41. VLOM pumps

What is a VLOM pump?

A **VLOM** pump is one which can be operated and sustained using **V**illage **L**evel **O**peration and **M**aintenance.

The term **VLOMM** is also used, meaning **V**illage **L**evel **O**peration and **M**anagement of **M**aintenance.

This addition emphasizes the role of users as the *managers of maintenance* – they may choose to use someone from *outside* the village to assist with more complicated repairs. Not all maintenance and repair needs to be done by the villagers for a pump to be classed as a VLOM pump.

Why are VLOM pumps needed?

Many handpump projects have failed because of:

- the absence of a sustainable system of handpump maintenance and repair;
- the installation of pumps which were not suitable for the heavy usage they received;
- the use of pump components which were damaged by corrosive groundwater; and
- a lack of community involvement in important aspects of the project planning.

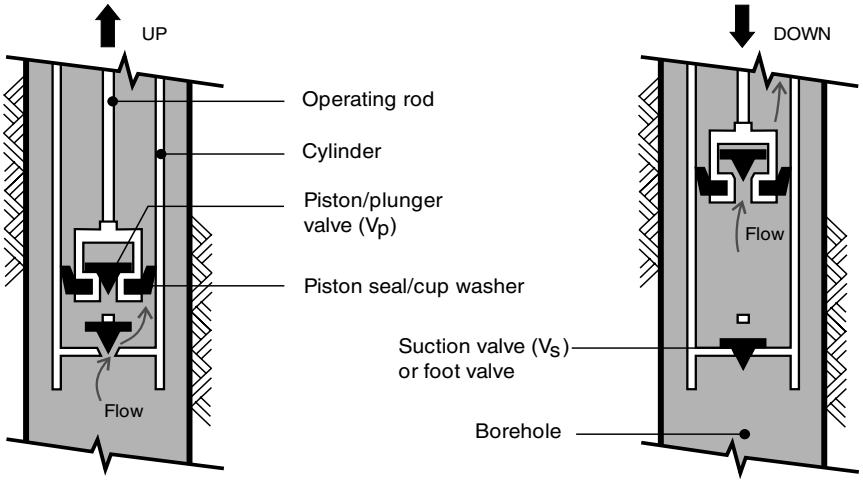
Source: *Rural Water Supplies and Sanitation* by Peter Morgan

The careful choice of a VLOM handpump can help solve the first three of these problems, but unless the community is involved from the beginning in the planning of the pump project and the management of the maintenance, it is unlikely that the handpump will be sustainable.

HOW MOST HANDPUMP CYLINDERS WORK

When the rod pulls the piston **up**:

- V_p closes because of weight of water above piston;
- Water above the piston is lifted up with the piston;
- V_s opens because of reduced pressure below the moving piston;
- Water is pumped.



When the rod pushes the piston **down**:

- V_s closes;
- The pressure of water below the piston opens V_p;
- Water passes through the piston;
- No water is pumped (unless the diameter of the rod is large, as in the case of many direct action pumps).

In most handpump cylinders a piston is alternately raised and lowered by a rod (or a string of rods joined together) which is connected to a handle, or sometimes to a flywheel and crank. These pumps are called **reciprocating handpumps.** The figure above illustrates how most cylinders work.

VLOM pumps

There are three types of reciprocating handpump.

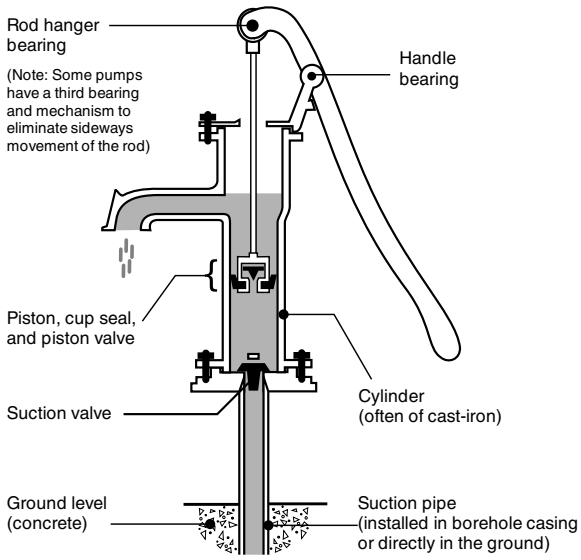
Type of pump	*Maximum pumping lift (m)*	*Cylinder above or below groundwater*
Suction	7 - 8.5	Above
Direct action	15 - 25	Below
Deep-well	45 - 80+	Below

One of the basic aims of a VLOM handpump is to make all the main wearing parts easy to reach and replace, and to reduce the wear and tear on the pump by good design. The main wearing parts of a reciprocating handpump are:

- The piston seal, which rubs against the inside face of the cylinder.
- The piston valve and suction valve (or foot valve), which are constantly opening and closing.
- The bearings in the pump-head, which are subjected to constantly changing loads.

Suction pumps

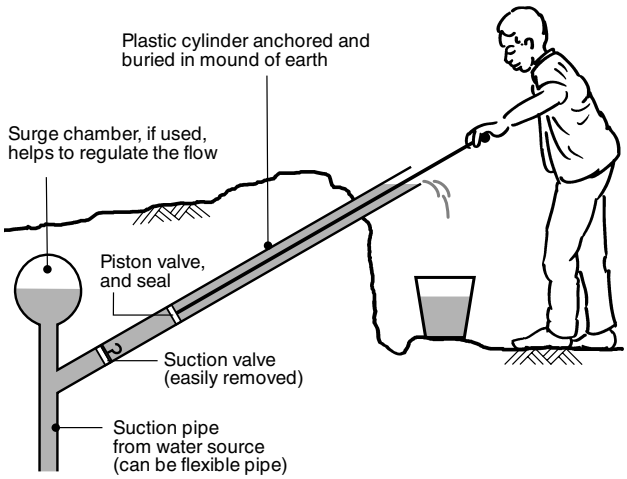
Traditional design



VLOM designs similar to traditional pumps are available, but often with these improvements:

- better suction valves to eliminate priming;
- smoother cylinder walls to reduce wear on piston seals;
- wear-resistant seal instead of leather (e.g. nitrile rubber); and
- better bearings to prevent the pivot pins wearing out the cast-iron (e.g. using hardened bushes around the pivot pins).

Rower design



The rower pump has other VLOM features.

- It allows very easy access to the piston and suction valve.
- It is relatively cheap and easy to manufacture.
- On some versions, the valves can be replaced using discs cut from car inner tubes.

Important: If this pump is to be used to draw drinking-water, care must be taken to avoid contaminating the cylinder, for example by using poor-quality priming water.

The cylinder of a suction pump is usually above ground level.

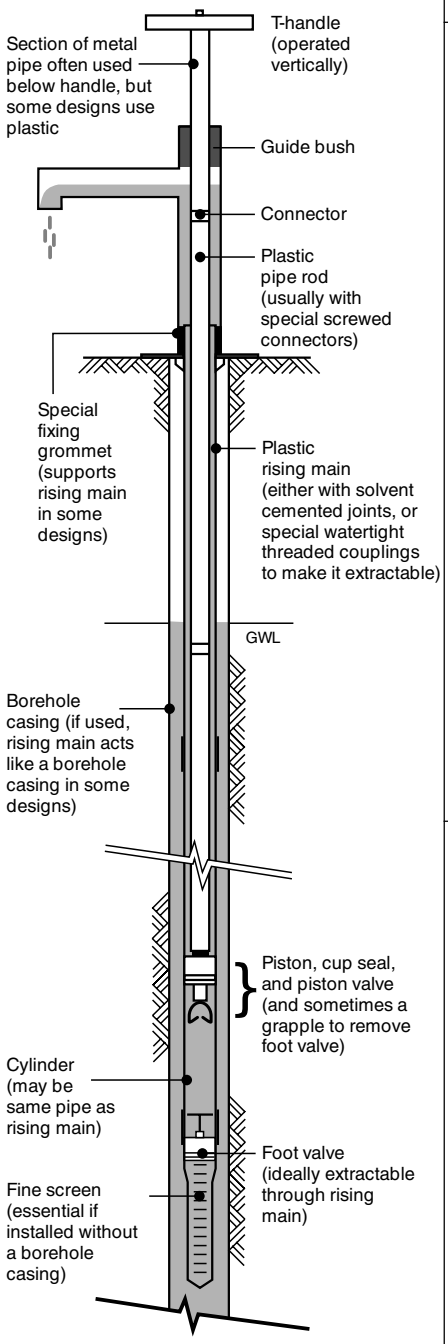
Main advantages

- Easy access to wearing parts because they are usually all above the ground.
- Fast delivery of water because of the large piston diameter (traditional designs), or long piston stroke (rower design).

Main disadvantages

- Only suitable for pumping lifts of up to about 7m.
- May need to be 'primed' by adding water to the cylinder if the suction valve leaks overnight.
- Villagers will often use polluted water to prime the pump, thereby contaminating it.
- Pump designs are often not suitable for use by more than about 50 people per day unless frequent repairs and replacements are carried out.

Direct action pumps

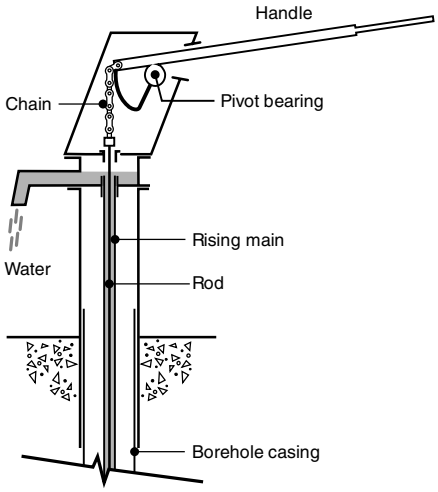


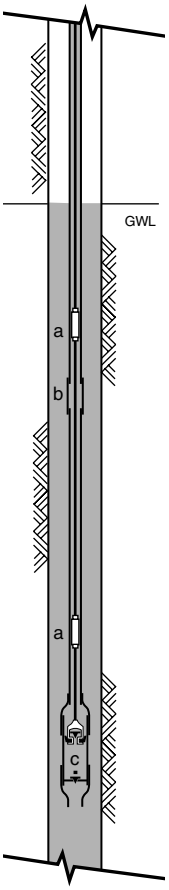
In most direct action handpump designs, the piston is raised and lowered by a 'T' bar handle, which is directly connected to an air-filled plastic pipe 'rod'. This rod floats in the water in the rising main, reducing the force needed on the upstroke. On the down-stroke, as more of the pipe rod enters the water in the rising main, it displaces an equal volume of water, so the pump delivers water on both the up-stroke and the down-stroke.

Deep-well pumps

Traditional design

Pump-head: Most pump-head lever handles work on a similar principle to the handle shown for the traditional suction pump. Some pumps use just one pivot and a chain (or belt) and quadrant system, such as in the India Mk II, shown below.

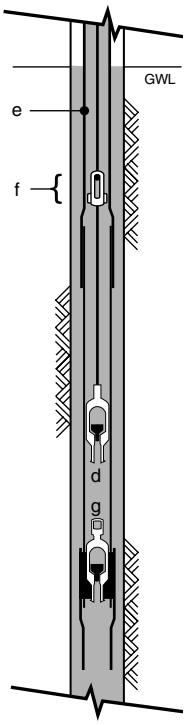




Rising main and cylinder: Traditionally, the rising main is of galvanized steel pipe with a smaller diameter than the piston. The string of pipes and operating rods have to be lifted so that the rod joints (a) and pipe joints (b) can be unscrewed section by section to reach the cylinder (c). This operation needs strong people with appropriate lifting and clamping tools, or a mechanized lifting system. Some manufacturers now supply, therefore, lightweight, thin-walled stainless-steel pipes joined with 'rope threads', or plastic pipes with special threaded collars to reduce the weight which needs to be lifted. Rubber 'O' rings can be used to make such joints watertight.

GWL: Groundwater level

Open-top cylinder design



Cylinder: Recent deep-well pump designs have 'open top cylinders' (OTC). These allow the piston (d) to be pulled up through the rising main (e) which is of the same or, preferably, a slightly larger, diameter than that of the cylinder. With these pumps, the piston can be pulled to the surface by pulling out the string of rods.

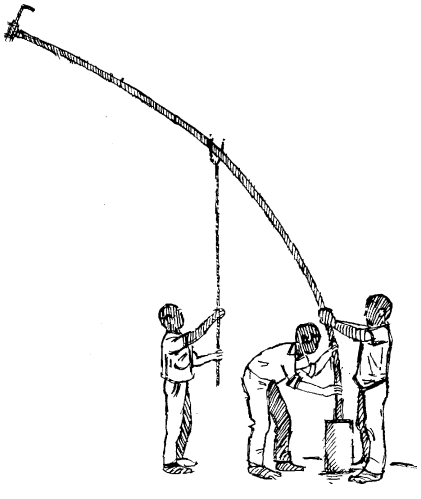
Rods: Most rod strings are joined by threaded couplings, but some pumps use special rod joints (f) which can be easily disassembled without tools.

GWL: Groundwater level

Foot valve: The best designs of OTC allow the foot valve (g) to be removed through the rising main, either with the piston, or by using a fishing tool which is lowered down inside the rising main on a piece of rope after the piston has been removed.

Rising main removal: In OTC pumps with extractable foot valves, the rising main should never need removing unless the pipe or the lining to the cylinder becomes damaged. Mains with screwed couplings are easily removed.

Should the removal of a solvent-cemented plastic rising main be necessary, the whole length can be removed by supporting it with tall poles so that it can bend to a large radius curve as it leaves the borehole.



VLOM pumps

Direct action pumps	Deep-well pumps	
	Traditional design	**Open-top cylinder design**
Main advantages • Easy access to piston (and sometimes the foot valve), which can be pulled through the rising main. • Relatively cheap, and easy to manufacture. **Main disadvantages** • Lack of lever handle makes it difficult to operate at pumping lifts much above 12m. • Pump design is often not rugged enough for use by more than about 50 people per day unless it is frequently repaired.	**Main advantages** • Pump is suitable for a wide range of pumping lifts. • Design can be strong enough to cope with intensive use. **Main disadvantages** • It is difficult to get access to the piston and foot valve.	**Main advantages** • Easy access to piston, and often to the foot valve. • Use of solvent-cemented plastic rising main is feasible. • Same advantages as for traditional design. **Main disadvantages** • Large diameter rising main (to allow piston extraction) can be expensive.

Other good features to look for in VLOM pumps:

Corrosion resistance by using:
- stainless steel rods (with deep-well pumps);
- plastic pipe 'rods' (with direct action pumps);
- brass, plastic, and/or rubber for valves and pistons; and
- plastic or stainless steel for the rising main.

Reduction of both production costs and number of different spare parts required by using:
- identical designs for the piston valve and foot valve;
- identical body for piston and foot-valve housing; and
- identical bearings for the rod hanger and handle (can be moulded from engineering plastics).

Few tools necessary for normal maintenance work.

Easily replaceable bearings.

Facility to use 'T' bar end to lever handles to reduce sideways forces on bearings. Handle ideally of adjustable length to suit leverage required.

Theft-resistant parts and 'captive nuts' where possible, so that they cannot be dropped or lost.

Important notes about sustainable maintenance:

Affordability and availability of spares

It is vital that there is a reliable distribution system of essential, affordable spares. Standardizing on one particular pump in a region, or country, can make this, and local technical support for repairs, more feasible.

In-country manufacture

Standardization on one pump in any country can also make the in-country production of a handpump, or at least the spares it commonly requires, a more attractive proposition because of the resulting high level of demand.

Quality control

To give good performance, handpumps and spares need to be produced by manufacturers who carry out stringent quality-control checks.

Vergnet diaphragm pump

This is a deep-well pump which works without rods; instead it uses hydraulic pressure from a small cylinder just under the baseplate of the pump to cause the alternate expansion and contraction of a cylindrical diaphragm in a larger cylinder at the bottom of the borehole. Models for operation by foot or by hand (lever or 'direct action') are available. The reinforced rubber diaphragm can only usually be manufactured in countries with a high level of industrial development.

Special VLOM features:

- Main wearing parts (in the upper cylinder) are easily accessible.
- When necessary, the main cylinder can reached by pulling it up using the two flexible plastic pipes attached.

Further reading

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