# UNIVERSITY OF COCHIN

B. Tech COURSE

I N

RUBBER PROCESSING AND TECHNOLOGY

DISSERTATION SUBMITTED

B Y

P.T. MICHAEL

In Partial fullfillment of B.Tech Course in Rubber Processing and Technology

PROJECT: A Small Scale Unit to Manufacture Radiator Hoses for Automobiles.

University Reg. No: 61.

# CONTENTS



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# F O R E W O R D

The object of the Project Report is not to procure loans or other benefits, as is the usual case. Instead, this is prepared as a dissertation Report for obtaining a University degree, and hence the usual form has been augmented with many technical and other information, which I think is called for in this context.

I express my thanks to all those who assisted me in preparing this report especially to Mr. C.M. George, Project Officer,; Mr. E.V. Thomas, Deputy Director; Mr. P. U. George, Cost Accountant and Mr. M. K. Balagopalan Nair, Chemical Engineer of Rubber Board.

KOTTAYAM, 9 P. T. MICHAEL.
15th March 1977.

PART .A

# I N T R O D U C T I O N

## A.1. GENERAL:

Rubber radiator hoses generally used are either tubings or to a much greater extent as reinforced hoses, .

Rubber hoses are divided into 2 Types, delivery and section hoses. Delivery hose is used for handling water, air, gases, chemicals etc. under pressure. Section hoses, on the other hand, is used for carrying liquids, under negative pressure, ie. below atmosphere pressure .

The three basic componants of a hose are:-

1) Rubber lining, compounded to withstand the corrosive or errosive action of fluids or solids with which it comes into contact while in service.

2) The reinforcing or strength member, constituted by multiple plies of coated fabric, usually cut on the bias or one or more layers of braided cords. These are intended to withstand external and internal pressure. The cords are impregnated with rubber to promote adhesion and to prevent chafing.

3) Rubber cover designed to withstand the operating conditions.

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A.2. PROSPECTS:

The present scheme envisages production of 1 lakh numbers of radiator hoses in small scale sector. Radiator hoses, now in common use, are the so called shaped hoses. Good quality radiator hose is a primary requsite for the effiecent cooling of automobile engines. Some of the generally observed defects are leakages and poor cerculation due to collapsed hoses. Leats sometime develop around the hose connections and the rubber disintegrates on the inside and gets clogged in the tube, causing engines to heat. Also rubber may be deposited in bits in the scales collected in corners/pockets of a water jacket. The mass of insulating sludge, so collected, does considerable harm to the engine. So such conditions are detrimental to the engine and warrant the use of good quality radiator hoses, lasting for a reasonable service period.

Worn out hoses are only replaced and not repaired. The usual replacement frequency is once in an year.

A. 3. PRODUCT DESCRIPTION.

Quite analagous with other types of hoses, the coolant hose also consists of a lining to resist heat and the action of various coolants including antifreezing materials. A reinforcing ply is now applied by knitting or by fabric applied at bias angle. The whole is now slipped on to a former of appropreate shape. The cover is applied. These are now wrapped with strips of fabric and loaded in autoclave and steam vulcanised.

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A.4. TYPES AVAILABLE :

Usually the hoses shall be of the following types.

Type. 1. With rubber lining and cover resistant to hot ethylene glycol.

Type. 2. With rubber lining resistant to ethylene glycol and sxy synthtic rubber cover resistant to hot oil.

Type. 3 With lining and cover from synthtic rubber resistant to oil.

Radiator hoses are covered by I.S.I specifications .

A. 5. EXPANSION AND/OR DIVERSIFICATION PROGRAMME:

The proposed unit intend to manufacture around 1 lakh radiator hoses for different vehicles, annually. It is surmised from the market survey that there will not be any difficulty in selling this much production. Even with this much production the plant capacity is not fully utilised. So expansion possibilities could be attempted, if necessary. Also the machinery can be used for producing other types of hoses without considerable additional expenditure.

## PART B.

## M A R K E T I N G A S P E C T S

B.1. Evalation of Prospects.

Rapid expansion and grouth of automobile industry in India in recent years has given greater impetus to the production of automobile ancillary products in India. Although the industry was facing a set back in the last few years, rasigns of improvement are evident. Presently auto-ancillary parts including radiator hoses, are being exported also.

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B.2.USERS/CUSTMERS ANALYSIS AND DEMAND :

The main field of application is automotive industry and so far no satisfactory substitutions has been made in place of rubber rediator hoses. Enquires have reveled that there is good consumption for hoses, especially for heavy duty vehicles like lorries, busses, trucks and also for Jeeps. On an average two hoses are used in every vehicle and these are replaced once or twice anually . Jeeps have considerably high replacement frequency because their engines get heated up owing to the continuous use in severe operating conditions.

In the 1961-75 period some 1,42,700 Jeeps were produced. In the same period the production of commercial vehicles were about 5,67,000 and cars 4,75,000 considering that these vehicles are still under use the requirement of radiater hoses goes to several lakhs per year.

STATISTICS OF PRODUCTION OF JEEPS IN 61-75 PERIOD

| Year | Production | Cumulative total |
|---|---|---|
| 1961 | 7500 | --- |
| 1962 | 7600 | 15100 |
| 1963 | 8100 | 23200 |
| 1964 | 10300 | 33500 |
| 1965 | 10400 | 43900 |
| 1966 | 9770 | 53670 |
| 1967 | 7300 | 60970 |

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| Year | Production | Cumulative total |
|---|---|---|
| 1968 | 7800 | 68770 |
| 1969 | 9300 | 78070 |
| 1970 | 11000 | 89070 |
| 1971 | 12500 | 101570 |
| 1972 | 13070 | 114640 |
| 1973 | 10000 | 124640 |
| 1974 | 8100 | 133740 |
| 1975 | 9000 | 142740 |

It is seen that for every 5 years the rate of increase in production is 50000 approximately. Thus it can be safely concluded that by 1980 the number of jeeps will be about 2 lakhs. For Jeeps 2 hoses are required and so 4 lakhs hoses will be required by then. Considering that one hose will be replaced every year the anuual requirement for jeeps alone will be 2 lakhs.

Approximately the same pattern applies to other vehicles also, may be with a less replacement frequency.

The avilable statics show considerable fluctuations. Specific informations on capacity, production, demand are not available.

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| Statistical Data | | Production of Radiator Hoses in organised sector | |
|---|---|---|---|
| 1964 | 276000 | 1970 | 548000 |
| 1965 | 446400 | 1971 | 602000 |
| 1966 | 524400 | 1972 | 519000 |
| 1967 | 392400 | 1973 | 529000 |
| 1968 | 358000 | 1974 | 403000 |
| 1969 | 487000 | 1975 | 486000 |

* Organised sector only.

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B.3. SALES CHANNELS :

This, being an automobile ancilary part, can be destributed through number of automobile parts dealers, already in line, all over the country and through automobile workshops. Also supply on contract basis to large transport undertakings, military etc. can be thought of. Usually the commission on sales to destributors vary from 15-20%.

B.4. GEOGRAPHICAL EXTENT OF MARKET:

The product could be sold within the country, export possibilities also can be taken into account.

B.5. COMPETATIVE SITUATION :

B.5.1. Home Market. Most of the units producing radiator hoses are located in North India. There are almost no units producing this item in Kerala. So home market can be reasonably exploited.

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B. 5.2. Export Market: Hoses including radiator hoses are now being exported to more than 35 countries of the world.

## PART C.

## PRODUCTION REQUIREMENTS

C.1 General : The basic requirements of any industrial undertaking are the same. They apply to hose production also.

C.2. Location: Design of a production system has got direct bearing an location, and the resulting physical factors affect the capital and operating costs and sometimes the productivity also. Again, plant once located is relatively immobile.

Site selection is of paramount importance from the following points of view.

1) Physical - Availability of land, building etc.
2) Infrastructural - availability of cheap and abundent supply of power, water etc.
3) Service facilities - transportation, communication facilities.
4) Availability of and proximity to rau materials and market,
5) Availability of cheap labour - skilled as well as unskilled.

Besides location in an industrially backward area, can avail such fringe benefits like tax reduction loans at concessional rates, 10% subsidy in fixed investments .

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Alternate choice is to locate in an industrial estate, where many facilities will be available. Some of the advantages include:-

1) Bult up area is available at a nominal rent.
2) Undue delay in getting power connections etc. are avoided.
3) Overhead expenses are curtailed.
4) Transport, communication facilities are already available.
5) Infrastructural requirements are already provided.
6) In an industrial estate like changanacherry, solely meant for rubber & plastics, the helps of common service facility centre can be had.

In the present case, the market is vide spread and so the approach is from physical facilities available and concessions available. A place in Kerala xiii (Kottayam) will suit the requirements of cheap and uninterrupted supply of power, r rau-materials, labour etc.

C.3. BUILDING:

Advantages of natural illumenation flexibility of layout, easier handling of materials all should be taken into account in building construction.

The total building area is 2500 sq.ft. The area available is split into the following departments.

| | |
|---|---|
| Office | Dough Preparation |
| Store | Spreading room |
| Mixing Dept. | Building Section |
| Extrusion Dept. | Curing Section. |

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C.4. PLANT LAYOUT:

Following points are taken into account in fixing layout.

1. Material handling should be minimum.
2. Uninturrupted flow of material.
3. Expansion at a later date which should devetail into existing operations.

A layout is given in Appendix IV.

C.5. RAW MATERIAL REQUIREMENTS:

Raw materials used are indigenously available and some are locally available. The total raw material requirements per annuam is Rs. 2,52,000, based a on current price.

The ingredients are appended below:-

1. Polymer:- Basic polymers used are SBR, natural rubber and sometimes CR .
2. Fillers: China clay, whiting, GPF black.
3. Accelerators: MBTS, TMT.
4. Activators : Zinc -Oxide, Stearic acid .
5. Process aids : aromatic oil.
6. Tackifiers : Pine tar
7. Curatives : Sulfur
8. Solvent oil :
9. Fabric - industrial clothing.
10. Antioxidants - Fletol, Ketone amine Condensate.

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C.6 QUANTITY REQUIRED AND PRICE.

The quantity of raw materials required are computed based on some standard sizes available in the market and annual production, and is given in Annexure I .

The raw material price also given in annexure I.

C.7. SOURCE OF SUPPLY:

Mostly available from agents and representatives in Kerala, so that orders can be easily placed and followed up. A list of suppliers are given in Appendix I .

C.7.2. TERMS OF PURCHASE:

Raw material purchase is done through banks . The purchased material will be kept in banks godown, and can be released as and when required, an payment of cash. The total amount has to be paid back within stipulated period. All materials purchased will be pledged to the abnk.

C. 8. PLANT & MACHINERY:

The machinery size, capacity and number are primarily determined by production capacity. Machinery required are listed below:-

1. Mixing mill 12" x 30" size, 30Hp motor with reduction gear and other accesorics.

   The capacity is 15 Kg. and the mill can mix the required quantity of compound within two shifts and has capacity excess.

2. $2\frac{1}{2}$" extruder with 8Hp motor.

3. Spreading machine 5' x 18' , steam heated, with 4 Hp motor.

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4. Ruleaniser 4' x 10' size, with trollys and other accesories.
5. Boiler 150 Kg/Hr with pumping wm motor and all accesories.
6. Air compressor 100 psi , 10 cfm.
7. Churning mill 40 gal.
8. Pumps
9. Balances
10. Building tables, hand tools, Mandrls etc.

SOURCES of supply givign in appendix II.

C.8.1. TERMS OF PURCHASE:

Terms of purchase may vary from one manufacturer to another . However generally speaking the rules are as follows.

1. Quotations are invited from suppliers and lowest bidder selected.
2. Quoted prices are exclusive of taxes, duties, packing, transporting charges etc.
3. 30% of the price is to be paid in advance and the remaining at the time of purchase.
4. Supplier has the right to cancel, change the delivery date, price due to unfore seen reasons.
5. Purchaser has the reight to inspect the machinery.
6. Warranty against defects assured.
7. Liabilities passes on to customer immediatly after purchase and any shortage should be notified within a week.
8. Normal delivery time is 2-5 months.

The current prices of machinery are given in Annexure.

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C.9. PERSONNEL REQUIREMENTS:

Administrative & Technical staff are as shown. Details given in ANNEXURE III.

| | No. |
|---|---|
| 1) Manager cum chemist | 1 |
| 2) Clerk - cum - typist | 1 |
| 3) Sales assistants | 2 |
| 4) Peon | 1 |
| Total | 7 |

Labour force required is hown below:-

| Department | Shifts | U.S. | S. | S.S. | Others |
|---|---|---|---|---|---|
| Mixing | 2 | 2 | 2 | -- | -- |
| Extusion | 1 | 1 | 1 | -- | -- |
| Spreading | 1 | 1 | 1 | -- | -- |
| Boiler operator | 1 | -- | 1 | -- | -- |
| Building | 2 | -- | 2 | 7 | -- |
| Curing | 1 | 1 | 1 | -- | -- |
| Fabric cutting | 1 | 1 | -- | -- | -- |
| Supervisors | 2 | -- | -- | -- | 2 |
| | | 6 | 8 | 7 | 2 |

U.S. UNSKILLED
S Skilled
S.S. Semi-skilled

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C. 10. UTILITIES :

Utilities include water electrical power and steam.

1) Water: Profuse quantities of water is needed in the factory for cooling mixing mills, extruder etc. and for producing steam and for toilet purpose.

2. Power: Electrical power can be tapped from a lowtension line as H.P. requirement is less. In industrial estates power connection is already available. Power requirement is given below:-

| | HP | Shifts. |
|---|---|---|
| Mixing Mill | 30 | 2 |
| Extruder 2½" | 8 | 1 |
| Spreading Machine | 5 | 1 |
| Churning mill | 4 | 1 |
| Water pump | 3 | 1 |
| Boiler | 5 | 1 |
| Air Compressor | 2 | 1 |
| | 57 | |
| Light, Fans etc. | 2 | 2 |
| Total | 59 | |

Power consumption is calculated in KWH . The HP of single/double/three shift machines are calculated and totalled and assuming 70% load factor, the actual power consumption calculated.

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| | HP | Hours | KWH |
|---|---|---|---|
| Single shift | 27 | 8 | 112.8 |
| Double Shift | 32 | 16 | 267.2 |
| Three shift | --- | --- | --- |
| | | | 380.00 |

Annual consumption - 1,14,000 KWH

Cost of Electrical Power at Rs. 0.15 per KWH.

= Rs. 17,100

3. STEAM : Steam is used for vulacnisation . Boiler capacity is 150 Kg/Hr. and the autoclaive is of size 4' x 10'. Autoclave work for 2 1 shift with a maximum working pressure of 45 psi. The steam consumption , giving all allouance, is calculated as 100 Kg./Hr. The effiecency of the boiler is assumed to be 100 Kg. of steam for 10Kg. of oil . Therefor furnace oil requirement per shift of 8 hours is 80 litres.

Annual requirement of oil - 24,000 lits.

Cost at Rs. 1.10 - Rs. 26,400.

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## PART .D.

## PROCESS OF MANUFACTURE

### D.1 COMPOUNDING:

SBR 1502 is used in cover and lining compounds as it has got improved heat resistance and resistance to coolant liquids, when compared to natural rubber. In spreading compound NR is used with advantage. Also silica, china clay etc. provide reasonable heat resistance. Heat resistant anti-degradants are also used.

### D.2 . PROCESS IN BRIEF:

Mastication and Mixing .

Of the rubbers used, NR has to be pre-masticated, to suit it for compounding.

The rubber is banded on the mill and when smooth band is formed other ingreeients like zine oxide, stearic acid, balck filler, accelerators and finally Sulfer ~~should~~ are added and compounded. Mixing time should be enough to get good dispersion without affectihg productivity.

The tube and cover compounds are first mixed and the cover compound sheeted out of the mill. Both compounds are matured for some time. The dough compound also is mixed and kept seperately.

D.2.1. EXTRUSION: The tube compouned is prewarmed in mill and the extruder is fed in strip form manually. The extruder is fitted with dies of varying sizes to produces linings of required cross section.

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D.2-2. SPREADING: The spreading compound is prepared in churning mill . The compound is well masticated to a low viscosity and fed into mixer, with solvent, and mixed well to get a homo geneous dought of viscosity, low enough to be spreaded.

The fabric is spread, continuously on the spreader, the compound being applied, behind the blade as it posses over the roll. The spread fabric is dried and wound up on rolls with liner in between. The spread fabric is cut in bias in required size.

D-2-3. BUILDING OPERATIONS. The extruded tube of required diameter, cut into specified lengths is blown onto the mandrel of appropriate shape, using compressed air. (Radiator hoses are often shpaed hoses and so shaped two piece mandrels are used for easy removeal of mandrel after curing.)

The required plies of fabric is then applied over the tube carefully to prevent air entropment. The rubber cover is then applied over the assembly and the whole is well consolidated. Then the hose is firmly wrapped with wet cloth tape as strip to give a cloth marked finish.

D.2-4. VULCANISATION:

The wrapped hoses are placed in tree formation around a central stand and placed on trolly and pushed into autoclave. Steam pressure is alloued to buildup and after curing the hoses cooled, cloth wrapping removed and mandrels taken out. The finished hoses are inspected for defects and packed.

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A flouchart is given in appendix III.

A formulation is given in appendix V.

D.3. QUANTUM OF PRODUCTION.

The total production is 1,05,000 number of radiator hoses for jeeps, Ambassador, Benz,(Tata) Bedford, Fargo, Fiat, Leyland.

D.4. PROCESS LOSS:

As in any other industry process loss is bound to occur. All attempts are made to minimise it to assure minimum production cost. A process loss of 5% is accounted for, in calculating material cost.

D. 5. QUALITY CONTROL & INSPECTION PROCEDURE:

Quality control operations are vital in any undertaking. Quality control avoids variations due to assignable causes, thus assuring uniformity and consistancy in products. Inspection and quality control measures are adopted right from purchase, through the in process stages, until the product is despatched.

Radiator hose has got I.S.I. specifications and so the product is tested as per I.S.I. specifications and standards. The ~~ISSI~~ I.S.I. marking is a symbol of quality and so approval by I.S.I. abtained. as early as possible.

Tests done are Tensile Strength , Elongation at Break of lining and cover, their thickness, adhesion accelerated agening test, I.D, O.D, swelling tests, proof pressure test etc.

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## PART . E

## S E L L I N G & D I S T R I B U T I O N

E. 1. MARKETING CHANNELS: The most commenly used sales methods are direct sixes sales and through agents and commission agents only large manufacturers can afford to open sales depots. This beings a small scale project, the quantum of production is small and so selling through agents on commission basis is preferred. Rediator hose, being an auto- ancillary, item can be sold trhough the large number of automobile parts, dealers, already in the line and through auto work shops. Besides, supply of contract bais to big transport under takings and to military could be tried. Since , there is no unit in kerala, particular care is taken to cater the local demand.

Two sales assistants are employed.

E.2. PRICING: The pricing policy adopted is to provide a reasonable profit, at the same time the product should be viable in the market, with price level at par with that of competitors or preferably below . The prices are exclusive of duties and taxes.

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PART . F

# F I N A N C I A L  A S P E C T S

## MANUFACTURING COST:

Manufacturing cost include all direct and inderict cost encurred in the manufacturing operation. This consists of cost of row materials, utilities, plant overhead, administrative expenses, .

### F. 1. RAW MATERIALS:

Total raw material requirement as given in Annexure I amounts to Rs. 2,52,000 per annum.

### F.2. UTILITIES:

Total cost of utilities as given in annexure IV is Rs. 43,500.

### F. 3. DIRECT PERSONNEL COST:

This include cost on direct labour and direct supervising staff.

Direct personnel cost
+ 15% benefits Rs. 99360.

### F. 4. ADMINISTRATION & OTHER OVERHEADS:

This will include maintance repair, general administrative expenses etc. and amounts to Rs. 51,400 per year.

Details given in Annexure V.

### F.5. FIXED CHARGES :

This included depreciation insurance, interest on loand etc. and amounts to Rs. 91,800.

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F. 6. FIXED CAPITAL :

Fixed capital include the sum of the expenses incurred for land, machinery, preoperative expenses and isshown below:-

Details given in Annexure I

| | | |
|---|---|---|
| 1. | Land & Building | Rs. 1,05,000 |
| 2. | Plant & Machinery | 2,94,500 |
| 3. | Preoperative expenses | 15,500 |
| 4. | Other fixed assets | 12,000 |
| | Total | Rs. 4,27,000 |

F. 7. WORKING CAPITAL:

Working capital means the working expense for a definite period of time (usually 3 month) during which time the product is launched into market and the sales value will be returned . This include raw materials, wages and other overhead expenses. The working capital requirement is given in Annexure Vi and is estimated to be Rs. 1,11,500.

F. 8. TOTAL FINANCIAL REQUIREMENTS:

This is constituted by the sum of fixed capital and working capital .

| | Rs. |
|---|---|
| Fixed Capital | 4,27,000 |
| Working Capital (3 months) | 1,11,500 |
| | 5,38,500 |

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## PART . G

## F I N A N C I N G  P L A N

The entrepreneur may not be in a position to shoulder the entire expenses, involved in starting a factory. Several financial Institutions are now providing financial assistance on elabrate terms.

Certain such institutions are:-

1) National Small Industries Corporation:

Machinery on hire purchase at 7% instn interest, repayable in 7 years.

2) State Small Industries Corporation:

Offers machinery on hire purchase on a margin money of 20% Repayment starts after 2 years and payable within 7 years. Interest 7½% .

3) Kerala State Financial Corporation:-

Offers financial assestance as cash to small scale industries. They provide 100% on machinery and 75% on building cost. Interest 7-10% repayment to be completed within 10-12 years.

4) Commercial Banks:

Nationalised banks provide loans for machinery. Loans are given on 25% margin money and 12-16% interest . For working capital any amount can be taken with repayment period 3 years.

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**Financing of the Project:**

Gross capital requirements of Rs. 5,38,500 is realised in the following manner.

**Borrowings:** The whole machinery cost of Rs. 2,56,000 is taken from Kerala Financial Corporation

75% of land & Building cost of Rs. 75,000 also drawn from KFC.

Working Capital is taken from Nationalised Bank.

The rest is own fund.

| | |
|---|---|
| Term loan from KFC | Rs. 3,31,000 |
| Working Capital loan from Bank | Rs. 1,12,000 |
| Own Capital | Rs. 95,500 |
| | Rs. 5,38,500 |

## PART . H.

## P R O F I T A B I L I T Y

The Project under consideration is having a gross profit of Rs. 1,62,820 and net profit of Rs. 81,400.

The Capital investment is Rs. 5,38,500 and so this worksout to be 15.1% on total capital. The percentage of return on own capital of Rs. 98,500 is 85%.

Profit ratios on total capital, own capital, total sales turnover are worked out in Aneexure XII.

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## PART I.

## E C O N O M I C  V I A B I L I T Y

Economic viability of the project can rightly be judged Rar t from the profit ratios and from the payback period.

Interest Commitments :

| | Rs. |
|---|---|
| 7.5% on term loan from KFC | 24,800 |
| 16% on Working Capital loan from Bank | 17,900 |
| | 42,700 |

The term loan should have to be paid back within stipulated period with interest. As the interest commetments are lessened the ability to pay back increases, because of more inflow of cash. Payback period is calculated based on 1st years surplus.

The pay back period is workedout to be 3 years as shown in ANNEXURE XIII.

## PART J.

## S O C I A L  B E N E F I T S

Commencing an industry is obviously benefitial to the entrepreneur. From a uider perspective of national development also his attempt is praise uothy. Some of the several benefits are:-

1) It provides more employment opportunities.
2) Utilisation of capital/skill.
3) An attempt to mobilise resources so as to have more equitable distributation of national wealth.
4) Contribute to nations revenue earnings.

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## PART K.

## C O N C L U S I O N

Scheme can be given in brief as follows:

| | | |
|---|---|---|
| 1. | Fixed Capital | Rs. 4,27,500 |
| 2. | Working Capital | Rs.1,11,500 |
| 3. | Total Capital | Rs.5,38,500 |
| 4. | Plant & Machinery | Rs.2,94,500 |
| 5. | Building Area | 2500 $Ft^2$ |
| 6. | Labour force | 23 |
| 7. | Staff | 5 |
| 8. | Annual Production | 1,05,000 Radiator hoses |
| 9. | Net profit | Rs. 81,400 |

The project is quite feasible and sound in all respects.

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## ANNEXURE II

### ANNUAL RAW MATERIAL REQUIREMENTS

| Sl.No. | Material | Price per Kg. Rs. | Quantity Required | Total Cost Rs. |
|---|---|---|---|---|
| 1. | S.B.R. | 8.50 | 10800 | 91,800.00 |
| 2. | Natural Rubber | 7.00 | 2700 | 18,900.00 |
| 3. | Sinc Oxide | 14.00 | 540 | 7,560.00 |
| 4. | Stearic acid | 12.00 | 160 | 1,920.00 |
| 5. | Silica | 4.40 | 4050 | 17,820.00 |
| 6. | GPF black | 3.75 | 2700 | 10,120.00 |
| 7. | PPtd. Cal. Carbonate | 1.20 | 6750 | 8,100.00 |
| 8. | Processoil | 9.00 | 1350 | 12,100.00 |
| 9. | pine tar | 5.00 | 675 | 3,350.00 |
| 10. | Flectol H | 31.00 | 100 | 3,100.00 |
| 11. | Keton- Ammine Condensate | 32.00 | 100 | 3,200.00 |
| 12. | China clay | 0.35 | 10125 | 3,800.00 |
| 13. | M.B.T.S. | 28.40 | 202 | 5,700.00 |
| 14. | T.M.T | 27.00 | 40 | 1,080.00 |
| 15. | Sulfur | 2.00 | 202 | 400.00 |
| | TOTAL | | 40789 | 1,89,000.00 |
| Cost of 14500 meters of fabric at Rs. 3/- per meter | | | | 43,500.00 |
| Cost of solvent oil | | | | 7,500.00 |
| | Total raw material cost | | | 2,40,000.00 |
| 5% Allowance(Raw material allowance & scrap loss) | | | | 12,000.00 |
| | | | | 2,52,000.00 |

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# ANNEXURE I.

## FIXED CAPITAL REQUIREMENTS

| | | Rs. |
|---|---|---|
| A. | LAND & BUILDING: | |
| 1. | 15 cents of land at Rs. 20000/- per Acre | 3,000 |
| 2. | Cost of 2500 sq.ft. of building | 87,500 |
| 3. | Cost of construction a watertank | 10,000 |
| 4. | Site levelling & other work | 4,500 |
| | | 1,05,000 |
| B. | MACHINERY | |
| 1. | Mixing Mill 12" x 30" size with 30 HP motor | 75,000 |
| 2. | Extruder, 2½" size wirh 8 HP motor | 18,000 |
| 3. | Spreading Machine, 60" x 18' with 5 HP Motor | 35,000 |
| 4. | Autoclave, 4' x 10' size with trollys & other accesories | 28,000 |
| 5. | Solvent Mixir, 40Gal. 5HP Motor | 10,000 |
| 6. | Boiler, 150Kg/Hr. | 45,000 |
| 7. | Air Compressor 100psi. | 15,000 |
| 8. | Mandrels of differnt sizes and shapes | 5,000 |
| 9. | Building tables hand tools etc. | 3,000 |
| 10. | Pump, 3HP, Pipes | 5,000 |
| 11. | Balances, 50 Kg & 5 Kg. | 5,000 |
| | Price escalation 5% | 12,200 |
| | | 2,56,200 |

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| | | |
|---|---|---|
| | B/F. | 2,56,200 |
| Transportation & Freight 3% | | 7,700 |
| Errection & Installation 5% | | 12,800 |
| Sales tax & Other taxes 7% | | 17,800 |
| | | 2,94,500 |

OTHER ASSETS:

| | |
|---|---|
| Furniture & equipments | 5,000 |
| Laboratoary equipments | 5,000 |
| Miscellaneous | 2,000 |
| | 12,000 |

PREOPERATIVE EXPENSES

| | |
|---|---|
| Travelling Expense | 1,250 |
| Postage & Tel. | 500 |
| Rent & Establishment | 1,000 |
| Legal charges | 500 |
| Interest on block loan 3 lakhs @ 7½%, 6 months | 11,250 |
| Miscellaneous | 1,000 |
| | 15,500 |

Contd....28

TOTAL FIXED CAPITAL

| | Rs. |
|---|---|
| Land & Building | 1,05,000 |
| Plant & Machinery | 2,94,500 |
| Other assets | 12,000 |
| Preoperative expenses | 15,500 |
| | 4,27,000 |

## A N N E X U R E I I I

## MANPOWER REQUIREMENTS.

DIRECT LABOUR:

| | | Rs. |
|---|---|---|
| Skilled | 8 x Rs. 350 | 2,800 |
| Semiskilled | 7 x Rs. 300 | 2,100 |
| Unskilled | 6 x Rs. 250 | 1,500 |
| Supervisors | 2 x Rs. 400 | 800 |
| | | 7,200 |
| Annual wages including 15% benefits | | 99,360 |

ADMINISTRATIVE & OTHER INDIRECT EXPENSES:

| | | |
|---|---|---|
| Manager cum Chemist | 1 | 800 |
| Clerk- cum - Typist | 1 | 400 |
| Sales men | 2 | 800 |
| Peon | 1 | 250 |
| | | 2,250 |
| Annual salary including 15% benefits | | 31,050. |

Contd.....29

## A N N E X U R E  I V.

### UTILITIES (ANNUAL)

| | Rs. | Rs. |
|---|---|---|
| POWER: | | |
| Rs. 0.15 x 114000 Kwh. | 17,100.00 | |
| FURNACE OIL: | | |
| Rs. 1.10 x 24000 litres | 26,400.00 | |
| | 43,500.00 | |

## A N N E X U R E  V

### ADMINISTRATIVE & OTHER OVERHEADS.

| | | |
|---|---|---|
| 1) | Maintance & Repair | |
| | 1% on building | 1,050.00 |
| | 5% on machinery | 12,800.00 |
| 2) | Administrative Expenses | |
| | a) Adm. personnel | 31,050.00 |
| | b) Postage & Tel. | 1,500.00 |
| | c) Legal & Audit | 500.00 |
| | d) Travelling Allowance | 2,000.00 |
| | e) Stationery & Supplies | 1,500.00 |
| | f) Miscellaneous | 1,000.00 |
| | | 51,400.00 |

Contd....30

## ANNEXURE VI

### TOTAL WORKING EXPENSE.

| | Rs. Ps. |
|---|---|
| Raw material | 2,52,000.00 |
| Utilities | 43,500.00 |
| Direct personnel Cost | 99,400.00 |
| Administrative & other overheads | 51,400.00 |
| | 4,46,300 |
| Working Capital for 3 months | 1,11,500 |

## ANNEXURE VII

### GROSS CAPITAL REQUIREMENT

| | |
|---|---|
| Total fixed capital | 4,27,000.00 |
| 3 Months working capital | 1,11,500.00 |
| | 5,38,500.00 |

Contd.....31

## ANNEXURE VIII

### FINANCING PLAN

| | Rs. Ps. |
|---|---|
| Term loan from K.F.C on land & machinery | 3,31,000.00 |
| Working Capital (3 months) | 1,12,000.00 |
| Own funds | 95,500.00 |
| | 5,38,500.00 |

## ANNEXURE IX

### OTHER FIXED CHARGES

| | |
|---|---|
| Depreciation on Machinery 15% | 38,400.00 |
| Depreciation on Building 5% | 5,200.00 |
| Depreciation on other fixed assets 10% | 1,200.00 |
| | 44,800.00 |
| Interest on term loan from KFC. Rs. 3,31,000 @ 7½% | 24,800.00 |
| Interest on working Capital from bank Rs. 1,12,000 @ 16% | 17,900.00 |
| Insurance 1% | 4,300.00 |
| | 91,800.00 |

## ANNEXURE X

### ANNUAL COST OF PRODUCTION

| | |
|---|---|
| Total working expense per annum | 4,46,300.00 |
| Othar fixed charges | 91,800.00 |
| | 5,38,100.00 |

Contd.....32

## ANEXURE XI

### ANNUAL SALES AND PROFIT

| | | | Rs. Ps. |
|---|---|---|---|
| Jeep | 40000 Nos | x Rs. 7.00 | 2,80,000.00 |
| Ambasador | 15000 Nos | x Rs. 3.50 | 52,500.00 |
| Bedford | 15000 Nos | x Rs. 7.00 | 1,05,000.00 |
| Fargo | 15000 Nos | x Rs. 7.50 | 1,12,500.00 |
| Benz.Type 1 | 20000 Nos | x Rs. 8.00 | 1,60,000.00 |
| Type 2 | 20000 Nos | x Rs. 3.50 | 70,000.00 |
| Type 3 | 10000 Nos | x Rs. 2.50 | 25,000.00 |
| Leyland | 10000 Nos | x Rs. 4.00 | 40,000.00 |
| Fiat | 10000 Nos | x Rs. 4.00 | 40,000.00 |
| | | | 8,85,000.00 |
| Less 20% commission | | | 1,77,000.00 |
| Net sales Turnover | | | 7,08,000.00 |
| Less 1% Sales expenses | | | 7,080.00 |
| | | | 7,00,920.00 |
| Less cost of production | | | 5,38,100.00 |
| Profit before taxation | | | 1,62,820.00 |
| Less tax incidence 50% | | | 81,410.00 |
| Net Profit | | | 81,81,410.00 |
| Rounded off to Rs. | | | 81,400.00 |

Contd....33

# ANNEXURE XII

## PROFITABILITY

1. **Rate of return on own Capital :**

| | |
|---|---|
| Net profit | Rs. 81,400.00 |
| Own Capital | Rs. 95,500.00 |
| Rate of return on own capital | - 85.2% |

2. **Rate of return on gross Capital:**

| | |
|---|---|
| Total employed capital | Rs. 5,38,500.00 |
| Net profit | Rs. 81,400.00 |
| Precentage return on gross capital | 15.1% |

3. **Rate of return on sales:**

| | |
|---|---|
| Annual sales turnover | Rs. 708,000.00 |
| Net profit | Rs. 81,400.00 |
| Percentage return sales turnover | 11.5% |

Contd.....34

# ANNEXURE XIII

## PAYBACK PERIOD

| | | Rs. Ps. |
|---|---|---|
| a) | Net profit | 81,400.00 |
| b) | Depreciation total | 44,800.00 |
| | Available surplus (a+b) | 1,26,200.00 |
| | Less drawings | 16,200.00 |
| | Amount ± used to payback | 1,10,000.00 |
| | Tern loan to be paid back | 3,31,000.00 |
| | ∴ Payback period | 3 years |

Contd.....35

# APPENDIX I

## RAW MATERIAL SUPPLIERS.

| SUPPLIERS | ITEM |
|---|---|
| 1. Synthetics & Chemicals Ltd.<br>New Great Insurance Building,<br>7, J.N. Road, Bombay.20 | SBR Rubbers |
| 2. United carbon Ltd.<br>Backbay Reclamation,<br>Bombay.20. | Carbon black |
| 3. I.C.I. (india) Ltd.<br>Rishra, Hoogly Dist,<br>W. Bengal. | Rubber Chemicals |
| 4. Bayer India Ltd.<br>Thana, Bomaby. | Rubber Chemicals |
| 5. M/s. Mindia Chemicals Ltd.<br>Lakefield House, Sprott Road,<br>Bombay - 400 021. | Rubber Chemicals |
| 6. Kamani Metallic Oxides Pvt. Ltd.,<br>Kamni Chembers, Nicol Road,<br>Bombay - 400 001. | Zinc Oxide. |
| 7. Godreg Soaps Pvt. Ltd.,<br>Vikhroli, Bombay.79 . | Stearic acid. |
| 8. Esso Standard Eastern Inc.<br>17, J Tata Road, Bombay.1. | Solvent Oil<br>Rubber Process oil |
| 9. Madura Mills Pvt. Ltd.<br>P.O.Box No. 35,<br>Madurrai, T.N. | Fabric. |
| 10. Hindustan China Clay works,<br>Pappiniserry, Cannanore. | China clay. |

Contd.....36.

# APPENDIX II

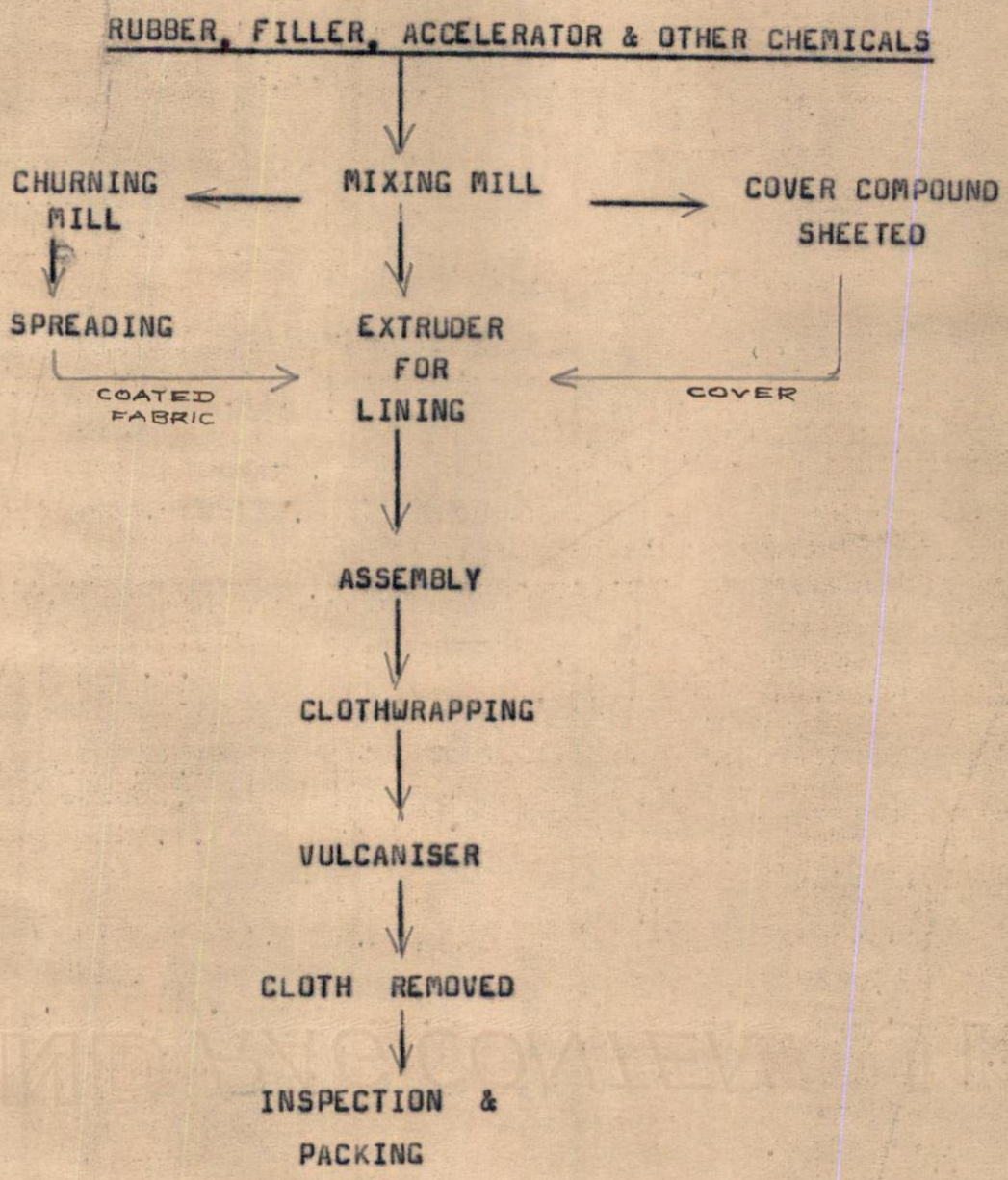
## LIST OF MACHINERY SUPPLIERS

| | SUPPLIERS | ITEM |
|---|---|---|
| 1. | Sohal Engg. Works,<br>Tulsi Pipe Road,<br>Off Haines Road,<br>Mahalaxmi, Bombay.400 013. | Mixing Mills<br>Extruders<br>Spreading Machines<br>Autoclaves. |
| 2. | Richardson & Cruddas Ltd.<br>Byculla Iron Works,<br>Bombay - 8. | Mixing Mills |
| 3. | Indian Expeller Works,<br>17A, Saitfaluadi,<br>Mazagon, Bombay.13. | " |
| 4. | Kelachandra Foundary,<br>Chingavanam, Kerala. | " |
| 5. | Blue bird Industries,<br>11, Bruce street,<br>Fort Bombay.1. | Boiler Mill<br>Spreading Machine<br>Churning Mill |
| 6. | Batliboi & Co.<br>Forbes Street,<br>Fort, Bombay.1. | Boiler<br>Air Compressor. |
| 7. | Warsha Boilers Pvt. Ltd.<br>Green House, Green street,<br>Bombay. 400 001. | Boilers. |

Contd.....37.

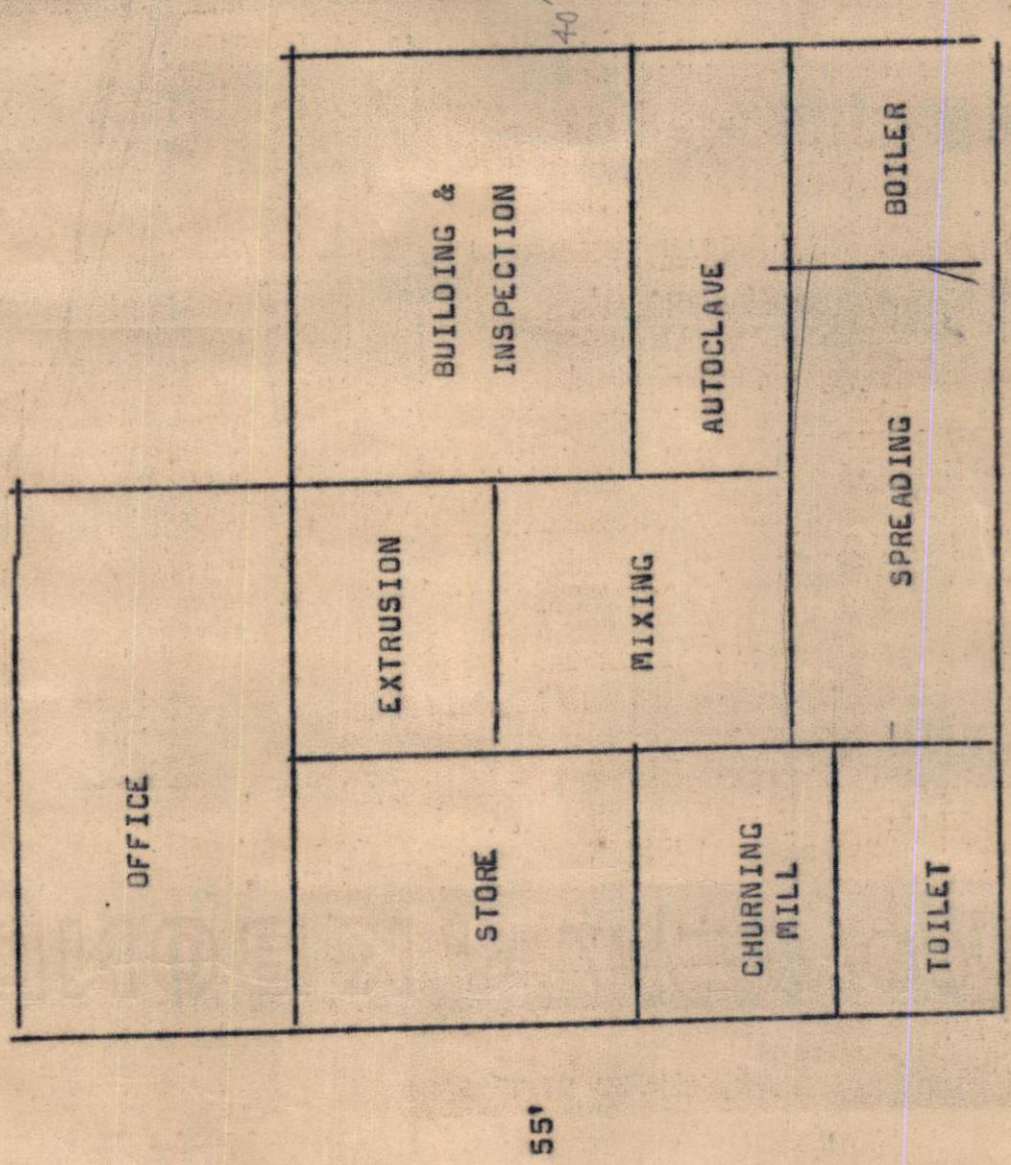
## APPENDIX III

## FLOW SHEET FOR THE PROCESS



## APPENDIX. IV

## LAYOUT FOR THE PROCESS



## APPENDIX V

## Typical Formulations

| | |
|---|---|
| SBR | 80 |
| NR | 20 |
| Stearic acid | 1.2 |
| Silica | 30 |
| GPF black | 20 |
| PPT. $CaCO_3$ | 50 |
| Clay | 75 |
| Pine Tar | 5 |
| A oil | 10 |
| Flectol H | 0.75 |
| Ketone Amine condensate | 0.75 |
| MBTS | 1.5 |
| TMT | 0.3 |
| S | 1.5 |
| Cure at 140° | 30' |

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