

U N I V E R S I T Y O F C O C H I N

B. Tech Course

IN RUBBER PROCESSING AND TECHNOLOGY

PROJECT REPORT

ON

A SMALL SCALE UNIT

TO MANUFACTURE HOSES IN KERALA .

Valued
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DISSERTATION REPORT

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PREFACE

This Project Report is prepared and submitted in the form of a dissertation unlike projections to procure loan to start enterprises. The primary mission therefore, for obvious reasons is the partial fulfilment of an academic technical degree. I do not claim this report to be exhaustive and complete in all respects. However it is felt the information contained therein is sufficient to start and operate the Project.

My thanks and gratitude are due to several persons who helped me in my endeavour. I express my appreciation and acknowledgement to all of them and particularly to S/Sri. V. Bhaskara Pillai Secretary, S/Sri. C.M. George and S/Sri. E.V. Thomas, Deputy Directors, S/Sri. M.K. Balagopalan and S/Sri. R.G. Unni of Rubber Board and Rubber Research Institute of India, Kottayam.

KOTTAYAM. 9.
28-4-1975.

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SECTION-A

INTRODUCTION

A.1 Product Description

Hose, in the commonly accepted sense may be described as a flexible pipe or conduit used for conveyance of materials. The anatomy of a hose today is the same as it was a hundred years ago and will be the same in as many years hence, in that basically it consists of a lining (tube), a reinforcement (carcass) and a cover. The tubes' function is to retain the material being conveyed and to protect the carcass from deterioration by the material. The carcass must provide the strength to withstand the internal pressure and/or any external forces that might be encountered. The cover primarily serves to protect the carcass from all types of environmental deteriorations.

Hoses find application in wide and varied fields. In one sense it is only a substitute for pipe; in another it is a super-pipe in that it is flexible and can easily be carried from one place to another. From all quarters, on land, on sea, in the air, or under ground, some ingenious use is being made of the flexible link that can be given by a hose.

The tube and cover are made from suitably compounded natural or synthetic rubbers for different purposes. The carcass may consist of yarn, cord, fabric, fine wire, or metal or plastic rod, or strip, depending upon the

service for which the hose is intended. Another rubber element normally associated with the carcass is known as the liner or insulation and its function, as the name implies is to insulate one portion of the carcass from another and to enhance the adhesion of the carcass to the tube and cover.

It is common to refer to hose by the service in which it is expected to perform (air, water, gasoline, welding etc). Also the hose industry further differentiates the products by referring to the various methods of manufacture as Moulded hose, Bradied hose, Machine-wrapped hose, knifed hose, hand-made hose, spiral reinforced hose etc.

This scheme envisages the production of simple hand-made hoses like water delivery hoses, water suction hoses and oil suction and delivery hoses. These do not necessitate a high level of technical know-how and also can easily be manufactured in a small scale factory. As the manufacture of nitrile rubber has started recently in the country, the necessity to import ~~ant~~ this is eliminated. Other simple pipings and tubings of vulcanized rubber can also be manufactured.

A.2. Evaluation of Prospects:

Rubber hoses find wide application in agricultural as well as industrial fields. The rapid electrification programme is also increasing the popularity of pump sets

which in turn require delivery and suction hoses. The demand for these hoses will increase with the enthusiasm of the farmers in adapting modern methods of farming. The present demand of oil hoses are large and as pointed out earlier the indigenous production of nitrile rubber makes the time ripe for the production of oil hoses locally. Also with the full exploitation of the Bombay-high and other oil rich areas in our country, the spurt in our oil industry will be tremendous which in turn will increase the demand for oil hoses considerably. From the simple fact that the present units are working additional shifts and round the clock it can be concluded that the requirements are quite large.

SECTION -B

MARKET SURVEY

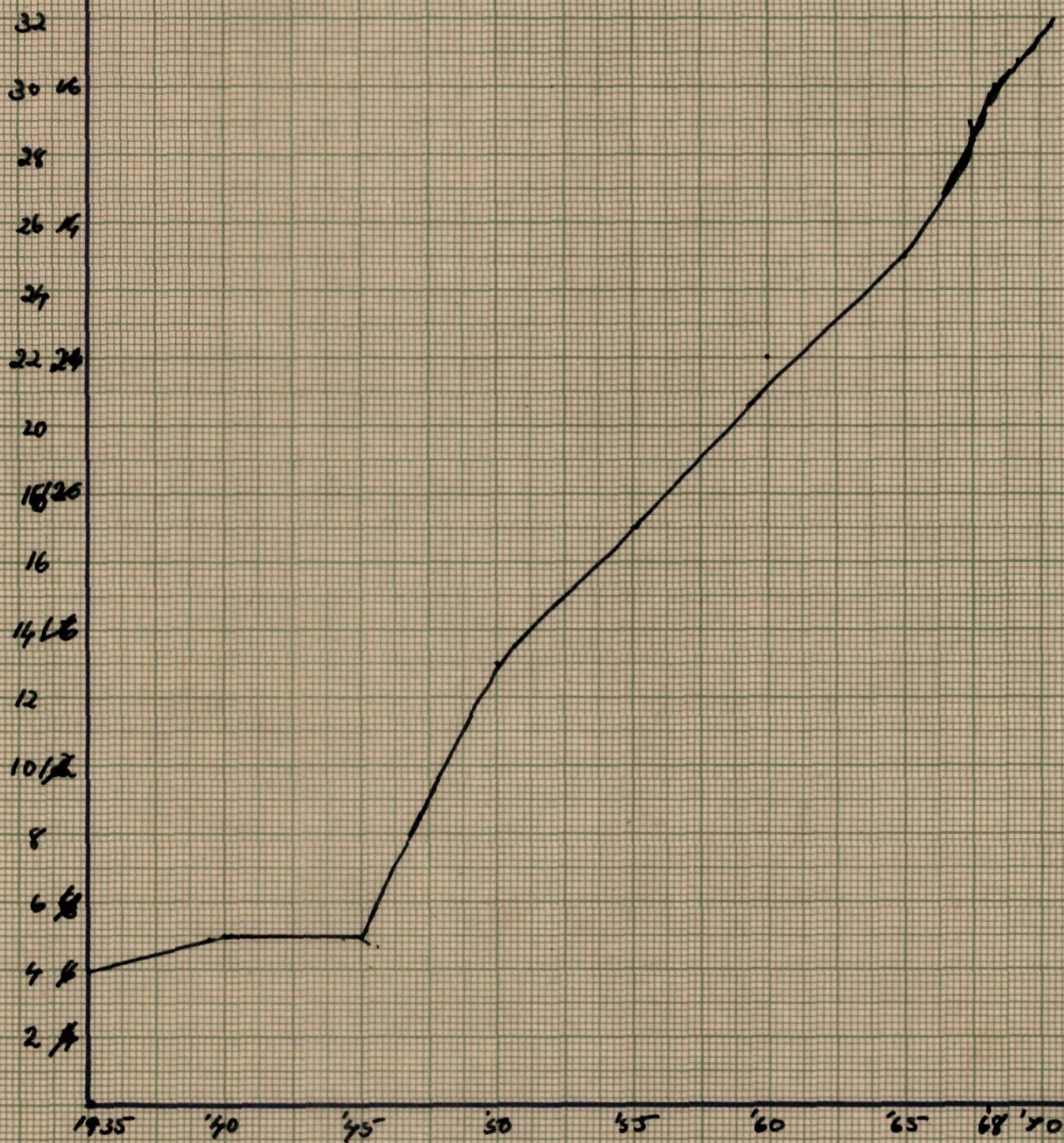
B.1. Users/Customers Analysis and demand

a) Fields of Application.

The main fields of application for suction and delivery hoses is in agricultural pump sets. From the increasing popularity of pump sets as evident from statistics it can be easily seen that the demand is only bound to increase. The oil suction and delivery hoses also is having a good future market with the growth in our oil industry in the offing.

Though specific informations on the capacity, production and demand of this item are not available,

Scale: X-axis: 1cm = 2.5 yrs.
Y-axis: 1cm = 2 units.



based on the performance of the existing units, it is clear that there is good demand for the product.

b) Statistics The fact that the demand is steadily increasing can be seen from the number of units producing hoses coming up year after year. In the graph the no. of units vs year is given. The kink in the curve during the period 1940-45 is evidently due to the second world war and the turmoil in Indian politics at that time. From the following available statistics it can be seen that the demand for almost all types of rubber goods including hoses has always been on the increase.

Table-1.

Index numbers of Industrial production of rubber products.

(Base 1960 = 100)

Year	Index No.
1951	56.1
1961	112.9
1963	135.5
1964	143.0
1965	159.4
1966	160.2
1967	171.4
1968	202.1
1969	215.5
1970	215.7

Consumption of all kinds of rubber products (including hoses) other than tyres & tubes, cycle tyres and tubes, footwear, Camel back, Cables, Foam and dipped goods and total rubber consumption are given below.

Table-2.

Year	Others (M. Tonnes)	Total consumption (M. Tonnes)
66-67	20297	103190
67-68	22511	109704
68-69	24196	108022
69-70	24710	131104

The available statistics on the production of rubber hoses themselves is incomplete. However production figures of the organised sector is given below. These figures show a general increase and a more recent mixed trend.

Table-3. Production of hoses: Type

Year	Radiator (1000 Nos)	Vacuum Brake ('000 Nos)	Other types ('000 metres)
1956	248.4	552.0	2012
1957	171.6	777.6	2432
1958	168.0	602.4	2809
1959	214.8	470.4	3432
1960	248.4	345.6	3593
1961	249.6	724.8	4632
1962	205.2	1113.6	5051

1963	207.6	1920.0	5390
1964	276.0	1920.4	6584
1965	446.4	561.6	6348
1966	524.4	566.4	9708
1967	392.4	925.2	6028
1968	358.4	955.9	6446
1969	488.5	401.5	5697
1970	470.3	773.3	5211

There is also a good export potential for the item as evidenced by the following figures:

Table-4

Value for Hoses Exported: (in '000 Rs-Post devaluation)

Year	Value
61-62	1460
62-63	633
63-64	1258
64-65	939
65-66	788
66-67	643
67-68	404
68-69	914
69-70	969
70-71	1883
71-72	1744.2
72-73	772.7
73-74	1438.2

B.2 Sales Channels and methods:

Most of the factories are selling their products directly, though some are having distributors in important cities and towns and the commission on sales given to the distributors vary from 15 to 20%.

For a new entrepreneur the easy way would be to sell through dealers already in the line and through agents. Later when well established, own depots can be opened for sales.

B.3 Geographical Extent of Market

According to statistics the present production of these hoses are not sufficient to satisfy the internal demand. Hence the product can be easily sold within the country. When established, the firm should open depots all over the country. At all times the possibilities of export should be scanned.

B.4 Competitive Situation:

a) Domestic Market

According to the available statistics, upto 1968, there are only 31 units producing these types of hoses in India.

b) Export Market:

Hoses are exported to about 32 countries mostly of the developing and underdeveloped class- the gulf and African countries- and also Sweden, Czechoslovakia etc. Typical monthly export figures are given below.

Table-5.

Export of Hoses-1974 January.

a) Vacuum Brake hoses:

Country	Kg	Value-Rs.
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Kenya	50150	88115
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b) Other hoses:

Abu Dhabi	355	2100
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Sri Lanka	3936	19625
-----------	------	-------

Jordan	3669	14505
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Saudi Arabia	24400	111173
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Singapore	100	1061
-----------	-----	------

Syria	2631	9254
-------	------	------

Tanzanian Republic	35091	157718
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c) Pplings and Tubings of Vulcanised Rubber:

Kenya	226	4300
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Mauritius	226	4300
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d) Total (of all above)	94649	327442
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Bestowed with cheap and abundant power, labour and raw material supplies a new entrepreneur from Kerala will be in a commanding position as far as competition in this field is concerned.

SECTION C

PRODUCTION REQUIREMENTS

C.1 Location: Similar to any other rubber-based industry, the prime requirements are power, water, availability of raw materials, skilled workers, transport conveniences etc. In all these Kerala is endowed in abundance. Specially in Alleppy district is selected since in addition to the above, this being a backward area there are other fringe benefits and encouragements from the part of Central & State Government such as 10% subsidy on fixed investment and also loans are available at concessional rates.

C.2 Materials Requirements.

The raw materials used for hose manufacture are mostly common to any other rubber-based industry. All are indigenously available. They are considered in four groups. The requirements of these are given in Annexure II-A. The total requirements of raw materials is Rs. 21,40,000.

1. Polymer

The raw polymers used are NR, SBR and Nitrile rubbers, the first being used predominantly. Whole Tyre Reclaim also is used.

NR is available locally the main market being Kottayam. The Synthetics and Chemicals plant-the only synthetic rubber plant in production in the country- has started production of Nitrile ~~mf~~ rubber along with their SBR'S.

Prices:	NR	-	Rs. 9 per Kg.
	SBR(1712)	-	Rs. 8.50 " "
	Chemaprene-3309X	-	Rs. 16.50"
	(Nitrile) Whole tyre reclaim	-	Rs. 3.30 "

The Synthetics and Chemicals have regional representatives in Kerala and hence orders can be easily placed and expedited.

Fillers.

The carbon black fillers are needed to improve the quality and the others for cheapening and thus making a viable product in the market.

The carbon blacks are produced in India by

- 1) Philips Carbon Co.
- 2) United Carbon Co.

The two types of Carbon blacks that will be used are at present priced as follows:

HAF	-	Rs. 6.60 per Kg.
PEF	-	Rs. 4.25 per Kg.

The other major fillers are clay and Whiting.

Clay is manufactured in Kundara in Kerala.

Prices: Clay	-	Rs. 0.25 per Kg.
Whiting	-	Rs. 0.30 per Kg.

Process aids:

This improves the polymers' processing characteristics during mixing, extruding, spreading etc. Naphthenic and anomatic oils, pine tar etc. are used.

prices:	Oils	-	Rs. 9 per Kg.
	Pine tar	-	Rs. 5 per Kg.

Other Chemicals.

These include Zinc Oxide, Stearic acid, Sulphur, Accelerators, Anti-oxidants etc. Zinc oxide, Stearic acid and Sulphur are available from local dealers. The accelerators, anti-oxidants etc are manufactured in India by Bayer India Ltd., Mindia and ICI. All these three are having agents and depots in Kerala.

It is desirable to enter into contract with at least two firms for ensuring an uninterrupted supply.

Fabric, Steel wire, Solvent etc.

The fabric is the strength member of the hose. Cotton fabric manufactured by Madura Mills and other mills under the trade name of 'industrial clothing' can be used for the purpose.

The solvent, petroleum naphtha, is to be used for preparing the dough in the churning mill or Solution mixer, for spreading.

The steel wires are used in suction hoses to prevent their collapse during service.

Prices:	Fabric	Rs. 2/metre
	Solvent oil	Rs. 3/litre.
	12 SWG Steel wire	Rs. 5/Kg.

Packing Materials: Hessian bags are sufficient and they are cheap.

Terms of Purchase.

All negotiations are done through banks. On a margin money of 30% the bank will spend 70% for the purchase of materials. The amount has to be paid back in 70 days with interest. The purchased material will be kept in the bank's godown and materials in small quantities are withdrawn whenever required.

C.3. Building, Plant and Machinery.

a) Land

About 2000 Sq.m. of land is required expecting possible expansions also.

b) Building

The built up area is estimated to be 600 sq.m. Requirements for each section is given below:

Table -6 Built up area:

Raw Material Storage	- 60 Sq.m. ✓
Compounding	- 40 Sq.m.
Mixing & Maturing	- 90 "
Extruder	- 20 "
Spreading Machine	- 30 "
Solution Mixer	- 10 "

Air Compressor	10 Sq.m.
Building tables	40 "
Vulcaniser with trolley	40 "
Administration, Godown Engg. Room, worker amenities, Packing & Despatch	260 "

Total	600 "
	=====

The Capital Requirements of land & building is given in Annexure- I A.

Plant and Machinery.

Main items of plant & Machinery are given below:

- 1) One 16" x 42" mixing mill with chilled cast iron rolls. ✓
Capacity of about 35-40 Kg per batch. With 60 H.P. motor (A.C) reduction gear etc.
- 2) One 14" x 36" mixing mill with chilled cast iron rolls. ✓
Capacity 25-28 Kg per batch. With 40 H.P. motor (A.C), reduction gear etc.
- 3) One 2½" extruder with 8 H.P. motor, D.C. Drive, ✓
reduction gear. Average Capacity 100 Kg/hr.
- 4) One spreading machine 60" x 18', 5 H.P. motor, ✓
Capacity 6.196 metres/min.
- 5) Solution mixer of 50 gallons (230 litres) capacity
with 5 H.P. motor. Also called churning mill.
- 6) Vulcaniser with trolley. 24" diameter and
60 ft. length.
- 7) Boiler with accessories. Capacity. 250 Kg/hr. (Press 150951)
- 8) Air Compressor 10 cft/min, 100 psi.

9. Wiring & Wrapping machine
10. Building rollers- 2 H.P.
11. Building tables, rack, hand-tools, consolidation tables etc.
12. Mandrells - different sizes.
13. Pump for cooling-water, Pipings etc.
14. Weighing machine - 100 Kg capacity
15. Weighing machine - 10 Kg capacity.
16. Pan type balance
17. 250 KVA Transformer for tapping power from a high tension line.

In addition to the above for the successful running of the factory with a view to producing quality product the following bare minimum testing equipments are necessary.

1. Thickness Gauge✓
2. Hardness Tester✓
3. Ageing Apparatus✓

The financial requirements for machinery are shown in Annexure IB. A list of Machinery suppliers is given in Appendix -I.

Purchase Procedure:

1. Quotations are made and satisfactory quotations are confirmed. The price quoted are inclusive of packings and transportation costs, octroi, excise etc.

2. 30% of the purchase money will have to be paid in advance and the remaining at the time of purchase. The payment can be negotiated through banks.

The following points should be always borne in mind in this connection.

1. Suppliers possess the right for cancellation, Changing delivery time and price due to unforeseen reasons.
2. Warranty against manufacturing defects is assured by the manufacturer.
3. Liabilities passes on to the customer immediately after despatch and shortages should be notified within one week.

C.4. Man-Power Requirements.

The factory personnel are of the following categories:

1. Managerial and administrative
2. Technical and Supervisory
3. Clerical
4. Labourers- Skilled, unskilled and semi-skilled.

Requirements of each category is as given below for each section.

Table-7. Factory personnel requirements.

Personnel	Working shift	Labour U.S.	per shift S.S.	shift S others	Total per day
1. Labourers					
Compounding	2	1	1		4
Mixing	2	1	2		6
Extrusion	2	2	1		6
Spreading	1	1	1		2
Building & Vulcanisation	3	8	3		33
Packing	1	2			2
Stores	1	1			1
Boiler room	3			1	3

Personnel	Working shift	Labour U.S.	per S.S.	shift S	Others	Total per day
Watchman	3	1				3
Sweeper	1	1				1
2) Technical & Supervisory						
Production & Quality Control.	3				1	3
Engineering	1				1	1
3) Manager-cum Technologist						
	1				1	1
4) Administration Accounts & Sales						
Officer-cum Marketing Assistant	1				1	1
Clerk/Typist	1				1	1
Total						68

Table-8.

Cost of Salaries and Wages

<u>Category</u>	<u>Cost per month</u>	<u>Numbers.</u>
Unskilled (U.S)	Rs. 250/month	40
Semi-skilled(S.S)	Rs. 300/month	18
Skilled (S)	Rs. 350/month	3
Supervisor	Rs. 600/month	4
Manager-cum-Technologist	Rs.1000/month	1
Administration officer	Rs. 700/month	1
Clerk/Typist	Rs. 400/month	1

The annual expenses for salaries and wages are given in Annexure II-B.

Training Programme:

For good productivity able and efficient technologist, supervisors, mill and extruder operators etc. are a must. A small industrialist can resort to the facilities provided by common facility service centre of the State Government in this connection.

C.5 Infra-Structure and other facilities.

Roads & Other Transports facilities.

This aspect should be taken into account during the site selection as provision by oneself is outside the capacity of a small entrepreneur.

Transportation of raw materials and finished products can be done by trucks which can be hired or by entering into a contract with a truck owner.

The selected site offers cheap and good transportation facilities to the various parts of the state (through the Vempanattu Back water) and to be main port of the state-Cochin- in case of any export necessity.

Utilities.

The utilities include water, power for machines and lighting etc. and steam.

Water used for:-

1. Cooling mixing mills, extruder etc.
2. Boiler
3. Toilets & others.

Table-9- Total water requirement per day

Mixing mills	20 Kilo litres
Extruder	20 Kilo litres
Boiler	1 Kilo litre
Others	2 Kilo litre

Total	43 Kilo litres.

Hence Annual consumption 13000 Kilo litres.

The site selection should hence ensure an abundant supply of water.

Power.

The electric power required is tapped from a high tension line through a transformer since it is cheaper.

The power requirement is ~~to be~~ 131 H.P.

Table-10

<u>Item</u>	<u>H.p.</u>	<u>Working Shifts</u>
Mixing mills 16" x 42"	60	2
Mixing mill 14" x 36"	40	2
Extruder 2½"	8	2
Spreading Machine	5	1
Churning mill	4	3
Cooling water pump	5	1
Boiler pumps	3	3
Air Compressor	2	3

Total	127	
Light, fan etc.	<u>3</u>	
Total	130	

This will come to about 100 K.W. Assuming a power factor of 0.8 and allowing a safety margin, 200 KVA transformer is intended to be installed, the additional capacity facilitating any expansion.

The power consumption is calculated in KWH units. The horse power of single shift, double shift and three shift machines are calculated separately and assuming a consumption of 80% the actual consumption is calculated.

Table-11. Power consumption per day.

Item	H.P.	KWH
Single shift machines	10	47.7
Double shift machines	108	1030.0
Three shift machines	9	129.0
Total		1207 KWH
Light, fan etc.	3	43

Total KWH for machines per day = 1207 KWH
=====

Consumption for light, fan etc/day = 43 KWH
=====

Annual power consumption by machines = 362000 KWH.

Annual power consumption for fan, light etc. = 12900 KWH

The capital requirements are shown in Annexure II C.

Steam.

Steam is consumed by the vulcaniser. Each charge is the vulcaniser will consume about 66 Kgs of steam and on the average there will be about 15 charges per day to be cured. Though the requirements of steam is small (about 1ton/day) the capacity of the boiler will have to be large-at least 250 Kg/hr so that pressure build up in the vulcaniser is rapid.

Hence the annual consumption of steam will be about 300 tons.

One litre of furnace oil is consumed for every 10 Kg of steam on an average. Hence the annual requirement of furnace oil will be 30 Kilo litres.

The financial requirements for steam are shown in Annexure-II C.

SECTION D

PROCESS OF MANUFACTURE AND PRODUCTION.

D.1 Brief Process

Mastication and Compounding.

Of the raw and reclaimed rubbers, NR has to be initially masticated to enable it to accept other compounding, ingredients into the rubber matrix.

The rubbers are banded on the two roll mills. When a smooth band is formed the other ingredients like stearic acid, Zinc oxide, Carbon black, other fillers, accelerators and sulphur are added and compounded. The mixing and compounding time should be long enough to obtain a good dispersion of the ingredients without hampering the productivity.

The tube and cover compounds are mixed and compounded separately and the cover compound is sheeted out from the mill to serve as the cover stock. Both compounds are stored and given a sufficient maturing time.

Extrusion

For feeding the extruder the tube compound is to be pre-warmed on the mill. A strip is cut and a continuous strip is fed into the extruder. The extruder can be filled with different dies so as to produce tubes of different circular cross-sections.

Spreading.

The spreading compound is prepared in the solution mixer or churning mill. The spreading compound is prepared in the mixing mill allowing sufficient time to achieve a low viscosity, and is fed into the mixer with solvent,

and the mixer is worked for a sufficient time to get a homogenous dough of consistent viscosity.

The spreading machine is fed with the dough and the fabric is continuously spread with the compound. Fresh supply of dough is given when it is depleted. The spread fabric is wound on rollers with a cotton liner to prevent adhesion.

Fabric Cutting.

The spread fabric is cut in a bias to the required length. They are then spliced together, applying the solvent if necessary.

Building:

The extruded tubes of required diameter are cut to the necessary lengths and are blown on to the mandrel, a cushion of air facilitating its progress. This is done by connecting one end of the hose to a supply of air from the air compressor.

The required layers of fabric are applied over the tube, care being taken to prevent any air entrapment. In the case of suction hoses a GI steel wire is spiralled over the assembly in between the fabric layers. The rubber cover is then applied over the assembly and the whole is consolidated with the consolidating rollers. Afterwards the assembly is tightly wrapped with cloth tape and kept on the trolley of the vulcaniser.

Vulcanisation

The assembled and wrapped hoses are put on the trolley and the trolley is pushed into the autoclave. The steam pressure is allowed to build up and when the cure time is over the trolley is pulled out. The cloth tape is removed from the hoses and the mandrell is taken out and, stored.

Packing & Despatch: The finished hose is packed in Hessian bags according to sizes and despatched according to orders.

Flow-Chart: A flow-chart of the process is given in Appendix II.

Other Details

Formulations: Some **typical** formulations are given in Appendix III.

The member of plies and Bursting Pressure.

The burst pressure for different types of hoses and the no. of plies are usually specified by the I.S.I. In turn, the burst pressure can be calculated by the following equation for a wrapped ply construction.

$$P = \frac{2.26 \times S \times N}{N} \quad \text{Where}$$

P = Bursting pressure

N = Number of plies

S = Fabric Tensile

D = Mean ply diameter.

Conversely when the pressure is specified, the type of fabric and the number of plies can be calculated.

D.2. Quantum of Production

Under the scheme hoses and tubings of various sizes and dimensions can be manufactured. For the purpose of calculations a typical daily production of the following hoses in the quantities given is envisaged.

Water delivery hoses (15 mtr. length each)

$\frac{3}{4}$ " I.D.	one ply	- 25 Nos.
1" I.D.	one ply	- 25 Nos
$1\frac{1}{2}$ " I.D.	one ply	- 25 Nos.
2" I.D.	one ply	- 10 Nos.

Suction Hoses (10 Mtr. length each)

2" I.D.	3 ply,	Wire reinforced - 15 Nos.
$2\frac{1}{2}$ " I.D.	3 ply,	Wire reinforced - 15 Nos.
3" I.D.	3 ply,	Wire reinforced - 15 Nos

Oil Suction and Delivery Hose (16 mtr length)

2" I.D.	3 ply,	Wire reinforced - 2 Nos.
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Annual Production

Water delivery hoses (15 mtr length each)

$\frac{3}{4}$ " I.D.	- 7500 Nos.
1" I.D.	- 7500 Nos.
$1\frac{1}{2}$ " I.D.	- 7500 Nos
2" I.D.	- 3000 Nos.

Water Suction Hoses (10 mtr length)

2" I.D.	- 4500 Nos.
$2\frac{1}{2}$ " I.D.	- 4500 Nos
3" I.D.	- 4500 Nos

Oil Suction & Delivery Hose (16 mtr length)

2" I.D.	- 600 Nos.
---------	------------

D.3 Process Loss.

As in any other industry, process losses are bound to occur during the different production operations. But at all levels, it should be restricted to the minimum and no stone should be left unturned in this connection to ensure low production costs and, productivity.

A process loss of 3% is accounted for in calculating the raw material costs.

D.4. Quality Control Measures.

Every product should have a certain level of quality, worth of its price. By quality what is meant is certain characteristics assigned to a product. Quality control ensures product uniformity and consistency of quality by keeping the variations within tolerances ie within certain specified limits. For a small entrepreneur quality consciousness will in the long run prove to be the foundation for success. Quality control measures should be taken from the very start of purchase of raw materials to the final despatch of finished product.

The raw materials are to be tested for the desired level of purity. These tests need not be repeated every now and then once an agreement with an established manufacturer has been made.

Strict supervision of the machinery and processes, and in-process materials are a must.

The finished products are to be tested according to I.S.I. specifications as far as possible. A list of I.S.I. specifications on Hoses is given in Appendix IV. An application for I.S.I marking should be made as soon as possible. The I.S.I. mark is an insurance of quality for the customer and when the product bears the I.S.I mark he won't settle for anything less.

The usual tests conducted on hoses are for length, Tensile strength and elongation at break of the lining and cover, thicknesses of tube and cover, Permanent set, Adhesion, Accelerated ageing, diameter-internal and external-oil absorption, Hydraulic test, Proof pressure test and swelling test.

D.5 Plant-lay-out.

In order to keep the operating costs at the minimum, the following points should be taken into account in determining the lay-out ~~plant~~ of the plant.

1. Materials Handling is to be the minimum
2. Room for further expansion
3. Ensure an easy flow of materials through the factory.

A lay-out of the plant is shown in Appendix V.

SECTION E.

Selling and Distribution Arrangements.

The most commonly adopted procedures for selling are direct sales by opening sales depots and sales through agents on commission basis. It would be impracticable for the small-industrialist to open depots all over the state. The product can be sold through agents and dealers in similar line and commission on sales given vary from 15 to 20%.

Within the state the product can be distributed by trucks taken on hire or on a long term contract. Outside the state it would be cheaper to use railway wagons.

SECTION. F.
CAPITAL REQUIREMENTS

F.1. Fixed Capital.

Fixed Capital is the sum of expenses incurred for land, building, Plant and Machinery, other fixed assets and pre-operative expenses that can be capitalised under present Company law provisions. It should also include expenses incurred on Office furniture etc.

Table. 12.

1. Land and Building.	Rs. 2,29,000.00
2. Plant and Machinery.	Rs. 6,32,300.00
3. Other fixed assets.	Rs. 15,000.00
4. Pre-operative Expenses.	<u>Rs. 31,000.00</u>
Total.	<u>Rs. 9,07,300.00</u> =====

Details of fixed capital requirements are shown in Annexure. I.

Working Capital.

The Working Capital provides fund for a definite period of production depending on the time taken for the realization of the sales value. This is calculated usually for 2 to 3 months. Working capital comprises of raw material costs (including packing materials), Salaries and Wages, utilities and other overheads.

Table. 13.

Working Capital.

1. Raw Materials.	Rs. 21,40,000.00
2. Salaries and Wages.	Rs. 3,21,360.00
3. Utilities.	Rs. 78,700.00
4. Other Overheads.	<u>Rs. 37,300.00</u>
Total.	Rs. 25,77,360.00
Working Capital (for 3 months)	Rs. 6,44,340.00
Rounded off	Rs. 6,44,500.00

Details are shown in Annexure II.

Total Capital Requirements.

Table. 14

Total Fixed Capital	Rs. 9,07,300.00
3 Months Working Capital.	<u>Rs. 6,44,500.00</u>
	Rs. 15,51,800.00
Rounded off	<u>Rs. 15,52,000.00</u> =====

SECTION. G.
FINANCING PLAN

At present, in the country there are several institutions extending financial help to new entrepreneurs. The terms and conditions and the extent of help offered differ from one institution to another. A list of institutions to be approached are given in Appendix

For the proposed factory the financing plan is as follows.

100% of the ex-factory price of machinery is taken from Kerala Financial Corporation against hypothecation of machinery. The Working Capital is taken as loan from Nationalised banks. The rest is own funds.

From KFC	Rs. 5,26,900.00
From Banks	Rs. 6,44,500.00

Total Drawings.	Rs. 11,71,400.00
Own funds.	Rs. 3,80,600.00

Total.	Rs. 15,52,000.00
	=====

There is no need of any foreign exchange for the factory as all the machinery and raw materials are indigenously available.

SECTION. H.
PRICING POLICY

The prices should not only fetch a profit on the investment but also should be viable in the market and should be as far as possible conforming to the prices of the competitors. A typical price list is given here. (Prices are F.O.R. destination, exclusive of Excise duty and taxes).

Table. 15
Prices of Hoses

Type	Size	Price (Rs/metre)
Water delivery hoses	$\frac{3}{4}$ "	2.20
	1"	3.00
	$1\frac{1}{2}$ "	5.00
	2"	6.40
Water Suction Hoses	2"	16.30
	$2\frac{1}{2}$ "	18.80
	3"	21.00
Oil Suction & Delivery	2"	38.00 .

SECTION. I
PROFITABILITY

Rate of return on own Capital.

Own Capital.	Rs. 3,80,600
Net Profit.	Rs. 3,37,000
Rate of return on own Capital	88.53%

Rate of return on Capital employed.

Fixed Capital.	Rs. 9,07,300.00
Working Capital.	Rs. 6,44,500.00
Total Capital employed.	Rs. 15,51,800.00
Net Profit.	Rs. 3,37,000.00
Rate of return on Capital employed	21.71%

Percentage Profit on Sales Turnover.

Annual receipts from Sales.	Rs. 42,25,000.00
Annual Profit.	Rs. 3,37,000.00
% Profit on Sales turnover.	7.977%

SECTION J
ECONOMIC VIABILITY

Interest ammitments.

7.5% interest on term loan from K.F.C.	Rs. 42,220.00
16% interest on Working Capital from Banks.	<u>Rs.1,03,100.00</u>
	Rs. 1,45,320.00 =====

Ability to pay back borrowed funds.

The term loan has to be paid back within the prescribed time. The pay back period is to be kept at the minimum time possible to save the interest to be paid year after year. Once the pay-back is started, year after year the ability to pay-back the borrowings increases since cash inflows are higher due to decreased interests.

Pay back period.

	<u>Rs.</u>
a) Annual Profit.	3,37,000.00
b) Depreciation.	<u>75,200.00</u>
c) Available surplus (a + b)	4,12,200.00
d) Less Drawings.	<u>1,48,750.00</u>
e) Amount used for repayment.	2,63,450.00
f) Term loan to be paid back	5,26,900.00
g) Pay back period.	2 Years.

SECTION. K.

SOCIAL BENEFITS

In the larger perspective of national development also, the entrepreneur is doing a good job by masterminding this ~~profit~~ project. It provides the following advantages to the society at large.

1. Offers employment for about 67 persons.
2. It is one more step towards ensuring a more equitable distribution of national income.
3. Mobilication and utilisation of capital and skill.
4. As the concern is to be located in an under developed rural area, it helps in the distribution of industries all over the country.
5. Increases the revenue earnings of the nation through taxes, excise duty etc.
6. Provides personal benefits to the entrepreneur.

ANNEXURE - I

FIXED ASSETS - CAPITAL REQUIREMENTS

A. <u>Land & Building</u>	<u>Rs</u>
1. 2000 Sq.m. of land at Rs. 7/- per Sq. metre.	14,000.00
2. Site levelling, fencing, drainage road etc.	5,000.00
3. Cost of 600 Sq.m of built up area at Rs. 300/- per Sq.m.	18,000.00
4. Overhead tank (50,000 litres)	30,000.00

Total.	2,29,000.00 =====

ANNEXURE I.B.

B. <u>Plant & Machinery.</u>	Rs
1. Mixing mill 16"x42" with accessories - one	1,56,000.00
2. Mixing mill 14"x36" with accessories - one	1,00,000.00
3. Extruder 2½" with accessories - one	12,500.00 ?
4. Spreading machine 60"x18" with accessories. - one	35,000.00
5. Solution mixer with accessories - one	10,400.00
6. Vulcaniser with accessories - one	30,000.00
7. Boiler-250 Kg/hr - with accessories.	45,000.00
8. Air compressor - 10 cfm, 100 psi, accessories	15,000.00
9. Wiring & Wrapping machine - one	10,000.00
10. Building Rollers.	4,000.00
11. Building tables, rack, hand tools and consolidation rollers.	25,000.00
12. Different sizes of Mandrells.	20,000.00
13. Pump for cooling water, pipings etc.	10,000.00
14. 200 KVA transformer.	50,000.00
15. Weighing machines.	
a. Platform balance.	1,200.00
b. Pan type balance.	800.00
c. Dial type balance.	<u>2,000.00</u>
Total.	5,26,900.00
Transportation and freight 3%	15,807.00
Erection and installation @ 5%	26,345.00
Provision for price escalation @ 5%	26,345.00
Sale Tax and other taxes @ 7%	<u>36,883.00</u>
Total.	<u>6,32,280.00</u>
Rounded off.	<u>6,32,300.00</u>

ANNEXURE I.C.
OTHER FIXED ASSETS

	<u>Rs.</u>
Office furniture and equipments.	5,000.00
Laboratory Equipments.	8,000.00
Miscellaneous.	<u>2,000.00</u>
Total.	15,000.00 =====

ANNEXURE I.D.
PRE-OPERATIVE EXPENSES

Travelling Expenses.	1,500.00
Postage, telegram and Telephone.	500.00
Printing & Stationary.	1,500.00
Advertisement.	1,000.00
Rent and Establishment.	1,500.00
Legal charges.	1,000.00
Interest on block loan (Rs. 6 lakhs taken @ $7\frac{1}{2}\%$ for 6 months)	22,500.00
Miscellaneous.	<u>1,500.00</u>
Total.	31,000.00 =====

ANNEXURE I.E.

TOTAL FIXED CAPITAL

	<u>Rs.</u>
Land and Building.	2,29,000.00
Plant and Machinery.	6,32,300.00
Other fixed assets.	15,000.00
Pre-operative Expenses.	31,000.00

Total.	9,07,300.00
	=====

ANNEXURE . II
WORKING CAPITAL COMPONENTS

ANNEXURE.II.A.

Raw Materials Requirements per Annum.

(Prices quoted are including transportation charges)

Sl. No.	Material.	Price/ Kg. Rs	Quantity Kg.	Total cost Rs.
1	Natural Rubber.	9	80,000	7,20,000.00
2	SBR	8.50	30,000	2,55,000.00
3	Chemaprene.	16.50	4,000	66,000.00
4	WT Reclaim.	3.30	36,000	1,18,800.00
5	Carbon black-HAF	6.60	7,500	49,500.00
6	Carbon black-FEF & SRF	4.25 (av)	7,500	31,875.00
7	Clay	0.25	2,00,000	50,000.00
8	Whiting.	0.30	95,000	28,500.00
9	Oil (Naphthenic and Paraffinic)	9.00	13,000	1,17,000.00
10	Zinc Oxide.	15.00	3,000	45,000.00
11	Stearic Acid.	11.00	2,400	26,400.00
12	PBN	35.00	1,200	42,000.00
13	CBS	45.75	1,200	54,900.00
14	TMT	30.50	120	3,660.00
15	Sulphur	2.00	3,000	6,000.00
16	DOP	12.00	500	6,000.00
17	Paraffin Wax.	2.50	50	125.00
18	MBTS	32.50	80	2,600.00
19	Nonox B.	36.35	66	2,400.00

20.	Renacit.	23.50	13.5	320.00 (ap.)
21.	Pine tar	5.00	670.60	3,350.00
22.	MOR,TMT etc (For Nitrile)	40.00 (av)	235.00	9,400.00
23.	Wire 12 SWG.	5.00	9,000.00	45,000.00
24.	Solvent Petroleum Naphtha	3.50/ litre.	40,000.00 litres.	140,000.00
25.	Fabric.	2.00/ metre.	150,000 mtrs.	3,00,000.00
26.	Solvent - Petroleum Naphtha or SBP	3.50/ litre.	40,000 litres.	1,40,000.00
27.	Miscellaneous (Packing materials, lubricants)			9,770.00

21,40,000.00
=====

ANNEXURE II.B.

MAN-POWER REQUIREMENTS

Category.	Number per day	Cost per month. Rs.	Annual Expenses. Rs.
1. Manager-cum-Technologist	1	1,000	12,000.00
2. Administration Officer.	1	750	9,000.00
3. Supervisors.	4	2,000	24,000.00
4. Clerk/Typist.	1	400	4,800.00
5. Skilled Workers.	3	1,050	12,600.00
6. Semi-Skilled Workers.	18	5,400	64,800.00
7. Unskilled Workers.	40	10,000	1,20,000.00
Total.	68	20,600	2,47,200.00
30% fringe benefits.			74,160.00
Total.			3,21,360.00

ANNEXURE.II.C.

ANNUAL WORKING EXPENSES ON UTILITIES

	<u>Rs</u>
362000 KWH of power @ Rs. 012/Unit.	43,440.00
12900 KWH of power @ Rs. 0.20/Unit	2,580.00
30000 Litres of furnace oil for steam @ Rs. 1.05/litre.	31,500.00
Transportation of fuel (about Rs.0.04/litre)	1,180.00

Total.	78,700.00
	=====

ANNEXURE II.D.

OTHER OVERHEADS

Repairs & Maintenance on building @ 1%	2,290.00
Repairs & maintenance on machinery @ 5%	18,960.00
Travelling and advertisement.	3,000.00
Printing and Stationary.	1,500.00
Postage and telephone.	1,000.00
Insurance (1% of total fixed Capital)	9,050.00
Audit fee and legal charges.	500.00
Miscellaneous.	1,000.00

	37,300.00
	=====

ANNEXURE. II.E.

TOTAL WORKING EXPENSES PER ANNUM.

	<u>Rs.</u>
1. Raw Materials.	21,40,000.00
2. Salaries and Wages.	3,21,360.00
3. Utilities.	78,700.00
4. Other overheads.	37,300.00

Total.	25,77,360.00
	=====
Working capital for 3 months	6,44,340.00
Rounded off.	6,44,500.00
	=====

ANNEXURE. III

TOTAL CAPITAL REQUIREMENTS

	<u>Rs.</u>
Total fixed Capital.	9,07,300.00
Three months Working Capital.	6,44,500.00

Total.	15,51,800.00
Rounded off.	15,52,000.00
	=====

ANNEXURE. IV.
FINANCING PLAN

Rs.

Term loan from Kerala Financial
Corporation for machinery.

5,26,900.00

From Banks - Working Capital.

6,44,500.00

Total Borrowings.

11,71,400.00

Own funds.

3,80,600.00

Total.

15,52,000.00

ANNEXURE. V.I.

DEPRECIATION PER ANNUM

	<u>Rs.</u>
Depreciation on Machinery @ 10%	63,200.00
Depreciation on building @ 5%	10,500.00
Depreciation on other fixed assets @ 10%	1,500.00

Total.	75,200.00
	=====

ANNEXURE V.2.

INTEREST PER ANNUM

Interest on term loan for machinery from KFC @ 7.5%	42,220.00
Interest on working Capital loan @ 16%	1,03,100.00

Total.	1,45,320.00
	=====

ANNEXURE-VI

ANNUAL COST OF PRODUCTION

Total Working Expenses per Annum	Rs. 25,77,360.00
Total Depreciation	Rs. 75,200.00
Total Interest commitments	Rs. 1,45,320.00

Total	Rs. 27,97,880.00
	=====

ANNEXURE -VII

ANNUAL SALES AND PROFIT

Water delivery hoses (15 mtr. length)

¾"	I.D.	7500 Nos	Rs. 2,47,500.00
1"	I.D.	7500 Nos	Rs. 3,37,500.00
1½"	I.D.	7500 Nos	Rs. 5,62,500.00
2"	I.D.	3000 Nos.	Rs. 2,88,000.00

Water Suction hoses (10 mtr.length)

2"	I.D.	4500 Nos.	Rs. 7,33,500.00
2½"	I.D.	4500 Nos.	Rs. 8,46,100.00
3"	I.D.	4500 Nos.	Rs. 9,45,000.00

Oil delivery & Suction

2"	I.D.	600 Nos.	<u>Rs. 3,64,900.00</u>
----	------	----------	------------------------

Total Sales Rs.42,25,000.00

Less 20% Commission 8,45,000.00

33,80,000.00

Less Transportation Charge
@ Rs.200/ton for about
500 tons

1,00,000.00

32,80,000.00

Less Annual Cost of production 27,97,880.00

Gross Profit 4,82,120.00

Tax incidences @ 30% 1,44,636.00

Net Profit 3,37,484.00

=====

Rounded off 3,37,000.00

ANNEXURE- VIII.

PROFITABILITY

ANNEXURE- VIII A

Rate of Return on own Capital

Own Capital Rs. 3,80,600

Net Profit Rs. 3,37,000

Rate of return on own capital = 88.53%

B. Percentage Profit on Capital Employed.

Total Capital Employed Rs. 15,52,000

Net Profit Rs. 3,37,000

Percentage Profit on Capital employed = 21.71%

C. Percentage Profit on Sales Turn over.

Annual return on sales Rs. 42,25,000

Net Profit Rs. 3,37,000

Percentage profit on sales turn over = 7.977%

D. Percentage Profit on Fixed Assets.

Total fixed Capital Rs. 9,07,300

Net Profit Rs. 3,37,000

Percentage Profit on sales = 37.15%

E. Percentage Profit on Working Capital.

Total Working Capital Rs. 6,44,340.00

Net Profit Rs. 3,37,000.00

Percentage Profit on Working Capital = 52.30%

ANNEXURE-IX.

Pay Back Period.

a) Annual Profit	Rs. 3,37,000
b) Depreciation	Rs. 75,200
c) Available Surplus (a+b)	Rs. 4,12,200
d) Less drawings	Rs. 1,48,750
e) Term loan to be paid back	
	= 526,900.00
Pay back period	= 2 Yrs.
	==~=====

APPENDIX. I.
SUPPLIERS OF MACHINERY

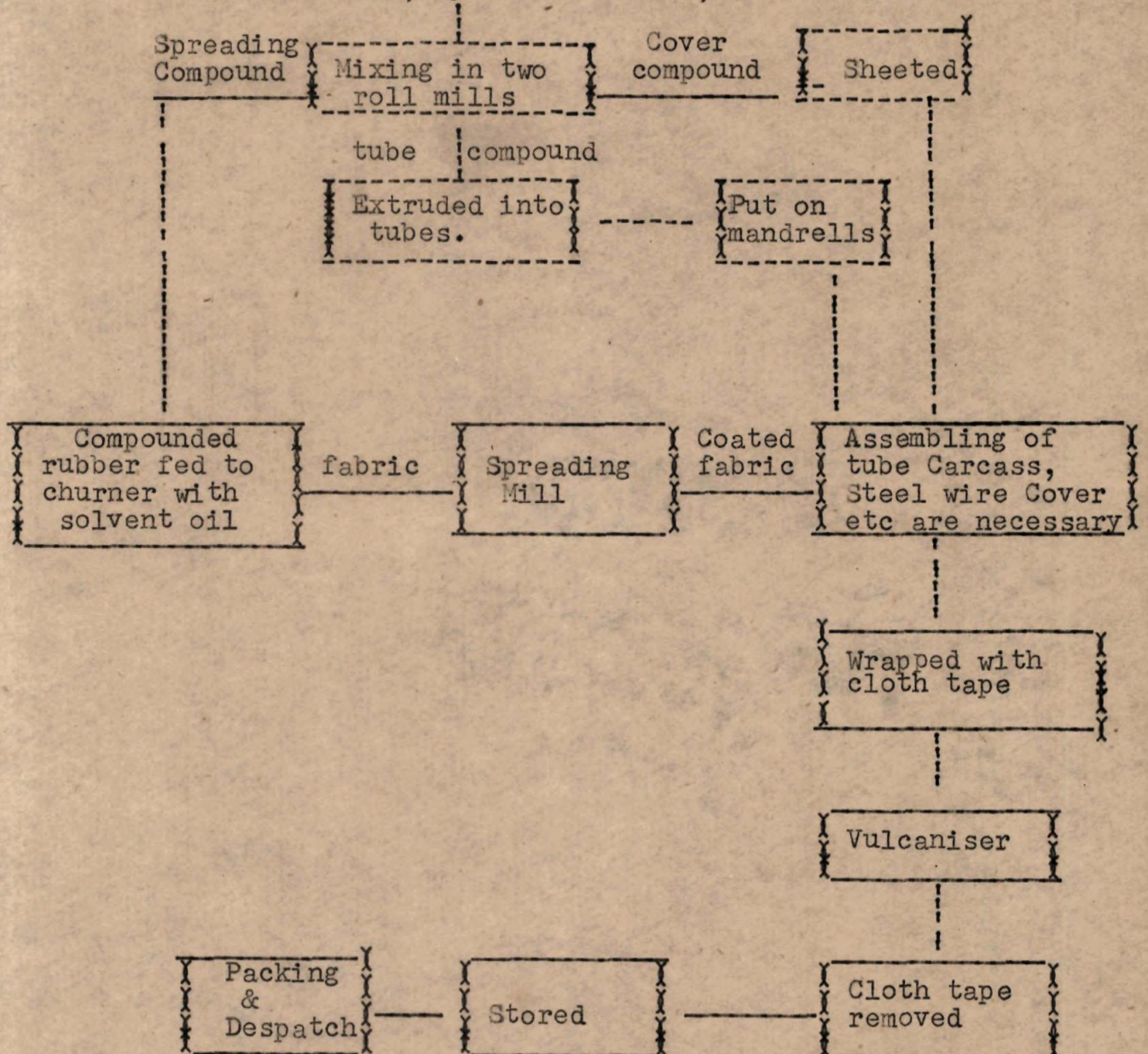
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|-----------------------------------------------------------------------------------------------------|--------------------------------------------------------|
| 1. Richardson & Crudas Ltd.
Byculla Iron Works,
Bombay - 400 008. | Mixing mills
Extruders. |
| 2. Sohal Engineering Works,
Tulsi Pipe Road,
Off Haines Road,
Mahalaxmi, Bombay - 400 013. | Mixing mills,
Extruders,
Spreading machines. |
| 3. Indian Expeller Works,
17 A, Saitafalwadi,
Mazgaon, Bombay-400 010. | Mixing mills
Extruders. |
| 4. Blue Bird Industries,
11, Bruce Street, Fort,
Bombay - 400 001. | Spreading machines,
Churning mills,
Boilers etc. |
| 5. Batliboi & Co., Private Ltd.,
Forbes Street, Fort,
Bombay - 400 001. | Boilers and Air
Compressors. |
| 6. Varsha Boilers Private Ltd.,
Green House, Green Street,
Bombay - 400 001. | Boilers. |

APPENDIX-I

RUBBER HOUSE

FLOW SHEET

Natural Rubber, Synthetic Rubber, Reclaimed Rubber



APPENDIX-III.

Typical Formulations:

Water delivery hoses and Suction Hoses.

a) Tube:

Natural Rubber Sheets	60
SBR-1712	20
WT Reclaim	40
Carbon black-FEF	15
Hard Clay	150
Whiting	50
Naphthenic oil	10
Zinc oxide	2.5
Stearic acid	2
Antioxidant PBN	1
Accelerator CBS	1
Accelerator TMTD	0.1
Sulphur	2.5

b) Cover:

Natural Rubber Sheets	60
SBR-1712	30
WTR	20
HAF	10
Hard Clay	150
Whiting	75
Aromatic oil	12
Zinc oxide	2.5
Stearic acid	2
PBN	1
CBS	1
PMTD	0.1
Sulphur	2.5

C) Spreading Compound:

EBC 3 X	100
Renacit VII	0.1
Whiting	100
Pine Tar	5
Aromatic oil	4
Zinc oxide	5
Stearic acid	2
PBN	1
MBTS	0.6
Sulphur	2.5

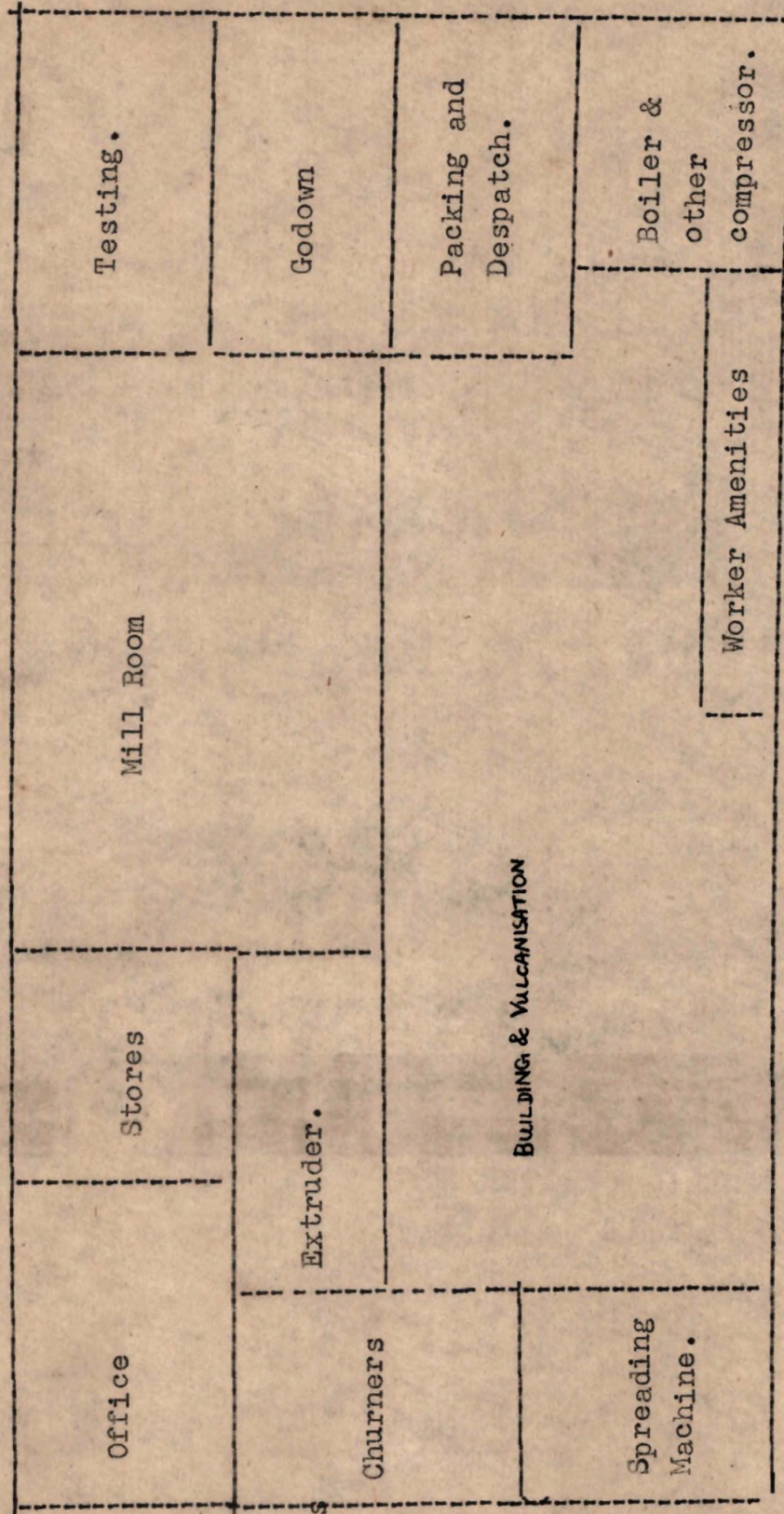
APPENDIX. IV

List of ISI Specification on Hose Pipes:

	<u>Title</u>
IS-444-1964	... Water Hose of Rubber, Low Pressure, with Woven Reinforcement.
IS-445-1964	... Water Hose of Rubber, High Pressure, with Woven Reinforcement.
IS-446-1964	... Air Hose of Rubber, Light Duty, with Woven Reinforcement.
IS-447-1964	... Welding & Cutting Hose of Rubber, with Woven Reinforcement.
IS-635-1964	... Oil and Solvent Resisting Hose of Rubber with Woven Reinforcement.
IS-636-1964	... Fire-Fighting Hose (Rubberlined, Woven Jacket)
IS-911-1963	... Braided Air Hose of Rubber, Heavy Duty.
IS-912-1963	... Braided Air Hose of Rubber, Light Duty.
IS-913-1963	... Braided Water Hose of Rubber, High Pressure.
IS-914-1963	... Braided Water Hose of Rubber, Low Pressure.
IS-1677-1963	... Braided Spray Hose of Rubber, High Pressure.
IS-2396-1963	... Braided Hose of Rubber for Petrol and Diesel Fuels.
IS-2410-1963	... Suction Hose of Rubber for Fire Service.
IS-2482-1963	... Water Suction Hose of Rubber for Light Duty.
IS-2765-1964	... Radiator Hose.
IS-3557-1975	... Air Hose of Rubber, Heavy Duty, with Woven Reinforcement.

APPENDIX. V
LAY-OUT

40 mtrs.



15 mtrs

40 mtrs.