PROJECT REPORT ON A SMALL SCALE UNIT

TO MANUFACTURE

AUTOMOBILE CHANNELS

SUBMITTED TO THE UNIVERSITY OF COCHIN

IN PARTIAL FULFILMENT OF

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POLYMER SCIENCE AND RUBBER TECHNOLOGY

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CHAPTER - 1

INTRODUCTION

1.1. PROJECT:-

Automobile channels and beadings form a sizable part of the extruded rubber goods. This project report is prepared for a unit producing automobile channels, having an installed capacity of 90 tons per annum.

1.2. GENERAL:-

Rubber channels and beadings of different sizes and shapes are used at different parts in all automobiles. They serve different purposes such as sealing a joint, preventing rubbing of different parts of automobiles, decreasing vibrations etc.

1.3. PRODUCT DISCRIPTION:-

Automobile channels are extruded products, available both in continuous length as well as in the form of closed loops of standard shape and dimensions. The function of the channels in an automobile is manifold depending on the area of usage. So, the shape, size and hardness of channels vary accordingly. This necessitates, besides the change in processing, the use of different compounding ingredients for different types of channels.

The important properties required for the automobile channels are (i) Good weather resistance, (ii) Good crack and tear resistance, and in special cases,

good heat resistance, good resiliance etc.

Automobile channels of astonishingly large variety of shapes and sizes are being used now-a-days. Shapes of some common automobile channels are given in Appendix IV. Since there is a large variety of automobiles ranging from scooter to large earth-movers, the variety of rubber channels used in them is also large. The fact that, even in the case of one category of vehicles, the shape and size of channels used are different for different makes, is a major reason for the proliferation of the types of automobile channels. The only exception to this is the bus, in which case, at-least the shape of channels used is the same in all makes.

The important type of channels and beadings used in automobiles are ~~xhi~~ wind screen and rear window stripe, door-seals, truck-lid seals, engine-mounting stripe, Q-channels etc.

Wind-screen and rear-window stripe of automobiles are basically long extrudates with three grooves on its sides. Of this, one groove encompass the glass-edge and another grips the edge of the automobile body. In the third groove, the long metallic or rubber strip called lock is inserted to ensure good grip by the other two grooves. Even-though the channels for each make of automobile are tailor-made according to the specification of the automobile industry, the hardness of the wind-screen and the rear-window stripe is always 65 ± 5 Shore A.

Door seals are mainly hollow beadings, which seals the gap in between the door and the body by getting themselves compressed. These beadings are often g fixed to its position by using adhesieves or by using metallic clips.

Truck-lid seals are made of compounds of lower hardness and their main purpose is to reduce the vibration and to prevent the rubbing of metallic parts.

Engine-mounting channels often have rectangular cross-section. The most important property required in this case is heat resistance. Q-channels are mainly used as luggage-boot seals.

All the above mentioned channels are manufactured from natural rubber, styrene-butadiene rubber and polychloroprene rubber. But according to a new innovation which is being fast popularised, the channels are made from SP rubber, in which case the curing stage is altogether eliminated. The extruded channels which are partially vulcanised are directly marketed and when higher temperatures are being encountered during service, these channels get further vulcanised, whereas ordinary channels starts getting degraded.

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CHAPTER-2

MARKET SURVEY

Since automobile channles forms an integral part of an automobile, its consumption is directly related to the total vehicle population of the country and the yearly production of automobiles. The total vehicle population relates to the replacement market of the automobile channels, whereas the yearly production of automobiles relates to the original equipment market. The total vehicle population and the production targets of the Indian automobile industry for coming few years is given in the Appendix-I.

2.1. Present demand:-

The present consumption of automobile channels and beadings in the country is estimated to be 3,622 tons. As regards to the consumption of each category of vehicles, the consumption of cars is the maximum ie., around 1150 tons per annum, followed by that of bus. The average requirement of a single ordinary bus is 15 kgs and that of a luxury coach is 55 kgs. The consumption of automobile channels by each category of vehicles is given in the Annexure II.

2.1.1. Original Equipment:-

The present original equipment market for the automobile channels is around 1200 tons.

In the case of automobiles, where the fully finished automobile rolls out of the factory, the automobile manufacturers are the direct consumers. Cars, light trucks,

scooters, tractors etc. comes under this category. Here the number of consumers is limited, but the consumption is high. So this market is easy to handle and so, is more attractive. In the other category of vehicles, whose body is not build by the automobile manufacturer, the demand for channels, naturally comes from the automobile body manufacturers. Bus, Lorry, 3 wheelers etc. belong to this category. Due to the exhorbitant costs of body-building charged by large-scale bus body builders outside the state, the tendency of smaller units starting body building in the state is on the increase. Thus, the regional original equipment market of channels for buses, Lorries, autorickshaw etc. are bright.

2.1.2. Replacement Market:-

The replacement market depends mainly on the vehicle population and the replacement period. The replacement period is different for different types of automobile channels. It is mainly dependent on the area of usage and the overall service conditions. But, for most types it is approximately 5 years.

The present requirement of automobile channels for replacement purpose is around 2400 tons per annum. The regional share of this market is comparatively larger due to the larger number of automobiles used here. This is more marked in the case of cars, buses and 3 wheelers, which incidently, consumes a major share of the automobile channels and beadings. The automobile population of Kerala, South India and India is given in the Appendix III.

2.2. Assessment of future demand:-

From the production target of the Indian automobile Industry for the coming years, as given in Appendix-I, it is clear that the demand for automobile channels will be increasing year by year. The demand projection for the year 80-81 is 3747 tons that for 81-82 is 3885 tons etc. Details are given in Appendix-II.

2.3. Current Supply:-

The details of current production of automobile channels are not available. Though there are a large number of units producing automobile channels and beadings, there is actually a shortage of good quality channels in the market. Often, the quality conscious consumer is forced to buy sub-standard quality channels, because the producers of good quality channels are not able to meet the present demand.

Due to all these facts, starting a new unit producing good quality automobile channels is bound to succeed.

2.4. Dependence of demand on other factors:-

As in the case of every other product, the demand is dependent on the quality, the easy availability and the price of the channels.

The quality of an automobile channel is mainly judged by the fine finish, the correct tolerance of size and shape of the channel. But durability is the single most important criteria in assessing the quality of the automobile

channels. Since automobile channels are mainly tailor-made products, the specifications regarding the hardness, size, shape and dimension xx are laid by the automobile industry for each type of channels.

Sales of Automobile channels to bulk consumers like automobile manufacturers or big automobile body-builders can be made on direct-sale basis, whereas that for the replacement purpose can be sold through automobile spare-parts shops on commission basis. These two marketing methods will ensure easy sales of the product in the market.

The price of the channels should be such that it could offer the highest quality among other makes of channels in the market, which is sold at comparable prices.

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CHAPTER-3

PRODUCTION REQUIREMENTS

3.1. Land and building:-

3.1.1. Location:-

The location of the plant has got good influence on the installing and operating costs of a unit. The location for the plant is selected after ensuring that it has got all the infra-structural facilities like the availability of raw materials, water, power, cheap and skilled labour, transport and communication facilities etc.

The proposed plant can be most advantageously set up in an Industrial Estate in Kerala, where an uninterrupted supply of water and electricity is available.

3.1.2. Plant layout:-

In deciding the layout of a plant the main objective is to utilise the available facilities most advantageously and thereby reduce the operational costs to a minimum. It should also be flexible to accomodate future expansion of the plant. The layout of the plant is given in Appendix - IV.

3.1.3. Building:-

After taking into consideration the future expansioon requirements, a factory building of floor area 2400 sq. with sides (60 ft. x 40 ft.) is desired for this unit. The division of this space for individual requirements is as follows:-

Office	-	300 sq.ft.
Raw material stores	-	225 "
Weighing	-	75 "
Mill room and stock storage	-	200 "
Extruder	-	300 "
Autoclave	-	300 "
Hand fly presses	-	200 "
Finishing	-	100 "
Inspection and packing	-	200 "
Finished goods stores	-	200 "
Boiler, toilet and corridors	-	300 "
	-	2400 sq.ft.

The minimum plot area requirement for the factory is about 7000 sq.ft.

3.2. Basis & Presumptions:-

For calculating the raw material requirements, man power, utility and other requirements, the following assumptions are made:-

a) Out of the installed capacity of 90 tons per annum on a two shift basis, the capacity utilisation in the first year is 80% and that in the subsequent years is 90%.

b) The product mix constitutes of equal quantities of long continuous channels (like bus wind-screen channels, door beadings etc.), channels for cars and channels for lorries.

c) The compounding formulation for these types of channels are the same, though, in practice it will vary for each types of channels.

3.3. Raw material requirements:-

According to the typical formulation given in Appendix VII-A, the raw material requirement is calculated after allowing a process loss of 4%. In addition to this, other materials like talc, other anti-tack agents, adhesives, packing materials etc. are also required. The annual requirement of each of these items and their cost is given in Annexure II-A.

Source of supply:-

List of raw material suppliers is given in Appendix VIII.

3.4. Plant and Machinery requirement:-

Each machinery is selected so that maximum utilisation of other available facilities is made. The machinery required for this unit can be categorised according to the basic operations to which they are used for. The operations are mixing, extruding, curing, joining of ends etc.

Since the prices of machinery changes from time to time and is different for different makes, an average price is taken for cost analysis. The list of machinery and equipments required is given in Annexure I-B.

A brief description of the machinery is given below:-

a) Mixing Mill:-

Mixing mill of size 12" x 30" with chilled cast iron rolls, driven by a 30 H.P. motor is used. Its mixing capacity is 18 kgs/batch. Mill is used both for mixing and for warming the matured rubber stocks just before extruding.

b) Extruder:-

A 2½ inch extruder having facility for heating the die head with steam is used for extruding the channels. The L/D ratio of the screw is 4.3 and is driven by a 7.5 H.P. motor at a schroll speed of 36 r.p.m. The accessories required for the extruder are various dies, a rotating table, a long table, and a small tank for soap solution etc.

c) Autoclave:-

An autoclave of size 3' x 14' is used for curing the extruded channels. The length of the 14' is required because, the channels of intricate shapes, hollow beadings etc. cannot be coiled up as in the ordinary case and so has to be cured on long trays. The accessories required for the autoclave are 6 long G.I. trays of size 2' x 13' and 10 circular trays of diameter 2 feet.

d) Boiler:-

An oil fired baby-boiler of capacity 150 kg/hr. is used.

e) Hand-fly presses:-

Two 6" x 6" hand-fly presses with steam heated platens are used for joining the ends of the channels. Different moulds, with grooves corresponding to various

channels are the main accessory required for the press.

The list of suppliers of these machineries is given in Appendix - IX.

Terms of purchase:-

The purchase of machinery is done by inviting quotations from suppliers, and confirming the most suitable one. An advance of about 1/4th of the cost has to be forwarded alongwith the order and the rest during delivery.

3.5. Man power requirement:-

The total number of administrative and production personnels is fixed so as to have an efficient administration and smooth running of the factory.

3.5.1. Administrative staff:-

The administrative staff consist of the following personnels:-

(i) A Manager cum technologist who will be in charge of the factory as a whole and the production, in particular.

(ii) Sales Officer cum Accountant, who is required to handle the accounts of the factory as well as sales operations.

(iii) Clerk cum typist.

(iv) Peon

The administrative staff works only in the general shift.

3.5.2. Production Staff:-

(i) Production Supervisors:- 2 persons (1 per shift)

Each production supervisor will be in charge of the production in each shift.

(ii) Skilled workers: 6 persons. (3 per shift)

One skilled worker each is required for the mill, extruder and the press.

(iii) Semiskilled workers:- 4 persons (2 per shift)

One semiskilled worker is required at the press and another for helping the mill-man for weighing the compounds etc.

(iv) Unskilled workers: 4 persons. (2 per shift)

These workers are required to assist the extruder operator for operations like transferring the extruded items to the autoclave and at times, they are required to collect the finished goods and do the necessary packings.

3.6. Utilities and other Infrastructural requirements:-

3.6.1. Water:-

Water is taken from the water supply scheme available in the Industrial Estate and is collected in the overhead tank to ensure uninterrupted supply. Water is required for cooling the mixing mill-rolls, for steam generation and other general purposes like washing, toilet etc. The daily requirement is estimated to be 9 kiloliters and so the annual water charges will be Rs.540/= @ Rs.0.20 per Kilolitre.

3.6.2. Electric power:-

The power requirements of the major machineries are as follows:-

		HP	K.W.
1.	Mixing mill	30	22.4
2.	Extruder	7.5	5.6
3.	Boiler	0.75	0.56
4.	Light, fan etc.		1.0

The annual power requirements based on 300 days - 2 shift basis is approximately 100,000 KWh. Including the monthly charge of Rs.5/= per connected load, the annual electricity bill, @ Rs.0.165/unit amounts to Rs.18,180/=

3.6.3. Transport and Communication facilities:-

The Industrial Estates are provided with good transport and communication facilities and so the transportation of raw materials and finished goods will be easy.

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CHAPTER-4

DISCRIPTION OF PROCESS OF MANUFACTURE

4.1. Process details:-

The manufacture of automobile channels is relatievely simple. But great care to be taken to ensure that the dimensions of the extrudate fully confirms to the prescribed specifications. Basically the manufacture of automobile channels involves the extrusion of the compounded rubber using the die of required shape and curing the extrudate in an autoclave.

The important steps involved in the manufacture of automobile channels are compounding, mixing, maturing, extrusion and curing. In the case of endless channels,. an additional step of end-joining is necessary. The process flow chart is given in Appendix - I. The above steps are described below:-

4.1.1. Compounding:-

As with all other products, compounding is the most important step in the manufacture of automobile channels, because this determines the cost, the end-properties etc. to a large extent. The choice of each ingredient is made with the objective of getting the best quality channel for the specific end use to which it is meant, at the cheapest rate. Moreover, the processing also should be easy.

The most important criteria for selecting the ingredients are given below.

a) Polymer:- For ordinary purposes, natural rubber alone or its blend with styrene-butadiene rubber is used. For high weather resistance, polychloroprene rubber is mmt used.

b) Fillers: The fillers are used for reinforcing and enhancing the processing properties and to cheapen the product. Whole tyre reclaim increases the extruding properties while FEF black does the same alongwith reinforcing the rubber. Whiting and clay gives more hardness to the compounds and also cheapens it.

c) Process aid: Napthenic oil is used due to its high compatability.

d) Accelerators:- In the usual varieties of channels MBTS boosted with DPG (Vulcacit F) is used to have processing safety as well as shorter curing cycle.

e) Activators:- Zinc oxide and stearic acid activates the accelerators.

f) Sulphur:- Sulphur is the curing agent.

In the case of sponge weather strips, TMT is used to get quicker cure which gives closed-cell structure. If the cure is delayed, sponge with open-cell structure will be formed which is having an inferior sealing property. Due to its satisfactory blowing characteristics and cheapness, sodium bicarbonate is usually the preferred blowing agent. The required expansion is approximately 4 times the original volume of the extrudate.

4.1.2. Mixing:-

Rubber and other ingredients are weighed according to the specific recipe and batch-weight and is mixed on the 2 roll mill. First rubber is masticated and to it, the ingredients are added in the specific order, in which the curatives are always added towards the end of the mixing cycle. The mixed stock is then slebbed off and stacked on the racks in the stock-storage area for maturation.

4.1.3. Maturing:-

The maturation step, usually for 24 hours, improves the uniformity of the stock.

4.1.4. Warming:-

The matured stock is warmed on the mixing mill for about 5 minutes, just before extrusion. This step is necessary because the extruder used is a hot-feed extruder. Here the viscosity of the compound is reduced and the dispersion of the ingredients in rubber matrix is improved. Long ribbon shaped pieces are cut from the mill-roal, given a dip in talc solution, if required, and stacked on racks, ready to be fed to the extruder.

4.1.5. Extruding:-

The warmed rubber stock is fed to the hopper of the extruder which is fitted with the required die and the extrudate taken on the metal trays.Die alone or die and pin (in the case of hollow extrudates) determine the final size and shape of the channel. Channels with simple cross section

and which are marketed in continuous lengths are taken on circular trays with talcum powder bed, spirally winding it without gap in between the coils. This is done using the rotating table in front of the extruder. The channels are given light brusing of talcum powder before winding, to prevent sticking. For end-less channels, required length of the extrudate is taken on long G.I. sheet trays after applying talc. For channels requiring a highly polished surface, the extrudate is passed through a small tank containing the solution of an anti-tack material such as seperating agent LE and taken on the pans, without application of talc.

In the case of narrow channels, it is preferable to strain the compound before extrusion. This is done using the extruder by placing a metal-sieve plate consisting of 30 and 80 mesh sieves, before the breaker plate, and forcing the rubber compound through it.

Sagging, deformation, scorchiness etc. are the main problems encountered in the channel manufacture. Sagging and deformation at the extrusion stage is prevented by the addition of factice and that at the curing stage is prevented by using boosted accelerators which gives quicker cure set-up. The problem of scorching is controlled by maintaining a good heat-history for the rubber compound and by carefully regulating the barrel and die-head temperatures of the extruder. Usually a temperature of 60 - 70°C is used for barrel and 80 - 90°C for the die-head.

4.1.6. Curing:-

The extrudates on trays are transfered to the autoclave and cured at the specified temperature for the specified time. Usually the temperature employed is about 150°C.

End-joining:- For end-less channels like wind-screen channels of cars and lorries, the long channel is taken, and is taper-cut at necessary lengths and the fast curing rubber compound (adhesive) is applied to the ends and is joined together. The joint is cured using the 6"x 6 " hand-fly press equipped with moulds having grooves corresponding to the shape of the channels to be joined.

4.1.7. Inspection and finishing:-

The cured channels are inspected for any defects such as blisters, porosity, rough surface and incorrect dimensions. Removal of any residual flashes can be done simultaneously.

4.2. Process Loss:-

The process loss in the manufacture of channels can be classified as follows:-

a) Handling loss:- This comprises of the losses of the compounds during transportation, handling, weighing and mixing.

b) Losses during extrusion:- This is mainly due to scorching and porosity of the compounds.

c) Losses during end-joining:- This consists of the extra-length of the channel cut-off before joining. Though this loss cannot be fully eliminated, it should be reduced to the least possible value.

4.3. Quality Control:-

For the success of the industry, strictest quality control should be ensured as far as possible. The dimension of the channels and its hardness are the two main parameters measured.

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CHAPTER - 5

P R I C I N G

In determining the prices for the products, great care has to be taken since it has got pronounced effect on the financial state of the factory and its future growth.

Since the automobile channels produced by this unit are of high quality, the selling strategy is to sell the product on quality. So, cost-oriented pricing can be adopted. But since the unit cost of channels is comparable with the existing market price, competition oriented pricing can also be adopted in the initial stages of market penetration.

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CHAPTER - 6

CAPITAL REQUIREMENTS

The financial aspects of the firm is analysed in the following heads:-

1. Fixed Capital requirement.
2. Working capital requirement.
3. Gross capital requirement.
4. Total manufacturing cost.

6.1. Fixed Capital Requirement:

This is the sum of the expenses incurred for plant, machinery, land, building and pre-operative expenses. The extimated fixed capital requirement is as follows:-

1. Land and building	-	1,40,700.00
2. Plant and machinery	-	3,00,000.00
3. Pre-operative expenses	-	38,000.00
4. Miscellaneous fixed assets	-	10,000.00
Total fixed capital	-	4,88,700.00

Details of each item is given in the Annexure-I.

6.2. Working Capital requirement:-

For calculating the working capital requirement, it is assumed that one month's raw material inventory and two months for manufacturing, storing, selling and credit realisation are necessary for the smooth,uninterrupted functioning of the plant. So the working capital in this

case is the total variable cost incurred during this period of 3 months and is classified into the following heads.

	Cost, Rs.
1. Raw material cost -	5,43,000.00
2. Manufacturing cost :	
a. Cost of Utilities -	80,000.00
b. Salaries & wages -	1,31,000.00
3. Other overheads -	31,100.00
Total working capital (Annual)	7,85,100.00
Working capital for 3 months-	1,96,300.00

Details of the above each items is given in Annexure II.

6.3. Gross Capital Requirements:-

This is the total investment required to start the factory. Details are given in Annexure -III-A.

6.4. Total Manufacturing Cost:-

This consists of all direct and indirect costs involved in the manufacturing operation. This can be categorised as follows:-

1. Raw material Cost.
2. Personnel cost:- ie., salaries and wages.
3. Utilities:- This comprises of the costs incurred for power, water and steam.

4. Overhead expenses:- This includes maintenance of building, machinery, insurance premium etc.

5. Other fixed costs and interest on loans:- This consists of factory depreciations, interest on term loan and working capital.

The annual costs involved on these heads in the first year are as follows:-

		Rs.
1.	Raw material cost	- 5,43,000.00
2.	Personnel cost	- 1,31,000.00
3.	Utilities	- 80,000.00
4.	Overhead expenses	- 31,100.00
5.	Other fixed costs and interest on loans	- 1,13,800.00
	Total cost of production	- 8,[illegible]8,900.00

Details of cost on each of the above heads are given in Annexure IV.

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CHAPTER - 7

FINANCING PLAN

Any plan to set up an industrial unit should be backed by a sound fm financial plan. It should clearly specify the amount to be borrowed, the source of borrowing, the amount to be spent by the enterpreneur, and the source and quantum of subsidy, if available etc.

7.1. Source of funds:-

The following sources offer financial assistance to set up and run an industrial unit. Their details are given below.

7.1.1. State Small Industries Development Corporation:-

This agency offers machinery on hire purchase on a margin money deposit of 20%, at an interest rate of 7.5% Repayment starts after 2 years and should be completed within 7 years. It offers special concessions to technically qualified persons.

7.1.2. State Financial Corporations:-

This agency offers a loan of 85% of the land, building, machinery and miscellaneous assets upto 10 lakhs at an interest rate of 10.25% for units at specified backward areas and at the rate of 11.85% for units at other places. Repayment should begin in the 2nd half of the second year and is to be completed within 10 years in 17 equal half yearly instalments.

7.1.3. Commercial Banks:-

Nationalised banks offers loans for machinery on 25% marginal money at an interest rate of 12 to 16%. Repayment period is 3 years.

7.1.4. National Small Industries Corporation:-

This agency offers loans for machinery purchasing at 7.5 % interest. The repayment period is 7½ years.

7.1.5. Industrial Development Bank of India:-

Offers 75% of the capital investment at an interest rate of 12%.

7.1.6. State Government Industries Department:-

This department offers a loan of 90% of the machinery cost at 6.5% interest under the Rural Industries Project.

7.2. Financing of the Project:-

The Gross capital of Rs.6,85,000.00 is proposed to be realised in the following manner.

Loans	= Rs.	5,30,300.00
Own capital	= Rs.	1,54,700.00
Gross capital	= Rs.	6,85,000.00

7.2.1. Loans:-

85% of the land, building, machinery and other miscellaneous equipments is to be borrowed from Kerala Financial Corporation at 12% interest. This comes to be Rs.3,83,100.00

75% of the working capital, amounting to Rs.1,47,200.00 is to be borrowed from the Industrial Development Bank of India or any nationalised bank, at an interest rate of 15%. Details are given in Annexure III-B.

7.2.2. Own Capital:-

The difference between the Gross capital requirement and the total loans available, ea is called the marginal money. This is to be borne by the enterpreneur. Details are given in Annexure III-C.

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CHAPTER - 8

PROFITABILITY

Profitability is the best yard-stick to measure the financial viability of a project and it is expressed in the following forms:-

1. Rate of return on own capital.
2. Rate of return on capital employed.
3. Profit on sales turn over.

Since the proposed unit utilises the optimum production capacity only from second year onwards, profitability for the first 2 years is calculated below:-

8.1. Sales turn over & profit account:-

	1st year Rs.	2nd year Rs.
Total sales returns	13,15,000.00	14,75,900.00
Less excise duty @ 18.75% (ie 75% of 25% duty)	2,46,600.00	2,76,700.00
	10,68,400.00	11,99,200.00
Less selling & distribution charges @ 5%	65,700.00	74,000.00
	10,02,700.00	11,25,200.00
Cost of production	8,98,900.00	9,84,600.00
Gross profit	1,03,800.00	1,40,600.00
Income tax	47,700.00	73,100.00
Net profit	56,100.00	67,500.00

8.2.1. Rate of Return on own capital:-

	1st year	2nd year
Own capital	Rs. 1,54,700.00	Rs. 1,65,600.00
Net profit	Rs. 56,100.00	Rs. 67,500.00
Rate of return on own capital	36.26%	40.76%

8.2.2. Rate of Return on Capital Employed:-

	1st year	2nd year
Gross capital	Rs. 6,85,000.00	Rs. 7,05,775.00
Net profit	Rs. 56,100.00	Rs. 67,500.00
Rate of return on capital employed	8.19%	9.56%

8.2.3. Profit on sales Turnover:

	1st year	2nd year
Annual reciepts from sales	Rs. 13,15,000/-	Rs. 14,75,900/-
Net profit	Rs. 56,100/-	Rs. 67,500/-
Profit on sales turnover	4.27%	4.57%

8.3. Break even Analysis:-

The bare minimum quantity of production, which has to be attained in order to have a no loss no gain state, called the break even point is calculated as follows:-

$$B.E. = \frac{F}{P - V}$$

F = Annual fixed costs.

P = Unit price

V = Variable cost/unit produced.

Total variable cost

Item		Cost Rs.
Raw Materials	-	5,43,000.00
Utilities & direct labour	-	80,000.00
Interest on working capital	-	21,900.00
Excise duty	-	2,46,600.00
Distribution cost	-	67,500.00
Total	-	9,59,000.00

Annual fixed cost = cost of sales - variable cost.

Cost of sales comprises of cost of production, distribution cost and central excise duty.

Annual fixed cost = 12,11,200.00 -
9,59,000.00

= 2,52,200.00

Annual production = 72,000 kgs.

Unit selling price = $\frac{\text{Annual sales Income}}{\text{Quantity produced}}$

= $\frac{13,15,000}{72,000}$ = Rs.18.26/kg.

Unit variable cost = $\frac{9,59,000}{72,000}$ = Rs.13.32/kg.

Break even point = $\frac{2,52,200}{18.26 - 13.32}$ = 51,053 Kg.

Accoording to the produot mix envisaged, the break even production is

17,018 kgs of continuous channels,

4,862 pairs of car wind screen channels.

7,400 number of lorry wind-screen channels.

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CHAPTER - 9

ECONOMIC VIABILITY

9.1. Interest Commitments:-

Interest on loan from KFC @ 12%	=	Rs. 46,000.00
Interest on working capital from banks @ 15%	=	Rs. 21,900.00
Total	=	Rs. 67,900.00

9.2. Ability to Payback borrowed Funds:-

Though most of the financing institutions offer long payback periods, it is advisable to keep this period at a minimum. Once the payback is started the ability to pay back increases due to higher cash-flows because of decreased interests.

Loan repayment period:

Annual Net profit	=	Rs. 56,100.00
Depreciation	-	Rs. 45,900.00
Available surplus	-	Rs.1,02,000.00
Less drawings @ 25%	-	Rs. 25,500.00
Amount used for repayment	-	Rs. 76,500.00
Term loan	-	Rs.3,83,100.00

Repayment period = 5 years.

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CHAPTER - 10

SUMMARY OF THE PROJECT

		Rs.
1. Total fixed investment	-	4,88,700.00
2. Working capital requirement	-	1,94,500.00
3. Total investment	-	6,82,500.00
4. Working shift/day	-	Two
5. Employment potential	-	20 persons.
6. Annual production	-	72 tons.
7. Annual sales	-	13,15,000.00
8. Break even production	-	51 tons.
9. Rate of retun on investment	-	8.19.%

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ANNEXURES

ANNEXURE - I

Fixed Assets:-

Items	Cost Rs.
1. Land and building	1,40,700.00
2. Plant & Machinery.	3,00,000.00
3. Miscellaneous fixed assets	10,000.00
4. Pre-operative expenses	38,000.00
Total Fixed Assets	4,88,700.00

ANNEXURE - I-A

Land & Buildings:-

Item	Cost. Rs.
1. Cost of 7000 sq.ft. of land @ Rs.5/= per sq.ft.	35,000.00
2. Cost of building of floor area 2400 sq.ft. @ Rs.40/ per sq.ft.	96,000.00
3. Site improvement & fencing	3,500.00
	1,34,000.00
Contingency @ 5%	6,700.00
Total	1,40,700.00

ANNEXURE -I-B

Plant & Machinery:

	Item	Price Rs.
1.	Mixing mill (12" x 30") with all accessories	95,000.00
2.	63 mm (2½") Extruder	45,000.00
3.	3' x 14' Horisontal steam vulcaniser	20,000.00
4.	Baby boiler (150 kg/hr) with accessories)	48,000.00
5.	Dies	30,00.00
6.	G.I. trays (circular & rectangular)	1,000.00
7.	6" x 6" hand fly presses (2 Nos.) and neceassary moulds	10,000.00
8.	Weighing balance (50 Kgs' & 5 Kgs.)	7,000.00
9.	Miscellaneous equipments	1,500.00
	Total	2,30,500.00
	Contingency for price escalation @ 5%	11,525.00
		2,42,025.00
	Sales tax @ 8.8%	21,298.00
	Installation & transportation @ 10%	24,203.00
	Distribution system for water & steam, lighting and cabling @ 5%	12,101.00
	Total	2,99,627.00
	Rounded off	3,00,000.00

ANNEXURE - I-C

Miscellaneous fixed assets:-

Item	Cost Rs.
Office machineries & furniture	6,000.00
Fire fighting equipments	2,500.00
testing equipments like Hardness tester	1,500.00
Total	10,000.00

ANNEXURE - I -D

Pre-operative expenses:-

	Item	Cost Rs.
1.	Interest on loan @ 12% for 6 months for Rs.4,50,700.	23,000.00
2.	Establishment	2,000.00
3.	Travelling expenses	2,500.00
4.	Postage, Telephone, Telegram and legal charges	2,500.00
5.	Advertisement & printing	2,500.00
6.	Building Insurance	1,500.00
7.	Property tax	1,500.00
8.	Miscellaneous	700.00
	Total	36,200.00
	Contigency @ 5%	1,800.00
	Total	38,000.00

ANNEXURE - II

Working Capital:-

		cost. Rs.
1.	Total raw material cost	5,43,000.00
2.	Direct manufacturing cost	2,11,000.00
3.	Other overheads	31,100.00
	Total	7,85,100.00
	Working capital for 3 months	1,96,275.00
	Rounded off	1,96,300.00

ANNEXURE - II-A

Raw materials:-

Annual Production : 72,000 Kg.
Process loss @ 4% 3,000 Kg.

Total raw material requirement: 75,000 Kg

Material	Percentage by weight	Price/ kg Rs.	Annual requirement (kg)	Cost/ Annum Rs.
Natural rubber EBC (3 X)	30.46	11.50	22850	2,62,775.00
Whole tyre reclaim	15.23	4.60	11425	52,555.00
Zinc oxide	1.9	14.00	1430	20,020.00
Steric acid	0.57	17.30	428	7,404.00
Whiting	26.66	0.50	20000	10,000.00
China clay	11.42	0.40	8570	3,428.00
FEF black	7.62	15.00	5710	85,650.00
Paraffin wax	0.57	6.50	428	2,782.00
Naphthenic oil	3.81	13.00	2850	37,050.00
Vulcacit P[1]	0.42	63.50	314	19,940.00
Antioxidant H.S[2]	0.38	54.20	286	15,500. 00
Sulphur	0.95	3.80	715	2,717.00
Talc		0.50	3000	1,500.00
Seperating agent LE[3]		6.00	75	450.00
Adhesieves		20.00	600	12,000.00
Packing materials				9,000.00
Total				5,42,771.00
		Rounded off		5,43,000.00

1. Accelerator M.B.T. boosted with D.P.G. - by Bayer India.
2. Quinoline type antioxidant - by Bayer, India.
3. Antiback material marked by Bayer . India.

ANNEXURE - II-B

Direct Manufacturing Cost (Annual)

	Items	Cost Rs.
1.	Cost of Utilities	80,000.00
2.	Salaries & Wages	1,31,000.00
	Total	2,11,000.00

ANNEXURE - II-B-1

Cost of Utilities:-

	Item	Cost Rs.
1.	a) Cost of 1,00,000 Kwh power @ 16.5 ps/Unit	16,500.00
	b) Charge for connected load	1,680.00
2.	Cost of 25,500 litres of furnace oil @ 2.40/litre	61,200.00
3.	Cost of water. 2,700 kilolitres @ Rs.0.20/kilo litre	540.00
	Total	79,920.00
	Rounded off	80,000.00

ANNEXURE II-B-2

Salaries & Wages:

a) Administrative Staff:-

Position	No.of shift	Total personnel per day	Monthly salary Rs.	Total salary Rs.
Manager cum technologist	1	1	1200.00	1200.00
Sales Officer cum Accountant	1	1	700.00	700.00
Clerk cum Typist	1	1	450.00	450.00
Peon	1	1	250.00	250.00
		Total		2600.00

b) Production Staff:-

Production Supervisor	2	2	600.00	1200.00
Skilled worker	2	6	450.00	2700.00
Semiskilled worker	2	4	400.00	1600.00
Unskilled worker	2	4	350.00	1400.00
		Total		6900.00

Total salaries & wages/month	= 9500.00
Total salaries & wages/annum	=114000.00
Benefit & allowances @ 15%	17100.00
Total salaries & wages inoluding benefits	131100.00

ANNEXURE - II-C

Other Overheads:-

	Item	Cost Rs.
1.	Repairs & maintenance of building @ 1%	1,400.00
2.	Repairs & maintenance of machines @5%	12,000.00
3.	Travelling and advertising expenses	7,500.00
4.	Insurance @ 1% on fixed capital	4,500.00
5.	Property taxes	1,200.00
6.	Stationary, postage and telephone	3,500.00
7.	Miscellaneous	1,000.00
	Total	31,100.00

ANNEXURE-III-A.

Gross capital requirement:-

Item	Rs.
Total fixed capital	4,88,700.00
Total working capital for 3 months	1,96,300.00
Total	6,85,000.00

ANNEXURE -III-B

Loans:-

	Item	Rs.
1.	Long term from K.F.C. (85% of the fixed assets excluding pre-operative expenses)	3,83,100.00
2.	Loan from Nationalised banks (75% of the working capital)	1,47,200.00
	Total	5,30,300.00

ANNEXURE-III-C

Own capital

Item	Rs.
15% of the Land, building & Machinery	67,600.00
25% of the working capital	49,100.00
Pre-operative expenses	38,000.00
Total	1,54,700.00

ANNEXURE IV

Total cost of production:-

	Item	Cost Rs.
1.	Raw material	5,43,000.00
2.	Utilities	80,000.00
3.	Personnel expenses (salaries & wages)	1,31,000.00
4.	Other overheads	31,100.00
5.	Other fixed costs and Interests on loans	1,13,800.00
	Total	8,98,900.00
	Rounded off	8,99,000.00

ANNEXURE-IV-A

Other fixed costs & interest on loans:

Item	Rs.
1. Depreciation:	
a. Depreciation on machinery @ 15%	36,304.00
b. Depreciation on Building @ 5%	4,800.00
c. Depreciation on other fixed assets @ 10%	1,000.00
d. Amortisation of pre-operative expenses @ 10%	3,800.00
2. Interest on loans:	
a. Interest on working capital @ 15% for Rs.1,47,200.00	21,900.00
b. Interest on estimated term loan @ 12% for Rs.3,83,100/-	46,000.00
Total	1,13,804.00
Rounded off	1,13,800.00

ANNEXURE -V

Sales Returns:-

Item	Quantity	Rate Rs.	Cost Rs.
Continuous channels like Bus wind screen channel, door beadings etc.	21,000 kg.	10/kg	2,40,000.00
Car windscreen and rear window channels.	6845 pairs	65/pair	4,45,000.00
Lorry windscreen channels	10,500 Nos.	60/No.	6,30,000.00
		Total	13,15,000.00

ANNEXURE - VI-(

Project Profit and Loss account (Rs.in Thousands)

	YEAR				
	1	2	3	4	5
Production (in thousand kg)	72	81	81	81	81
Sales Income	1315	1475	1475	1475	1475
Raw material	543	611	611	611	611
Utilities	80	88.5	88.5	88.5	88.5
Personnel	131	137.7	144.5	151.7	159.3
Other overheads	31.1	31.1	31.1	31.1	31.1
Depreciation	45.9	45.9	45.9	45.9	45.9
Interest on					
a) Term loan	46	46	41.4	35.3	29.1
b Working capital	21.9	24.4	24.4	24.4	24.4
Excise duty	246.6	276.7	276.7	276.7	276.7
Cost of production	1145.5	1261.3	1263.5	1264.6	1266
Cost of distribution	65.7	74	74	74	74
Cost of sales	1211.2	1335.3	1338.5	1338.6	1340
Profit before tax	103.8	140.6	138.4	137.3	135.9
Income tax	47.7	73.1	71.6	70.8	69.9
Net profit	56.1	67.5	66.8	66.5	66
Profit + Depreciation	102	113.4	112.7	112.4	111.9

APPENDICES

APPENDIX - I

Vehicle population of India & production targets of Indian Automobile Industry.

Name of vehicle	vehicle population as on 31.3.1979.	Production targets (in thousands)				
		79 - 80	80-81	81-82	82-83	83-84
2 wheelers	14,31,692					
Scooters		260	300	345	395	450
Motorcycles		91	102	113	125	138
3 wheelers:	49,420	25	30	35	40	45
Cars	7,53,779	42	44.1	46.3	48.7	51
Jeep	1,05,053	11	12.1	13.3	14.6	16.1
Bus	1,19,479	13.1	14.5	15.9	17.5	19.3
Lorry	3,75,303	32.9	36.1	39.6	43.7	48.2
Light truck		20.5	22.6	25	27.3	30
Tractor	2,69,724	54.2	58.3	63	68	73.5
Trailor	96,808	Data not available.				
Others	33,854	"				

Sources: 1. All India Automobile & Ancillary Industries Association.
2. Central Statistical Organisation, Ministry of planning, New Delhi.

APPENDIX - II

Projected consumption of automobile channels:

Channels of Item		Consumption				
		Replacement (tons)	Original Equipment (tons)			
			79-80	80-81	81-82	82-83
Soooters	@ 0.3 Kg.	86	78	90	103.5	118.5
3 wheelers	@ 3.8 and 1.8 for 50% of the vehicles each	32	64	84	108	112
Cars	@ 6 kg.	905	252	265	278	292
Jeeps	@ 2.5 kg.	52.5	27.5	30	33	37
Buses	@ 55 kg and 15 kg for luxury & ordinary types in the ratio 1 : 8	465	255	282	309	340
Lorry	@ 4 kg	220	132	144	15.8	175
Light trucks	@ 3.5 kg	70	72	79	87.5	95.5
Tractors	@ 2 kg.	108	108	117	126	136
Trailors*	Bus : Lorry in the ratio 1:4 @ 30 kg & 10 kg each.	270	150	165	182	200
Others*	@ 3 kg	200	72	82.5	91	100
	Total	2408.5	1213.5	1338.5	1476	1586
	Total consumptionof the year		3622	3747	3884.5	3994.5

* Rate of increase assumed as 10%.

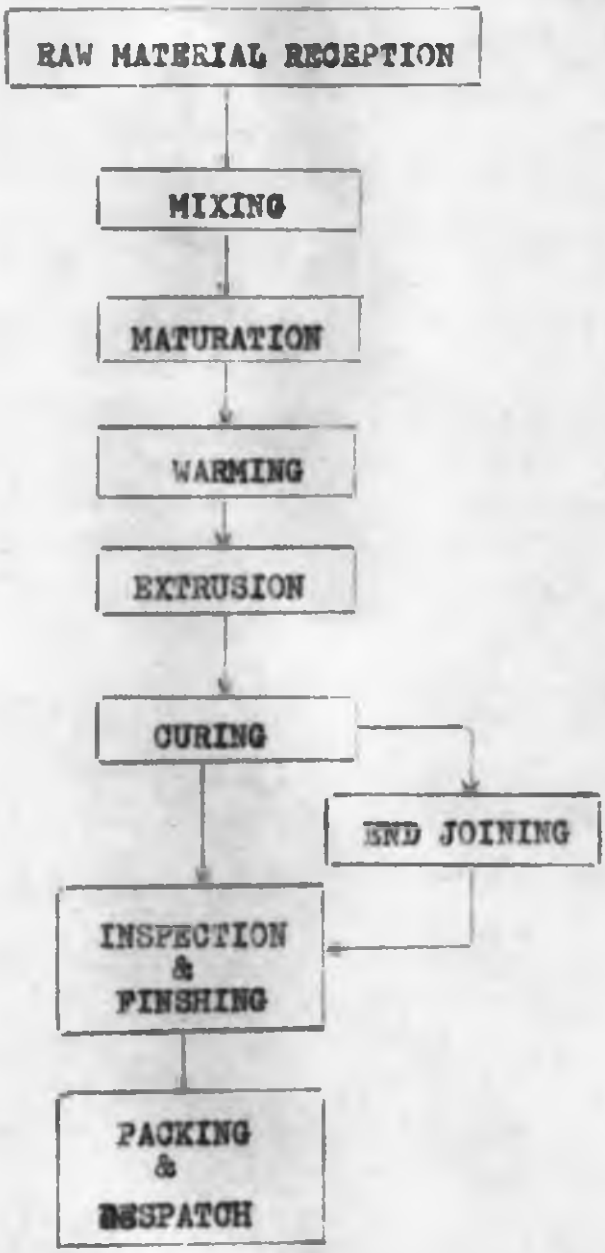
Appendix - III

Vehicle population of south India (as on 31.3.1979)

State/region	No. of vehicles			
	Car	Bus	Truck	3 wheelers
Kerala	45664	8328	17498	5017
Tamilnadu	68713	10694	38105	4952
Andra Pradesh	27365	2879	8361	6925
Karnataka	55011	10165	26912	16555
South India	197753	31176	90876	33449
India	753779	119479	375305	117811

Source : All India Automobile and Ancillary Association.

APPENDIX - V


RAW MATERIAL RECEPTION
MIXING
MATURATION
WARMING
EXTRUSION
CURING
END JOINING
INSPECTION & FINSHING
PACKING & DESPATCH

APPENDIX-IV

CROSS SECTIONS OF SOME AUTOMOBILE CHANNELS

I. WIND-SCREEN CHANNELS OF:-

Buses, Three wheelers etc.

Lorries

Cars

II. OTHER CHANNELS:-

Door Beadings

Luggage boot seal

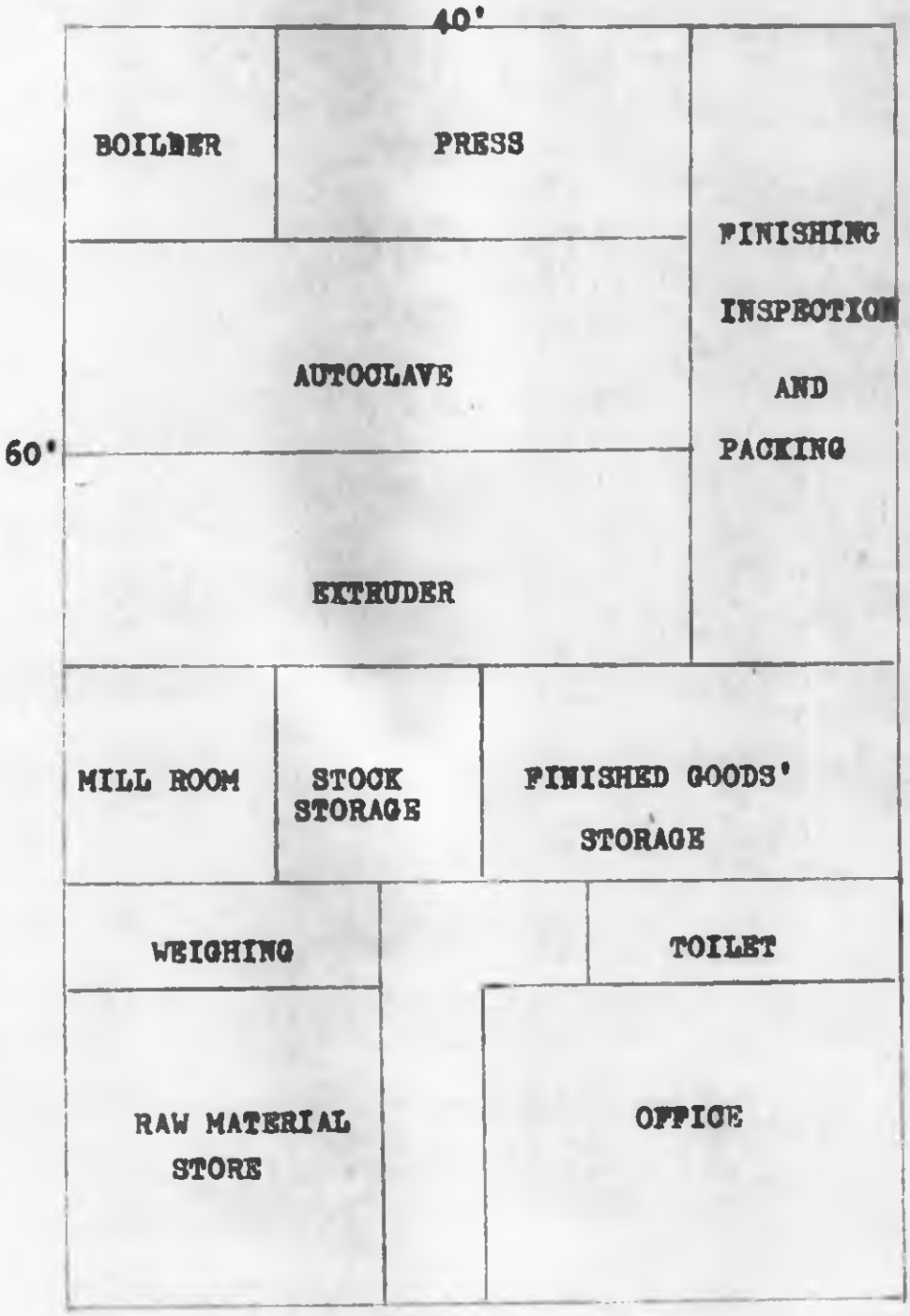
Quarter glass channel

Side glass beading.

Bonnet beading

APPENDIX- VI

PLANT LAYOUT



APPENDIX-VII

Typical compounding formulations for automobile channels:-

a. General Channels:-

material		Parts by weight
Natural rubber	-	80
Whole tyre reclaim	-	40
Zinc oxide	-	5.0
Steric acid	-	1.5
Whiting	-	70
China clay	-	30
FEF black	-	20
Paraffin wax	-	1.5
Naphthenic oil	-	10
Vulcacit F[1]	-	1.1.
Antioxidant H.S.[2]	-	1.0
Sulphur	-	2.5

Cure 20 minutes at 145°C

1. MBTS - boosted with DPG
2. Quinoline type ~~auth~~ antioxidant.

b. S.B.R. Sponge weather strip:

material		Parts by weight
SBR 1010	-	100
Plastogen	-	10
Medium process oil	-	70
Oleic acid	-	10
Zinc oxide	-	5
Sodium bicarbonate	-	20
Agerite stalite*	-	1
Hard clay	-	45
Thermal black	-	45
TMT	-	1.2
Sulphur	-	3

Cure 10 minutes at 150°C

* Antioxidant - A mixture of octylated diphenyl amines.

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C. Weather resistant channel.

Polychloroprene	-	100
Stearic acid	-	1
Octylated diphenylamine	-	1
Paraffin wax	-	2
Light process oil	-	15
FEF	-	25
Clay	-	75
Thiourea	-	0,5
Magnesium oxide	-	4
Zinc oxide	-	5

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APPENDIX VIII

List of Raw material suppliers:-

Natural rubber:-

1. Plantation Corporation of Kerala Ltd., Kottayam-686004.
2. Kerala State Co-operative Rubber Marketing Federation, Cochin-6820016.

Reclaim rubber:-

1. Indian Rubber Regenerating Co. Ltd., F-2, Wagle Industrial Estate, Thana, Maharastra.

Carbon black:-

1. Philips Carbon black Ltd., Netaji Subash Road, Calcutta -1.
2. United Carbon (India) Ltd., NKM International House, 178, Backbay Reclamation, Bombay - 400 027.

Zinc Oxide:

1. Anand chemicals, 8 Horniman Circle, Bombay - 1.
2. Waldier Ltd., A-1, Gillander House, Netaji Subash Road, Calcutta-1.

Steric Acid:

1. The calcutta chemicals Co., 35, Paduitia Road, Calcutta - 29.
2. M/s Godrej Soaps (P) Ltd., Eetern Expresse High way, Vikroli, Bombay-400079.

Process Oil:-

1. Arieto Chemicals (P) Ltd., 77, X Khetwadi, Bombay - 22.
2. Rollwala Associates, 12, mill Officer's colony, Ashram Road, Ahmedabad - 9.

Rubber Chemicals:

1. M/S Bayer India Ltd.,
   82, Vir Nariman Road,
   P.B.No.1436,
   Bombay-400001.

2. The ACCI Ltd.,
   34 chawrighar,
   Calcutta-13.

3. Mindia Chemicals Ltd.,
   Wake Field House,
   11 Sprot Road,
   Ballard Estate,
   Bombay - 400038.

Sulphur:

1. IA & IC (P) Ltd.,
   86, Dr. Annie Besant Road,
   Bombay - 400018.

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APPENDIX-IX

Rubber Machinery Manufacturers:-

1.	Indian Expellor Works (P) Ltd., A/4, Naroda Industrial Estate, Naroda, Ahmedabad-382330.	Mixing Mill, Extruder, Handfly press.
2.	Sohal Engineering Works, Sohal Industrial Estate, L B Sastri Marg, Bombay-400078.	Mixing mill, Extruder, Handfly press
3.	Santhosh Industries, A-1, Sona Udyog, Parsi Panchayat Road, Andheri (East), Bombay-400069.	Mixing mill, Extruders, Autoclaves.
4.	Kelachandra Iron & Steel Works, Chingavanam, Kottayam, Kerala.	Mixing mill, Handfly press, autoclave & Extruder.
5.	Premier machinery Enterprises, 71, General Patters Road, Madras - 600,002.	mills, Extruders, Press, autoclave.
6.	Modern Engineering Works, 310, Jogani Industrial Estate, 541, Senapati Bapt Marg, Dadar, Bombay - 400028.	Mills, Extruders, Press, autoclave
7.	Blue steel Engineers (P) Ltd., 144 A/2 Industrial Estate, Fergusan Road, Bombay - 400013.	Rubber testing Instruments.
8.	Avery (India) Ltd. Armenian Street, Madras-1.	Weigh scales.
9.	Polymer Engineering Services, 6, Lalbhag Road, Bangalor 560007.	Testing equipments, moulds and dies
10.	Common Facility Service Centre tool Room, Changanacherry Industrial Estate, Kottayam (Dist), Kerala.	Moulds, Dies and tools.
11.	Varsha Boilers Pvt.Ltd., Green House, Bombay - 1.	Boilers.
12.	Kosha (India) Ltd., 2, N.K. Industrial Estate, Vishwesher Nagar, Off.Arey Road, Goregaon (East), Bombay - 63.	Boilers.

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