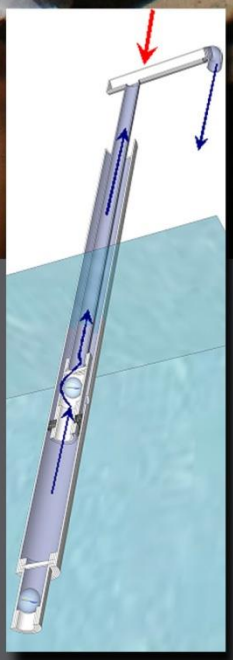
SMART Centres



EMAS pump

www.emas-international.de
www.smartcentregroup.com

The SMART Centre Group

1 Copy right and disclaimer

The EMAS pump has many details which can be best learned with practical training. Therefore it is highly recommended to use this manual in combination with practical hands on training that can be provided by a SMART Centre in Tanzania, Malawi, Zambia or other countries. Please feel free to contact them via: www.smartcentregroup.com

This manual is part of a range of manuals “Pump”. Manuals in this range are:

Pumps:

- Rope pump model 1 A-frame
- Rope pump model 2 Family model
- Rope pump model 3 Pole model
- Rope pump model 4 P-frame
- care taker training
- EMAS pump

Manual digging wells and drilling boreholes:

- Geology and Site Selection;
- Well digging
- SHIPO drilling
- Making of SHIPO drilling set
- Mzuzu drilling
- Making of Mzuzu drilling set
- Rota sludge drilling
- Making of Rota sludge drilling set

Business skills

- Training of Drilling companies.
- Business, financial and marketing planning

Version: 15 March 2017

Authors: Rik Haanen

Credits: The EMAS pump is designed by Wolfgang Buchner

2 Table of contents

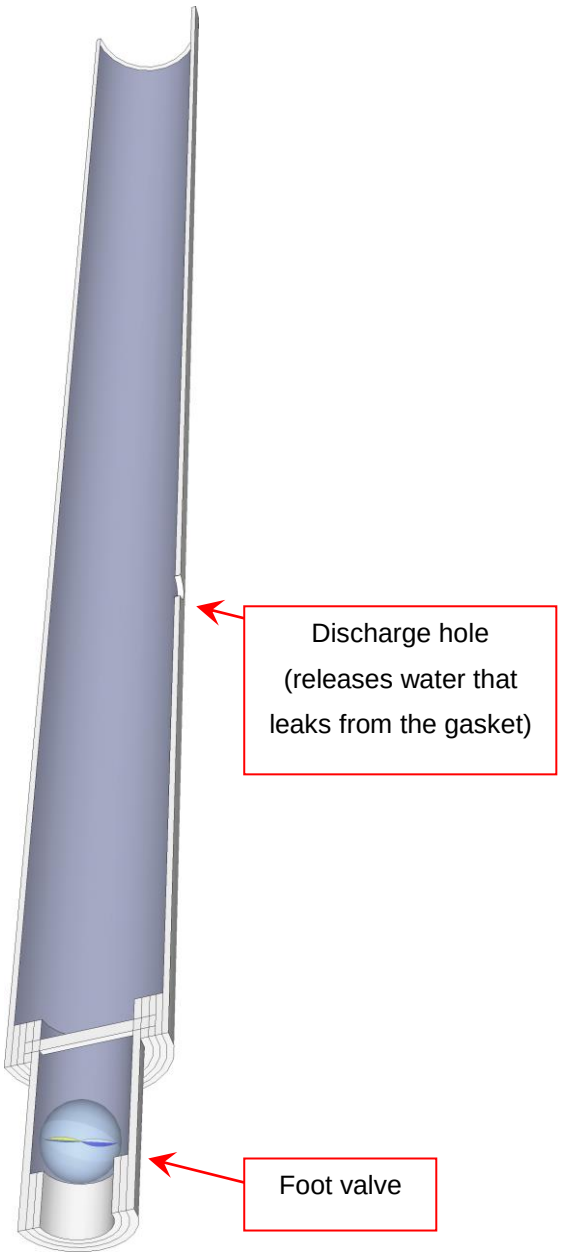
3 Parts of EMAS pump

The EMAS pump I can be made from different sizes of (PVC) pipes. Which sizes of pipes to choose will be discussed in paragraph “7 Sizes of pipes and characteristics” page 7

3.1 Piston and Cylinder pipe

Piston pipe

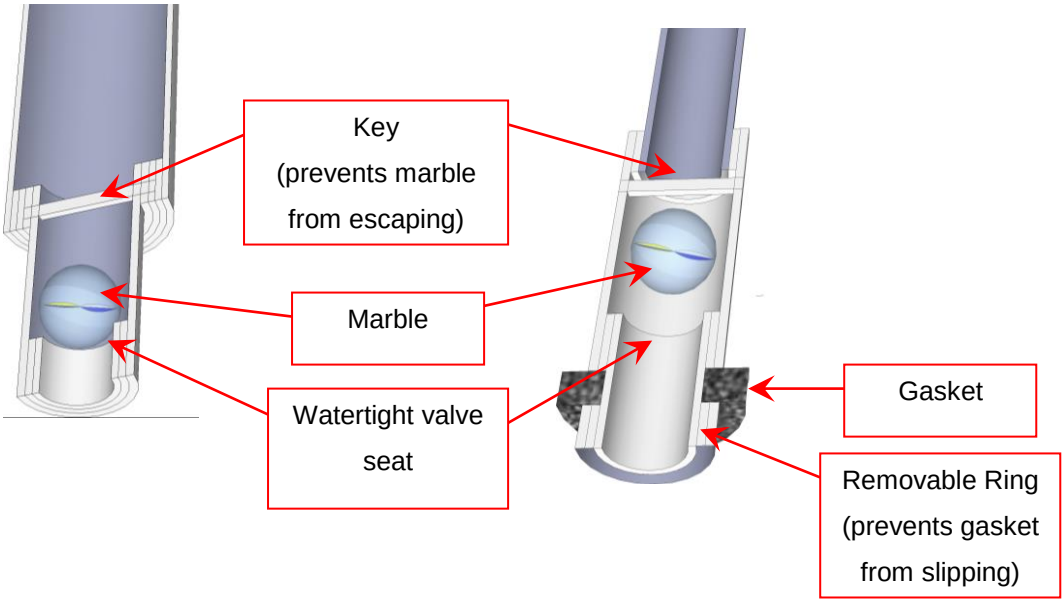
Cylinder pipe



3.2 Valves

The only difference between Foot and Piston valve is that the Piston valve has a rubber Gasket attached to it.

Foot valve **Piston valve**



4 How to make a EMAS pump

Please study the instruction video at

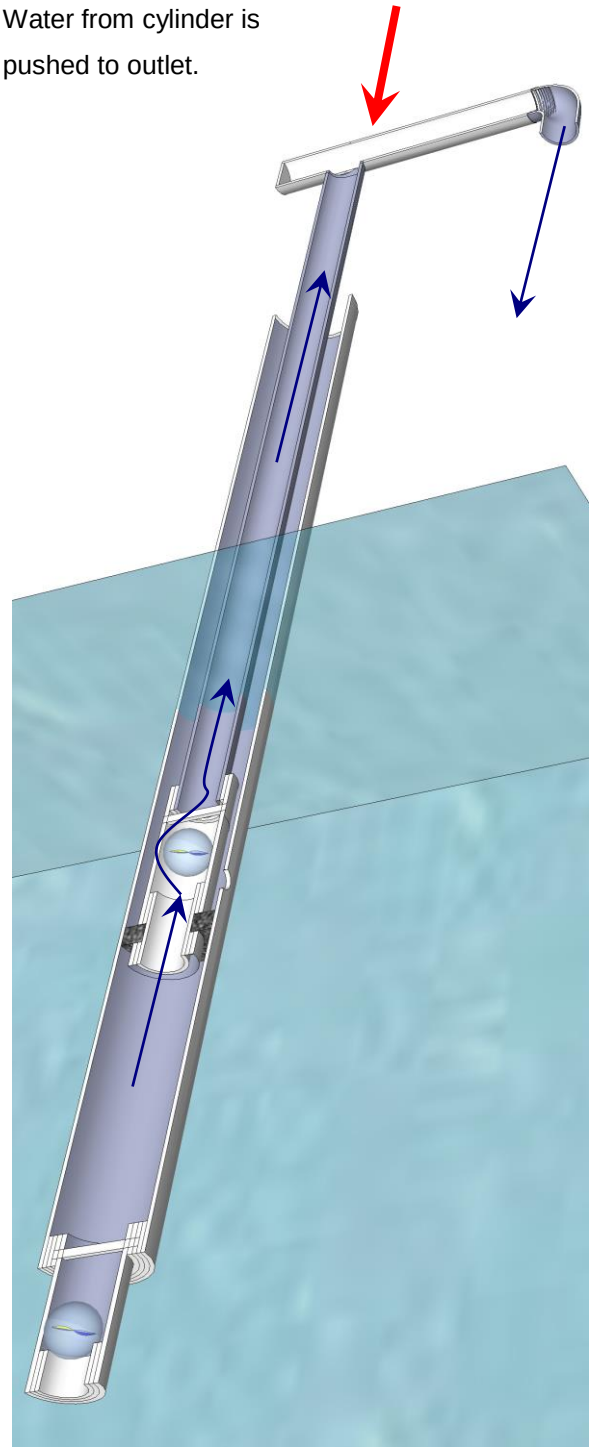
http://www.emas-international.de/index.php?id=83

or https://vimeo.com/8365884

5 Working of EMAS pump

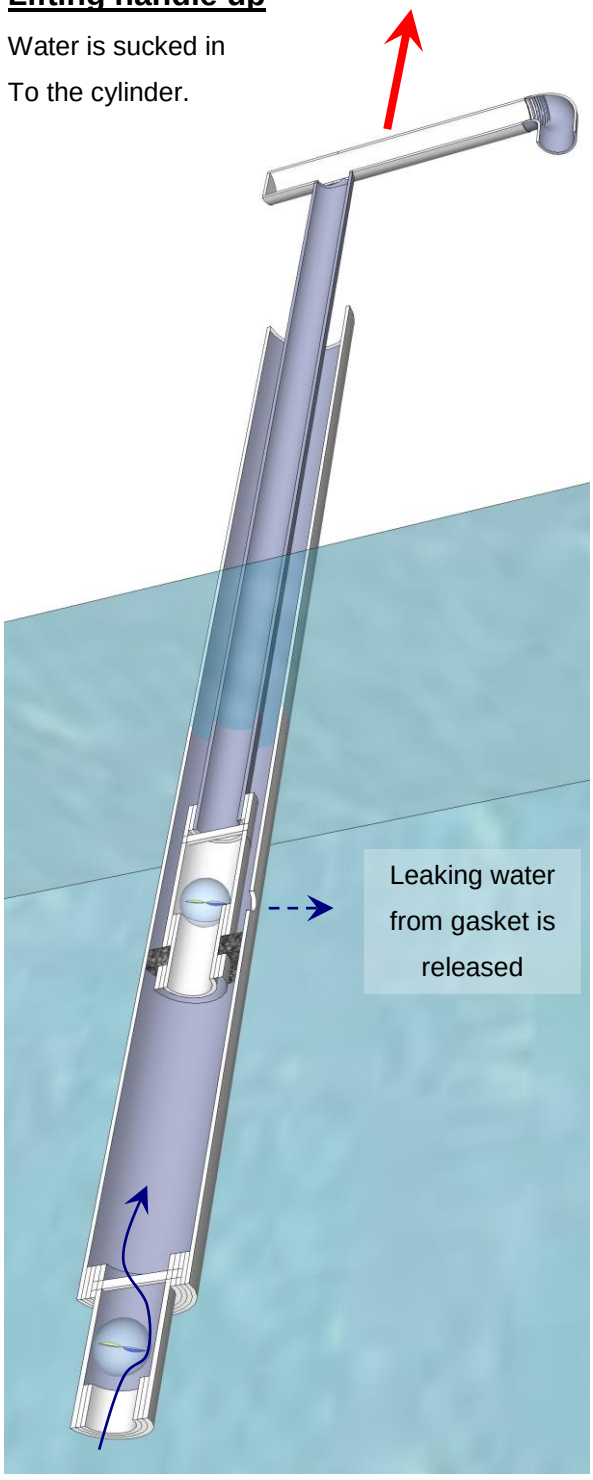
Pushing handle down

Water from cylinder is pushed to outlet.



Lifting handle up

Water is sucked in To the cylinder.

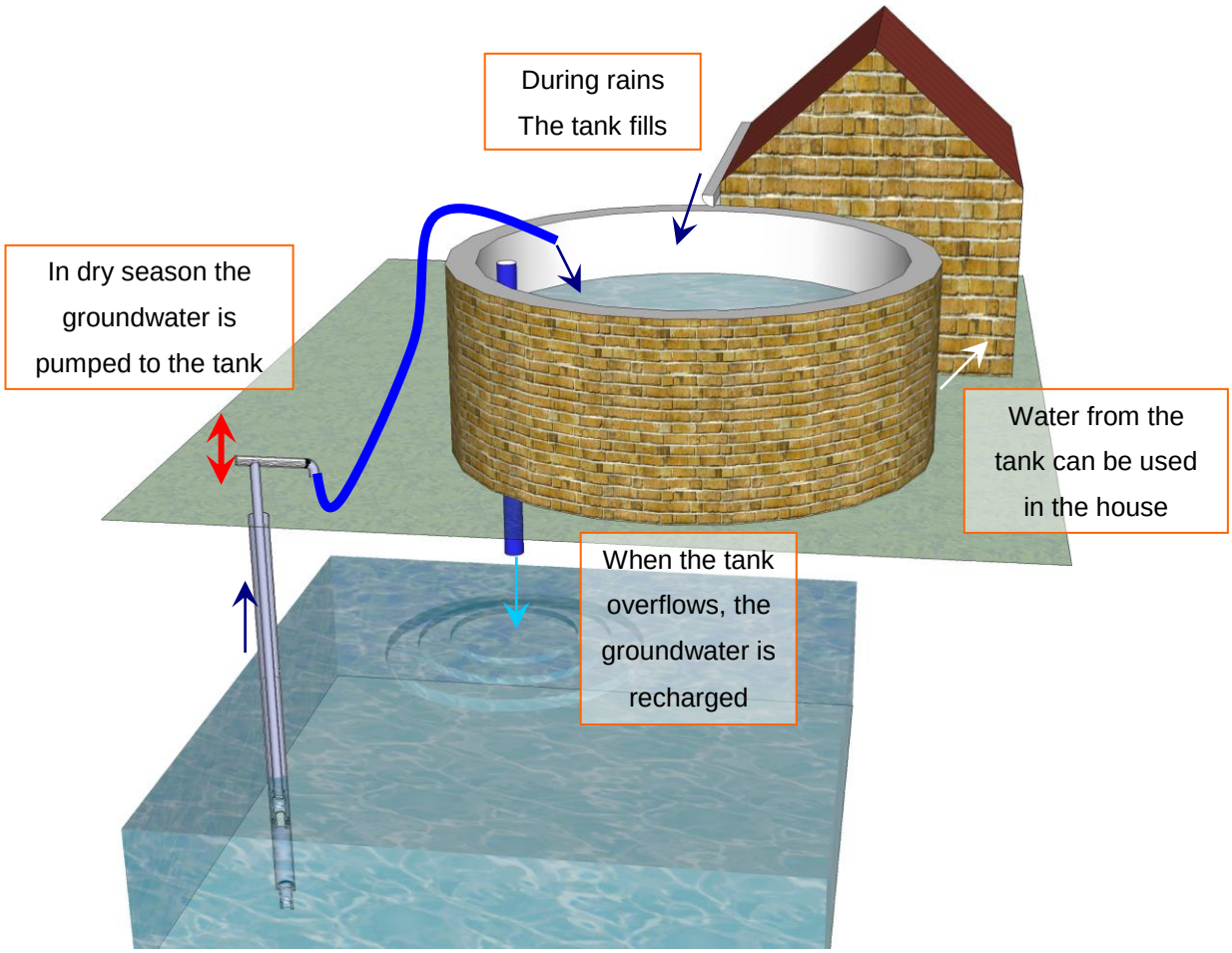


6 EMAS pump and overhead tank

In Bolivia, the cost of a 12 meter length standard pump is of approximately 20 Euros.
In contradiction with the rope pump, the EMAS pump can push water through a flexible hose for example to an overhead tank.

In the example drawing below:

- the tank is filled when it rains
- when the tank overflows then the groundwater is recharged through the blue pipe (pipe stops at first permeable layer, so water is filtered before reaching the ground water table)
- in the dry season, the tank can be filled again from the groundwater with the EMAS pump and a flexible hose
- the tank can be connected to pipe in the house



7 Sizes of pipes and characteristics

All EMAS pumps have an outlet pressure that allows pumping up to 60 meters height, or 2 Km horizontally. High pressure EMAS pumps can elevate water up to 100 meters. The flow varies between 0.2 and 1 litre per pumping stroke, according to the pattern. The measure of the EMAS pump most commonly used is between 6 and 12 meters, but there are wells that need as much as 40 meter pumps.

7.1 Length of pipes

The Piston (or pumping) pipe and Cylinder pipe should be a few meters longer the depth of the water table on its deepest level during intensive pumping in the dry season. So that the foot valve will always be under water.

7.2 Diameters of pipes

Diameters of pipes depend on what is available in your area. When the trainer assigns you (or your team) to make your own valve, he or she will provide you with different types and sizes of pipes and marbles. You will notice that each group or individual will make its own design of valve. This paragraph explains effects of different sizes of different pipes.

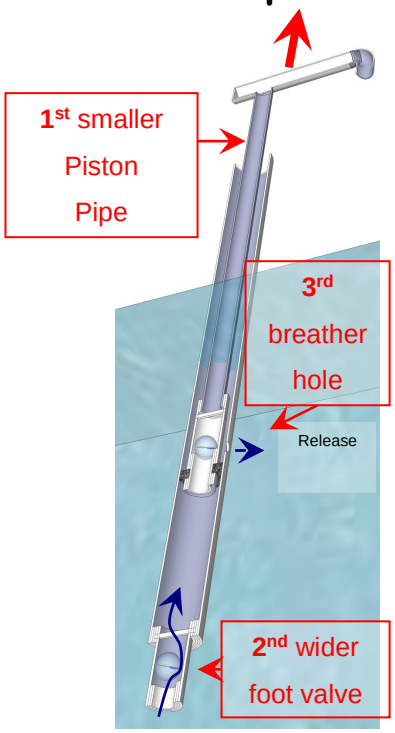
7.3 Yield or pumping volume

Primary: The bigger the cylinder pipes the more water volume / yield per pumping stroke (but makes pumping more heavy).

Secondary: Increased leakage between Gasket and Cylinder pipe decreases the pumping volume.

Finally: Slow closing valves (too big distance between valve seat and Key) will reduce the volume.

7.4 Required lifting (pulling) power



The Lifting motion is the most difficult action for human beings. For each type of pump, the weight of the water needs to be lifted. So the deeper the water level and the higher you want to pump the water, the heavier it will be.

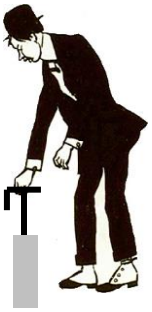
Primary: But also the wider the piston (or pumping) pipe, the more water must be lifted and the heavier it will be.

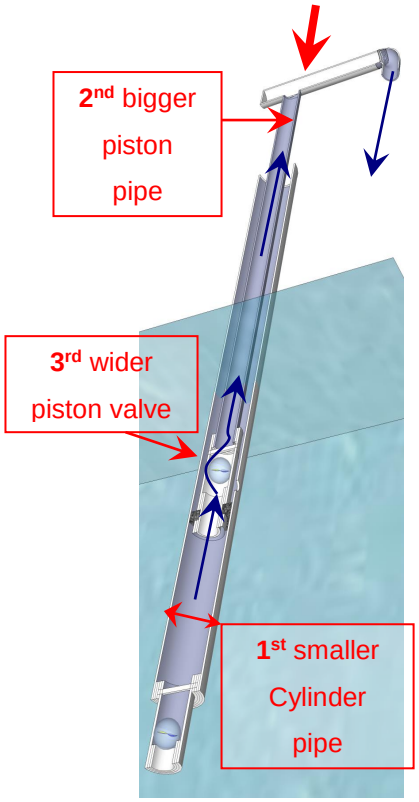
Therefore it is good to keep the diameter of the pumping pipe of as small as possible (example 19mm or ½"). Although it makes pushing the handle down a little bit heavier because the hydraulic friction will increase in the piston (or pumping) pipe. But pushing is easier than lifting (or pulling).

Secondary: Friction in the foot valve makes lifting more difficult. So a foot valve with lots of space for water to pass makes lifting easier. But when it is too big, it will close slowly and that will result in less pumping volume. If the Cylinder is bigger, more water has to pass the foot valve. So a bigger cylinder will increase friction and make pulling a bit heavier.

Finally: When the Discharge hole is too small or missing, then water that leaks water between Piston and Cylinder pipe above the Gasket will be lifted unnecessarily each time. Always make one or two Discharge holes in the Cylinder pipe above the maximum Gasket position.

7.5 Required pushing power





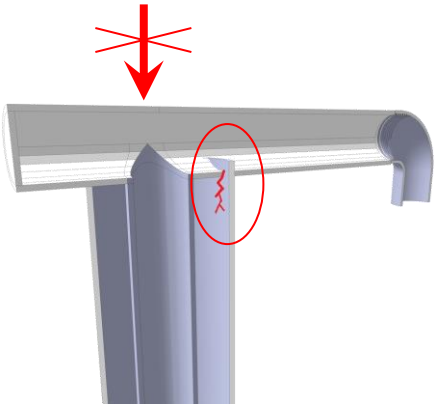
The Pushing motion is easier for human beings then Lifting.

The required pushing power depends mainly on friction in piston valve and the piston or pumping pipe. This friction is mainly caused by the speed in which the water is squired through the piston valve and piston pipe.

Primary: The more volume you are pumping in one stroke, the heavier pushing will be. So a bigger Cylinder pipe will require more force when pushing the handle down.

Secondary: A smaller piston or pumping pipe increases the speed of the water and therefore the friction and it will require a bit more pushing power. But remember that a smaller piston pipe will also require less lifting power (which is more difficult). So only choose a bigger piston pipe when water levels are shallow.

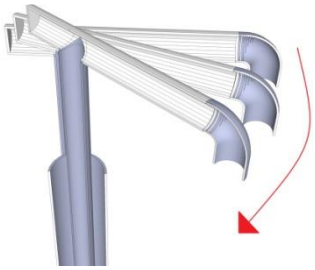
Finally: Friction in the piston valve will make pushing the handle down a bit more difficult. So a piston valve with lots of space for water to pass makes it easier. But when it is too big, it will close slowly and that will result in less pumping volume. The size of your piston valve is limited by the Cylinder pipe.



8 Use and maintenance

8.1 Best use

When pumping, do not hit the top of the Cylinder pipe with the handle (metallic T). The plastic cylinder pipe may suffer damage, or it may slide from the layer that fastens the cylinder pipe and entire the cylinder pipe may fall into the well.

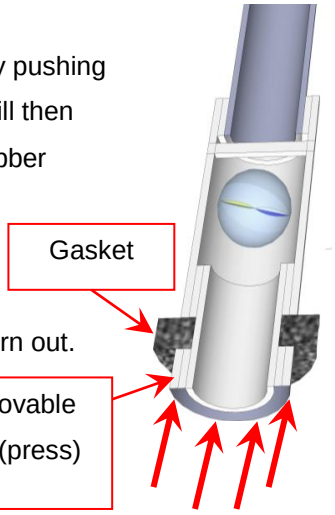


It is advisable not to pump always in the same position of the holder; by varying it, the abrasion of the outlet valve is distributed throughout its surface, thus increasing the valve life span.

Many people wish to protect their pump from undue use. If you wish to put a padlock for the pump, weld a ring to the guide metallic pipe, and another ring to the T holder.

8.2 Maintenance

When the pressure of the valve decreases, it is because the gasket is worn out. By pushing the removable ring a little bit up, you will put more pressure on the gasket which will then expand a bit. You can do this it several times. If that does not work, change the rubber gasket (cutting a small piece from a tire).



The outlet valve has a life span of about 500.000 liters. Then it has to be changed with a new one.

The EMAS pump allows changing 3 - 4 valves. Then, also the plastic pipes are worn out.

When using a pump made of PVC pipes, first the couplings in the pumping pipe are worn out until the bell is pierced. The problem is solved cutting the defective bell and coupling it anew.

If the pump cylinder has fallen, ask for help from the driller. With a screw thread at the sharp end, you may recover the pump. Do not use sticks or other things.

In case the foot valve is defective, the pump may continue to operate provisionally, pumping skilfully, quickly accelerating the pipe upwards and suddenly stopping (reverse hydraulic ram).

If the piston valve fails, pumping can also take place in an emergency, removing the entire outlet pipe and using the cylinder as a reverse hydraulic ram.

When removing and introducing lengthy pumps from/to deep wells, the risk exists to break the pipes. In order to avoid damages, arch the pump, bending it.

If you use strips of a rubber inner tire to fix the pump to the apron/well then it is important for the rubber between the well and the pump to be always in good conditions; otherwise the risk exists for the cylinder to unfasten, and be the cause of trouble. For the rubber not to break up, burnt by the sun, it is advisable to envelop with a cloth, and tie it with thread or wire.