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TECHNO-ECONOMIC INVESTMENT PROFILE ON V-BELTS FOR AUTOMOTIVE REPLACEMENT MARKET

prepared for

THE GULF ORGANIZATION FOR INDUSTRIAL CONSULTING

Industrial Investment Division
Vienna, February 1991
1.0 EXECUTIVE SUMMARY

The term 'V-Belts' includes standard V-section belts, and a wide range of non-V-section belts which are tailored to individual engine designs. It is recommended that any initial project be restricted to standard V-section belts.

An annual production level of 396,000 belts is initially recommended, representing an annual turnover of US $1,220,000. The projected return would be US $365,000 gross profit. Additional sales of V-belts for the general non-automotive market would also be feasible.

The investment in machines, installation, commissioning and know-how fee is estimated at US $1,025,000 plus site, building and local costs.
2.0 PRODUCT DEFINITION

There are three basic types of V-Belts in general use including automotive applications. The cross-sections of these basic types are as follows:

- **Wrapped plain V**

- **Raw edge plain V**

- **Raw edge cogged or toothed**
ISO4184—DIN7753—BS3790—RMA IP22

Metric | Imperial
--- | ---
3150 | 1000
3550 | 1250
6700 | 2650

SPZ | SPA | SPB | SPG | 8V

<table>
<thead>
<tr>
<th>Metric</th>
<th>Imperial</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>7500</td>
</tr>
<tr>
<td>2240</td>
<td>8000</td>
</tr>
<tr>
<td>2360</td>
<td>8500</td>
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<td>2410</td>
<td>9000</td>
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<td>2540</td>
<td>9500</td>
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<td>2650</td>
<td>10000</td>
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<td>2800</td>
<td>10500</td>
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<td>3000</td>
<td>11000</td>
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<tr>
<td>3350</td>
<td>11500</td>
</tr>
<tr>
<td>3550</td>
<td>12000</td>
</tr>
</tbody>
</table>

Data sheet: Notes on standardisation and abbreviations:
- "DIN" = Deutsches Institut für Normung e.V.
- "RMA" = Rubber Manufacturers' Association
- "BSI" = British Standards Institution
- "IP22" = Protection against dust and water"
For the automotive replacement market, wrapped plain V-belts to international standard sizes (see Figure 1) are most common, being used primarily for driving engine ancillaries: the air cooling fan, the alternator (or generator) and sometimes the water pump.

Current vehicle designs may also have additional belt drives for air-conditioning units, camshafts, fuel injection pumps and power steering pumps and these are increasingly of the raw edge toothed type. However, these are often of non-standard sizes for specific vehicle types and necessarily of smaller production runs for the replacement market and are not considered suitable for a start up project.

The more common cross sections of V-belts are SPZ, SPA, SPB and SPC. There are standard sizes for these belts as defined in ISO 4184. The most common sizes (size denoting the pitch length in millimetres) for general and automotive use are 800mm, 900mm, 1000mm. The ISO range for non-automotive uses goes up to 12500mm.
3.0 TECHNOLOGY REVIEW

3.1 Review of Technology Options

The basic construction and production technology is common to all three types being a rubber/textile reinforcement/rubber sandwich which is compressed between rolls with adhesive.

Wrapped belts have a woven textile cloth wrapped around the complete belt which improves wear resistance and reduces the effect of liquids (such as oil or water) on the belt, whereas the toothed belt shares the same basic construction as the raw edge V-belt but has an additional operation to machine the teeth in the belt.

Materials used were traditionally rubber and cotton, but belts have since been developed using nitriles or other rubbers, and polypropylene, terylene and kevlar for the textile reinforcement. For automotive V-belts, it is now common to use nitrile rubber and polyester reinforcement textile braid.

For the GOIC market it is only sensible to consider the most popular type of automotive V-belt, namely the wrapped plain V-belt. This will be polypropylene reinforced rubber or nitrile and has the advantage of being the most common type used in general industry. Almost every car uses at least one V-belt of this type, and it is this type of belt that needs the most frequent replacement.

3.2 Review of Production Scale Ranges

The European market of over 100 million vehicles is served by only 5 or 6 major manufacturers, each typically producing 7 to 10 million belts per annum.
The GOIC vehicle population is approximately 3.3 million vehicles. The indicative market for replacement automotive V-belts of the wrapped V type can be estimated at 1.32 million belts per annum on the basis of an average of 2 belts per vehicle and an average belt life of 5 years.

The suggested production capacity of a start-up project is 30% of this market estimate, representing 396,000 belts per annum under single shift operation. This capacity would provide sufficient opportunity for expansion to service export markets and indeed the general industrial V-belt market, with the possibility of the capacity being doubled by two shift operation. These figures assume 240 working days per year, i.e. a 5 day week for 48 weeks.

These production quantities are too low to consider local manufacture of the rubber/nitrile sheet, or the weaving/braiding textile reinforcement. The scale of plant is governed by the size of the calender and 'belt-build' machines. These will have a capacity of at least 1 million units per annum and so the plant will be somewhat oversized for the immediate market.

Once the project is established, there is the possibility of introducing cogged raw edge belts. These require a second Calender process which would really mean a second expensive machine. The raw edge does not present a special problem, as it replaces the wrapping process with one that places the 'wrapping' only along the top outer surface of the belt. In the event that the initial investment is required to include manufacture of cogged belts, then it basically means adding in a further US$172,000 of capital for a second calender machine.

The cogged unwrapped belts are usually tailored for a specific model of car, and that may mean special tooling for each model of belt. One needs to be confident of the quantities of any model of car before stocking up for special belts.

Our recommendation is to defer this additional investment.
3.3 **Recommended Production Technology**

It is suggested that the preferred option is to start with the conventional plant wrapped V-belt because:

- the production runs of each type will be much greater;
- the technology is more flexible;
- the non-automotive market can be served from the same production system.

V-belt plants in Europe normally serve the general market as well as the automotive market.

3.4 **Sources of Technology**

It is strongly recommended that operation of a start up plant is undertaken with the technical back-up of one of the established original equipment manufacturers to ensure high standards of product quality.

The following are manufacturers of belts:

**FENNER INTERNATIONAL LIMITED**
Marfleet, Hull, Yorkshire, England, HU9 5RA, UK
Tel: 0482 781234 Fax: 0482 709170 Tlx: 592687

**GATES HYDRAULICS LIMITED**
Station Road, St Neots, Huntingdon, Cambridgeshire, England, PE19 1QF
Tel: 0480 75333

PIRELLI
Via e Piaaggio, 28. 66013 Chieti Scala, Italy
Tel: 0871 5091 Fax: 0871 509703 Tlx: 310135

POGGI TRANSMISSIONI MECCANICHE SPA
26, v. Di Vittorio, Villanova, 40055 Castenaso, Italy
Tel: 5178 00 21 Fax: 71 78 17 89 Tlx: 510698

GOODYEAR INTERNATIONAL CORPORATION
1144 East Market Street, Akron, Ohio 44316, USA
Tel: 0101 216 796 2121
4.0 THE PRODUCTION PROCESS

4.1 Process Flow

The production process for conventional V-belt production is summarised below (and in Figure 2). The suggested layout is shown in Appendix 1. The total production time per belt is between 4 and 5 minutes. All the operations essentially rely on manual loading of each of the machines and thereafter manual transfer to the subsequent operations in an essentially batch type operation:-

1. **Preparation of Rubber**

   Receive and unpack rubber sheet (quantities too small for purchasing and mixing raw rubber). The ready-to-use sheet is impregnated with adhesives required during the subsequent rolling and bonding operations.

2. **Preparation of Textile Reinforcement**

   For these small quantities it will be bought-in ready to use.

3. **Belt Forming** (see Appendix 2)

   - The rubber sheet is warmed in the warming mill (basically a set of large heater rollers): the objective is to make the rubber sufficiently pliable to accept subsequent moulding in the calendering operation.

   - The calender machine consists of two heavy duty rollers. The upper roller is plain on its surface. The lower roller has the inverse form of the V-section formed on the surface of the roller. The upper roll presses the rubber progressively into this mould as the two rolls rotate.

   - The end product of the calender process is to produce a moulded rubber sheet about one metre wide, grooved with 20 V's running parallel to its length. The length of the sheet is determined by the desired length of the finished belt.
PRODUCTION PROCESS FLOW CHART FOR Automotive V-Belts

1. Receive rubber sheet and textile reinforcements
2. Allocate sheet quantities for next shift
3. Sheet passed through warming mill
4. Warmed sheet fed into profile calender
5. Textile braid loaded on building machine
6. Profile sheet and topping sheet fed on to building machine
7. Fully built belt sheet slit into individual belts
8. Textile jacket added to each belt on "flipping machine"
9. Individual belts fed on to rotor curing aids
10. Each belt placed on to bolt length verification machine
11. Any incorrect length bolt removed
12. Sheet and cutters removed
Reinforcement textile is then fed from reel and wound on to mandrels on the building machine as a first operation, and the thin rubber topping sheet rolled on top of this textile matrix as the second operation.

The build process combines the reinforcement matrix and the topping sheet with the wide sheet of 'calendered' rubber, having 20 or so moulded V sections, into a continuous wide loop. This loop is held into shape by the continuous filament winding of the reinforcement textile braid.

A sheet of belts is then slit into 20 individual belts on a slitting machine.

4. Fabric Coating of Belt
- The outer woven fabric is placed on reel feeders:
- Each belt is placed on a pulley set of the fabric coating machine ('flipping machine');
- The woven fabric is fed on to outer surfaces of belt (being pre-impregnated with adhesive).

5. Belt Milling
Belt milling is an optional process, depending on belt duty. The belt is placed on rotating pulleys which feed the belt past a rubber milling head to produce a precision angle to the belt. This operation would not be required for automotive belts.

6. Belt Curing
The belts are placed on a rotor curing machine which has heated rollers and radiant heaters, the belt being rotated continuously.

7. Length Verification
The belt is run on a calibrated pulley set to check its length. Incorrect length belts may be recured.
8. **Packing**

A simple card sleeve around the belt is adequate for most markets and then packed in a carton.

4.2 **Tooling**

The large roll on the calender machine which carried the V-belt form is an expensive tool, and for that reason cross sections should be limited to types Z, A, B and perhaps C.

The large roll on the build machine does not have to be so strong and is less expensive, but must be matched to the length of final belt required. It is assumed that production will start with 800mm, 900mm, 1000mm rolls for the building machine.

4.3 **Outline Machinery List**

- **Rubber Warming Mill**
  - USS 105,000
- **Profile Calender (combined roller & press)**
  - USS 172,000
- **Building Machine**
  - USS 114,000
- **Rubber Slitting Machine**
  - USS 88,000
- **Textile Covering Insertion Machine**
  - USS 12,000
- **Rotor Cure with Motorised Mandrels**
  - USS 70,000
- **Length Verification Machine**
  - USS 18,000
- **General, Handling & Storage Items**
  - USS 18,000
- **Air Compressor**
  - USS 18,000
- **Pallet Trucks, Racking, Work Surfaces,**
  - **Packing Equipment & Small Tools**
  - USS 35,000

An initial set of spare parts which may be treated as working capital inventory is costed at 7½% of the new machinery and equipment cost:

USS 48,750
4.4 **Budget Machine Cost Estimate**

The estimate for the minimum machinery listed in 4.2 based on ex-works Europe costs is:

<table>
<thead>
<tr>
<th>Machines</th>
<th>USS 650,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carriage</td>
<td>USS 053,000</td>
</tr>
</tbody>
</table>

4.5 **Budget Cost for Erection of Machinery**

This assumes two specialists are sent out from Europe, and assumes an adequate supply of local labour and tradesmen. Local accommodation of specialists is not included:

<table>
<thead>
<tr>
<th>Specialist Installers</th>
<th>USS 50,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flights</td>
<td>USS 12,000</td>
</tr>
</tbody>
</table>

Commissioning of the machines and helping to run up the plant should form part of any know-how or license agreement.

4.6 **Site Requirements**

A level site with mains electricity, water and sewage connections is required, with reasonable access for heavy road transport. The site should be not less than 1.5 times the floor area of the buildings, i.e., 1500 square metres (30m x 50m) for the site including 1000 square metres for the building. If finances permit, one would favour a site 2.5 times the floor area (50m x 50m) to allow for some expansion without moving site.

The site layout is shown in Appendix 1 and comprises:

<table>
<thead>
<tr>
<th>Production Area</th>
<th>580m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warehouse area</td>
<td>270m²</td>
</tr>
</tbody>
</table>
Office area : 150m²
Hardstanding area : 500m²
Total Land : 1500m²

4.7 Buildings and Civil Works

The main building should be weatherproof and appropriate to local climatic conditions. There will be no abnormal floor loads.

Surface drainage should be adequate to minimise the chance of flooding the factory area.

There are no other special civil works or structural features required.

The front office section of the building should contain:
- General Manager’s office;
- Production Control office;
- Sales and Administration office.

Total office space is likely to be 15% of the total building, ie. 150 square metres and should be serviced with:
- 3-phase electrical supply (250 kVA)
- Water (general washing and cleaning only)
- Sewage (no special effluents)

4.8 Raw Materials

The basic raw materials required are:

a) Rubber, either NBR or SBR
- Acrylonitrile-butadiene copolymer
- Styrene butadiene copolymer

(SBR is widely used in vehicle tyres and may therefore be the choice if a tyre
factory is in the vicinity to act as a source of raw material)

b) Textile reinforcements for the internal matrix (polypropylene yarn)
c) Textile reinforcements for the outer cover (woven polypropylene fabric)
d) Packing materials (card sleeves and cartons)
e) Lubricants

Total weight of raw materials for the specified nominal production levels is 46,000 kg per annum or 1,000 kg per working week. The rubber comprises about 44% of this weight, the textile 34% and packing 22%.

Anticipated rejection rate is 2% which can nearly always be salvaged by reprocessing.

4.9 Raw Material and Consumable Items Prices

Typical input costs per belt are:-

- Rubber and adhesives  | USS 00.66
- Textile Reinforcements | USS 00.14
- Packing                | USS 00.09
- Consumables:          | 
  Release agents, lubricants  | USS 00.02

Prices for the major raw materials are likely to be:

<table>
<thead>
<tr>
<th>Material</th>
<th>USS/Kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rubber and adhesives</td>
<td>13.50</td>
</tr>
<tr>
<td>Textile reinforcement yarn</td>
<td>03.70</td>
</tr>
<tr>
<td>Packing boxes and cartons</td>
<td>03.60</td>
</tr>
<tr>
<td>Release agents and lubricants</td>
<td>12.00</td>
</tr>
</tbody>
</table>

The input/output ratio should be less than 1.02 once production is routine, i.e. scrap rates of under 2%. These low rates reflect the potential to recycle
rubber, and to reprocess belts that are not running 'true' when first produced.

4.10 Utility Requirements
(Typical European prices per belt)

- Electricity (ovens & machines) ± 0.035
- Water ± 0.009

Electrical requirements based on 200kW hour peak loading.
Water requirements should not exceed 4000 litres per shift.

There should be no requirement for steam or other fuels, but no allowance has been made for factory and office heating and air conditioning.

4.11 Annual Maintenance Costs

These should be low in Year 1, rising to an ongoing rate in Year 3. Typically these will be under 10% of the overhead cost, ie, under ±0.006 per belt based on Year 3 potential output. These annual maintenance costs include subcontractual local manpower costs. They are additional to the costs of maintenance carried out by personnel already employed at the factory.

4.12 Manpower Requirements

The following outline workforce can be increased as production volume builds up, but this skeleton workforce is all that the business can support in the formative years:

General Manager:
Will have production engineering, financial and man-management skills. Chartered Engineer with 5 years industrial experience.
Sales Manager:
Basically a working salesman. Three years' experience in selling to the motor distribution trade.

Accountant/book-keeper:
General understanding of book-keeping, debtors and creditors. To work in co-operation with Company Auditors. Five years' experience in similar work.

Office Staff (2):
Internal sales duties. GCSE or equivalent. One to have 3 years' experience of internal sales.

Production Engineer:
Qualified and experienced in continuous production work. Technician Engineer Status.

Foreman:
Must have engineering trade skills and have served formal craft apprenticeship. Experience of supervising staff.

Maintenance Fitter:
Must have engineering trade skills, and have served formal craft apprenticeship.

Operators (7):
General factory skills, but not trade skills.

Summarising the skill requirements of the above personnel:

Management and Professional 4
Semi-skilled office staff 2
Skilled tradesmen 2
Semi-skilled tradesmen 2
Unskilled 5
4.13 Pre-Production Costs

It is assumed that this operation will be set up either as a licence operation or as a know-how deal.

A typical licence & know-how fee would be US$ 260,000 plus 5% of ex-works selling price. This fee should include the direct costs of:-

- Plant Commissioning;
- Management Staff Training;
- Operator Training;
- Initial Production Trouble-shooting.

Royalty is clearly a matter for negotiation. One would expect a 5% Royalty to cover travel and visit costs of the technology supplier for all routine matters.

4.14 Early Years Production

The following is a typical early years production profile for a new plant:-

Year 1- 50,000 belts
Year 2- 150,000 belts
Year 3- 396,000 belts (full production)

4.15 Construction Period

Buildings 16 weeks
Special Machines: 26/38 weeks
Calender
Belt Build Machine
Slitting Machine
Shpping 6 weeks  
General Plant & Machinery 20 weeks  
Shpping 6 weeks  
Installation 8 weeks  
Commissioning 4 weeks  
Production Run-Up 4 weeks  

Construction period:-  

<table>
<thead>
<tr>
<th>Activity</th>
<th>Week</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

| Buildings      | ********** |
| Special m/c    | ******************* |
| shipping       | *** |
| General plant  | *********** |
| & m/c          | *** |
| shipping       |     |
| Installation   | ****  |
| Commissioning  | **   |
| Production     | **   |
| run-up         |      |

4.16 Environmental Aspects

There should be no abnormal environmental problems. Conventional waste tips should be satisfactory.
These are indicated as cost per belt based on a standard belt having an ex-works price of US $3.08

- Material: USS 0.91
- Labour: USS 0.61
- Overhead: USS 0.61
- Profit: USS 0.95

Material costs include delivery to the factory of the raw materials.

Labour costs are for direct staff, which comprises production engineer, foreman and operators plus production staff in the offices.

Overheads include indirect staff, additional staff costs, local taxes, utilities, plus selling and administrative costs.
6.0 INTERNATIONAL PRICES

Typical international retail price of a V-belt is US $5.88.

Typical pricing structure for such a V-belt is:-

<table>
<thead>
<tr>
<th>Price Type</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retail Price</td>
<td>US$ 5.88</td>
</tr>
<tr>
<td>Trade Price</td>
<td>US$ 4.41</td>
</tr>
<tr>
<td>Ex-Works Price</td>
<td>US$ 3.08</td>
</tr>
</tbody>
</table>

Belt prices for vehicles include typical prices as follows:-

For popular cars up to 2 litres:-

<table>
<thead>
<tr>
<th>Price</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>US$ 2.66</td>
<td>Pump belt (a flat belt)</td>
</tr>
<tr>
<td>US$ 4.38 - 7.37</td>
<td>Alternator drive belt (standard V-belt)</td>
</tr>
<tr>
<td>US$ 22.80</td>
<td>Camshaft drive belt (special toothed belt)</td>
</tr>
</tbody>
</table>

For small engines the prices are around 75% of the above, and for larger vehicles about 50% higher.
V - BELT PRODUCTION PROCESS

WARNING
MILL
(See Fig 1)

PROFILE
CALENDER
(See Fig 2 & 3)

BUILD
CONTINUOUS
(See Fig 4)

SLIT
ROLL OF
V-BELT SHEET
(See Fig 5)

"FLIP" ON TEXTILE JACKET
(See Fig 6)

WOVEN TEXTILE JACKET

BRAID

TOPPING SHEET

FULLY BUILT ROLLED SHEET OF V-BELTS

COLD SHEET

WARM SHEET

V-PROFILE SHEET

INDIVIDUAL V-BELT
APPENDIX 2 - V-BELT PRODUCTION PROCESS

**FIG 1**

- **SMOOTH SURFACE UPPER ROLL**
- **LOWER ROLL HAS V-PROFILES MACHINED INTO IT**
- **PREWARMED RUBBER SHEET FED INTO PROFILE CALENDER MACHINE**
- **RUBBER SHEET AFTER PASSING THROUGH CALENDER MACHINE**

**PROLIFIC CALENDER MACHINE**
APPENDIX 2 - V-BELT PRODUCTION PROCESS

CONTINUOUS REINFORCEMENT - BRAIDED ROPE

REINFORCEMENT BRAID BEING WRAPPED AROUND CALENDERED RUBBER SHEET

CALENDERED RUBBER SHEET WRAPPED AROUND ROLLER - V-SECTION INWARDS

BUILD MACHINE - REINFORCEMENT BEING WOUND ON TO V-PROFILE CALENDERED SHEET

FIG 2
BUILD MACHINE — TOPPING SHEET BEING ROLL-PRESSED ON TO BRAIDING REINFORCEMENT TO FORM CLOSE ROLL OF BELTS.

FIG 3
APPENDIX 2 - V-BELT PRODUCTION PROCESS

SLITTING ROLL

CONTINUOUS SHEET OF BELTS BEING ROLL-SLITTED INTO INDIVIDUAL BELTS

SLITTING MACHINE

FIG 4
APPENDIX 2 - V-BELT PRODUCTION PROCESS

CONTINUOUS STRIP OF WOVEN TEXTILE JACKET

V-BELT + TEXTILE JACKET

PLAIN V-BELT

GUIDEPLATE

FLIPPING MACHINE - WOVEN TEXTILE JACKET FED ON TO SLOWLY ROTATING V-BELT UNTIL BELT FULLY COVERED

FIG 5
TECHNICAL PROFILE DATA REQUIREMENTS

ASSESSMENT AND SUMMARY SHEET

Product(s) : V - Belts for Automotive Replacement Market
Capacity : 396,000 belts/year
Number of Shifts : 1.0
Number of working days/year : 240
Production output by product (incl. efficiency ratio) : Year 3: 396,000 V-Belts, 2% Scrap Rate

INVESTMENT - US DOLLARS [Basic Exchange Rate Used USS1.0 = QR3.65]

- Plant/machinery (FOB):
  * Main production plant/machinery (1) : $579,000
  * Storage equipment : $18,000
  * Auxiliary equipment : $48,000
  * Packaging equipment : $5,000
  * Pollution control equipment : 
  * Engineering /Design fees : include in know-how fee (if required)
  * Sub-Total of Above Machine : $650,000
  * Carriage : $53,000

(1) Note. Separate detailed schedule of plant/machinery items to be attached.

- Spare parts (1 year):
  (initial set as inventory for working capital) : 48,750

- Erection costs:
  (including any technical assistance)
  USS62,000 : This does not include local accommodation of specialist installers

Freight charges: (to Arab Gulf Port) : USS500.00
Site and building requirements (M2)

- Production area: 580m²
- Warehouse area: 270m²
- Office area: 150m²
- Hardstanding area: 500m²

Total site land: 1500m² (including 1000m² for the floor area of the building)

Transport equipment (if available)
- Local purchase

Furniture and fixtures (if available)
- Estimated by GOIC
- Local purchase

Pre-production expenses (consultant component estimates)

- Training
  * Fees: £24,000
  * Number of persons: 2 - 2
  * Period: 2 weeks - 4 weeks
  * Location: UK

Sub Total Cost: £24,000

- Travel expenses: £16,000
- Commissioning: £33,000
- Studies (if required): £40,000
- Licence fee (if required): £150,000

TOTAL: £260,000

5% of ex-works price
Construction programme
(Total in calendar months)

- Engineering/Design/Purchase : 38 weeks
- Delivery/equipment : 06 weeks
- Buildings : 16 weeks
- Installation : 08 weeks
- Commissioning : 04 weeks

TOTAL : 55 weeks from "go-ahead"
(Please see bar-chart)

Production programme
(Production achievable after commissioning in °)

- First year of production : 50,000 hoses
- Second year of production : 150,000 hoses
- Third year of production : 395,000 hoses

PRODUCTION AND OPERATION COSTS

Raw materials:

<table>
<thead>
<tr>
<th>PRODUCT</th>
<th>QUANTITIES (**)</th>
<th>PRICES (USS T)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rubber &amp; adhesive</td>
<td>20</td>
<td>13.500</td>
</tr>
<tr>
<td>Textile reinforcement</td>
<td>15</td>
<td>03.700</td>
</tr>
</tbody>
</table>
**Consumables:**
(i.e. Chemicals and other materials)

<table>
<thead>
<tr>
<th>PRODUCT</th>
<th>QUANTITIES (**)</th>
<th>PRICES (USS/T)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Packing</td>
<td>10</td>
<td>03,600</td>
</tr>
<tr>
<td>Consumables &amp; scrap</td>
<td>0.8</td>
<td>12,000</td>
</tr>
</tbody>
</table>

**Royalties:** 5% of ex-works price/year.

**Utilities (**)**

<table>
<thead>
<tr>
<th>Utility</th>
<th>USS per V- Belt (excluding building heating and air-conditioning)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel</td>
<td>-</td>
</tr>
<tr>
<td>Process water</td>
<td>0.009</td>
</tr>
<tr>
<td>Electricity</td>
<td>0.035</td>
</tr>
<tr>
<td>Steam</td>
<td>-</td>
</tr>
<tr>
<td>Cooling water</td>
<td>-</td>
</tr>
<tr>
<td>Compressed air</td>
<td>0.010</td>
</tr>
<tr>
<td>Gas (*** )</td>
<td>-</td>
</tr>
<tr>
<td>Gas oil</td>
<td>-</td>
</tr>
</tbody>
</table>

(**) Unit (Kg, T, m³, ...) per unit of product or per year.

(*** ) Natural, LPG etc. (please define)

**Maintenance cost:**
(including spare parts, excluding local manpower)

$0.006 / belt
Labour (by relevant skill and categories):

<table>
<thead>
<tr>
<th>Production (a)</th>
<th>No./Shift</th>
<th>Administration</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 2 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Production</td>
<td>1</td>
<td>General Manager</td>
<td>1</td>
</tr>
<tr>
<td>Engineer</td>
<td></td>
<td>Sales Manager</td>
<td>1</td>
</tr>
<tr>
<td>Foreman</td>
<td>1</td>
<td>Accountant</td>
<td>1</td>
</tr>
<tr>
<td>Maintenance</td>
<td>1</td>
<td>Office Staff</td>
<td>2</td>
</tr>
<tr>
<td>Fitter</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operators</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>10</td>
<td>TOTAL</td>
<td>5</td>
</tr>
</tbody>
</table>

(a) Includes Maintenance Personnel.

International Sale Prices (By product): USS

<table>
<thead>
<tr>
<th>PRODUCT</th>
<th>EX - WORKS</th>
<th>RETAIL</th>
</tr>
</thead>
<tbody>
<tr>
<td>V- Belt</td>
<td>3.08</td>
<td>5.89</td>
</tr>
</tbody>
</table>

Comparative Existing Location (b) Production Cost (breakdown):

<table>
<thead>
<tr>
<th>Cost item</th>
<th>Cost (in $)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw materials/consumables</td>
<td>0.91</td>
</tr>
<tr>
<td>Labour (direct only)</td>
<td>0.61</td>
</tr>
<tr>
<td>Utilities</td>
<td></td>
</tr>
<tr>
<td>Maintenance</td>
<td>0.61 + utilities selling costs + taxes + administrative cost.</td>
</tr>
<tr>
<td>General expenses</td>
<td></td>
</tr>
<tr>
<td>Distribution expenses</td>
<td></td>
</tr>
<tr>
<td>Depreciation</td>
<td></td>
</tr>
<tr>
<td>Profit</td>
<td>0.95</td>
</tr>
<tr>
<td>TOTAL</td>
<td>3.08</td>
</tr>
</tbody>
</table>
To be provided for comparison with Arabian Gulf cost breakdown.

(b) e.g. USA, W. Europe, Japan, Korea (as applicable).