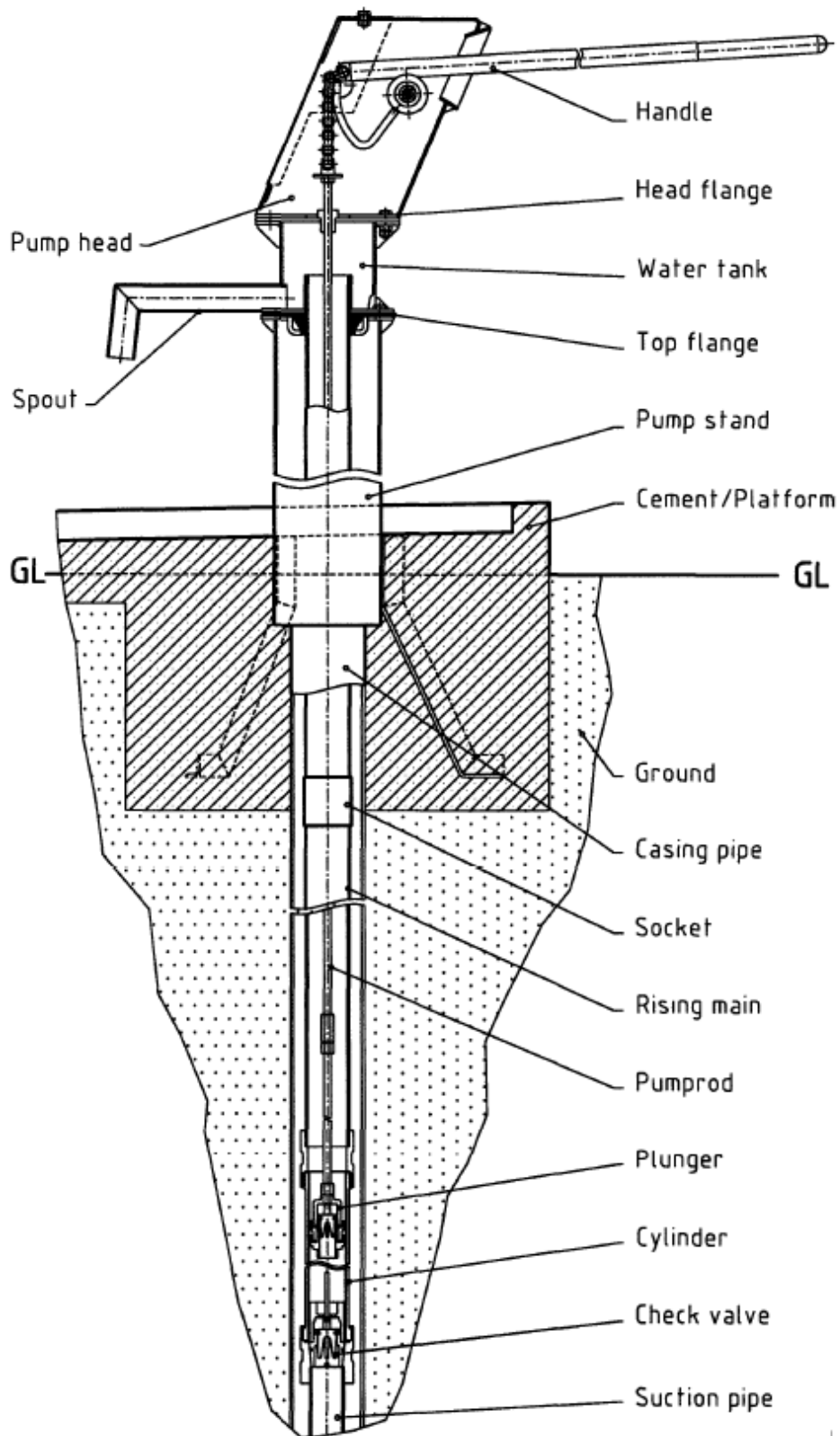


Installation & Maintenance Manual for the India Mark III Handpump

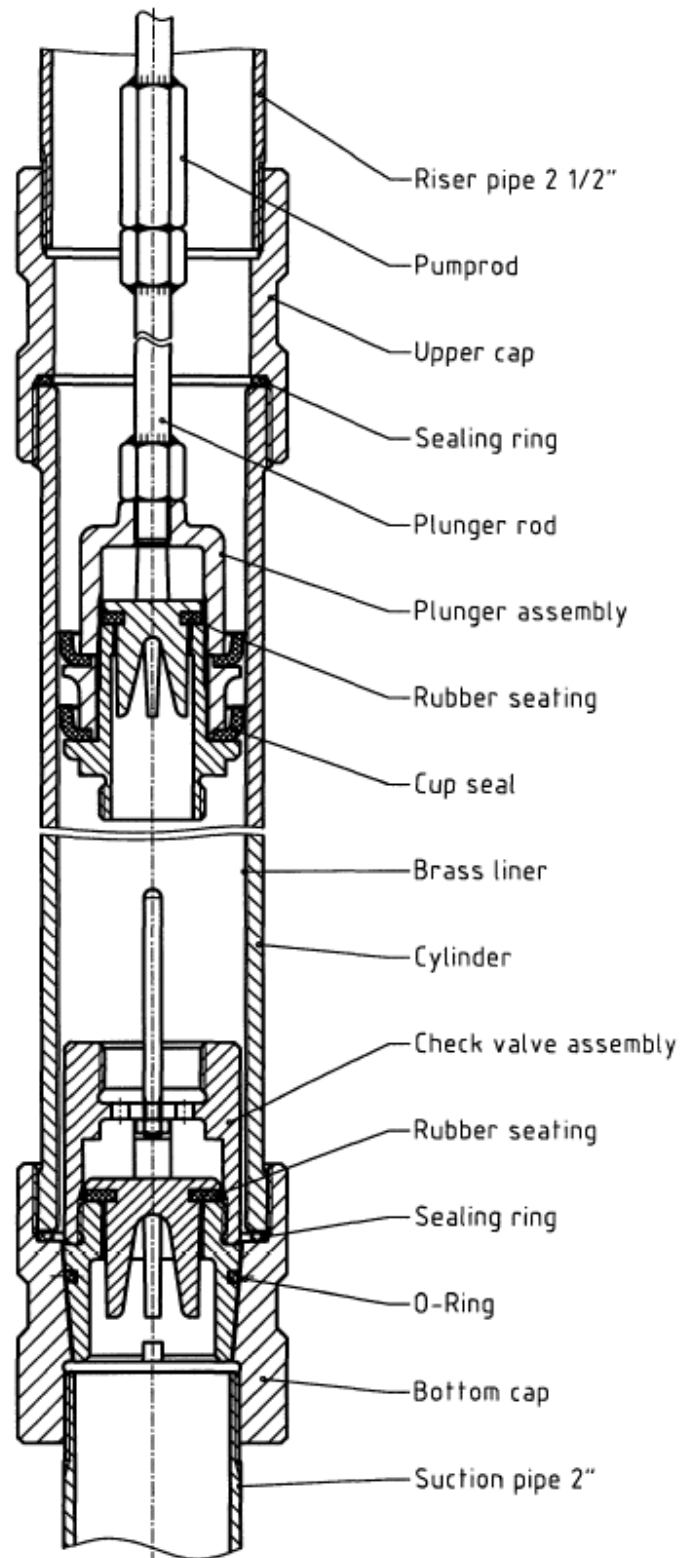


Senegal

Drawing of an India Mark III Pump installed on a Borehole



Drawing of the India Mark III Pump Cylinder



General Comments

Sustained safe drinking water supply and sanitation facilities are essential to improve the living conditions of the rural population. The provision of safe water helps to combat water borne diseases and improves community health in general. Benefits of a safe water supply can reach far beyond considerations of public health and have a positive influence on the general well being, economic status and quality of life in a community.

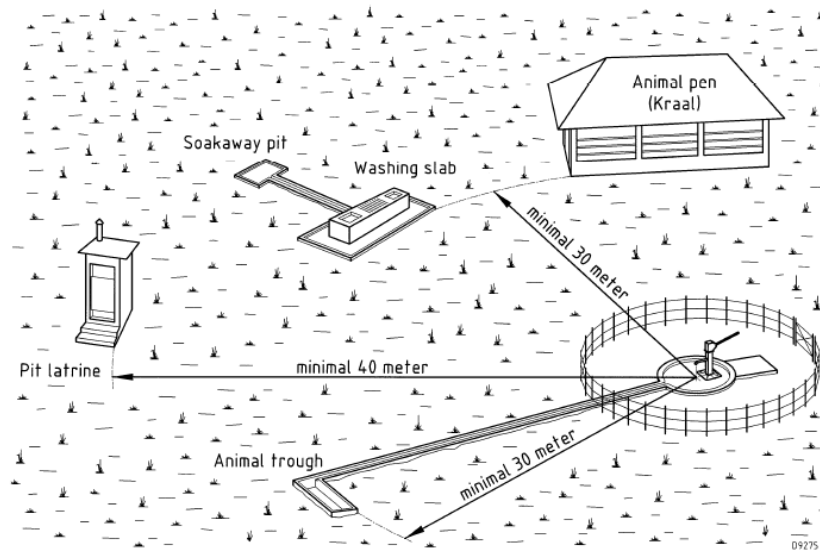
Protection of Water Source

If a well site is chosen and the well drilled (or dug) into the ground at a site which is elevated and away from water logged areas during the rainy season, the water which percolates from an underground aquifer into the well should be pure enough to drink.

However, a water point obviously attracts a great deal of human contact. This is a potential source of contamination and should be protected against. The safety measures are as follows:

Well Siting

- The well should be in an elevated place, so that during the rainy season the water will run away from it, rather than into it,
- It should be at least 40 meters away from a latrine and uphill of the latrine,
- It should be at least 30 meters away from a cattle kraal, and uphill of the kraal,
- It should be well away from any depressed area in the ground, such as hollows used for rubbish dumping, hollows used for brick making or any other areas where water might collect.



Hygiene Education and Water Supply

Throughout the water supply process, it is vital to bear in mind the important linkages between health, hygiene education and water. An awareness of the intimate relationships between these factors should be made clear to all water users.

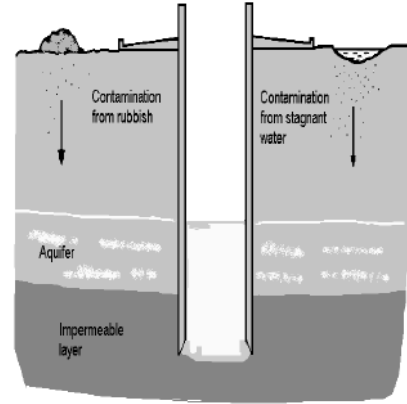
Before the arrival of a new or improved water supply system, the water users of a village should receive hygiene training with regard to the collection, storage and use of water.

For example, the transmission of diseases through contaminated water may not be understood in the community.

Cleanliness in the area of the water point is an important factor in the overall impact of the introduction of a new or improved facility.

If the surrounding area is not kept clean and free of animals, debris, waste and stagnant water, the water point could become a hub for the transmission of many infectious diseases.

In this respect, the ability of the community to manage the system and ensure regular cleaning of the water point is vital.



Tools and Materials

All tools can be bought at La Colobane in Dakar. Standard spanners can easily be bought in any town around the country. French names are attached along with reasonable prices.

Pipe vice



Two stillsons, 24''



Rod vice (#4)



Chain support (3 1/2" x 1 1/2")



Two round spanner 19mm



Two flat spanners 17mm



Two adjustable spanners



Lockjaw



English name	French name	Price (FCFA)
Pipe vice	Etau a tuyau	35,000
Stillsons	Cles a griffes	15,000 each
Rod vice	Etau a tige	12,500
Chain support	Cravate a chaine	1,000 at a welder's
Standard spanners 19 & 17mm	Cles # 19 & 17	1,500-2,000 each
Adjustable spanners	Cle a molette	4,000 each
Lockjaw	Pince etau type Americain	4,000

Part 2 Maintenance and Repair

Preventive Maintenance

Every pump owner, caretaker or the user committee is responsible for preventive maintenance of the water point (handpump including surrounding) and therefore is entitled to receive regular training from the supplier of the handpump. However, the India Mark II Pump is not a VLOM handpump (VLOM = Village Level Operation & Maintenance) and therefore most interventions need to be done with the help of an Area Mechanic.

Preventive maintenance means regular check-up of the handpump at a fixed time interval and changing of spare parts before they are fully worn.

As an example; if the estimated lifetime of a cup seal is one year, the cup seal will be changed after a period of one year even if it is still functional. If during a preventive maintenance check a check valve leakage is noticed, the caretaker must contact the area mechanic. He should carry out repairs in the check valve even though the pump has not broken down.

Such interventions help in preventing the sudden failure of the pump.

Time Intervals of Preventive Maintenance Interventions

Monthly Checks (made by the Pump Users)

- Check all Flange bolts and nuts for tightness (8 off),
- Check that Handle axle nuts and Chain bolt and “Nyloc” nut are tight,
- Grease the Chain,
- Repair holes and cracks on pump platform,
- Clean drainage and repair cracks,
- Clean the pump surroundings and repair the fence.

Tree monthly Checks (made by the Pump Users with assistance of a Pump Mechanic)

- Check if any fasteners of the pump are missing - if so, add the missing parts.
- If any unusual noise is noticed, check reason for the same (worn ball bearings or scratching of bent pumprods). Contact area mechanic for replacements.
- Check if the Pump stand is shaky during operation. If yes, the stand is loose in the foundation and contamination of the well can take place. Take corrective measures to improve the foundation.
- Check if there is leakage in the pump. If more than 10 strokes are required before water flows from the spout, it means the pump is leaking beyond an acceptable limit. This needs to be attended to. It may be necessary to replace a Rubber seating, a Sealing ring or attend to a leaking joint in the Rising main. For attending to a defect of all “Down Hole Components” you need the help of the area mechanic with his special equipment.

However, a special leakage test can be conducted by the pump users themselves, prior to the notification to the area mechanic.

- Carry out a “Leakage- and Discharge Test” (see [Page 26](#)).

Yearly Replacements

- Dismantle “Above Ground” and “Below Ground Components”.
- Replace Rubber seatings (Upper valve and Lower valve), Cup seals (2 off) and sealing rings (2 off).
- Replace Ball bearings.

Please Note: If one of the replaced components is still in good shape, spare it for emergency replacement (in case a new spare part is not immediately available).

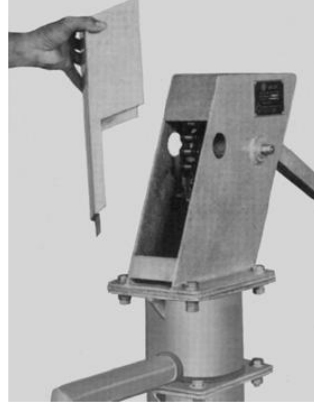
Dismantling Procedure Sequences

A) Dismantling the "Above Ground Components"

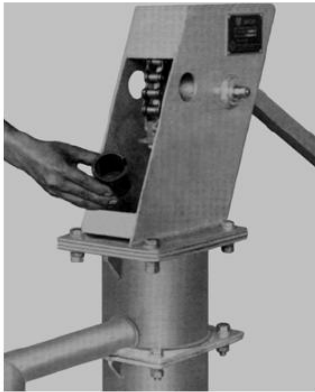
Step 1 Loosen Front cover bolt.



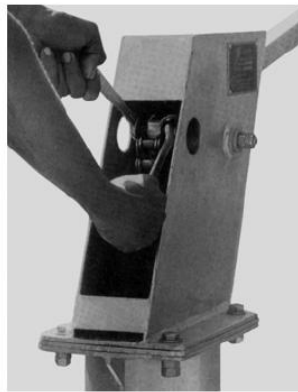
Step 2 Remove Front cover from Pump head.



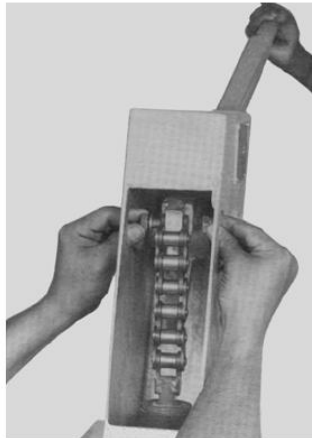
Step 3 Lower Pump handle, put Chain support below the Chain assembly.



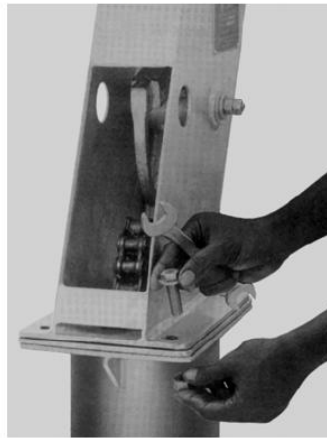
Step 4 Lift Pump handle to top position and loosen "Nyloc" nut with spanners.



Step 5 Remove the "Nyloc" nut from bolt and remove Chain from the Handle.



Step 6 Loosen and remove bolts and nuts connecting Head and Water tank.



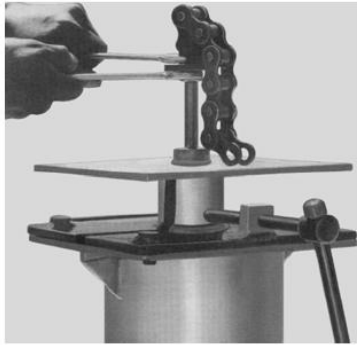
Step 7 Lift and remove Head assembly (chain passes hole in Head flange).



Step 8 Lift Third plate with Pumprod assembly and insert Rod vice.



Step 9 Place Third plate on Rod vice, take off the Chain support and remove the Chain assembly.



Step 10 Unscrew check nut and remove Third plate assembly.



B) Dismantling the "Below Ground Components"

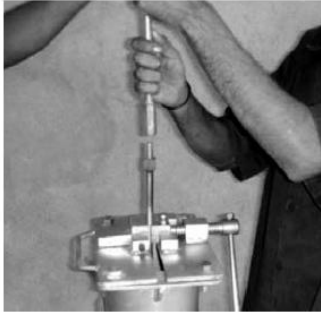
Step 1 Attach Rod lifter to Top rod, hold Rod lifter and remove Rod vice.



Step 2 Lift Pumprod assembly by hand until next connection is about 30 cm above the Water tank. Introduce Rod vice and clamp Pumprod securely in this position.



Step 3 Open the connection with two spanners and remove the rod.



Step 4 Continue this procedure until the Plunger rod with Plunger is removed.



Step 5 Remove all bolts between Water tank and Pump stand.



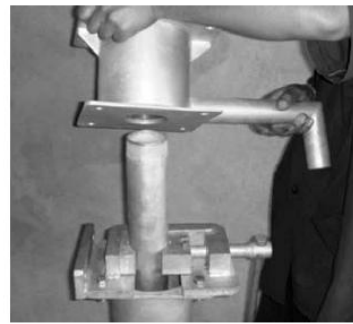
Step 6 Attach a short piece of a Riser pipe to the Water tank socket.



Step 7 Lift Water tank upwards (30 cm) and introduce and fasten Pipe vice.



Step 8 Unscrew and remove Water tank by turning the Spout by hand.



Step 9 Pull up Rising main with Lifting spanners (Socket 30 cm high).



Step 10 Tighten the Pipe vice, unscrew the pipe connection and remove pipe.



- Step 11** Continue with this procedure until last pipe with cylinder is retrieved.



Dismantling the “Below Ground Components” with the help of a Tripod and Chain block or Pulley with Rope

- Step 1** Attach Pipe clamp to Riser pipe and connect it with the hook of the Chain block.
- Step 2** Lift chain until tight and then open Pipe vice slowly and remove it.
- Step 3** Lift Rising main pipe until next Socket (about 30 cm above Top flange of Pump stand).
- Step 4** Introduce Pipe vice and secure the Rising main securely.
- Step 5** Remove Pipe clamp and open first Riser pipe with two pipe wrenches.
- Step 6** Remove Top pipe and fasten Pipe clamp on protruding Riser pipe.
- Step 7** Connect Pipe clamp to the hook of the Chain block again.
- Step 8** Continue this procedure until the whole Rising main is dismantled.
- Step 9** The Cylinder can then be removed from the last Riser pipe.

Dismantling the Pump cylinder

- Step 1** Both caps of Cylinder can be unscrewed and the Plunger & Check valve removed.
- Step 2** Plunger & Check valve can also be dismantled to replace worn parts like Cup seals, Rubber seatings and O-ring (see also “Preparation of Pump cylinder on [Page 13](#)).

Once the defective pump components have been replaced and the pump is re-assembled again, explain to the pump users what the problem was and why the break down happened.

Assembling of plunger

Step 1

Place Rubber seating to the Upper valve.



Step 2

Attach a Cup seal to the lower part of the Spacer.



Step 3

Attach another Cup seal at the top of the Spacer.



Step 4

Introduce the Follower into the Spacer and ...



Step 5

...place the Upper valve on top of the assembly.



Step 6

Attach Plunger body and tighten securely.



Step 7

Take Plunger rod and tighten it to the Plunger assembly.



c) Assembling of Check valve

Step 1

Place O-ring to the groove of the Check valve seat.



Step 2

Place Rubber seating to the Check valve.



Step 3

Insert the Check valve into the Check valve seat.



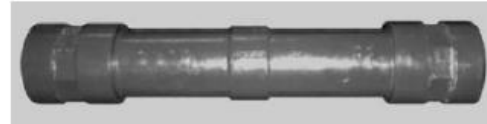
Step 4

Attach the Cage with Push rod and tighten it securely.



d) Assembling of Cylinder

Prior to assembling check cleanliness of Cylinder liner and clean all threads and prepare them with sealing fluid or hemp fibre with grease.



Step 1

Place Sealing ring in the Bottom cap.



Step 2

Screw Cylinder pipe with liner to the Bottom cap.



Step 3

Place Sealing ring in the Upper cap.



After applying hemp fibres with grease or sealing fluid to the threaded ends of the Cylinder, attach a Bottom cap and a Upper cap and fasten the caps tightly (see below).

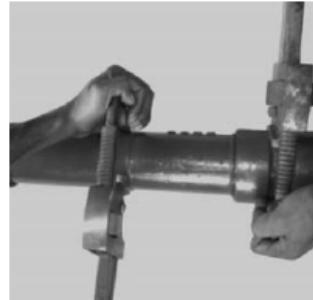
Step 4

Attach Bottom cap and Upper cap by hand.



Step 5

Fasten Bottom- and Upper cap securely with pipe wrenches.



e) Leakage test of Cylinder

Before the installation of the "down hole components" takes place, check first the assembled Cylinder for leakages. Proceed as follows:

Step 1

Connect Plunger assembly to the thread of the Check valve assembly.



Step 2

Introduce the whole assembly into the Cylinder assembly.



Step 3

Place Cylinder in a bucket with water and proceed as described below.



Additional comments to Step 3:

- Immerse the suction part of the Cylinder into a bucket filled with clean water,
- Make sure that the cone of the Check valve is sitting tight in the Bottom cap,
- Dis-engage the Plunger from the Check valve by turning it "anti clock-wise",
- If Plunger is free, operate the protruding Plunger rod up and down,
- As soon as the Cylinder is filled with water, place it in a vertical position and check for any leaks,

Be aware that a small amount of water is dripping from the outer surface of the Cylinder. Wait therefore for some minutes until the Cylinder surface is dry, not to assume any dripping water automatically as leakage.

If there is any leakage, try to tighten Bottom cap and Upper cap or check proper location of Check valve, before dismantling the Cylinder for finding the reason of the leakage.

Once the Cylinder is water tight, the installation of the "down hole components" can start.

B) Preparation of “Above Ground Components”

a) Assembling Pump Handle



Step 1 Fit one Ball bearing on the Bearing mounting assembly.



Step 2 Introduce the mounting assembly into the Bearing housing of the Handle.



Step 3 Introduce the Spacer from the other side of Bearing housing.



Step 4 Fit the second Ball bearing in the Bearing housing.



Step 5 Introduce the Pressure plate onto the Bearing mounting assembly.



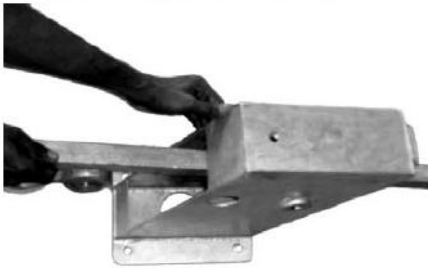
Step 6 Add M12 nut and screw the Bearings fully together (with 19 mm spanners).



Step 7 After removing the Bearing mounting assembly, the Pump handle is ready for assembling with the Pump head.

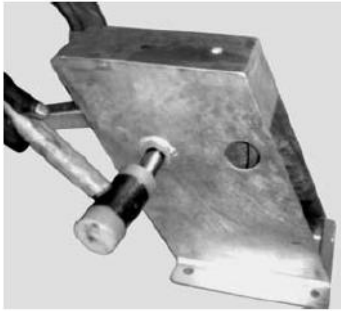
b) Assembling Pump Head

Step 1 Introduce Pump handle assembly into the Pump head assembly,



Step 2 Push the Handle axle through the Axle bushes of the Head assembly and the Ball bearings of the Handle assembly.

Step 3 Knock the Handle axle gently with the hammer into the end position.



Step 4 Push Axle washer over the protruding thread and tighten it with an M12 nut.



Step 5 If Pump handle is moving smoothly, use a second nut as a Check nut to secure the correct position.



Step 6 Fasten the Check nut with two 19 mm spanners.



Maintenance of Pump Surrounding

Handpumps with platforms offer a good protection, because they seal off the well from external sources of contamination. However, even when handpumps are fitted, contaminations can still pollute the well through:

- a) Cracked platforms and drainage channels,
- b) Stagnant water near the well,
- c) Animals (and human) excrements too close to the well (no fence),
- d) Waste and other sources of contamination too close to the well.

It is the important task of the **Handpump Caretaker** to:

- a) Check the platform for cracks and do the necessary repair,
- b) Eliminate stagnant water by filling the dents and holes with earth,
- c) Maintain the fence around the water point, so that no animals have access,
- d) Keep the surroundings clean and tidy at all times,
- e) Instruct the pump users how to use the pump and how to keep the pump surroundings clean.

(See also chapter Well Siting and Hygiene Education and Water Supply on [Page 7](#))

Platform Maintenance Tools

The following tools are recommended for regular maintenance of platforms:

- a) Hammer and chisel for opening cracks and for taking off weathered and bad quality cement,
- b) Bucket - for measuring cement, sand (gravel) and water,
- c) Shovel - for mixing the concrete,
- d) Trowel - for applying the concrete mix.

Instructions for mixing Concrete for Platform Repair

Mixing of concrete

As measurement can be used a bucket, shovel or trowel, depending on how much concrete is needed.

1. Fill **1 measurement of cement** and pour it on a hard smooth surface preferably on the platform,
2. Fill **2 measurements of sand** pour this onto the cement,
3. Mix the cement and sand until the mixture is a uniform colour,
4. Fill **3 measurement of gravel** and pour it onto the sand/cement mixture (gravel can be made by crushing rock with a hammer),
5. Turn the mixture over three times,
6. Form a crater in the middle of the pile and add water in the crater, being careful not to add too much water. If you need water you can always add some more later,
7. Carefully turn the concrete on the side of the crater into the water. Don't let the water spill over or it will wash away the cement,
8. Turn the pile over until it is moist and uniformly mixed with the water; the concrete should be dense and just moist,
9. If the concrete is too dry, make another crater in the middle of the mixture and add a little more water,
10. If the concrete mix is too wet, add more cement, sand and gravel, do not add only cement or sand.
11. Remember that the **Curing time for the concrete is seven (7) days**, therefore the platform has to be protected for seven days and the new concrete has to be kept wet throughout the seven days in order to receive the required strength.

For more information about constructing platforms for handpumps please consult the two manuals:

- a) Platform for Handpumps on Boreholes and
- b) Platform for Handpumps on Dug wells.

Annexes

Annex 1

Trouble Shooting

Trouble	Possible Causes	Remedy	Who
Pump works easily, but no flow of water	Worn cup-seals	Pull out rising main, open cylinder and replace all worn cup-seals	Pump mechanic
	Water level dropped below cylinder	Add more riser pipes and pumprods	Pump mechanic
	Broken chain	Replace chain	Pump users
	Check valve jammed (not closing)	Pull out rising main, open cylinder, check function of check valve and make replacements if needed	Pump mechanic
	Pumprod disconnected	Pull out rising main and join disconnected pumprods	Pump mechanic
Delayed flow or little flow of water	Check valve leaking	Pull out rising main, open cylinder, check leaking of check valve and make replacements if needed	Pump mechanic
	Worn sealing rings	Pull out rising main, check sealing rings and make replacements if needed	Pump mechanic
	Worn cup-seals	Pull out rising main, open cylinder and replace all worn cup-seals	Pump mechanic
	Damaged rising main (leaking pipe threads or severe pipe corrosion)	Pull out rising main, check all riser pipes and make replacements if needed	Pump mechanic
Folding of chain during down-stroke	Plunger jammed inside cylinder	Pull out rising main, open cylinder, check size of plunger and cylinder and replace wrong or defective components	Pump mechanic
	Top rod too long, plunger is sitting on top of the check valve	Take off pump head, check correct length of pumprod assembly and trace top rod if needed	Pump mechanic
Noise during pump operation	Lack of grease on chain	Grease chain	Pump user
	Worn ball bearings	Replace ball bearings	Pump mechanic
	Shaky foundation	Check foundation and make necessary repair	Pump mechanic
Shaky pump handle	Loose handle axle nuts	Tighten handle axle nuts	
	Worn or damaged spacer	Replace spacer	
	Worn or damaged axle	Replace handle axle	Pump mechanic
	Worn ball bearings	Replace ball bearings	Pump mechanic
	Bearings loose in bearing house	Replace handle assembly (for possible repair)	Pump mechanic