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ROPE PUMP  
TECHNOLOGY TRANSFER

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**ROPE PUMP  
TECHNOLOGY TRANSFER**

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## **ROPE PUMP TECHNOLOGY TRANSFER.**

### **PRESENTATION**

The Technology Transfer Division of the Rope Pump Company (Empresa Bombas de Mecate), the Nicaraguan Institute for Aqueducts and Sewage System (Instituto Nicaragüense de Acueductos y Alcantarillado - INAA), and the Swiss Development Agency (COSUDE), have the pleasure of presenting the documents entitled "Documents on the Rope Pump Technology Transfer".

These interesting documents include the technical information (work methods, production processes, technical specifications, etc), presented in very simple terms and illustrations so as to permit the transmission of the knowledge, experience and quality required for producing, installing and maintaining the Manual Pump in the correct manner.

Nicaragua is a pioneer in the development and promotion of this technology and has reached a high level of acceptance within the population and organizations working to improve sanitation and water provision. This situation has gained attention worldwide, leading to requests for further information from people and organizations from a large number of countries and agencies.

In order to respond to this situation, INAA, COSUDE and Bombas de Mecate have joined efforts, resulting in this base documentation and a training center equipped to transmit this technology.

The transfer of the rope pump technology to developing countries is a South-South effort, but the invaluable North-South cooperation is essential for its execution so that its development in other countries can become a reality.

This technology, which has been proven to its sustainability through its high quality, has had a great impact on the rural areas of Nicaragua and is today documented and available to developing countries. It represents a great contribution to improving the conditions of water provision and sanitation, and thus, better living conditions for the world's population.

The realization of this program ratifies the ties of friendship between Nicaragua and the donor countries.

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## Republic of Nicaragua:

<b>Geographical location:</b>	<b>Central America</b>	
<b>Population</b>	<b>4,357,000</b>	<b>1)</b>
<b>Area in km<sup>2</sup></b>	<b>119 838 km<sup>2</sup></b>	<b>1)</b>
<b>Density</b>	<b>36.4 hab/km<sup>2</sup></b>	<b>1)</b>
<b>Urban population (%)</b>	<b>54.4 %</b>	<b>1)</b>
<b>Gross National Product per capita</b>	<b>380 US\$/pp (1995)</b>	<b>2)</b>
<b>Life expectancy</b>	<b>68 years</b>	<b>2)</b>
<b>Infant mortality (per 1000 births)</b>	<b>46</b>	<b>2)</b>

**Eighty eight percent of the population is concentrated in 44 % of the total area, mostly in the western part of the country.**

<b>Water service</b>	<b>Total population</b>	<b>Rural population</b>
<b>Piped water to the house or yard or public tap</b>	<b>60.1 %</b>	<b>27.4 %</b>
<b>River source or ravine</b>	<b>14.5 %</b>	<b>30.7 %</b>
<b>Private or communal well</b>	<b>20.8 %</b>	<b>37.0 %</b>

**Rural population with access to potable water: 35 %**  
**Number of hand dug wells (estimate): 100,000**  
**Depth of hand dug wells: 50 % between 0 and 10 meters, 35 % between 10 and 20 meters and 15 % deeper than 20 meters.**

**Hand dug wells with rope pump: 7,000**  
**Perforated wells with rope pump: 500**

**Number of perforated wells: ± 2,000**

- 1) National population and housing census 1995. Instituto Nacional de Estadísticas y Censos (National Institute for Statistics and Cesus).**
- 2) World Development Report 1997.**

# **ROPE PUMP TECHNOLOGY TRANSFER DOCUMENTS**

## **I- ROPE PUMP PRODUCTION PHOTOMANUAL**

**This manual illustrates, through a photographic sequence, the step-by-step production process. It also contains diagrams, and a description for its operation. The manual is directed at new producers of rope pump components.**

## **II- MANUAL OF TECHNICAL DRAWINGS.**

**These three manuals contain technical specifications, such as measurements and types of materials for each pump: Family well rope pump, Extra-strong rope pump and Community well rope pump. It also indicates the variation of materials to be used depending on the depth of the wells.**

**These manuals also include the Technical Drawings of each of the pumps' mechanisms.**

**The manual is a reference book for producers, providing specifications for the materials required in the elaboration of the pumps.**

## **III- INSTALLATION AND MAINTENANCE MANUAL.**

**This manual explains the procedures for installing the rope pumps. It also includes an explanation of the most common types of maintenance and repairs. This manual is directed at installers of the pumps and can also be used to teach users how to do their own repairs in order for the pump to remain active.**

## **IV - GUIDE FOR INTRODUCING THE ROPE PUMP.**

**This is a document which indicates the procedure recommended for the successful introduction of rope pump technology.**

**The future production unit will need to carry out a socio-economic diagnostic study, introduction to the market, and product development. Omitting any of these steps could lead to failure.**

## **V - REQUIREMENTS TO START PRODUCTION OF ROPE PUMPS.**

**This is a document that explains the technical means, materials and the organization required by a workshop producing rope pumps.**

**This includes production equipment, installation, administration, and the budget for these requirements.**

## **ROPE PUMP TECHNOLOGY TRANSFER**

**The Technology Transfer Division of Bomba de Mecate has elaborated the following documents:**

- \* Guide for introducing the rope pump.**
- \* Requirements to start production of rope pumps.**

**These documents present some important indicators and activities that must be taken into consideration when executing the technology transfer. The requirements for production, installation, administration, promotion and budgets for each are also specified.**

**The documents reflect part of the aspects that must be taken into account in the technology transfer and which contribute substantially to its success, since they are part of the Nicaraguan experience.**

# GUIDE FOR INTRODUCING THE ROPE PUMP

The introduction of the rope pump can be divided in different phases:

## First Phase:

- 1- Investigation of the technical, economical and social feasibility.
- 1a) Availability of materials. Technical capacity, (metal workshops, ceramics, plastics, PVC tubes, reprocessing old tires). Situation in rural areas concerning water depth, type of wells, density of wells. Contamination.
- 1b) Economic situation of the country. Acquisition capacity of the population. Define type of organization or firm to be established. Other economical constraints. Import possibilities.
- 1c) Social acceptance to be expected. Experiences gained and problems in previous projects which could affect execution. Present customs and practices.

## Second Phase

- 2- In the second phase the real production and introduction should be started.
- 2a) Formalization.  
First of all the structure in which the activity will be executed has to be defined and formalized. Local taxes and permits have to be taken into account.
- 2b) Training and production of prototypes.  
Training could be done on the spot or by sending technicians and future administrators over to Nicaragua. The last option will make them able to understand the problems to be encountered during the introduction. While the production part can be covered in its different dimensions.  
Production of prototypes on the spot can be done by sending over a set of for example, 50 of the spare parts most difficult to produce, which will serve as an example as well. In this way the introduction of the first set of pumps will not take too much time.
- 2c) Introduction of the pump.  
This is a time consuming process involving at least one year. The population has to be reached, and the support of the local population is needed. At the end it's a process where the people are convinced by neighbor or family.

## Third Phase

- 3) Promotion, commercialization and increasing of the production

- 3a) The introduction will take at least one year. Promotion through the participation in fairs or exhibitions and announcements in newspapers and radio-stations. The promotion through house to house visits to possible clients is fundamental.
- 3b) In the third phase the production capacity has to be increased which can include production of all parts of the rope pump.
- 3c) In case it's considered necessary, experimented Nicaraguan personal could give guidance to production problems while quality control can be considered as essential.

#### **Fourth Phase**

- 4 Independent and auto-sustainable production.

### **PARTICIPATION AND SUPPORT BY EXTERNAL SUPPORT AGENCIES**

- \* Preliminary phase.
  - Support in distribution of packets of information
- \* First Phase:
  - Support to feasibility study and evaluation of the results,
  - Shipment of packet of demonstration pumps
- \* Second Phase:
  - Agreement on structure with local interested parties.
  - Financial support for:
    - . Limited infrastructure
    - . Local training
    - . Training in Nicaragua.
    - . Initial promotion.
  - Establish contacts with local organizations dedicated to water and sanitation.
  - Define non-reimbursable part and reimbursable part of the pre-financing, which depends on the development of the activities.
- \* Third phase:
  - Continuous guidance and augmentation of the pre-investment in:
    - . Development of production capacity and promotional activities
    - . Quality control of production, installation and administration.
- \* Fourth phase:
  - Evaluation and publication of obtained results.



## **REQUIREMENTS TO START PRODUCTION OF ROPE PUMPS.**

### **\* FEASIBILITY STUDY. STUDY OF THE TECHNICAL, ECONOMICAL AND SOCIAL FEASIBILITY.**

- **Technical capacity, availability of materials.**
- **Economic situation of the country. Acquisition capacity of the population. Market to expected.**
- **Situation in rural area. Depth water table, number of hand dug wells.**
- **Present alternatives of other hand pumps, price, quality, efficiency, guarantee.**
- **Social acceptance to be expected. Problems encountered in former projects. Local customs.**

### **\* VISIBLE INVENTORY.**

- **Building**
- **Equipment for administration.**
- **Materials for demonstration and promotion.**
- **Machines and tools for the production.**
- **Stock of raw materials.**
- **Vehicles.**

### **\* STRATEGIC PLACE**

- **Accessible for clients**
- **In neighborhood of commercial centre to buy raw materials for production as iron, pipes etc.**
- **Should have a hand dug well available for demonstration purposes for possible buyers.**

### **\* ADMINISTRATION.**

- **A solid administrative structure (conform local laws) to be able to operate legally. (Taxes, contracts etc.)**
- **Financial administration, to control and elaborate strategies.**
- **Documentation to inform the clients.**

**\* QUALITY AND GUARANTEE**

- The maximum depth of application of the rope pump is related to the quality of the product
- Quality and guarantee are the prerequisite for a client to serve as promotor of the product.
- Quality is very much related to the durability of the rope pump.

**\* STRATEGY RELATED TO PROMOTION, PRICE AND TYPE OF PRODUCT.**

- A Promotion programme to make known the product.
- Respond to the market with the right type of rope pump. (Family well rope pump, the extra strong rope pump, the community well rope pump, with and without protection cover, pump for drilled well, post mounted rope pump etc.)
- Get acquainted with the organizations related to rural development. Water & Sanitation, Health, Agriculture etc.

**\* INTERCHANGE OF EXPERIENCES. (TECHNOLOGY TRANSFER.)**

- Familiarize with existing experiences and technologic alternatives which includes different rope pump designs.
- Experiences on production technology
- Experiences on promotion and introduction strategy.

## **CONTENT OF A PRODUCTION FACILITY FOR ROPE PUMPS.**

### **PRODUCTION OF THE WHEEL.**

- **Welder and its accessories (2 x)**
- **Electric drill and bits**
- **Vice-bench.**
- **Pipe cutter**
- **Guillotine**
- **Scissors to cut zinc and riveting tool.**
- **Bending-tool for 1/2" and 3/4" pipes**
- **File, different types**
- **Hammer, sledge-hammer, saw.**
- **Plummet, measuring-tape, set-square, center-pons.**
- **Three production molds to weld the wheel with standard dimensions.**
- **Stock of raw materials.(Pipes, angle iron, iron rods (reinforcement rods), electrodes, etc.)**

### **PRODUCTION OF THE PISTONS.**

- **High density polyethylene**
- **Machine to inject the polyethylene.**
- **Molds of 1/2", 3/4", 1", 1½" and 2" where the polyethylene is injected in.**

### **PRODUCTION OF THE GLAZED CERAMIC PIECE FOR THE GUIDE BOX.**

- **Clay**
- **Kiln (Temperature up to 2300 grades Fahrenheit or 1300 Celsius.)**
- **Containers to process the clay**
- **Raw material to glaze the ceramic piece**
- **Different uncomplicated tools**

### **GUIDE BOX**

- **Molds of plate steel as shuttering to pour the concrete in.**
- **PVC pipes, iron wire and the ceramic piece.**
- **Raw material to make concrete.**
- **Rudimentary stove to heat and widen the ends of PVC-pipes used.**

#### **STOCK:**

- **Stock of raw materials to produce thw wheel.(Pipes, angle iron, iron rods (reinforcement rods), electrodes, etc.)**
- **PVC-pipes**
- **Cut up Truck-tires used for the pulley wheel**
- **Sand, cement and gravel**
- **Clay and raw material for glazing.**

#### **TRANSPORT:**

- **2 Four wheel drive trucks for installation and to provide raw materials.**
- **Tools for maintenance and repair of vehicles.**

#### **ADMINISTRATION:**

- **Furniture, 2 desks, seats and archive**
- **Computer and printer for financial administration and elaborate documents.**

#### **PROMOTION:**

- **Documents describing the product and its installation and maintenance, posters brochures, leaflet, etc.**
- **Advertisement-boards to promote the product.**
- **Demonstration rope pumps to be used in expositions, fairs, conferences etc.**

## FINANCIAL REQUIREMENTS:

INITIAL INVESTMENTS IN MACHINES, TOOLS, STOCK, FURNITURE etc.  
in US\$, (dollars United States)

### I) ADMINISTRATION

Desk (2)	400.-	
Archive	100.-	
Seats (5)	100.-	
Computer and printer	2,200.-	
Table	100.-	
Paper and office equipment	<u>1,500.- +</u>	
Subtotal		4,400.-

### II) WORKSHOP TO PRODUCE THE WHEEL.

Welders (360.- US\$ each 2x)	720.-	
Guillotine	500.-	
Vice-bench	45.-	
Vice-bench for pipes	40.-	
Bending-tool (manual)	150.-	
Saw (2)	12.-	
Pipe cutter	50.-	
Sledge-hammer	15.-	
Hammer	10.-	
Measuring-tape (2)	5.-	
Set-square (2)	15.-	
Center pons (2)	10.-	
Drill and accessories	150.-	
File, different types (3)	30.-	
Production molds (4)	200.-	
Scissors	15.-	
Riveting tool	<u>5.- +</u>	
Subtotal		1,972.-

### III) PRODUCTION OF THE PISTONS AND PREPARATION OF THE ROPES WITH PISTONS.

Plastic injection machine	500.-	
Molds to inject pistons (5)	625.-	
Different small tools.	50.-	
Subtotal		1,175.-

**IV) PRODUCTION OF THE GUIDE**

Kiln	3,000.-	
Molds to pour concrete (20)	240.-	
Different small tools	100.-	
Subtotal		3,340.-

**V) INSTALLATION EQUIPMENT.**

Second hand Pickup (2) 9.000,- US\$ each	18,000.-	
Installation tools	800.-	
Tools for maintenance and repair of the vehicles	300.-	
Subtotal		19,100.-

**VI PROMOTION AND ADVERTISING.**

Demonstration tables for rope pumps in expositions, fairs, conferences etc.	1,000.-	
Documentation, posters, brochures, leaflet etc.	750.-	
Subtotal		1,750.-

UNFORSEEN AND ROUNDING 263.-

**TOTAL MACHINES, TOOLS AND EQUIPMENT: 32,000.-**

**INITIAL STOCK**

PVC pipe	1500.-	
Materials to produce the wheel	2300.-	
Materials to produce pistons	600.-	
Materials to produce the guide	700.-	
Rope	300.-	
TOTAL INITIAL STOCK		5,400.-

**OPERATION EXPENDITURES.**

**Initial expenditures to introduce and promote the product until equilibrium will be reached where expenses are covered by revenues.**

**First year, sale of 300 rope pumps.**

**Second year first semester, sale of 250 rope pumps**

**Second year second semester, sale of 350 rope pumps.**

**Third year, equilibrium without pay off on initial investment. (Expenses will depend strongly on local salaries.)**

**EXPENSES STAFF/PERSONAL:**

**I) ADMINISTRATION**

Administrator  
Assistant administrator  
Receptionist and salesman/woman

**II) WORKSHOP PRODUCTION OF THE WHEEL**

Welder  
Assistant

**III) PRODUCTION PISTONS AND PREPARING ROPES.**

Operator injection machine.  
Operator molds.  
Workmen preparing ropes.

**IV) PRODUCTION OF THE GUIDE BOX.**

Ceramic workman  
Producers of the guide box

**V) INSTALLATION GROUP.**

Chauffeur (installation workman at the same time)  
Installation workman.

**VI) PERSONAL DEDICATED TO PROMOTION ACTIVITIES**

The participation in fairs and exhibitions will be covered by the same personal. The installation group has additional and continuous mandate to visit areas of interest to promote the rope pump. (Expenses for installation of the rope pump are mixed with promotion expenses.)

The number of personal will increase from 4 persons in the initial phase to 12 persons at the end of the second year. (Expenses are estimated based on 8 persons during two years with a medium salary of 125 US\$ a month.)

**TOTAL EXPENSES PERSONAL: 24,000.-**

**EXPENSES RELATED TO PROMOTION.**

Includes brochures, leaflets and other propaganda materials (300 US\$), advertisements in newspapers and radios (150 US\$/month), participation in fairs and expositions 5 times 700 US\$. advertisement boards etc.

**TOTAL EXPENSES IN PROMOTION 8,000.-**

**OPERATIONAL COSTS,**  
Fuel, travelling-expenses 5,000.-

**EXPENSES RELATED TO FORMALIZATION JURIDIC STRUCTURE**  
2,000.-

**COMMUNICATION (TELEPHONE, FAX)** 1,000.-

**RENT OF BUILDING FOR OFFICE, PRODUCTION AND STORAGE**  
24 month x 200 US\$ 4,800.-

It is not recommended to rent a building, as the promotion related to certain direction has a value in the order of 10.000 US\$ for the future enterprise. It is advised to start on own property to prevent future expenses.

**EARNINGS BY SELLING OF ROPE PUMPS DURING THE FIRST TWO YEARS:**  
PUMPS SOLD, 300 (1 year) + 250 (2 year 1 sem.) + 350 (2 year 2 sem) FOR A  
TOTAL OF 900 pumps.  
NET INCOME at 30 US\$ / pump. 27,000.- US\$

**SUMMARY**

**INITIAL INVESTMENTS**  
TOTAL MACHINES, TOOLS AND EQUIPMENT: 32,000.-  
TOTAL INITIAL STOCK 5,400.-  
TOTAL EXPENSES PERSONAL: 24,000.-  
TOTAL EXPENSES IN PROMOTION 8,000.-  
OPERATIONAL COSTS, 5,000.-  
EXPENSES RELATED TO FORMALIZATION 2,000.-  
COMMUNICATION (TELEPHONE, FAX) 1,000.-  
RENT OF BUILDING (24 month x 200 US\$) 4,800.-

**TOTAL EXPENSES** 82,200.-

**NET INCOME at 30 US\$ / pump.** 27,000.- US\$

**INITIAL CAPITAL NEEDED:** 55,200.- US\$

**This amount does not include expenses related to training, technology transfer and supervising.**