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India Mark II and III handpumps

Manual of site selection and construction of borehole

This manual has been prepared by UP Jal Nigam, Lucknow and designed and published by PSU Foundation, Lucknow.

Diagrams on pages 39-48, 54-57 have been reproduced from :

i. *Indian standard*
Code of practice for installation and maintenance of deepwell handpumps
Part 1 : Installations
IS 11004 (Part 1) : 1985

ii. *Indian standard*
Deepwell handpumps (VLOM) specifications
IS 13056 : 1991

iii. *Indian standard*
Deepwell handpumps specifications (third revision)
IS 9301 : 1990

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INTRODUCTION

The need for safe drinking water

Unsafe or contaminated water is the cause of many fatal and dangerous diseases. Approximately 75 to 80 percent of diseases are caused by use of contaminated water. Millions of people, particularly children, die due to water-borne and water-related diseases like cholera, typhoid, dysentery, diarrhoea, gastro-enteritis, infectious hepatitis, guinea-worm, malaria, filaria, brain fever, etc This emphasises the need for safe water for human consumption. As such, it becomes the primary duty of a Public Health Engineer to ensure that the source of water selected for community water supply is not polluted, or, if polluted, is made free of pollution before it is conveyed to the community

The main sources of water are surface sources i e. the water available on the surface of the earth through rivers, rivulets, springs, impounded reservoirs, ponds, etc., and underground sources, i.e. the water obtained from shallow open wells, bore holes, deep wells and infiltration galleries.

Industrialisation and rapid population growth in developing countries have increased the demand for water as well as the chances of contamination of surface sources and, to some extent, underground sources

In rural areas in India water is generally drawn from open wells, ponds and rivers and is used for drinking and other purposes without first making it free from contamination For drinking water in rural areas, such an arrangement has to be provided which is free from contamination and can be safely used by the population. The India Mark II and Mark III handpumps are such arrangements through which safe drinking water to the community can be supplied economically on account of their being installed down to the second strata, which normally remains free from contamination.

India Mark II and Mark III handpumps

The India Mark II handpumps is a safe and economical system of supplying water to the community, and has been used successfully for the last ten years or so. The conventional shallow handpump, which is also in use in urban and rural areas, has several drawbacks such as

- Very low discharge beyond 8 metres depth
- More wear and tear, hence more break-downs
- Requires greater manual effort in operation.
- Yield is insufficient for serving the community

While trying to overcome the above drawbacks and provide a dependable source of community water supply, UNICEF on the request of the Government of India, developed the India Mark II handpump in coordination with various government and voluntary agencies These handpumps are now- being used in different developing countries throughout the world The India Mark III handpump is a further development of the India Mark II handpump, where the diameter of the riser pipe is the same as that of the

cylinder, thus allowing the pump rod, piston and foot valve to be pulled up for maintenance without the need to dismantle the riser pipe.

Major assemblies and components

The four major assemblies of the India Mark II and Mark III handpump are :

Pump head assembly (above ground mechanism)
Fully hot galvanised fabricated steel structure consisting of head-handle assembly, water tank and stand assembly (pedestal). The only difference between Mark II and Mark III handpump is the size of the connector in the water tank.

Cylinder assembly
Cast iron body fitted on the inside with a seamless brass liner having excellent inner surface finish Plunger and foot valve components are of gun metal as per IS : 318-1981 with nitrile rubber buckets and sealing rings. The Mark III cylinder is different from that of the Mark II, in that it has a foot valve assembly that can be pulled up without removing the riser pipe or cylinder.

Connecting rods
12 mm diameter electro-galvanised mild steel bright bars (of length of 3.0 m) along with hexagonal coupling and locking nuts.

Riser pipe
32 mm nominal bore (NB) for Mark II and 65 mm NB for Mark IIIGI medium class pipe in 3 m standard length along with coupling sockets.
(***Ref : Diagrams 1(a) to 5(b); pp. 39-48***).

Advantages
In alluvial soil, a borehole fitted with a India Mark II/III handpump is considered an ideal source of safe drinking water for the following reasons :

- Technology is simple
- Per capita investment is comparatively low.
- Installation and maintenance at the village level is fast and easy
- Diesel, electricity, wind, etc., is not required for operation of the handpump
- Functions continuously throughout the day and is also sturdy.
- Limited space is required.
- Regular disinfection is not necessary. However, chlorination of borehole and handpump assembly at the time of installation, after major repairs below ground level or at the time of natural calamities like floods, etc., is imperative.

The other important positive features of India mark II/III handpumps are·

- The pedestal is grouted into the concrete platform which acts as a sanitary seal to prevent percolation of waste water into the bore well.
- Since there are no parts in the pump that wear out fast, the pump can withstand continuous operation by larger communities for longer periods.
- All steel components exposed to water and the atmosphere are galvanised for protection against corrosion
- A mechanical advantage of approximately 8:1 in the handle bar lever ensures operation with the least effort Even a child can easily operate the pump.
- With an improved brass-lined cast iron cylinder, failures in the cylinder are minimised.
- The use of chain link, sealed ball-bearings and high quality raw materials ensures years of trouble-free operation.
- It is capable of pumping water from wells as deep as 90 metres.

Limitations

The India Mark II/III handpump is generally suitable for lifting water from boreholes of depths ranging from 25 to 50 metres. For wells of greater depths (between 50 to 90 m) the modified extra deepwell version is recommended. This is because for depths of over 50 metres, the water discharge will be lower in proportion to the effort put in.

Working principle of India Mark II/III handpumps

Water comes out of the handpump when it's handle is moved up and down When the pump handle is brought down, the piston in the cylinder moves up and a vacuum is created inside the cylinder body, and therefore, the water around the cylinder inside the borewell rushes towards the vacuum space, opens the lower valve upwards and enters the cylinder

When the handle is lifted up and the piston in the cylinder moves down, the lower valve closes and water inside the cylinder body is pumped through the gap in the piston cage and the upper valve Thus, with continuous operation of the handle, water is pumped up through the pipes to the water tank of the pump and comes out through the spout.

Maintenance of India Mark II/III handpumps

Unlike shallow well handpumps, India Mark II or Mark III handpumps are not that easy to repair It requires sufficient know-how to dismantle and reassemble the parts. Therefore, either the maintenance of India Mark II/III handpumps should be entrusted to an expert agency, or the mechanic who is allowed to handle the handpump should be trained in its maintenance Spare parts must be of approved quality and from qualified suppliers.

PRE-SITE SELECTION CONSIDERATIONS

Selection of villages

Since funds are limited, villages will have to be covered in a phased manner by the community water supply system. `Problem villages' of habitations, as identified according to the criteria approved by the Government of India (as given below) should be given first priority.

Scarcity criteria

During the year 1972, to assess the problem of drinking water in the rural areas, the Government of India laid down the following criteria for villages with a drinking water problem ·

Category I
Villages not having an assured source of drinking water within a reasonable distance of 1.6 km or within a depth of 15 metres, below ground level. In hilly areas, villages where the difference of elevation between the habitation and water source is more than 100 metres.

Category II
Villages which have water sources that suffer from excess of salinity or iron or fluorides and other toxic elements hazardous to health.

Category III
Villages which are endemic to cholera, guinea-worm infestation, etc.

Mapping of the area

The water points in a village should be decided on the basis of actual field survey. A notional map (eye sketch) for an individual revenue village including each habitation/hamlet should be prepared, depicting the 1991 census population and the population belonging to the socially weaker sections of the society The following important details should be indicated on the map :

- Habitations belonging to the socially weaker section of the society
- Schools - primary, middle and secondary
- Hospitals - primary health centres and veterinary centres
- *Anganwadi* centres
- *Panchayat* ghar/office
- Market places
- Existing India Mark II/III and Tara handpumps
- Sanitary wells (traditional protected water source)
- Compost pits and public latrines
- Other features like natural drains, village ponds, etc.

The ponds and depressions should also be shown on the map for planning better waste water disposal points
(Ref : Map; p. 60)

Number of handpumps per village

The exact number of handpumps to be provided in a particular habitation/hamlet of a village will be decided based on the following criteria :

- As a first step, notional maps of each habitation/hamlet of a particular village should be prepared and studied thoroughly with respect to settlement pattern.
- One handpump per 250 persons (maximum) on the basis of design population should be provided. However, the maximum walking distance to any handpump should not exceed 150 metres from any household within the habitation/hamlet.
- In the village/habitation which has a population consisting of weaker sections along with other groups, the determination of number of handpumps should be worked out separately for the weaker sections and for the remaining population.
- Each habitation/hamlet having a minimum of 10 households or population of a minimum of 50 persons, should be provided with a separate handpump.
- Water points should also be provide for public institutions such as schools(primary, middle and secondary school), hospitals (primary health centre and veterinary hospital), *Anganwadi* Centres and market places in the close vicinity of the village. Taking the above factors into consideration, the number of handpumps should be worked out separately for every habitation/hamlet of the village.

Disposal of waste water

Water should not be allowed to collect around the handpump. Otherwise the area will soon become unhygienic and a breeding place for mosquitoes, which transmit malaria, filaria and brain fever. Drainage, therefore, is one of the vital aspects to be considered for the proper placement of a handpump. As a general principle, the handpump should be provided on a higher elevation. The natural ground slopes and the location of existing natural drains/water sources should be examined. However, at certain locations it may not be possible to connect the handpump with the natural drainage. In such circumstances, alternatives should be carefully worked out so as to either utilise the waste water for irrigation on a piece of waste land or provide a soak-pit at a distance not less than 6 metres from the pump ***(Ref : Soakpit; p. 33)*** Consent in writing from the owner of the land, through which the drain passes where the soak-pit is provided, should be obtained.

SITE SELECTION

Social aspects

Once the village has been selected and the notional map drawn according to the given criteria ***(Ref : Selection of villages; Mapping of the area; Number of handpumps per village; pp. 4-5)*** as a first step, the social scientist with a junior engineer should visit the proposed handpump sites marked on the notional map. The villagers residing (especially women) around the handpump site may be individually contacted and their responses, reactions and suggestions may be invited. To decide the location of the most suitable site, a meeting may be convened of the users around the handpump.

The site should be conveniently accessible to the potential users. No handpump site should be selected on a private or disputed land, unless it has been agreed with the land owner in writing that the handpump will be used as a public amenity. The handpump should be so located that it may not fall prey to vandalism or destruction. The handpump should not be located in front of a liquor shop, nor should it be located at the boundary of two habitations belonging to two different socio-economic groups

Community participation

Right from the time of selection of sites for proposed handpumps in the villages, the community should be encouraged to participate in selection of sites and proper maintenance and upkeep of the handpumps. Handpump level and village level committees or *Jal Samitis* should be formed at the level of each handpump in each village.

The approach to seek people's participation in site selection as well as proper maintenance of handpumps should be one of humility and openness, the idea being never to impose one's point of view but always to suggest, keeping the community's socio-cultural background in mind.

Handpump level committee

The time of selection of sites for the proposed handpumps is a good starting point to form a handpump level committee. This committee will not only be responsible to the users of a particular handpump, but will also link up with the *Jal Samiti* at the village level

A handpump level committee consists of a minimum of 5 members of whom at least 2 are women. One or two members of the committee will be given training in preventive maintenance as handpump caretakers

Functions Of handpump level committees

- To ensure proper use and upkeep of the handpump.

- To ensure full support to the caretakers in preventive maintenance, recording of defects and also in sending information to Jal Nigam to undertake below-ground-level repair/maintenance.
- To encourage users to keep the platform and surroundings clean, and to maintain it with the co-operation and collective efforts of the community.
- To determine necessary requirements for waste water disposal and environmental sanitation. Further, to give advice on proper construction and maintenance.
- To regularly monitor water quality and request Jal Nigam for periodic water testing
- To ensure that users not only take safe water from the handpump but maintain its quality during its handling and storage till final consumption
- To ensure efficient service by occasionally checking and greasing the chain, bolts, nuts and bearings and cleaning the dirt through the slit provided in the head assembly.
- To educate the children in personal hygiene and the proper handling of the handpump.

Village level committee

For the site selection and for the maintenance of handpumps village level water committees will be involved. The villages already have a legally constituted local authority i.e the *Gram Panchayat.* The activities entrusted to the *Gram Panchayat* are so many that a separate village level water committee will be required to support them in issues related to water and sanitation.

A village level committee should have as many members as the number of handpumps in a village, each one representing one handpump committee and at least half the members should be women.

Functions of village level water committee

- To assist Jal Nigam in the selection of socially acceptable and technically suitable sites for handpumps.
- To maintain close rapport with Jal Nigam for efficient services in case of major repairs.
- To identify and recommend persons for training to be imparted by Jal Nigam on the proper maintenance of handpumps.
- To hold meetings with handpump caretakers regularly and monitor the status of water supply, quality of water and cleanliness around the handpump
- To identify measures for waste water disposal in consultation with Jal Nigam.
- To undertake social awareness drives for upgrading the sanitary conditions all around the village.
- The village level committee shall be empowered to raise voluntary funds from the handpump users, in order to meet the expenses for proper maintenance of handpumps

This village level committee will procure handpump spares, tool kits, grease, etc , which are essential requirements for the maintenance of the portion of the handpump which is above the ground level, either from the local Jal Nigam division or through suppliers approved by Jal Nigam.

After the final selection of a particular handpump site, the Junior Engineer/Social Scientist will fill up the format of site location This format shall be signed by the Junior Engineer, Social Scientist and 4 to 5 potential users of the handpump.

Technical aspects

Geohydrological aspects

In certain areas, groundwater is not easily available and not every borehole yields water. In such cases, before deciding the location for the installation of the handpump, a geohydrological survey should be carried out and probable sites should be identified on the basis of the following details:

- Depth, discharge and type of strata encountered during the boring of tubewells and dug wells that exist in the vicinity of the proposed water point
- Lowest water level (draw down during summers should also be accounted for).
- Local flood level and general ground level.
- Quality of water.

The quality of water of existing tubewells, handpumps, dug wells etc., should be analyzed according to the following parameters:

- Presence of salinity.
- Presence or absence of fluorides
- Presence of iron and manganese.

Some extra sites should also be identified so that in case of failure on certain locations, alternative locations may be tried Sufficient space should be available for free movement of the tools and plant and for setting up of boring/drilling machines at site. The parameters indicating physical and chemical quality of water should not exceed the limits given in **Table 1**.

Table 1 : Quality Standards

The physical and chemical quality of water should not exceed the limits shown in the table below:

S.No.	Characteristics	Acceptable	Cause for Rejection
1.	Turbidity (units on JTU scale)	2.5	10.0
2.	Colour (units on Pt - Co scale)	5.0	25.0
3.	Taste & odour	Unobjectionable	Objectionable
4.	pH	7.00 to 8.50	<6.50 and >9.2
5.	Total dissolved solids (mg/l)	500.00	1500.00
6.	Total hardness (mg/l) as $CaCo_3$	200.00	600.00
7.	Chlorides (as Cl) (mg/l)	200.00	1000.00
8.	Sulphates (as So_4) (mg/l1)	200.00	400.00
9.	Fluorides (as F) (mg/l)	1.00	1.50
10.	Nitrates (as NO_3)	45.00	45.00
11.	Calcium (as Ca) (mg/l)	75.000	200.00
12.	Magnesium (as Mg) (mg/l)	30 00	150.00
	If there are 250 mg/l of sulphates, Mg content can be increased to a maximum of 125 mg/l with the reduction of sulphates at the rate of 1 unit per every 2 5 units of sulphates.		
13.	Iron (as Fe) (mg/l)	0.10	1.00
14.	Manganese (as Mn) (mg/l)	0.05	0.50
15.	Copper (as Cu) (mg/l)	0.05	1.50
16.	Zinc (as Zn) (mg/l)	5.00	15.00
17.	Phenolic compounds (as Phenol)(mg/l)	0.001	0.002
18.	Anionic detergents (as MBAS) (mg/l)	0 20	1.0
	Toxic Materials		
19	Arsenic (as As)/(mg/)	-	0.05
20.	Cadmium (as Cd) (mg/l)	-	0.01
21.	Chromium (as hexavalent Cr) (mg/l)	-	0.05
22.	Cynaides (as CN) (mg/l)	-	0 05
23.	Lead (as Pb) (mg/l)	-	0.10
24	Selenium (as Se) (mg/l)	-	0.01
25.	Mercury (total as Hg) (mg/l)	-	0.001
26.	Polynuclear aromatic hydrocarbons	-	0.2 ug/1
	Basic Activity		
27.	Gross Alpha activity	-	3 Pci/l
28.	Gross Beta activity	-	30 Pci/l
	Pci = Pico Curie		
	Bacteriological Standards		
	E Coil count should be zero in any sample of 100 ml and coliform organisms should not be more than 3 per 100 ml. If repeated samples show the presence of coliform organisms, steps should be taken to Isolate and remove the source of the pollution. If coliform exceeds 3 per 100 ml the supply should be disinfected.		

Expected yield of the well

The capacity of the well may be determined either by the discharge method or by the recuperation method

Discharge method

Using a pump discharging at a constant rate, water level is lowered in a well at intervals of time the water level is noted. The discharge equation for this method will be .

$P\Delta t = A\Delta h + Kh\Delta t$ where

P = Steady rate of pumping
K = Specific yield of the well
Δt = Interval of time
A = Area of section of the well
h = Average draw down during the
Δh = Depression during the interval Δ t

Hence we can work out the value of K for each set of observation. When the water level is maintained constant after a particular draw down the equation becomes :

$P\Delta t = Kh\Delta t$
or $P = Kh$

Recuperation method

This is usually adopted in continuation of the previous method. When the water level is lowered down over a significant depth, the pumping is stopped and the water level is allowed to rise. The time for the rise of the water level for small intervals of Δh are noted The equation for this method is derived from the previous equation with P = o and t taken as negative i e $A\Delta h = Kh\Delta t$

In case of small dia. tubewells such as used for handpumps, a 1 HP air lift pump with a generator set of 1 KVA may be used to lower the water level. For measurement of water level at different interval of time, an airline with pressure gauge will be used.

Waste water disposal/drainage

A site for the water point should be so selected that waste water does not collect around the handpump. The ideal solution is to channel waste water into a garden, pond or to some other point where the excess water may be discharged through a drain. ***(Ref : Diagram 6; p. 49)*** No formula or pre-defined solution can be spelled out for the drainage of every location but in general, while selecting a handpump site, one or more of the following should be within a reasonable distance to ensure disposal of waste water

- Kitchen garden/garden
- Pond
- Field (agricultural field)
- Pit (permanent in nature)

If these are not available, the next best solution is to construct a soak-pit at a distance not less than 6 metres from the pump.

The various considerations to be kept in mind for selecting the ultimate disposal of waste/excess water are·

- Ultimate disposal should be within a reasonable distance of the handpump.
- Normally it is not required to cut across a road/drain, but when necessary proper crossing should be provided.
- The ultimate disposal point should not be open to flooding/water logging.
- The waste/excess water should preferably be put to community use.
- By itself it should not create environmental/pollution problems for the community.

The waste water can be used for irrigation on waste land for growing plants. Though drainage is a very important aspect in selecting a suitable site, a proper balance has to be struck so that the handpump may not be out of reach of the potential families. It will be advisable to try out various alternatives of disposal discussed earlier.

Drain construction

The handpump site should be located preferably at a higher point than the general surroundings, so that waste water may not accumulate around the handpump and may easily drain to a final disposal point. Where a drain crosses the road or another drain, due care must be taken to provide a suitable pipe underneath the road.

Soak-pit

Suitable land at a reasonable distance, if available for construction of the soak-pit may be connected by an underground drain or a pipe

Bathing and washing platforms

While selecting a site, it should be ensured that there is ample space for the other water related activities like the construction of separate bathing or washing platforms, near the handpump It is recommended that a separate bathing and washing platform, equipped with proper drainage, at a distance of not less than 3.0 metres from the handpump platform be provided, and the cost of the same be borne by the users

Minimum distance

The handpump site should always be located at a reasonable distance from individual households to avoid nuisance to the individual property. This also limits the possibilities of the handpump being used as an individual property. A distance of about 6 metres should be ensured as far as possible.

Parallel to the road

A handpump next to a road should be installed parallel to it so that the handle does not cause any hindrance to the people or traffic passing by

Precautions against contamination

The handpump should not be located at a place where contaminated groundwater is likely to be met. To safeguard against possible contamination the following precautions must be followed:

Safe distance of drinking water source from leaching pit should be as follows :

- Site should be at least 10 metres away from the compost garbage.
- Site (platform) must be above the high flood level.
- The minimum horizontal distance from any source of pollution in different soil condition, should be as per the table given below:

Table 2

S.No.	Ground water level below ground	Effective size of soil formation	Minimum horizontal distance from the source of pollution
1	> 2 m	< 0.2 mm (fine sand, clay, silt)	3 m
2	> 2 m	> 0.2 mm (coarse sand)	3 m
3	< 2 m	> 0.2 mm	10 m
4	< 2 m	< 0.2 mm	10 m

INSTALLATION

After having selected the site, the execution work for installing an India Mark II/III handpump is taken up. For installation of the handpump, a borewell of 200 mm diameter is constructed for tapping the groundwater source. Normally, the depth of the bore is kept around 30-40 m depending upon the depth of the water bearing strata. The depth of the bore may be on the higher side, upto 60 metres depending upon the depth of suitable water bearing strata, but in no case should it be less than 25 m.

Due care of the possibility of the lowering of the general groundwater table in the area should be taken by consulting the records available with the Central/State Ground Water Board, and before the lowering of the assembly it must be ascertained that a minimum of 10 m water column is available over the cylinder assembly.

Procurement of materials required for India Mark II/III handpump

Materials required for installation of the handpump should be of the best quality according to relevant ISI specifications (***Ref : Table 3***) and should have proper inspection certificates.

Following sub-paragraphs describe the precautions to be taken while receiving supplies and in obtaining materials from the stores for construction work

Table 3 : Details of the relevant IS : codes for India Mark II and Mark III handpump works

S.No.	Details	Relevant IS Code	Authorised **Supplier/ Agency**
A.	**Procurement of materials**		
1.	**Handpump**		
a.	India Mark Deepwell handpump	IS 9301 : 1990	As approved by UNICEF
b.	India Mark III Deepwell	IS 13056 : 1991	and UP Jal Nigam
2.	UPVC pipe: 6 kg/cm^2		
a.	140mm/110 mm diameter	IS 4985 : 1981	As approved by UP Jal Nigam
b.	63 mm diameter	IS 4985 : 1981	As approved by UP Jal Nigam
3.	GI pipe (Riser Pipe)		As approved by UP Jal Nigam
a.	32 mm diameter (medium)	IS 1239 (part I): 1979	
b.	65 mm diameter (medium)	IS 1239 (part I): 1979	
4.	UPVC Ribbed Strainer:	IS 12818 : 1989	As approved by UP Jal Nigam
a.	63 mm diameter slot size - 0.2 mm		
B.	**Installation**	IS 11004 (Part I)·1985	As approved by respective circle and division of UP Jal Nigam
C.	**Packing & storing**	IS 12732 . 1989	As approved by UNICEF and UP Jal Nigam

Thus, all the materials should be received and stored in good condition and should be thoroughly inspected at the consignee's end. Inspection should be carried out soon after the receipt.

Packing and storing

Ensure that materials received in the stores are duly stamped by the authorised inspecting agents and are properly packed. Unless otherwise specified in the contract or order, packing should be as follows·

- The cylinders should be packed in wooden cases and the net weight of each case should not exceed 50 kgs.
- The pump head assembly should normally be wrapped in paper or open-ended polyethylene bags and straw/woodwool to withstand road transit.
- The connecting rods should be packed in bundles of 10. Each bundle should be wrapped in open-ended polyethylene bags and then with two layers of hessian cloth
- The riser pipe (32 mm or 65 mm dia. GI Pipe of medium quality) should be packed as per IS 4740 : 1979

Testing

Materials received in the stores should be tested before use. Testing should be done in the manner specified below.

Sampling

Unless otherwise specified in the contract/order, the procedure given in IS-2500 (part I) - 1975 should be adhered to.
In general, sampling is done by randomly drawing part of the material from the lot, which is considered to be representative of the entire lot.

Type test

Performance of the pump should be checked by placing the pump cylinder in a barrel of 200 litres water capacity The barrel should be fed with water at the rate of 20 l/min by means of suitable arrangements. The pump should be primed and the test should start only after getting continuous flow of water through the spout The water should then be collected in a container for 40 continuous strokes to be completed in one minute and the discharge thus measured should not be less than 15 litres (IS 9301 1990 and IS 13056 : 1991)

Visual and dimensional tests

- All the pumps should be examined for finish and visual defects.
- All dimensions of the assemblies should be checked and confirmed that they are as per IS specifications
- The handle should have a reasonably good surface contact with the bracket
- Riser pipe holder shall be checked for verticality The maximum allowable tilt is 1 mm for a 300 mm long plain mandrel screwed to the coupling (holder).

- The flanges should be reasonably flat to provide proper matching.
- The strokes of the pump should be 120 in 3 minutes.
- Connecting rod and plunger rod should be examined for straightness and formation threads. The hexagonal coupler should also be subjected to similar checks.
- Pump head and cylinder should be marked with the manufacturer's name, trade mark, batch number and serial number.
- The chain should be smeared with graphite grease prior to despatch
- One hexagonal nut should be attached to chain coupling to be used for locking the last connecting rod to chain coupling.
- Assembly should be checked for alignment of rod with respect to guide bush.
- The lateral play at the end of square section of the handle should not exceed 2mm on either side.
- The clearance between handle and bracket should not be less than 1.5 mm.
- Check valve and plunger valve should move freely after assembly.
- The cylinder assembly should be checked for leakage of water

Guarantee period

Any material found defective/rejectionable is liable to be replaced at supplier's cost within the guarantee period. Unless otherwise specified in the contract or order, normally guarantee periods for various components against bad workmanship or bad material are as under

- Pump and accessories : 12 months from the date of installation or 18 months from the date of supply, whichever is earlier.
- Leather/rubber components : 6 months from the date of supply.

Standard specifications

The pipes, fittings and other components should be as per Indian Standard Specifications and should be obtained from those firms which are approved by Jal Nigam/UNICEF Proper arrangements for storage of material should be made at stores as well as at sites.

As far as possible, the entire material required for a particular site should be procured and transported at one time, to avoid loss of time

Proper check should be adopted in using the materials at site. If any material is found defective or is of inferior quality it should be removed and kept separately to avoid inter-mixing with good material

For successful completion and good quality work it should be ensured that·

- the pipes, strainers and connecting rods do not have any cracks or undesirable dents,
- the threaded ends of GI pipes and connecting rods are intact and are in good condition Each and every pipe must be fitted with a HDPE cap at one end and with a socket at the other end,
- cement, bentonite, etc , are in a fresh and good condition.

Tools and plant required for boring of the tubewell and installation of India Mark II/III handpump

Checklist

A check list of tools and plant required should be prepared before taking the work in hand to avoid any hindrance and inconvenience in the work. ***(Ref : Table 4)***.

Tools and plant

Tools and plant required at site should be in satisfactory condition. Due care should be given to the following :

- Ensure that the legs of the tripod and wire rope of the boring set are capable of withstanding sufficient load and jerks during the process of boring and lowering.
- Threads at both ends of every casing pipe must be in good condition. The couplings should also be subjected to a similar check.

Table 4 : Tools required for Installation of India Mark II/III handpumps

S.No.	Details of Tools	Quantity
A	**List of Standard Tools**	
1.		
a	Pipe vice to suit 32 mm NB (India MK II)	1 No.
b	Pipe vice to suit 65 mm nominal bore (India MK III)	1 No.
2	Die set for 12 mm connecting rods	1 set
3.a	Die set for 32 mm nominal bore GI pipe (India MK II)	1 set
b	Die set for 65 mm nominal bore GI pipe (India MK III)	1 set
4	600 mm pipe wrench	2 No.
5	450 mm pipe wrench	1 No.
6	300 mm pipe wrench	1 No.
7	M17 x M19 double-ended spanners (10 x 12 mm)	2 No.
8	Screw Driver 300 mm long	1 No.
9	Screw Driver 150 mm long	1 No.
10	1 kg ball pane hammer with handle	1 No.
11	Hacksaw frame with spare blades 300 mm	1 No.
12	Pressure type oil can (1/2 pint with oil)	1 No.
13	Wire brush	1 No.
14	250 mm half round file with handle	1 No
15	250 mm flat file with handle	1 No.
16	0-9 number punch (6mm)+A-Z letter punch	1 set
17	Nylon rope (3 mm thick) 75m	75 m
18	Spirit level 300 mm	1 No.
19	Paint brush 12 mm	1 No.
20	Pipe stand	1 No.
B	**List of Special Tools**	
1	Tank pipe lifter	1 No.
2.a	Riser pipe clamp (self locking clamp) for 32 mm dia. pipe (Mark II)	1 No.
b	Riser pipe clamp (self locking clamp) for 65 mm dia pipe (Mark III)	1 No.
3	Coupling spanner	1 No.
4	Connecting rod lifter	1 No.
5	Handle axle punch	1 No.
6	Lifting spanner	3 No.
7	Chain coupler supporting tool	1 No.
8	Connecting rod vice	1 No.
9	Crank spanner	2 No.
10	Bearing seater	1 No.
11	Mirror 100 x 100 mm	1 No

Details of T & P required for boring of tubewell are mentioned in Table 7

Table 5 : Details of Material Required for Installation of India Mark II/III Handpumps

S.No.	Details of Materials/ Boring Tools	Quantity	Relevant IS Code	Approving agencies
a)	***Casing Pipe (Hand Boring)***			
1	150 mm dia. MS pipe 3 m long (for Mark II) 200 mm dia. MS pipe 3 m long (for Mark III)	40 m	IS: 4270 II revision MT 19(3875)	As approved by UP Jal Nigam
2	Tripod 6-9 m high	1 No		
3	Wire rope 12 mm dia.	60 m		
4	MS pulley 150 mm dia.	1 No		
5	Wooden clamps	1 set		
6	Crab wrench	1 No		
7	Bailer-125 mm dia OD Bailer 150 mm dia. OD - 150 mm India Mark II - 200 mm India Mark III	1 No		
8	900 mm chain wrenches	2 Nos.		
b)	***Hydraulic Jet Boring***			
1	40 mm dia. GI pipe	40 m		
2	Nozzle	1 No		
3	Water foot pump	1 No		
4	Swivel	1 No		
5	Tripod 6-9 m high	1 No		
6	Delivery and suction pipe material	20 m each		
c)	**Palm And Sludger Method**			
1.	40 mm dia. GI pipe	40 m		
2.	Cutter 6"dia /8" dia. - 150 mm India Mark II - 200 mm India Mark III	1 No		
3.	Wooden support for lever arm	1 No		
4	Balli 100 mm dia.	1 No		
5.	Jute/Nylon rope 20 mm dia.	20 m		
d)	***Lowering Of Permanent Housing***			
1.	PVC pipe with separate collars i) 110 mm x 6 kg/140 mm x 6 kg - 150 mm India Mark II - 200 mm India Mark III	24 m or	IS 4985 : 1981	
	ii) 63 mm x 6 kg	As per requirement	IS 4985 : 1981	
2.	PVC strainer 63 mm x 6 kg with 0.2 mm slot	1 No 3 M	IS 12818 1989	
3.	Blind pipe 63 mm x 6 kg PVC	1 M	IS 4985 1981	
4.	Blind pipe cap	1 No	IS 10214	
5	Reducer 110 mm x 63 mm (Reducer 140 mm for Mark III)	1 No		
6.	Solvent cement	As per requirement		

- Proper arrangements for storage of T & P should be made at the site of work.
- Ensure that the entire T & P required for successful completion of work are procured and transported at one time to the site of work to avoid loss of time and excess cost of transportation.
- Ensure that standard tools required for installation of pump as per IS 11004 (Part-I)· 1985 (**Code of Practice for Installation and Maintenance of Deepwell Handpumps**) are available at the site of work.

Boring of tubewell

The India Mark II/III handpump draws water from the deep water bearing strata which is free from contamination The purpose of the borehole is to facilitate penetration of a system of vertical pipes into the water bearing strata to ensure potable, durable and trouble-free water supply

For installation of a Mark II/III handpump, a borewell of 150 mm/200 mm diameter is constructed for tapping the groundwater source. Normally, the depth of the bore is kept in between 25 to 50 m, depending upon the depth of suitable water bearing strata, but in no case should the depth of the bore be less than 28 m. To obtain sufficient discharge and trouble-free functioning, the handpump must be installed over a vertical borehole. Every precaution has to be taken, therefore, in the proper selection of the boring site with respect to geohydrological aspects. Utmost care should also be taken to seal the tapped strata so that the contaminated water of the upper layer does not percolate downward.

Methods of boring

In alluvial soil, boring of wells for India Mark II/III handpumps is normally carried out by the following methods, according to the site requirements ·

1 Boring with casing pipe
2 Boring without casing pipe
   a Hydraulic jet boring method
   b Palm and pressure (Sludger) method
3. Boring partially with casing pipe and partially by sludger method.

Different boring methods discussed in this manual are suitable for alluvial formations generally found in the State of Uttar Pradesh and that too for restricted depths required for water supply through India Mark II/III handpump only For tubewell construction in rocky areas and for deeper drilling in alluvial formation required for piped water supply system, drilling is carried out by Rotary-Percussive Drilling (DTH) rig, Direct Rotary rig, Reverse Rotary rig, Percussion rig and other improved rigs as per requirement of site conditions. Such drillings are not dealt with in this manual (***Ref : Table 6***)

Table 6 : Comparison of the three boring methods

S. No.	Item	Casing Pipe method	Hydraulic Jet method	Palm & Sludger method
1.	Handling of equipment	Equipment is heavy	Equipment is light	Equipment is light
2.	Transportation of equipment	More transport facilities are required for transporting the casing pipe & tripod, etc	Less transport facilities required	Less transport facilities required
3.	Verticality vertical of Bore	Very accurate vertical bore can be formed	Less accurate vertical bore can be formed	Less accurate bore can be formed
4.	Geological formation	Suitable for sandy strata and alluvial soil. Not suitable for thick clay, hard pan, *'kankar'*	Quite suitable for thick clay, hard pan and *'kankar'*	Suitable for clay strata
5.	Time required	More time required	Less time require	Less time required
6.	Sampling	Strata may be precisely determined	Not so precise	Not so precise
7.	Depth of boring	40 to 50 m	80 to 90 m	30 to 40 m

Boring with casing pipe

Casing pipe method for drilling/boring of boreholes for India Mark II/ III handpumps in soft unconsolidated formation is the most suitable and reliable method. This method is not suitable for formations having hard pan or thick clay and *kankar.*

Method of boring - (*Ref : Diagram 7; p. 50*)

In the casing pipe method, the boring operation is completed in the following steps:

- A working pit of size 20 x 20 x 30 cm is dug with the boring spot as its centre.
- While the pit is being dug, all the pipes are checked, their threads are cleaned with a wire brush and sand paper, and are test-jointed with sockets, numbered and stacked in order, over a raised platform of *`ballies'*.
- The first casing pipe fitted with cutting shoe at the driving end is lowered and erected upright at the marked spot with sufficient force so that it is firmly held in position
- The MS tripod with a pulley fixed in its hook is erected over the pit such that it is centred over the casing pipe.

- The wooden clamps are now fixed on the casing pipe at a convenient height over the ground.
- A platform is constructed over the wooden clamps which is to be loaded with sand bags whenever needed during the boring operation.
- The bailer is now held over the casing pipe with the help of wire rope, whose other end, passing over the pulley, is either fixed on to the crab wrench or is held by the helpers for driving the bailer into the casing pipe.

The verticality of the casing pipe is now checked and the boring operation is started. The bailer is swiftly released into the pipe so that it hits the soil with full impact and digs into the soil. It is then slowly lifted. With repeated lifting and releasing operations the excavated soil enters the bailer and is held inside by means of a flap near the cutting edge of bailer. The function of the flap is such that it allows the cuttings into the barrel when it hits the soil and retains them when the bailer is lifted up.

After 40-50 strokes, when the bailer is full of cuttings, it is pulled out from the casing pipe and emptied outside the pit. The borer standing over the platform guides the boring operation and gives instructions to pull out the bailer from time to time.

As the pulverised soil is taken out, the casing pipe goes on sinking. Subsequent pipe lengths in the order of their number are added with sockets as the boring operation proceeds.

Depth of boring is measured regularly by taking the soundings inside the pipe. Samples of excavated soil are collected, dried and preserved in a crate and recorded ***(Ref : Geohydrological data; p. 25)***.

Every time a new pipe length is added, the wooden clamps and platform are to be lifted and fixed over the added pipe.

These operations are continued till the boring reaches the safe zone of 30 - 40 m depth below ground level and at least 6 m of water-bearing strata is available. It is preferable to place the strainers in medium sand (0.25 mm to 0.50mm) as the size of slots is only 0.2 mm. However, if fine sand strata (0.125 mm to 0.250 mm) is met with, utmost care has to be taken in coarse sand filling around the screens and during development of the tubewell. Extremely fine sand (0.062 to 0.125 mm) is not at all suitable as WBS (Water Bearing Strata) and the boring should be continued till we get a suitable strata *(Ref : Coarse sand packing; Development of tubewells; p. 28)*. 1 m of extra depth is then bored to provide space for a blind pipe beyond the strainer to accommodate sand particles that may enter the tubewell during its development.

During the boring operation, if it is felt that the pipe is not sinking despite the increase in the depth of the bore, the platform is loaded with sand bags so as to provide extra thrust on the sinking pipes.

The casing pipe must be pulled out by about 2 to 3 m and then again it should be driven into the bore by rotating it clock wise only The pipe must sink under its own weight to ease the extraction process. When the boring operation is completed, a boring chart is to be prepared with the help of soil samples recorded at different depths, to ascertain the water bearing strata, depth for filling of the coarse sand and also for the location of the strainers.

The casing pipe is to be pulled out after the lowering operation of the assembly is completed, ***(Ref : Lowering of tubewell assembly in the bore hole; p. 26)*** taking into consideration the coarse sand filling around the strainer and also for sealing the aquifer against possible contamination. The jack may be used as and when required to facilitate extraction.

Table 7 : Requirement of T & P

S.No.	Item	Quantity	Usage
1.	100 mm dia. MS pipe tripod 6-9 m high	1 No	For operating & holding the pulley
2.	150 mm dia. MS pulley	1 No	For guiding the wire rope
3.	12 mm dia. wire rope	60 m	For holding & operating the Bailer
4.	a. 125mm dia. bailer *b. 150mm dia. bailer	1 No 1 No	For cutting the bore & pulling out the cuttings from casing pipe
5.	Wooden clamps (wooden sleepers-2 nos.) each of 25 x 25 cm & 2 m long	1 set	For holding 150mm/200mm dia. casing pipe in position & for making loading platform
6.	Pipe wrench & chain wrench	1 each	For jointing & tightening of pipes
7.	Well cap	1 No	For capping the pipe after boring operation
8.	Wire, brush, sand paper, lubricating oil & grease	As per requirements	For jointing of casing pipe
9.	Spades, pickaxes, baskets, etc.	As per requirements	For excavating & removal of surplus earth
10.	Strata box	1 No	For collecting of soil samples found at different strata
11.	Empty cement bags	As per requirements	For filling the sand to load the platform for sinking of casing pipes
12.	Plumb bob	1 No	For checking the verticality
13.	a 150 mm dia.(MS pipes each 3m long with built in sockets *b. 200mm dia. MS pipes each 3 m long with built in sockets	As per requirements	For making of the bore
14.	Cutting shoe 150mm dia/200 dia *	1 No	For driving the casing pipe and to be fixed at the bottom of the first casing pipe

* for India Mark III

Hydraulic Jet Method (Hand Operated)

The hydraulic jet method is one of the well known methods for small diameter bore in soft soils. This method is also quite suitable for hard soils like thick clay, hard pan and *kankar* where the casing pipe method may not work. It also has an advantage over the palm & sledger method as it prevents soil from caving in due to the thrust of circulating liquid. Bentonite clay may be used to strengthen loose soils.

Method of boring ***(Ref : Diagram 8; p. 51)***

- Water is pumped into the boring pipe fitted with a cutter at the bottom and let out through the annular space between the pipe and the bore hole.
- The boring pipe is rotated manually with the aid of a pipe wrench with a steady downward pressure. The water is forced by a foot pump through a flexible pipe fastened to the tripod where it culminates in a box where the top of the drill pipe gets supported with a pulley arrangement over the tripod. This pipe can move up and down as required.
- The soil under the cutter gets soft and loose by the action of the jet of water and is washed out with it as the cutter proceeds down with the weight of the pipe. Additional lengths of pipe are added till the required depth is reached. The wash water emanating from the annular space indicates the type of soil that is being encountered by the cutter.
- When the desired depth is reached, the jet pipes are withdrawn and the casing (housing) pipe with the strainer is lowered into the borehole. To avoid any soil subsidence around the casing pipe, the tubewell should be developed before installing the handpump ***(Ref : Coarse sand packing; Development of tubewells; p. 27)***.

Palm and Sludger Method

The palm and sludger method is suitable for drilling bores in alluvial soils and medium hard soils. It is not suitable for hard soils like clay where the water jet method may be applied. This is most suitable for remote areas where it is difficult to transport and erect the heavy T & P for casing method of boring.

Method Of Boring ***(Ref : Diagram 9; p. 52)***

- A working pit of nearly 1m x 1m x 1m depth is dug at the boring spot. Another pit of 1m x 2m x 2m size is also dug close to the boring spot. It is used as a sump to retain water which is taken to the working pit by means of a drain or a 100mm diameter pipe.
- A cutting shoe of 150 mm/200 mm size is fixed at the driving pipe end of the boring pipe of 40/50 mm dia. The pipe is erected in the working pit
- The boring pipe, with cutter attached to it, is raised and lowered by the lever action and the bore filled with water from the sump, which is close to the working pit.
- When the boring has proceeded a few metres down, the water from the bore pipe is pumped by the operator closing the top end of pipe during the upward stroke and releasing it during the downward stroke. The sludge formed inside the boring pipe is

sucked up during the upward stroke due to suction and comes out from the pipe during the downward stroke due to hydraulic pressure inside the boring pipe.

- This method when carried out with quick up and down strokes enables the washing from the bore pipe to come out of the pipe. The bore is always kept full with water from the sump to retain the bore under water pressure. In case the strata met with is very porous and absorbs the water of the bore, bentonite is added to check the water wastage because the water column is essential in this method to avoid collapse of the bore. The process is continued, connecting the pipes one over the other till the second aquifer of 6 m thickness is attained and 1 m extra boring for the blind pipe is drilled. During the boring one person should check the verticality of the pipe with the help of a plumb bob from time to time. For the upward and downward motion of the boring pipes, a lever system with two vertical posts fixed near the boring pit is prepared for speedy work with minimum labour requirement. As the boring proceeds, soil samples are collected from the flow coming out at the top of the boring pipe and the preparation of strata chart and lowering of pipe assembly is carried out ***(Ref : Geohydrological data; lowering of tubewell assembly in borehole; pp. 25-26)***
- When the boring is completed all the boring pipes are pulled out with the help of clamps fixed just below the socket of a boring pipe.
- When all the boring pipes are removed, the bore is ready for lowering the pipe assembly. The development process should start immediately.

Geohydrological data (IS 11189 : 1985)

Samples of drill cutting from different strata should be collected at suitable intervals, preferably at every 2 m depth drilled, or at closer interval if a change in the strata is met with.

After the drilling has reached sufficient depth, all the samples of strata collected, should be carefully examined and analyzed. The samples should be dried, stored and preserved carefully till the installation of handpump and satisfactory withdrawal of water. The data about the geological stratum met with may be maintained in a log sheet. This sheet will enable interpretations regarding the nature of formations (hard, soft, unconsolidated, etc.) and will give an idea of the strata for other boring in the same habitation.

TYPICAL EXAMPLE : details of handpump no. 3 installed in village Magadapur of block Kumbhi tehsil Gola, district Lakhimpur-Kheri.

Sl No.	Lithology	Depth Range (M) From	To	Thickness (M)
1	Surface soil	0	3	3
2	Sandy clay	3	8	5
3	Gravel mixed with clay & *kankar*	-	-	-
4	Fine sand	8	12	4
5	Sticky clay mixed with *kankar*	12	27	15
6	Fine sand	27	31	4
7	Water bearing coarse sand	31	38	7
TOTAL				**38**

Lowering of tubewell assembly in the bore hole

Tubewell assembly consists of 110/140 mm dia. & 63 mm dia. PVC pipes, 63mm dia. strainer and 1 m long blind pipe. The total length of assembly should be worked out according to the actual depth of the bore. The size of the slots of the strainers is generally fixed as 0.20 mm. This size is quite suitable for the water-bearing strata where coarse sand (0 25 to 0.50 mm) is available, in case of very fine sand (0.125 to 0.25 mm) coarse sand filling around the strainer should be carried out carefully. The strainer pipe length of which is calculated with the 1 m long blind pipe with cap or plug, is first jointed and then lowered into the borehole. By adding blind pipes of required size and lengths one by one, lowering of the assembly is completed.

Procedure for lowering

The threads of blind pipe and ends of the strainer are checked and cleaned. The end caps screwed on the lower end of the blind pipe and the strainer is fixed on the other end. This part of the assembly is then lowered into the casing pipe.

The remaining pipe lengths are then added one by one and lowered into the borewell till lowering is completed upto the selected water bearing strata The length of housing pipe 110/140 mm OD shall be kept 2 m greater than that of riser assembly. The additional 2 m depth of housing pipe is essential to cut off entry of any sand particles reaching the pump cylinder by reducing the upward velocity of flow. Likewise there should be a cover of at least 2 m between the strainer top and the housing pipe to obtain uniform flow from the strainer Thus for a 24 m setting, a minimum of 32 m borehole depth is required. The upper end of the housing pipe which is kept about 0.6 m above the ground level is now capped to avoid entry of any foreign material into the tubewell assembly, already lowered. ***(Ref : Diagram 10; p. 53)***

Details of assembly for placement of cylinder at 24.0 m depth

• Depth of bore	32 m
• 110 mm dia. PVC pipe/ 140 mm dia.	27 (26 m below GL and 1m above GL)
• 63 mm dia. PVC pipe	1 m
• 63 mm dia. strainer including 1.0 m blind pipe	4 m

Important considerations in borewell construction

Coarse sand packing

This is a miniature form of gravel packing. In case of the casing pipe method, coarse sand is filled between the temporary casing pipe and housing pipe simultaneously when the casing pipes are being pulled out to the height of strainer so that the annular space between strainer and borehole is filled up with coarse sand of required size. The coarse sand filling should be ensured 25 to 30 cm above the top of the strainer.

In the palm & sludger and water jet methods, the filling of coarse sand is done up to the bottom of the housing pipe. Care must be taken that the borehole is full of water and coarse sand filling is done immediately after the lowering of the tubewell assembly. Verticality of tubewell assembly should be maintained by introducing perforated separators during coarse sand filling.

To achieve uniform packing around the pipe an inverted cone should be used

Development of tubewell

All methods of boring cause compaction of unconsolidated materials in an annulus of variable thickness and deposition of finer particles around the borehole, which reduces the permeability of the strata and effects the yield This may also create problems during operation such as blocking of the screen or it may enter the cylinder causing damage to cylinder lining, valve and leather bucket, etc.

The development is done by over pumping at 15% to 25% higher discharge by increasing the number of strokes per minute than the expected discharge of the well It consists of removal of finer material and opening up the passage in the formation, so that water can enter the well through the screen much more freely.
Proper development has been satisfactorily done when :

- The stabilisation of the sand formation has taken place, that is, discharge is sand free.
- Permeability of the formation is increased.
- Turbidity is reduced to 10ppm after 20 minutes of continuous operation of pump

Development may preferably be done by a separate double cylinder manually operated pump keeping it at ground level Where the sub-soil water is deep, an air lift pump with generating set may be used

for the above purpose.

Verticality check of the borehole

The verticality of the borehole is of prime importance. During the boring operations, it should be checked from time to time and corrective measures should be taken to ensure no more than 10 mm deviation in a 30 m depth.

Verticality check in casing pipe method

A simple method is, to make two similar discs of iron plates about 3 mm thick and of a diameter 2 to 3 mm less than the inside bore of the pipe. The discs are jointed with an iron rod or pipe of about 25 mm diameter at a distance of about 4 metres and tightened with nuts. A knob is fixed on the top nut to which a thin steel wire is attached and the disc is suspended into the borewell by the wire passing over a pulley suspended from a tripod. When the discs are lowered down into the housing pipe, the wire is exactly in the centre of the same. If the housing pipe is not truly vertical, on further lowering of discs into it, the wire will deviate from the centre and will be indicated at the top of the pipe. Some holes should be punched in the discs so that they can easily be immersed in the water.

Setting right the well sunk out of plumb

A simple method is to loosen the soil on the side towards which the casing pipe is required to be pulled back to bring it into plumb again. The casing pipe is forced back by jacks which should be applied about a metre below ground level so as to have a good hold on the side. The soil can be loosened by an additional boring which may be of about half the diameter of the casing pipe. When the pipe has been forced into the correct position, the hollow space left should be filled with gravel and earth, well rammed, so that the pipe does not spring back, and then the jacks should be removed. As soon as a slight deviation from verticality is noticed it should be set right.

Verticality check in sludger and water jet method during boring operation

Verticality of the borehole is checked by means of a plumb bob which is placed at about 3 m above ground level along the drill pipe. In case the drill is out of plumb, corrective measures should be taken.

Well sealing

After the tubewell is developed properly, well sealing is done. The sealing aims at blocking the passage of contaminated water into the safe zone where the strainer is located. Sealing is done by using puddle clay and bentonite. Sealing starts above the coarse sand filling from the bottom end of the 110 mm/140 mm diameter PVC housing. In the bottom half, bentonite is used as a filler and in the

rest clay is used which is prepared out of well-screened *Chikni Mitti* (puddle clay) which may be brought from a nearby pond, if not found during the boring operation

1 kg of bentonite is well mixed with 2 kg of water to make a thin paste. This thin paste is then poured into the annular space between housing pipe and bore with the help of a cone. Due to higher specific gravity, this paste settles down and displaces an equal amount of water. After the bentonite has been filled upto the required depth a paste of puddle clay starts coming out and all the water is removed from the annular space.

In case of the casing pipe, the temporary casing after being pulled out upto the height of the strainer for coarse sand packing, is gradually pulled up at regular intervals as the sealing process proceeds

On drying, bentonite and clay swell up enough to make the annular space seepage-proof

In case of the sludger and the water jet method, due care should be taken in carrying out the above operation. It should be carried out in continuation with the coarse sand packing and it must be ensured that during both the operations the borehole is filled with water.

Precautions in preparing the tubewell

The following precautions are of prime importance for obtaining a safe and adequate discharge over a long period:

- The borehole should be vertical ***(Ref : Verticality check of the borehole; p. 28)***
- The tubewell assembly consisting of PVC pipes of 110 mm/140 mm diameter, strainer and blind pipe (PVC) should be truly vertical. Spacers should be provided while lowering the tubewell assembly
- The coarse sand filling should be done with clean, well sieved sand of size 0.5 to 1 0 mm in the annular space between strainer and the naked bore.
- The tubewell should be carefully developed.
- When the casing pipe method is used, the temporary casing pipe should be pulled out carefully. A jack may be used in extracting the pipes.
- When the boring operation is completed or suspended, the open end should be capped.
- Sealing of the annular space between the bore and blind pipes should be done by pouring a solution of puddle clay/bentonite from the top opening.

Installation of India Mark II/III handpump

Proper installation plays a vital role in the smooth running of deep-well handpumps For a trouble-free and long operative life of the pump, the India Mark II/III handpump should be installed strictly in accordance with the Indian Standard specifications laid down in IS 11004 (Part-I)· 1985 and the detailed procedure given in the booklet

India Mark II Handpump Installation and Maintenance Manual. (A UNICEF, WESS, New Delhi publication 1986).

However, some important points are discussed below, which should be adhered to during the installation of the handpump.

- Remove the casing pipe cover and measure the depths of the borewell and the static water level and ensure that it is free from obstruction.
- Check the height of borewell casing It should be above ground level and little lower than the pedestal flange.
- Cover the casing pipe open end.
- Decide the direction of the drain : look at how the land slopes, drain must slope down, spout must face the drain ***(Ref : Diagram 11; p. 54)***
- Dig a square pit of size 76 cm x 76 cm and 40 cm deep, with casing pipe in its centre
- Prepare cement-concrete mix in the ratio 1:2:4 (1 part cement, 2 parts coarse sand and 4 parts of 20 mm gauge stone grit) having slump of 6 to 8 cm and water-cement ratio as 0.8. Pour this mix in 8 cm deep layers into the pit already excavated in size 76 cm x 76 cm x 40 cm, and level it.
- Remove cover of the casing pipe, place the stand assembly (pump pedestal) vertically over the borewell casing pipe in such a manner that when the water tank is fitted, the spout should be over the leg facing the drain; the other two legs will be on the handle side
- Fill pit upto ground level with 1 2:4 concrete mix by pouring concrete mix in layers Ramming and pining should be done to avoid presence of any air bubbles in the concrete.
- Recheck that the top flange of the stand assembly is level
- If lean concrete 1.6:12 is to be laid for platform, remove earth 8 cm deep around the square pit to 185 cm diameter and 26 cm broad for drain upto the required length and 60 cm x 60 cm for foot-stand (standing platform) at the opposite end of the drain after the platform. Pour 1:6.12 concrete in 8 cm thick layer.
- Assemble all the components of mild steel platform shuttering of standard dimensions and put them over the prepared ground/base of the borewell. Apply oil on the surface of all components of steel shuttering which shall be in contact with concrete.
- Before pouring concrete for the construction of platform, drain and foot-stand, ensure that :
  - dimensions of the platform shuttering are as per standard dimensions ***(Ref : Diagram 12; p. 55)***
  - the top of the platform is in level with the top of the pedestal legs
  - the pedestal is in line/centre with the foot-stand and drain Pour 1:2:4 concrete upto the top of the legs and complete the foot-stand, platform, and drain upto the final disposal point.
  - cover the stand assembly by a cover plate.
- Allow the concrete to set for 3 hours and remove the shuttering components i.e., foot-stand, platform inner ring, platform outer

ring and drain. Place thorny bushes all round the platform and drain to avoid any damage ***(Ref : Diagram 13; p. 56)***
- Allow concrete to set for 7 days.

After 24 hours of completion of concrete of platform, curing should be done regularly for all seven days. To cure concrete, block the drain-end and fill platform with water. Warn people to keep away from the thorny bushes kept around the platform and drain.

Procedure for handpump installation

Installation of India Mark II/III handpumps by using non-standard tools available in the hardware shops, is always dangerous and unsafe To make the installation and maintenance of these handpumps simpler, faster and safer, special tools ***(Ref : Table 4 part B;)*** have been designed. For installation of India Mark II/III handpumps the following steps should be adopted:
- Check and ensure that all the special tools are available in the tool box
- Ensure that riser pipes and connecting rods are kept in the pipe stand. Lay out the pipes and connecting rods. Check that pipes and rods are clean and the threads are good (intact) and free from dust The size and the dimensions of the threads must be checked with the help of "go" and "no go" gauges.
- Check the cylinder in a bucket of water. If the check valve assembly leaks, replace it After ascertaining that the cylinder does not leak, join the first connecting rod to the plunger rod and screw the first riser pipe into the cylinder using jointing compound and tighten the same fully. Wipe off excess jointing material and lower the cylinder, first riser pipe and connecting rod into the borewell
- Fix successive pipes and rods one by one and keep on lowering the same into the well till the last pipe is lowered
- The cylinder should be installed at a minimum depth of 24 m and it should be ensured that the cylinder is placed 6 m above the bottom of the borewell.
- Fix water tank on the stand assembly.
- Push the connecting rod down gently as far as possible. Set the piston stroke length just upto the top of the water tank and cut the rod at the same level Cut the threads on the rod for at least 45 mm length
- After fixing the check nut to the connecting rod, screw the chain on to the rod. Rotate the head of the pump so that the chain gets fully tightened and place the head on the water tank.
- Fix the handle and connect the chain to the handle.
- Lubricate the chain with graphic grease. Tighten the check nut on the chain coupler.

After ensuring the following checks, tighten the cover bolt fully and fix the inspection cover :
- During operations the handle touches the top and bottom stop of the bracket. If not, then remove the head and check the setting of the top connecting rod.

- Connecting rod moves up and down freely in the guide bush. If not, then the rod must have got bent while threading. Make the same straight or replace to enable free movement of the rod.
- Axle nut and lock nut are tightened fully and the handle axle is firmly retained.
- Chain, anchor bolt and nut are fully tightened.
- All the flange bolts and nuts are tight and lock nuts are also tightened fully.
- Nothing is left inside the head.

Operate the pump handle until sand free and odourless water comes out from the handpump. This may require roughly one to two hundred strokes.

Testing of water sample

After the development of the borewell a water sample should be collected and should be sent to a nearby laboratory for its chemical and bacteriological analysis, as detailed in ***Table 1.*** Before construction of the platform and the drain it must be ascertained that water obtained from the borewell is safe and potable. In no case should the handpump be commissioned for public use if the water is found unsafe for drinking purposes.

Chlorination

The borewell has to be disinfected before it is commissioned for public use. The following procedure may be adopted for disinfection of the borewell·

- Place 300 gms (5 match boxes full) of bleaching powder in a bucket of water and mix it thoroughly with the help of a stick
- Remove the four bolts from the lower part of the handpump water tank Lift the water tank and clamp the riser pipe to a raised position.
- Pour bleaching powder solution into the open end of the stand assembly (pedestal)
- Lower the water tank and bolt it back to the stand assembly (pedestal). Tighten it fully
- The handpump should not be used for at least 6 hours or more. In fact, it is preferable not to use the handpump for 24 hours. If convenient, during this period the handle of the pump should be removed.
- Next day, pump until the taste of chlorine is just noticeable in the water, and all objectionable tastes and odours are removed.
- The handpump should then be opened for public use.

The handpump must promptly be disinfected :

- at the time of installation
- after a natural calamity, such as floods
- after break-down repairs.

- if the handpump platform gets damaged or destroyed and a new platform is constructed.

Platform and drain construction

The construction of the platform and drain has already been discussed in brief ***(Ref : Installation of India Mark II/III handpumps; p. 29)***. However, while constructing the platform, foot-stand and drain, due care should be taken of the following:

Dimensions of platform, foot-stand and drain

The platform foot stand and drain should be constructed in accordance with the standard approved dimensions of UP Jal Nigam ***(Ref : Diagram 14; p. 57)***.

Methods for prevention of soil subsidence under the slab and along the drain

The platform slab, foot-stand and drain shall be monolithically casted so as to avoid any unequal settlement. In view of the above, sufficient thickness is provided and the same should be strictly adhered to for the safety and durability of the structure. As a measure of further safeguard, brick-on-edge of 100 cm width around the platform slab if constructed on fillings may be provided; otherwise 50 cm width for brick-on-edge will be sufficient. For the drain too, 22.5 cm wide brick-on-edge may be provided in the last 1 m length.

In exceptional cases, where the soil is loose or filled up, a nominal reinforcement of 0.2% may be provided in both direction in the handpump platform, foot-stand and drain.

Soak-pit

It is observed that sometimes handpumps have to be installed at such locations where the handpump drain cannot be easily connected to the natural drainage system. Under these circumstances, the waste water stagnates at the end of the drain and around the platform ultimately causing unhygienic conditions. In such cases pits may be constructed as an alternative means of waste water to the soak-pit. ***(Ref : Diagram 15; p. 58)***

The size of the soak-pit will depend upon the type of soil, and the quantity of water reaching the soak-pit The tentative size of the soak-pit to be provided with the handpump for different soils is given in **Table 8**. However, it is preferable that percolation test of the soil as per IS 2470 (part-I) may be carried out in one or two cases.

Sizing

The dimensions of the soak-pit for 250 users may be adopted as follows:

Table 8

S.No.	Type of soil	Diameter (m)	Depth (m)
1	Pure sandy soil	1.50	1 50
2	75% sand + 25% clay	1.50	2.00
3	50% sand + 50% clay	1 50	2.50
4	25% sand + 75 % clay	1 50	3.00
5	Pure clayey soil	Soak-pit will not be successful	

Construction

As mentioned earlier, a soak-pit may be a potential outlet for disposal of waste water, provided that the permeability of the surrounding soil is satisfactory. Clayey soil may be useless for soak-pits; sandy soil offer much greater scope for success.

Washing platform (optional)

It is observed that most of the village community use the handpump platform itself for the purpose of bathing and washing. To avoid this, construction of a separate washing/bathing platform is warranted. The size of such a platform shall be 150 cm x 150 cm. It should be constructed at a minimum distance of 3 m from the handpump, preferably adjacent to the drain The community should be motivated to bear the cost of the same ***(Ref : Diagram 16; p. 59)***.

Cattle trough (optional)

At some handpump sites it is found that cattle are brought to the handpump for drinking water. Cattle should not be allowed to use the handpump for the following reasons:

- Risk of contamination of the water source
- Risk of damaging the platform and drain

It is therefore recommended that for the cattle, a separate cattle trough may be constructed by the users at their cost at a distance not less than 6 metres from handpump.

Time schedule for construction and period for curing

Soon after the construction of the tubewell and testing of water, arrangements will be made for the construction of platform and thereafter installation of the handpump machine The time schedule to be followed for construction of borewell, handpump platform, standing platform, a drain of 3.0 m length, and finally the installation of the handpump, including its development, is given in the following table:

Table 9 : Construction of tubewell by casing method

S.No.	Activities	Minimum period required in days		
		Ordinary soil	Soil mixed with *kankar & bajari*	Very very sticky clay
1. a)	Boring			
	0 to 30	2	3	4
	31 to 45	2	4	5
b)	Lowering of PVC assembly,coarse sand filling & extraction	1	1	1
	Total (a + b)	5	8	10
2	Construction of handpump platform,standing platform & drain 3 m long	1	1	1
3.	Curing period	7	7	7
4.	Installation of handpump development	1	1	1
Total Period		**14**	**17**	**19**

Procedure for embossing on India Mark II/III handpump

The following details should be embossed on each handpump in the order given below

1 Code of district/tehsil, as per P & T Department
2 Code no. of village, as per latest census
3 Name of the programme under which the handpump has been installed, using the following notations

Accelerated Rural W/S/ Programme	ARP
Minimum Needs Programme	MNP
SIAD	SD
DUTCH	DSP
Harijan Basti Programme	HB
Drought	DR
UNICEF	UNICEF

4 Serial number of handpump
5 Financial year of commissioning of handpump
6 Depth of casing assembly below GL (in metres including strainer where provided)
7 Depth of cylinder below GL (in metres)

Illustration

Embossing is done on the third handpump installed in the year 1990-91 under ARWSP in village Magadapur of Gola Tehsil, district Lakhimpur-Kheri. The depth of the casing assembly of handpump below GL is 37 00 m and depth of the cylinder below GL is 23.93 m.

- Code of Lakhimpur-Kheri district/Gola Tehsil KHI/GOL
- Code number of Magadapur village ('81 census) 258

- Notation of ARWSP ARP
- Serial number of HP 3
- Year of commissioning 1990-91
- Depth of assembly/cylinder 37/23

Embossing should be done on the pedestal. If the embossing is to be done on any other part of the handpump, permission from a competent authority is required.

On Pedestal UPJN-KHI/GOL
258-APR-3
1990-91-37/23 MTS

Guidelines for users and engineers

DO'S	DON'TS
For Users	
Do use the pump gently.	Don't use the pump roughly.
Do operate the handle with long slow strokes	Don't operate the handle with short, quick strokes.
Do clean the platform regularly.	Don't let the platform get dirty.
Do keep the area around the platform dry and clean.	Don't let water collect around the platform
Do make sure that no one throws rubbish near the pump.	Don't let rubbish collect near the pump.
Do keep the drain clean.	Don't allow the drain to get choked with dirt and rubbish.
Do keep animals away from the pump.	Don't allow animals to loiter around the pump.
For Engineers	
Do construct the soak pit (minimum 6 metres) from the pump.	Don't make soak pit too close to the pump.
Do engrave the pump data on the pedestal of the pump.	Don't forget to engrave the pump data on the pedestal of the pump.

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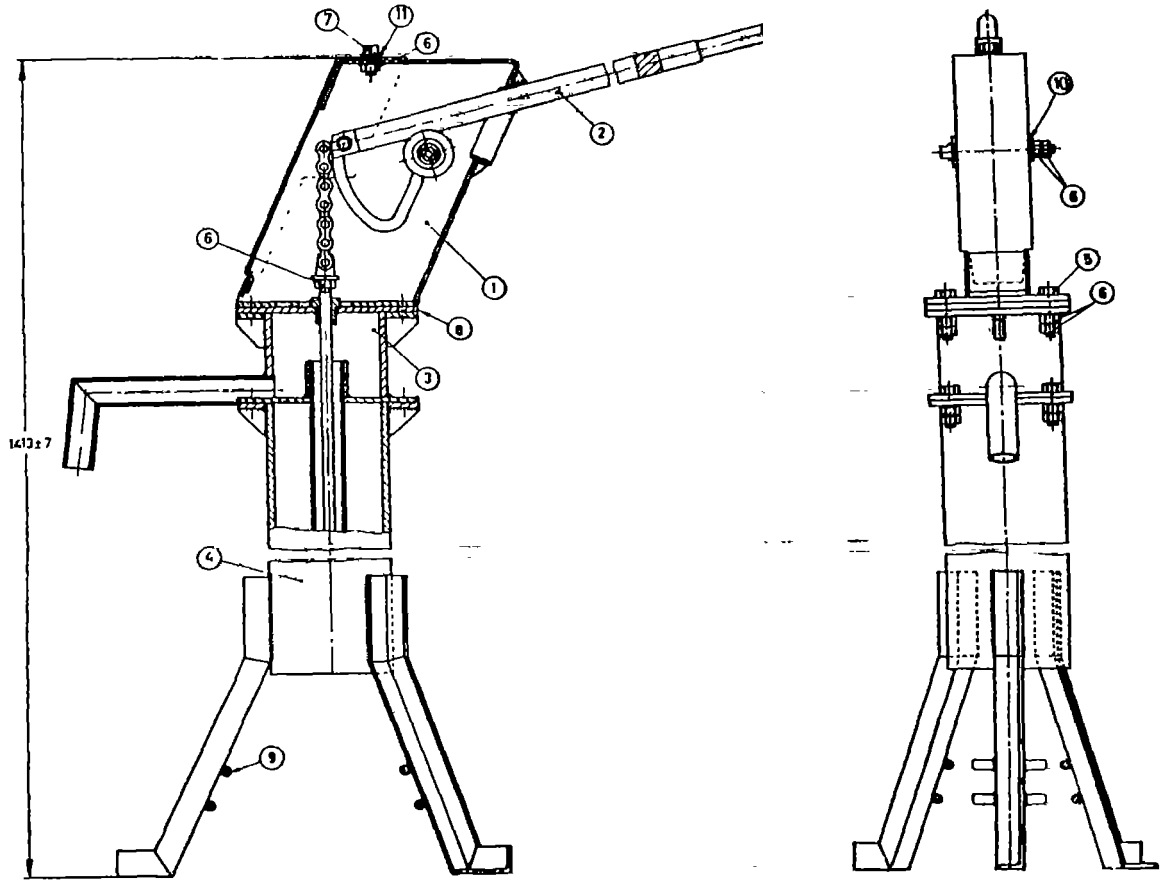
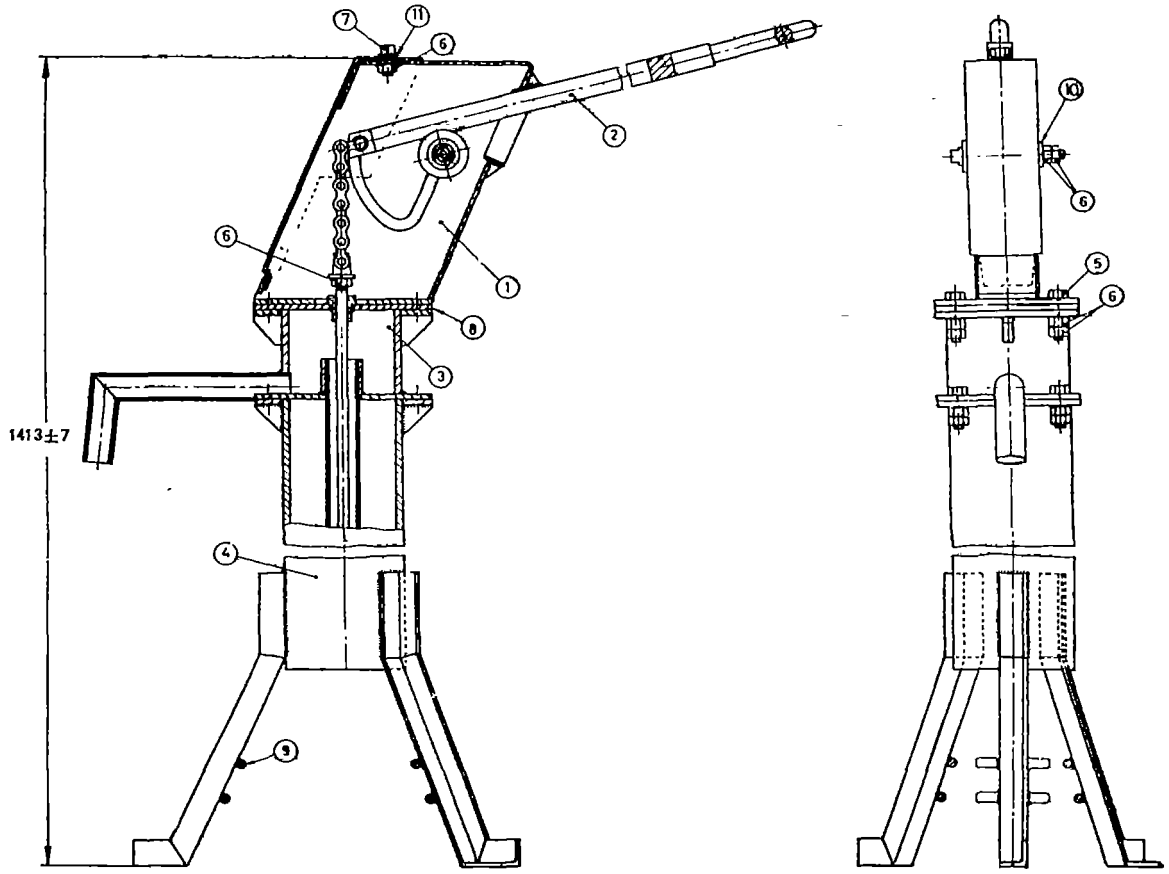


Part No.	No. Off	Description	Material
11	1	Washer (To suit M12 Bolt)	Type A IS 2016 . 1967
10	1	Washer (As per Fig 6H)	
9	6	Spikes	Fe 410 S IS 226 . 1975
8	1	Third plate	Fe 410 S IS 226 : 1975
7	1	Hex bolt M12 X 20	IS 1363 (Part 1) . 1984
6	20	Hex nut M12	IS 1363 (Part 3) . 1984
5	8	Hex bolt, Hex screw M12 X 40	IS 1363 (Part 1) 1984 IS 1363 (Part 2) 1984
4	1	Stand assembly	
3	1	Water tank assembly	
2	1	Handle assembly	
1	1	Head assembly	

All dimensions in millimetres

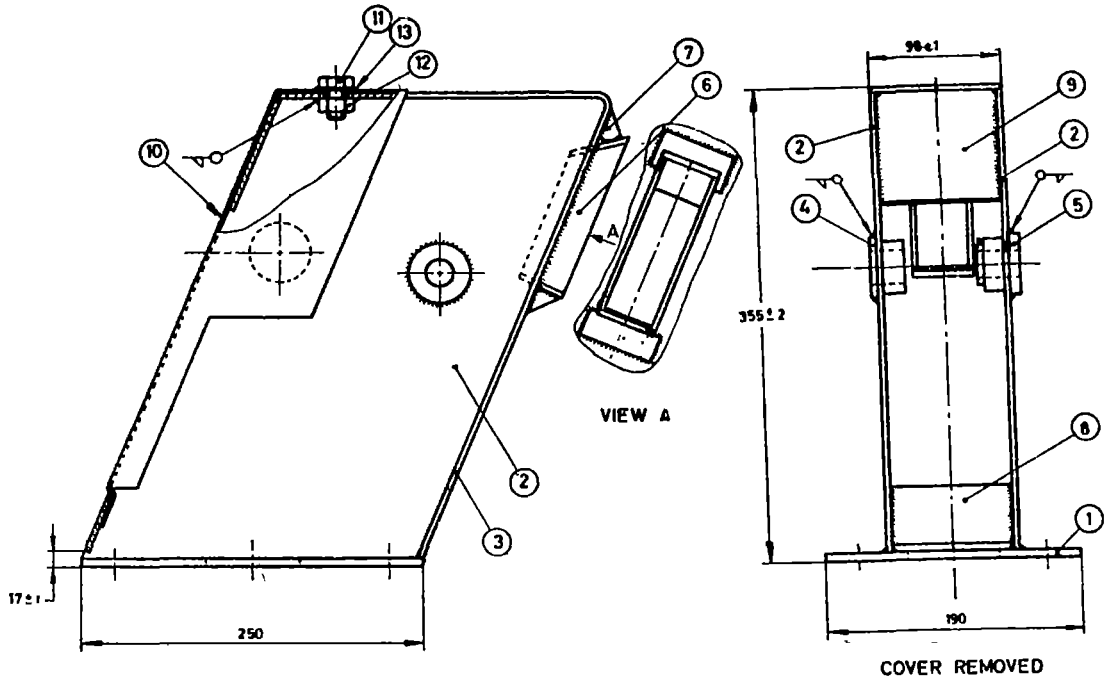
Diagram 1a : Deepwell handpump (IM II)



Part No.	No. Off	Description	Material
11	1	Washer (To suit M12 Bolt)	Type A IS 2016 . 1967
10	1	Washer (As per Fig 6H)	
9	6	Spikes	Fe 410 S IS 226 . 1975
8	1	Third plate	Fe 410 S IS 226 . 1975
7	1	Hex bolt M12 X 20	IS 1363 (Part 1) · 1984
6	20	Hex nut M12	IS 1363 (Part 3) . 1984
5	8	Hex bolt, Hex screw M12 X 40	IS 1363 (Part 1) 1984 IS 1363 (Part 2) 1984
4	1	Stand assembly	
3	1	Water tank assembly	-
2	1	Handle assembly	-
1	1	Head assembly	-

All dimensions in millimetres

Diagram 1b : Deepwell handpump (VLOM)



Part No.	No. Off	Description	Material
13	1	Washer (To suit M12 Bolt)	Type A IS 2016 . 1967
12	1	Hex nut M12	IS 1363 (Part 3) 1984
11	1	Hex bolt M12 X 20	IS 1363 (Part 1) . 1984
10	1	Front cover	Ordinary grade of IS 513 . 1986
9	1	Front top end plate	Fe 410 S IS 226 1975
8	1	Front bottom end plate	Fe 410 S IS 226 . 1975
7	2	Gusset	Fe 410 S IS 226 1975
6	1	Bracket	Fe 410 S IS 226 . 1975
5	1	Axle bush (left)	Fe 410 S IS 226 . 1975
4	1	Axle bush (right)	Fe 410 S IS 226 . 1975
3	1	Back plate	Fe 410 S IS 226 . 1975
2	2	Side plate	Fe 410 S IS 226 1975
1	1	Pump head flange	Fe 410 S IS 226 . 1975

NOTES

1 Inside fillet welding of side plates and back plate to the flange should be 3 2 mm, Min.

2. Welding fillets in other places should be 4 mm, Min.

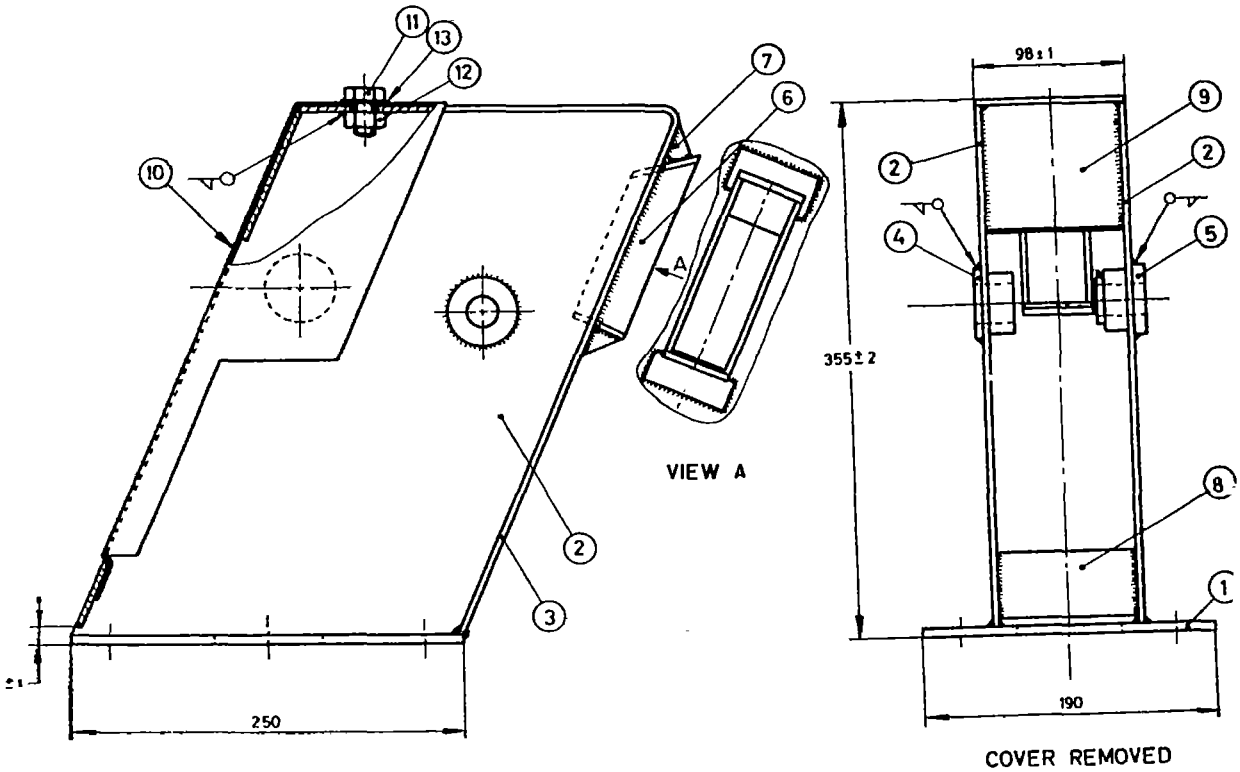
3 The side plates shall be welded inside and outside as shown in the drawing

4 The head assembly shall be welded from inside and outside The outside seal welding run shall be ground smooth

5 Reaming of the left and right axle bushes shall be done to ensure internal dimensions and alignment

All dimensions in millimetres

Diagram 2a : Head assembly (IM II)



Part No.	No. Off	Description	Material
13	1	Washer (To suit M12 Bolt)	Type A IS 2016 . 1967
12	1	Hex nut M12	IS 1363 (Part 3) 1984
11	1	Hex bolt M12 X 20	IS 1363 (Part 1) 1984
10	1	Front cover	Ordinary grade of IS 513 1986
9	1	Front top end plate	Fe 410 S IS 226 . 1975
8	1	Front bottom end plate	Fe 410 S IS 226 . 1975
7	2	Gusset	Fe 410 S IS 226 . 1975
6	1	Bracket	Fe 410 S IS 226 1975
5	1	Axle bush (left)	Fe 410 S IS 226 . 1975
4	1	Axle bush (right)	Fe 410 S IS 226 1975
3	1	Back plate	Fe 410 S IS 226 . 1975
2	2	Side plate	Fe 410 S IS 226 1975
1	1	Pump head flange	Fe 410 S IS 226 : 1975

NOTES

1 Inside fillet welding of side plates and back plate to the flange should be 3 2 mm, Min

2 Welding fillets in other places should be 4 mm, Min

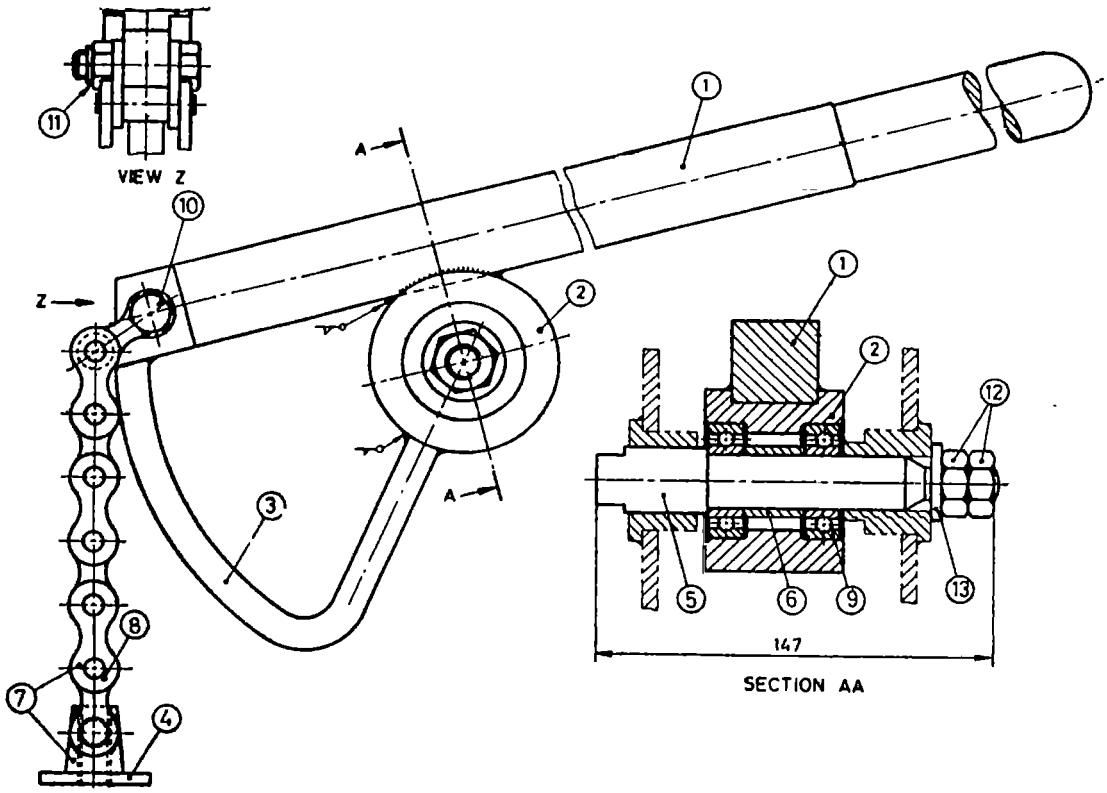
3 The side plates shall be welded inside and outside as shown in the drawing

4 The head assembly shall be welded from inside and outside The outside seal welding run shall be ground smooth

5 Reaming of the left and right axle bushes shall be done to ensure internal dimensions and alignment

All dimensions in millimetres

Diagram 2b : Head assembly (VLOM)



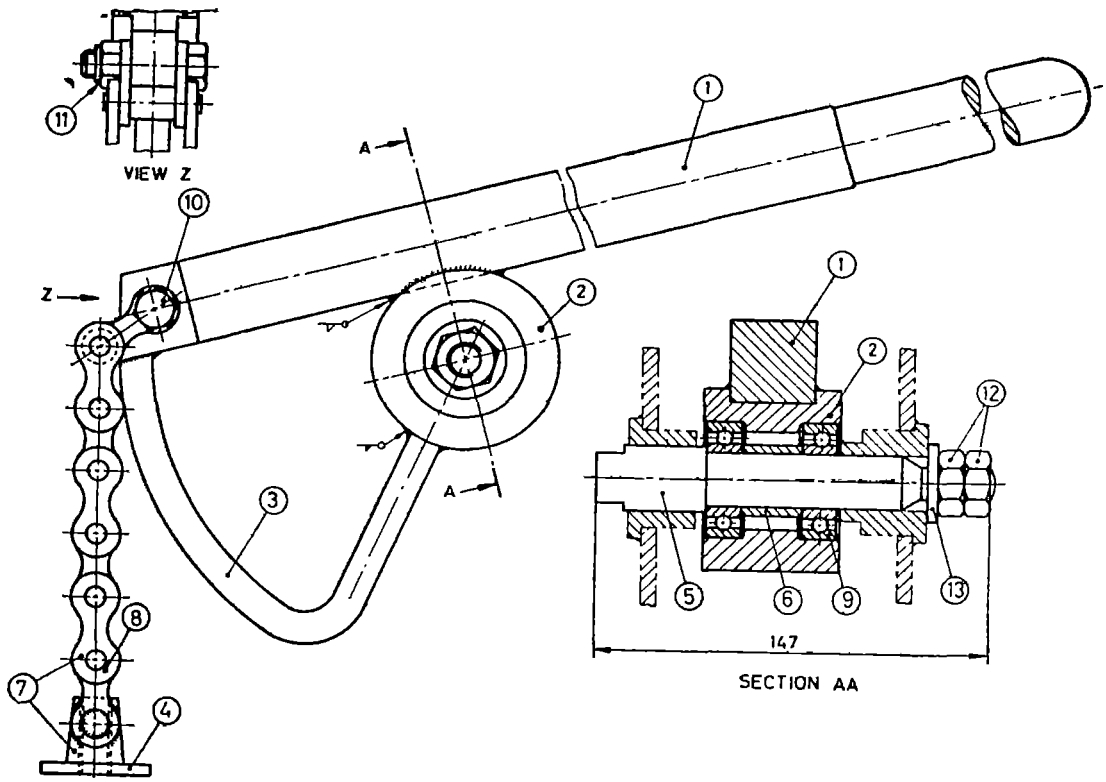
Part No.	No. Off	Description	Material
13	1	Axle washer (4 mm thick) - to suit M12	Type A IS 2016 . 1967
12	2	Hex nut M12	IS 1363 (Part 3) 1984
11	1	Prevailing torque type steel hex locknut M10 X 1.5	IS 7002 . 1972
10	1	Hex bolt M10 X 1.5 X 40 IS 1364 (Part 1) - 8 8	IS 1364 (Part 1) 1983
9	2	Single side shielded, Bearing	Designation 20 BC 02 PP IS 6455 . 1972
8	1	Roller chain (25 4 mm pitch)	IS 2403 . 1975
7	1	Chain with coupling	
6	1	Spacer	Fe 410 S of IS 226 . 1975
5	1	Handle Axle	Ni-Cr stainless steel, Ni 8%, Min Cr 17% Min
4	1	Chain coupling	Fe 410 S of IS 226 1975 or Class 2 of IS 2004 1978
3	1	Roller chain guide	Fe 410 S of IS 226 . 1975
2	1	Bearing housing (Shall be fully packed with lithium based grease)	Fe 410 S of IS 226 . 1975
1	1	Handle bar	Fe 410 S of IS 226 . 1975

NOTE

Welding fillet shall not be less than 6 mm at all places excepting for housing holder where it shall be not less than 4 mm

All dimensions in millimetres

Diagram 3a : Handle assembly (IM II)



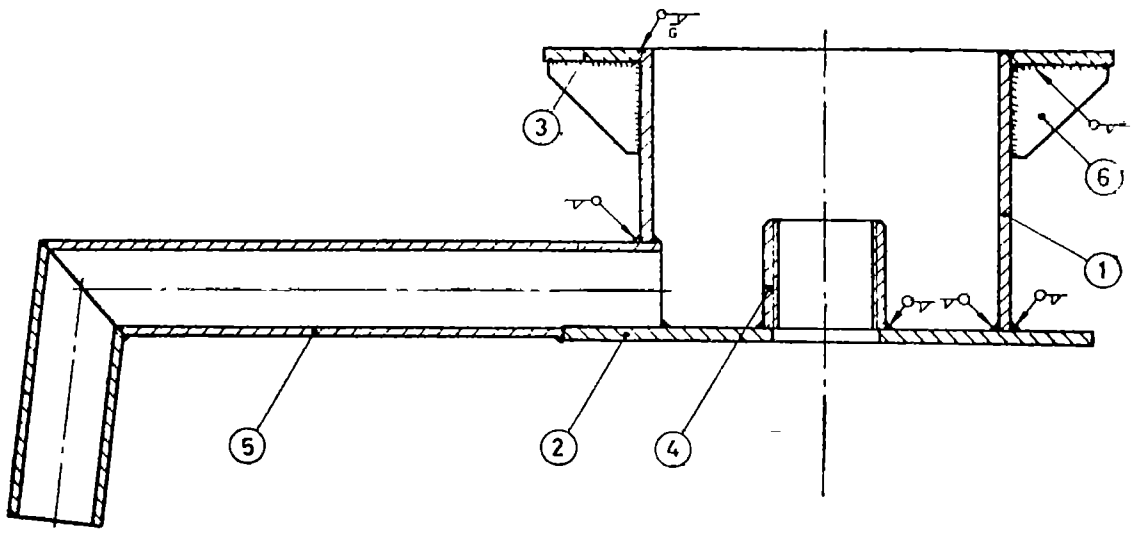
Part No.	No. Off	Description	Material
13	1	Axle washer (As per fig 6H)	Type A IS 2016 1967
12	2	Hex nut M12	IS 1363 (Part 3) 1984
11	1	Prevailing torque type steel hex locknut M10 X 1 5	IS 7002 1972
10	1	Hex bolt M10 X 1 5 X 40 IS 1364 (Part 1) - 8 8	IS 1364 (Part 1) 1983
9	2	Single side shielded, Bearing	Designation 20 BC 02 PP IS 6455 1972
8	1	Roller chain (25.4 mm pitch)	IS 2403 1975
7	1	Chain with coupling	
6	1	Spacer	Fe 410 S of IS 226 1975
5	1	Handle Axle	Ni-Cr stainless steel, Ni 8%, Min Cr 17% Min
4	1	Chain coupling	Fe 410 S of IS 226 . 1975 or Class 2 of IS 2004 1978
3	1	Roller chain guide	Fe 410 S of IS 226 1975
2	1	Bearing housing (Shall be fully packed with lithium based grease)	Fe 410 S of IS 226 1975
1	1	Handle bar	Fe 410 S of IS 226 . 1975

NOTE

Welding fillet shall not be less than 6 mm at all places

All dimensions in millimetres

Diagram 3b : Handle assembly (VLOM)



Part No.	No. Off	Description	Material
6	2	Gusset	Fe 410 S of IS 226 . 1975
5	1	Spout	IS 1239 (Part 1) . 1979
4	1	Riser pipe holder	Fe 410 S of IS 226 . 1975
3	1	Tank top flange	Fe 410 S of IS 226 . 1975
2	1	Tank bottom flange	Fe 410 S of IS 226 . 1975
1	1	Tank pipe	IS 1239 (Part 1) 1979

NOTES

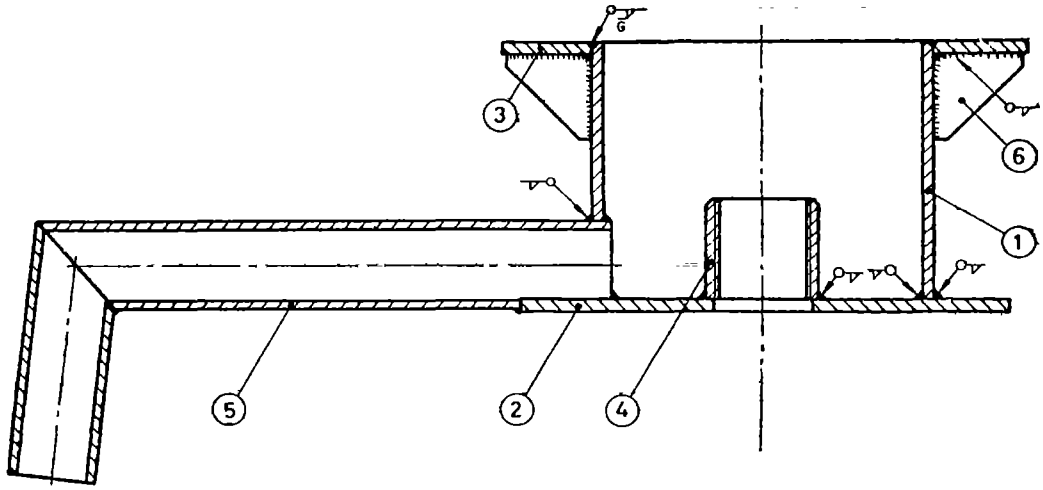
1 Fillet size of weld at all places shall be minimum 6 mm excepting spout where it shall not be less than 4 mm
The inside welding of the tank pipe shall be given a sealing run

2 One side of coupling to be faced

3 Sealing run on the top flange to be ground smooth.

All dimensions in millimetres

Diagram 4a : Water tank assembly (IM II)



Part No.	No. Off	Description	Material
6	2	Gusset	Fe 410 S of IS 226 . 1975
5	1	Spout	IS 1239 (Part 1) 1979
4	1	Riser pipe holder	Fe 410 S of IS 226 . 1975
3	1	Tank top flange	Fe 410 S of IS 226 . 1975
2	1	Tank bottom flange	Fe 410 S of IS 226 . 1975
1	1	Tank pipe	IS 1239 (Part 1) 1979

NOTES

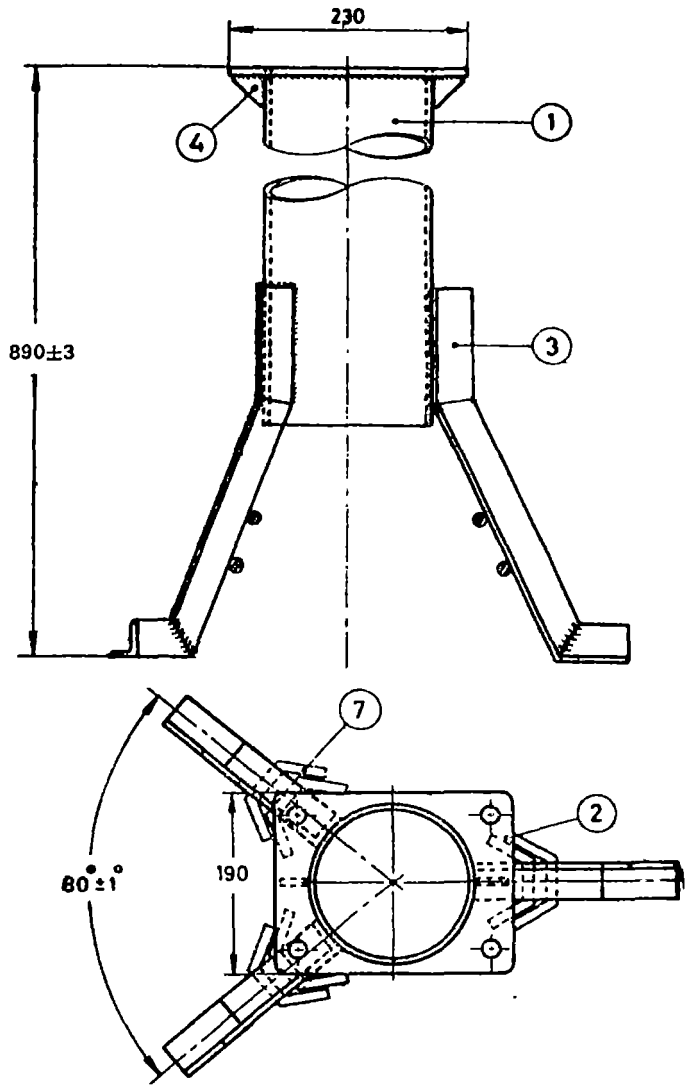
1 Fillet size of weld at all places shall be minimum 6 mm excepting spout where it shall not be less than 4 mm
The inside welding of the tank pipe shall be given a sealing run

2. One side of coupling to be faced

3 Sealing run on the top flange to be ground smooth

All dimensions in millimetres

Diagram 4b : Water tank assembly (VLOM)



9B STAND ASSEMBLY

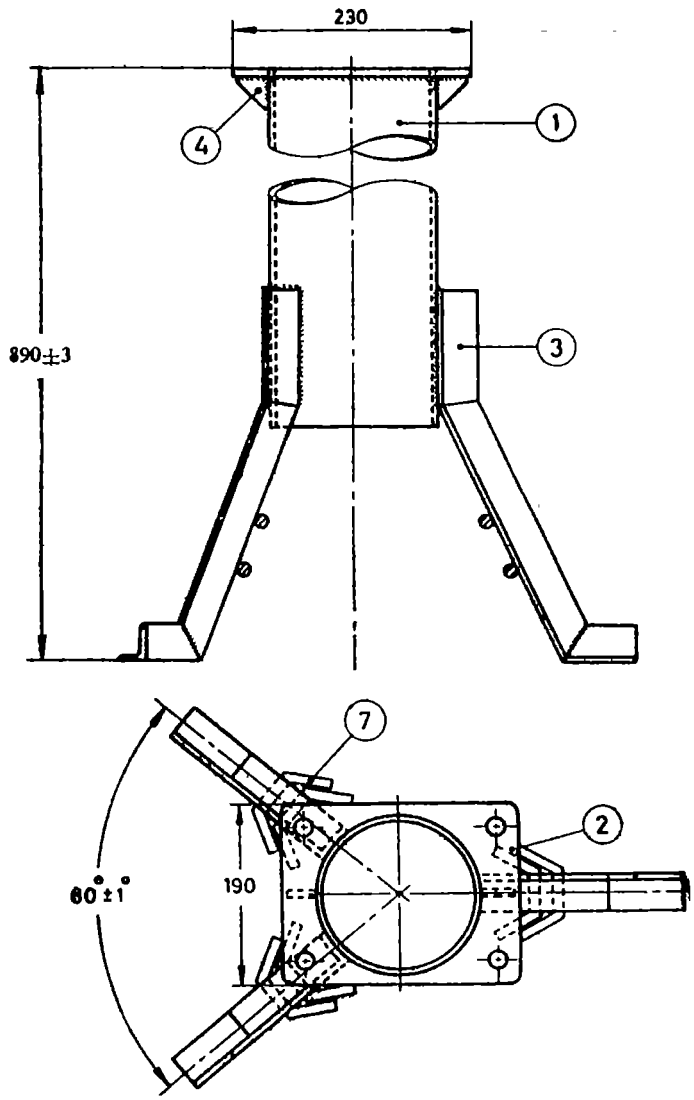
Part No.	No. Off	Description	Material
7	6	Spikes	Fe 410 S of IS 226 . 1975
6	1	175 NB pipe	IS 1161 1979
5	1	Reducer collar for telescopic stand assembly	Fe 410 S of IS 226 1975
4	2	Gusset	Fe 410 S of IS 226 1975
3	3	Leg	IS 808 . 1989
2	1	Stand flange	Fe 410 S of IS 226 . 1975
1	1	Stand pipe	IS 1239 (Part 1) 1979

1 Stand Assembly - Recommended for use in bore wells having 100 mm and 125 mm NB casing pipe

2 Telescopic Stand Assembly - Recommended for use in bore wells having 150 mm and 125 mm NB casing pipe

All dimensions in millimetres

Diagram 5a : Stand assembly (IM II)



9B STAND ASSEMBLY

Part No.	No. Off	Description	Material
7	6	Spikes	Fe 410 S of IS 226 1975
6	1	175 NB pipe	IS 1161 · 1979
5	1	Reducer collar for telescopic stand assembly	Fe 410 S of IS 226 1975
4	2	Gusset	Fe 410 S of IS 226 · 1975
3	3	Leg	IS 808 . 1989
2	1	Stand flange	Fe 410 S of IS 226 . 1975
1	1	Stand pipe	IS 1239 (Part 1) · 1979

1 Stand Assembly - Recommended for use in bore wells having 100 mm and 125 mm NB casing pipe

2. Telescopic Stand Assembly - Recommended for use in bore wells having 150 mm and 125 mm NB casing pipe

3 The spikes shall be welded at 100 mm and 150 mm height respectively from the bottom of the leg

All dimensions in millimetres

Diagram 5b : Stand assembly (VLOM)

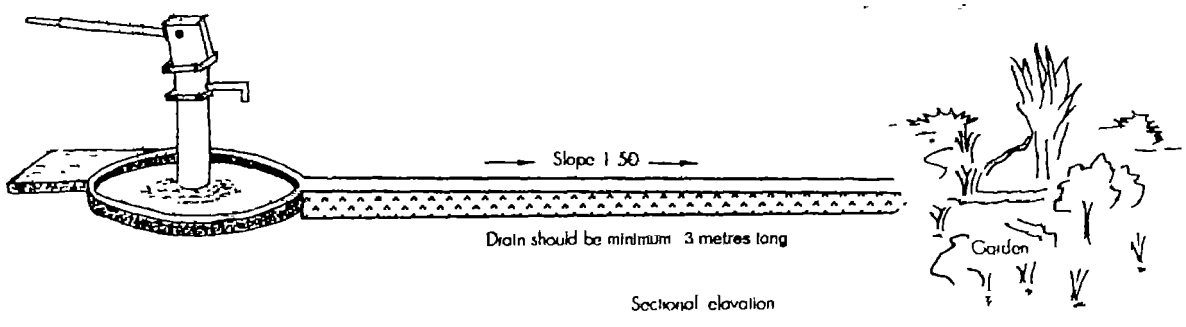


Diagram 6 : Drain leading to the garden

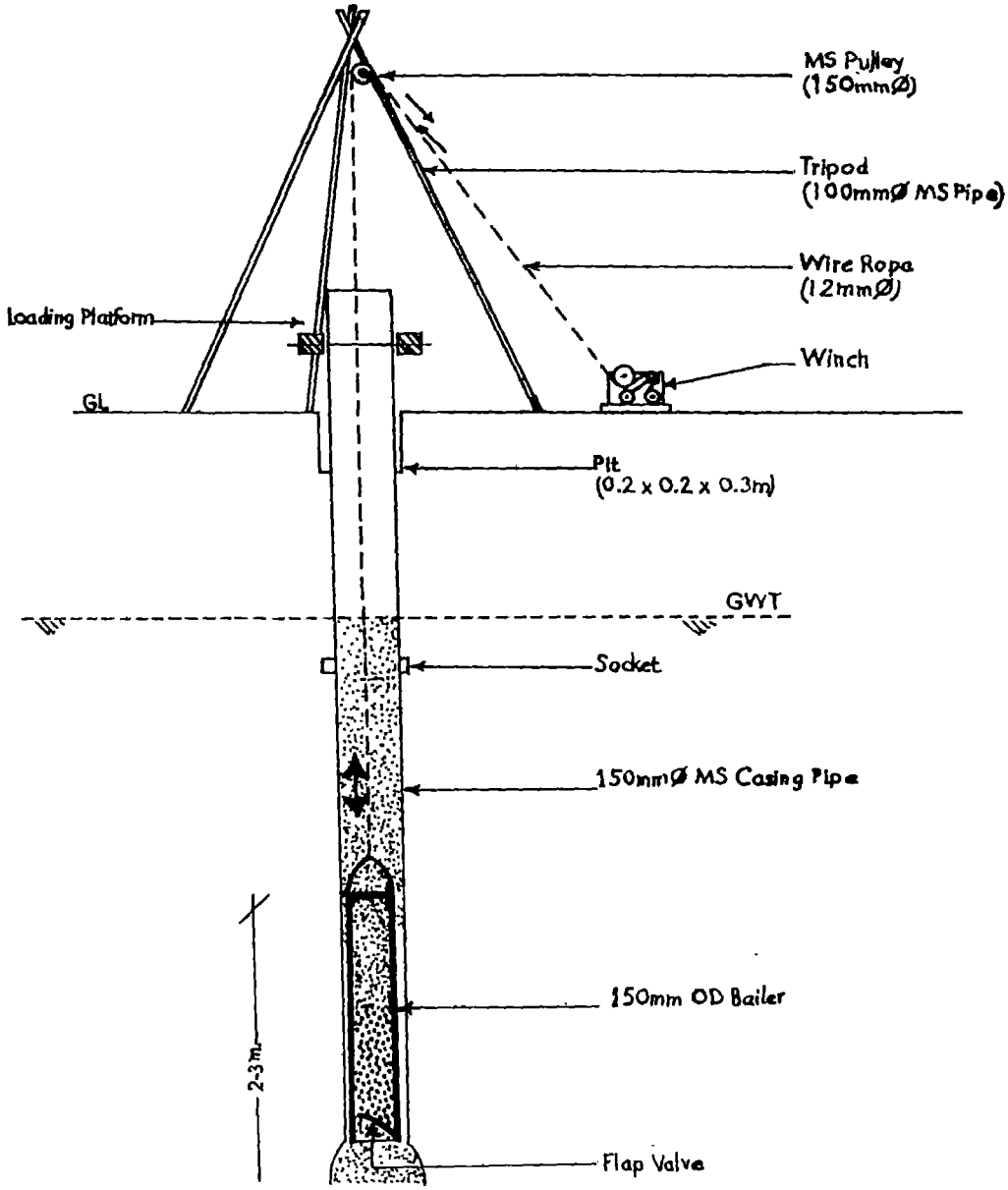


Diagram 7 : Casing pipe method

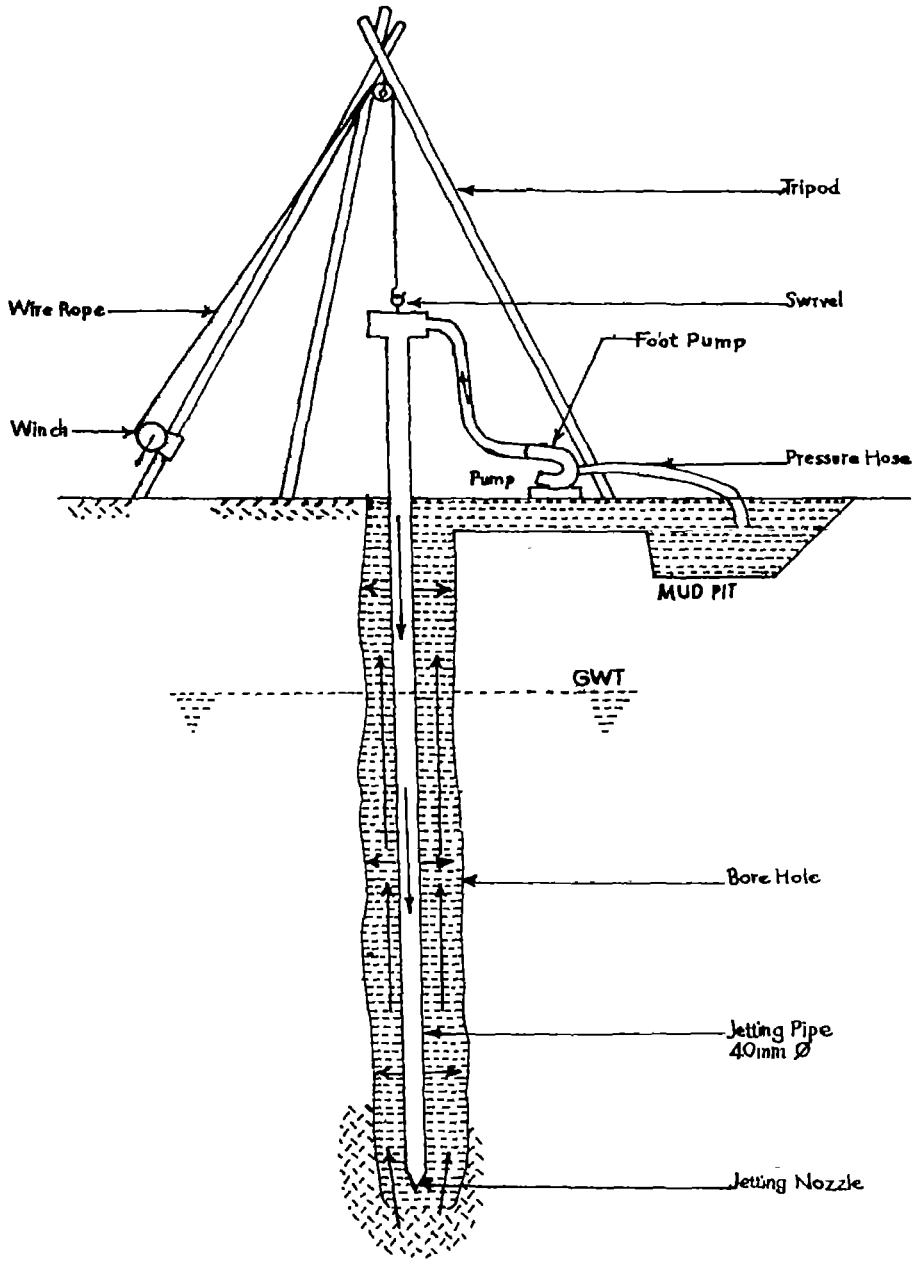


Diagram 8 : Water jet method

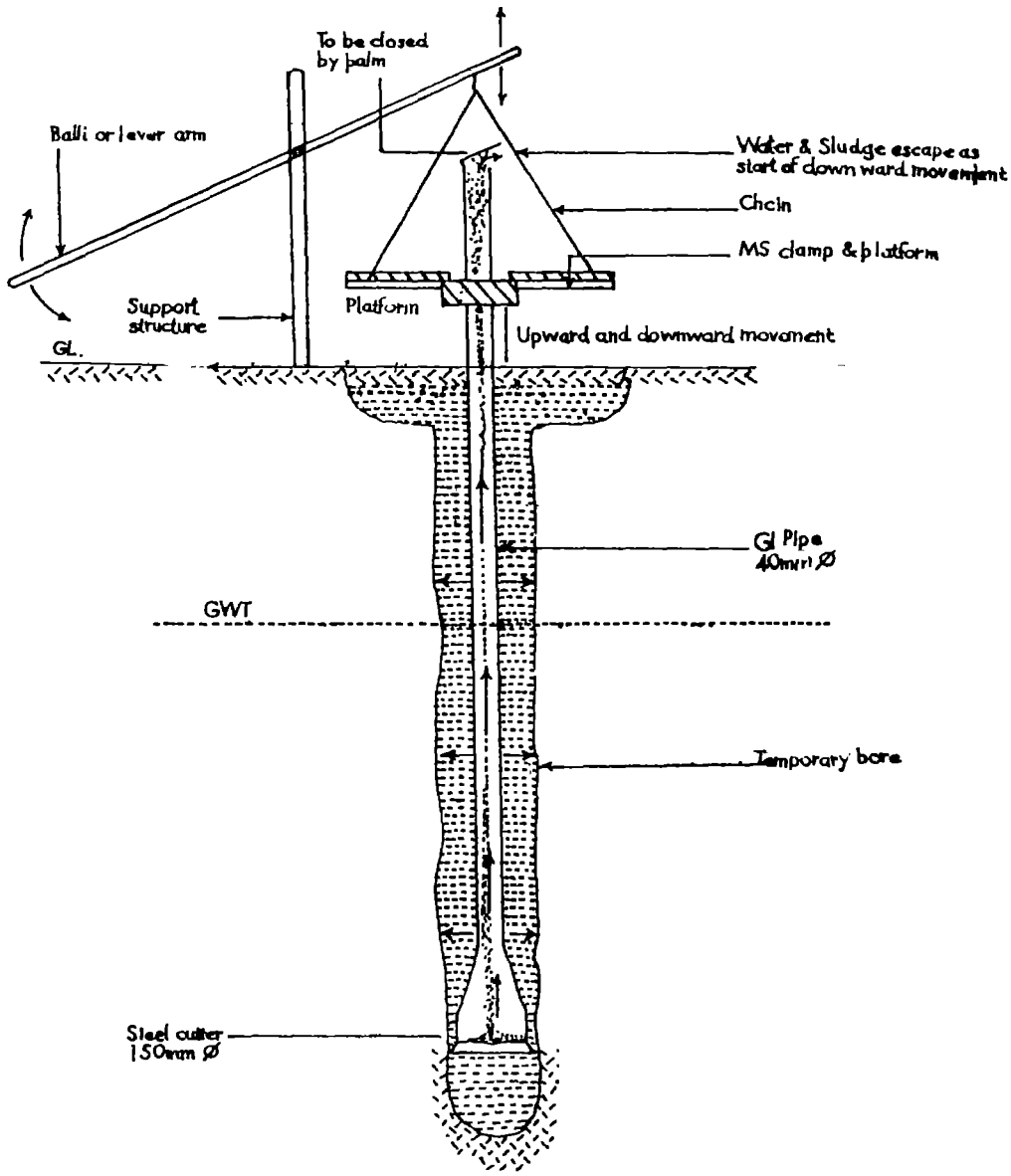


Diagram 9 : Palm and sludger method

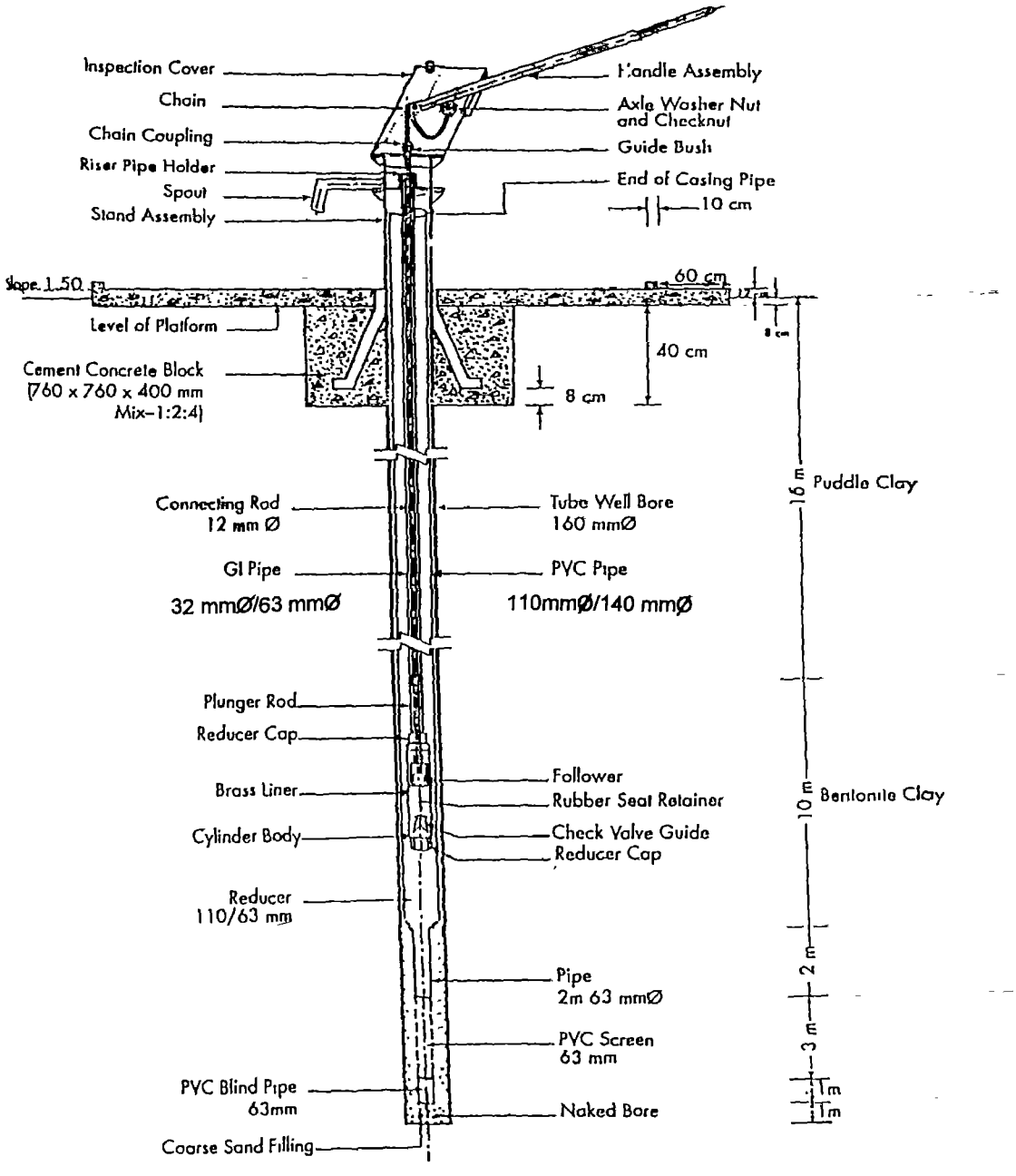


Diagram 10 : A typical well design for India Mark II/III deep well handpump in alluvial soil - 32 metres deep

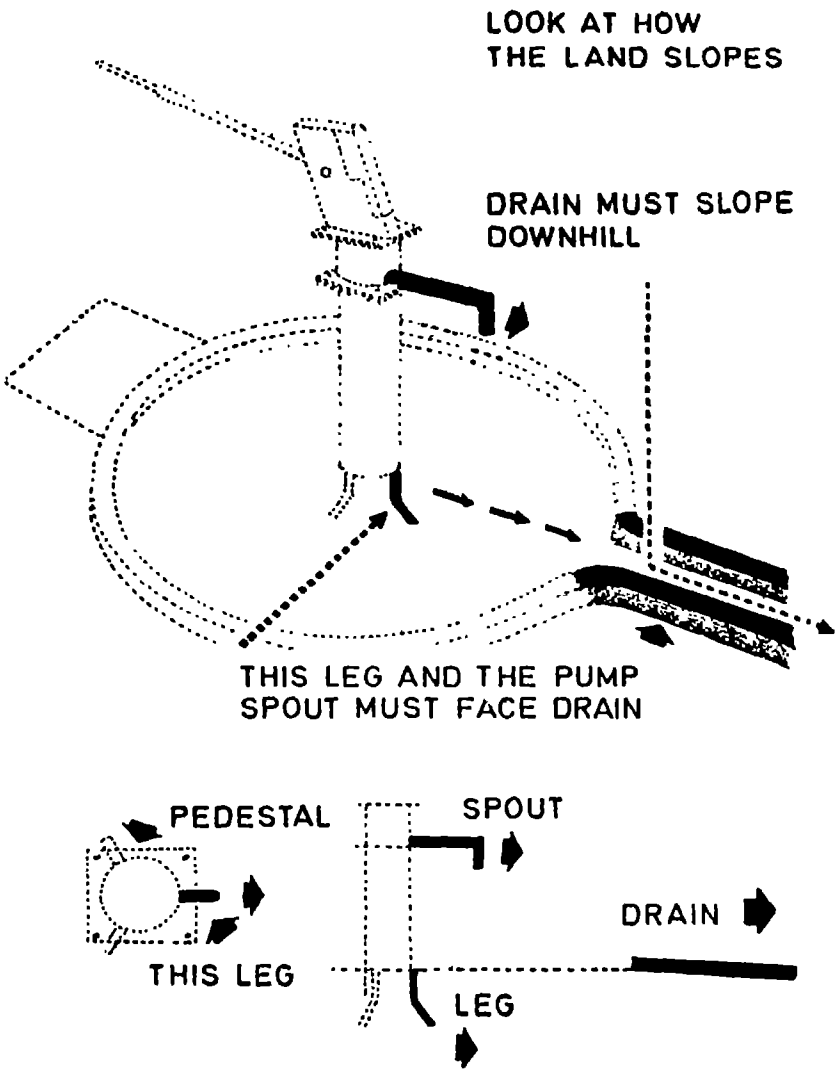


Diagram 11 : Direction of drain

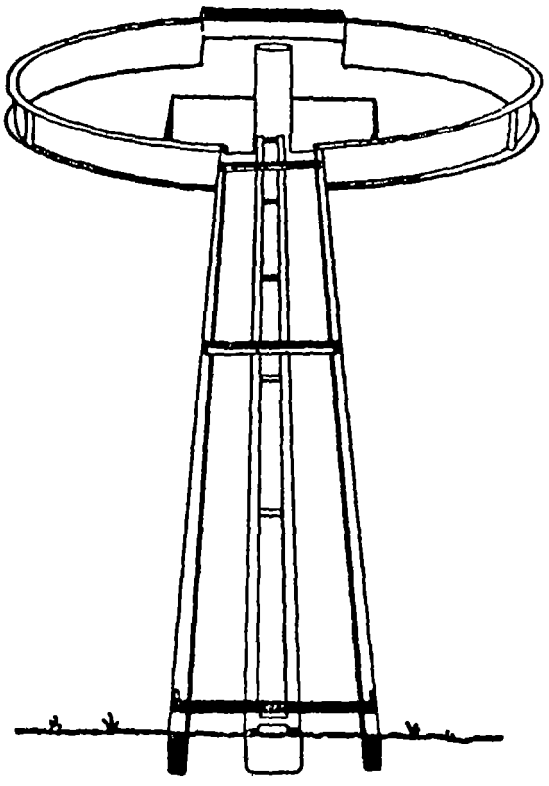
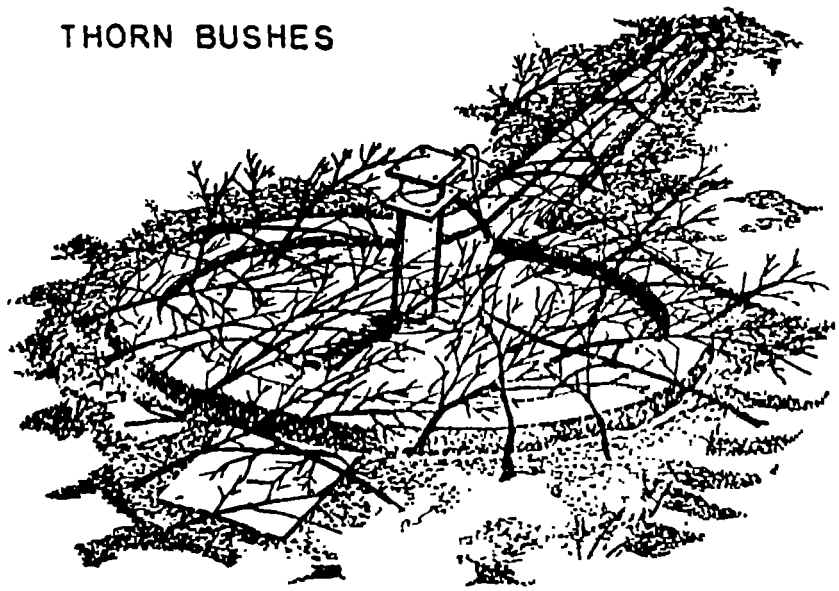


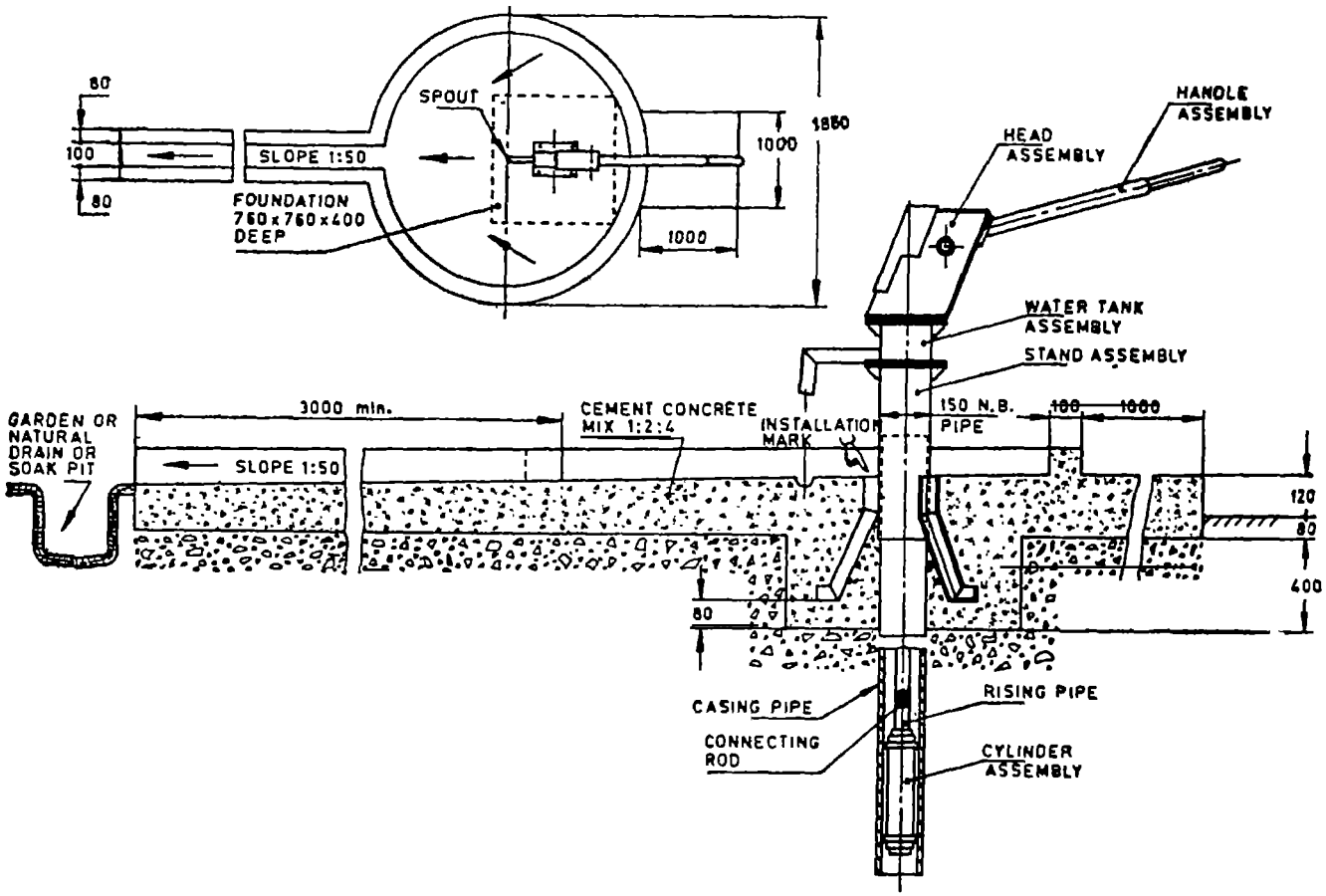
Diagram 12 : Construction of platform and drain with metal shutterings

To cure concrete, block drain and fill platform with water for seven days. Ask villagers to keep away from installation



Important
ALLOW CONCRETE TO SET FOR 7 DAYS

Diagram 13 : Prevent platform and drain from cracking



NOTES

1 The free end of the casing pipe shall be minimum 300 mm above the installation mark.

2 Casing pipe is not required when the bore pipe passes through rocks.

3 Separate platform for washing clothes/utensils and cattle trafs may be provided if required.

All dimensions in millimetres.

FIG. 1 TYPICAL SET-UP FOR DEEPWELL HANDPUMP

Diagram 14 : Typical set-up for deep well handpump

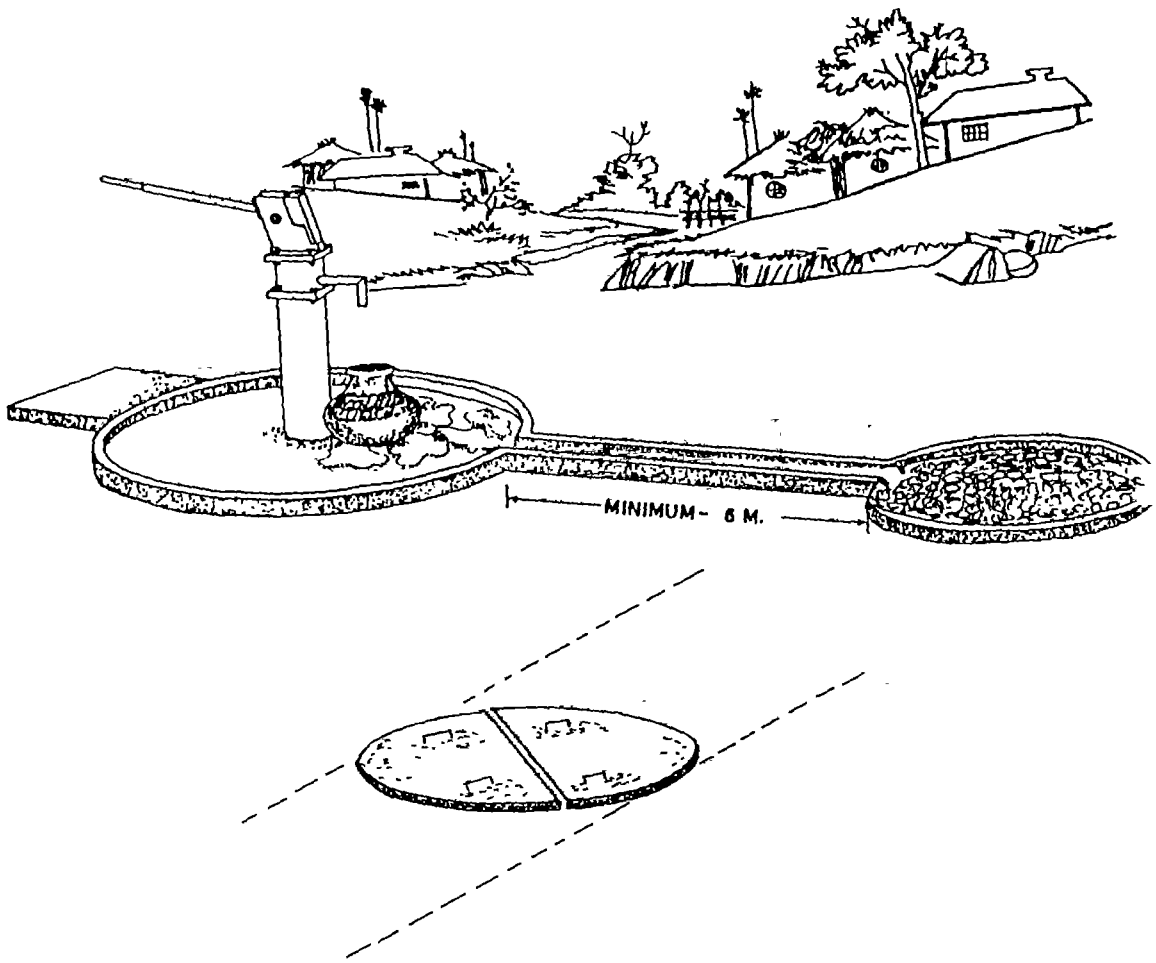
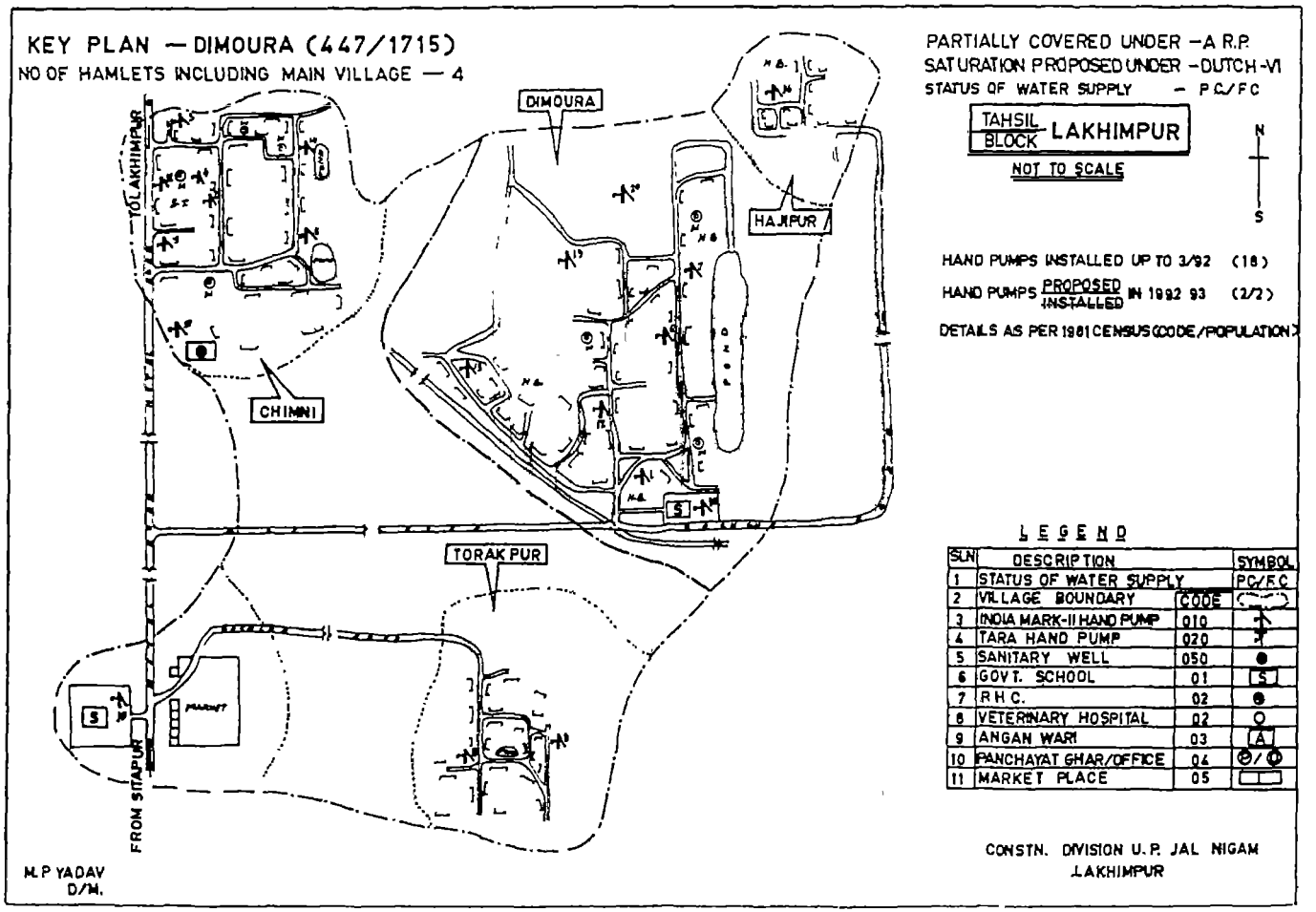


Diagram 15 : Arrangement for tapping of waste water to the soak-pit


KEY PLAN — DIMOURA (447/1715)
NO OF HAMLETS INCLUDING MAIN VILLAGE — 4
DIMOURA
HAJIPUR
CHIMNI
TORAK PUR
TO LAKHIMPUR
FROM SITAPUR
PARTIALLY COVERED UNDER — A R.P.
SATURATION PROPOSED UNDER — DUTCH-VI
STATUS OF WATER SUPPLY — P.C./F.C.
TAHSIL / BLOCK LAKHIMPUR
NOT TO SCALE
N
S
HAND PUMPS INSTALLED UP TO 3/92 (18)
HAND PUMPS PROPOSED / INSTALLED IN 1992 93 (2/2)
DETAILS AS PER 1981 CENSUS CODE/POPULATION
LEGEND
SLN | DESCRIPTION | | SYMBOL
1 | STATUS OF WATER SUPPLY | | P.C./F.C.
2 | VILLAGE BOUNDARY | CODE |
3 | INDIA MARK-II HAND PUMP | 010 |
4 | TARA HAND PUMP | 020 |
5 | SANITARY WELL | 050 |
6 | GOVT. SCHOOL | 01 | S
7 | R.H.C. | 02 |
8 | VETERINARY HOSPITAL | 02 |
9 | ANGAN WARI | 03 | A
10 | PANCHAYAT GHAR/OFFICE | 04 |
11 | MARKET PLACE | 05 |
CONSTN. DIVISION U.P. JAL NIGAM
LAKHIMPUR
M.P YADAV
D/M.

Map

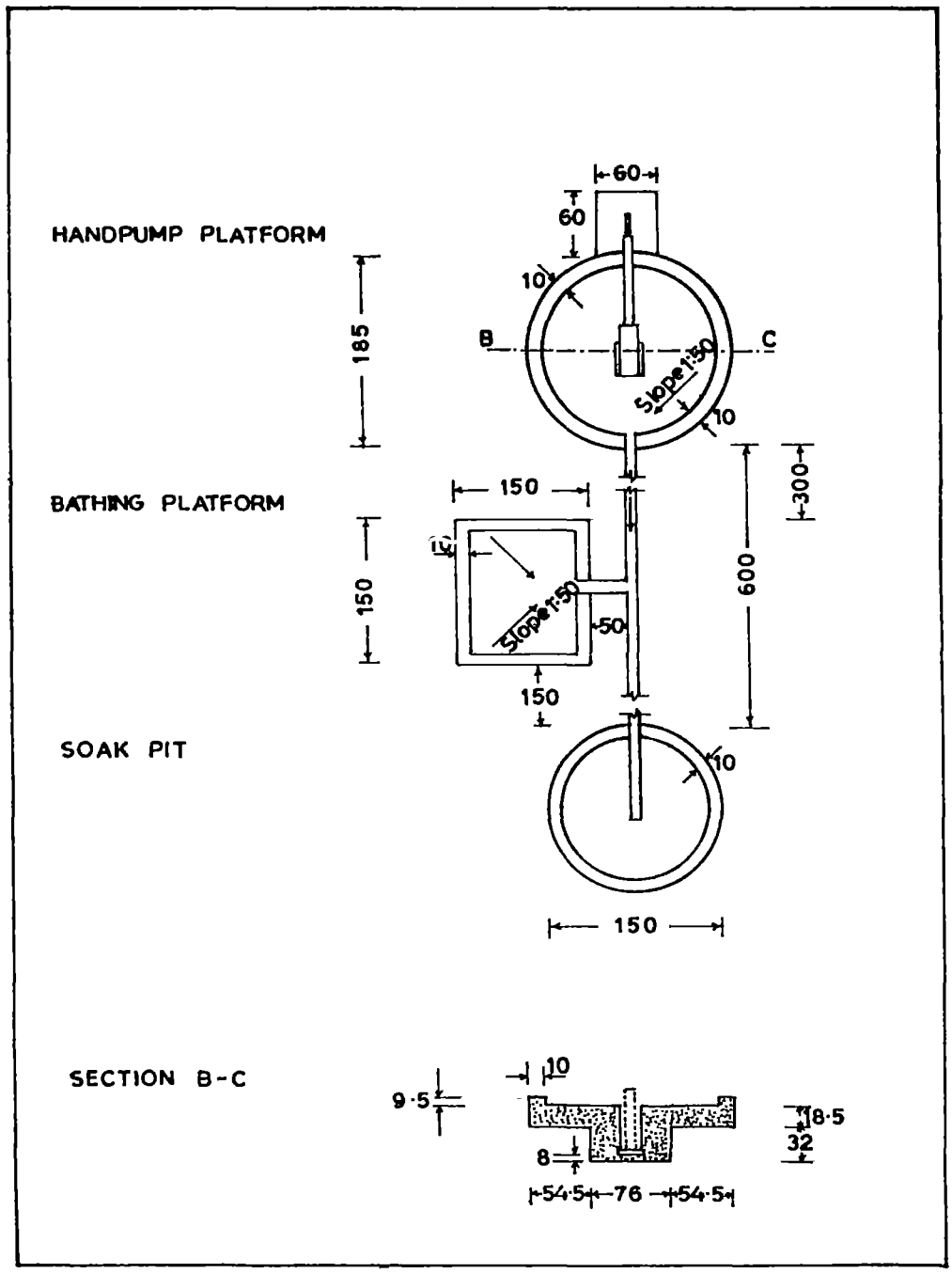


Diagram 16 : India Mark II handpump with separate washing platform and disposal arrangements

INDO-DUTCH CO-OPERATION
IN RURAL WATER SUPPLY AND
SANITATION
IN UTTAR PRADESH