PROJECT REPORT ON A SMALL SCALE UNIT

TO MANUFACTURE

PVC INSULATED HOUSE WIRES

SUBMITTED TO THE UNIVERSITY OF COCHIN

IN PARTIAL FULFILMENT OF

BACHELOR OF TECHNOLOGY DEGREE COURSE IN

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By

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CHAPTER-1

INTRODUCTION

This is a project on the manufacture of PVC insulated house wires.

PVC is by ~~th~~ far the most widely used plastic as an insulating and sheathing material in the cable industry. The PVC insulated cables offer certain technical and economical advantages, for certain applications, which cannot be matched by rubber (synthetic or natural), polythene or any other plastic. Therefore, the use of PVC cables is fast-increasing for a variety of applications including household wires.

PVC is tough; resistant to chemical and microbiological attacks. The few chemicals which do attack PVC are not likely to come into contact with the cable of a normal public distribution system. In an industrial plant, hazards could arise from contact with concentrated sulphuric acid, highly chlorinated hydrocarbons, cresylic acid, pyridine, Furfural and ketones.

PVC does not support combustion. It is resistant to abrasion, to penetration and to permanent deformation.

Advantageous characteristics of PVC cables are:-

1. Immunity to corrosion, abrasion and moisture.
2. Low weight and overall physical dimensions of the cable.
3. Easy flexibility.

4. Ability to sustain severe bending.
5. Resistance to the effects of D.C.Voltages.
6. Fire retarding properties.
7. High resistance to ageing and consequently prolonged life.
8. Negligibly low water absorption.
9. Bright and attractive colours.
10. PVC cable coverings are adequately tough and do not call for additional protection in the form of expensive conduits or encased wiring system.
11. It can be sunk into the plaster of new buildings for concealed wiring. The installation is much simpler even in most easily accessible places such as roofing.
12. Highly resistant to oil, grease and most of the acids and alkalies where as rubber insulated cables suffer damage due to grease, oil, etc. and are vulnerable to deterioration by paints, distemper, etc. that may be applied on the wiring, and as such require ps protection like braiding for many purposes.

The manufacture of house wiring cable is reserved for SSI units. The demand for PVC insulated housewire is expected to grow in view of the fact that rubber insulated housewire, the main competitor, is relatively costly and is in short supply.

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CHAPTER - 2

LITERATURE SURVEY

Quite a lot of literature is available regarding the development of cable industry.[1,2,3,4,5] A brief summary is given below:-

Tracing the origin of electric cable, it was nearly 150 years age that the first cable was made in U.K. One of the article clearly explains the advantages and draw backs of various materials used as insulant for an electric cable. The extrusion plant which was in existence in the cable-making industry was equipped for use with rubber and the operators were familiar with this material. It is not surprising, therefore, that the cable makers did not take a very active part in the darly development of plasticised vinyl resins. Likewise, the rubber industry generally did not become actively interested in the new materials until they were generally accepted.

The use of plastics in cable before the last World War was virtually unknown. During this war, the supply position of rubber became very difficult especially so in Germany, and PVC came in as a handy material. Plasticised and compounded PVC has since then been acknowledged all over the world as an ideal insulating material for this purpose. In Germany, the development of PVC as insulating and sheathing materials was rapid and by 1962, the share of PVC power cables was over 80% on the length basis.

A detailed report on the initial development of Indian Cable Industry appeared in the report of the national productivity council.[6] According to this report, we had the first cable plant, the Indian Cable Company Limited (ICC) in 1923. It was the only cable unit before 2nd World War. The National Insulated Cable Co. of India Ltd. (NICCO) was established in 1942 and equipped for the manufacture of all types of house-wiring cables.

In 1960, the Government of India set up a standing committee for preparing a progressive substitution programme. The first measure introduced was substitution of aluminium for copper conductors. It may surprise many that in 1962 when the European manufacturers were still using copper, India pioneered the use of aluminium in cables. Today, aluminium has almost completely replaced copper as a conductor in domestic cables as well as power cables. The Aluminium Industries Ltd. (ALIND) was the first unit to introduce manufacture of insulated aluminium conductors.

In India, the production of PVC insulated cables started only after independence. Siemens were the first to introduce PVC cables in India. The beginnings of PVC cables were made in a small scale and the success was so rapid that by 1962 the number of PVC cable manufacturers rose to 117 units, most of them being small and medium sized units. The actual production of rubber and plastic insulated household wires rose from about 44 million core metres in 1953 to 364

million core metres in 1965-'66.

Now-a-days, plastic insulated, especially PVC insulated, household wires are becoming more and more popular and are fast replacing the use of rubber insulated wires for housewirings.

Brig.S.Ramachandran[7] has given a comprehensive report on the latest development of cable industry in India and he successfully compared the characteristic properties of the insulating materials such as XLPE, impregnated paper and PVC.

Comparision of Properties

	Property	XLPE	Impregnated Paper	PVC
1.	Dielectric loss factor (tans) at 50 cps & 20°C	0.0002	0.004	0.02-0.10
2.	Dielectric constant at 50 cps & 20°C	2.3	3.5	4.0 - 8.0
3.	Volume resistivity at 20°C in ohm-cm.	10^{19}	10^{16}	10^{16}
4.	Tensile strength (MN/m^2)	15	--	15
5.	Max.continuous conductor temperature in °C.	90	65/70	70
6.	Max.conductor temperature at short circuit in °C.	250	160	160
7.	Emergency overload in °C.	130	110	95
8.	Elongation at Break, %	500	--	200
9.	Dielectric strength KV/mm	60	40	25 - 30
10.	Specific gravity	0.92	1.0	1.4
11.	Resistance to abrasion	good	--	good

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Property	XLPE	Impregnated paper	PVC
12. Deformation resistance at 150°C	good	good	poor
13. Ageing resistance at			
100°C	excellent	good	moderate
120°C	good	moderate	poor
150°C	moderate	poor	--
14. Resistance to moisture penetration.	good	excellent	excellent
15. Resistance to fungus	good	good	moderate
16. Incidence of failure	low	low	--
17. Fire resistance	poor	poor	excellent

The manufacture of house-wiring cables is reserved for development in the small scale sector by government regulations.

Considering the above factor it is worthwhile to start a small scale unit for the manufacture of housewire cable in Kerala both from the manufacturer's as well as from the customer's point of view.

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Literature Survey - References are given in Appendix - I.

CHAPTER - 3

PROCESS OF MANUFACTURE

The proposed unit intends to manufacture the following PVC insulated cables and plastic wires.

PVC insulated cables:-

Nominal cross-sectional area of conductor	Applications
1.5 mm^2	For ordinary light load.
2.5 mm^2	ordinary plug points
4 mm^2	power plugs
6 & 10 mm^2	motors.

Plastic wires (twin-twisted):-

Plastic wires are more flexible than the PVC insulated cables because they normaly are made of a large number of thin wires.

No.of wires and Nominal cross-sectional area of a wire.	Applications
14/0.2 mm^2	For light load (0-watt bulbs)
23/0.2 mm^2	Upto 16 watt bulbs.
40/0.2 mm^2	Ordinary plugs.
60/0.2 mm^2	Power plugs.

The unit also has facilities for manufacturing the following types:-

i) PVC insulated service drop wire. It consists of three PVC insulated entwined wires and is used for service connections.

ii) Flat type PVC insulated cord consisting of two parallel vinyl insulated wire for electrical appliances.

iii) PVC insulated control cable for (a) electrical appliances (b) low tension cables for automobiles (c) indoor telephone wire and (d) wiring of switch boards.

In all the above cases, each core carries current less than 10 amperes. These are suitable for use where the combination of ambient temperature and temperature raise due to a continuous load in the conductor does not exceed 70°C. The unit intends to manufacture only 250/440 volts grade, which can be used for single phase and 3 phase system where the voltage between each conductor and earth does not exceed 250 V.

3.1. Flow Chart:-

The flow charts for the manufacture of PVC insulated cables and wires are given in Appendix-II. The details of each step is described below:-

3.1.1. Wire Drawing:-

Since it is intend to buy copper wires of approximately 3.2 mm. diameter, this step is necessary to produce thin wires of size, SWG 20 to 42, for the manufacture of plastic wires. This is done with the drawing machine in the unit. The drawing machine is usually equipped with a number of dies made of diamond. The reduction in diameter that can be obtained by a single die is approximately 12 to 15%. So the number of dies should be chosen so as to get the required diameter.

3.1.2. Bunching:-

It consists of twisting a group of wires together - in the bunching machine - with the same length of lay for all strands without regard to roundness or geometric arrangement. This is for copper wires used in the manufacture of plastic wires. In the present project, the maximum number of wires used in a plastic wire is 60, and bunching of this number can be done in one step.

3.1.3. Pre-heater for conductor:-

The conductor is pre-heated prior to its entry to the cross-head, usually to a temperature just below the processing temperature of the PVC. It is done by passing an electric current through a short section of the conductor so that heat is generated, by ohmic resistance. The preheating of the conductor prevents premature shrinkage of the hot plastic away from the conductor surface.

3.1.4. Pre-heater for PVC granules:-

In order to exclude the moisture absorbed by the granules during storage or processing, the material is dried at about 90°C before being fed to the hopper of the extruder.

3.1.5. Insulation (Extrusion):-

The coating of wire with PVC for electrical use is achieved in the following sequence.

3.1.5.1. Pay-off:- A wire tensioning and pay-off unit carrying the bare wire drums releases the wire under proper tension to the cross-head mounted on the extruder.

3.1.5.2. Dies:- Two types of dies are used; "pressure" dies and "tubing" dies. The tubing die extrudes a thin-wall tube around the conductor. This tube is drawn by vacuum on to the conductor after it leaves the die. The vacuum is pulled through the clearance btween the conductor and its passageway through the cross-head. In pressure dies, the molten plastic contacts the wire before it leaves the die while the melt is still under some pressure.

Tubing dies require a larger clearance between conductor and passage because vacuum must be drawn through that clearance. For tubing dies, the lands are parallel and their length is equal to the final covered diameter whereas pressure dies have no land, and the plastic goes through a converging, tapered annular passage.

In both types, the conductor passes through the cross-head through a "guider-tip" which is axially adjustable.

3.1.5.3. Extruder and Cross-head:- PVC granules are fed to the extruder as cold granules and heated to the required temperature (150 - 180°C). For colouring, the required quantity of colour masterbatches are mixed with PVC granules before feeding to the hopper of the extruder. The granules melt and the molten plastic is forced through a screen-pack/ breaker plate assembly. The cross-head die mounted on the extruder changes the direction of flow of the PVC melt by 90° and thus enables the wire, which it receives straight from the pay-off unit, to be coated. The wire passes through the

central hole of the nipple holder to the nipple which centres with the die for coating. The outside of the nipple holder is so profiled that it guides the flow of the melt uniformly all over the annular space between the nipple and the die opening. A temperature controller arrangement automatically maintains the temperature of the various zones.

3.1.6. Cooling Bath:-

The coated wire emerging from the die passes through the long water-trough and gets cooled. It is the cooling operation that sets the shape of the product. The rate of cooling affects the production rate as well as the properties of the product. The coated wire must be cooled sufficiently to allow coiling without permanent distortion.

The air-gap between die and cooling bath influences the appearance of the insulation. The air-gap allows the surface of the coating to become annealed and to obtain a gloss as well as to reduce stresses. The gap length varies according to the linear speed of the coated wire. The coated wire leaving from the cooling trough is given a mechanical wipe to force excess water and to dry the coating before it is measured.

3.1.7. Measuring:-

The length of the covered product is measured by a linear measuring unit operated by the wire or cable passing between two rollers.

3.1.8. In-line testing and control:-

The diameter of the coated conductor is measured mechanically or electrically. The eccentricity of the coated wire is measured, which is very important as the conductor must be centered in its insulation.

Spark testing for insulation is provided by passing coated wire through a high voltage field or by the gliding contact with a metal electrode at high potential. If there are any breaks, pin-holes or thin spots in the covering, a circuit is completed with the conductor and a signal buzzer or light is set-off. The destructive effect of the spark marks the faulty section so that it can be cut out or repaired later.. If only a couple of faults are registered in any hour the line is considered satisfactory.

3.1.9. Take-up:-

The main criteria for pay-off and take-up systems are their ability to

1. permit maximum use of the extruder;
2. handle various reel sizes, wire sizes and liner speeds;
3. avoid any vibrations on the wires;
4. avoid deformation on the conductor and covered wires;
5. permit minimum time for stoppage or change of reels.

The pulling and winding arrangement takes up the covered wire from the cooling trough at a uniform rate by means of a capstan wheelr The capstan wheel consists of two winding drums - grooved to hold the wires that are wrapped around them four or five times before being led to the take-up

stand. The capstan wheel shaft is driven by means of a motor through a variable speed drive and gear box. The capstan wheel can, therefore, be driven at various speeds not only to facilitate minor adjustments in the diameter of the coated wire, but also to vary the pulling rate to suit different sized cables.

The built-in winding device takes up the cable from the capstan and winds on a spool. The pitch of winding is adjustable, depending on the diameter of the cable. When the spool is fully wound, the wire is cut and it is removed. An empty spool is mounted for further winding.

3.1.10. Twisting:-

In some cases two or three coated cables will be required to be twisted together before coiling. The coated wire twisting machine and the cable rewinding machine are used for this purpose.

3.1.11. Coiling:-

Wind-up or twisted cables are coiled and cut as per requirement of the customer and it is packed.

The following steps should be observed while starting-up the process.

The conductor is threaded through the system first. Next the extruder is started and the proper conditions of speed and temperature achieved. When the PVC just squirts out of the die around the stationary wire, wire is started and brought up to full speed. If the covering is not evenly

distributed around the wire, centering bolts on the die are adjusted, which displaces the die with respect to the guider.

3.2. Quality Control:-

Quality control is based on the concept that the quality must be built in the production at each and every step in wires and PVC insulated cable making, from raw materials to despatch and not by final inspection. There are written standards for each key operation. A rigorous scheme of testing of raw materials, process inspection and testing of the completed cables is followed in the proposed unit.

Though the government has enforced the quality control from April 1, 1978, it is yet to be implemented forcefully. The objective of the order is to ensure uniformity and better quality coupled with safety of installations and appliances.

The unit intends to manufacture the PVC insulated household wires as per Indian Standards Specification, IS:694, ~~as~~ which stipulates the required quality of the cable and the PVC compounds to be used.

Routine and type tests are required to be conducted on insulated cables from the point of view of quality control. The tests include insulation resistance, shrinkage of insulation, colour fastness, moisture absorption, high voltage test or spark test, tensile and elongation of insulation and sheath.

3.2.1. Process Inspection:-

The following chart explains the inspection methods:

Process	Checking points:-
(i) Wire Drawing	a) Wire diameter and surface.
	b) Elongation on annealed copper wire.
	c) Conductor resistance.
(ii) PVC Extrusion (Insulation)	a) Surface, thickness and concentricity of insulation, porosity.
	b) Spark testing or water testing.
(iii) PVC Extrusion (Sheathing)	a) Porosity, thickness and concentricity of sheath .
	b) Overall diameter of cable.

3.3. Utilisation of Scrap:-

Very little scrap is generated in wire-covering operations as it is uneconomical to strip the coating from substandard wire. Furthermore, the little-all plastic scrap that is generated in start-up is unsuitable for re-use as the reprocessing and rehandling impairs the x insulating ability. It is sold as scrap (2%). The wastage will be 1% of the total material.

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CHAPTER-4

MARKET SURVEY

The demand for domestic housewiring cables, depends on the new construction programmes, rural electrification programme, etc. The replacement of old wiring also should be done at times as the life of domestic wiring is 15 to 20 years. The demand for controlling cables arises from activities in new industries, industrial complexes, railway signalling, etc.

4.1. Power development & demand for PVC & VIR (vulcanised India Rubber) insulated cables:-

The industrial and economic development of a country can be gauged by the progress made in generation, transmission and distribution of electrical power. It is a well-known fact that India is extremely backward in the power development. The electric power development started in India with the setting up of a 130 KW hydel station in Darjeeling in 1897, and through slow development, the installed capacity in the country reached to only 2.3 million KW by 1951. Thereafter the five year plans have been giving due stress on the power development. The power generation registered a cumulative average annual growth of 9% during the period 1951-1978.

The demand of PVC rubber cables is also related to the rural electrification and house building activities in the country. In India about 65% of the population live in about 5,76,000 villages all over the country and rural electrification has remained a problem. The demandfor household wiring

cables have been more or less in proportion to the number of electrified villages. Thus the economics of power generation, to a large extent, is dependent on the efficiency of transmission and distribution networks. In this respect, houbs hold wires has its own role to play. The following table gives an idea about their relationship.

Period	Installed capacity. million KW	Energy generated in million KWh	PVC & VIR cables production MCM*	No.of villages electrified.
1950-51	2.3	6575	35.5	3000
1955-56	3.42	10775	78.2	7400
60-61	5.6	20100	200	24200
65-66	10.2	32000	364	52300
70-71	20	80000	563	110,600
78-79	25.6	--	565	212324
83-84 (Estimated)	44	--	1000	--

* Million Core Metres.

Source:- Indian Rubber & Plastics Age, March 1967.
Hand book of Industrial data 1975.

The demand pattern of household wires of course depends on the building activity itself. Here a correct assessment of the building activity in the country in terms of number is not possible and further would be erratic due to the vast difference in the sizes of the buildings that are constructed.

The replacement of old wiring is also another source of PVC insulated housewiring cables. The production of VIR cables is decreasing as PVC has superior properties.

There are 23 units engaged in the manufacture of PVC & VIR cables with an installed capacity of 1246.67 MCM against a licensed capacity of 1316.67 MCM. It is envisaged that the capacity target would be 1281 MCM by 1982-83 and target production be 1000 MCM.

The production figures of PVC & VIR cables and flexibles in the last ten years are given below:-

Year	PVC & VIR cables & flexibles MCM
1969-70	488
1970-71	563
71-72	650
72-73	750
73-74	670
74-75	580
75-76	420
76-77	570
77-78	530
78-79	565

Source:- Indian Rubber and Plastics Age.

The industry is still producing only 80 percent of the total demand of PVC insulated house wiring cables.

4.2. Demand of PVC insulated housewiring cables in Kerala:-

Kerala has surplus power and it is based soley on hydel projects. In Kerala, almost all the villages are electrified. The demand for PVC insulated household wires will increase in view of the envisaged electrification programme, the anticipated increase in the number of connections to the consumers and activities in the field of construction works. Replacement of old wiring is another source for the demand.

Considering the above facts there is a bright future for PVC insulated cables and wires in the coming years.

The following table gives an idea about the value of the PVC & VIR cables & flexibles produced in India.

Year	Production	Value (Rs. in lakhs)
1976	484.51	3795.4
1977	479.09	5018.1
1978	524.9	4427.9

Source:- Guide lines for Industries - 1979-80.

CHAPTER-5

PRODUCTION REQUIREMENTS

The following essentials are required to manufact 145 Kgs. of PVC insulated copper cables and 200 Kgs. of P insulated aluminum cables in one shift per annum.

5.1. Land and Building:-

A good site for the proposed project may be deter by the following factors.

i) Availability of raw materials;
ii) Demand for the production and nearness to the market;
iii) Transportation facilities; and
iv) Availability of power, water and skilled labour.

Forseeing the future expansion programme, the tot land requirement is estimated as 10,000 sq.ft. Of these building constitute about 3,000 sq.ft. The details of la and building are given in Annexure-I-A.

5.2. Requirements of machinery and equipment:-

The following mechineries are selected for the proposed project.

5.2.1. Extruder:- For extruding 150 kgs. of PVC compound in one shift/day, an extruder having a screw diameter of and extrusion capacity of 7 to 23 kgs. per hour is select It must have the necessary accessories such as pay-off, cooling and take-up arrangement and a preheater for preh PVC granules. This extruder should have 16 dies in order produce coverings of different diameter. A list of manuf urer's of wire coating plant are given in Appendix-III.

5.2.2. Wire drawing machine:- This is for sizing of the copper wires to the required diameter (20 to 42 SWG) and having 22 dies.

5.2.3. Flexible twisting Machine:-

This is to twist the PVC insulated wires.

5.2.4. Coiling Machine:- The wound-up insulated cables are cut to customer's requirement in the coiling machine. Usually one coil of PVC insulated aluminium cable and copper cable will be having 100 metres and 91.4 metres in length respectively.

5.2.5. Bunching Machine:-

The proper type of bunching machine is selected.

5.2.6. Testing Equipments:- To do high voltage test, tensile and elongation of insulation, insulation resistance and conductor resistance.

The details regarding the cost of the machineries is given in Annexure - I-B.

5.3. Requirements of Raw Material:-

The main raw materials required are PVC compound (insulation grade), colour masterbatch, copper and aluminium conductors. The PVC compound/colour masterbatches can be directly purchased from the manufacturer's. A list of the PVC compound/colour masterbatches suppliers is given in Appendix IV. The coppoer and aluminium conductors are available either through government quota or from local market.

The purchase of raw materials are done by documentary bills through bank. The annual consumption and cost of raw material is givan in Annexure II-A.

5.4. Requirements of Man-power:-

The following number of staffs are required in the respective areas of the unit.

1. Administrative staff:-

Manager	-	1
Accountant-cum-clerk	-	1
Peon-cum-watchman	-	2
		4

2. Labour Requirements:-

Job description	No.of shift	No.of labourers/day		
		Skilled	Semi-skilled	Unskilled
1. Extruder	1	1	2	-
2. Wire drawing machine	1	1	--	--
3. Flexible twisting machine	1	1	--	--
4. Coiling Machine	1	1	--	--
5. Bunching Machine	1	1	--	--
6. Testing machine	1	1	--	1
7. Packing & despatch	1	--	1	1
8. Electrician-cum-Machanic	1	1	--	--
9. Foreman	1	1	--	--
Total		8	3	2

A foreman is required to supervise the production programmes. The details of employees salaries with benefits are given in Annexure - II-B.2.

5.5. Requirements of Utilities:-

The approximate water and electric power requirements of the project are given below:-

5.5.1. Requirements of Water:-

From experience, the water requirement are as follows:-

Water consumption in cooling	-	5000 Lrs.
Water for personnel uses	-	1000 Lrs.
Total	-	6000 Lrs.

A water pump (2 HP) is provided for supply of water from the well.

5.5.2. Requirements of Power:- The total load connected is 42 HP (31.3 KW). The load connected to each machinery and cost of power used per annum is given in Annexure - II-B.1.

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CHAPTER-6

CAPITAL REQUIREMENTS, FINANCING PLAN AND PROFITABILITY

The financial aspects of the unit is given below:-

6.1. Fixed Capital Requirement:-

It is the sum of the expenses occured on land, building, plant and machinery. The estimated fixed capital needed is Rs.8,18,640.00. Details of the fixed capital is given in Annexure-I.

6.2. Working Capital Requirement:-

This depends on the raw material inventory and credit facilities. The working capital is calculated for a period of 3 months. The total working capital expenditure (3 months) is Rs.7,42,060.00. Annexure II gives all the details of Working Capital.

Annexures III and IV gives an idea of the total gross capital and total manufacturing cost.

6.3. Financing Plan:-

The enterpreneur cannot meet all the money needed for the unit from his own pocket. So a better planning must be done to finance it. He should have a better knowledge about the financial facilities available in the state.

Certain financial institutions provide 85% of fixed capital costs. Certain others give 100% of machinery cost.

Financing of the Project:-

The unit intends to take 85% of the cost of land and building.and 100% of the machinery from Kerala Financial Corporation as loan at an interest of 11.85%. 100% of the working capital is taken from a nationalised bank at an interest of 16%. The balance of the total capital is taken by the enterpreneur.

The details are given below:-

1. Borrowing:

Loan from KFC	-	6,89,220.00
Loan from Nationalised bank	-	7,42,060.00
2. Own capital	-	1,29,420.00
Total	-	15,60,700.00

6.4. Pricing & Selling:-

Better selling, better profit method is followed. The selling price of PVC insulated copper and aluminium cables per kg.42/= and Rs.35/= respectively. The annual receipts from sales is Rs.39,27,000.00.

6.5. Profitability:-

Financial viability of the project can be measured through profitability. The following factors are considered.

6.5.1. Rate of return on own capital:-

Own capital	-	1,29,420.00
Net profit	-	1,58,503.00
Rate of return on own capital	-	122%

6.5.2. Rate of Return on capital employed:-

Gross capital	-	15,60,700.00
Net profit	-	1,58,503.00
Rate of return on capital employed	-	10%

6.5.3. Profit on Sales Turnover:-

Annual receipts from sales	-	39,27,000.00
Net profit	-	1,58,503.00
% profit on sales turnover	-	4%

6.6. Breakeven Analysis:-

Breakeven point is that quantum of sales at which the unit is just able to recover all expenses. In other words, it is the point at which neither a profit nor any loss incurred.

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

where F = Annual fixed costs.

P = selling price per kg.

V = Variable cost per kg.

Total sale of product	-	39,27,000.00
Total production	-	1,03,500 Kg.
Price per kg. (P)	-	Rs.37.94

Total variable cost:-

(i) Raw material	-	28,18,100.00
(ii) Utilities	-	12,094.00
(iii) Direct labour	-	62,700.00
(iv) Sales expense	-	2,35,620.00
Total	-	31,28,514.00

Variable cost per kg. (v) = Rs.30.22.

Fixed Cost (F)

(Cost of production + sales expense) - variable cost

= 3,45,623.00

Calculation:

Break Even Point = $\frac{F}{P-V}$ = $\frac{3,45,623.00}{37.94 - 30.22}$

= 44,769 kg/annum.

6.7 Payback period:-

1. Annuel Net profit	-	1,58,503.00
2. Depreciation	=	69,472.00
Total	-	2,27,975.00
3. Less:- Drawings	-	57,000.00
4. Amount used for repayment	-	1,70,975.00
Term loan to be paid back	-	6,89,220.00
Payback period	-	4 years

6.8. Conclusion:-

The proposed project's main points are given below:-

1.	Total fixed Investments	-	8,18,640.00
2.	Working capital required	-	7,42,060.00
3.	Total investment	-	15,60,700.00
4.	Working shift/day	-	1
5.	Personnel Required	-	17
6.	Annual production	-	43,500 kg of PVC insulated copper cables & 60,000 kg. of PVC insulated aluminium cables
7.	Annual sales	-	39,27,000.00
8.	Break Even Production	-	44,769 Kg.
9.	Rate of Return on investment	-	10%

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ANNEXURES

ANNEXURE - I

FIXED ASSETS:-

	Item		Cost. Rs.
1.	Land and Building	-	1,70,000.00
2.	Machinery and Equipment	-	5,44,720.00
3.	Pre-operative Expenses	-	28,920.00
4.	Miscellaneous Fixed Assets	-	75,000.00
	Total	-	8,18,640.00

ANNEXURE- I-A

LAND & BUILDING

	Item		Cost Rs.
1.	Cost of 10,000 sq.ft. @ Rs.2/-	-	20,000.00
2.	Cost of 3,000 sq.ft. built area @ Rs.50/=	-	1,50,000.00
	Total	-	1,70,000.00

ANNEXURE-I-B

MACHINERY AND EQUIPMENT

Item		Cost Rs.
1. Extruder with all accessories	-	2,03,640.00
Central Excise duty and sales tax @ 12%	-	24,437.00
2. Wire drawing machine	-	80,000.00
3. Flexible Twisting machine	-	20,000.00
4. Coiling Machine	-	20,000.00
5. Bunching Machine	-	18,000.00
6. Testing Equipments	-	1,25,000.00
7. Water pump	-	3,000.00
Total	-	4,94,077.00
5% provision for price escalation	-	24,704.00
Total	-	5,18,781.00
Distribution of power, lighting, cabling, etc. @ 5%	-	25,939.00
Total	-	5,44,720.00

ANNEXURE-I-C

PRE-OPERATIVE EXPENSES:

Item	Cost Rs.
Interest on loan @ 11.85% for three months	- 20,420.00
Travelling expenses	- 2,000.00
Postage, Telephone, telegram and printing charges	- 2,500.00
Building insurance	- 1,000.00
Miscellaneous	- 3,000.00
TOTAL	- 28,920.00

ANNEXURE - I-D

MISCELLANEOUS FIXED ASSETS:-

Item	Cost Rs.
Vehicle & Furniture	- 70,000.00
Miscellaneous	- 5,000.00
Total	- 75,000.00

ANNEXURE - II

WORKING CAPITAL:

	Item	Cost Rs.
1.	Total Raw Material Cost	- 28,18,100.00
2.	Manufacturing cost	- 79,829.00
3.	Other overheads	- 70,313.00
	TOTAL	- 29,68,242.00
	Working capital (3 months)	- 7,42,060.00

ANNEXURE - II-A

RAW MATERIAL COST (ANNUAL)

Material	Annual Requirement Kg.	Price/kg Rs.	Cost/Annum Rs.
1. PVC compound (insulation grade)	45,000	18.00	8,10,000.00
2. Colour Masterbatch	450	18.00	8,100.00
3. Copper wire	30,000	40.00	12,00,000.00
4. Aluminium wire	30,000	26.00	7,80,000.00
		Total	28,18,100.00

ANNEXURE -II-B

MANUFACTURING COST:-

Item		Cost Rs.
1. Cost of utilities	-	12,094.00
2. Total salaries	-	67,735.00
Total		79,829.00

ANNEXURE - II-B-1

TOTAL CONNECTED LOAD AND COST OF UTILITIES (POWER)

Machine	-	HP
1. Extruder	-	23
2. Coiling Machine	-	2
3. Flexible Twisting Machine	-	3
4. Bunching Machine	-	3
5. Wire Drawing Machine	-	5
6. Testing Equipment	-	2
7. Water pump	-	2
8. Fan, lighting, etc.	-	2
Total	-	42 HP or 31.3 KW

Cost of Utilities:-

a. Annual charge for connected load @ Rs.5/=	-	1878.00
b. Annual electrical requirement cost @ 0.17 Rs./KW, assuming a load factor 0.8		10216.00
Total	-	12094.00

ANNEXURE -II-B-2

SALARIES AND WAGES:

a. Salaries of administrative staff:-

Position	No.of shift	Total personnel per day	Monthly salary Rs.	Total salary Rs.
1. Manager	1	1	900.00	900.00
2. Accountant-cum-clerk	1	1	500.00	500.00
3. Peon-cum-watchman	1	2	250.00	500.00
			Total	1900.00
			Salary per annum	22,800.00

b. Wages of labourers:

Position	No.of shift	Personnel per day	Monthly salary Rs.	Total salary Rs.
1. Foreman	1	1	650.00	650.00
2. Skilled	1	7	400.00	2800.00
3. Semi-skilled	1	3	300.00	900.00
4. Unskilled	1	2	250.00	500.00
			Total	4850.00
			Salary per annum.	57,000.00

Total salary per annum (a) + (b)	58,900.00
Benefits and allowances @ 15%	8,835.00
Total salaries & wages (including benefits)	67,735.00

ANNEXURE - II-C

OTHER OVERHEADS

	Items		Cost Rs.
1.	Repairs and Maintenance of building @ 1%	-	15,000.00
2.	Repairs and Maintenance of machinery @ 5%	-	25,940.00
3.	Packing material	-	5,000.00
4.	Travelling expenses	-	5,000.00
5.	Insurance, 2% on fixed capital	-	16,373.00
6.	Stationary, Postage, Printing, etc.		3,000.00
	Total	-	70,313.00

ANNEXURE - III

GROSS CAPITAL REQUIREMENTS:

	Items		Cost Rs.
1.	Total fixed capital requirements	-	8,18,640.00
2.	Total working capital requirements.	-	7,42,060.00
	Total	-	15,60,700.00

ANNEXURE-IV

TOTAL COST OF PRODUCTION-(ANNUAL)

	Item		Cost Rs.
1.	Raw material cost (Annexure - II-A)	-	28,18,100.00
2.	Utilities (Annexure II B.1)	-	12,094.00
3.	Salaries and Wages (Annexure II B.2)		67,735.00
4.	Other overheads (Annexure II.C)		70,713.00
5.	Other fixed cost and interest on loans. (Annexure IV-A)	-	2,69,875.00
	Total	-	32,38,517.00

ANNEXURE IV-A

OTHER FIXED COSTS & INTEREST ON LOANS:-

	Items		Cost Rs.
a.	Depriciation		
	1. Depreciationon Machinery @10%	-	54,472.00
	2. Depreciation on building @ 5%	-	7,500.00
	3. Depreciation on other fixed assets @ 10%	-	7, 500.00
b.	Interests on loan:		
	1. Interest on working capital @ 16%		1,18,730.00
	2. Interest on estimated term loan @ 11.85%		81,673.00
	Total		2,69,875.00

ANNEXURE - V

SALES AND INCOME AND PROFIT

Sales		Rs.
43,500 kg of PVC insulated copper cables @ Rs.42/= per kg.	-	18,27,000.00
60,000 Kg. of PVC insulated Aluminium cables @ Rs.35/= per kg.	-	21,00,000.00
Total Sales	-	39,27,000.00
Less:- Sales expense @ 6% on sales turnover	-	2,35,620.00
	-	36,91,380.00
Less:- Cost of production	-	32,38,517.00
Gross Profit	-	4,52,863.00
Less:- Tax @ 65%	-	2,94,360.00
Net Profit	-	1,58,503.00

A P P E N D I C E S

APPENDIX- I

LITERATURE SURVEY - REFERENCES:-

1. Indian Rubber & Plastics Age, April, 1973.
2. Extrusion of Plastics. By E.G.FISCHER
3. Indian Rubber & Plastics Age, March 1967.
4. Rubber & Plastics Digest, Vol.8, March, 1973.
5. Rubber & Plastics Digest, Vol.8, September 1973.
6. Cable Industry in U.S.A.,& Japan Communication.
7. Rubber & Plastics Digest, Vol. 14, December, 1979.

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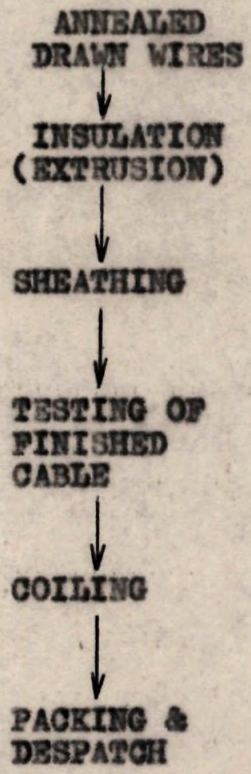
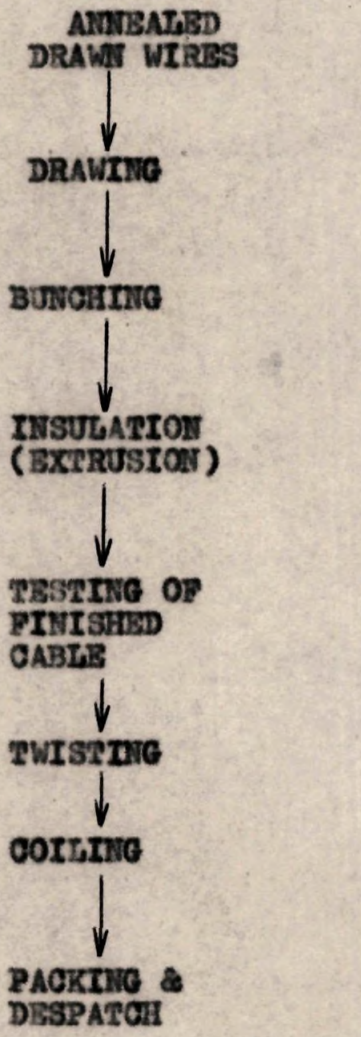
APPENDIX- II

F L O W C H A R T

(1) PVC INSULATED CABLES



(11) PLASTIC WIRES (TWIN-TWISTED)



APPENDIX-III

RAW MATERIAL SUPPLIERS:-

PVC Compound - Insulation & sheathing grades:

1. M/S National Organic Chemical Industries Ltd.,
   Mafatlal Centre,
   Nariman Point,
   Box No.1, Bombay-1.

2. M/S Shriram Chemical Industries,
   16, Jhandewalan Estate,
   New Delhi - 55.

3. Pioneer Plastic Industries,
   1/7 Deshabhandu Gupta Road,
   New Delhi - 110055.

4. Calico Chemicals,
   Ramachandra Mansion,
   245 (NEW), Mount Road,
   Madras - 600006.

5. Kamal Plastics Industries,
   C/62/2, Okhla Industrial Estate,
   Phase II, New Delhi - 110020.

6. Ajantha Plastic Industries,
   Plot No.8, Gali No.4,
   Friends Colony,
   Shahdara, Delhi - 32.

7. Kundalia Industries,
   63, Njafgarh Road,
   Rama Marg, New Delhi - 110015.

8. Kerala Vinyls,
   Perumbavoor.

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APPENDIX IV

LIST OF MACHINERY SUPPLIERS:

1. M/S Brimco Plastic Machinery Pvt. Ltd.,
   BRIMCO HOUSE,
   Plot No.55, Govt. Industrial Estate,
   Kandivili (West),
   Bombay - 400067

2. M/S Kirti Thermoplast Engg.Works,
   3, Panchal Sahkari,
   Udyognagar, Dhudeshwar,
   Ahmedabad.

3. M/S Remica Plastic Machinery Mfrs.,
   Opp. Ruston Mills,
   Dhudeshwar Road,
   Ahmedabad - 1.