U. K. | U. S. A. |
| 1962 | 7.40 | 3.58 | 4.16 | 3.36 | 2.84 | 2.50 |
| 1963 | 3.98 | 3.58 | 3.84 | 3.36 | 2.84 | 2.50 |
| 1964 | 3.98 | 3.58 | 3.84 | 2.81 | 2.30 | 2.15 |
| 1965 | 3.96 | 3.58 | 3.84 | 2.81 | 2.04 | 1.96 |
| 1966 | 3.96 | 3.58 | 3.84 | 2.81 | 2.04 | 1.85 |
| 1967 | .. | 3.58 | 3.58 | 2.15 | 1.52 | 1.58 |
| 1968 | .. | 3.58 | 3.50 | 2.15 | 1.52 | 1.34 |
| 1970 | .. | 3.00 | 3.50 | 2.00 | 1.30 | 1.34 |

The world market price of filament yarn of 1st quantity at present is between 2.75-415 $/kg depending on the denier number, shrinkage and twisting for staple fibers the price in the world is quoted as 1.10 to 1.40 $/kg. German producers, do not think that

export prices will continue to fall; they rather expect increases of 10-20 percent.

In Pakistan only yarn imports of substandard quality are permitted. The C & F price of Japanese twisted fil ment yarns of substandard quality is:

1.54 to 2.20 $/kg (100 to 45 den.)

The same taxes, duties and bonus vouchers are levied on them as Nylon yarn i.e. a total of

489 percent on C & F value

The landed costs thus are:

43 to 62 Rs/kg.

The charges levied on staple fibers are:

320 percent on C & F value.

The landed cost of staple fibers thus:

20 to 28 Rs/kg.

Estimated Sales Revenue

Estimated sales revenue is summarized in Table 15 a below:-

Table 15a

Estimated Sales Revenue for year 1st and 2nd and through 10th
Rs(000)

| Annual Production | Price per 1 ton | 1st Year | 2nd Year | 3rd Year |
|---|---|---|---|---|
| Utilization of Capacity | | 85% | 95% | 100% |
| Annual tons (t/y) | Rs/t | 5100.0 | 5700.0 | 6000.0 |
| Staple form fibers | 9500.0 | 40375.0 | 44650.0 | 47500.0 |
| Filament yarn | 12500.0 | 10625.0 | 11875.0 | 12500.0 |
| | 10000.0 | 51000.0 | 57000.0 | 60000.0 |

## SECTION 3

## FACILITIES AND MANUFACTURING

### 3.0 Operating Facilities

### 3.1 Plant Location

The selected site for the implementation of polyester plant is in Karachi - Korangi near of Bengal-Nylon plant. This area is designated for the Development of Industry of Karachi about 10 miles out of Karachi.

This area is partly developed with communication and others.

### 3.2 Auxiliary Facilities

The specific conditions prevailing in Pakistan and on the proposed plant site have been the basis for the optimum design of the auxiliary equipment and facilities.

The facilities stipulated under this item contribute toward the independency of the overall factory. The connection to the various utilities supplies and transportation facilities described in this project Report represent the economically optimum solution.

The auxiliary facilities cover the following:-

3.2.1 Steam boiler for the production of 2 t/h. steam complete with stack, burner set, air blower and steam distribution piping. The burner operates fully automatically and is capable of producing the steam requirements for the

complete plant Sui gas shall be used for firing the heat load is approx. 21 million kcal/h. In term of Natural gas about 23000 cuft/h.

3.2.2. Water cooling tower for the cooling of 180 $m^3$/h. recirculated cooling water.

3.2.3. Storages

- Storage for DMT
- ---"--- Ethylene glycol
- ---"--- Finished products

3.2.4 Instrument air and compressed air station supplying 800-1000 $Nm^3$/h of compressed air to all instruments and other consumers throughout the whole plant.

3.2.5 Air Conditioning unit, complete, for supply of conditioned air to the spinning and staple fiber production plants and to the spinning and staple fiber production textile laboratories.

3.2.6 Dow-term heat unit, complete, to heat the condensation and spinning plants designed for firing with Sui gas heat load approx. 6 million kcal/h, consisting of heater, stacks, burner set air blower, heat exchangers, pumps and piping for the distribution dow term.

3.2.7 Ethylene glycol recovery unit, complete for the destitation and upgrading of once used ethylene glicol, consisting of raw and pure glycol containers distillation and reactification column, heat exchangers pumps, piping, electricals and instrumentation.

The recovered pure ethylene glicol is returned to the esterification process, which provides for higher economic of the overall plant i.e. minimum loss of glicol.

3.2.8 Unit for producing high purity Nitrogen (1-3 ppm $O_2$) and unit for producing inert gases. Both units complete with distribution system.

3.3. Polyester fiber plant

The following operating units and services will constitute the plant.

1. Polyethylene terephthalate chips production, including esterification and polycondensation (converting glycol and DMT/Di-glycol terephthalate) into chips.
2. Methanol glycol distillation unit.

   Methanol-glycol mixture which is formed in the polycondensation phase is fractionally distilled and separated (by esterification) to its constituents.
3. Yarn fiber production unit

   The semifinished chips are pneumatically sent to spinning, vessel and melt extruded.
4. Spinning production unit includes the hot airowing, spinning, setting, crimping and cutting operation.
5. Water supply and treatment
6. Laboratories.

3.1.1 The Buildings

For the overall plant the following buildings are included:-

1. Two storied administration buildings are wide, 40 m. long and 10 m. high.

2. Research laboratory building approx. 12 m wide, 20 m long and 10 m high.

   The groundfloor accommodates the central control room and the electrical room while the first floor accommodates the research laboratory, wash rooms, and change rooms.

1 Central building for the first aid station and doctor's room.

1 Canteen - approx. 16 m. wide, 41 m long and 5 m. high.

1 Building for the central workshop approx. 12 m. wide, 20 m. long and 5 m. high.

2 Gate houses, each approx. 4 m wide 4 m. long and 3 m. high.

3.4 Raw Material and Processes

3.4.1 Raw Material

This project is continuation of the Project "B" which is producer and supplyer of the main raw material.

If the basic plants BTX-aromatics (Project A) and Monomer Complex (Project B) would be located very close to this project then the transport of DMT will be avoided.

Ethylene glycol and chemicals will be imported.

3.1.2 Outline of the Process

Polyethylene terephthalate for fibers is prepared commercially by two routes - transesterification and

- direct esterification

The transesterification route consists of the catalized exchange of ethylene glycol groups for the methyl groups of dimethyl terephthalate (DMT) to yield bis (2-hydroxyethyl) terephthalate. The liberated methanol is removed from the system by distillation in order to drive the exchange to completion. The bis (2-hydroxyethyl) terephthalate, under-goes polycondensation, usually in the presence of catalyst and under reduced pressure to remove ethylene glycol) to from polyethylene terephthalate. Titanium dioxide is generally added as a delustrant before polymerisation. Originally a batch process is in using and the molten polymer should be cooled, broken into chips, blended, and remelted before melt-spinning into fiber.

Continuous process in which the molten PET is fed directly to the spinnerets have been available for several years now the choice between batch or continuous operation apparently depends more on the types of the fibers required than on the slight differences in the economics of the two process when large amounts of a particular fiber are made for an extended period, the continuous process is best, but if a variety of fibers of varying deniers and types is required, the more flexible batch process is preferred. Even in continuous processes a significant part of

polymer is often made into chips to allow greater production flexibility. In general, the continuous process is better suited to large scale experienced producers. Until 1965, all PET (polyethylene terephthalate) was made using DMT in the transesterification process. The DMT had the advantages of relatively low melting point (140°C), low boiling point, and good solubility in common industrial solvents, permitting it to be purified by distillation crystallisation, or a combination of the two. Terephthalic acid (TPA) was not commercially available in grade pure enough to produce an acceptable polymer and was considered harder to process because it could not be handled as a melt.

The commercial availability of TPA pure enough to make acceptable polymer has resulted in an increasing adoption of TPA and the direct esterification process in which the bis (2-hydroxyethyl) terephthalate is obtained by the reaction of ethylene glycol with TPA. The recovered by-product is water.

The advantage of direct esterification using TPA over transesterification using DMT are these:-

3.4.2.1 Faster reaction

3.4.2.2 Less catalyst residue in the polymer

3.4.2.3 The by-product (water) does not require the special recovery system needed for methanol.

3.4.2.4 Stabilisers, such as phosphates and phosphites, can be added during the process without adversely affecting the polymerisation reaction.

3.422 Higher molecular weight polymers result (of particular importance for tire cord and industrial fibers).

3.4.2.6 The TA yields about 15% more polymer per unit of production.

3.4.2.7 Some TA process require less ethylene glycol in the reaction mixture than their DMT based counterparts, more production is thus achieved per unit volume reactor.

3.4.2.8 For chip producing processes the cost saving on staple is of the order of 10% and appears to be decisive.

Although accurate raw material costs are not available because much DMT is produced captively and merchant DMT and PTA are sold on the basis of negotiated contracts fiber grade PTA and DMT are reported to be priced equally at 15-18 cent per pound. Since one pound of PTA is theoretically equivalent to 1.17 pounds of DMT, this would give the PTA a price advantage of about 3 cents per pound. In addition that 1.5 mol. of ethylene glycol is used per mol. of PTA compared to at least 1.8 mol. per mol. of DMT. However, since essentially all the unused ethylene glycol is recovered, the major impact of this disparity would be upon capital and utility costs.

The direct esterification process has grown from essentially nothing 1964 to more than 25 per cent of the industry in 1968. While many existing facilities may continue to use DMT, there is strong tendency to switch from DMT to TPA, for new installations. One industry source estimates that by 1980 half of the world's polyester fiber and film production will be made from TPA.

Inspite of above arrangements we conclude that Pakistan should start with DMT-process and later to adopt to TA-process.

3.4.3 Polycondensation

Two distinct stages, each requiring a separate reaction vessel and different processing conditions are required in the main polymer process. Some TA based processes involve a third prepolymer stage but the overall chemical reaction which take place are similar. In the first vessel DMT or TA is reacted with excess ethylene glycol to give bis (B hydroxyethyl) terephthalate "Monomer" which is then polycondensed in the second vessel to give polyethylene terephthalate. Methanol in the case of DMT, or water in the case of TA feedstock is given off from the first stage of the process, and glycol from the second. The polymer is usually produced in the from of chip which is dried, blended and pneumatically transported to the spinning area.

3.4.3.1 Spinning

The dry blended polymer chip is converted into filaments by a melt process where the chip is changed into a molten state using electrical heating, followed by extrusion where the molten polymer is pumped through a filter and spinneret. The filaments are cooled by air, then a dilute solution of spin finish is applied to the spun-yarn, which is finally collected on a package.

In the case of staple fiber, several spun yarns from adjacent spinning positions are brought together to give a two of denier convenient for subsequent processing and collected in a large can.

In both cases, a low degree of molecular orientation is given to the spun yarn by arranging a take-up speed considerably higher than the filament extrusion velocity.

3.4.3.2 Drawing - Continuous Filament Yarn (uncrimped)

To make the spun yarn useful, it is necessary to increase its crystallinity and molecular orientation. This is done by a hot drawing process where the yarn is stretched by several hundred per cent. The drawn yarn properties depend on the degree of stretch applied at drawing and different degrees of stretch are used for medium and high tenacity yarns.

3.4.3.3 Processing - Staple Fibre and Crimped Yarn

The processing of spun tow to crimped fibre involves several stages carried out in sequence. The first stage is drawing. where the spun material from several cans of tows is combined together via a creel and the combined tow is hot stretched between a set of feed rolls and draw-rolls.

The tow is then crimped so that the material can be processed on conventional textile machinery, dried, and heat stabilised to maintain the mechanical properties of the fiber.

For products required as continuous tow, the heat stabilised material is carefully packed in boxes. In those cases where the product is required in staple form, the heat stabilised tow is cut and then compressed into a bale.

3.4.3.7 Recovery Facilities

a) Methanolysis

Waste polymer, waste yarn, waste staple fibre is reacted with excess methanol to produce DMT and glycol. The DMT is isolated, re-distilled, and re-crystallised to produce polymer grade material which is then returned as feed material to the polymerisation reaction.

The liquor containing methanol and glycol is sent to the methanol recovery section where the methanol is separated and purified and the glycol fraction is sent to the glycol recovery section.

In the case where terephthalic acid is used as the feed material a process of hydrolysis is used for its recovery from waste polymer.

b) Glycol Recovery

Impure glycol from the polymerisation section is refined by distillation. Crude glycol from the methanolysis or hydrolysis plant is first distilled to remove impurities such as spin finish oil. This product is then bulked with impure glycol from the polymerisation section and refined by distillation. The refined glycol is finally mixed with new glycol and used as a portion of the feed material to the polymerisation section.

The methanol/water fraction is sent to the methanol recovery section.

c) Methanol Recovery

Impure methanol from methanolysis, glycol recovery and polymerisation sections, is distilled to produce a refined methanol containing around 1% impurities (mostly water). Part of the methanol is available for the manufacture of DMT, the remainder is sent to the methanolysis plant. In the case where T.. is used a methanol recovery plant is not required.

## 3.8 Estimation of Site and Construction Costs

The installation cost of the proposed plant is estimated to be Rs. 72,112,000 including a contingency of 10%.

A summary of the estimated cost is given in Table 16.

Cost of machinery and equipment are based on current estimates of suppliers and represent delivered cost including freight, insurance, import duties and landing expense erection and installation, engineering and fees. The total estimated cost for equipment is Rs. 60,178,000.

Table 16

Summary

Estimated Site and Plant Construction Costs

| Item | |
|---|---|
| 1. Land | 950.0 |
| 2. Site preparation and development | 2000.0 |
| 3. Buildings | 7284.0 |
| 4. Production equipment | 60178.0 |
| 5. Transport equipment | 1200.0 |
| 6. Office equipment | 500.0 |
| Sub-Total | 72112.0 |
| Development cost | 9808.0 |
| Total | 82220.0 |

3.5.1 Spare Parts

Spares of about 3% of equipment cost are included in the initial cost of plant with the total CIF value Rs.1,875,000.

3.5.2 Development Cost

Total development cost is estimated with Rs. 9,808,000 including foreign exchange of Rs. 3,200,000.

These item consists of three categories.

3.5.2.1 Pre-operating expenses which include all expenses in pre-constructing period, the preparation of the various documentation consultancy, preparing of the main project construction supervision, salary for personnel, travels administrative expenses.

3.5.2.2 Training and start-up expense include all the expenses for local training and abroad, expenses for foreign technician and start-up expense.

3.5.2.3 Interest during the Construction

This is calculated on the basis of the present condition of loan term from the international and local financial institution. International (foreign) loan is calculated at 7% for local at 8%. It is calculated that period of construction would last about 3 years estimated details of interest during construction is given in Table.....

3.5.2.4 Contingency

This is estimated as total of 10% of CIF cost of equipment.

3.5.2.5 Engineering and know-how are included in the Fixed Investment Costs

3.5.2.6 Custom duty, Insurance and Transport

These items have been calculated on the following basis for imported equipment on CIF basis (FOB+overseas transport).

The break up is as follows:-

| | |
|---|---|
| 1. Custom duty | 35% |
| 2. Insurance clearance internal transport | 4% |

3.5.2.7 Project Schedule

Anticipated schedule of the project, that the start of operation after 36 month after authorisation is given to proceed with detailed design work. Therefore, it would be technically reasonable to operate according to the following schedule:-

| | |
|---|---|
| 1st Year after start-up | 85% |
| 2nd ---------"--------- | 95% |
| 3rd ---------"--------- | 100% |
| 4th ---------"--------- | 100% |

3.5.2.8 Organisation, Management, Personnel and Remuneration

This project will be independent unit in the promotion of Petrochemical Complex Industry. As we have mentioned, the principal raw material will be purchased from the Monomer Complex (Project B) which will be supplier for both plants in West and East.

The executive administrative personnel is given in Table 18 for operating personnel.

3.5.2.9 **Remuneration**

Salaries and wages estimated to be paid to personnel manning the plant are based on the reasonable level in the time of operation. These salaries and wages are detailed in Table 17.

## SECTION 4

## COST OF OPERATION

### 4.0 Estimated Cost of Operations

The estimated annual production costs of Polyester fiber production at full capacity is shown in Table 20. This is based on 7680 operating hours per year which permits adequate downtime based on experience in similar plant. In this cost are: raw materials, chemicals, supplies, labour fringe benefits production, overhead, depreciation and amortization. In addition there are estimated administrative expense of Rs.1,945,000.0.

Estimated expense for the wagesand salaries are given in Table 17. Fringe benefits in Table 19.

### 4.0.1 Price Basis

The estimation of annual production costs for polyester fiber is based on the following assumption. The price of principal raw material which are coming from the Project B has been taken on the basis of formed selling price which are adjustable depending on the policy of price.

#### 4.0.1.1 Cost of Material and Utilities:

| | |
|---|---|
| 1. DMT | Rs.2700.0/ton |
| 2. Ethylene glycol | Rs.1200.0/ton |
| 3. Catalyst and chemicals | Rs. 380.0/ton of fiber |
| 4. El. power | Rs. o.07/kwh. |
| 5. Steam | Rs. 9.0/ton |
| 6. Cooling water | Rs. 0.054/$m^3$ |

| | |
|---|---|
| 7. Compressed air | Rs. 0.1/$Nm^3$ |
| 8. Fuel | Rs. 100/Ton |
| 9. Nitrogen | Rs. 0.3/$Nm^3$ |
| 10. Packing material | Rs.1650/ton of fiber |

4.0.1.2 Interest on Long Term Loan

The rate of interest is estimated as follows:-

- On foreign loan at 7%
- On local loan at 8%

4.0.1.3 Repair and Maintenance

The expenditure for maintenance is taken through two categories:-

- In fixed cost are taken labour/charges.
- In variable cost as "another supplies" in value of 3% of equipment cost plus overseas freight.

4.0.1.4 Insurance

This includes insurance of plant as a whole against fire and operational hazards miscellaneous rent bills and local taxes levied by the Government. It is estimated 2% on erected cost.

4.0.1.5 Wages and Salaries are given in Table 17.

Estimated general and administrative expense are given in Table 20.

## Table 17

**Estimated Salaries and Wages of Operating Personnel**
**Rs(000)**

| | Annual Employee Wages | | | No of employee | Total annual Pay Roll |
|---|---|---|---|---|---|
| | Hourly rates | Annual hours | Annual wages | | |
| **1. Production** | | | | | |
| - Operators | 2.2 | 1760 | 3872.0 | 60 | 232.3 |
| - Helpers | 1.0 | 1760 | 1760.0 | 35 | 61.6 |
| - Shift Engineers (Foremen) | 4.0 | 1760 | 7040 | 20 | 140.8 |
| - Plant Engineers (Supervisors) | 8.0 | 1760 | 14080.0 | 12 | 168.9 |
| - Plant Labour Chemist | 7.0 | 1760 | 12320.0 | 20 | 246.0 |
| Sub-Total | | | | 147 | 849.6 |
| **2. Maintenance** | | | | | |
| Workers | 2.2 | 1760 | 3872.0 | 55 | 212.9 |
| Helper | 1.0 | 1760 | 1760.0 | 35 | 61.6 |
| Engineers(Foremen) | 4.0 | 1760 | 7040.0 | 18 | 126.7 |
| Engineers (Supervisors) | 8.0 | 1760 | 14080.0 | 10 | 140.8 |
| Sub-Total | | | | 118 | 542.0 |
| Total | | | | | 1391.6 |

Table 18

Executive and Administrative Personnel Expense
Rs(000)

| | Annual employee salary | No of employee | Total annual pay out |
|---|---|---|---|
| 1. General Manager | 36,000.0 | 1 | 36,000.0 |
| 2. Technical Manager | 30,000.0 | 1 | 30,000.0 |
| 3. Marketing and Sales Manager | 16,000.0 | 1 | 16,000.0 |
| 4. Financial Manager | 16,000.0 | 1 | 16,000.0 |
| 5. Chief Medical Officer | 16,000.0 | 1 | 16,000.0 |
| 6. Stores and Warehouse Manager | 14,000.0 | 1 | 14,000.0 |
| 7. Personnel Manager | 14,000.0 | 1 | 14,000.0 |
| 8. Administrative Officer | 14,000.0 | 1 | 14,000.0 |
| 9. Purchasing Manager | 14,000.0 | 1 | 14,000.0 |
| 10. Chief Engineer | 18,000.0 | 1 | 18,000.0 |
| 11. Assistant Engineer | 10,000.0 | 2 | 20,000.0 |
| 12. Accountants, Lawyers, Buyers Planners, Engineers, Salesmen and other profe-sional perso. | 5,000.0 | 25 | 125,000.0 |
| 13. Secretaries, Clerks | 3,500.0 | 30 | 105,000.0 |
| 14. Porters, other unskilled labours | 2,000.0 | 30 | 60,000.0 |
| Total | | ~~127~~ 92 | 498,000.0 |

## Table 19

### Fringe Benefits
Rs(000)

Fringe benefits amount is computed by applying percentage to following salaries and wages
Rs(000)

| | Salaries | Fringe benefits |
|---|---|---|
| Production | 849.6 | 509.7 |
| General Administrative | 498.0 | 298.8 |
| Maintenance | 542.0 | 325.2 |
| Total Pay Roll | 1889.6 | 1133.7 |

## Table 20

### Estimated General and Administrative expense
Rs(000)

| Expense | |
|---|---|
| Salaries and Wages | 498.0 |
| Fringe benefits | 298.8 |
| Sub-Total | 796.8 |
| Maintenance | 20.0 |
| Fringe benefit | 12.0 |
| Production overhead | 8.0 |
| Supplies | 80.0 |
| Sub-Total | 90.0 |
| Depreciation and Amortization | 30.0 |
| Local taxes, telephone, stationery and other miscellaneous expense | 350.0 |
| Total expense | 1266.8 |

## Table 21

### Annual Cost of Operation
### -Production Costs-

Polyester Fibers Plant
Capacity : 6,000 t/y Staple Fiber

| | Unit | Consumption per 1 ton | Unit price $/unit | Cost per 1 ton | Total cost for 1 year |
|---|---|---|---|---|---|
| **A. Variable Oper. Costs** | | | | | |
| 1. Raw Material | | | | | |
| -DMT | t | 0.900 | 2700.0 | 2430.0 | 14580.0 |
| - Ethylene glycol | t | 0.300 | 1200.0 | 360.0 | 2160.0 |
| - Catalyst & Chemicals | lb | | | 380.0 | 2280.0 |
| Sub-Total (1) | | | | 3170.0 | 19020.0 |
| 2. Utilities | | | | | |
| - El. power | kwh | 2000.0 | 0.007 | 140.0 | 840.0 |
| - Steam | $t_3$ | 10.0 | 9.0 | 90.0 | 540.0 |
| - Cooling Water | $m^3$ | 300.0 | 0.054 | 16.2 | 96.2 |
| - Clarified water | $m^3$ | 30.0 | 0.054 | 1.6 | 9.6 |
| - Compressed air | $Nm^3$ | 500.0 | 010 | 50.0 | 300.0 |
| - Fuel | t | 0134 | 100 | 13.4 | 70.4 |
| - Nitrogen | $Nm^3$ | 200.0 | 030 | 60.0 | 360.0 |
| Sub-Total (2) | | | | 369.3 | 2216.2 |
| 3. Other Material & Supplies | | | | | |
| - Maintenance | lb. | | | 166.6 | 1000.0 |
| - Packing material | lb. | | | 1650.0 | 9900.0 |
| Sub-Total (3) | | | | 1816.6 | 10900.0 |
| **B. Fixed Cost** | | | | | |
| - Labour | | | | [illegible] | 1391.6 |
| - Fringe benefits | | | | [illegible] | 834.7 |
| - Factory overhead | | | | | 556.4 |
| - Depreciation & Amortization | | | | | 7519.0 |
| Total fixed costs | | | | | 10301.7 |
| Total cost of operation | | | | | 42438.3 |
| Production cost per 1 ton | | | | lb.7073.0 | |
| | | | | $1485.9 | |

Table 22

Estimated Variable Production Costs
Rs(000)

| Item | Total Variable Cost | | |
|---|---|---|---|
| | F.E. | L.C. | Total |
| DMT | - | 14,580.0 | 14,580.0 |
| Ethylene glycol | 2,160.0 | - | 2,160.0 |
| Catalyst and chemicals | 2,280.0 | - | 2,280.0 |
| El. power | - | 840.0 | 840.0 |
| Steam | - | 540.0 | 540.0 |
| Cooling water | - | 96.2 | 96.2 |
| Clarified water | - | 9.6 | 9.6 |
| Compressed air | - | 300.0 | 300.0 |
| Fuel | - | 70.0 | 70.0 |
| Nitrogen | - | 360.0 | 360.0 |
| Packing supplies | 6,000.0 | 3,900.0 | 9,900.0 |
| Maintenance supplies | 1,000.0 | - | 1,000.0 |
| Total | 11,440.0 | 20,696.0 | 32,136.0 |

Table 23

Estimated Fixed Cost
Rs(000)

| Categories | Rs(000) |
|---|---|
| **Production Labour** | |
| - Plant operators | 232.3 |
| - Plant helpers | 61.6 |
| - Maintenance helpers | 212.9 |
| - Maintenance helpers | 61.6 |
| - Chief foremen | 266.0 |
| - Plant supervisors | 209.7 |
| - Plant chemist | 246.0 |
| Total | 1391.6 |
| - Fringe benefits at 60% | 834.9 |
| - Prod. overhead at 40% | 556.6 |
| - Depreciation and amortization | 7519.1 |
| Total fixed costs | 10302.2 |

# S E C T I O N 5

## FINANCIAL EVALUATION

### 5.0 Estimated Capital Investment

The total capital investment requirements for the polyester plant in Chittagong is given in Table 24 below:-

Table 24

Polyester Fibers Plant
Capacity : 6,000 t/y.
Location : Chittagong- East Pakistan

| | F.E. Rs(000) | L.C. Rs(000) | Total Rs(000) |
|---|---|---|---|
| A. Site and Project Cost | | | |
| 1. Land Acquisition | - | 950.0 | 950.0 |
| 2. Site preparation & development | - | 2,000.0 | 2,000.0 |
| 3. Buildings | - | 7,284.0 | 7,284.0 |
| 4. Production equipment | 35,511.0 | 24,967.0 | 60,478.0 |
| 5. Transport equipment | 800.0 | 400.0 | 1,200.0 |
| 6. Office equipment | - | 500.0 | 500.0 |
| Sub-Total A | 36,311.0 | 36,101.0 | 72,412.0 |
| B. Development Cost | | | |
| 1. Pre-operating | 2,000.0 | 1,000.0 | 3,000.0 |
| 2. Training and start-up | 1,200.0 | 1,600.0 | 2,800.0 |
| 3. Interest during the constr. | - | 4,008.0 | 4,008.0 |
| Sub-Total B | 3,200.0 | 6,608.0 | 9,808.0 |
| Sub-Tota A + B | 39,511.0 | 42,709.0 | 82,220.0 |
| C. Working Capital | | | |
| 1. Inventory | - | - | 10,625.0 |
| 2. Account Payable | - | - | (1,635.0) |
| 3. Cash | - | - | (1,635.0) |
| Sub-Total C | - | - | 10,625.0 |
| Total capital investment | | - | 92,845.0 |

Estimated Development Cost
Rs(000)

Table 25

| | Development Cost | | |
|---|---|---|---|
| | F.E. | L.C. | Total |
| 1. Pre-operating Expense | | | |
| - Final documentation<br>- Construction adm. superv.<br>- Travelling & Consultancy | 2,000.0 | 1,000.0 | 3,000.0 |
| Total | 2,000.0 | 1,000.0 | 3,000.0 |
| 2. Training and start-up | 1,200.0 | 1,600.0 | 2,800.0 |
| 3. Interest during constr. | - | 4,008.0 | 4,008.0 |
| Total development costs | 3,200.0 | 6,608.0 | 9,808.0 |

## 5.1 Site and Complex Cost

Of the total investment of Rs. 92.8 million, will be required for site and complex cost. This total includes all costs for materials equipment cost, erection, installation, engineering, royalities, and other similar associated costs. Expenditure for know-how is also included in this total.

## 5.2 Development Cost

It is anticipated that Rs. 9,808,000 will be required for development cost to cover expenses associated with pre-operating, training and start-up and interest during construction.

It is anticipated that the training programme will cover a period of two years starting one year before start-up and continuing through the second year after start-up. The plan provides for six months of overseas training for 15-30 key people of the production, maintenance and management team.

Interest during construction is estimated to be Rs. 4,008,000 as detailed in Table 32.

## 5.3 Working Capital

Beginning working capital reflect the estimated needs of the plant at start-up and is calculated in Table 26.

Spare parts inventory is based on a two-year requirement and is estimated to be approximately 3 percent of the original cost for factory.

Work in process inventory is estimated on the basis of total production cost invested at any one time excluding depreciation and amortization computations indicate that this cost will equal about ten days of out-of pocket expense as indicated.

There is no provision in beginning working capital for finished goods. However, as production increases there will be a requirement for additional working capital as the work in process is converted into finished goods and then into accounts receivable. It is estimated that at capacity the complex will need about 30 days supply of finished goods in order to supply normal peak demands.

It is assumed that the plant will pay all trade creditors within 30 days. Accounts payable at the end of any month will be only those payable accomulated from the proceeding 30 day period. However, in case of work in process and finished goods, payables will approximate 10 and 30 days of variable production costs as outlined in table 28.

## 5.4 Depreciation and Amortization

Depreciation and amortization rates are shown in Table 29.

## Table 26

### Estimated Working Capital
Rs(000)

| Item | Total Working Capital | | |
|---|---|---|---|
| | Before start-up | End of 1st Year | End of 2nd Year |
| 1. Inventory | | | |
| - Spare parts | 1875.1 | 1875.1 | 1875.1 |
| - Raw material | 3550.0 | 3550.0 | 3550.0 |
| - Maintenance and packing supplies | 4000.0 | 4000.0 | 4000.0 |
| - Work in process inventory | 1200.0 | 1200.0 | 1200.0 |
| - Finished goods inventory | - | 4000.0 | 4000.0 |
| Total | 10625.0 | 14625.1 | 14625.0 |
| 2. Account Receivable 2) | - | 7500.0 | 8700.0 |
| Less | | | |
| Account Payable 3) | | | |
| - Spare parts | (156.2) | (156.2) | (156.2) |
| - Raw material | (1500.0) | (1500.0) | (1500.0) |
| - Maintenance & packing supplies | (333.0) | (333.0) | (333.0) |
| - Work in process | (850.0) | (850.0) | (850.0) |
| - Finished goods | - | (2500.0) | (2800.0) |
| Total | (2839.2) | 5339.2 | (5639.2) |
| Cash required 4) | 2839.2 | 5339.2 | 5639.2 |
| Net working capital required | | | |
| - Before start-up | 10625.0 | - | - |
| - End of 1st year | - | 22125.0 | - |
| - End of 2nd year | - | - | 23325.0 |

Estimated Working Capital Requirement
- Inventory -
Rs(000)

Table 27

| Inventory category | | Inventory | | | |
|---|---|---|---|---|---|
| | | F.E. | L.C. | Before start-up | At full capacity |
| 1. Spare parts | | | | | |
| Original equipment | | 29988.0 | 9520.0 | - | - |
| Transport equipment | | 800.0 | - | - | - |
| Total | | 30788.0 | 9520.0 | | |
| 2. 2-Years Spare Parts | | | | | |
| Requirements | 3% | 923.0 | 285.6 | - | - |
| Fright and insurance | | 120.0 | 20.0 | - | - |
| Import duty | 35% | - | 365.0 | - | - |
| Inland fright | | - | 60.0 | - | - |
| Contingency | 10% | 92.3 | 9.5 | - | - |
| | | 1135.0 | 740.1 | 1875.1 | 1875.1 |
| 3. Raw Material | | | | | |
| DMT | | 350.0 | 3200.0 | - | - |
| Total | | 350.0 | 3200.0 | 3550.0 | 3550.0 |
| 4. Maintenance and Packing Supplies | | | | | |
| - Maintenance | | 1500.0 | - | - | - |
| - Packings | | 1500.0 | 1000.0 | - | - |
| Total | | 3000.0 | 1000.0 | 4000.0 | 4000.0 |
| 5. Work in process | | | | | |
| 10 days of product.cost before depreciation | | 400.0 | 800.0 | 1200.0 | 1200.0 |
| 6. Finished goods | | | | | |
| 30 days of production cost before depreciation | | 1500.0 | 2500.0 | - | 4000.0 |
| Total inventory required | | | | | |
| - Before start-up | | - | - | 10625.0 | - |
| - At capacity | | - | - | - | 14625.1 |

Table 28

Estimated Working Capital Requirements
- Compulation of Account Payable -
Rs(000)

| Accounts Payable Category | Total Account Payable | | |
|---|---|---|---|
| | Before start-up | End of 1st Year | End of 2nd Year |
| 1. Spare Parts | | | |
| 1 month (1875:12) | 156.2 | 156.2 | 156.2 |
| 2. Raw Materials | | | |
| 1 month (3550:12) | 295.8 | 295.8 | 295.8 |
| 3. Maintenance & Packing Supplies | | | |
| 1 month (4000.0:12) | 333.0 | 333.0 | 333.0 |
| 4. Work in Process | | | |
| 10 days of variable cost | 850.0 | 850.0 | 850.0 |
| 5. Finished Products | | | |
| 30 days of production | - | 2800.0 | 2800.0 |
| Total Account Payable | | | |
| Before start-up | 1635.0 | - | - |
| End of 1st Year | - | 4135.0 | - |
| End of 2nd Year | - | - | 4435.0 |

Table 29

Estimated Depreciation and Amortization
Rs(000)

| | Average Life | | Assets | Total depreciation |
|---|---|---|---|---|
| | Years | Rate % | | |
| **A. Depreciation** | | | | |
| 1. Land | - | - | 950.0 | - |
| 2. Site preparation | 20 | 5 | 2000.0 | 100.0 |
| 3. Buildings | 20 | 5 | 7284.0 | 364.2 |
| 4. Production equipment | 10 | 10 | 60478.0 | 6047.8 |
| 5. Transport equipment | 4 | 25 | 1200.0 | 300.0 |
| 6. Office equipment | 10 | 10 | 500.0 | 50.0 |
| Sub-Total | | | 72412.0 | 6862.0 |
| **B. Amortization** | | | | |
| 1. Pre-operating cost | 15 | 6.7 | 3000.0 | 201.0 |
| 2. Training and start-up | 15 | 6.7 | 2800.0 | 187.0 |
| 3. Interest during construction | 15 | 6.7 | 4008.0 | 268.5 |
| Sub-Total | | | 9808.0 | 675.1 |
| Total depreciation and amortization | | | | 7519.1 |

5.5 Proposed Financing

The estimated foreign exchange and local currency requirement of the plant is shown in Table 30 below:-

Table 30

Estimated Foreign Exchange and Local currency Requirement
Rs(000)

| Item | F.E. | L.C. | Total |
|---|---|---|---|
| - Site and Complex cost | 36,311.0 | 36,101.0 | 72,412.0 |
| - Development cost | 3,200.0 | 6,608.0 | 9,808.0 |
| - Working Capital | 3,750.0 | 6,875.0 | 10,625.0 |
| Total | 43,261.0 | 49,876.0 | 92,845.0 |

It is assumed that Investor will participates about 35% of the total investment capital in the form of shareholders equity and the balance will be in the firm of long-term debt.

It is assumed that the loan would be obtained for Rs.60,000,000 as following:-

Rs. 43,261,000 (72.0%) Foreign long term loan

Rs. 16,739,000 (28.0%) Local long term loan

Table 31 shows the timing of the estimated capital requirements of the plant segregated between debt and equity capital.

The ratio equity : Debt is assumed 35:65

Table 31 shows the timing of the estimated capital requirements of the plant segregated between debt and equity capital.

The long term debt was assumed to mature in 12 years. However, after grace period, ten equal annual sinking fund payments would retire the debt as indicated in Table 33.

Table 31

Estimated Timing of Capital Requirements by type of Capital
Rs(000)

| Year before start-up | Quarter | Capital to be provided | | |
|---|---|---|---|---|
| | | From equity | From debt | Grand Total |
| (3) | First | 8,000.0 | - | 8,000.0 |
| | Second | 2,000.0 | - | 2,000.0 |
| | Third | 2,000.0 | - | 2,000.0 |
| | Fourth | 2,000.0 | - | 2,000.0 |
| | Total | 14,000.0 | - | 14,000.0 |
| (2) | First | 4,000.0 | 3,500.0 | 7,500.0 |
| | Second | 8,000.0 | 3,500.0 | 11,500.0 |
| | Third | 3,000.0 | 5,000.0 | 8,000.0 |
| | Fourth | 3,000.0 | 8,000.0 | 11,000.0 |
| | Total | 18,000.0 | 20,000.0 | 38,000.0 |
| (1) | First | 845.0 | 10,000.0 | 10,845.0 |
| | Second | - | 10,000.0 | 10,000.0 |
| | Third | - | 12,000.0 | 12,000.0 |
| | Fourth | - | 8,000.0 | 8,000.0 |
| | Total | 845.0 | 40,000.0 | 40,845.0 |
| Grand Total | | 32,845.0 | 60,000.0 | 92,845.0 |

**Estimated Development Cost**
**Interest during Construction**
**Rs(000)**

**Table 32**

| Year before | Quarter | Total loan | Loan drew | Issued Balance | Interest on Drawn down @ | | Interest on Unused balance 1% | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Per year | Per quarter | Per year | Per quarter | |
| | | A | B | C | D | E | F | G | E + G |
| (2) | | 60,000.0 | 3,500.0 | 57,500.0 | 210.0 | 52.5 | 575,0 | 143,7 | 196.2 |
| | | 60,000.0 | 7,000.0 | 53,000.0 | 420.0 | 105.0 | 530.0 | 132.5 | 237.5 |
| | | 60,000.0 | 12,000.0 | 48,000.0 | 720.0 | 180.0 | 480.0 | 120.0 | 300.0 |
| | | 60,000.0 | 20,000.0 | 40,000.0 | 1200.0 | 300.0 | 400.0 | 100.0 | 400.0 |
| | | | | | | | | | 1133.7 |
| Total for year (2) | | | | | | | | | 525.0 |
| (1) | | 60,000.0 | 30,000.0 | 30,000.0 | 1800.0 | 450.0 | 300.0 | 75.0 | 650.0 |
| | | 60,000.0 | 40,000.0 | 20,000.0 | 2400.0 | 600.0 | 200.0 | 50.0 | 800.0 |
| | | 60,000.0 | 52,000.0 | 8,000.0 | 3120.0 | 780.0 | 80.0 | 20.0 | 900.0 |
| | | 60,000.0 | 60,000.0 | - | 3600.0 | 900.0 | - | - | 2875.0 |
| Total for year (1) | | | | | | | | | 4008.7 |
| Total interest during construction | | | | | | | | | |

Table 33

Estimated long-term Debt Pay-off and interest
Rs(000)

| Year | Beginning debt balance | Annual year end payment | Ending debt balance | Interest at 7% |
|---|---|---|---|---|
| 1 | 60,000.0 | 6,000.0 | 54,000.0 | 4,200.0 |
| 2 | 54,000.0 | 6,000.0 | 48,000.0 | 3,780.0 |
| 3 | 48,000.0 | 6,000.0 | 42,000.0 | 3,360.0 |
| 4 | 42,000.0 | 6,000.0 | 36,000.0 | 2, 940.0 |
| 5 | 36,000.0 | 6,000.0 | 30,000.0 | 2,520.0 |
| 6 | 30,000.0 | 6,000.0 | 24,000.0 | 2,100.0 |
| 7 | 24,000.0 | 6,000.0 | 18,000.0 | 1,680.0 |
| 8 | 18,000.0 | 6,000.0 | 12,000.0 | 1,260.0 |
| 9 | 12,000.0 | 6,000.0 | 6,000.0 | 840.0 |
| 10 | 6,000.0 | 6,000.0 | - | 420 |

5.5 Estimated Sales Revenue

Estimated sales revenue is discussed in detail in Section of Marketing and we would summarised in Table 34 below:-

Table 34

R Estimated Sales Revenue for Year 1-2 through Year 6
Rs(000)

| | Sales | Annual Metric Tons | | | Annual Sales Revenue Rs(000) | | |
|---|---|---|---|---|---|---|---|
| | | Year 1st t | Year 2nd | Year 2nd through 10 | Year 1st t | Year 2nd | Year 2nd through 10 |
| Polyester filament | 12500.0 | 8500.0 | 9500.0 | 1000.0 | 10625.0 | 11875.0 | 12500.0 |
| Polyester staple | 9500.0 | 4250.0 | 4750.0 | 5000.0 | 40375.0 | 44650.0 | 47500.0 |
| Total | | | | | 51000.0 | 57000.0 | 60000.0 |

Year 1 and 2 reflects a lower sales revenue due to normal start-up problems. However, the plant is expected to operate at capacity starting with year 3rd.

5.6 Estimated Cost of Operations

Production costs is developed in Table 21. Production costs are allocated only to materials and utilities, other material supplies and fixed costs which include labour, fringe benefits, factory overhead and depreciation.

5.7 Income Tax

No income tax is calculated for observed period of six years because the country use to apply exception of it i.e. years tax-holiday is established in order to stimulate an investment in the country.

Total adjusted tax rate after six year is 45 percent.

## 5.8 Fund Generated from Operation

A summary of the estimated funds generated from operations for for the six years period after start-up is shown in Table 35 and detailed in Table 42.

Table 35

Estimated Funds Generated from Operation
Rs(000)

| Yr | Sales | Operating income | Net income before income tax | Net income after income tax | Depreciation and Amortization | Fund generated from operation |
|---|---|---|---|---|---|---|
| 1 | 51000.0 | 13403.4 | 8036.0 | 8036.0 | 7519.0 | 15555.0 |
| 2 | 54000.0 | 16170.0 | 11123.0 | 11123.0 | 7519.0 | 18642.0 |
| 3 | 60000.0 | 17563.0 | 13166.0 | 13166.0 | 7519.0 | 20685.0 |
| 4 | 60000.0 | 17563.0 | 14055.5 | 14055.5 | 7519.0 | 21574.5 |
| 5 | 60000.0 | 17563.0 | 15001.2 | 15001.2 | 7519.0 | 22520.2 |
| 6 | 60000.0 | 17563.0 | 15920.0 | 15920.0 | 7519.0 | 23439.0 |

The importance of the cash generated from operation as a source of funds to be used in perpetuating the business will be apparent from a review of the estimated cash flow which is presented in Table 41. It will be from these funds that the new project will be able to retire long term debt replace facilities at the end of their useful lives, and to expand into the production of other chemical products essential to the economy of Pakistan.

The projected coverage of interest requirements on long-term debt as well as debt service coverage are shown in Table 36.

Table 36

Estimated Fund Available for Servicing Interest in Debt

| Yr | Estimated Interest Coverage | | | Estimated Debt Service Coverage | | |
|---|---|---|---|---|---|---|
| | Profits before interest and income taxes 1) | Interest | Times interest earned | Cash 2) generated before interest and after income tax | 3) Debt Service | Times earned |
| 1 | 12236.0 | 4200.0 | 2.9 | 19755.0 | 10200.0 | 1.95 |
| 2 | 14903.2 | 3780.0 | 4.0 | 22422.0 | 9780.0 | 2.30 |
| 3 | 16296.2 | 3360.0 | 4.8 | 23815.2 | 9360.0 | 2.55 |
| 4 | 16296.2 | 2940.0 | 5.5 | 23815.0 | 8940.0 | 2.66 |
| 5 | 16296.2 | 2520.0 | 6.3 | 2381500 | 8520.0 | 2.80 |
| 6 | 16296.2 | 2100.0 | 7.8 | 23815.0 | 8100.0 | 2.95 |

Note:- 1) Operating income plus interest income
2) Includes depreciation and amortization
3) Interest plus debt retirement

Even after providing for debt retirement and dividend to shareholders assumed to equal 40 percent of the annual net profit, the cash build-up is substantial as indicated at the bottom of Table 42. The beginning cash balance of Rs. 5.09 million rises to a total of 109.8 million and the end of six years of operation of course, part of this cash will eventually be used to replace the original fixed assets as they wear out. Except for transportation equipment, the life of most production equipment and machinery is approximately 15 years. Therefore, major equipment replacement should begin approximately during the twelve to fourteen year except for the replacement of transportation equipment which will begin during the fourth year.

Because the cash accumulates to a level in excess of requirements it was assumed such excess would be invested in Bank Certificates of Deposit at 5%, as indicated in Table 44.

5.9 Projected Balance Sheets and Capitalisation Ratio

The estimated balance sheets for six years period after start-up are in Table 12. In preparing these data the following assumptions were employed.

- Cash Only that cash required for daily operations will be retained in working capital. This cash requirement is estimated to equal trade payables. As previously indicated, excess cash accumulated from operations were assumed invested in certifieates of deposit.

- Receivables. Estimated to average about 45 days, or about 15% of annual sales.

- Inventories - Approximately 14.6 million of inventories is considered appropriate as outlined in the discussion of beginning working capital. This sum is equal to a turnover of 5-times or 20 percent of annual sales.

- Payables - Trade creditors were assumed paid within 30 days. These payable are estimated about 25% of Inventories plus receivables. It should be noted that all temporary and miscellaneous items, such as prepaid expenses salaries and wages payable, taxes payable have been included from the balance sheets since such items are assumed to be expended or paid during the fiscal year incurred.

- Long-Term Debt - Estimated 65% of the total investment required at start-up.

- Net Retained Earnings Accumulated

Represent annual net profits after dividends accumulated over the six year period following start-up. Because of the build-up of retaining earnings, shareholders.

Table 37

Estimated Capitalization and Ratio
Rs(000)

| | Long Term Debt | | Capital Stock and surplus | | Total Capitalization and surplus | |
|---|---|---|---|---|---|---|
| | Amount | Percent | Amount | Percent | Amount | Percent |
| At Start-up | 60000.0 | 64.64 | 32835.0 | 35.36 | 92835.0 | 100.0 |
| 1 | 54000.0 | 57.00 | 40881.0 | 43.00 | 94881.0 | 100.0 |
| 2 | 48000.0 | 49.66 | 48667.0 | 50.34 | 96667.0 | 100.0 |
| 3 | 42000.0 | 42.05 | 57883.0 | 57.95 | 99883.0 | 100.0 |
| 4 | 36000.0 | 34.72 | 67712.0 | 65.28 | 103712.0 | 100.0 |
| 5 | 30000.0 | 27.73 | 78223.0 | 72.27 | 108223.0 | 100.0 |

5.10 Break-even Level

The average selling price of products would be Rs.9401/ton.

Based on the foregoing, the plant would be able to sell 4800 t/y of fibers and still break-even on a net income basis. This represents a level of production equal to 40% of capacity.

Break-even on a funds generated basis that is at that level of operations whens cash flow would equal the amount required for debt retirement is indicated to be 32% of capacity. Table 38 down shows, the estimated profit and loss at capacity and the net income and funds generated break-even levels.

Table 38

Estimated Profit and Loss (1)
At capacity and Break-even points
Rs(000)

| | At full capacity 2) | At 40% Capacity 3) | At 32% Capacity 4) |
|---|---|---|---|
| Average Selling price Rs/t | 10,000.0 | 10,000.0 | 10,000.0 |
| Metric tons sold | 6,000.0 | 3,000.0 | 2,700.0 |
| Total sales revenue | 60,000.0 | 30,000.0 | 27,000.0 |
| Cost of Operations | | | |
| A. Variable prod. cost | 32,136.0 | 16,068.0 | 14,461.2 |
| B. Fixed prod. cost | 10,301.0 | 10,301.0 | 10,301.0 |
| Total | 42,437.0 | 26,369.0 | 24,762.0 |
| C. General and Administr.exp. | 1,266.8 | 1,266.8 | 1,266.8 |
| Total cost of operation | 43,703.8 | 27,635.8 | 26,028.8 |
| Operating profit | 16,296.2 | 2,364.2 | 971.2 |
| Other income expense: | | | |
| - Interest income | 709.5 | 709.5 | 709.5 |
| - Interest expense | 2,940.0 | 2,940.0 | 2,940.0 |
| Total other - Net | 2,230.5 | 2,230.5 | 2,230.5 |
| Net income before tax | 14,065.7 | (134.2) | -1,269.3 |
| Income tax | ---------- | Tax Holiday | ---------- |
| Net income after tax | 14,065.7 | 132.2 | - |
| Add Depreciation & Amort. | 7,519.0 | 7,519.0 | 7,519.0 |
| Total cash generated 5) | 21,584.7 | 7,651.2 | 6,250.0 |
| Debt retirement | (6,000.0) | (6,000.0) | (6,000.0) |

Note:- 1. Computed for a 4th year of operation following six-years tax holiday.
2. Sales level in full production.
3. Sales level of which net income equals zero.
4. Level at which funds generated equals long-term debt retirement.
5. Cash generated before payment of any dividends

5.11 Return on Investment

Estimates of the return to be return to be earned on the total investment in the business as well as on shareholders investment will be found in Table 39.

It may be noted that the highest returns are generally earned in the sixth year of operation since it is assumed that thereafter the plant will be in a taxable position.

The payback of total investment is anticipated to be about 5.8 years and 2.6 years for the shareholders investment.

5.12 Economic Feasibility

The overall results of this study indicate that the development of a synthetic fibers production in East and West Pakistan based on the own raw material is economically feasible and profitable. In forming this judgement consideration has been given to the projected return on investment together with the value of the project to the economy and progress of Pakistan (both Wings). Actually the selling price and connected revenue will be determined by future policy of the Government.

1. Foreign Exchange

The savings in foreign exchange by producing 6,000 t/y Polyester fibers rather than importing a like quantity will be significant. This is shown in Table 40.

## Estimated Return on Investment
Rs(000)

Table 39

| | Total income 1) | Total Investment: Investment: Original | Total Investment: Investment: Average | Total Investment: Return(percent): Original | Total Investment: Return(percent): Average | Net income | Shareholders Investment: Investment: Original | Shareholders Investment: Investment: Average | Shareholders Investment: Return (percent: Original | Shareholders Investment: Return (percent: Average |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 12236.0 | | - | 13.2 | - | 8036.0 | - | - | 24.5 | - |
| 2 | 14903.0 | | - | 16.1 | - | 11123.0 | | - | 34.0 | - |
| 3 | 16526.0 | 92815.0 | - | 17.8 | - | 13166.0 | 32845.0 | - | 40.0 | - |
| 4 | 16995.0 | | - | 18.3 | - | 14055.5 | | - | 42.8 | - |
| 5 | 17521.5 | | - | 19.0 | - | 15001.2 | | - | 45.8 | - |
| 6 | 18020.0 | | - | 19.5 | - | 15920.0 | | - | 48.5 | - |
| Average | 16033.0 | | | 17.3 | | | | | 39.2 | |
| Pay back | | | | 5.8 year | | | | | 2.6 year | |

## Saving of Foreign Exchange Rs(000)

Table 40

| | Year After Start-up | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| CIF Cost | 43696.3 | 48837.6 | 51408.0 | 51408.0 | 51408.0 | 51408.0 |
| Less foreign exchange Required: | | | | | | |
| - Purchased chemicals and supplies (Spare parts & Packings) | 9344.0 | 10443.3 | 10993.0 | 10993.0 | 10993.0 | 10993.0 |
| - Capital equipment replacement | 937.0 | 938.0 | 938.0 | 938.0 | 938.0 | 938.0 |
| - Pay back of long term | 4321.0 | 4321.0 | 4321.0 | 4321.0 | 4321.0 | 4321.0 |
| - Payment of long term interest | 3100.0 | 2709.0 | 2408.0 | 2107.0 | 1806.0 | 1505.0 |
| - Replacement of transport equipment | - | - | - | - | 1200.0 | - |
| Total foreign exchange required | 17702.0 | 18411.0 | 18660.0 | 18359.0 | 19258.0 | 17757.0 |
| Balance foreign exchange savings | 25994.0 | 30426.6 | 32248.0 | 33049.0 | 32150.0 | 33651.0 |

5.13 Value of the Project to the Economy and Progress of West Pakistan.

The synthetic fiber production offers an impressive benefits to the economy and opens new project in the development of Textile Industry of Pakistan:

Among the specific benefits are these:-

- Plant will provide nearly thousand of new employees, trained and up-graded in working skills will become more productive members of the economy.

- Expenditure of salaries, goods and services relating to the plant will raise the income of the area in which plant is located

- Synthetic fiber production will give new impulseto the development of textile industry.

- The Government will be provided with additional source of taxable revenue while returning a profit after taxes to investors.

Estimated Cash Flow
Rs(000)

Table 41

| | Year before start-up | | | Balance before start-up | Year after start-up | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 3 | 2 | 1 | | 1st | 2nd | 3rd | 4th | 5th | 6th |
| **A. Source of Funds** | | | | | | | | | | |
| - Financing | - | - | - | - | - | - | - | - | - | - |
| - Equity capital | 14000.0 | 18000.0 | 845.0 | 32845.0 | - | - | - | - | - | - |
| - Long term loan | - | 20000.0 | 40000.0 | 60000.0 | - | - | - | - | - | - |
| - Net profit (after dividends | - | - | - | - | 8036.0 | 7786.1 | 9216.0 | 9839.0 | 10501.5 | 11144.0 |
| - Depreciation & Amortz.- | - | - | - | - | 7519.0 | 7519.0 | 7519.0 | 7519.0 | 7519.0 | 7519.0 |
| - Increase in payable | - | - | - | 2839.2 | 2500.0 | 300.0 | - | - | - | - |
| Total | | | | 95684.0 | 18055.0 | 15605.1 | 16835.0 | 17358.0 | 18010.5 | 19663.0 |
| **B. Application of Funds** | | | | | | | | | | |
| - Land | - | - | - | 960.0 | - | - | - | - | - | - |
| - Site preparation | - | - | - | 2000.0 | - | - | - | - | - | - |
| - Buildings | - | - | - | 7284.0 | - | - | - | - | - | - |
| - Production equipment | - | - | - | 40678.0 | - | - | - | - | - | - |
| - Transport.equipment- | - | - | - | 1200.0 | - | - | - | - | - | - |
| - Office equipment | - | - | - | 500.0 | - | - | - | - | - | - |
| - Preparation expense- | - | - | - | 3000.0 | - | - | - | - | - | - |
| - Training and start-up | - | - | - | 2800.0 | - | - | - | - | - | - |
| - Interest during construction | - | - | - | 4008.0 | - | - | - | - | - | - |
| - Beginning inventory- | - | - | - | 10625.0 | - | - | - | - | - | - |
| - Increase in inventory | - | - | - | - | 4000.0 | - | - | - | - | - |
| - Replacement of spare parts | - | - | - | - | 7500.0 | 1200.0 | - | - | - | - |
| - Replacement of transport | - | - | - | - | 935.0 | 935.0 | 935.0 | 935.0 | 935.0 | 935.0 |
| - Pay back of long term debt. | - | - | - | - | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 1200.0 | - |
| Total | 14000.0 | 38000.0 | 40845.0 | 92845.0 | 18435.0 | 8135.0 | 6935.0 | 6935.0 | 8135.0 | 6935.0 |
| **C. Cash** | | | | | | | | | | |
| Increase or decrease (A-B) | - | - | - | - | (380.0) | 7470.0 | 9900.0 | 10423.0 | 9875.5 | 11728.0 |
| At beginning of period | - | - | - | - | 2839.2 | 2459.2 | 9929.0 | 19829.0 | 30255.0 | 40120.5 |
| At end of period | - | - | 2839.2 | 2839.2 | 2459.2 | 9929.0 | 19829.0 | 30255.0 | 40120.5 | 51848.5 |

Estimated Balance Sheets
Rs(000)

Table 42

| | Balance before start-up | At End of Year 1st | 2nd | 3rd | 4th | 5th | 6th |
|---|---|---|---|---|---|---|---|
| **Assets** | | | | | | | |
| Current Assets | 2839.2 | 5339.2 | 5639.2 | 5639.2 | 5639.2 | 5639.2 | 5639.2 |
| Cash (on hand) | - | - | - | 4595.0 | 14190.0 | 24516.0 | 34481.0 |
| Cash(invested in certificate of deposit) | - | 7500.0 | 8700.0 | 8700.0 | 8700.0 | 8700.0 | 8700.0 |
| Account receivable (trade) | 10625.0 | 14625.0 | 14625.0 | 14625.0 | 14625.0 | 14625.0 | 14625.0 |
| Inventories | 13464.2 | 27464.0 | 28964.2 | 33554.2 | 43154.2 | 53480.2 | 63445.2 |
| Total current assets | | | | | | | |
| Fixed Assets | | | | | | | |
| - Land | 950.0 | 950.0 | 950.0 | 950.0 | 950.0 | 950.0 | 950.0 |
| - Site preparation | 2000.0 | 2000.0 | 2000.0 | 2000.0 | 2000.0 | 2000.0 | 2000.0 |
| - Buildings | 7284.0 | 7284.0 | 7284.0 | 7284.0 | 7284.0 | 7284.0 | 7284.0 |
| - Production equipment | 60478.0 | 61415.5 | 62358.0 | 63290.5 | 64228.0 | 65165.5 | 66102.0 |
| - Transport equipment | 1200.0 | 1200.0 | 1200.0 | 1200.0 | 1200.0 | 2400.0 | 2 00.0 |
| - Office equipment | 500.0 | 500.0 | 500.0 | 560.0 | 500.0 | 500.0 | 500.0 |
| - Total fixed assets | 72412.0 | 73349.0 | 74287.0 | 75224.5 | 76162.0 | 78299.0 | 79236.0 |
| Less-Accumulated depreciation | - | 6862.0 | 13724.0 | 20586.0 | 27448.0 | 34310.0 | 41172.0 |
| Total net fixed assets | 72412.0 | 66487.0 | 60563.0 | 58638.0 | 48714.0 | 43989.0 | 38064.0 |
| Other Assets | | | | | | | |
| - Pre-operating expense | 3000.0 | 3000.0 | 3000.0 | 3000.0 | 3000.0 | 3000.0 | 3000.0 |
| - Training and start-up | 2800.0 | 2800.0 | 2800.0 | 2800.0 | 2800.0 | 2800.0 | 2800.0 |
| - Interest during construction | 4008.0 | 4008.0 | 4008.0 | 4008.0 | 4008.0 | 4008.0 | 4008.0 |
| Total other assets | 9808.0 | 9808.0 | 9808.0 | 9808.0 | 9808.0 | 9808.0 | 9808.0 |
| Less-Accomulated amortization | - | 675.0 | 1314.0 | 1971.0 | 2628.0 | 3285.0 | 4942.0 |
| Total net oter assets | 9808.0 | 9151.0 | 8494.0 | 7837.0 | 7180.0 | 6523.0 | 4866.0 |
| Total assets | 95684.0 | 100220.0 | 102306.0 | 105522.0 | 109351.0 | 113862.0 | 119016.0 |
| Liabilities and shareholders equity | | | | | | | |
| Current liabilities | 2839.2 | 5339.2 | 5639.0 | 5639.0 | 5639.0 | 5639.0 | 5639.0 |
| - Account payable (trade | - | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 |
| - Currently maturing L.T. Debt | - | 11339.2 | 11639.0 | 11639.0 | 11639.0 | 11639.0 | 11639.0 |
| Total current liabilities | 54000.0 | 48000.0 | 42000.0 | 36000.0 | 30000.0 | 24000.0 | 18000.0 |
| Long term debt | 32845.0 | 32845.0 | 32845.0 | 32845.0 | 32845.0 | 32845.0 | 32845.0 |
| Shareholders equity: | | | | | | | |
| Capital stock | - | 8036.0 | 15822.0 | 25038.0 | 34877.0 | 45378.0 | 56532.0 |
| Net retained earning accumulated | 32845.0 | 40881.0 | 48667.0 | 57883.0 | 67712.0 | 78223.0 | 89377.0 |
| Total shareholders equity | 9568 .0 | 100220.2 | 102306.0 | 1055 .0 | 109351.0 | 113862.0 | 119016.0 |
| Total liabilities and shareholders equity | | | | | | | |

## Estimated Profit and Loss Statement
Rs(000)

Table 43

| | Year After Start-up | | | | | |
|---|---|---|---|---|---|---|
| | 1st | 2nd | 3rd | 4th | 5th | 6th |
| A. Net Sales | 51000.0 | 57000.0 | 60000.0 | 60000.0 | 60000.0 | 60000.0 |
| B. Cost of sales | | | | | | |
| - Variable cost | 18030.6 | 20174.0 | 21236.2 | 21236.2 | 21236.2 | 21236.2 |
| - Other supplies | 9265.0 | 10355.0 | 10900.0 | 10900.0 | 10900.0 | 10900.0 |
| - Fixed cost excluding depreciation | 2782.0 | 2782.0 | 2782.0 | 2782.0 | 2782.0 | 2782.0 |
| - Depreciation and Amortization | 7519.0 | 7519.0 | 7519.0 | 7519.0 | 7519.0 | 7519.0 |
| Total cost of sales | 37596.6 | 40830.0 | 42437.2 | 42437.2 | 42437.2 | 42437.2 |
| C. Gross Income | 13403.4 | 16170.0 | 17563.0 | 17563.0 | 17563.0 | 17563.0 |
| D. Operating expense: | | | | | | |
| General & Administr. Expense | 1266.8 | 1266.8 | 1266.8 | 1266.8 | 1266.8 | 1266.8 |
| E. Operating income | 12236.0 | 14903.2 | 16296.2 | 16296.2 | 16296.2 | 16296.2 |
| F. Other Income or Expense: | | | | | | |
| - Interest income | - | - | 229.5 | 709.5 | 1225.0 | 1724.0 |
| - Interest expense long t. loan | 4200.0 | 3780.0 | 3360.0 | 2940.0 | 2520.0 | 2100.0 |
| Total other income or expense - Net | 4200.0 | 3780.0 | 3130.0 | 2240.5 | - 1296.0 | - 376.0 |
| G. Net income before income tax | 8036.0 | 11123.0 | 13166.0 | 14055.5 | 15001.2 | 15920.0 |
| H. Income tax | - | - | - | - | - | - |
| Net income after income tax | 8036.0 | 11123.0 | 13166.0 | 14055.5 | 15001.2 | 15920.0 |
| I. Dividends for equity shareholders 30% | - | 3336.9 | 3949.8 | 4216.5 | 4500.0 | 4776.0 |
| Net income retained earning | 8036.0 | 7786.1 | 9216.2 | 9839.0 | 10501.5 | 11144.0 |

## Table 44

Estimated Interest Income
Rs(000)

| Beginning balance year | Annual cash balance | Invested in Certificate of deposit | Interest income 5% |
|---|---|---|---|
| 1 | 2839.2 | - | - |
| 2 | 2459.2 | - | - |
| 3 | 9929.0 | 4590.0 | 229.5 |
| 4 | 19829.0 | 14190.0 | 709.5 |
| 5 | 30255.0 | 24516.0 | 1225,8 |
| 6 | 40120.5 | 34481.0 | 1724.0 |
| | | | 2890 |

## Acknowledgement

Having this opportunity I wish to express my appreciation of the help information and cooperation given to me.

The Government Project Representative, Project Manager, Project Co-Manager, Counterpart Staff and Collegues in the Project.

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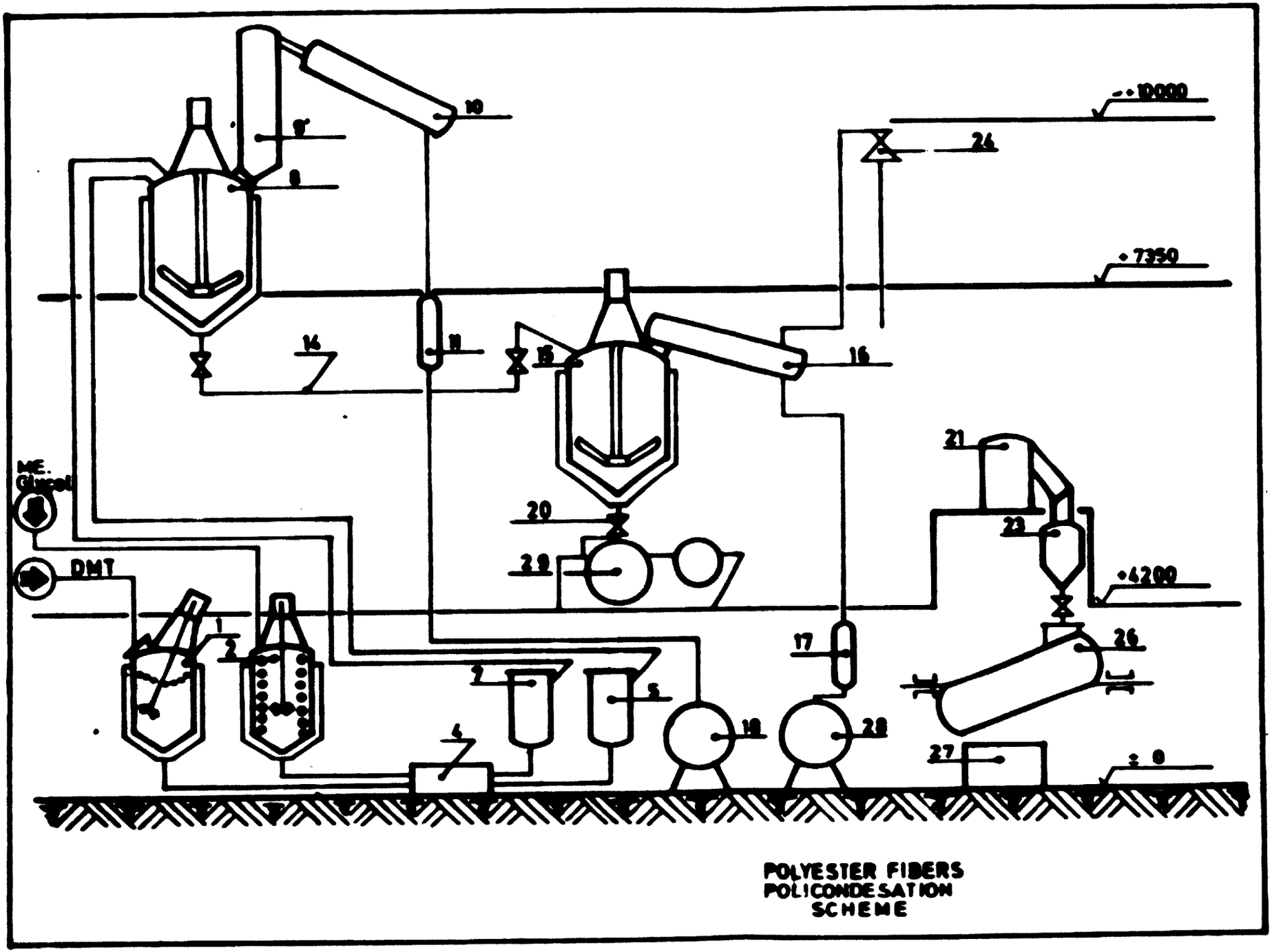
The Director and Staff members of Humphreys & Glasgow Ltd.,




POLYESTER FIBERS
POLICONDESATION
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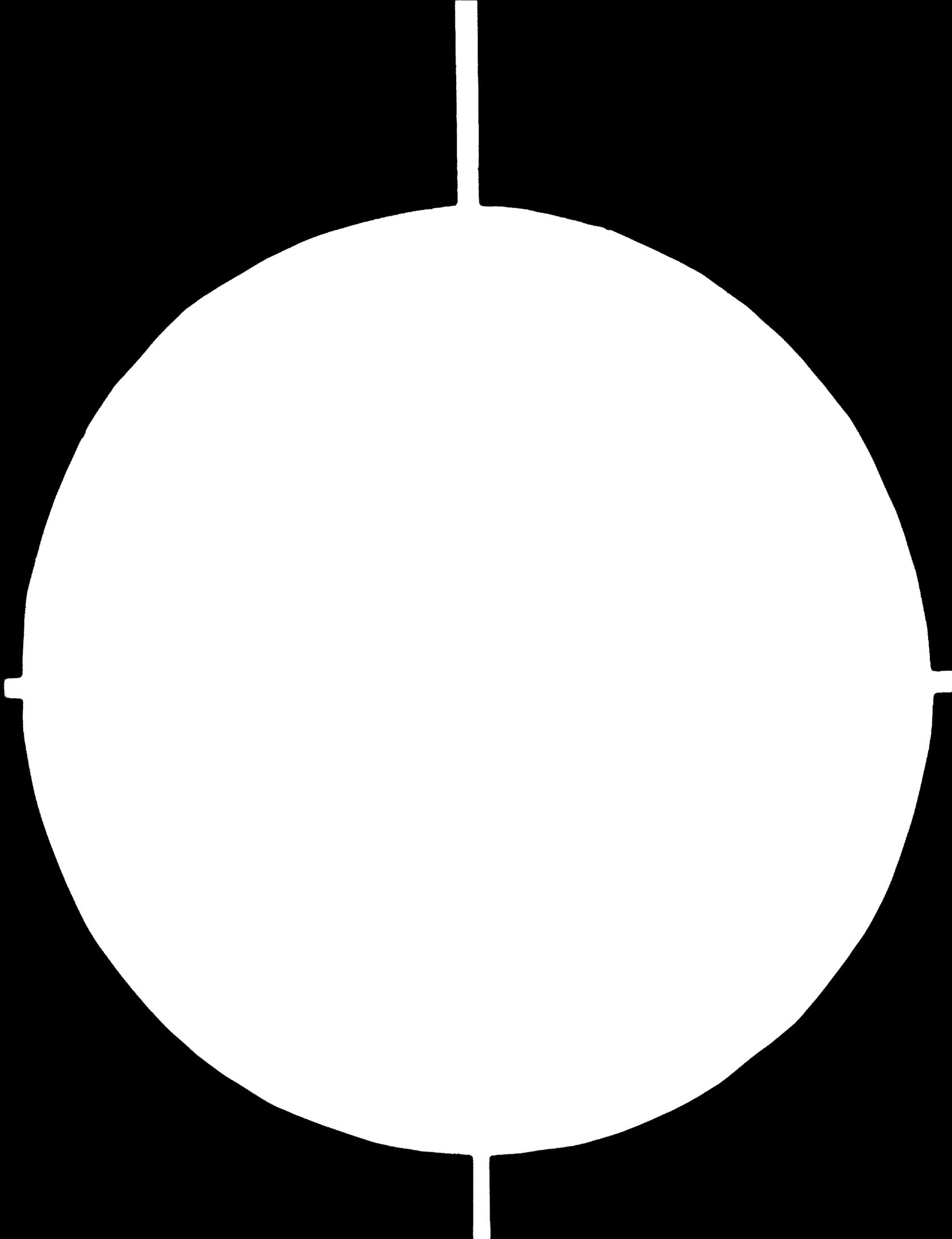
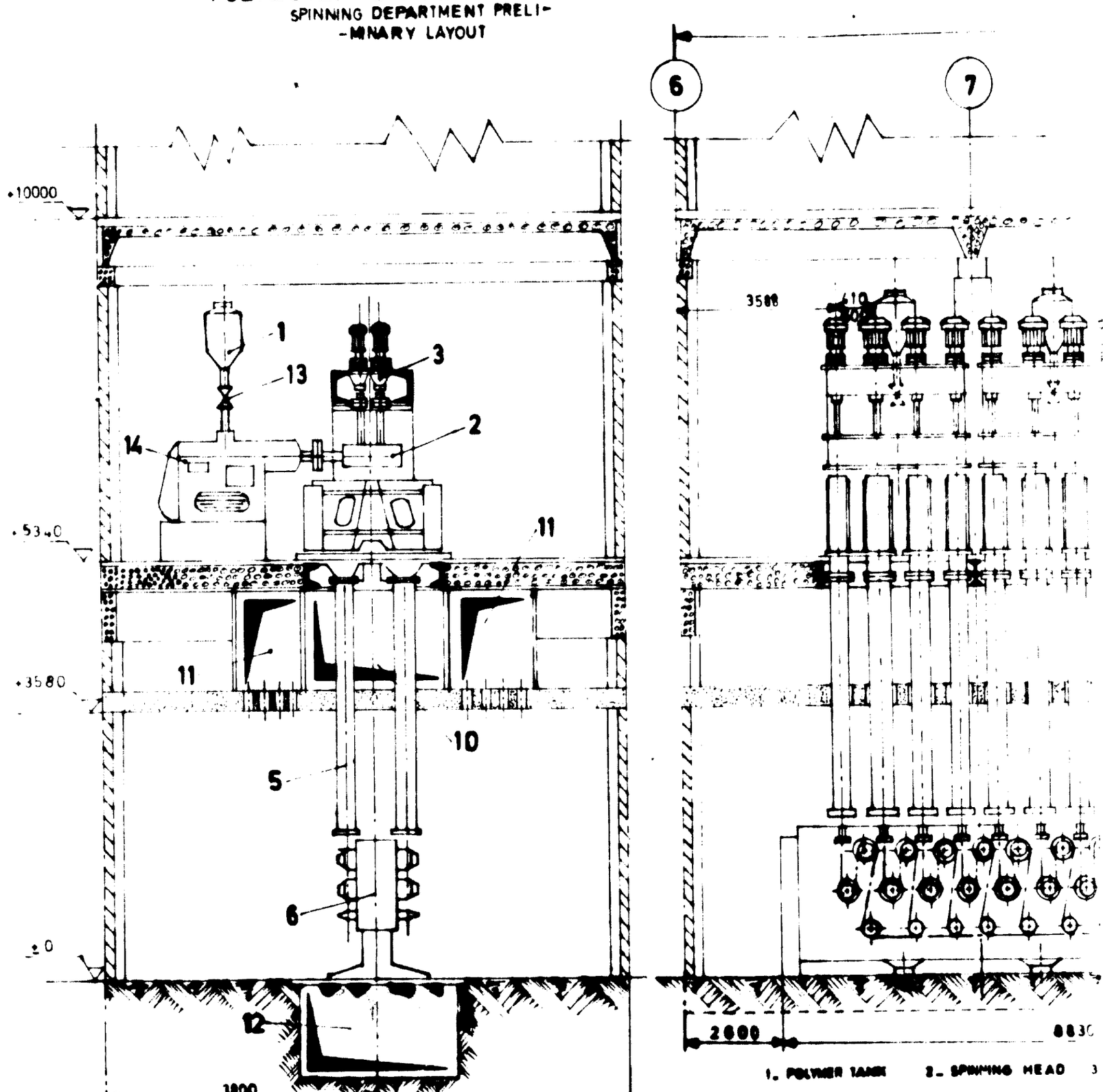
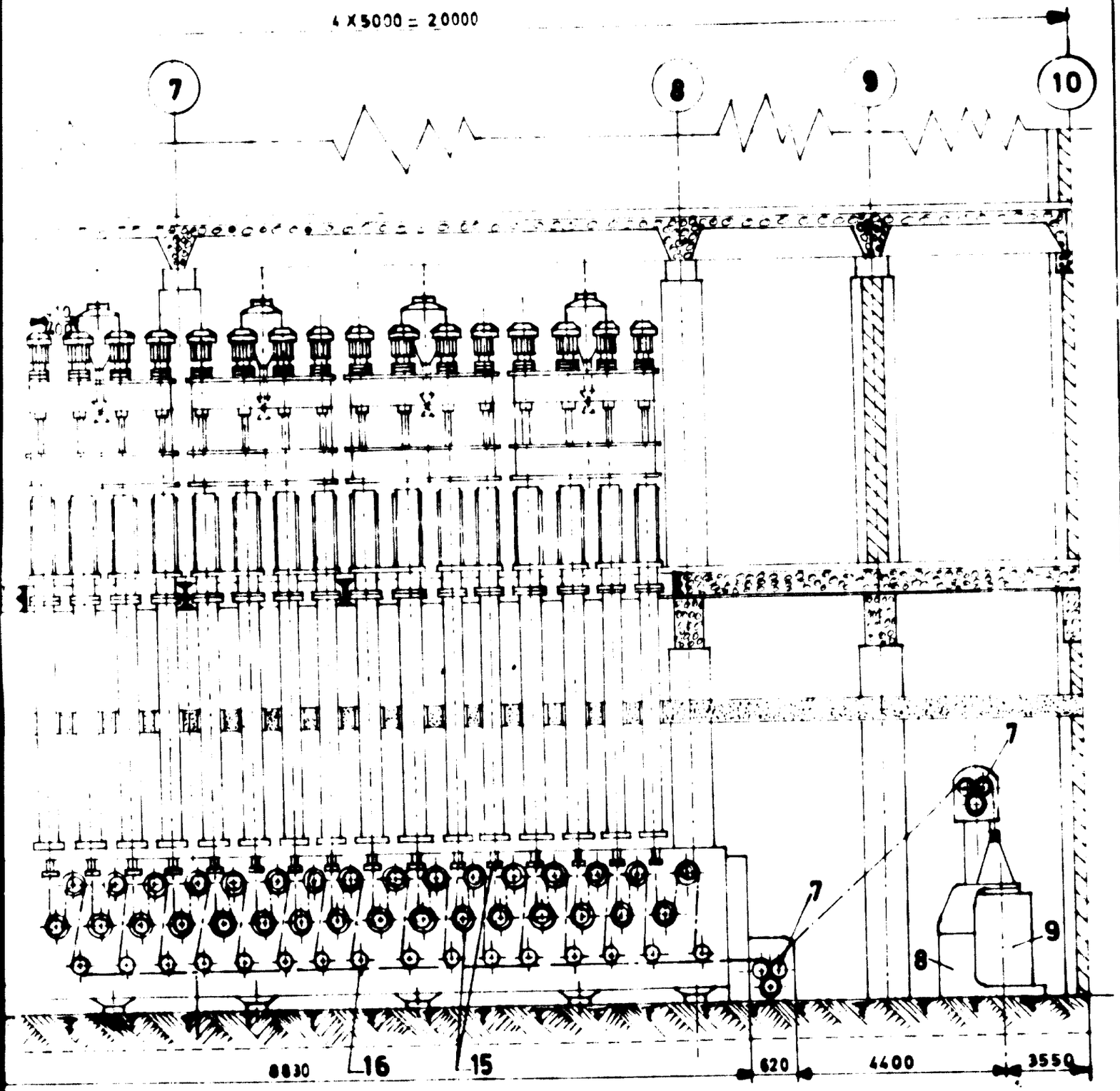


# POLYESTER STAPLE FIBER PLANT

SPINNING DEPARTMENT PRELI-
-MINARY LAYOUT



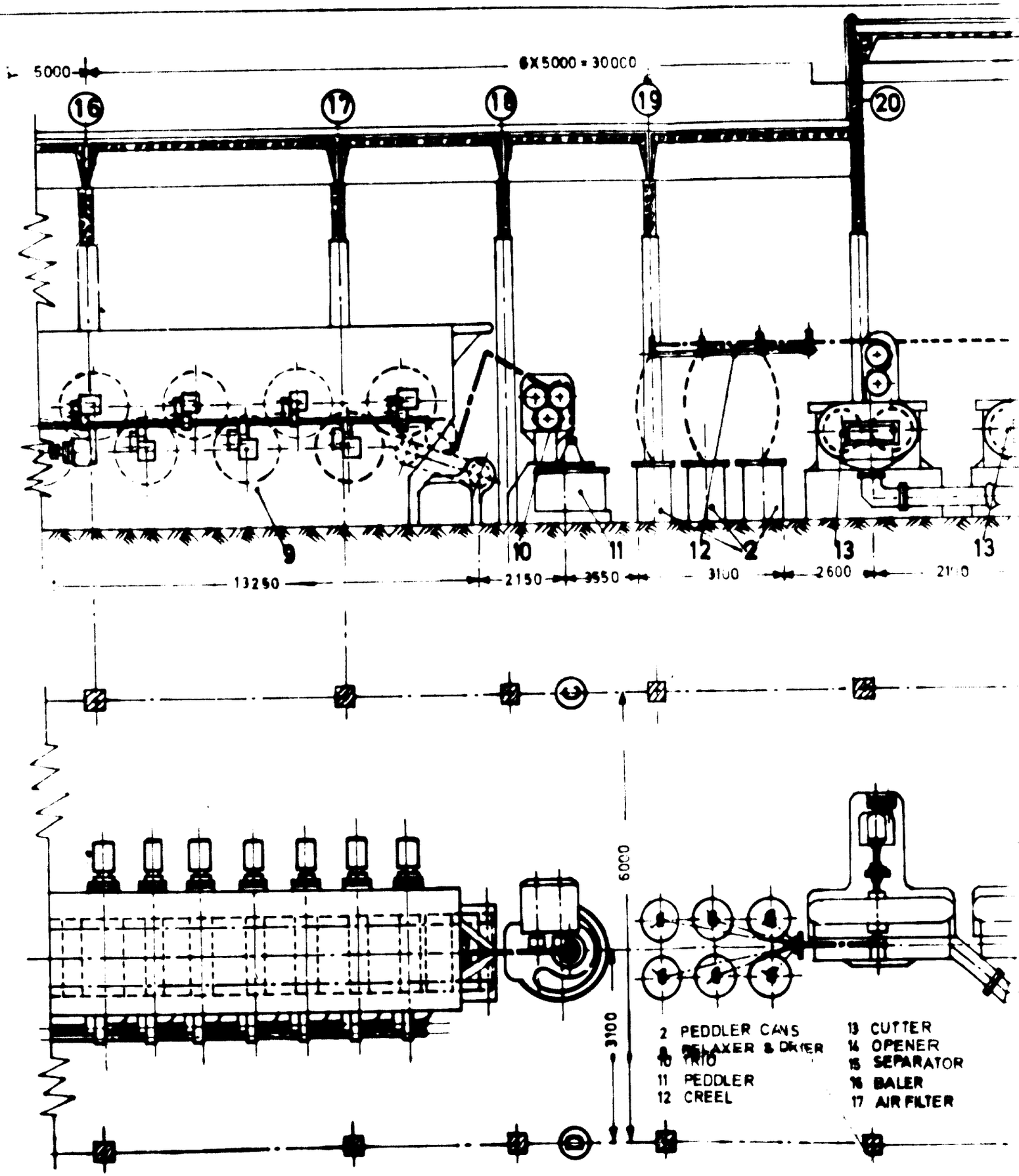

SECTION 1




YMER TANK 2_ SPINNING HEAD 3_ SPINNING PUMP DRIVE 4_ COOLING CHIMNEY 5_ SPINNING TUBE

E UP MACHINE 7_ [illegible] 8_ PEDDLER 9_ PEDDLER CAN 10_ AIR DUCT FOR COOLING CHIMNEY

DITIONED AIR DUCT 12_ RETURN AIR DUCT 13_ VALVE 14_ EXTRUDER 15_ FEEDING ROLLS 16_ YARN GUIDE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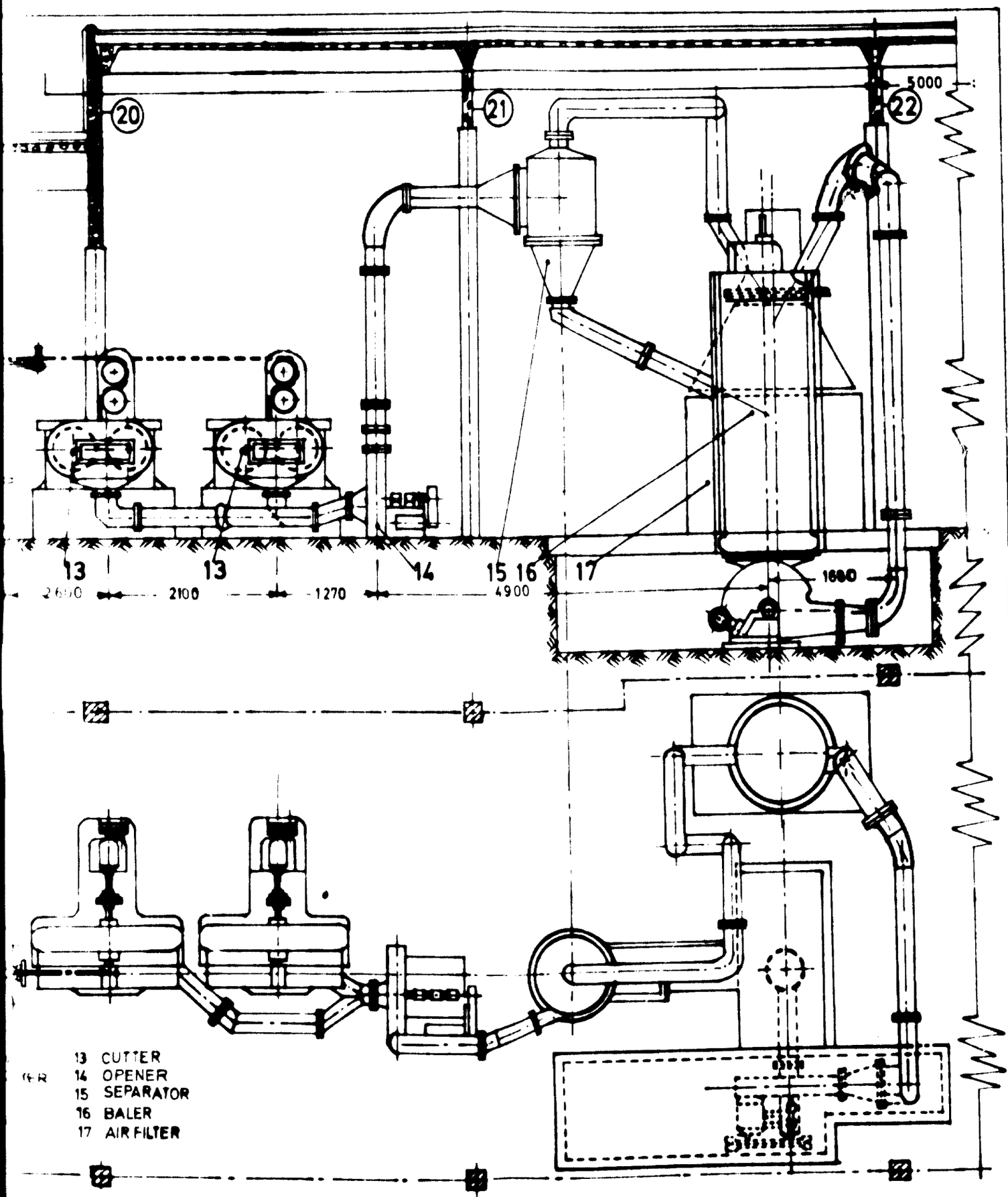
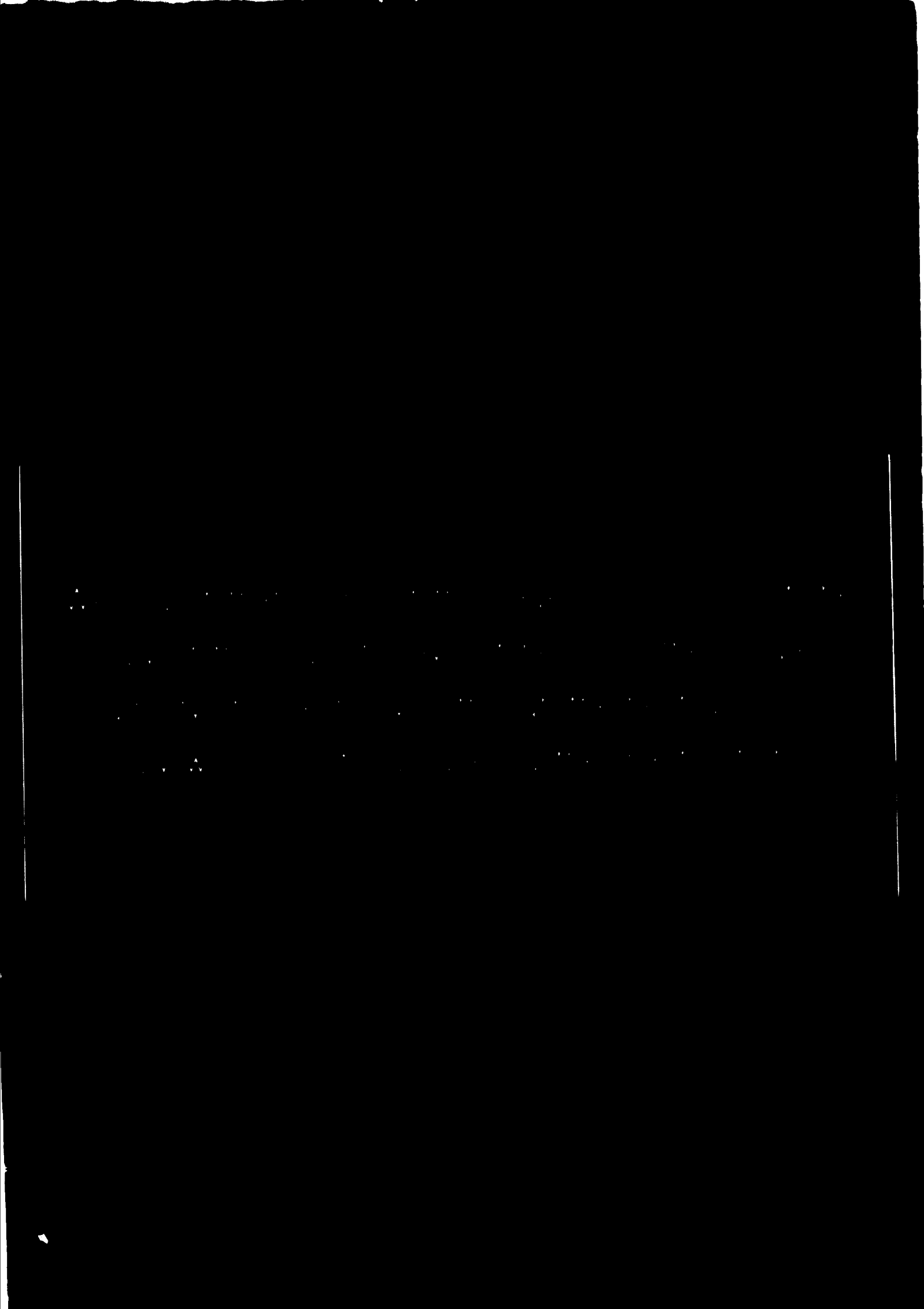
2 PEDDLER CANS
8 RELAXER & DRIER
10 TRIO
11 PEDDLER
12 CREEL
13 CUTTER
14 OPENER
15 SEPARATOR
16 BALER
17 AIR FILTER

SECTION 1




POLYESTER STAPLE FIBER PLANT
STAPLE CUTTING AND BALING PRELIMINARY LAYOT

SECTION 2



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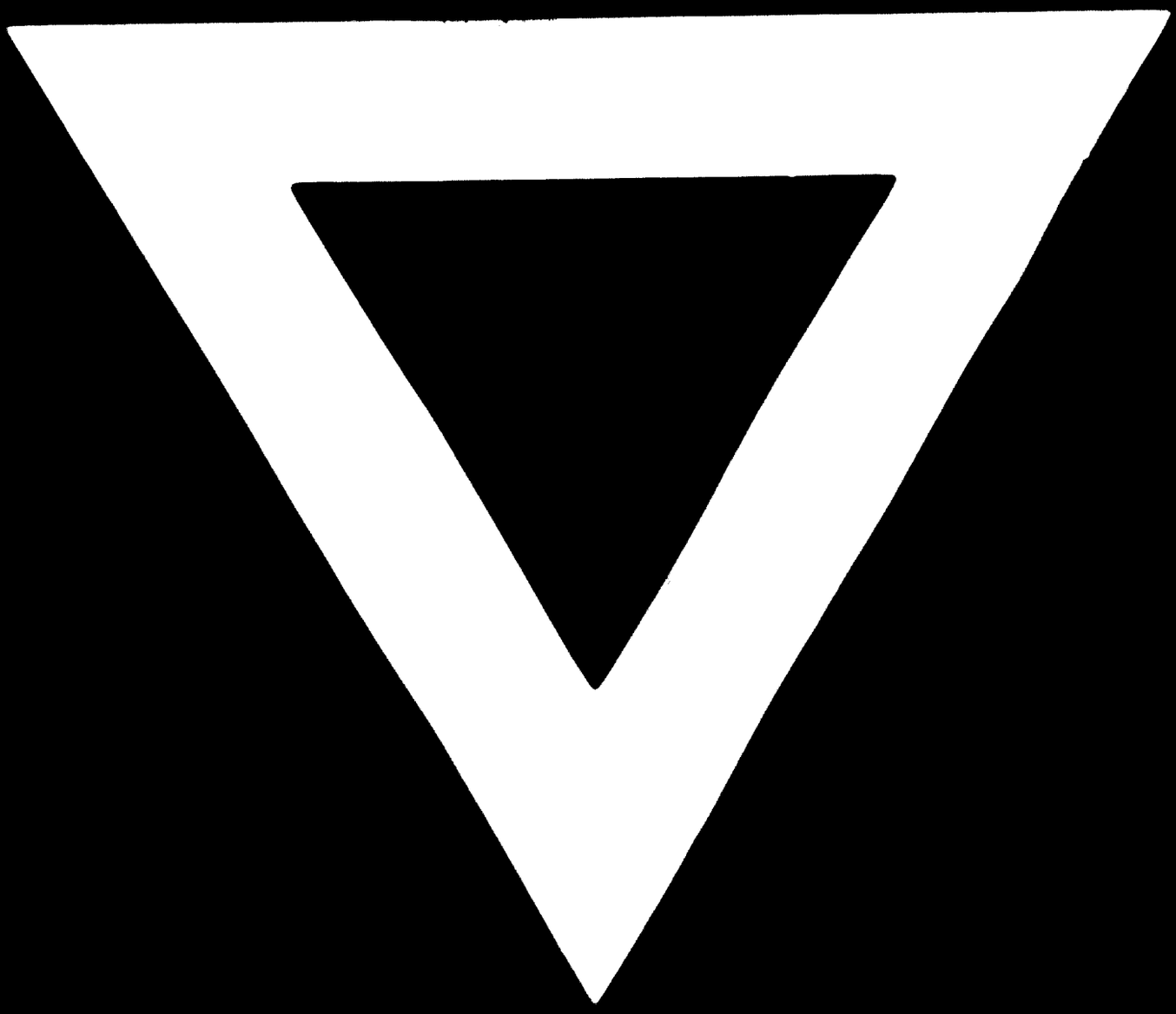

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ILL 5.5+10