

# Manual for the Abakus Pump:

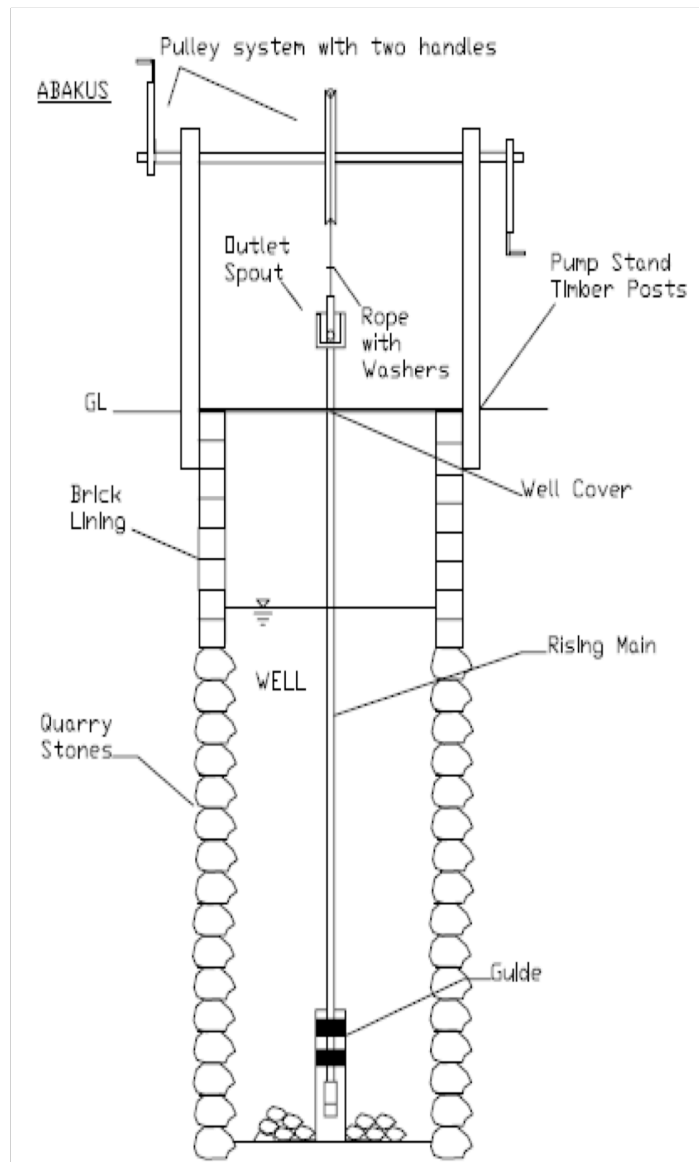
## A Non-Technical Construction Guide



Document prepared by Water Works, September 2010.

 **WATER WORKS**

## How the Pump Works



The principle behind the pump is water lifting. The action of turning the handle pulls a loop of rope around a wheel, through a guide at the bottom of the well and up a plastic pipe (rising main) that is submerged under water. The rope has equally spaced circular disks (washers) along its length. These disks trap water in the rising main and lift it into the outlet spout.

# How to Make the Pump

## 1. The Posts:

The posts hold the shaft (see page 13).

### Materials you need:

- 2 x 6 m (11cm x 4.5cm) soft wood planks
- nails

### Tools you need:

- a hammer and a spirit level



When building the well wall, leave space for the posts to be placed in the ground. The hole should be between 35cm and 50cm in depth.



The poles need to be spaced apart so that the shaft (see page 13) fits perfectly between them.



Fix the posts together at the bottom and middle. Do not fix the posts together at the top. This will be done later.



Space the posts apart with a plank of wood (called the stiffener) so that they fit in the middle of the holes. The plank will also make sure that the posts are aligned.



Cast the posts in concrete making sure they are perfectly straight using a spirit level.

## 2. The Guide

The guide feeds the rope (and washers) into the pipe.

### Materials you need:

- a timber log

### Tools you need:

- a chisel

#### **Inlet (Side 1):**



#### **Outlet (Side 2):**



#### **Inlet Side:**

The Inlet side is where the rope goes through. The edges must be smooth to stop the rope from getting torn and to stop the washers from breaking.

#### **Outlet Side:**

The outlet side is where the pipe is attached, where the rope goes out and into the pipe. The groove is made in the wood to make sure the hole in the pipe allows the rope (and washers) to go through it without catching the edges of the pipe.

### 3. The Wheel

The wheel turns the rope.

Materials you need:

- *bicycle wheel with spokes and tyres*
- *hardwood plank for the hub*
- *screws*

Tools you need:

- *wood saw*
- *chisel*
- *screw driver*
- *a piece of string*
- *pliers*



Remove the spokes from the wheel. They will be used later.



Cut a piece of wood so that it fits perfectly in the middle of the wheel.



Put a piece of bicycle tyre on the edge of the wood and nail the wood to the wheel.



Find the middle of the wheel by using two pieces of string.



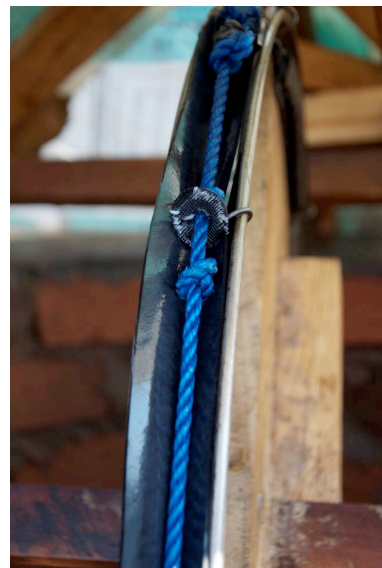
Cut a hole in **exactly** the middle of the wood so the shaft fits in it perfectly (see page 13)



Use the spokes to make clamps on the wheel. These clamps grab the knots in the rope so that the rope does not slip as it is turned (see below).



To increase the grip between the wheel and the rope, strap two bands of rubber bands over the clamps. This will also protect the rope and washers from wear.



### 3. The rope with Washers (rubber disks):

The washers are attached to the rope. They lift the water up the pipe.

#### Materials you need:

- 30 metres of rope
- bicycle tyre or tough rubber

#### Tools you need:

- a sharp knife or strong scissors
- screw driver



The washers are circular rubber disks made from bicycle tyres or similar strong rubber. They need to be cut so that they are 1 to 2mm smaller than the hole in the pipe.



Make a hole exactly in the middle of the washer using a screwdriver that has been heated in a fire.



Place the washers on the rope spacing them at 1m apart. Make sure that all the washers are facing the same way (curving in the same direction) on the rope. Tie a knot on each side of the washer to keep it in place. **Also tie a knot in the rope in-between (in the middle of) the washers.**



Stretch the rope. This is very important.

#### 4. The Turning Shaft

The wheel is attached to the shaft. The shaft turns the wheel.

Materials you need:

- 2 metre shaft of hard wood. 2in x 2in

Tools you need:

- chisel
- pieces of broken glass



Make a smooth circle in the shaft to rest on the posts. Make sure that the smooth circles are spaced the same distance as the posts are spaced apart.

## 5. The Handles:

The handles are used to turn the shaft. There are several ways to make these handles. Below, two options are presented.

Option 1:

Materials you need:

- 2 bicycle pedals
- Soft wood plank
- Lashing rubber band

Tools you need:

- wood saw
- chisel



On one side of a piece of plank, make a square hole having the same dimensions as the shaft. On the other side of the plank, make a groove to fit a bicycle pedal. Once the pedal has been fitted, fasten it using a rubber band.



Finish off by cutting the edges of the pedal to make it a grip. To make the grip more comfortable, lash it with rubber bands.

Option 2:

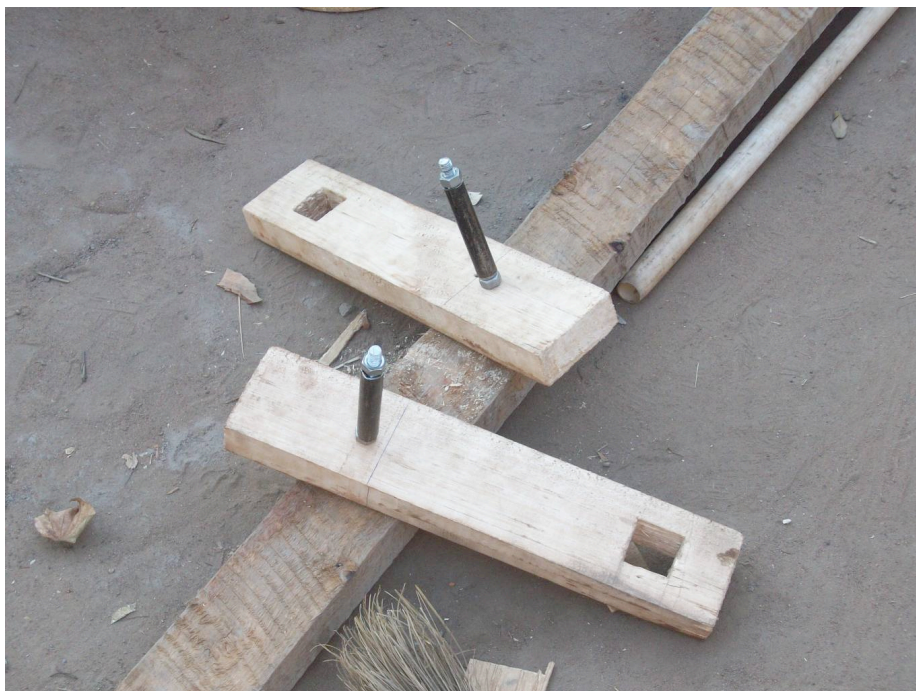
Materials you need:

- 2 bolts with knots
- Soft wood plank
- Steel tubing

Tools you need:

- chisel
- wood drill
- super glue

Use the same size of wood and cut the square in the same place as option 1. Proceed by drilling a hole where a bolt can be placed and attached by knots. Use steel tubing to make a smooth grip. This grip should be able to rotate as the pump is operated.



## 6. The outlet Spout

The outlet spout catches the water from the pipe and brings it to the surface for collection. There are several ways to make the outlet spout. Below, two options are presented.

Option 1:

### Materials you need:

- *soft wood planks*
- *nails*
- *wood glue*
- *rubber for insulation*

### Tools you need:

- *wood saw*
- *hammer*



Using pieces of plank, the outlet spout can be made as a “wood box” which is nailed to the stiffener and rests on the well edge. Use wood glue to carefully seal all cracks.



Once installed, enclose the top of the outlet spout with planks allowing only a little opening for the water to come out.

Option 2:

Materials you need:

- 1 metre of 40mm PVC pipe
- 0.5 metre of 110mm PVC pipe
- Solvent cement and rubber washers

Tools you need:

- hack saw



Construct a T junction out of the 110mm PVC pipe and the 40mm PVC pipe. Use rubber washers and solvent cement to hold the pieces together.



Attach the outlet spout to the pipe using planks of wood. Since the outlet spout pipe is bigger than the rising pipe, the water will exit out of the spout and not back down.

# Installing the Pump

## Step 1:

On the posts, attach blocks of wood (called bushings) with nails at the desired shaft height. Make sure that the shaft is completely level when placed on the bushings. Attach sheets of scrap metal to the bushings to decrease friction.



Proceed by placing the shaft, with the wheel and the handles attached, on the bushings. Finally, turn the wheel to make sure that it spins steadily. If this is not the case it may be necessary to adjust the wheel with wood stiffeners. Making sure that the wheel spins steadily is very important!

## Step 2:

Empty the well of water and make sure that the base of the well is level.



**Step 3:**

Attach the pipe to the guide using inner tube rubber with the fat end of the pipe at the bottom. Feed the rope (with washers attached) through the guide and pipe.



**Step 4:**

Place the guide at the bottom of the well making sure that the pipe is going straight up and is in line with the pulley wheel. **Carefully**, place stones on the plate attached to the guide so that the guide is fixed.

**Step 5:**

Install the outlet spout (see pictures page 16 and 17). Regardless of the 2 options chosen it is important to install it before the rope is fully attached. Make sure that the outlet spout allows the rope to go straight on the wheel!

**Step 6:**

Connect the rope ends with a knot which will not come undone. Wrap the ends with rubber and metal wire so that they do not catch on the guide when the pump is used. It is important to find the correct tension in the rope. If too tight it will be hard to use, if too loose then the rope will slide on the wheel and not work.

**Step 7:**

Test the pump to make sure it is working properly. If not, do the following checks:

- Is the wheel spinning steadily?
- Is the rope at a correct tension?
- Are there sufficient spokes on the wheel?
- Is the guide, pipe, outlet spout and wheel perfectly aligned?