Sarvodaya Rural Technical Services

MANUAL FOR THE INSTALLATION AND MAINTENANCE OF THE SARVODAYA HANDPUMP SL 5

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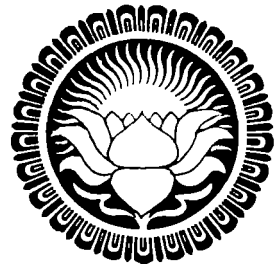

By M.C. Brunner / U. Steiner
HELVETAS - TEAM
Moratuwa, Sri Lanka,
March 1986

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PREFACE

The Context

Sarvodaya is a nationwide voluntary movement in Sri Lanka, which in its attempt to build a new person, a new village and a new society, is concerned with assisting the people in satisfying **ten basic human needs:** environment, water, clothing, food, housing, health, communication, fuel, education and spiritual.

The Sarvodaya Rural Technical Service (SRTS) has been assisting villages in the construction of rural infrastructure for several years, with special emphasis on simple and safe drinking water supplies. The construction of piped gravity water systems is promoted in areas where an adequate amount of spring water with sufficient hydraulic head can be tapped Communities of the coastal and plateau areas are supported by SRTS in the construction of **hand dug wells.** Several hundred common wells have been constructed with SRTS assistance during the past few years all over Sri Lanka. SRTS has published a manual for the construction of hand dug drinking water wells, which is available on request.

About This Manual

This manual provides the necessary information to install and maintain the Sarvodaya SL 5 handpump in hand dug wells or drilled tube wells. It is to be used by SRTS technicians, installation crews,and village caretakers. It may also serve as a tool for training and education, and is available to any agency outside Sarvodaya interested in the SL 5 pump

Related manuals published by SRTS are:

- **— Manual for the Construction of Hand Dug Drinking Water Wells in Sarvodaya Villages in Sri Lanka**
- **— Manufacturing Instructions for SL 5 Handpumps**

Why Handpumps?

Wells, be they hand dug or drilled, always tap water sources lying below the earth's surface. Because ground water does not normally flow out of a well by its own energy, one needs some kind of water lifting equipment to get the water out of the well The most common lifting equipment for an open, hand dug well is a rope with a bucket while in the case of a drilled tube well, some kind of mechanical pumping installation is required.

An open hand dug well allows easy access to the ground water, but it also allows easy contamination. The wind may blow in dust, leaves and dirt. Animals may pollute the water. Buckets and ropes used may be infected by hand and ground contact. The risks of water contamination and subsequent spreading of water related diseases increase tremendously with increasing number of users unless adequate measures are taken to protect the ground water.

The minimal hygienical requirements promoted by SRTS for a common well used by several families are:

- — That a well be lined and that a drainage apron be constructed
- — That a permanently fixed single rope and bucket be installed such that ground contact of either rope or bucket is prevented.

Clearly the safest solution is to completely seal the well with a concrete cover and use a pump to extract water from the well. Given the high capital outlay, maintenance cost, and problems of supplying spare-parts for a motor pump, the installation of handpumps is often the most cost-effective and hygienically safe option for rural water supplies.

In short, the main advantages of a handpump are, that:

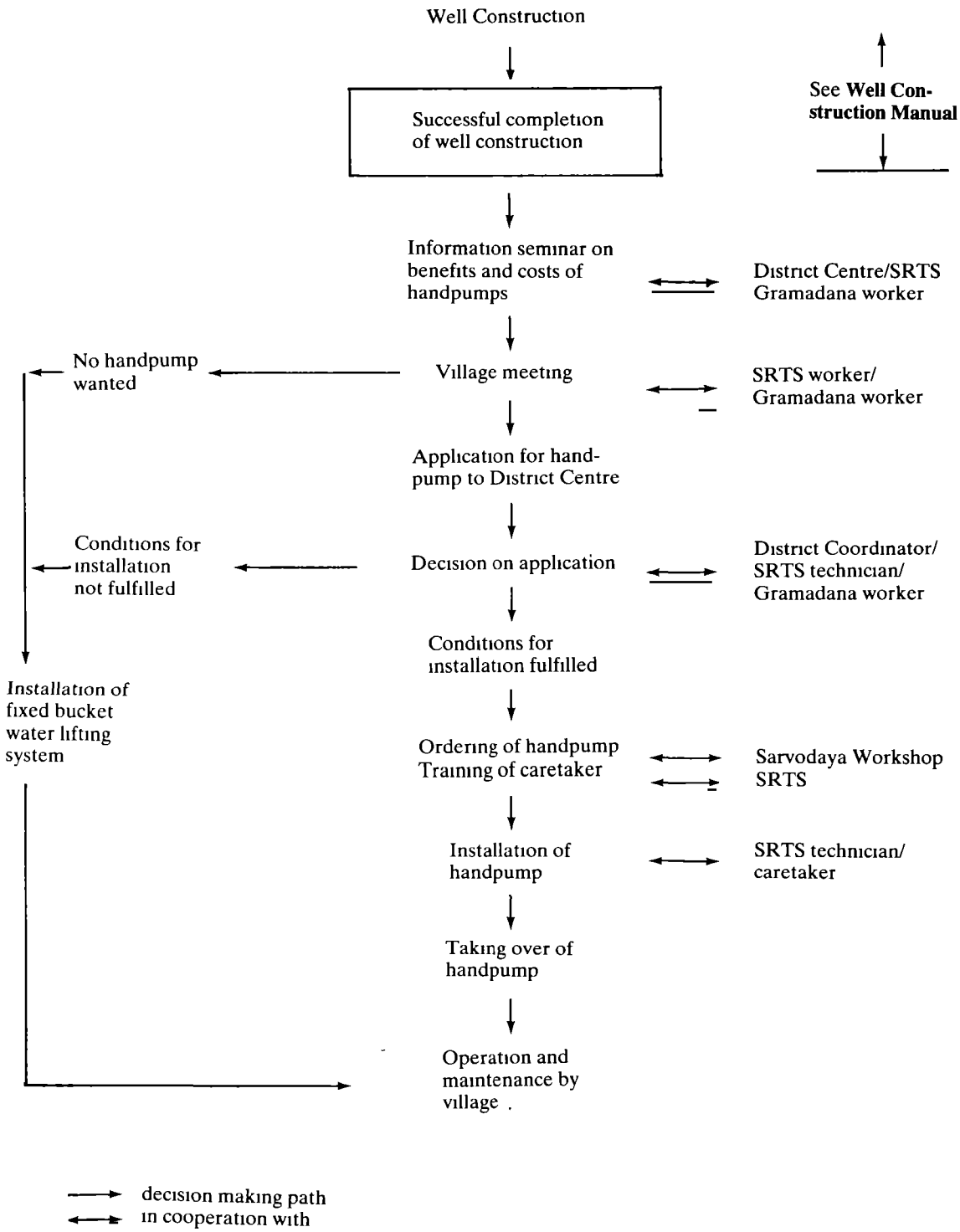
- — The extraction of ground water is easy and hygienically safe.
- — There is maximum protection of drinking water from pollution. Note· the hygienical benefits of sealing a well normally far out-weigh the benefit of direct sunlight (ultraviolet radiation) reaching the water in an open well.

— The running cost is minimal.
— There are minimal maintenance requirements, and local level maintenance is possible with minimal equipment, if the pump is appropriately designed.

In order to reap the full benefits of a handpump, it must, of course, be:
— always kept in proper working order, and
— always properly used.

This will require a considerable awareness on the part of the users with regard to the problems related to organizing and financing the pump's maintenance.

Decision-Making Flow Chart for the Installation of Handpumps in a Sarvodaya Village



Duties and Responsibilities of the Parties Involved in the Installation and Maintenance of Handpumps in Sarvodaya Villages

Sarvodaya District Centre / Divisional Centre

— To motivate and educate
— To organize information seminars explaining the benefits and costs of handpump installations
— To select villages based on written applications

Sarvodaya Rural Technical Service

— To supply and install handpumps
— To train caretakers
— To provide toolkits
— To stock and supply special spare-parts like rubber seals, ball bearings etc
(Delivery will be made against payment)

Village

— To establish a Sarvodaya Shramadana Society (already a condition for the well construction)
— To participate in an information seminar
— To make an informed decision about the installation of a handpump, and apply in writing to the District Centre
— To select a caretaker
— To set up a maintenance fund, fix user contributions, and set the caretaker's allowance, if any
— To take over full responsibility for operation and maintenance of the well and the handpump.
For a village caretaker's duty sheet, see Chapter IV of this manual "Pump Maintenance"

I. TECHNICAL DESCRIPTION OF THE SL 5 HANDPUMP

1. Features

The SL 5 has been developed to meet the high need for clean drinking water in Sri Lanka with a locally produced lift pump.

The design concept of the SL 5 is based on the requirements that:

- The pump be resistant to rough handling.
- Contamination of the well be prevented.
- All below ground parts be made of corrosion free materials, and therefore resistant to the aggressive water in Sri Lanka.
- The pump lift water from an intermediate depth of 20 m.
- The parts subject to wear and tear be longlasting and easy to replace.
- Maintenance be minimal, simple and feasible with minimal manpower, skill and equipment
- All materials be produced or be easily available in Sri Lanka.
- Manufacturing be possible in simply equipped workshops

In keeping with these requirements, the pump stand of the SL 5 handpump is made of robust galvanized steel and all parts coming in contact with water are of PVC, polyethylene, rubber or brass. The piston, machined from PVC and brass, is equipped with NEOPREN (synth. rubber) piston cups which not only have a substantially longer life time than leather cups, but also raise the overall mechanical efficiency of the pump to 86% (at a waterhead of 6.5 m) and the volumetric efficiency to 99%
For regular maintenance of the piston and the foot valve only two spanners are required. Both the piston and the foot valve can be extracted through the pump head within 1 — 2 minutes without removing the rising pipe. All normal maintenance work can be done by a single person without the use of heavy equipment. The 3" rising pipe can be removed by hand, since it will be empty of water once the foot valve is removed. The flexible polyethylene (PE) pipe used in tube wells can be removed in one piece, while the more rigid PVC pipe used in hand dug wells needs to be cut into pieces of 6 — 8 m for removal.

Every workshop equipped with a turning lathe, a drilling machine, and a welding transformer can manufacture the SL 5. However, the electroplating and hot dip galvanizing will have to be done by specialized workshops or companies.

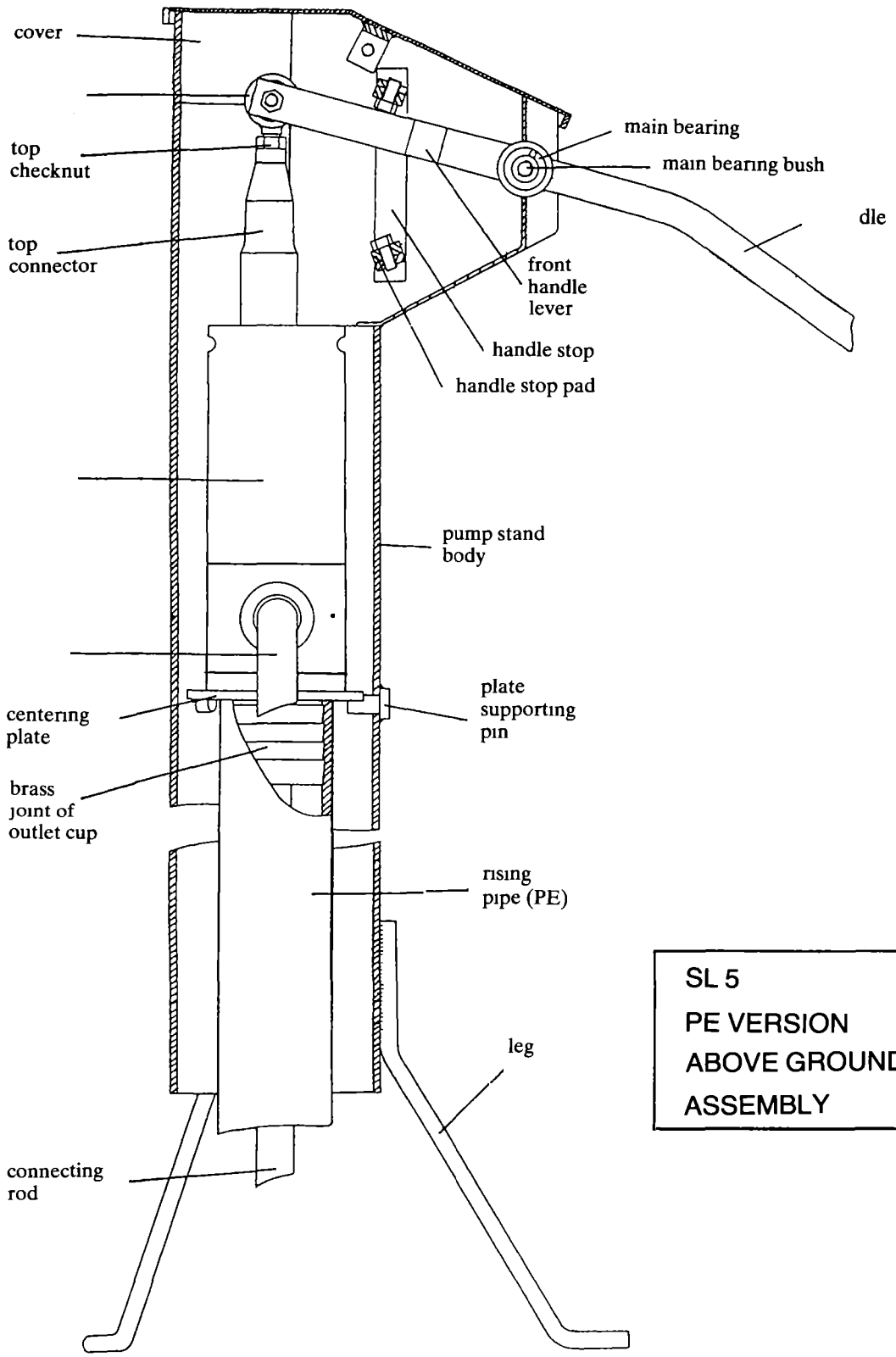
All of these attributes make the SL 5 a suitable handpump both for tube wells and hand dug shallow wells with water tables less than 20m below ground The fact that all maintenance can be done by one village caretaker with minimal equipment makes the SL 5 a true VLOM (Village Level Operation and Maintenance) pump.

As mentioned above, there are two models of the SL 5 handpump, which have the following distinctions:

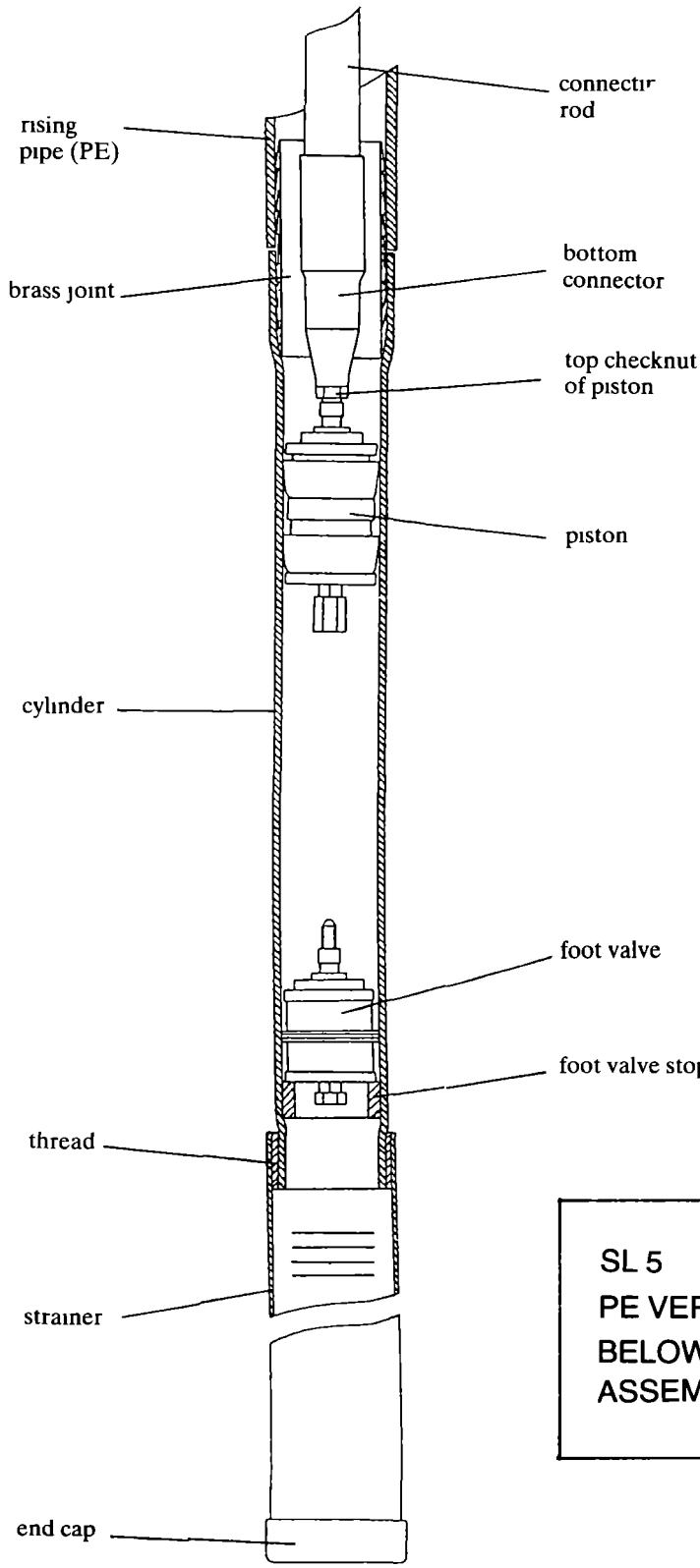
- The so-called **PVC Version** has a PVC rising pipe, a short pump stand, and is for installation in shallow wells with a raised well cover. Note that the long stand may also be used if the well cover is at ground level. The PVC rising pipe rests on the bottom of the well.
- The so-called **PE Version** has a PE rising pipe, a long pump stand, and is designed to be placed in tube wells. The PE rising pipe hangs freely from the pump stand in the bore hole.

2. Sectional Details

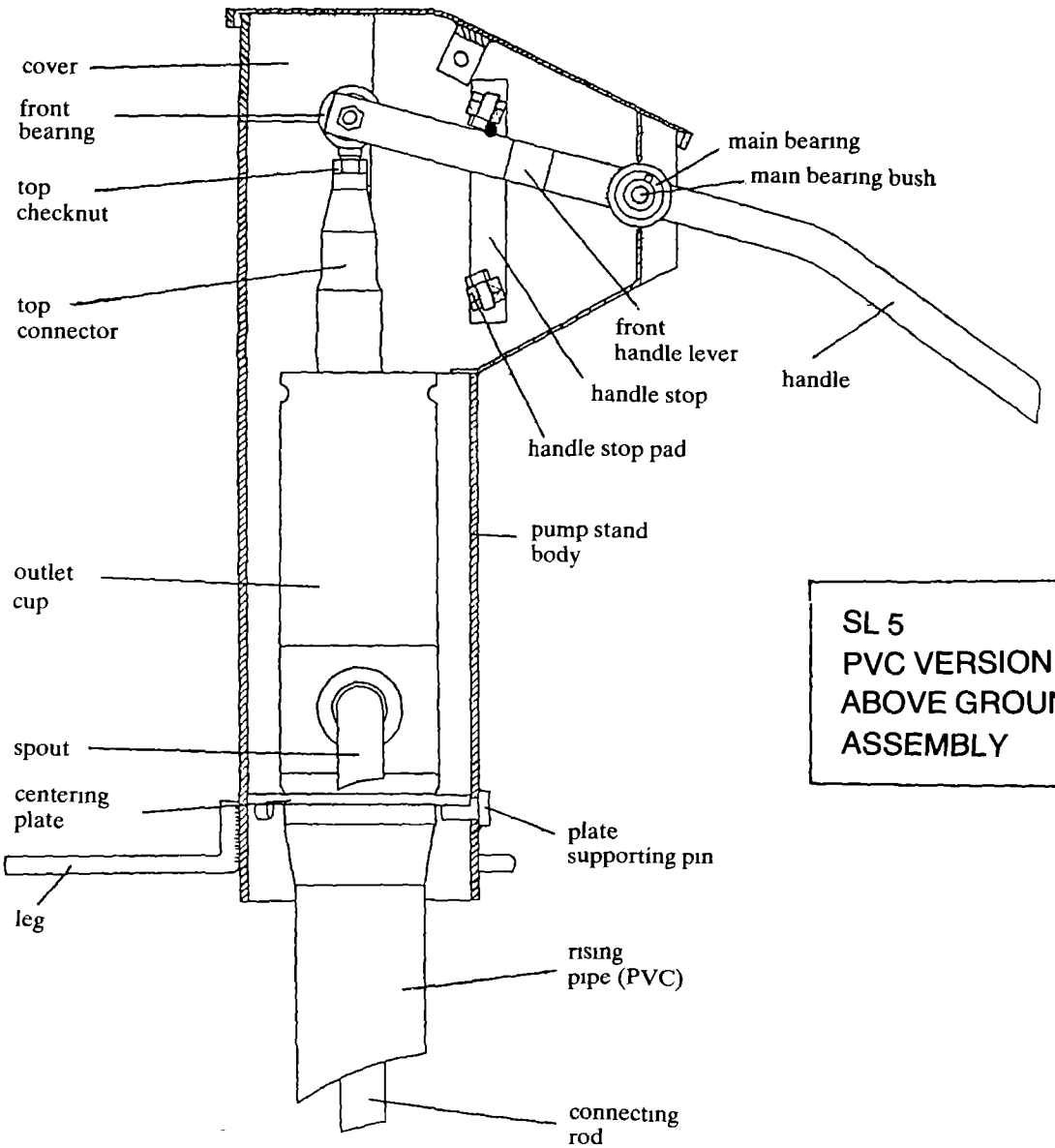
The following four pages depict the sectional details for both versions (PVC and PE) of the SL 5.



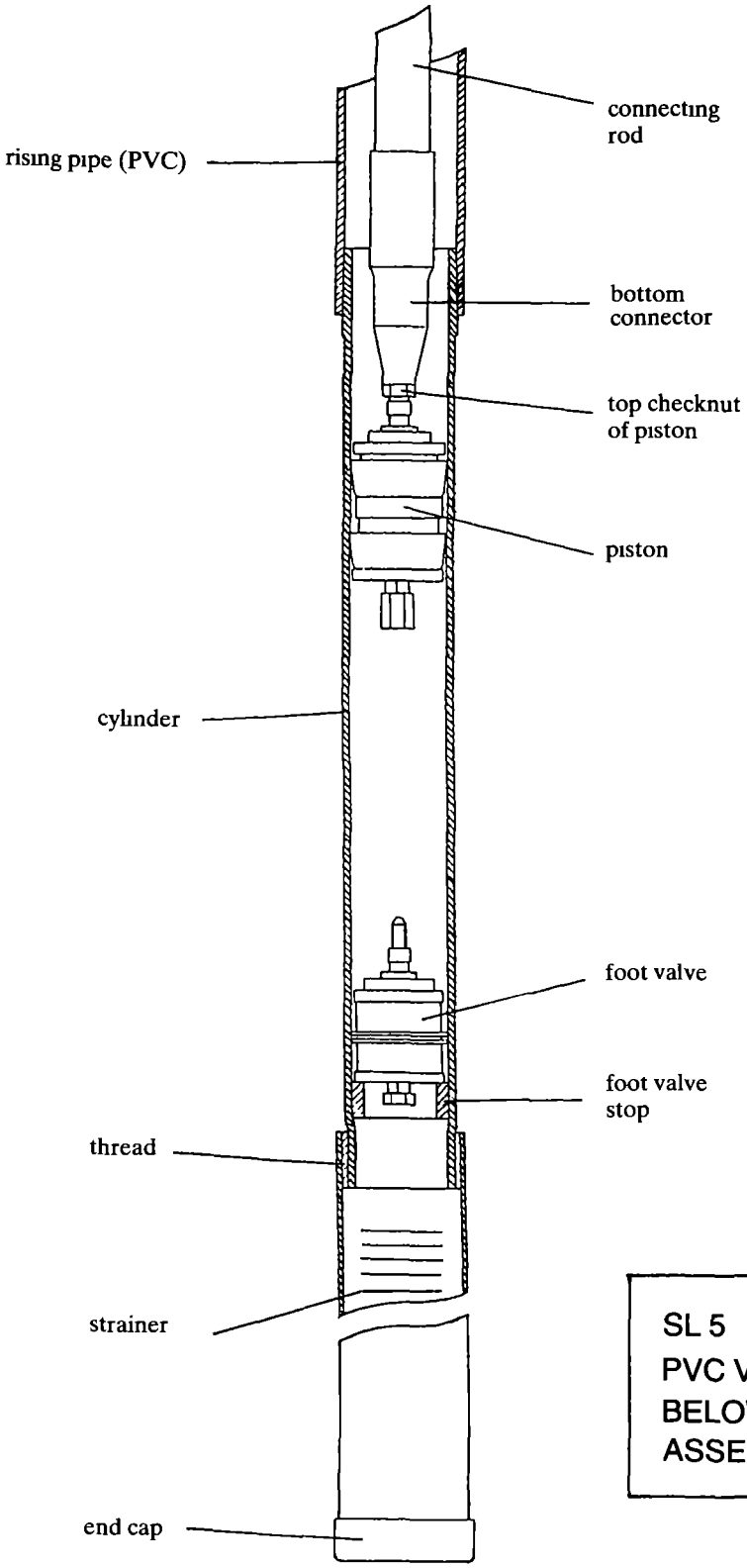
SL 5
PE VERSION
ABOVE GROUND
ASSEMBLY



SL 5
PE VERSION
BELOW GROUND
ASSEMBLY



SL 5
PVC VERSION
ABOVE GROUND
ASSEMBLY



SL 5
PVC VERSION
BELOW GROUND
ASSEMBLY

II. WELL COVER / PLATFORM CONSTRUCTION

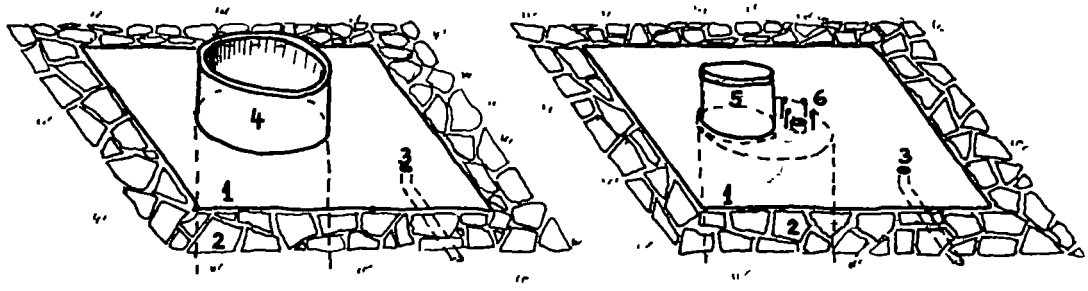
1. Hand Dug Well

a) Types of Well Heads

For the construction of the well lining and the drainage apron, consult the **Manual for the Construction of Hand Dug Drinking Water Wells in Sarvodaya Villages in Sri Lanka,** or the relevant standards of the supervising agency if it is not a Sarvodaya village.

There are two possible types of well heads found in Sarvodaya villages:

According to the Sarvodaya Manual: According to earlier SRTS designs.



Explanation:

1. Concrete drainage apron (rectangular or round)
2. Protective hardcore (rubble stones)
3. Drainage (pipe or open channel)
4. Open well with raised head wall
5. Partly closed well with manhole entrance.
6. Reinforcing iron rods for pump pedestal

b) **Types of Pump Stands**

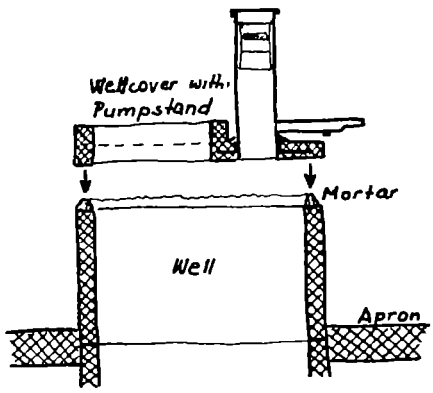
The SL 5 pump stand is available in two different mainbearing heights:

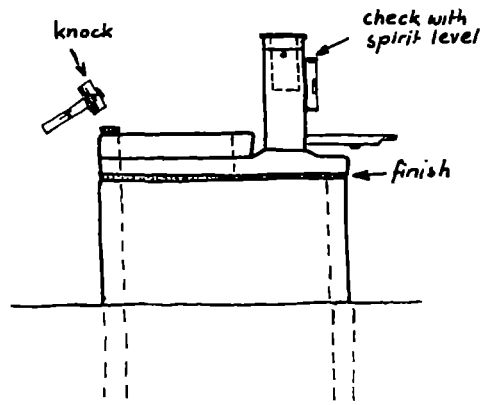
— 50 cm for installation directly on the concrete cover of a well with a raised head wall
— 95 cm for installation on a ground level platform (dug well or tube well)

Make sure to order the correct pump stand height when ordering the pump. State the type of well on which the pump is to be installed, e.g.: dug well raised, dug well ground level, or tube well.

c) **Installation on Raised Well Cover**

— Cast the well cover with the pump stand near the well, using the drawing at the end of this chapter (P 14). Make sure to cast the cover on **horizontal** ground. The pump stand must be exactly **vertical.** Check it with a spirit level or plumb
— After setting, cover the slab with wet bags, and keep wet for three days.
— Let it set for at least **seven days** from the date of casting the cover.
— Before placing the cover on the well, lay a small amount of stiff cement mortar 1 : 4 on the well rim
— Place the cover carefully on this mortar, and adjust it by knocking the cover into the mortar until the pump stand is vertical. The spout of the pump should face the drain.
— Finish the joint between the cover and the well, and if necessary, the top of the well, with mortar.
— The pump is now ready for installation (see Chapter III below).

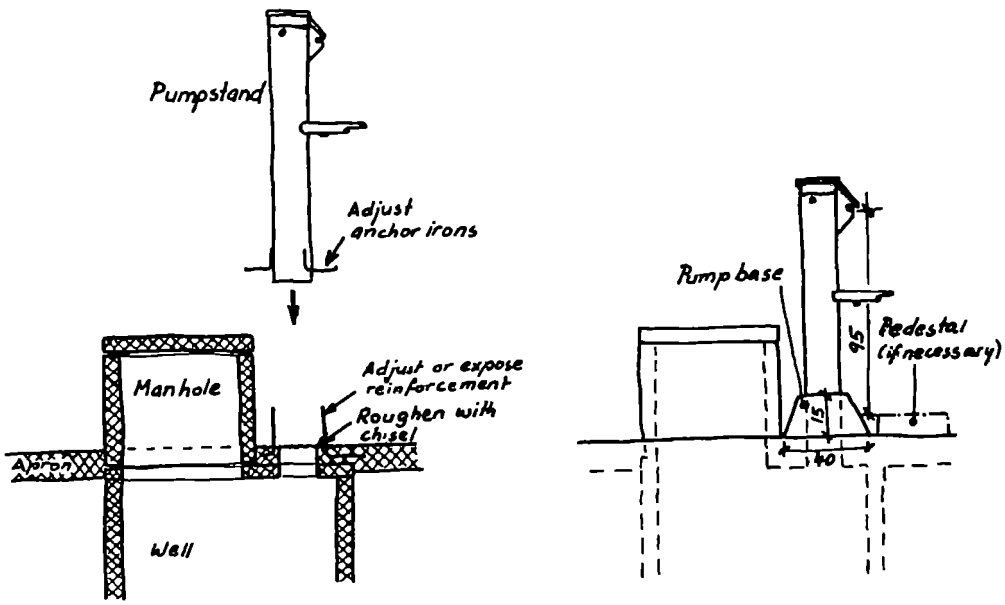




d) **Installation on Ground Level**

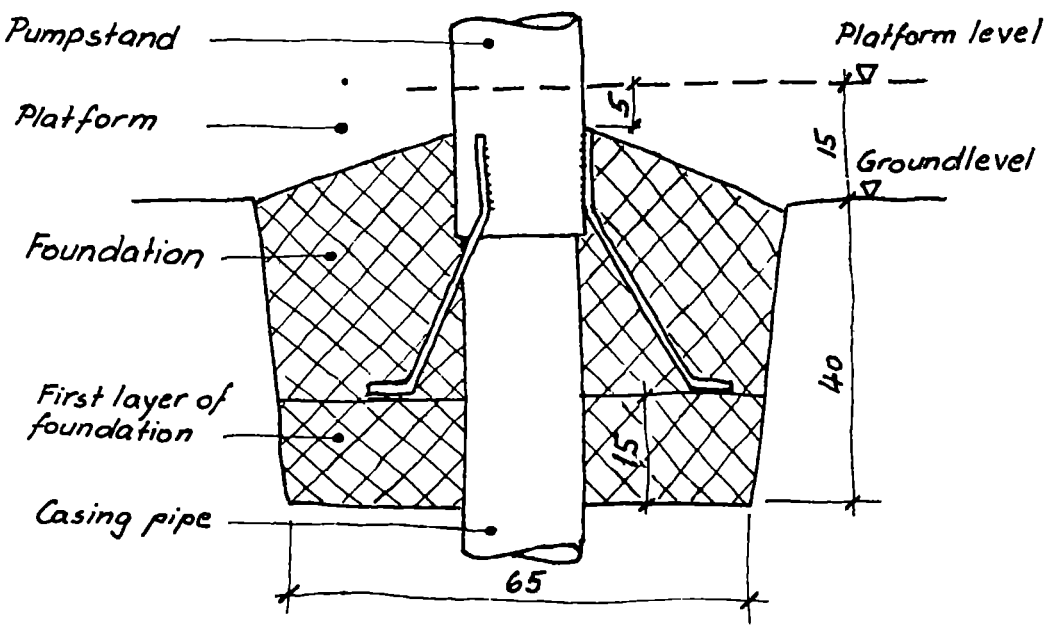
— Roughen the pump base area with a chisel. If necessary, chisel the hole to lower the riser pipe (min diameter = 4"). If there are no reinforcing irons for the pump pedestal, expose some platform reinforcement in the pedestal area by chiselling off some concrete.
— Bend the anchor irons welded to the pump stand bottom to a horizontal position, and cut their length, if necessary, with a hacksaw. (The anchor irons are designed for tube well installation, hence the need for adjustment)
— Put the pump stand into place Fix it to a vertical position, checking it with a spirit level. The spout of the pump should face the drain. Make sure that there is a good connection between the anchor irons welded to the pump stand and the reinforcement of the platform.
— Put the pump base form work into place and cast the base with concrete 1 : 2 : 3.
— Wait for two days for the setting of the concrete.
— Remove the form work, and finish the pump base with cement paste. Cast a pedestal for the users if the bearing is more than 100 cm above the apron. Ideally, the bearing height should be 95 cm.

— **Wait for five more days**
— The pump is now ready for installation (see Chapter III below).

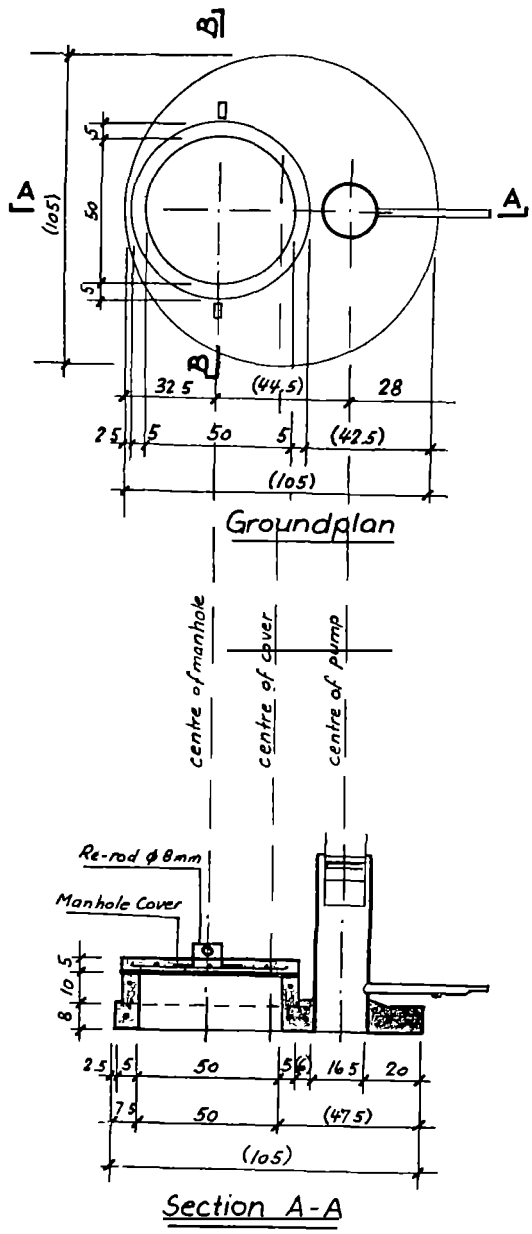


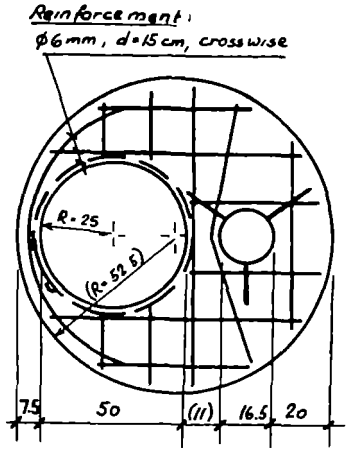
2. Tube Well

— Cut the casing pipe at ground level. Cover it.
— Dig a square pit at least 65 cm (25") long and 40 cm (16") deep around the casing pipe.
— Prepare concrete 1 : 2 : 4
— Pour a first layer of concrete 15 cm (6") deep into the pit.
— Decide where to make the drain.
— Place the pump stand over the casing pipe. The pump must stand vertically (check with a spirit level) and the spout must face the drain.
— Fill the rest of the pit with concrete. Carefully ram the concrete. Check again that the pump stand is vertical. The pump base now looks as follows:



— Construct the platform according to the standard plan shown on p. 15 at the end of this chapter (or the one of your supervising agency).
— Cover the platform with wet bags. Block the drain and fill the platform with water.
— **Wait** for at least **seven days** to allow the concrete to set.
— The pump is now ready for installation (see chapter III below).



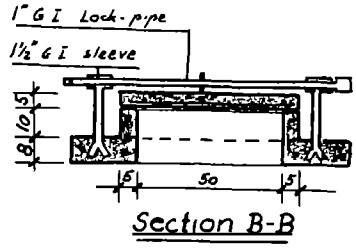


Approximate List of Materials

Cement : 1/2 bag
Sand 50 l(~7 pans)
Metal : 80 l(~11 pans)
(for mixture 1:2:3)

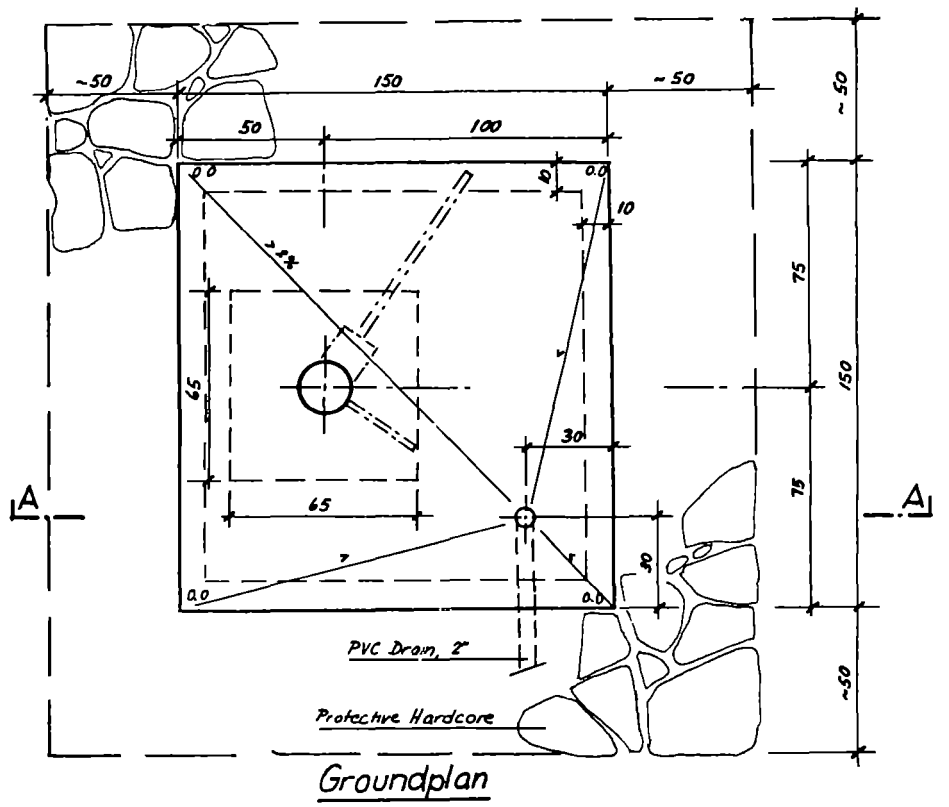
Rods Ø6mm· 12m

1" G.I pipe with socket: 1 m
G I Tees, 25 cm high· 2 pc



NOTE: The above drawings are for a well with an outside diameter of 105 cm Measurements shown in ( ) will change for other diameters. Likewise the material requirements will also differ.

SARVODAYA HANDPUMP SL 5
WELL COVER



Material Needed for Platform (incl. Foundation):

Cement : 3 bags
Sand :270 l (~36 pans)
Metal :450 l (~60 pans)
Rods :Ø6 mm : 32 m (7.1 kg)

SARVODAYA HANDPUMP SL 5
TUBE WELL PLATFORM

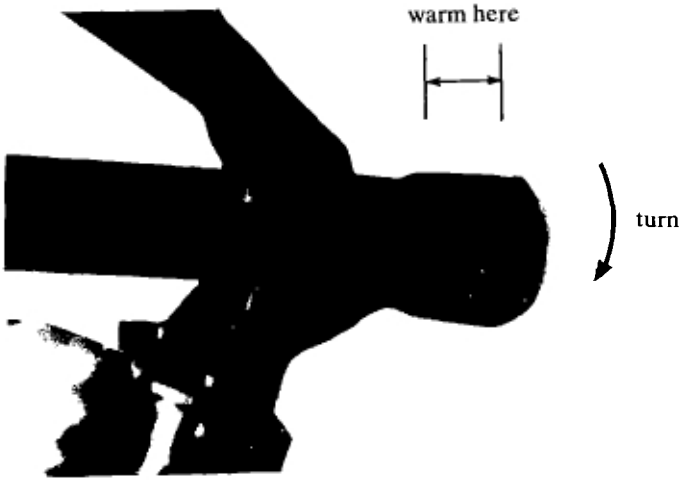
III. PUMP INSTALLATION

1. General

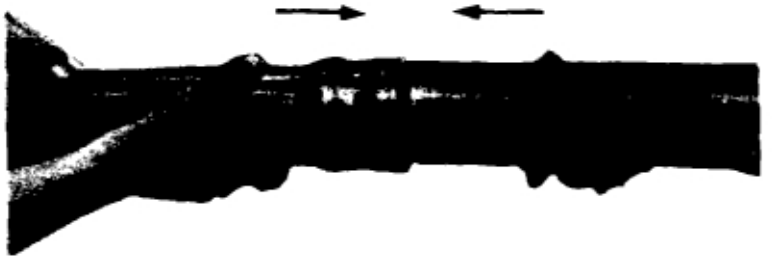
a) Adjusting the Fitting of PVC Parts

The two parts joined by PVC solvent cement will only be safely connected if there is no play in the fitting Therefore, it is very important to make sure that the parts fit well by joining them first without any solvent cement **before** installation. The following is the procedure for adjusting the fitting of a 3" rising pipe, but of course, it is also applicable for the 1¼" connecting rod:

— Join the parts **without** using any solvent cement.
It must be possible to join them without applying excessive force, and **no** play is allowed.



If there is any play, use the blow lamp to warm the expanded part (the socketed end) very carefully as shown in the picture. During warming, turn the pipe slowly.



As soon as the warmed region starts to shrink slightly, insert the corresponding pipe Make sure both pipes are in line

— Cool the joint with water for 1 minute.
— Take the two pieces apart.To join them for good, proceed as described below.

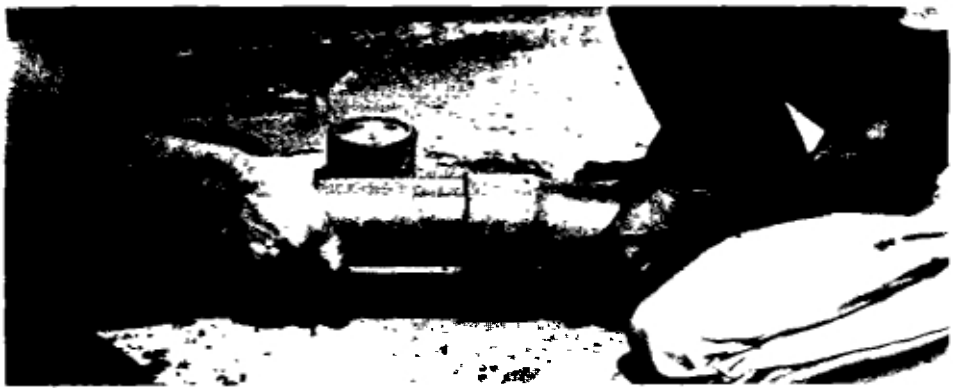
b) **Joining PVC Parts**

— Check that the parts fit and have no play. If they do, adjust the fitting as described above.

— Wipe off all traces of dust and grease on the surfaces which will be joined using a cloth soaked in methylated spirits.

— Sandpaper both surfaces.

— Apply a thick layer of solvent cement on both surfaces, covering the surfaces completely.



— Insert the pipe into the socket,turning gently Wipe off excess solvent cement
— Allow the joint to dry for at least 10 minutes before using.

c) **Determining the Appropriate Installation Depth**

— **PVC Rising Pipe** (hand dug shallow wells):
The installation depth equals the well depth
(The strainer stands on the well bottom)

— **Polyethylene (PE) Rising Pipe** (tube wells):
Consult the tubewell drilling report for well depth, static water level and yield of the well
In general the installation depth is determined by the table below:

Tube well depth	PE Rising pipe length
up to 18 m	tube well depth minus 6 m
18 m to 30 m	2 / 3 of the well depth
above 30 m	20 m

Exceptions:

1 If the static water level is below the installation depth obtained from the above table.
2 If the installation depth is only slightly below the water level, and the yield of the well is very low

In these cases consult the supervising authority

2. Installation of PVC Rising Pipe

PVC rising pipe is used for hand dug shallow wells.

a) **Preliminary Work**

— Measure the exact well depth.
— Place the centering plate inside the pump stand. Check that the outlet cup fits and that the spout can be inserted easily when the outlet cup is placed inside the pump stand. Make sure that the outlet cup fits on to the 3" rising pipe used.
— Check that the sockets of the 3" pipe fit tightly If they don't, refer to Chap. 1 a of this section.

b) **Preparatory Work**

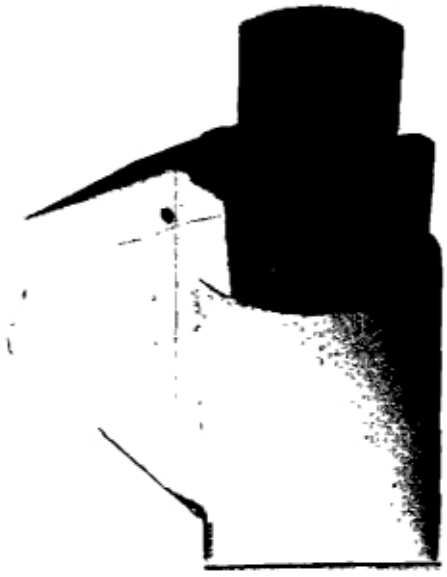
— Join the cylinder to the bottom of the first length of rising pipe Push the cylinder firmly in as far as possible, but do not hammer it in Leave at least 10 min. to dry before handling.

— Prepare the rising pipe by drilling two holes ∅ 2 mm into opposite sides of the socketed end.

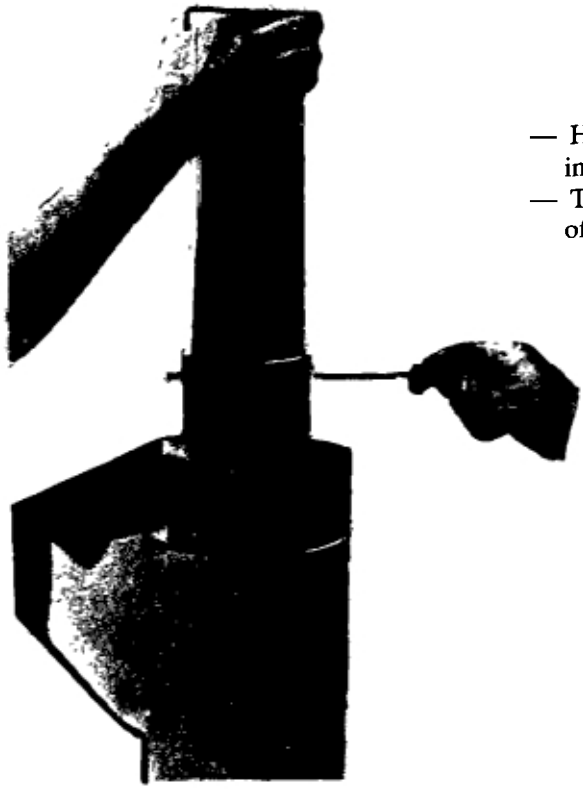
— Solvent cement the end cap to the strainer.
— Clean the threads of the cylinder and strainer. Screw the strainer to the cylinder

c) **Installing the Rising Pipe**

— Place the centering plate inside the pump stand.



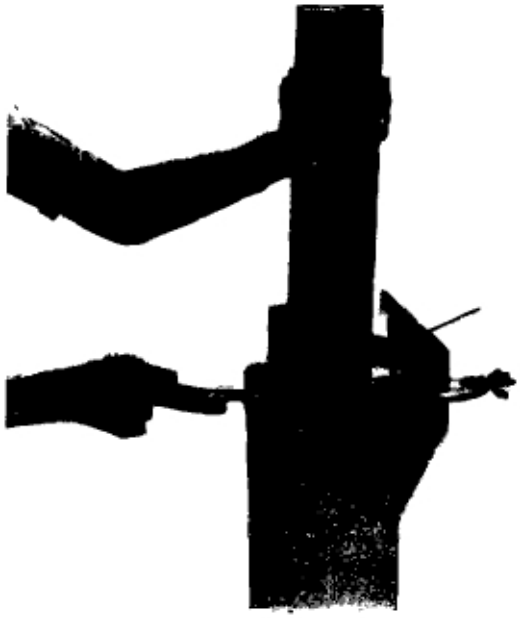
— Lower strainer, cylinder and the first length of rising pipe into the well.
— Clamp the socketed end with wooden blocks as shown.
— Clean, sandpaper, and apply solvent cement to the socket and the next length of rising pipe.



— Hold the next length of rising pipe vertically and insert it into the socket.
— To secure the joint, screw ½" brass screws into both holes of Ø 2 mm which were drilled before .

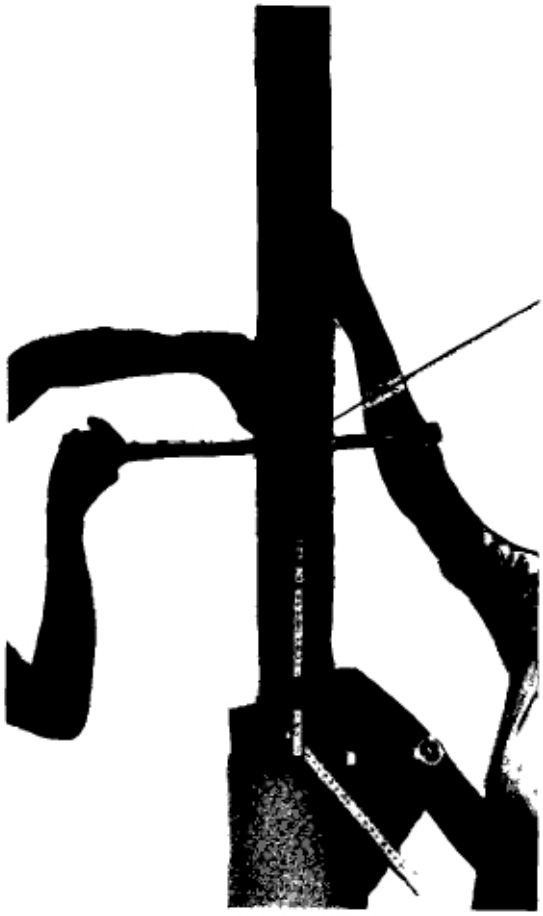
— Add on additional pipe lengths until the endcap reaches the bottom of the well.

d) **Fixing the Outlet Cup**



— When the endcap has reached the bottom of the well, lift the rising pipe up and push it down vigourously a few times until it does not move further down

— Mark the upper end of the pump stand on the rising pipe with a hacksaw

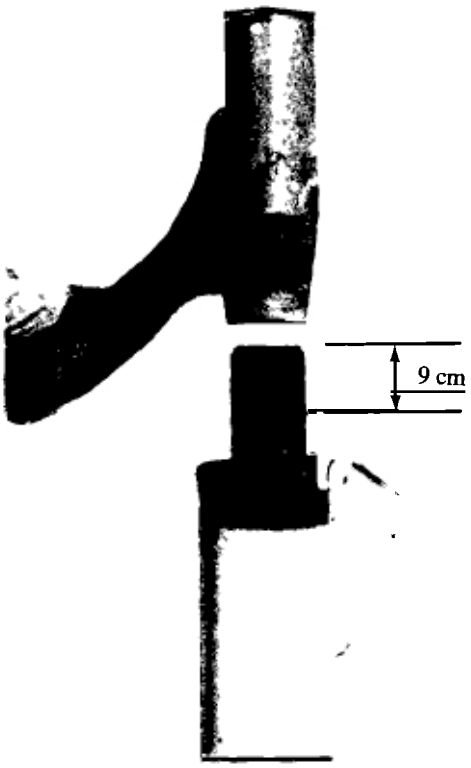


— Pull up the rising pipe approx 600 mm and clamp

— Measure down 440 mm from the mark

— At that point, cut the rising pipe.

— Check that the outlet cup fits easily onto the rising pipe

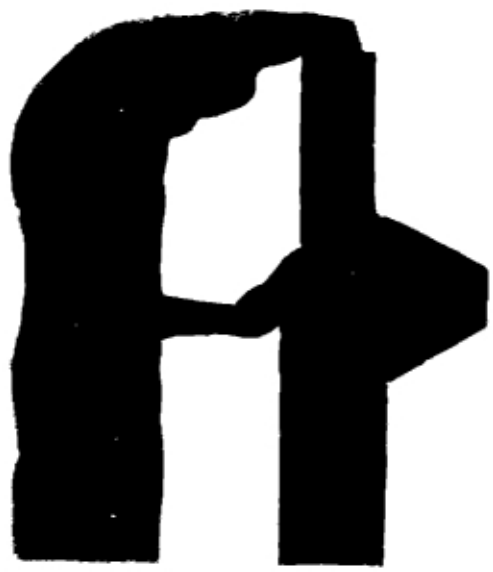


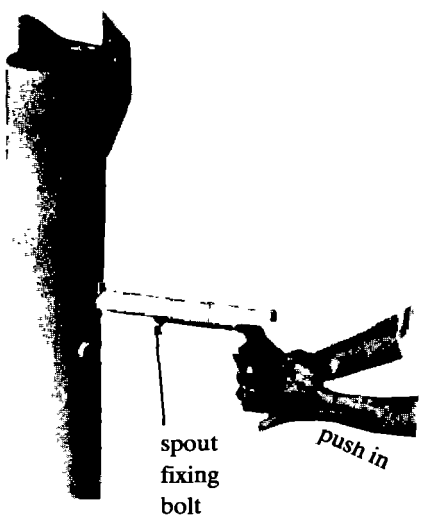
— Mark a lengh of 9 cm at the end of the rising pipe

— Clean, sandpaper, and apply solvent cement to this area.

— Fit the outlet cup on the rising pipe and push it down to the mark.

— Hold the rising pipe inside, and lower it to the ground





— Turn the outlet cup to the correct position

— Apply some Vaseline (not grease) to the long end of the spout and insert it.

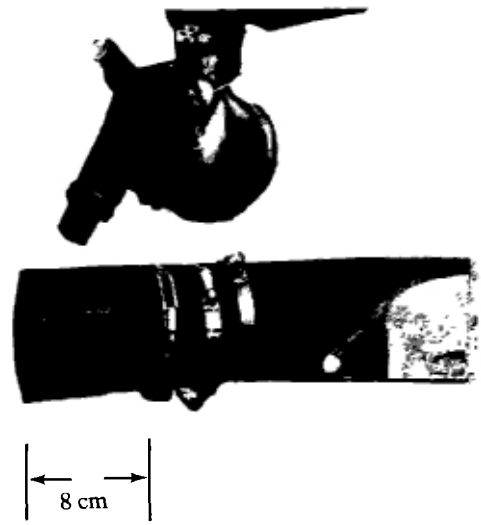
— Grease the spout fixing bolt and tighten it.

3. Installation of Polyethylene (PE) Rising Pipe

a) **Preliminary Work**

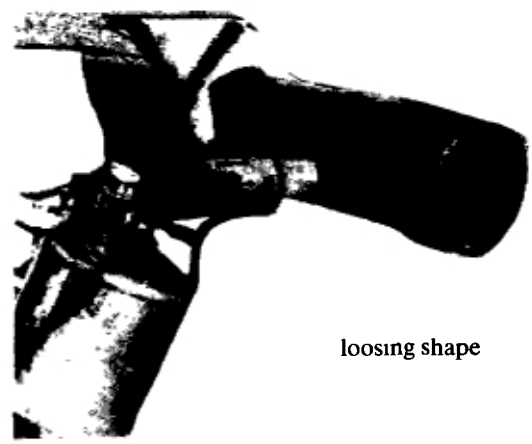
— Measure to exact well depth
— Determine the appropriate rising pipe length as described in chap. 1. c of the "Installation" section.
— Place the centering plate inside the pump stand. Check that the outlet cup fits, and that the spout can easily be inserted when the outlet cup is placed in the pump stand.

b) **Preparatory Work**



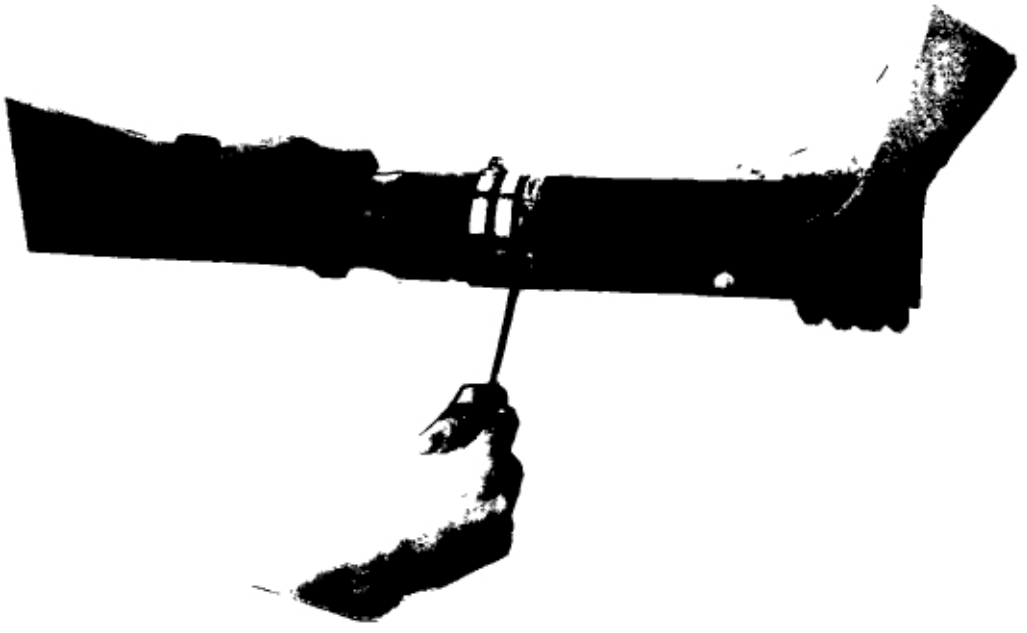
— Place three hose clips near one end of the PE-pipe
— Warm approx. 8 cm. of pipe inside and outside carefully and equally

The correct temperature is reached when the pipe can be compressed easily, but still returns to its original shape when the pressure is taken off

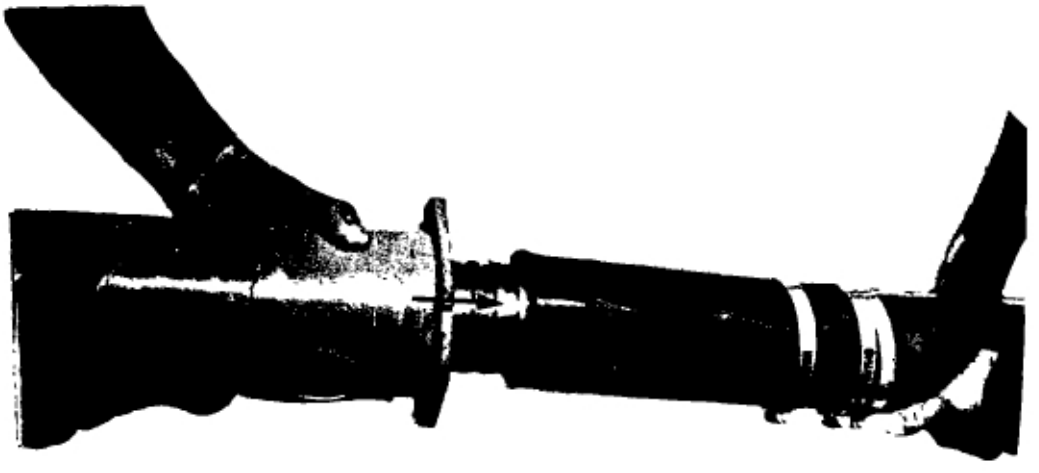


loosing shape

As soon as the pipe starts loosing its shape it has been heated it too much.
Cut off a piece and start again, if this happens

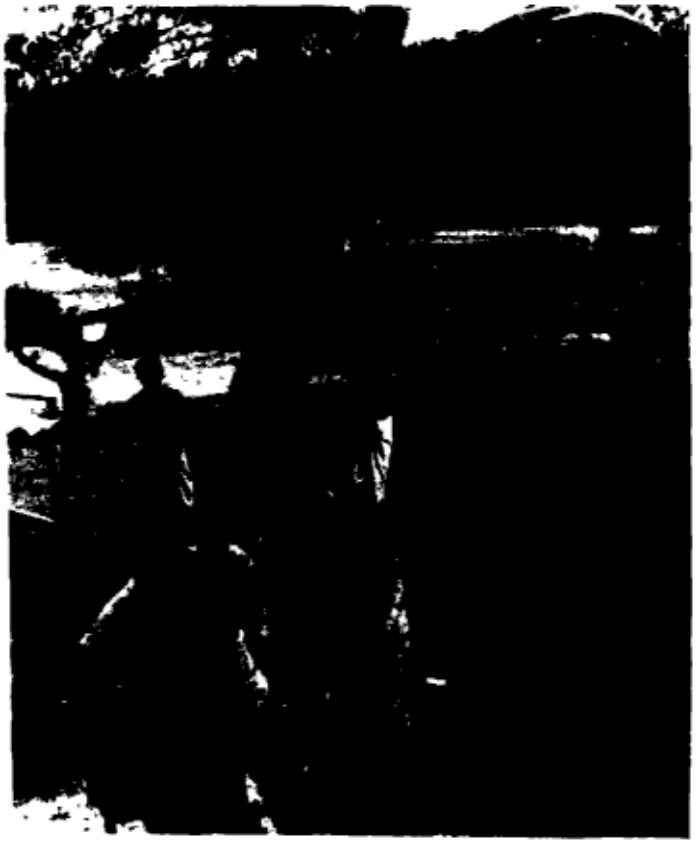


— Insert the brass joint of the cylinder as far as possible into the PE pipe Tighten the hose clips.
— While the PE pipe is still warm, check that the cylinder is in line with the PE pipe.
— Let the joint cool for 2 — 3 min. and then apply water to quicken the cooling process.
— Open the hose clips and move them to the other end of the pipe.

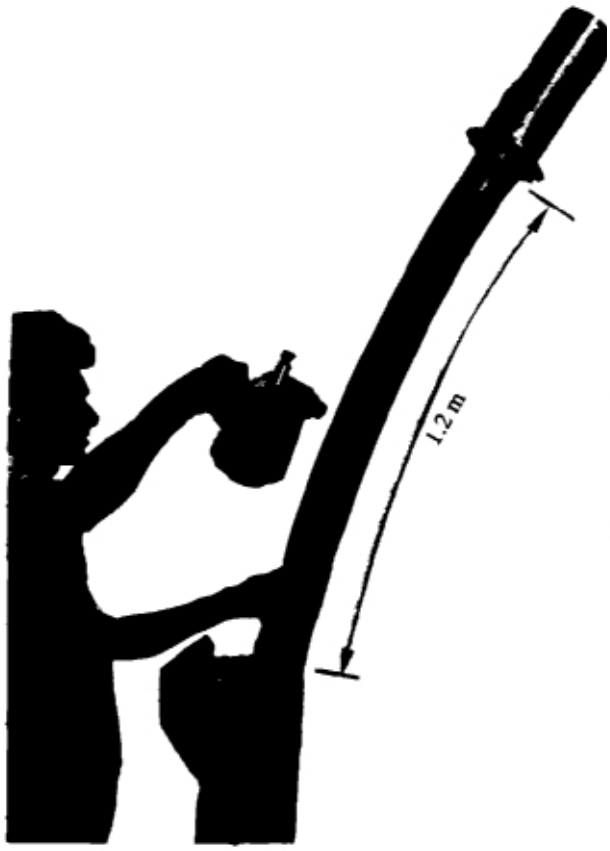


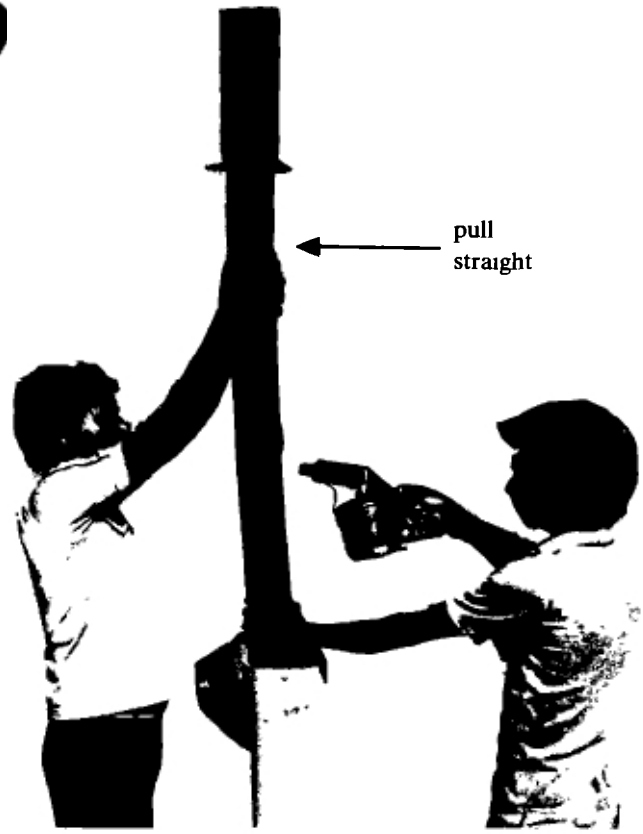
— Warm the other end of the pipe as described above.
— Insert the brass joint of the outlet cup into the PE pipe with the centering plate in its place. Tighten the hose clips.
— Check that the outlet cup is in line with the PE pipe.
— Allow 2 — 3 mins. to cool, then futher cool with water and remove the hose clips

c) **Installation of the Rising Pipe**



Feed the PE pipe into the tube well.





— Push the PE pipe down until there are 1.2 m (4 ft) left above the pump stand.
— Warm the whole length carefully with the blowlamp until the pipe softens slightly

— Pull the pipe straight.
— Hold it straight and cool it with clean water.

— Push down the rising pipe completely.
— Fit the centering plate correctly on the plate supporting pins.
— Turn the outlet cup to the correct position, apply a little Vaseline (not grease!) to the long end of the spout and insert it.
— Grease the spout fixing bolt and tighten it.

4. Preparing The Piston and The Foot Valve

Piston

— Loosen the checknut, and tighten the main nut firmly

— Hold the main nut with spanner No 17 and fully tighten the check-nut with spanner No. 19 .

Foot Valve

— Loosen the checknut
— Tighten the main nut until you feel considerable resistance

Caution: Make sure that the foot valve bolt does not turn when tightening the main nut The turning of the foot valve bolt may damage the bolt seal.

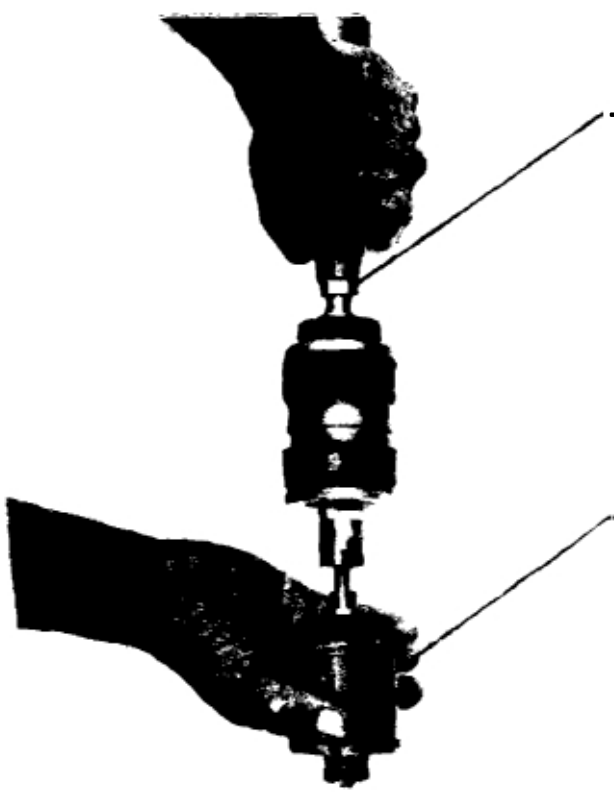
— Hold the main nut with spanner No. 17 and fully tighten the checknut with spanner No 19.

5. Installation of the Connecting Rod

a) Preparatory Work

— Check that the connecting rod sockets fit tightly on to the 1¼" PVC pipes used for the connecting rod. If they don't, adjust them as described in Chap. 1.a of the "Installation" section.

— Join the required number of 1¼" pipe lengths according to the length of the rising pipe. Clean and sandpaper each joint before solvent cementing.

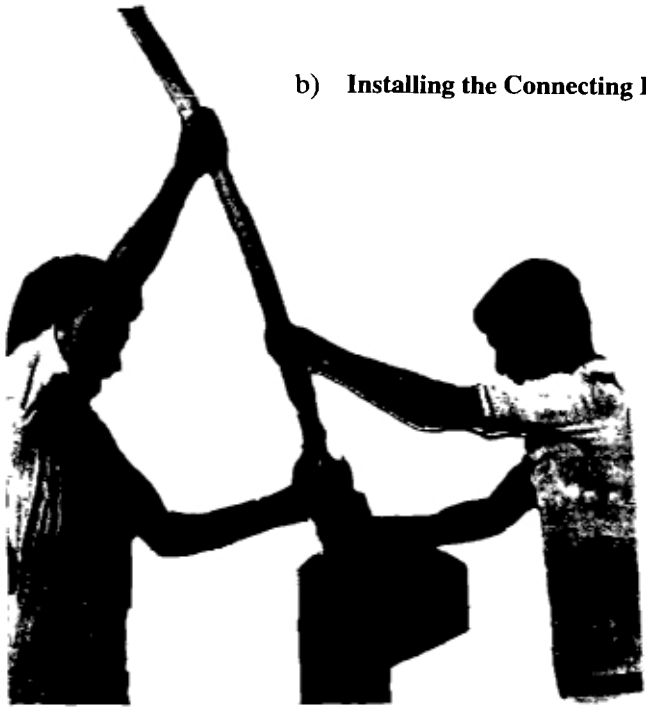


— Fit the connector with the **brass** inset on to one end. Screw the piston into the brass connector and tighten the checknut firmly with spanner No. 19.

— Screw the foot valve into the checknut of the piston until it stops. Loosen it ½ turn.

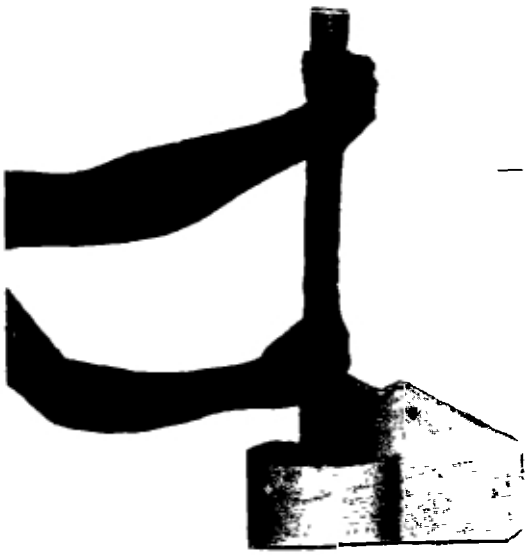
— Allow the joined connecting rod to dry at least 10 min. before proceeding further.

b) **Installing the Connecting Rod**



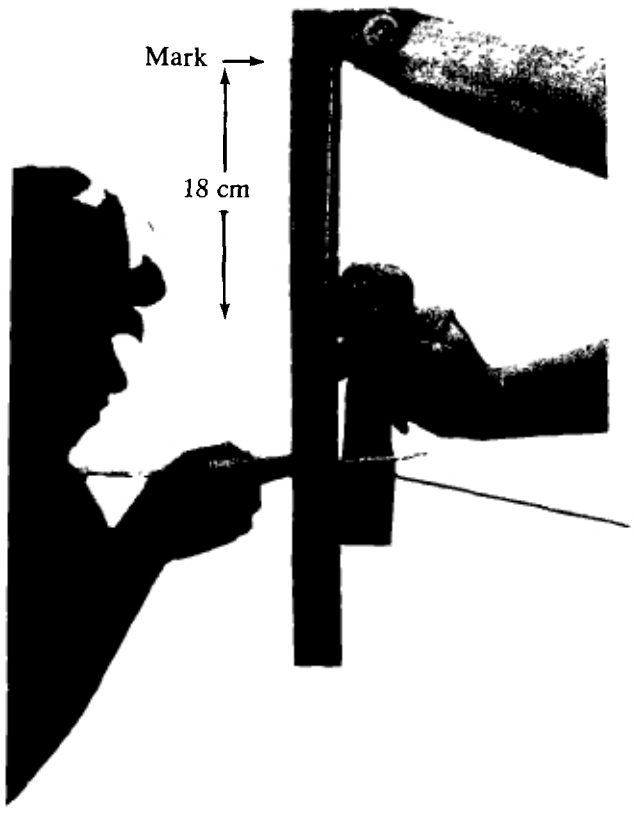
— Feed the assembled foot valve, piston, and the connecting rod into the rising pipe.

— When the foot valve can be felt entering the cylinder, push the rod very carefully down approx. 60 cm more, until a firm resistance is felt. The foot valve has now reached the foot valve stop



— Unscrew the piston from the foot valve by turning the connecting rod counter clockwise until the rod moves up easily

— Push the rod down as far as possible and mark the upper end of the pump stand on the rod



— Measure down 18 cm from the mark. Hold the bolt of the front bearing at this place.

— Mark the connecting rod where the socket of the top connector ends.

— Cut the rod at the mark.

— Clean, sandpaper and apply solvent cement to the inside of the socket and to the end of the connecting rod.

— Push the top connector as far as possible on to the connecting rod

— Allow to dry at least 10 min before using.

6. Installation of the Handle

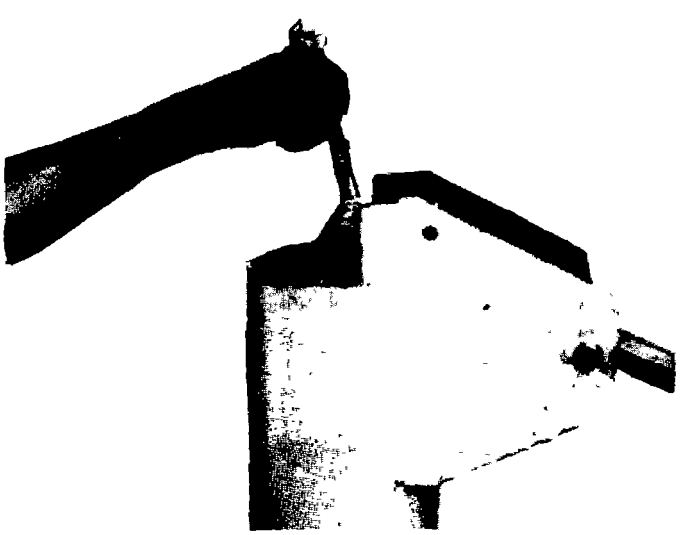
— Grease the ball bearings, the bearing bush, and the thread.

— Fit the handle inside the pump stand.

— Grease the spring washer and the handle bolt. Tighten the bolt fully

Check:1) That the foot valve can be screwed on easily (for a detailed description, see section entitled "Maintenance" Chap 2· "Removing Foot Valve").

2) That there is a minimal vertical distance of 5 cm (2") between the down-most position of the front lever of the handle and the front bearing, when the front bearing is pushed down as far as possible.



— Insert the front bearing bolt and tighten it fully.

7. Final Check List

Make sure that:

— the handle moves smoothly from the top to the bottom handle stop

— there are no scraping or squeaking noises

— the connecting rod doesn't touch anywhere

Check that:

— the main bearing bolts are tight

— the spout fixing bolt is tightened

— the front bearing bolt is tight

Put on the pump stand cover, grease the cover fixing bolts and tighten them.
Explain the do's and don'ts (see "Maintenance" section) to the villagers

For tube wells:
Tell the villagers that they will have to do a certain amount of pumping until the water comes clean

8. Chlorination

It is strongly recommended to chlorinate the wells after the installation of the handpump, after major repairs, or after pollution resulting from floods or other calamities

The procedure for the chlorination of hand dug wells is described in detail in the **Manual for the Construction of Hand Dug Drinking Water Wells in Sarvodaya Villages in Sri Lanka,** Appendix B.

Briefly summarized, chlorination is done as follows:

Dissolve 100 g of bleaching powder per m3 of well water and pour the solution into the well, either through the manhole or through the pumphead (between the pump stand and the outlet cup, but not into the outlet cup) Operate the handpump until the chlorine odour appears at the spout. Wait for about 12 hours. After 12 hours, pump the well water to waste until the odour of chlorine disappears.

IV. PUMP MAINTENANCE

1. Village Caretaker's Duty Sheet

— Explain to the users the proper handling of the pump:
  — Use the pump with long, slow strokes.
  — Do not force any objects or dirt into the spout opening or the main bearing slit Do not block the spout by hand.
  — Do not use the pump roughly

— Maintain the pump according to the maintenance schedule (chapter 4 of this section) Follow the work descriptions in this manual for maintenance and repairs
— Keep the platform and drain clean
— If a breakdown occurs, repair the pump as quickly as possible If the repair cannot be carried out, inform the supervising authority immediately

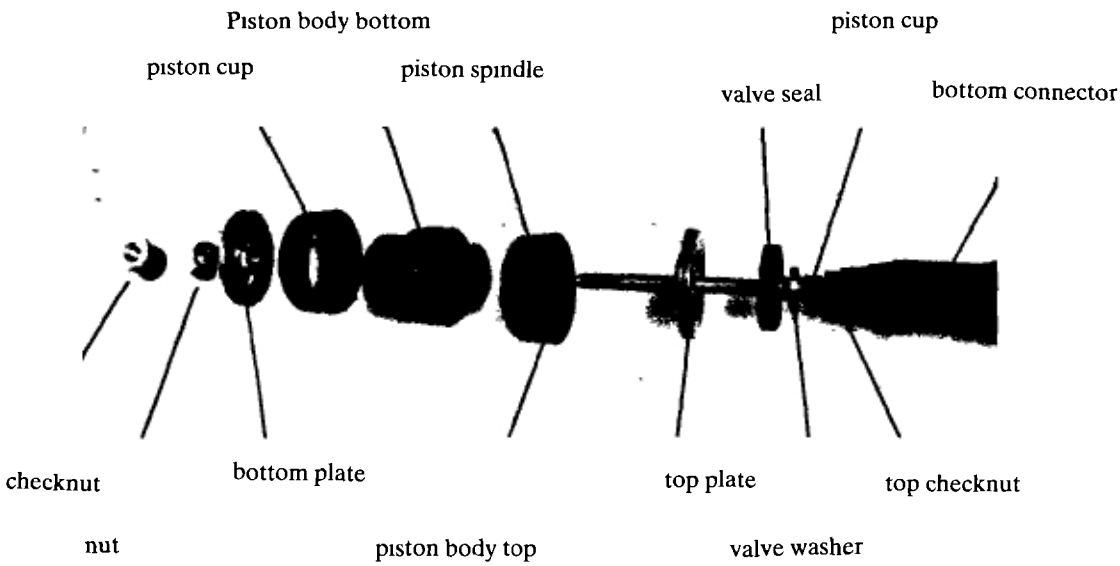
2. Description of Maintenance work

a) **Removing the Piston**

— Remove the front bearing bolt

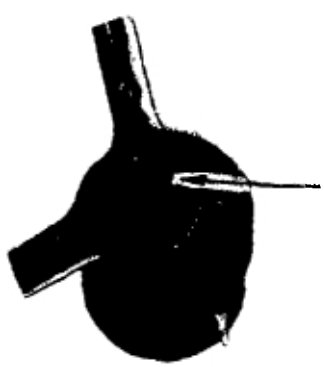
— Pull out the connecting rod As soon as the connecting rod starts bending, have someone hold it, so that the front bearing does not get dirty by touching the ground

b) **Replacement of Worn Piston Parts**



— Unscrew the checknut and nut of the piston.
— If the top piston cup is badly worn and the bottom one is in good condition, shift the bottom cup to the top and replace the bottom one with a new cup
— If both are worn replace both with new ones and re-order them for the maintenance kit
— If the valve seal is worn turn it upside down When both sides are worn, replace it
— Re-assemble the piston as shown above.
— Tighten the nut firmly.
— Hold the nut with spanner No 17 and fully tighten the checknut with spanner No 19

Caution: Screw on the checknut with the untapered thread-end facing the nut. The enlarged thread-end must be visible. This is important in order to catch the foot valve



— Make sure that the top checknut is also fully tightened.

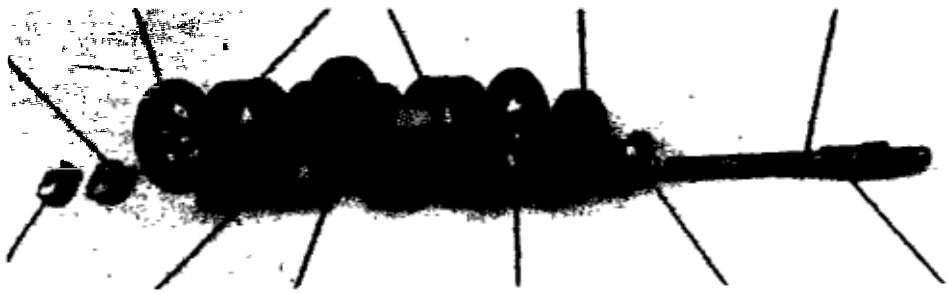
c) **Removing the Foot Valve**

— Remove the front bearing bolt
— Push the connecting rod down until resistance is experienced (the piston checknut now touches the foot valve bolt).
— Turn the connecting rod clockwise until it becomes difficult to turn.
— If the foot valve does not screw on to the piston, pull out the connecting rod completely Examine whether the checknut of the piston is screwed on upside down (i.e. the enlarged thread-end is not visible) or whether the thread is blocked. If so, correct the mistake, feed the connecting rod into the rising pipe, again try to catch the foot valve.

— When the piston and the foot valve are joined, pull out the connecting rod As soon as the connecting rod starts bending, have someone hold it, so that the front bearing does not get dirty by touching the ground

d) **Replacement of Worn Foot Valve Parts**

nut bottom plate body ring valve seal bolt seal



checknut body main seal top plate valve washer bolt

— Unscrew the nut and the checknut of the foot valve.
— If the valve seal is worn, turn it upside down. When both sides are worn. replace it.
— If the main seal has been damaged, replace it.
— If the bolt seal is not in good condition, replace it

— To re-assemble the foot valve, first push the bolt seal on to the foot valve bolt as far as possible

— Then put the valve washer and the seal on the bolt. Assemble the foot valve body.

— Insert the bolt into the body When the bolt seal enters its seat turn the bolt slowly to assure that the seal fits correctly Make sure that the bolt seal does not squeeze out of the seat anywhere

— Tighten the nut until considerable resistance is felt.

Caution: Make sure that the foot valve bolt does not turn, when tightening the nut The turning of the foot valve bolt may damage the bolt seal.

— Hold the nut with spanner No 17 and firmly tighten the checknut with spanner No 19.

e) **Re-assembling the Pump**

— If the foot valve has been removed, screw it into the checknut of the piston until it stops. Loosen it 1/2 turn

— Feed the foot valve, the piston and the connecting rod into the rising pipe.

— Push the connecting rod down until the foot valve reaches the foot valve stop Unscrew the foot valve by turning the connecting rod counter clockwise.

— Insert the front bearing bolt and tighten it fully

— Grease all bolts, the outside of the front bearing and its housing before closing the cover.

3. Major Repairs

Removing the Rising Pipe

This is an unusual repair and only has to be carried out in emergency cases (e.g. if the foot valve gets damaged and cannot be removed).

— **PVC rising pipe:**

If possible remove the foot valve. Pull out the rising pipe by lifting the outlet cup with the steel pin (rising pipe handle) provided in the tool kit

If the well is more than 10 m deep the rising pipe will have to be cut into two parts.

If the pipe has been cut during removal, it will have to be re-joined with a 3" socket (available in the market) when lowering it into the well again.

Make sure that the rising pipe is the same length as it was before removal

— **Polyethylene rising pipe:**

If possible, remove the foot valve.

Pull out the rising pipe by lifting the outlet cup with the steel pin (rising pipe handle) provided in the tool kit.

As the Polyethylene is flexible, there is no need to cut the rising pipe

4. Maintenance Schedule

a) Every Week

— Clean the platform and drain
— Check whether
  — The pump works easily and the water flow is satisfactory
  — The water comes immediately after pumping is started.
  — There are no strange noises during pump operation

— If any defects are detected, consult the section "Trouble Shooting" in this manual.

b) Every Month

— Open the pump cover.
— Tighten the front bearing bolt.
— Tighten the main bearing bolts.
— Look for rusty patches If seen, clean them with a wire brush or sand paper and apply anti-corrosive paint.
— Grease the cover bolts, close the pump cover, and tighten the cover bolts.

c) Once a Year

— Pull out the piston and the foot valve.
— Take the piston apart. Remove the top piston cup, replace it with the bottom one and put a new cup on the bottom. (See chapter "Description of Maintenance Work") If both cups are worn out, replace them both.
— Check the condition of the valve seals of the piston and the foot valve. If they are worn out turn them upside down, or replace them if both sides are worn out.
— Check all parts for cracks or other visual defects. If the defects are serious, order the part from the spare parts supplier.
— Reassemble the piston and the foot valve as described in chapter 2 "Description of Maintenance Work" of this section
— Remove the handle. Check for serious cracks in the welds. If necessary have the defect repaired locally.
— Grease the handle ball bearings on the **outside** only. (Never open the sealed ball bearings!) Grease the handle bearing seats and bearing bolts.
Grease the front ball bearings outside and the front bearing bolt.

— Look for rusty patches If seen, clean them with a wire brush or sandpaper and apply anti-corrosive paint
— Reassemble the pump as described in the "Installation" section of this manual.
— Make sure that all bolts, the front bearing and the checknut of the top connector are well greased and firmly tightened.

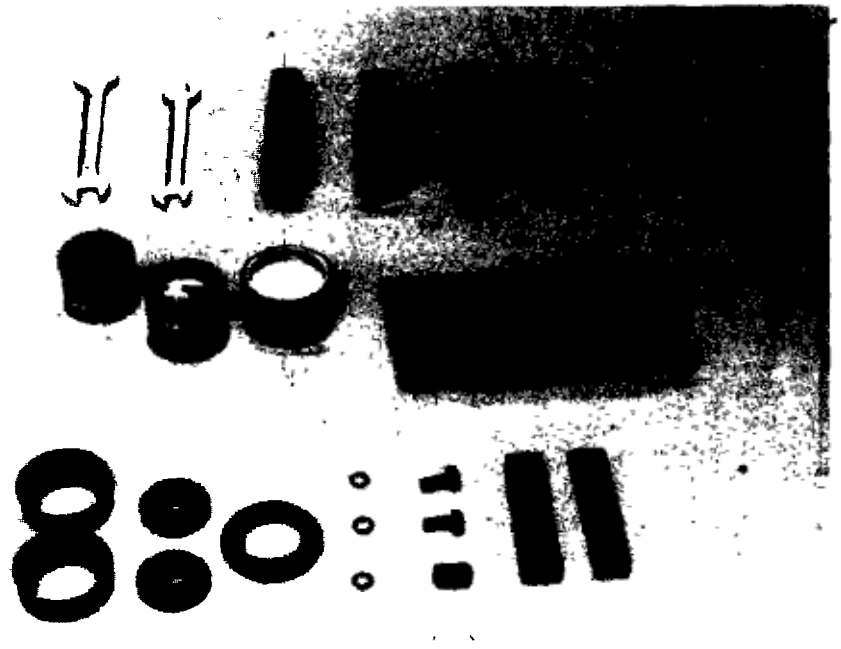
5. Trouble Shooting

Trouble	Cause	Remedy
Pump handle works easily, but no flow of water	a) Valve seals worn out	a+b) Remove piston and foot valve. Replace the defective parts.
	b) Piston cups damaged	
	c) Water level gone below cylinder	c) PVC rising pipe: Shorten tail pipe (if existing) or strainer PE rising pipe Extend the length by adding additional PE pipe with a brass joint
	d) Connecting rod broken or piston disconnected	d) If the bottom part of the connecting rod, or the piston, cannot be taken out, remove the rising pipe. Then repair the connecting rod with a 1¼" socket.
	e) Cylinder or rising pipe cracked	e) Remove the rising pipe, replace the broken section of rising pipe or the complete cylinder.
small flow of water	a) Valve seals worn out.	a+ b) Remove the piston and the foot valve Replace the defective parts.
	b) Piston cups damaged.	
	c) Cylinder or rising pipe split	c) Remove the rising pipe. Replace the broken section of rising pipe or the cylinder
Delayed water flow (i.e. water flow starts after several strokes)	a) Leakage of foot valve	a) Remove the foot valve. Check the valve -, bolt - and main - seals and replace them if worn out Tighten the nut firmly Clean the valve seat
	b) Leakage of rising pipe	b) The PVC rismg pipe may leak at the joints Repair with a 3" socket.

Handle difficult to operate	a) Piston cup jammed inside the cylinder. b) Unallowed object inside the cylinder or riser pipe.	a) Remove the piston if necessary. Replace the piston cups and tighten the piston nut firmly. b) Remove the piston and the foot valve. Take away foreign matter. If necessary, replace damaged parts.
Unusual noises	a) Rubber pad of handle stop worn out b) Connecting rod touching rising pipe or outlet cup.	a) Replace it with a new one. b) Installation fault. Inform installation team.
Shaky handle	a) Handle loose.	a) Tighten handle bearing bolts.
Water dirty or of bad taste	Bad site selection and drilling. Adverse chemical composition of ground water.	This is not the fault of the pump Inform installating authority.

Appendix A

Caretaker's Tool Box and Spare-parts



Tools:	1 spanner No. 19 1 spanner No. 17 4 rubber padded wooden blocks 1 rising pipe handle (steel pin Ø 10 mn) 1 hacksaw blade
Consumables:	1 tin of grease 1 tin of PVC solvent cement 1 tin of anti-corrosive paint 1 sheet of waterproof sandpaper
Spare-parts:	2 piston cups 2 valve seals 1 foot valve main seal 3 foot valve bolt seals 1 brass nut 17 mm 2 bolts M10 x 20 galvanized 2 handle stop pads

Appendix B

Tools and Parts for Pump Installation

Parts:

Pump stand with handle stop pads and cover with 3 bolts M10 x 20
Handle with — 2 bearings & bearing bushes
— 2 bolts M12 x 20 & 2 spring washers 12 mm
Front bearing with — 2 ball bearings & 2 bearing bushes
— bolt M10 x 100
— top checknut and top connector (MS)
Piston with top checknut
Bottom connector (brass)
Foot valve
Outlet cup
Centering plate
Spout
Cylinder (for PVC or PE) & strainer
End cap
Sockets 1¼"
Connecting rods 1¼"
Rising pipe 3"
Brass screws ½" (for PVC riser pipe only)

Tools:

Hacksaw
Tape 30 m and ruler
Hand drill and drill bit ∅2 mm (for PVC only)
4 wooden blocks (for PVC only)
Rising pipe handle
Blow lamp, matches, kerosene
Methylated spirit, sandpaper, PVC solvent cement, cloth
3 hose clips 4" (for PE only)
Grease, vaseline
Spanners No 17 and No 19

Rs. 50/-

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