

INSTALLATION MANUAL

FOR THE ROPE PUMP



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INTRODUCTION

This manual of technical drawings is part of the rope pump technology transference programme.

This is the second edition and is directed towards our clients, users, promoters and technicians to support the installation process..

In the chapter on technical specifications you will find information on the quantity of water drawn by the pump and an informative table about the diameter of pipes to be used depending on the depth of the well.

The most important chapter is on the installation of the pump. This chapter describes the correct way of installation using a combination of drawings and text. In the last chapter the maintenance and repair procedures are shown. The steps to be followed for repairs to the pump are similar to those used in its installation.

This manual can be used for the installation of the family well rope pump This is the cheaper version of the rope pump without extras. The family rope pump is the basis of the commercial success of the rope pump. This manual is applicable as well for the extra strong rope pump to be used on community wells and in cases when an intensive use of the pump is expected.

Separate annexes have been made to cover the installation of the extra strong rope pump on drilled wells and for special designs such as post-mounted rope pumps and motor-driven rope pumps.

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English version January 1999

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Drawings: Henri García Montoya.

TECHNICAL SPECIFICATIONS

Pumping Capacity of the rope pump according to depth:

Depth (metres)	Adult (Litres per minute)	Child (Litres per minute)	Time needed for an adult to fill a barrel (minutes)
5	70	39	3
10	41	19	5
15	27	13	8
20	20	10	10
25	16	8	13
30	14	6,5	15
35	12	5,5	18
40	10	4,8	20

The pumping capacity indicated in the table is based on operation under normal conditions. Even for children it is easy to fill a bucket thanks to the high efficiency of the pump. This is an important requirement to obtain the social acceptance of the rope pump.

The diametre of the pipes is determined by the depth from wellhead to water level.

Depth (metres)	Pumping pipes	Discharge pipes
0 - 11 metres	1 " inch	2 " inch
11 - 19 metres	3/4" inch	1 ½" inch
19 - 50 metres	1/2" inch	1 " inch

The pulley wheel is made from the inner sidewalls of 20" inch truck tires, but for wells deeper than 29 metres 16 " inch tires or smaller are used.

In shallow wells, up to 3 metres and up to 5 metres, pumping pipes of 2" and 1 ½" respectively are used with a discharge pipe of 3" inches.

Different variations of the extra strong rope pump can be found depending on the type of use that it is to be given. These variations are:

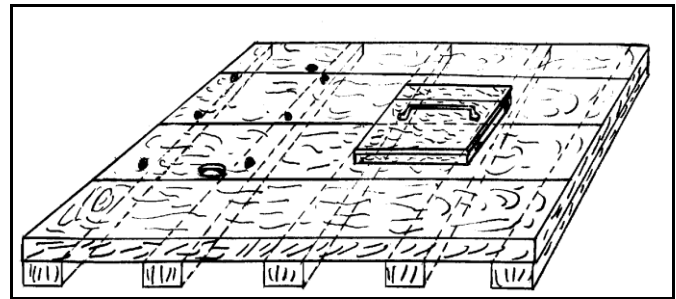
- The use of two pulley wheel handles for relatively deep wells in the range of 37 to 50 metres.
 - The use of wooden bearings similar to those used in the engine driven rope pump. These are employed when the rope pump is used during several hours each day. If more than 20 families are using the pump the application of wooden bearings is justified.
 - The application of a pulley wheel protector to cover the pulley and protect it from the sun and dust.
- These variations do not influence the installation process.

Specifications of the well covers and structures to fasten the rope pump.

In the next section a description is given for the construction of a wooden cover and concrete slab, as well as instructions on how to fasten the pump to the cover. The use of a concrete cover and drainage apron is recommended.

a) Wooden cover.

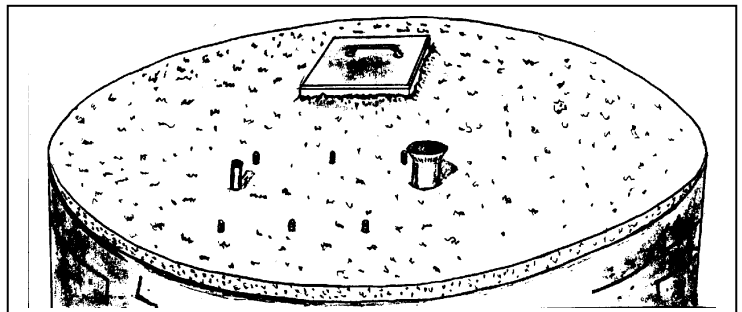
Place two wooden beams at least 2x4" thick across the wellhead. Place the wheel (support structure of the pulley wheel) on the beams accommodating them in such a way that the rope which hangs down loose does not touch the inside wall of the well or the beams. This can be checked with a plummet or by hanging a rope with a small weight down from the pulley wheel. The pumping pipe may be positioned so that it barely touches the wall or wellhead. The pulley wheel handle should extend far enough away from the wellhead to operate the pump. The two beams will be part of the wooden well cover. Reinforce the wooden cover with sufficient wooden beams which should be covered with planks at least 1" thick. In these cases an access hatch is not required because the pipes of the pump can be brought into the well while the cover is partially removed.



The pulley wheel handle should extend far enough away from the wellhead to operate the pump. The two beams will be part of the wooden well cover. Reinforce the wooden cover with sufficient wooden beams which should be covered with planks at least 1" thick. In these cases an access hatch is not required because the pipes of the pump can be brought into the well while the cover is partially removed.

b.1) The concrete slab.

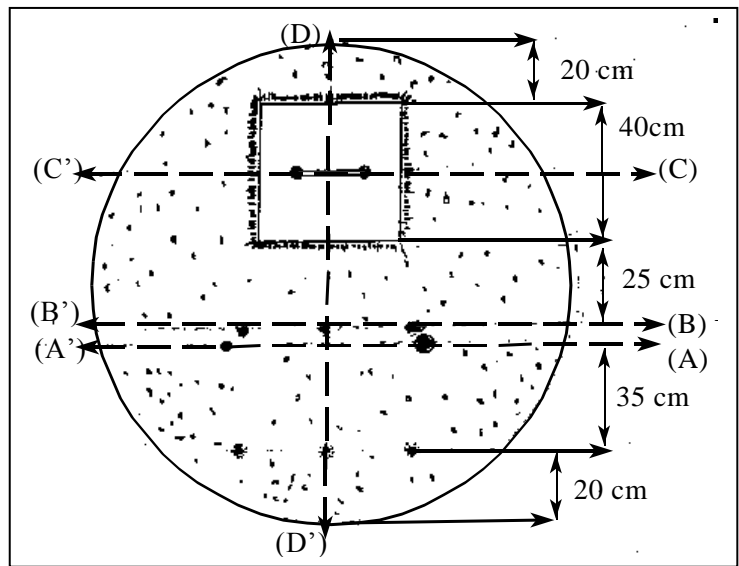
Protecting the water quality in the wells is one of the main reasons for installing hand pumps, because in this way the well can be sealed thereby preventing filtration. Although the rope pump does not seal the well hermetically it does give excellent protection against contamination. The use of a rope pump instead of a bucket with rope decreases contamination of the water, and the use of the concrete well cover gives even better results.



The construction of the concrete slab requires some experience in masonry. The materials needed depend on the diameter of the well. For a wellhead of 1.4 metre in diameter the following materials are needed.

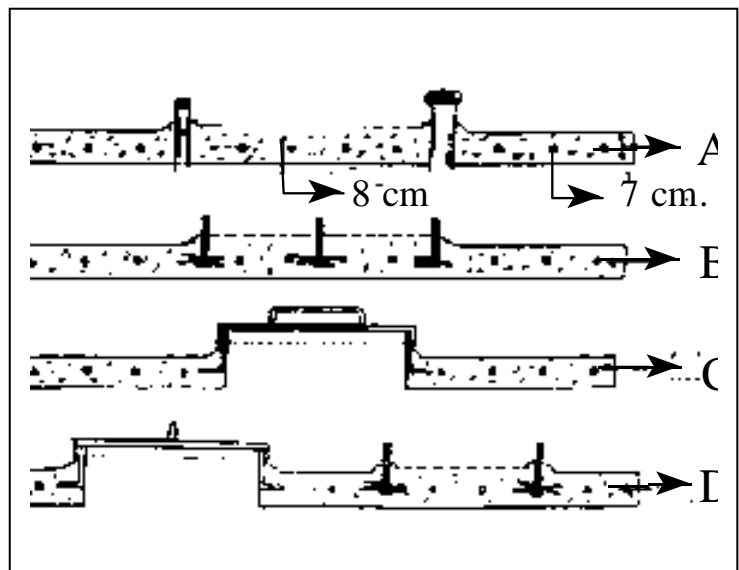
- 3 buckets 1/4" gravel
- 3 tins of sand
- 1 1/2 sacks of cement
- 24 metres 3/8" concrete iron rods
- 15 metres of fastening wire
- Strips of plywood measuring 5 metres in length and 7 centimetres in height
- 3 metres of 1"x 4" planks to make the mould for the access hatch
- the wheel for the extra strong rope pump
- protection pipes of which the diameter depends on the pumping pipe to be used
- 6 rustproof bolts with reinforcements and the cover of the access hatch with its frame, both of which can be purchased with the rope pump if desired

(The quantities of cement, gravel and sand indicated depend on the locally used containers, but they should be in a proportion of 1 : 2.5 : 5.)



Steps for building the concrete slab.

- Select a clean place for the elaboration of the slab.
- Make a circle from the plywood strips according to the dimensions of the well.
- Determine the position of the pump and the access hatch.
- Position the mould of the access hatch. The outside dimensions of the mould are equal to the inside dimensions of the access hatch frame.
- Cut and fasten the concrete iron rods for reinforcement. The rods should have a distance of about 12 centimetres between each one.
- Position the wheel with its bolts in such a way that the reinforcement rods do not disturb the positioning of the pumping or protection pipes, using the plummet to determine the exact place of these pipes. The angle-irons of the wheel should be placed on supports in order for them to remain about 2 centimetre above the concrete surface of the slab.
- The slab should be at least 7 centimetres thick.



Vertical section of the slab

- Prepare the mixture, wet the frame and rods and cast the concrete. Position the protection pipe and a piece of pumping pipe.
- Place the frame of the access hatch over the mould and lower it about two centimetres into the concrete mix.
- After a few hours the mixture for the plaster can be made.
- Fill the space underneath the angle irons and around the pipes so that any excess water will flow off the slab and not remain around the pipes or beneath the angle irons.
- Give a finishing touch to the slab with plaster.
- Wet the slab completely after three hours. This should be repeated at least three times a day for five days.

b.2) Installation on an already existent concrete slab.

The installation is similar to the installation on a wooden cover. The wheel is fitted on the slab in such a way that the rope which hangs down loose will not touch the inside wall of the well, while the pumping pipe may be positioned so that it barely touches the wall or wellhead. First the two holes for the pumping pipe and for the rope which hangs down are made. The last hole will be of greater diameter of normally 1 1/2" inch in which the protection pipe is placed. These holes are made first as concrete iron can be encountered which will make it necessary to reaccommodate the wheel structure slightly. Then the holes for the plugs are drilled, and the wheel can be screwed on the cover.

The installation on the newly made concrete slab is quite straight forward, as the wheel can be placed over the embedded bolts and fastened with the nuts.

c) Structure for installation on drilled wells

A drainage apron is made around the drilled well. The wheel should be positioned against the well where the lower support indicates the correct place. The bolts and their reinforcements are embedded in the concrete of the apron. The apron should be a few centimetres high at the point where the wheel is to be placed.

Details are explained in the annex on installation of the extra strong rope pump on drilled wells.

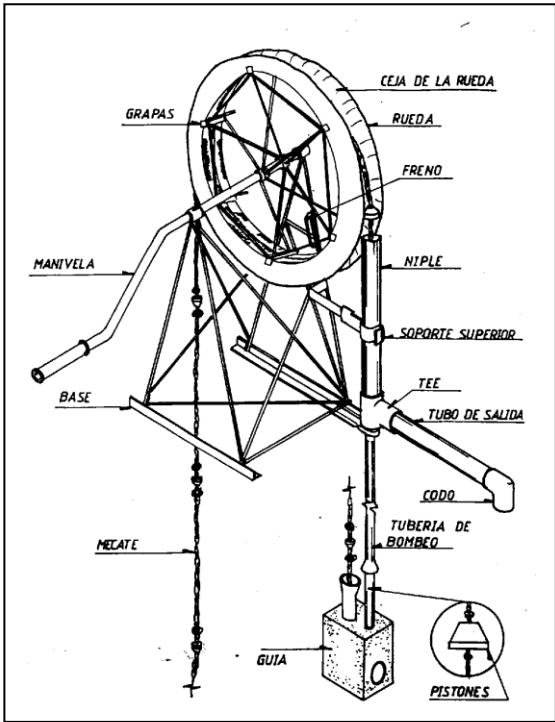
INSTALLATION

The rope pump has a simple design, made of just a few components and easy to install. We recommend that technicians who install the pump follow step-by-step the instructions given in this manual in order to ensure its proper functioning. In a separate annex some aspects of the installation of rope pumps on drilled wells are explained.

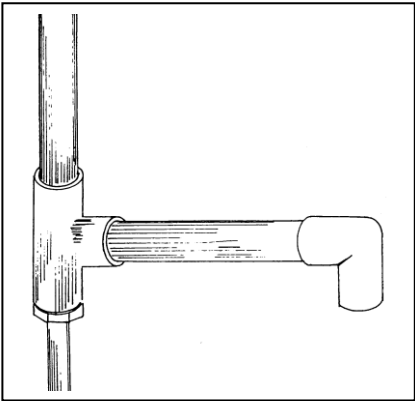
a) LIST OF COMPONENTS, TOOLS AND MATERIALS.

COMPONENTS:

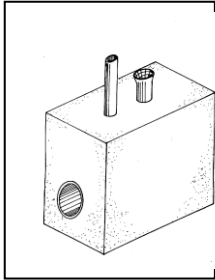
The rope pump consists of the following components:



a.1. Structure of the wheel



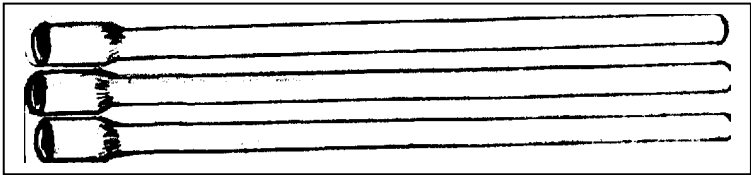
a.2. Discharge pipe.



a.3. guide



a.4. Rope with pistons



a.5. Pumping pipes

- * The pulley wheel is turned with the handle to move the rope and pump water.
- * The brake prevents the wheel from turning backwards after pumping.
- * The pipes are fixed to the supports
- * The pistons on the rope are fixed with a knot in front of and behind each piston, one metre apart. The rope is about 6 millimetres or a quarter of an inch in diameter.
- * The guide on the bottom of the well prevents rubbing or wear on the rope and pistons when entering the pumping pipe.

TOOLS AND BASIC MATERIALS:

Pipe-cutting saw, oil-syringe or greaser, 8 metres of galvanized wire to probe the pipes and insert the rope, matches or cigarette-lighter.

For installation on a prepared concrete slab: Key number 14 to fix the nuts.

For installation on a wooden cover:

Claw-hammer, saw, chisel, key number 10 and 11 if wood-screws are used.

Installation on a concrete slab which was not specially made for the installation of a rope pump requires the following additional tools: A 4 pound sledge-hammer, 5 and 8 mm augers for concrete, a drill, concrete chisels, and key number 10 or 11 to fix the screws in the plugs.

Useful tools, although not indispensable, are:

Measuring-tape, plummet, gauge, drill and 3/4" augers for wood, file or rasp for wood.

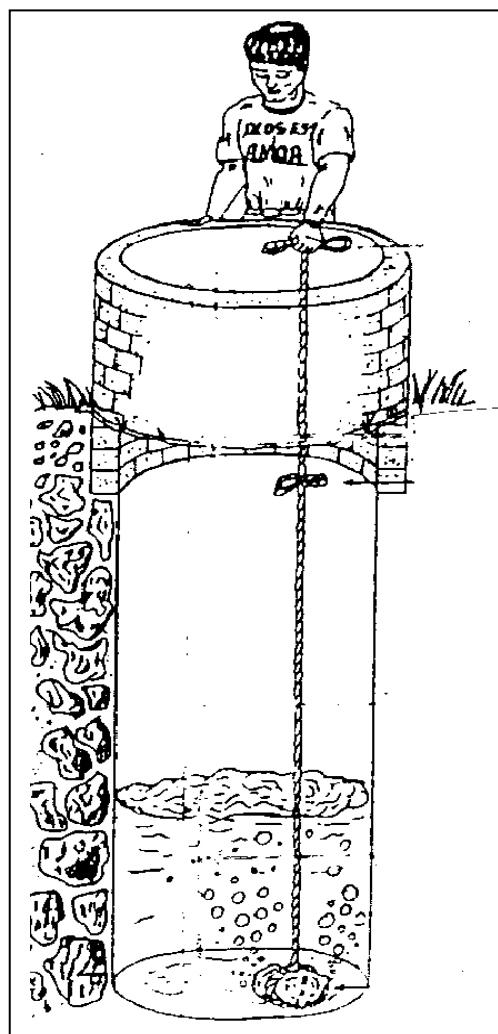
Materials for installing the rope pump are:

PVC-glue, 6 mm or 1/4" screws with hexagonal head, 8 mm concrete plugs, 2" and 4" inch nails.

b) INSPECTING AND MEASURING THE DEPTH OF THE WELL.

Make an inspection of the well and ensure that there are no roots or other type of rubbish in the well which could affect the functioning of the pump. It is always best that the well be cleaned before installing the pump.

To measure the depth of the well, a rope with a heavy object tied to one end is used. The weight should be lowered carefully from the wellhead until it touches the water level and a knot made; then it is lowered until it touches the bottom of the well and a second knot is made.



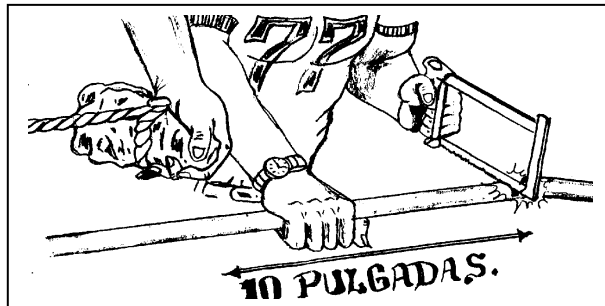
b.1. Measuring the well

The distance between the two knots gives an indication of the quantity of water in the well. Although the rope pump will work with a minimum of 20 centimetres of water in the well, it is recommended that the well has at least 1 metre of water.

Once this has been done, the rope is removed from the well and measured in arm-lengths. In this way the depth of the well from wellhead to water level, and the quantity of water in the well can be determined. The same rope is used to measure the length of the pumping pipe which can then be cut leaving about 10 extra inches. After inspecting and measuring the well, the diameter of the pumping pipe can be determined. This diameter depends on the depth from wellhead to water level. Refer to the chapter on Technical Specifications.



b.2. Measuring the depth



b.3. Cut the pumping pipe, leave 10 inches extra

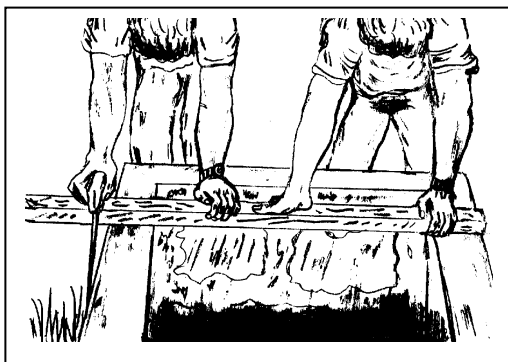
c) PREPARING THE CONDITIONS FOR INSTALLING THE PUMP ON THE WELL. (Wooden beams, Wooden cover, Concrete slab.)

In this paragraph a description is given on how to position the wheel on the well. First the conditions are prepared for wooden beams, a wooden cover, a concrete slab or the apron for the drilled wells as indicated in the paragraph on Technical Specifications.

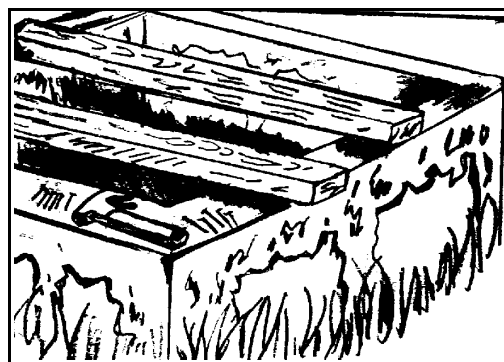
The wheel should be positioned at about 8 inches from the edge of the concrete slab to assure that the handle extends sufficiently for easy operation by its user.

c-1 Wooden Beams:

If no cover is present, two wooden beams of minimum 2" by 4" inch are used to position the wheel on the well.



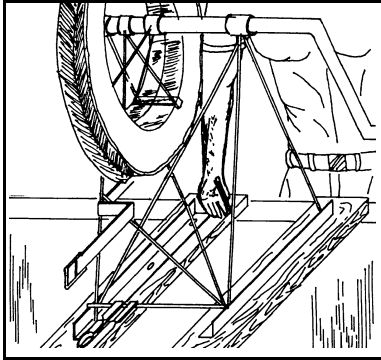
c.1.1. Place the beams



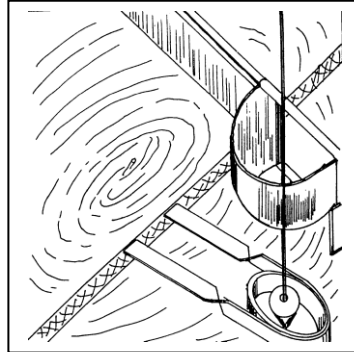
c.1.2. Two wooden beams

Position the wheel on the beams in such a way that the rope hanging down loose into the well does not touch the wellhead or the beams; this can be controlled with a plummet. The pumping pipe may be positioned against the wall or wellhead.

The wooden beams are fixed in the wellhead or nailed on the wellhead.



c.1.3. Position the wheel structure

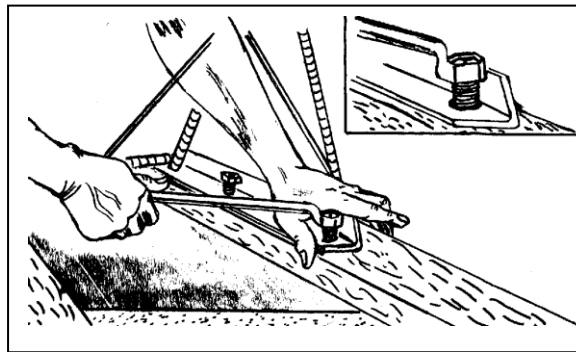


c.1.4. Beams embedded in the wellhead

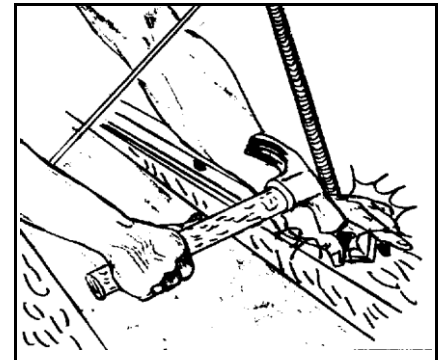


c.1.5. Beams nailed on the wellhead

The wheel can be screwed or nailed on the beams



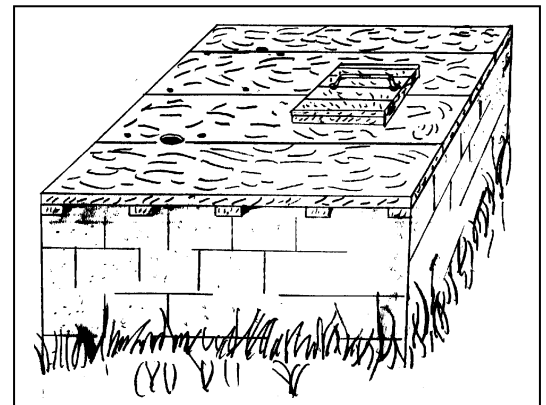
C.1.6. Fasten screws



C.1.7. Nailed

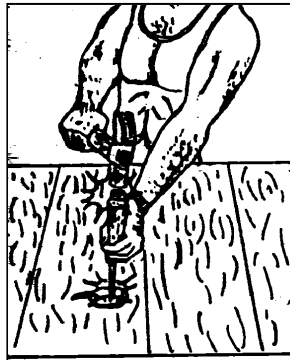
c-2. Wooden cover.

Place the wheel on the wooden cover in such a way that the rope hanging down loose into the well does not touch the wellhead. The pumping pipe may be positioned against the wall or wellhead. The wheel must be screwed onto the beams used to reinforce the wooden well cover. A hole the size of the diameter of the pumping pipe is made in the cover.

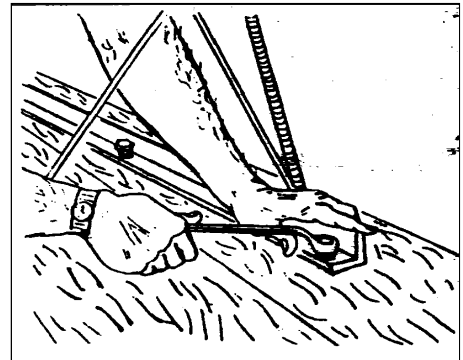


C.2.1. Wooden cover

A hole of the size of the pumping pipe is made exactly below the lower support. In the same way a hole of a greater diameter is made for the lowering rope, of a bigger diameter to let the rope and pistons pass freely without rubbing against the cover.



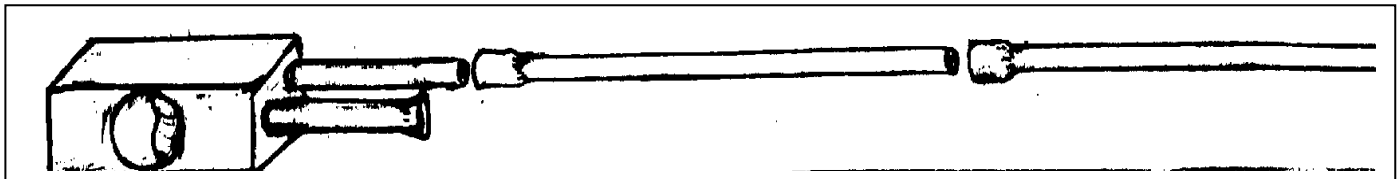
c.2.2. Make the holes



c.2.3. Fasten screws

c-3 Concrete slab:

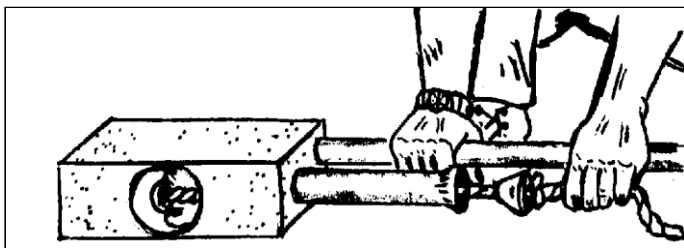
Fixing the wheel to the previously prepared concrete slab is quite easy. Place the wheel over the bolts and fix it with the nuts.



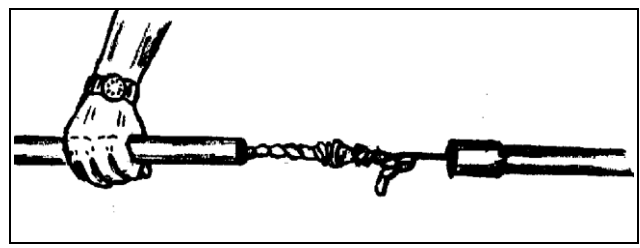
d.1. Extension of the guide and the pumping pipes

- 1- Position the guide near the well.
- 2- Position the pipes with the jacket towards the guide so that they can be joined.

e) HOW TO INSERT THE ROPE INTO THE PIPES.



e.1. Introduce the rope in the guide



e.2. Wire and rope to probe the pipe

Insert the end of the rope through the two pieces of pipe of the guide in such a way that the pistons go into the pipe like arrows and not like cups. In this way the pumping process functions where pistons pass through the pumping pipe like arrows and not like small cups. The rope is fastened to the galvanized wire to probe the pipes. The wire is about 8 metres in length. The wire is inserted into the first pipe starting at the end where the guide is placed.

Be careful that the pistons are not inserted backwards. Study the drawings carefully.

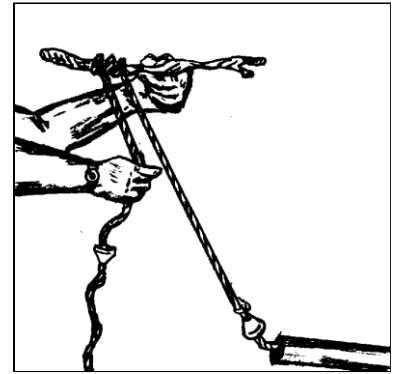
As the wire comes out of the first pipe, it should be pulled out and at the same time inserted into the next one and so on until leaving the last pipe. Then some small object must be



e.3 Pass the wire



e.4 Pass the rope

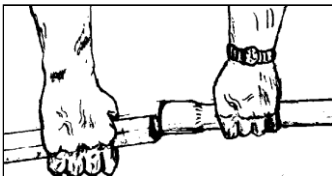


e.5. Tie a small object to the rope

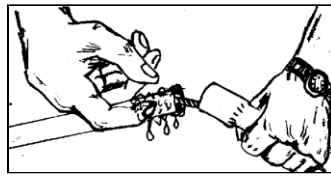
be tied to the rope to prevent it from slipping back into the pipe. During this process the pipes are not yet glued together. Unwind the other half of the rope and tie the two ends together to prevent the rope from falling down into the well during installation.

f) HOW TO PUT THE PVC-GLUE ON THE PIPES

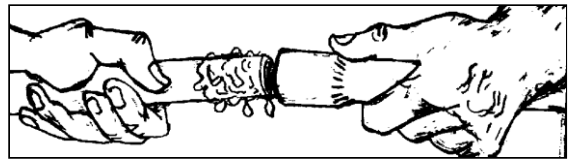
Before assembling the pipes, the jackets should be checked for dirt. Using a small brush or a finger, cover the outside part of the pipe at the side where there is no jacket with PVC-glue. Immediately thereafter insert the pipe into the jacket of the next pipe, giving it half a turn and leave it to dry for a few minutes. Do not put glue inside the jacket.



f.1. The pumping pipes



f.2. Put the glue on

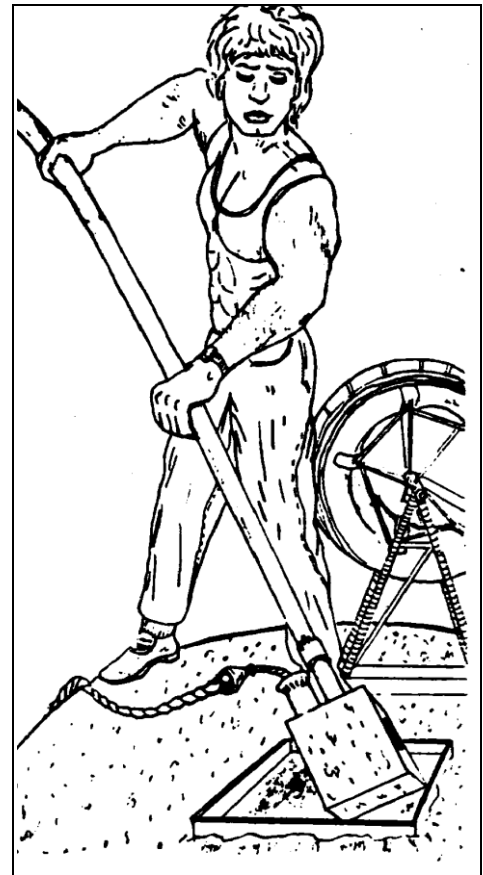


f.3. Connect the pipes

g) HOW TO INSERT THE PIPES WITH THE ROPE INTO THE WELL.

Insert the guide with the pumping pipe into the well through the access hatch. One person lowers the pipe while the other lowers the rope, using a bit of tension while the guide is lowered. (see drawing g1)

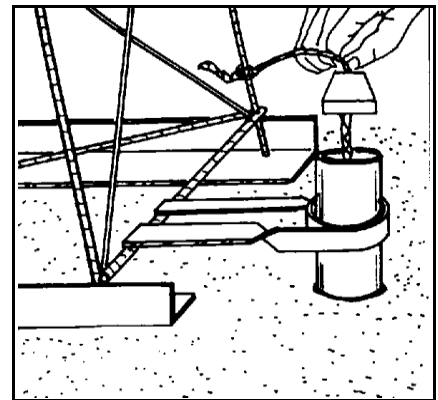
Prevent the pipe from rotating while it is being lowered into the well as this would cause the rope to wind itself around the pipe. When the guide touches the bottom of the well the two ends of the rope should be untied. The end of the rope which comes out of the pumping pipe should be passed from beneath through the hole in the slab. The pumping pipe should then be put through the same hole. (see drawing h1.) Pass the other end of the rope through the protection pipe and tie both ends to the wheel.



g.1. Introduce the pipes.

h) FASTEN THE PIPES TEMPORARILY TO THE LOWER SUPPORT.

Lift the pumping pipe until the guide no longer touches the bottom of the well. Cut the pipe four inches above the slab. In order to prevent the pipe from slipping back through the hole in the slab a rubber strip of inner-tube can be wound provisionally around the pumping pipe. After installation of the accessories the rubber strip can be taken away.



h.1. Pass the pipe through the

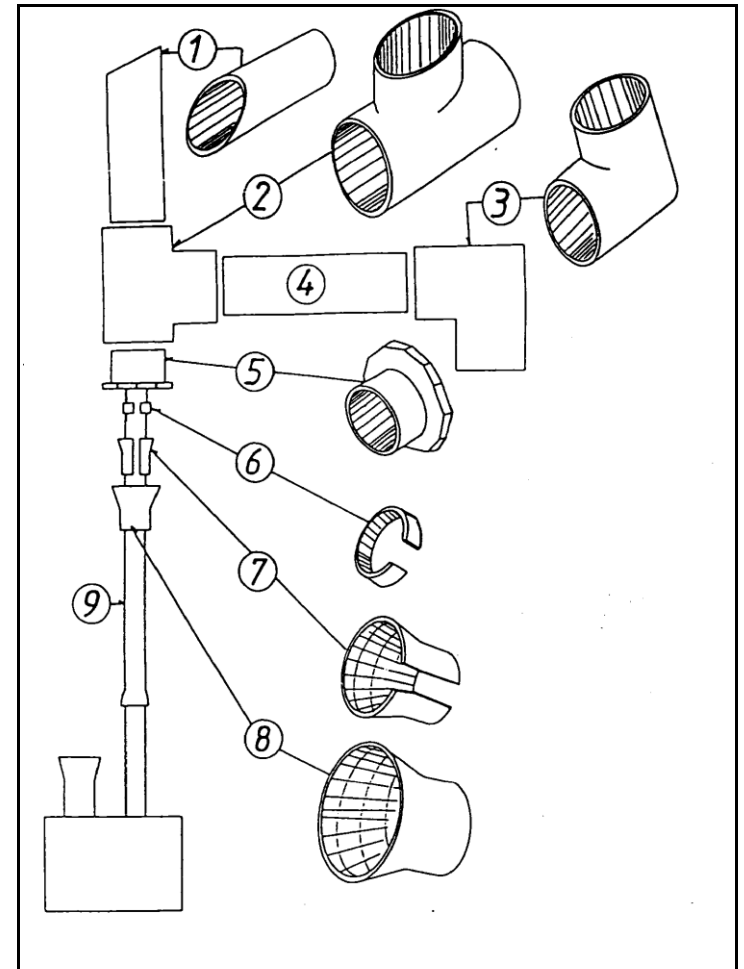
I) THE DIAMETRE OF THE PIPES AND ACCESSORIES DEPEND ON THE WELL DEPTH.

The installation accessories vary according to the well depth. Two different cases are distinguished and presented in the next pages, the range from 0 - 11 metres and the range from 11 - 50 metres depth. The pumping capacity is of course related to the well depth.

I-1.) Installation accessories for the range from 0 to 11 metres depth.

INSTALLATION ACCESSORIES OF THE ROPE PUMP FOR WELL DEPTHS
FROM 0 TO 11 Metres

No.	Accessories	Unit	DEPTH
			0 - 11 Metres
1	Nipple	Inches	2
2	Tee	Inches	2
3	Discharge elbow	Inches	2
4	Discharge pipe	Inches	2
5	Reduction	Inches	2 - 1
6	Primary wedge	Inches	1
7	Secondary wedge	Inches	1
8	Supporting wedge	Inches </td <td>1 1/4</td>	1 1/4
9	Pumping pipes	Inches	1



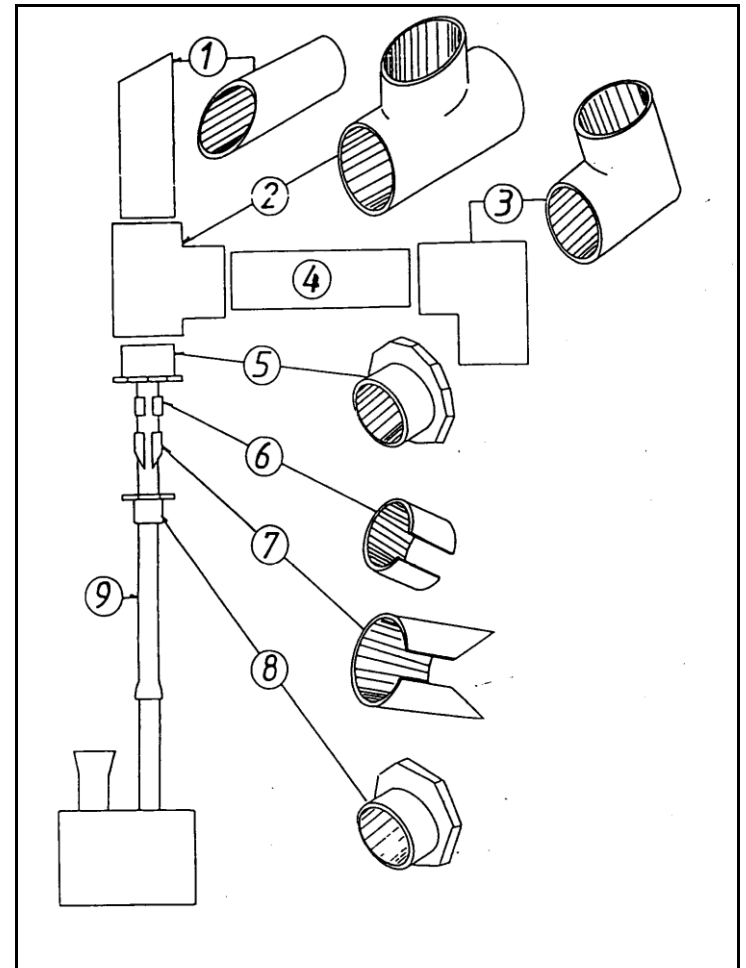
Installation accessories vary according to well depth.

- The use of a concrete cover and drainage apron is recommended.

I-2. Installation accessories from 11 to 50 metres depth.

INSTALLATION ACCESSORIES OF THE ROPE PUMP FOR WELL DEPTHS
FROM 11 TO 50 Metres

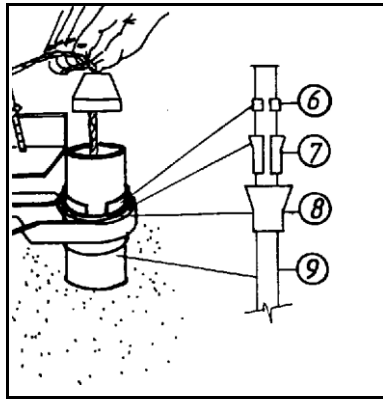
No.	Accessories	Unit	DEPTH	
			11 - 19 metres	19 - 50 metres
1	Nipple	Inches	1 ½	1
2	Tee	Inches	1 ½	1
3	Discharge elbow	Inches	1 ½	1
4	Discharge pipe	Inches	1 ½	1
5	Reduction	Inches	1 ½ - ¾	1 - ½
6	Primary wedge	Inches	¾	½
7	Secondary wedge	Inches	¾	½
8	Reduction	Inches	1 ¼ - 1	1 ¼ - ¾
9	Pumping pipes	Inches	¾	½



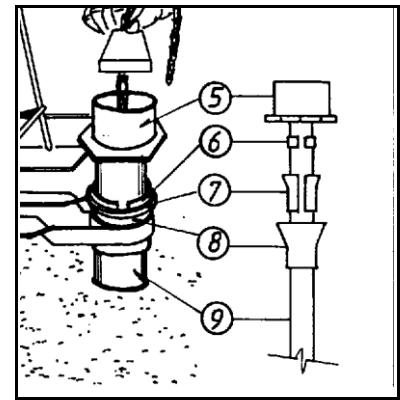
- Installation accessories vary according to well depth.
- Reduction number 8 is used to keep the pumping pipe in place in the lower support.
- The use of a concrete cover and drainage apron is recommended.

I-1) Installation of the accessories for the range from 0 to 11 metres depth.

Place the supporting wedge (8) over the pumping pipe (9). Glue the Primary wedge (6) 4 inches from the end of the pumping pipe with the pvc glue. Glue the secondary wedge (7) on top of the primary wedge. Once the glue has dried, place the supporting wedge (8) without glue over the primary and secondary wedge. Lower the pumping pipe (9) with the wedges into the lower support of the wheel. Place the reduction piece (5) without glue on the projecting end of the pumping pipe.



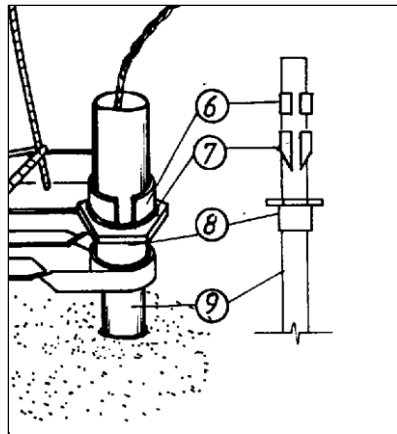
I.1.2. Glue the primary and secondary wedges, place the supporting wedge on top



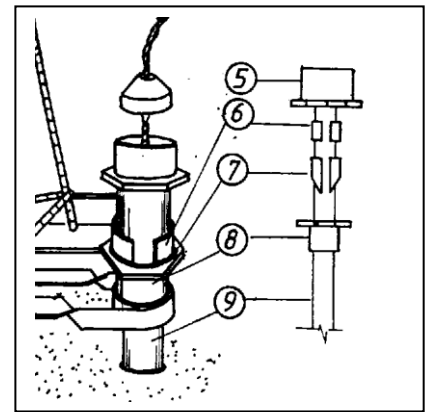
I.1.3. Place reduction on top of the pumping pipe

I-2. Installation of the accessories for the range from 11 to 50 metres depth

Place the reduction piece (8) over the pumping pipe (9). Glue the Primary wedge (6) 4 inches from the end of the pumping pipe with the pvc glue. Glue the secondary wedge (7) on top of the primary wedge. Wait until the glue has dried. Place the reduction (8) into the lower support of the wheel. Lower the pumping pipe (9) with the wedges into the reduction (8) in the lower support of the wheel. Place the reduction piece (5) without glue on the projecting of the pumping pipe.



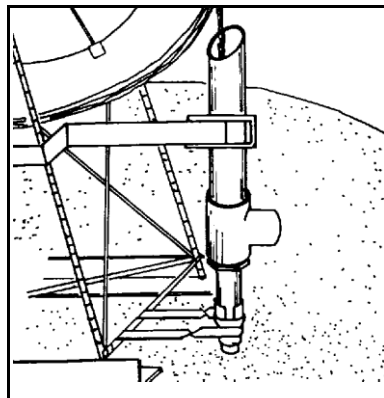
I.2.2. Place reduction in lower support and glue the wedges



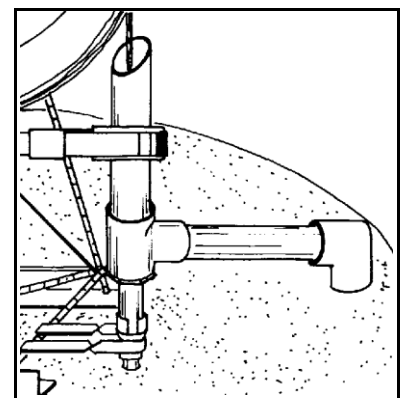
I.2.3. Place reduction on top of the pumping pipe

j) ASSEMBLY OF THE T-PIECE, NIPPLE AND DISCHARGE PIPE.

Place the T-piece on the reduction, and the Nipple on the T-piece. Place the upper support clamp around the nipple. Insert the discharge pipe in the T and place the elbow on the other end. Glue is not used in any of these procedures.



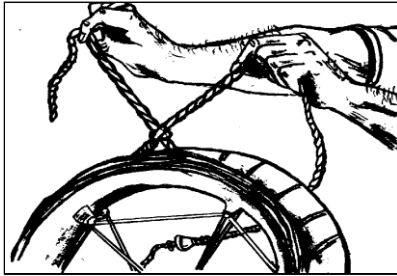
j.1. Place the T and the nipple



j.2. Discharge pipe and elbow

k) HOW TO KNOT TOGETHER THE TWO ENDS OF THE ROPE.

Place the rope, with the desired tension, over the pulley wheel to indicate where the knot should be made. Remove the rope from the pulley wheel and cut it, leaving about 5 extra inches at each end. Burn the ends with a cigarette lighter or



k.1. Tauten the rope.



k.2. Braid ends together

matches and twist them while they are hot. Take the two ends and braid them together as shown in figure k2, then put the rope back on the pulley wheel. The tension is correct when the rope does not slip or slide back over the pulley wheel while pumping water.

RECAPITULATION OF THE INSTALLATION ACTIVITIES:

1. Prepare the conditions for installing the pump on the well
2. Insert the rope with the pistons into the pipes with help of the probe.
3. Glue the pipes together.
4. Insert the pipes with the rope into the well.
5. Assembly of the accessories (as indicated in the table and drawings).
6. Knot ends of the rope together with a braid
7. Check the installed rope pump.

MAINTENANCE AND REPAIR

The rope pump has excellent characteristics with regard to its operation and maintenance.

Its operation is very easy and consists solely in turning the handle. The brake can be removed while pumping to prevent continuous noise. Once the pumping is finished, the brake must be put back on in order to prevent the pulley wheel and handle from turning backwards.

MAINTENANCE.

The maintenance can be divided into:

PROPER ROPE TENSION

It might be necessary to correct the tension in the rope during the first weeks of use, as the knots tend to lengthen the rope. Lack of tension in the rope will cause the rope to slip over the pulley wheel. To alter the tension in the rope, remove the rope and untie the knot. Put the rope back on the pulley wheel with the desired tension to measure where the new knot must be made, and repeat the process of braiding.

GREASING

Oil or grease the bushings of the axle necessary. Any type of oil or grease

FASTENING

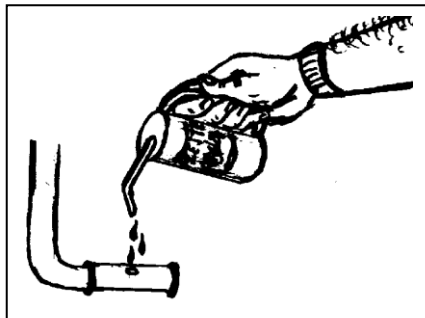
The fastening of the wheel should be the nails or screws.

CLEANING AND PAINTING

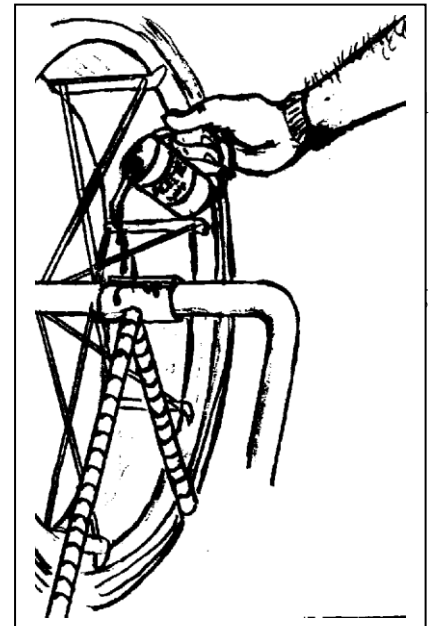
To prevent corrosion, clean and paint the wheel every year.

REPAIR.

With proper maintenance the rope pump should not cause any problem. The most common problems are caused by the rope which is of a thickness (1/4" or 6 millimetres) which would, under normal circumstances, last three years. The most common failures and their solutions are:



Oil the handle



Oil the bushings

WEAR TO THE ROPE

Excessive wear to the rope can occur when the rope is slipping over the pulley wheel while pumping or when the rope is rubbing against the well cover or wall. Replace the rope and prevent rubbing by correcting the tension.

REPLACING THE ROPE

To replace the rope, insert a support rope without pistons into the pipes while removing the worn rope. The same support rope will serve to insert the new rope into the pipes. Be careful of the direction of the pistons.

BROKEN ROPE

Before removing the pipes from the well a support rope without pistons but with a small weight on its end, should be lowered through the pumping pipe. (The weight must fit into the pipes while passing through the guide to the other side.) Next the pumping pipe is removed and the new rope with pistons is inserted with the help of the support rope.

If the pipes are already out of the well, the whole pipe must be probed with a wire the length of the pumping pipe in order to be able to insert the new rope with pistons.

ROPE STUCK IN THE PUMPING PIPE

This kind of failure is normally caused by waste in the well being suctioned into the pipe. Should it not be possible to solve the problem by pulling the rope backwards, the whole pipe must be taken out of the well in order to pull the rope more firmly. If neither of these procedures is successful, the pipe must be cut at the place where the problem is detected and changed. To join the pipes again a jacket must be made. This kind of work requires some experience.

THE WELL DRIED UP

If the well dries up, it should be deepened by about a metre. Before installing the pump again, an extra piece of pumping pipe is needed. The pumping pipe must be lengthened using an extra piece of pipe with the jacket directed downwards. An extra piece of rope is also needed.

HOW TO MAKE A JACKET ON A PIPE

The commercial pipes always have a jacket at one end. But in case it was necessary to cut the pumping pipe or if you only have access to a piece of pipe without a jacket it will be useful to know how to make one. Heat the end of the pipe (only one inch), take it out of the fire and insert a piece of the same type of pipe into the heated end. Repeat this procedure about three times to obtain a complete jacket. The pipe which was used to make the jacket will reduce its diameter when inserted into the heated pipe end. Cut this pipe when it is reduced too much. *(Prevent the pipe from burning or scorching at all times. The smoke generated by PVC is known to be very dangerous.)*