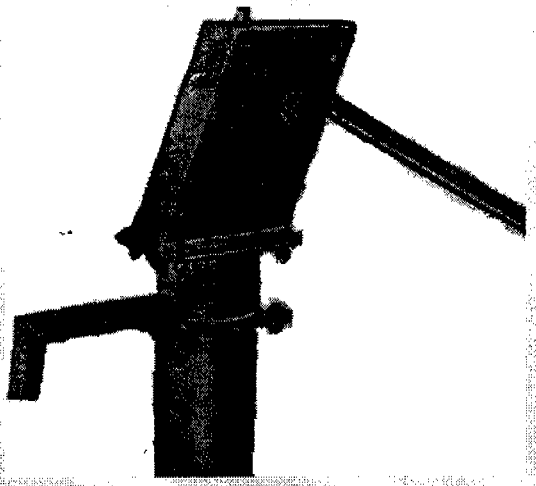
INDIA MARK II HAND PUMP



REPAIR AND MAINTENANCE DETAILS

GRZ

UNICEF

PREPARED BY UNICEF WASHE SECTION
FEBRUARY 2005

MAINTENANCE SCHEDULES: WEEKLY & MONTHLY

ONCE EVERY WEEK:

TOOLS AND SUPPLIES REQUIRED - ONE BUCKET

1. COUNT NUMBER OF STROKES TO FILL THE BUCKET WITH WATER:

- IF NO WATER
- IF MORE THAN 45 STROKES ARE NEEDED TO FILL BUCKETS
- IF 15 OR MORE STROKES ARE NEEDED BEFORE WATER STARTS TO FLOW
- IF THE HANDLE IS LOOSE
- IF THERE IS MUCH RESISTANCE IN HANDLE

} FOLLOW TROUBLE-SHOOTING GUIDE

ONCE EVERY MONTH:

TOOLS AND SUPPLIES REQUIRED
- ONE CRANK SPANNER
- WIRE BRUSH
- GREASE

1. LUBRICATE CHAIN - SEE PAGE 8

   1.1 REMOVE INSPECTION COVER
   1.2 CLEAN CHAIN
   1.3 APPLY GREASE TO CHAIN
   1.4 REFIT INSPECTION COVER

2. CHECK THAT ALL 8 FLANGE BOLTS ARE PRESENT AND TIGHT

   - IF LOOSE: TIGHTEN WITH CRANK SPANNERS
   - IF MISSING [illegible]

MAINTENANCE RECORD SHEET (SAMPLE)

VILLAGE _____ MONTH _____

CARETAKER _____

WEEKLY

	PUMP No.				
NUMBERS OF STROKES TO FILL THE BUCKET:	WEEK 1				
	WEEK 2				
	WEEK 3				
	WEEK 4				

FILL IN DATA WHEN ANY OF THE FOLLOWING PROBLEMS APPEAR:

NO WATER				
MORE THAN 45 STROKES ARE NEEDED TO FILL BUCKET				
15 OR MORE STROKES ARE NEEDED BEFORE WATER FLOWS				
THE HANDLE IS LOOSE				
MUCH RESISTANCE IN HANDLE				

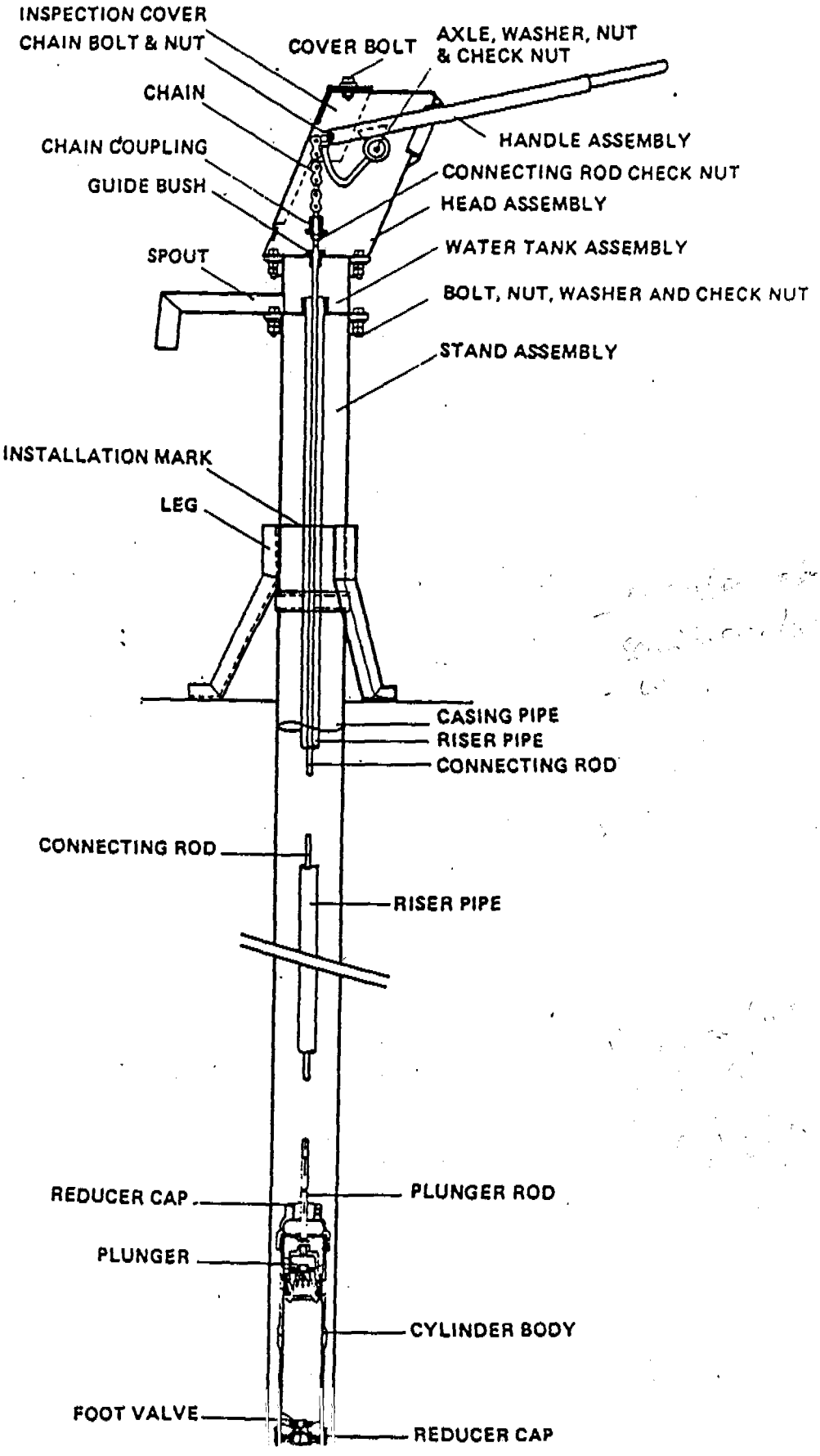
MONTHLY

CARRIED OUT CLEARNING AND GREASING				

NUMBER OF BOLTS	- LOOSE				
	- MISSING				

DATE _____ SIGNATURE _____

SECTION VIEW OF INDIA MARK II DEEPWELL HANDPUMP



TOOLS AND SUPPLIES FOR THE VILLAGE CARETAKER

LIFTING SPANNERS

LIFTER PIPE

CRANK SPANNERS 17x19mm

CONNECTING ROD VICE

CONNECTING ROD LIFTER (TEE-LIFTER)

AXLE PUNCH

HEAVY DUTY CLAMP

PIPE WRENCH 93mm

SMALL PIPE WRENCH 91mm

OPEN ENDED SPANNER 17x18mm

OPEN ENDED SPANNER 18x19mm

GARAGE SCREW DRIVER

WIRE BRUSH

PUMP CYLINDER (COMPLETE SET)

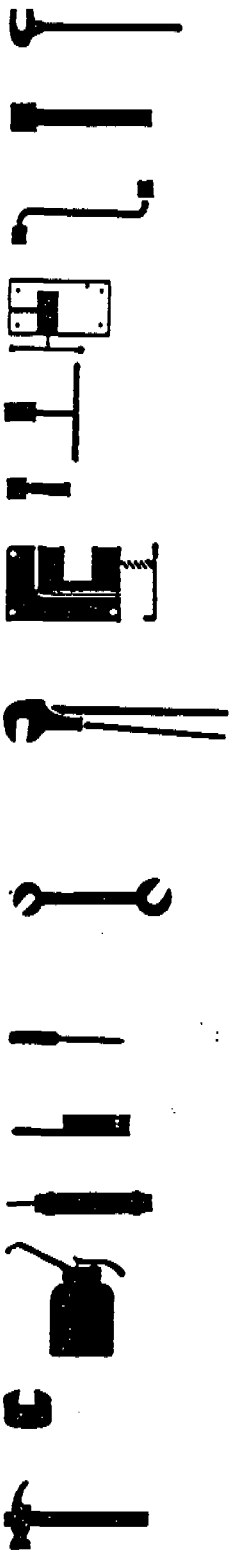
OIL CAN

CHAIN COUPLER SUPPORTING TOOL

HAMMER

HEMP

GREASE



TROUBLE SHOOTING GUIDE

PROBLEM	POSSIBLE CAUSE	REMEDY	REF.
NO WATER (LITTLE RESISTANCE IN HANDLE)	CHAIN DISCONNECTED	REMOVE INSPECTION COVER REFIT CHAIN	
	CONNECTING ROD DISCONNECTED	DISASSEMBLE PUMP - FOLLOW JOB GUIDE - UNTIL DISCONNECTED ROD APPEARS	p 8
	VALVE GUIDE OR PISTON DISCONNECTED	DISASSEMBLE PUMP - FOLLOW JOB GUIDE - EXCHANGE OLD PUMP CYLINDER WITH NEW PROVIDED BY MAJI DISTRICT OFFICE	p 8
DISCHARGES LESS THAN ONE FULL BUCKET OF WATER ON 45 STROKES	LEATHER CUP WORN OUT	DISASSEMBLE PUMP - FOLLOW JOB GUIDE - EXCHANGE OLD PUMP CYLINDER WITH NEW PROVIDED BY MAJI DISTRICT OFFICE	p 8
15 STROKES OR MORE ARE NEEDED BEFORE WATER FLOWS	LEAKAGE IN FOOT VALVE	DISASSEMBLE PUMP - FOLLOW JOB GUIDE - REMOVE OLD CYLINDER CLEAN FOOT VALVE TEST FOOT VALVE BY FILLING CYLINDER WITH WATER IF WATER REMAINS IN CYLINDER THEN: FIT CYLINDER TO RISING MAIN	p 8

TROUBLE SHOOTING GUIDE CONTINUED

PROBLEM	POSSIBLE CAUSE	REMEDY	REF
15 STROKES OR MORE ARE NEEDED BEFORE WATER FLOWS (CONTINUED)		IF WATER LEAKS: EXCHANGE OLD CYLINDER WITH OVER-HAULED CYLINDER PROVIDED BY MAJI DISTRICT OFFICE	
	LEAKAGE IN RISING MAIN PIPE SOCKETS	DISASSEMBLE PUMP - FOLLOW JOB GUIDE - DISCONNECT RISING MAIN UNTIL LEAKAGING APPEARS: WATER VISIBLE IN RISING MAIN BELOW LEAKING SOCKET - REINSTALL PUMP - PACK EACH JOINT PROPERLY FOLLOW JOB GUIDE ON HEMPING	P 8 P
	LEAKAGE IN REDUCER CAP	DISASSEMBLE PUMP - FOLLOW JOB GUIDE - - REMOVE REDUCER - CLEAN THREADS - PACK THREADS - REFIT REDUCER - REINSTALL CYLINDER	P
LOOSE HANDLE	HANDLE AXLE LOOSE	TIGHTEN BOLT FOR HANDLE	
RESISTANCE IN HANDLE	HANDLE AXLE DRIED OUT	DISASSEMBLE AXLE HANDLE - APPLY GREASE ON AXLE - REINSTALL HANDLE AXLE	P
	EXPANSION IN LEATHER CUPS	DISASSEMBLE PUMP - FOLLOW JOB GUIDE - - EXCHANGE OLD PUMP CYLINDER - WITH NEW PROVIDED BY D-with the ~~MAJI DISTRICT OFFICE~~	

... FOR DIS... ...
...ENT KIT" ...

...D TOOLS, HEMP, AND ...

...AROUND PUMP STAND

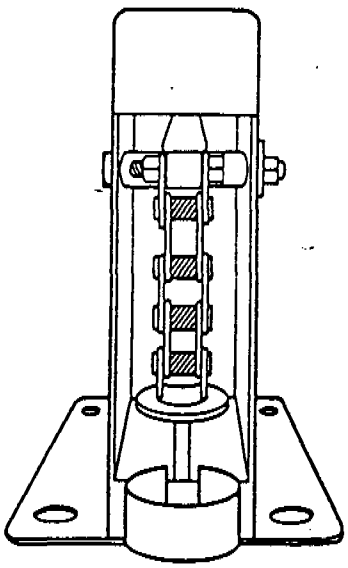
... 6 BUCKETS OF WATER ... ...ING
...D OF RISING MAIN, ... ETC.

...INSPECTION

...T INITIATED BY

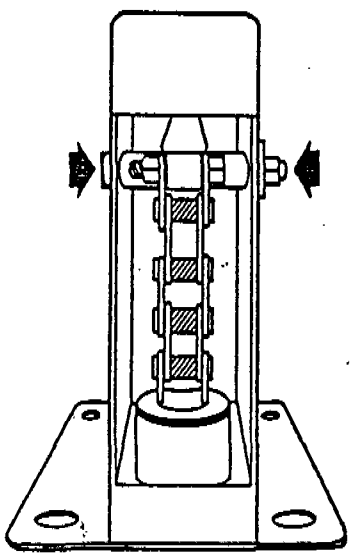
MAINTENANCE OF THE PUMP: DISASSEMBLY

3. INSERT CHAIN COUPLER SUPPORTING TOOL



TOOL:

4. REMOVE NYLOC NUT AND BOLT

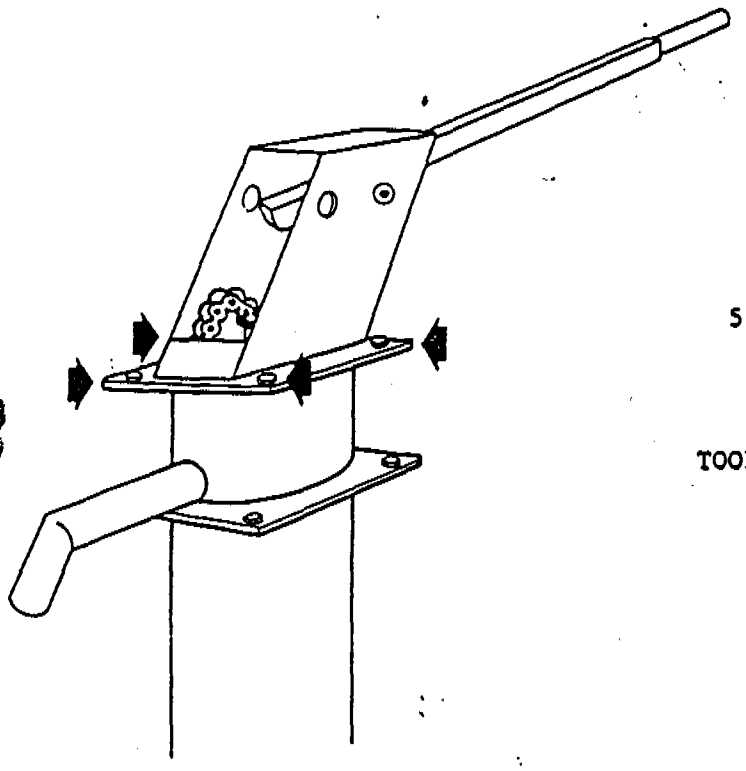


4.1 LIFT HANDLE IN TOP POSITION
4.2 UNSCREW BOLT AND NUT INDICATED BY ARROWS

TOOLS:

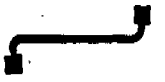
MAINTENANCE OF THE PUMP: DISASSEMBLY

5. REMOVE FLANGE BOLTS FROM HEAD ASSEMBLY

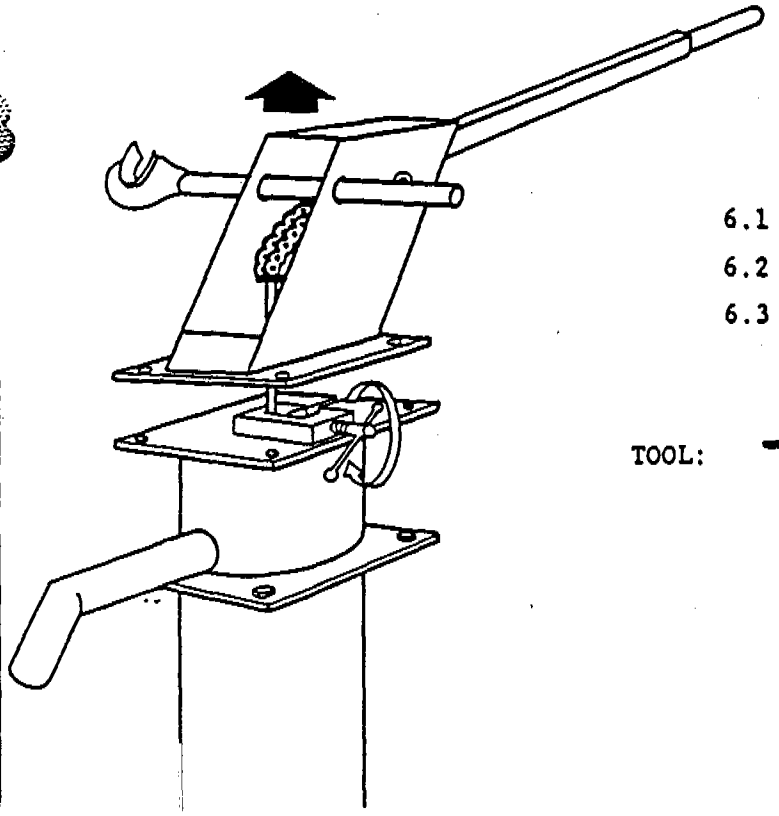


5.1 UNSCREW BOLTS INDICATED BY THE ARROWS

TOOLS:



6. FIT CONNECTING ROD VICE



6.1 INSERT LIFTING SPANNER

6.2 LIFT HEAD ASSEMBLY

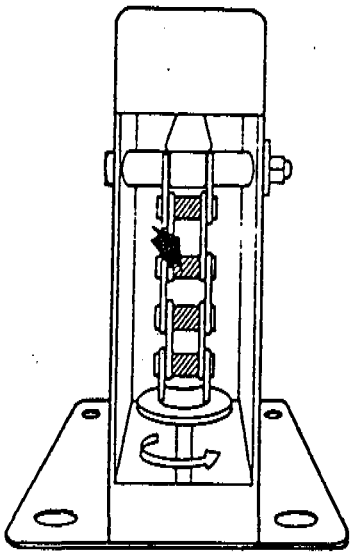
6.3 TIGHT VICE FIRMLY

TOOL:

MAINTENANCE OF THE PUMP: DISASSEMBLY

11

7. REMOVE CHAIN FROM CONNECTING ROD

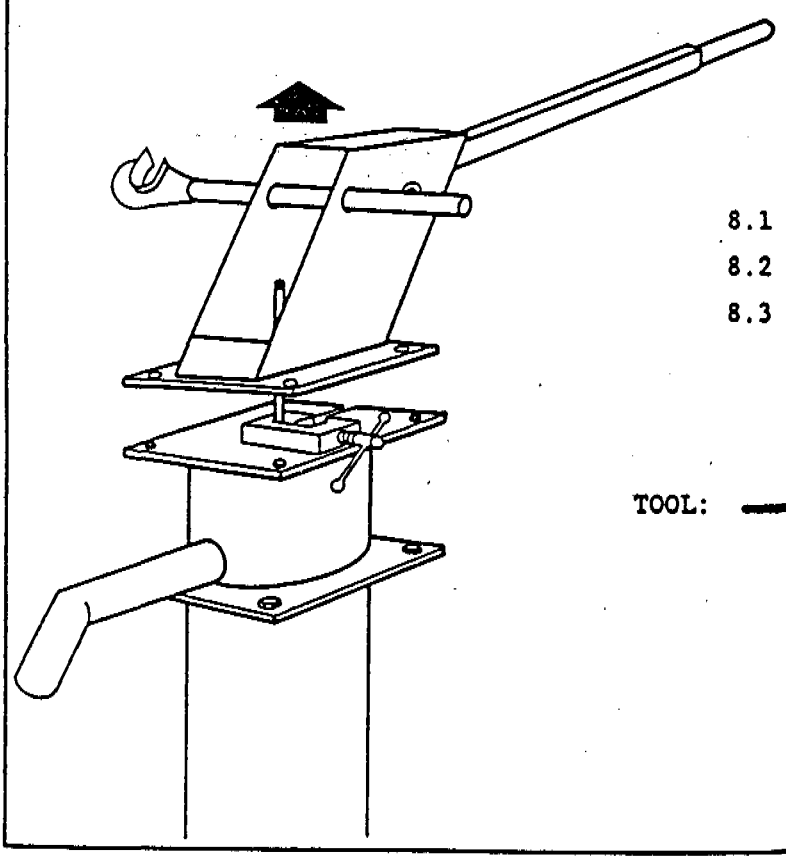


7.1 INSERT SCREWDRIVER INDICATED BY THE ARROW

7.2 TURN IN ↻ DIRECTION

TOOL:

8. REMOVE HEAD ASSEMBLY



8.1 INSERT LIFTING SPANNER

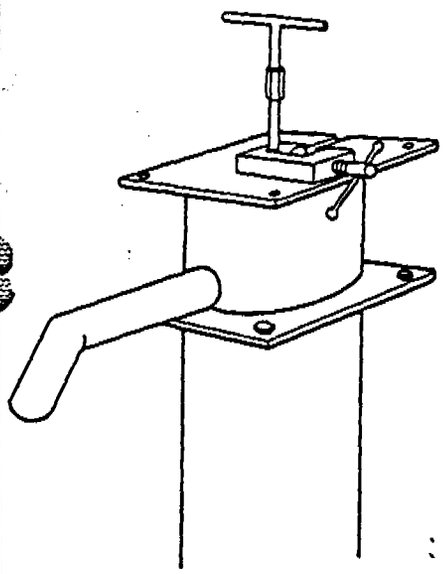
8.2 LIFT HEAD ASSEMBLY

8.3 PLACE HEAD ASSEMBLY 5-6 METRES FROM PUMP

TOOL:

MAINTENANCE OF THE PUMP: DISASSEMBLY

9. FIT CONNECTING ROD LIFTER



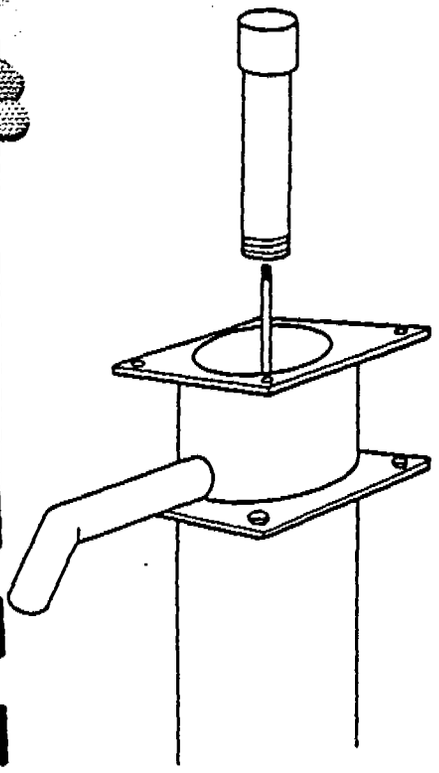
9.1 SUPPORT ROD

9.2 RELEASE VICE AND LOWER ROD CAREFULLY

9.3 REMOVE CONNECTING ROD VICE

TOOL: 

10. FIT PIPE LIFTER TO WATER TANK

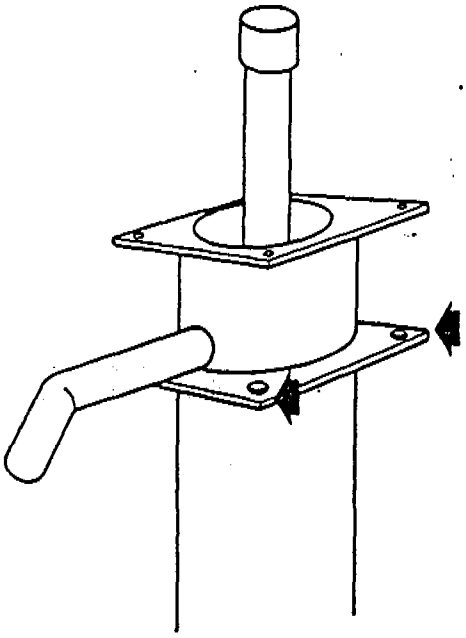


10.1 REMOVE CONNECTING ROD LIFTER

10.2 FIT PIPE LIFTER FIRMLY

TOOL: 

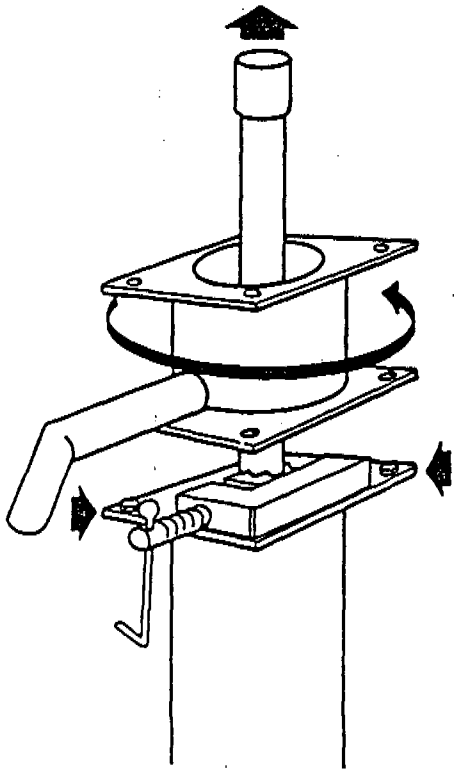
11. REMOVE WATER TANK FLANGE BOLTS



11.1 UNSCREW THE 4 BOLTS ON WATER TANK FLANGE

TOOLS:

12. FIT HEAVY DUTY CLAMP



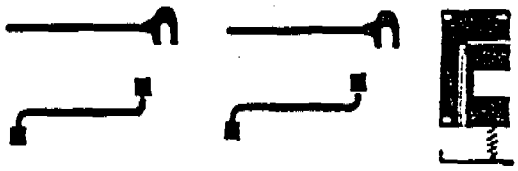
12.1 LIFT WATER TANK WITH LIFTING SPANNERS

12.2 TIGHTEN CLAMP FIRMLY

12.3 FIT TWO BOLTS FOR CLAMP AS SHOWN BY ARROWS

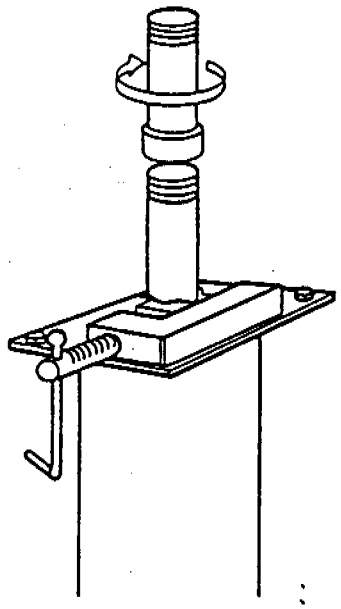
12.4 REMOVE WATER TANK BY UNSCREWING COUNTERCLOCKWISE (AS SHOWN BY ARROW)

TOOLS:



MAINTENANCE OF THE PUMP: DISASSEMBLY

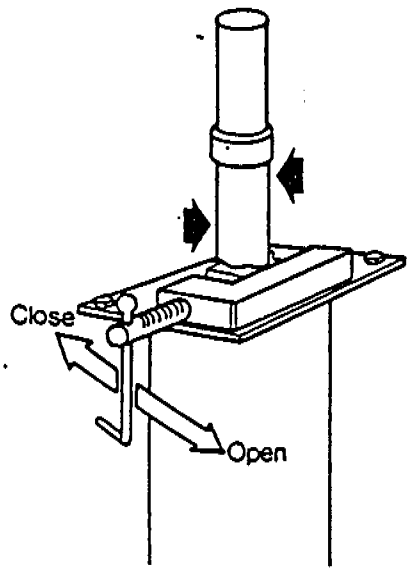
13. FIT PIPE LIFTER TO RISING MAIN



13.1 TIGHTEN FIRMLY

TOOLS: 

14. LIFT RISING MAIN



14.1 SUPPORT RISING MAIN WITH LIFTING SPANNERS

14.2 RELEASE HEAVY DUTY CLAMP CAREFULLY

14.3 LIFT RISING MAIN*

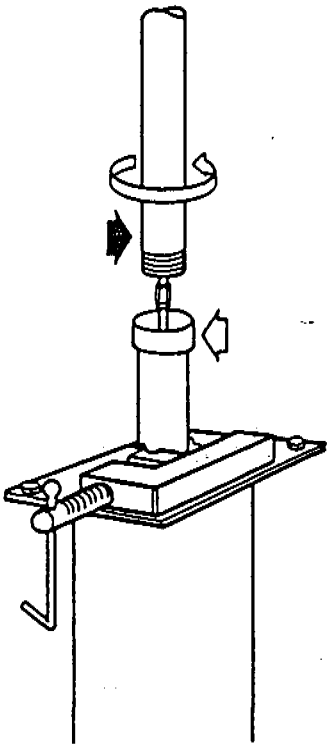
14.4 TIGHTEN HEAVY DUTY CLAMP FIRMLY

14.5 REPEAT UNTIL NEXT SOCKET APPEARS

TOOLS: 

* THE WEIGHT OF THE RISING MAIN WILL

15. DISCONNECT RISING MAIN AND CONNECTING RODS



15.1 SUPPORT SOCKET (INDICATED BY WHITE ARROW) WITH PIPE SPANNER

15.2 TURN PIPE (INDICATED BY BLACK ARROW) WITH ANOTHER PIPE SPANNER COUNTERCLOCKWISE

15.3 LIFT PIPE UNTIL ROD CONNECTION APPEARS

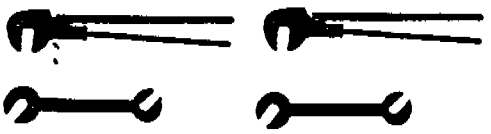
15.4 SUPPORT CHECK NUT WITH OPEN ENDED SPANNER

15.5 TURN CONNECTION WITH ANOTHER OPEN ENDED SPANNER

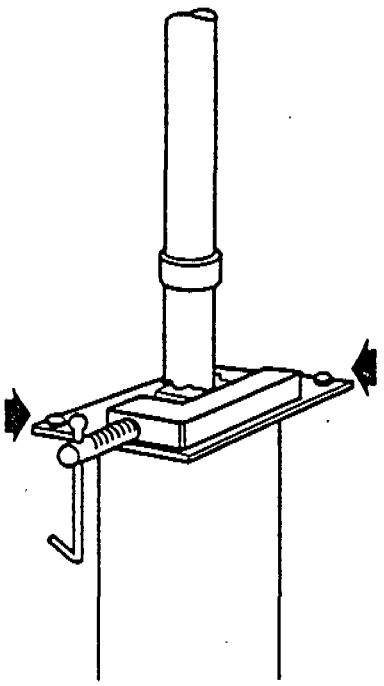
15.6 REMOVE PIPE AND CONNECTING ROD

15.7 REPEAT UNTIL CYLINDER APPEARS

TOOLS:



16. REMOVE HEAVY DUTY CLAMP



16.1 TIGHTEN CLAMP FIRMLY ON LAST P[illegible]

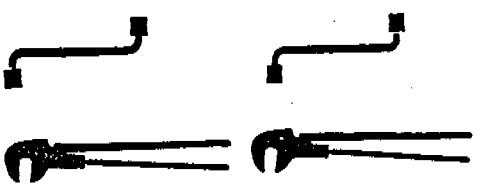
16.2 REMOVE BOLTS FROM CLAMP INDICATED BY THE ARROWS

16.3 REMOVE CLAMP WITH PIPE AND CYLINDER

16.4 RELEASE CLAMP

16.5 DISCONNECT CYLINDER

TOOLS:

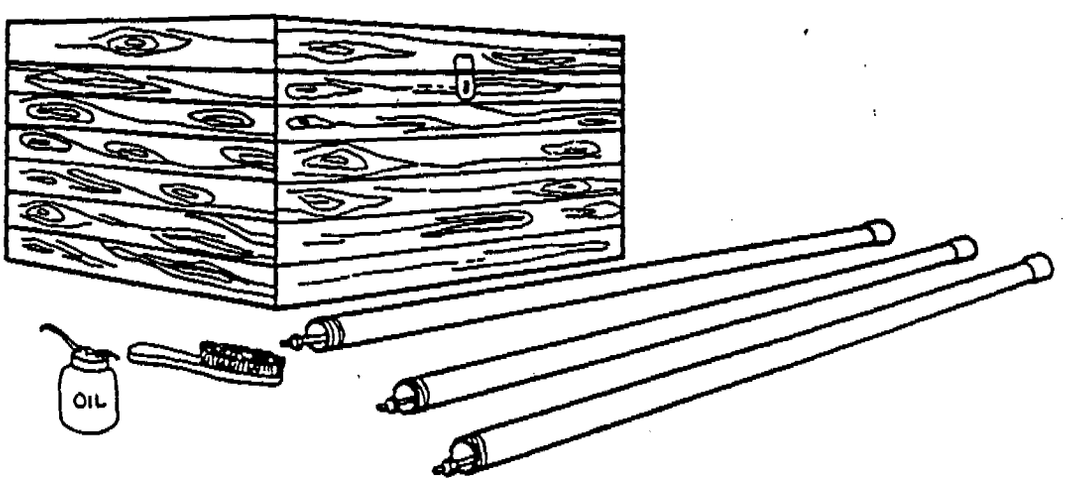


MAINTENANCE OF THE PUMP: PREPARATION OF RISING MAIN PIPES & CONNECTING RODS

1. PREPARATION OF RISING MAIN PIPES & CONNECTING RODS FOR ASSEMBLY

TOOLS REQUIRED:
- WIRE BRUSH
- OIL CAN
- HEMP

2. ARRANGE PIPES, TOOLS AND TOOL BOX



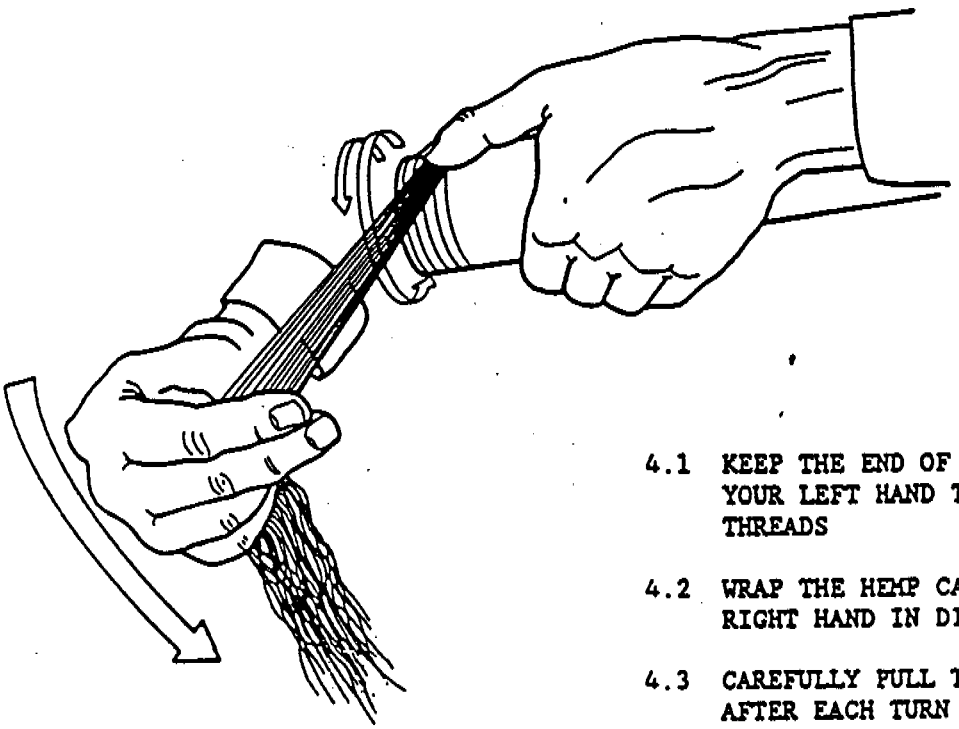
MAINTENANCE OF THE PUMP: PREPARATION OF RISING MAIN PIPES & CONNECTING RODS

3. SUPPORT PIPE ACROSS YOUR LEGS

3.1 CLEAN THREADS WITH WIRE BRUSH

3.2 KEEP LONG END OF PIPE TO YOUR LEFT SIDE

4. APPLY HEMP ON THREADS



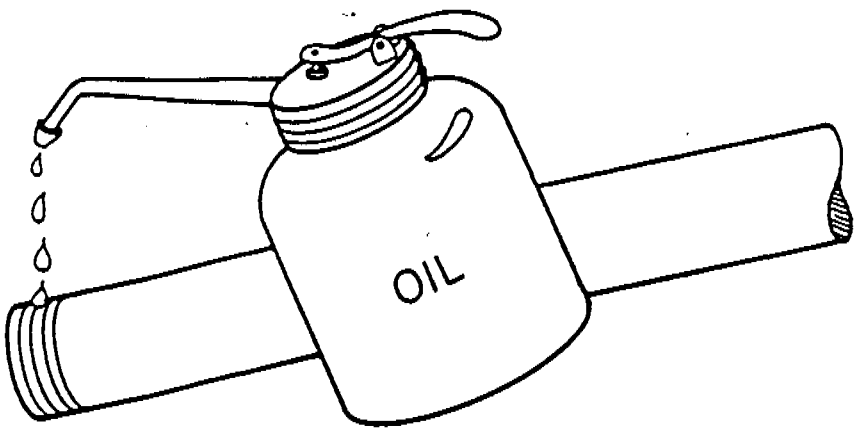
4.1 KEEP THE END OF THE HEMP BETWEEN YOUR LEFT HAND THUMB AND THE PIPE THREADS

4.2 WRAP THE HEMP CAREFULLY WITH YOUR RIGHT HAND IN DIRECTION OF ARROWS

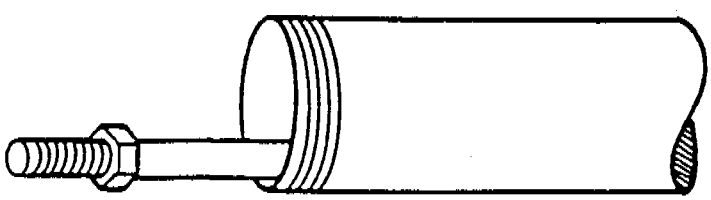
4.3 CAREFULLY PULL THE HEMP TIGHT AFTER EACH TURN

MAINTENANCE OF THE PUMP: PREPARATION OF RISING MAIN PIPES & CONNECTING RODS

5. APPLY 4-5 DROPS OIL ON HEMP

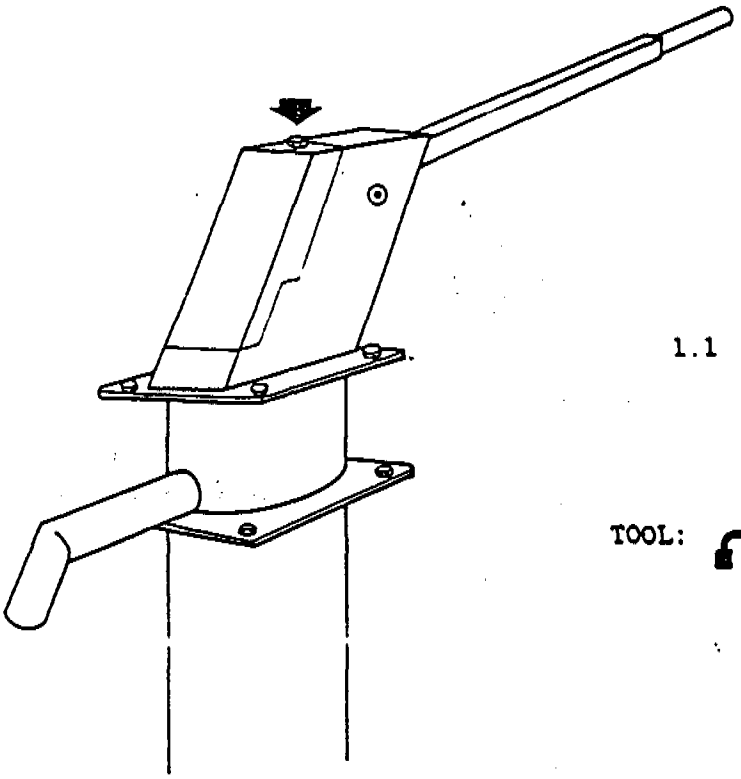


6. TURN CHECK NUT ON CONNECTING ROD TO THE END OF THREADS



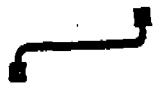
MAINTENANCE OF THE PUMP: REMOVAL OF THE PUMP HANDLE

1. REMOVE INSPECTION COVER

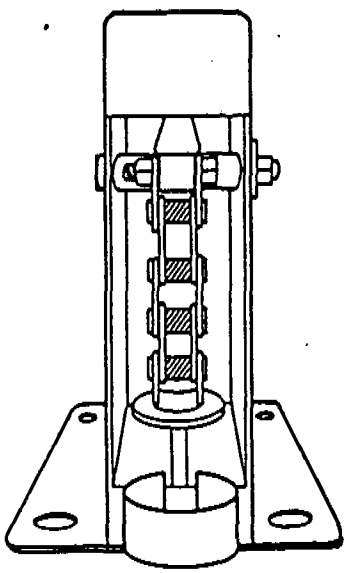


1.1 UNSCREW BOLT AS INDICATED BY THE ARROW

TOOL:



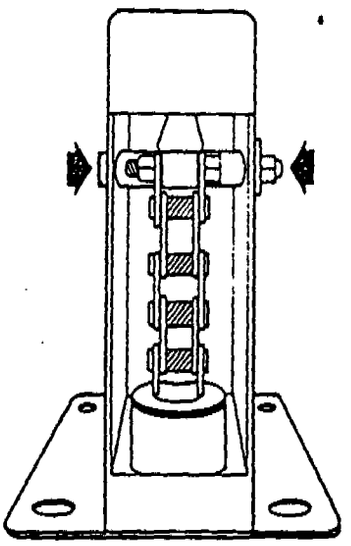
2. INSERT CHAIN COUPLER SUPPORTING TOOL



TOOL:

MAINTENANCE OF THE PUMP: REMOVAL OF THE PUMP HANDLE

3. REMOVE NYLOC NUT AND BOLT

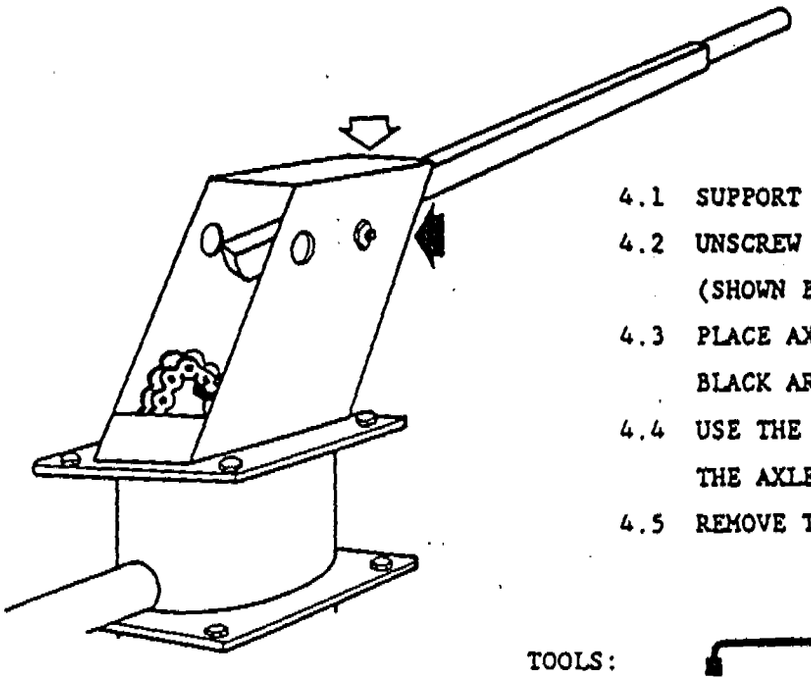


3.1 LIFT HANDLE IN TOP POSITION

3.2 UNSCREW BOLT AND NUT INDICATED BY THE ARROWS

TOOLS:

4. REMOVE AXLE BOLT



4.1 SUPPORT HANDLE

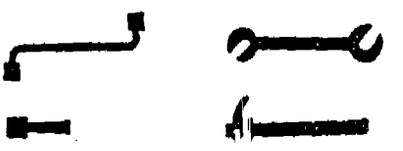
4.2 UNSCREW WASHER NUT AND CHECK NUT (SHOWN BY WHITE ARROW)

4.3 PLACE AXLE PUNCH ON BOLT (SHOWN BY BLACK ARROW)

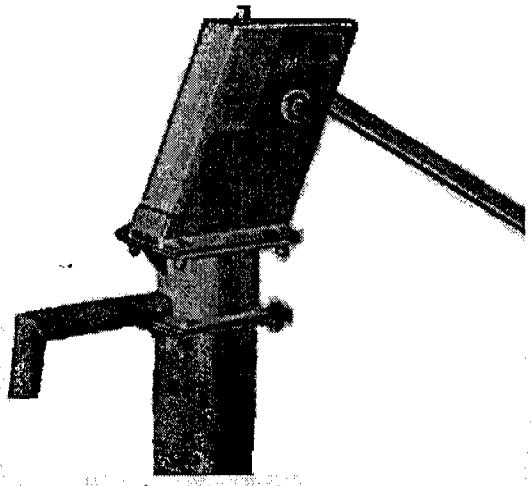
4.4 USE THE HAMMER CAREFULLY TO REMOVE THE AXLE BOLT

4.5 REMOVE THE HANDLE

TOOLS:



INDIA MARK II HAND PUMP



INSTALLATION OF THE PUMP HEAD, CYLINDER, RISER PIPES AND RODS

GRZ

UNICEF

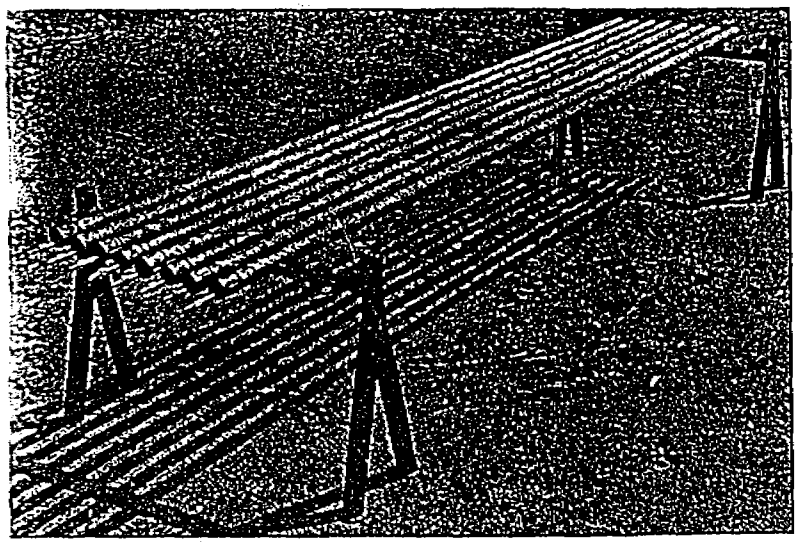
PREPARED BY UNICEF WASHE SECTION
FEBRUARY 2005

Step

10

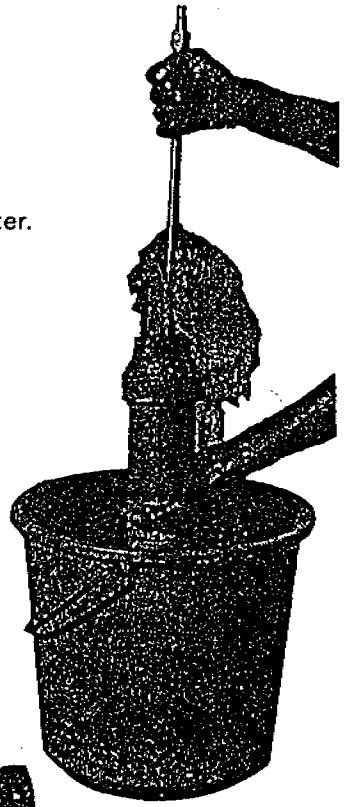
SEVEN DAYS LATER

Lay out pipes and connecting rods.
Check that pipes and rods are threaded properly
Check that all threads are good and clean
Ensure that all pipes have socket at one end

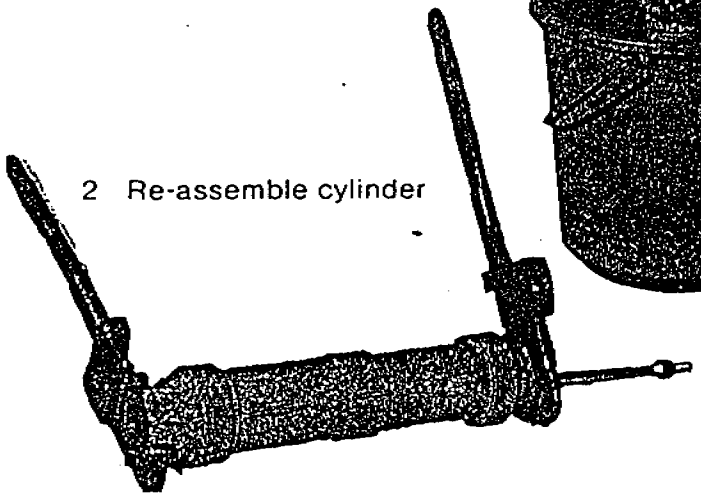


Step 11

CHECK CYLINDER OPERATION



3 Test cylinder in a bucket of water. If Check valve Assembly leaks replace it.

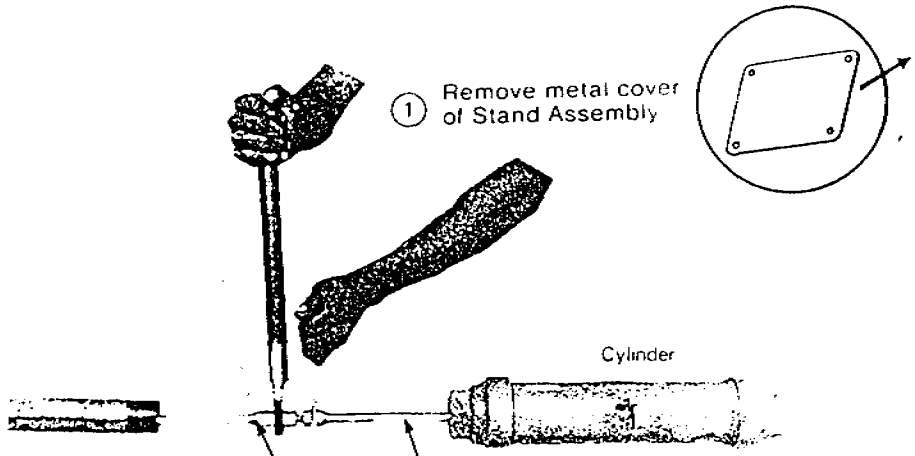


2 Re-assemble cylinder

1.....Open Cylinder and check that piston Assembly and check valve Assembly are tight and properly assembled

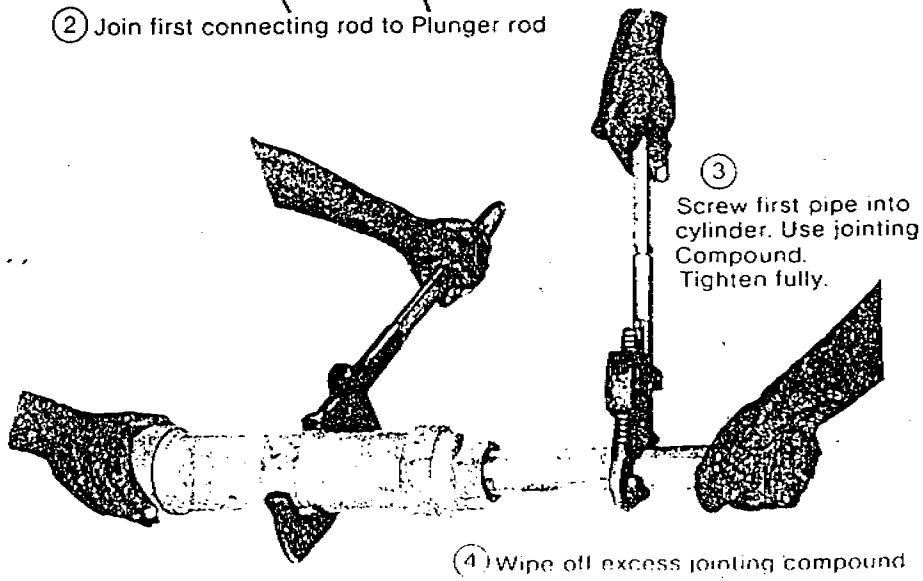
Step 12

FIX CYLINDER TO FIRST ROD AND PIPE



① Remove metal cover of Stand Assembly

② Join first connecting rod to Plunger rod



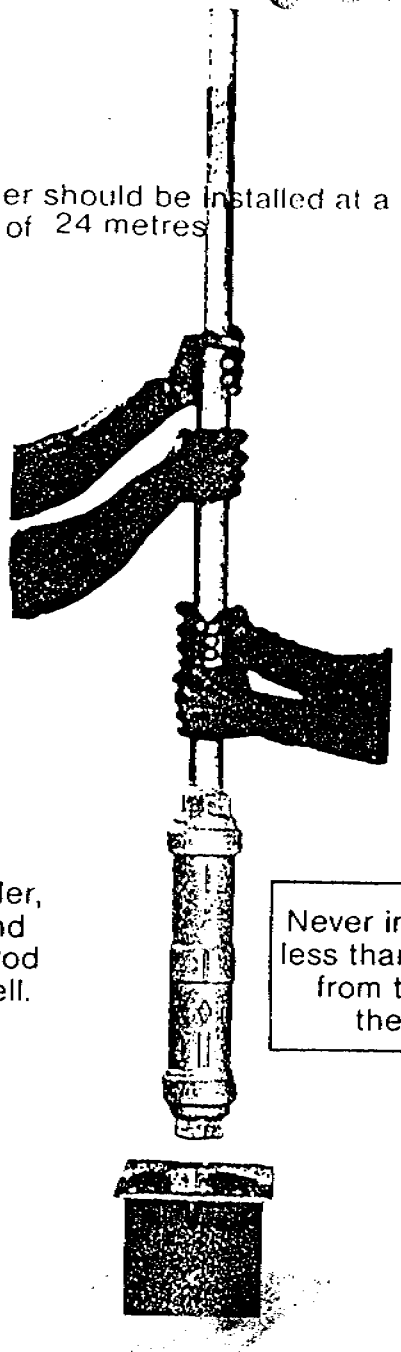
③ Screw first pipe into cylinder. Use jointing Compound. Tighten fully.

④ Wipe off excess jointing compound

Step

13

Cylinder should be installed at a minimum depth of 24 metres

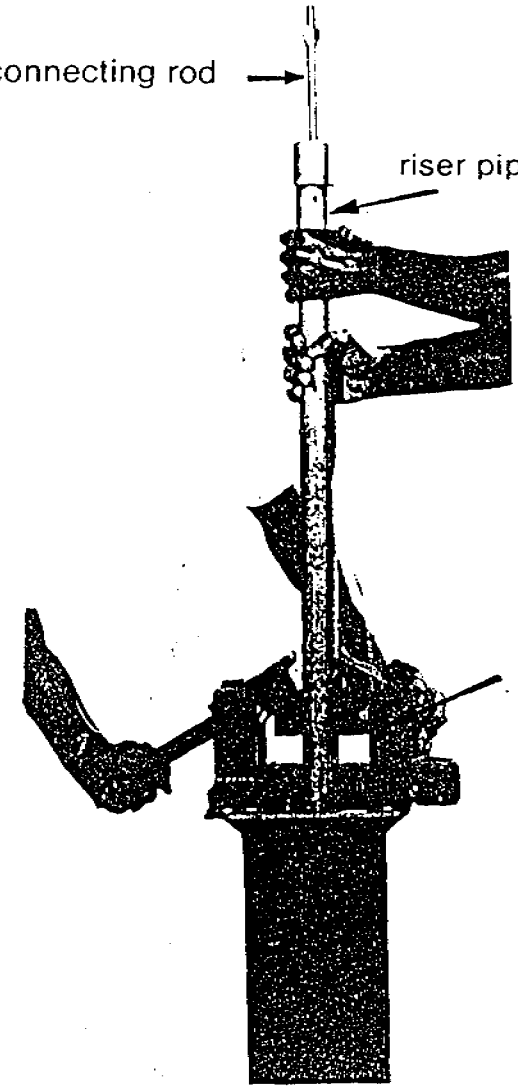


Lower cylinder, first pipe and connecting rod into tube well.

Never install a cylinder less than 6 Metres from the bottom of the tube well.

Step

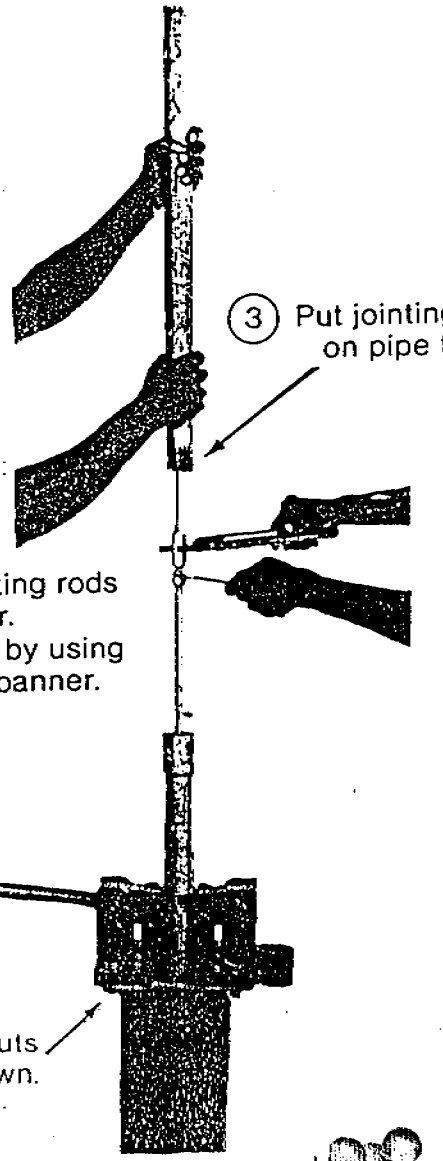
14



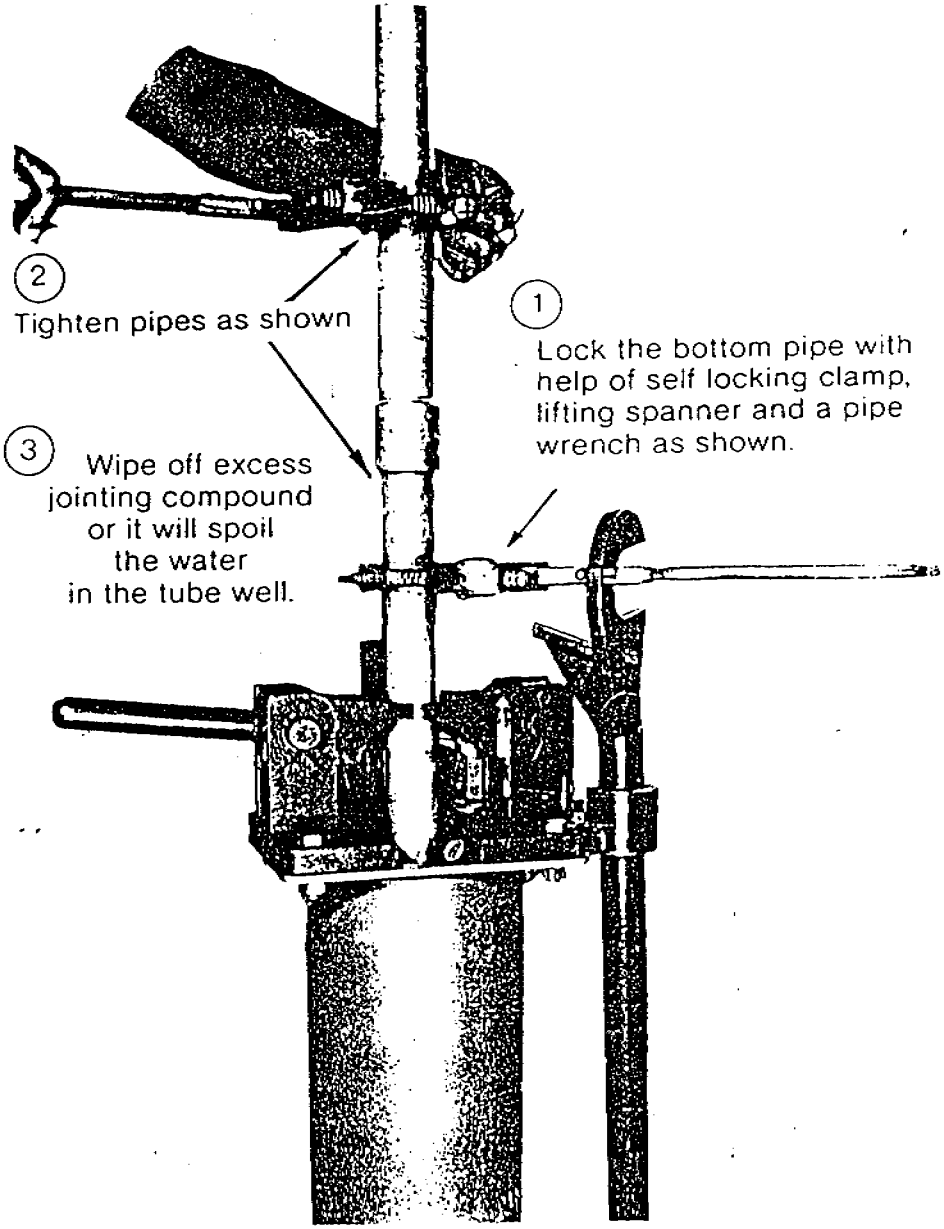
Insert the self locking clamp to clamp the riser pipe as shown.

FIX SUCCESSIVE PIPE AND RODS

Step 15

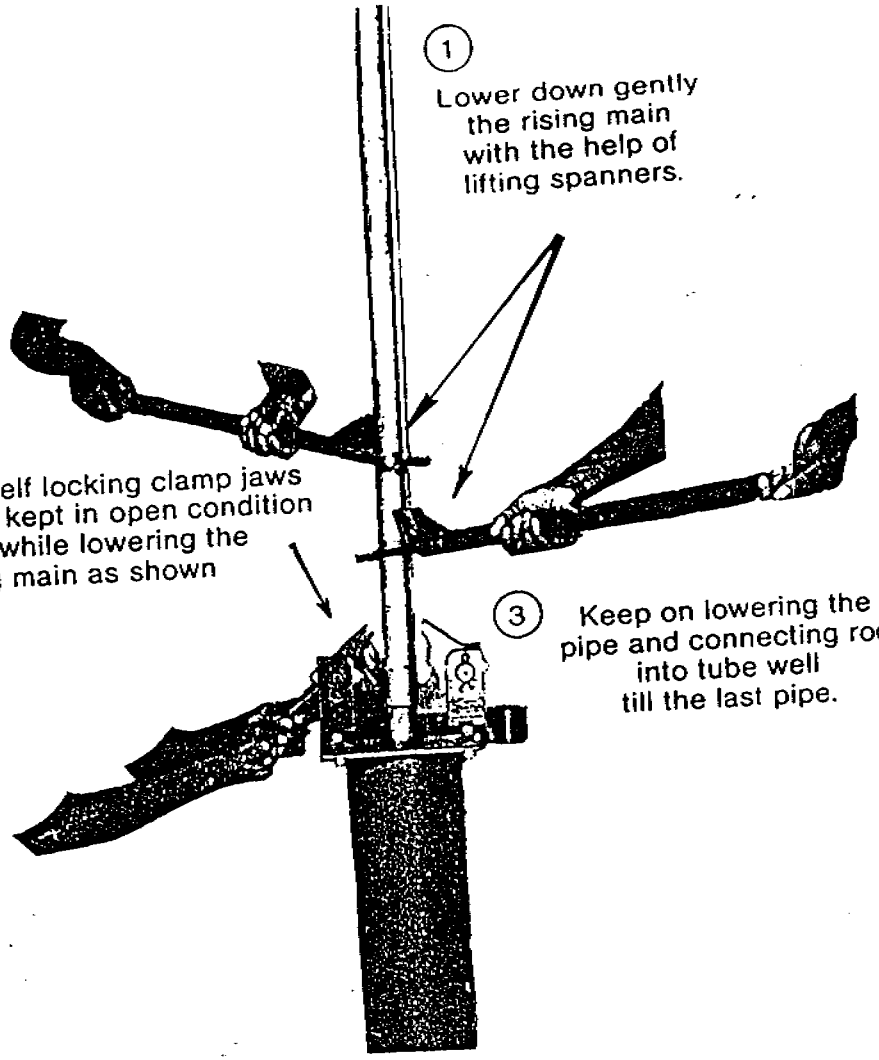


Step 16



Step

17



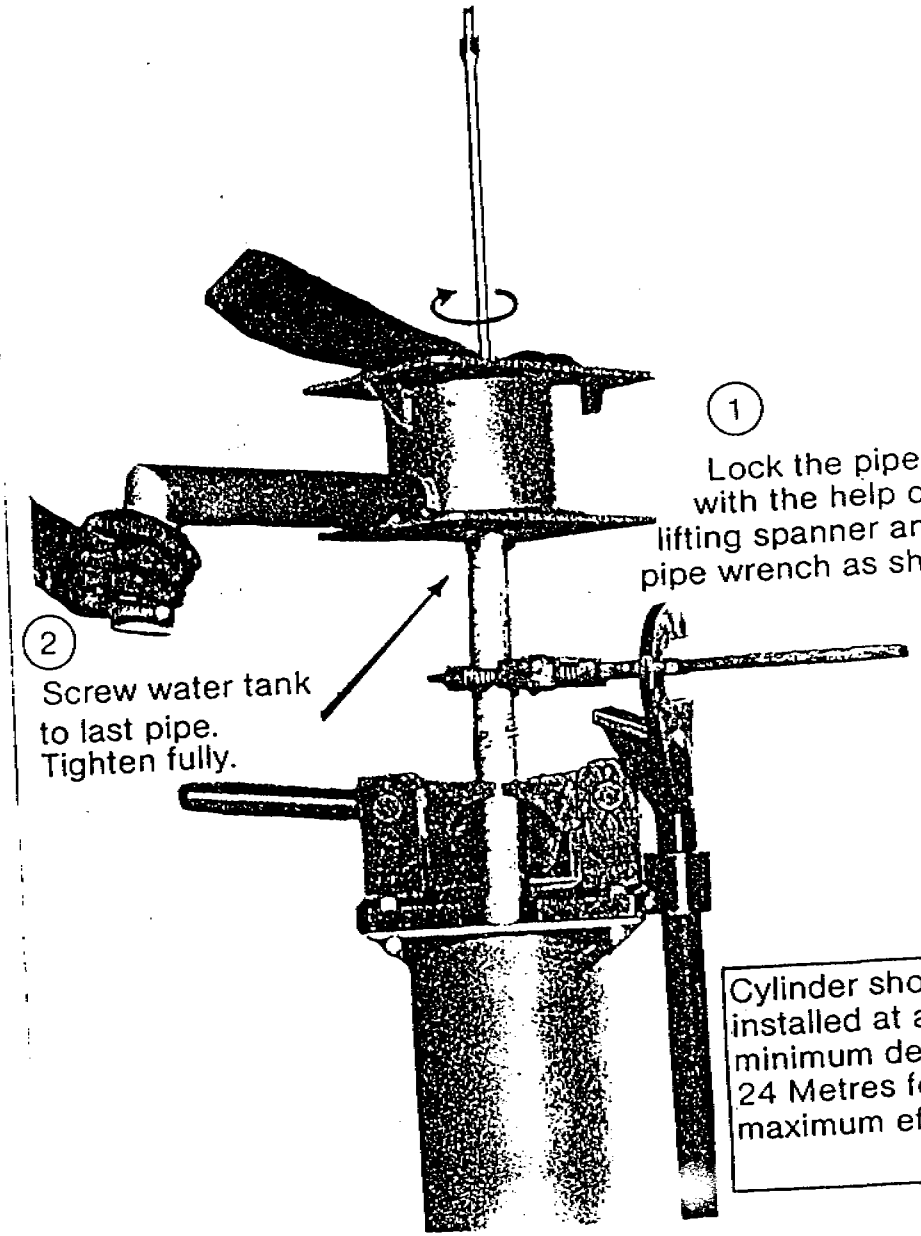
1. Lower down gently the rising main with the help of lifting spanners.

2. The self locking clamp jaws to be kept in open condition Only while lowering the rising main as shown

3. Keep on lowering the pipe and connecting rod into tube well till the last pipe.

8

FIX WATER TANK TO LAST PIPE

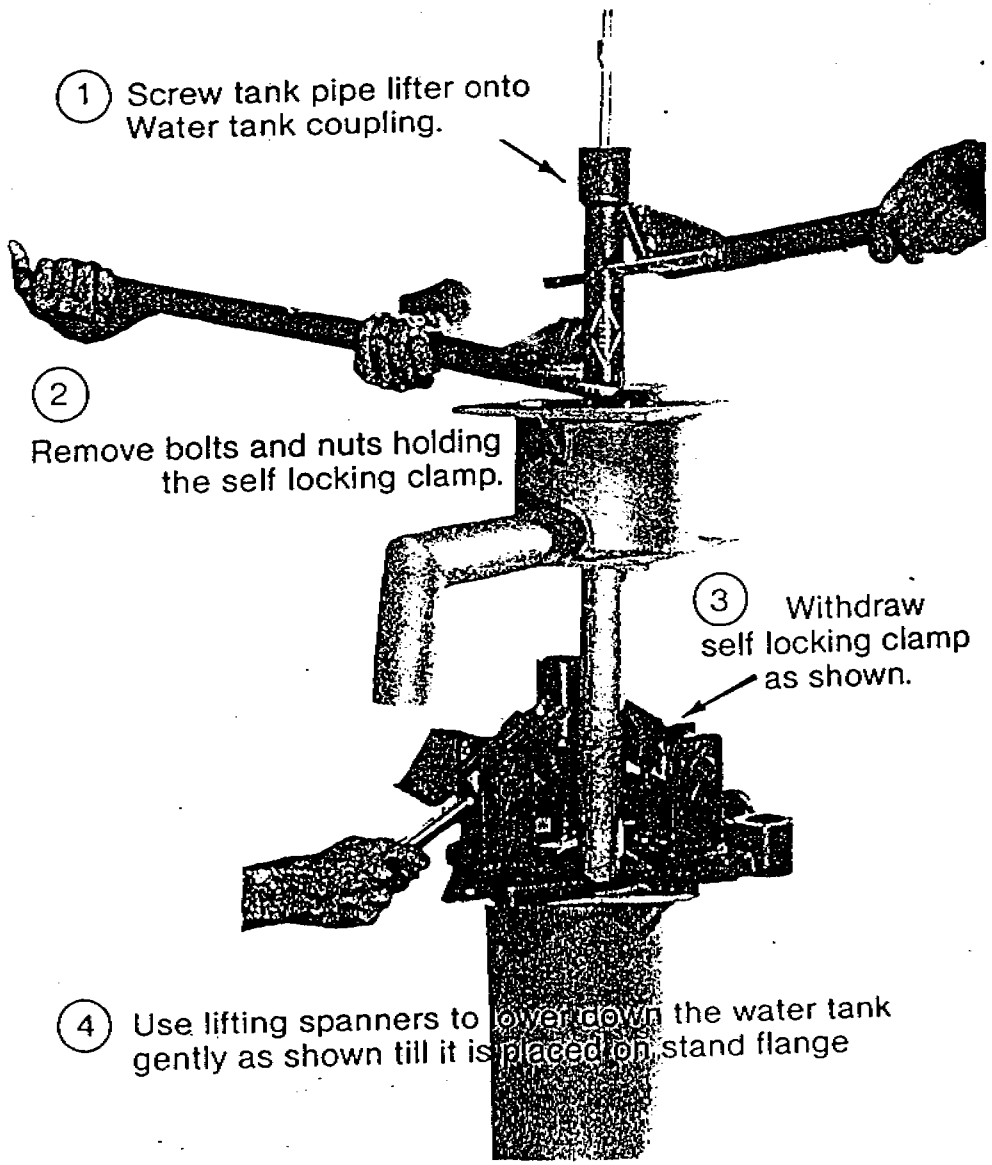


1. Lock the pipe with the help of lifting spanner and a pipe wrench as shown.

2. Screw water tank to last pipe. Tighten fully.

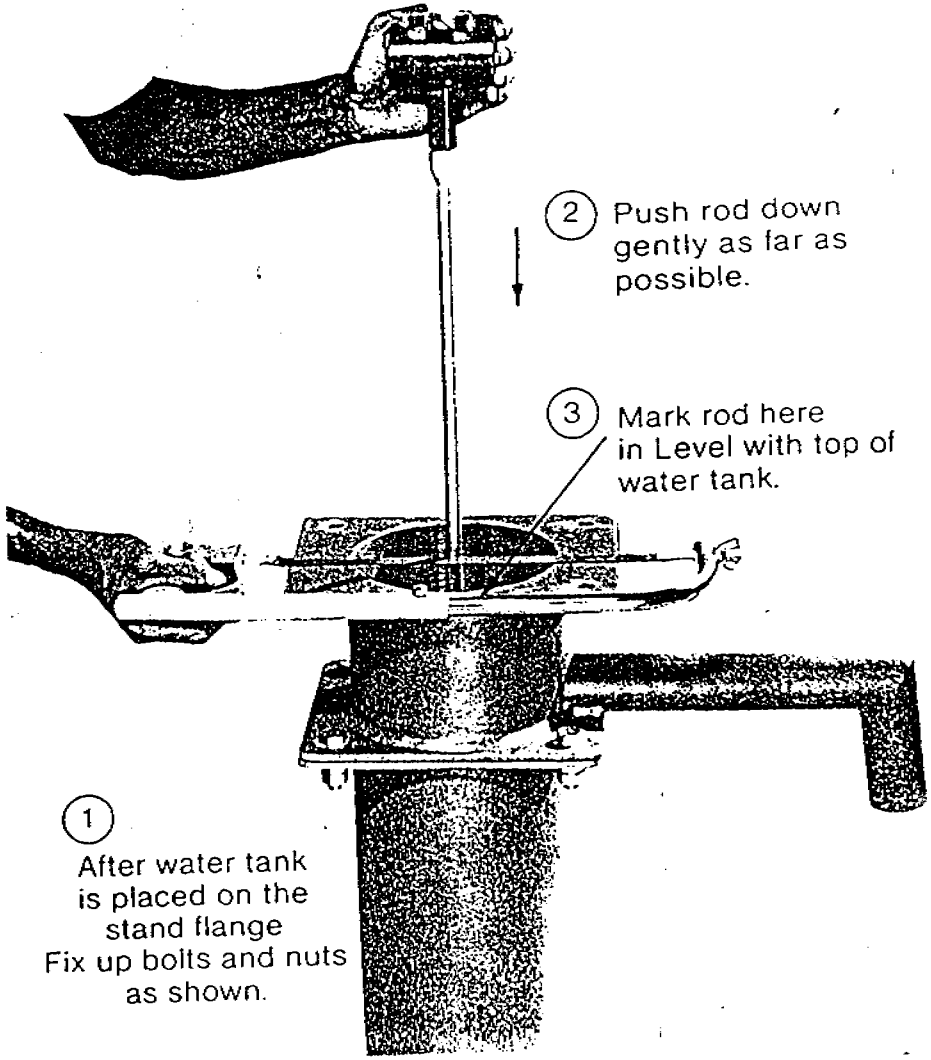
Cylinder should b installed at a minimum depth c 24 Metres for maximum efficier

Step 19



FIX WATER TANK ON STAND ASSEMBLY

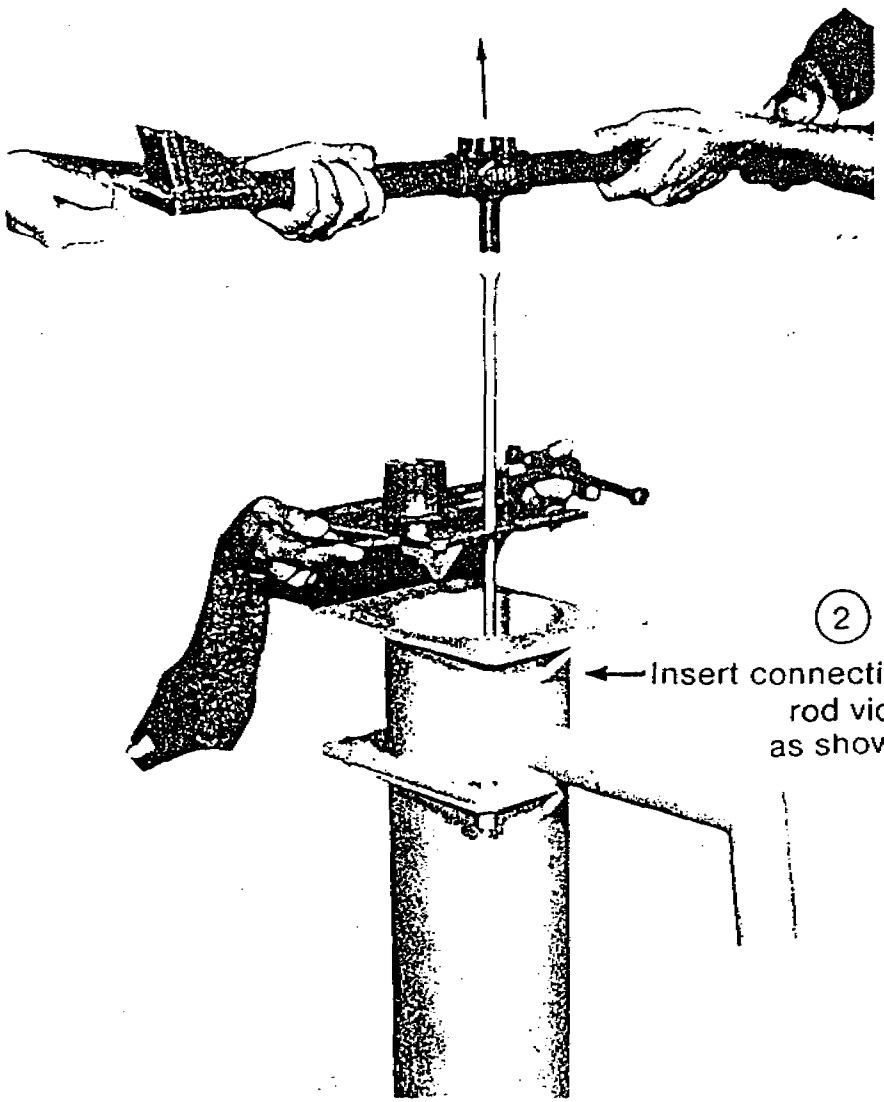
Step 20



Step

21

1 Lift rod as far as possible with help of connecting rod lifter as shown.

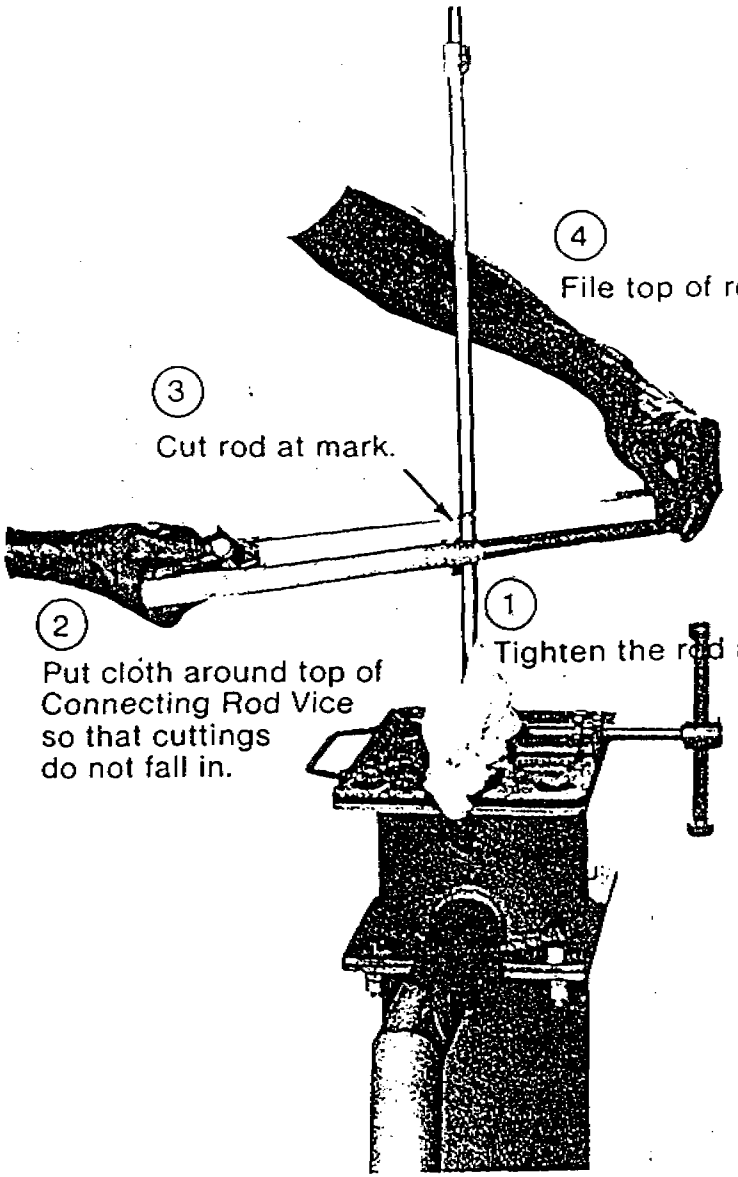


2 Insert connecting rod vice as shown.

Step

22

SET PISTON STROKE LENGTH



4 File top of rod smooth

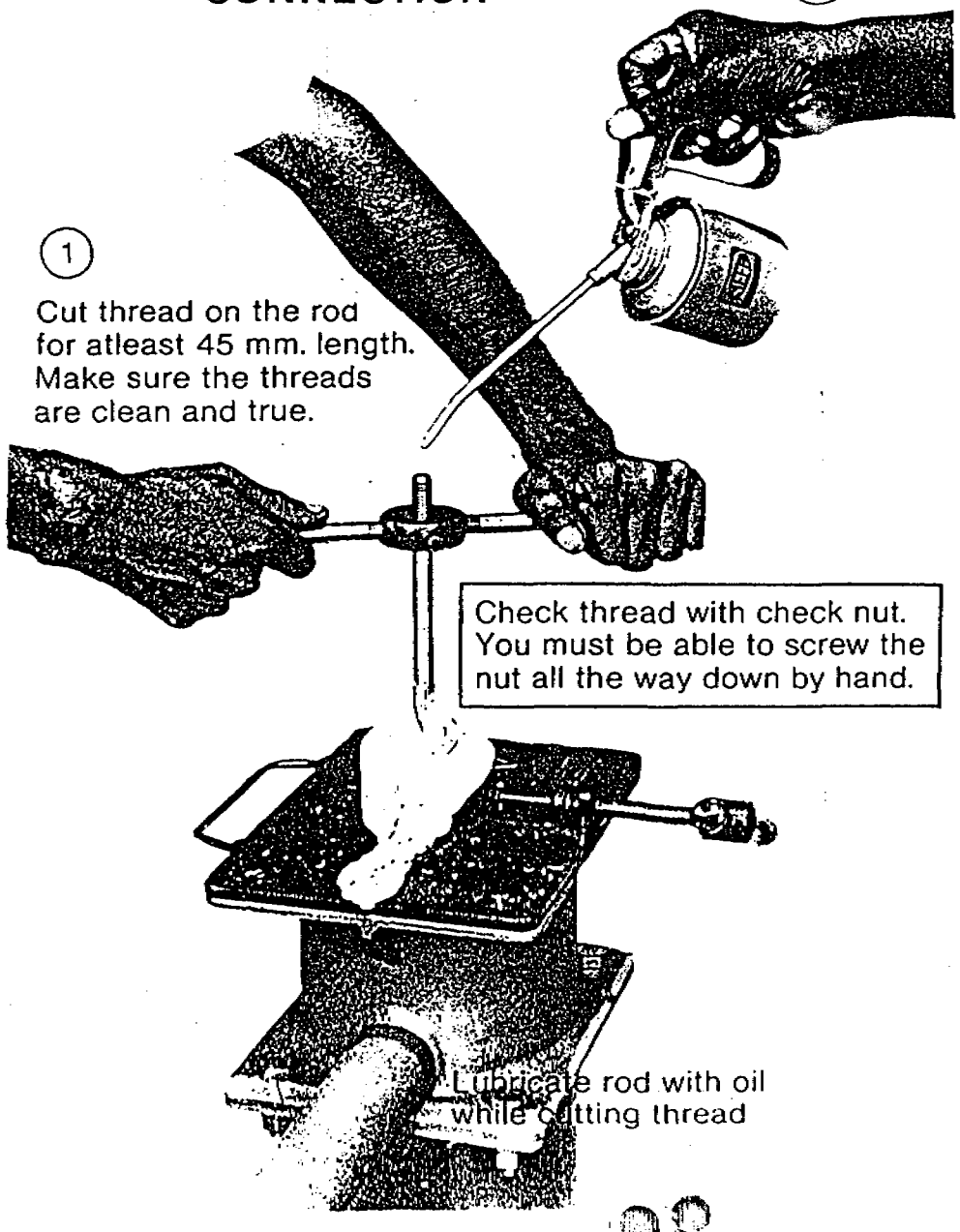
3 Cut rod at mark.

2 Put cloth around top of Connecting Rod Vice so that cuttings do not fall in.

1 Tighten the rod as shown.

CUT THREAD FOR CHAIN CONNECTION

Step 23



1

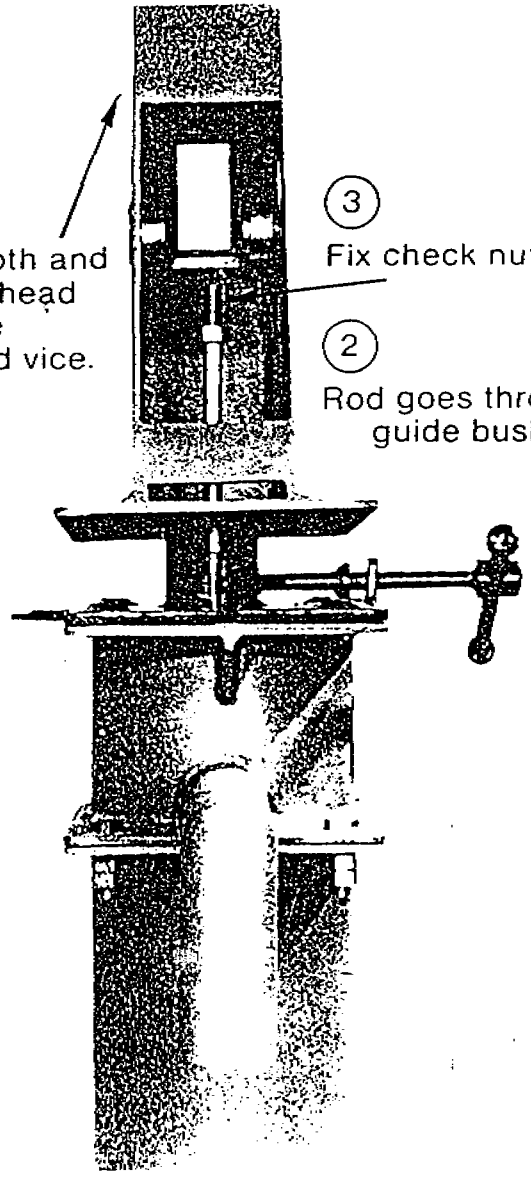
Cut thread on the rod for atleast 45 mm. length. Make sure the threads are clean and true.

Check thread with check nut. You must be able to screw the nut all the way down by hand.

Lubricate rod with oil while cutting thread

FIX HEAD ASSEMBLY

Step 24



1

Remove the cloth and Lower pump head on to the connecting rod vice.

3

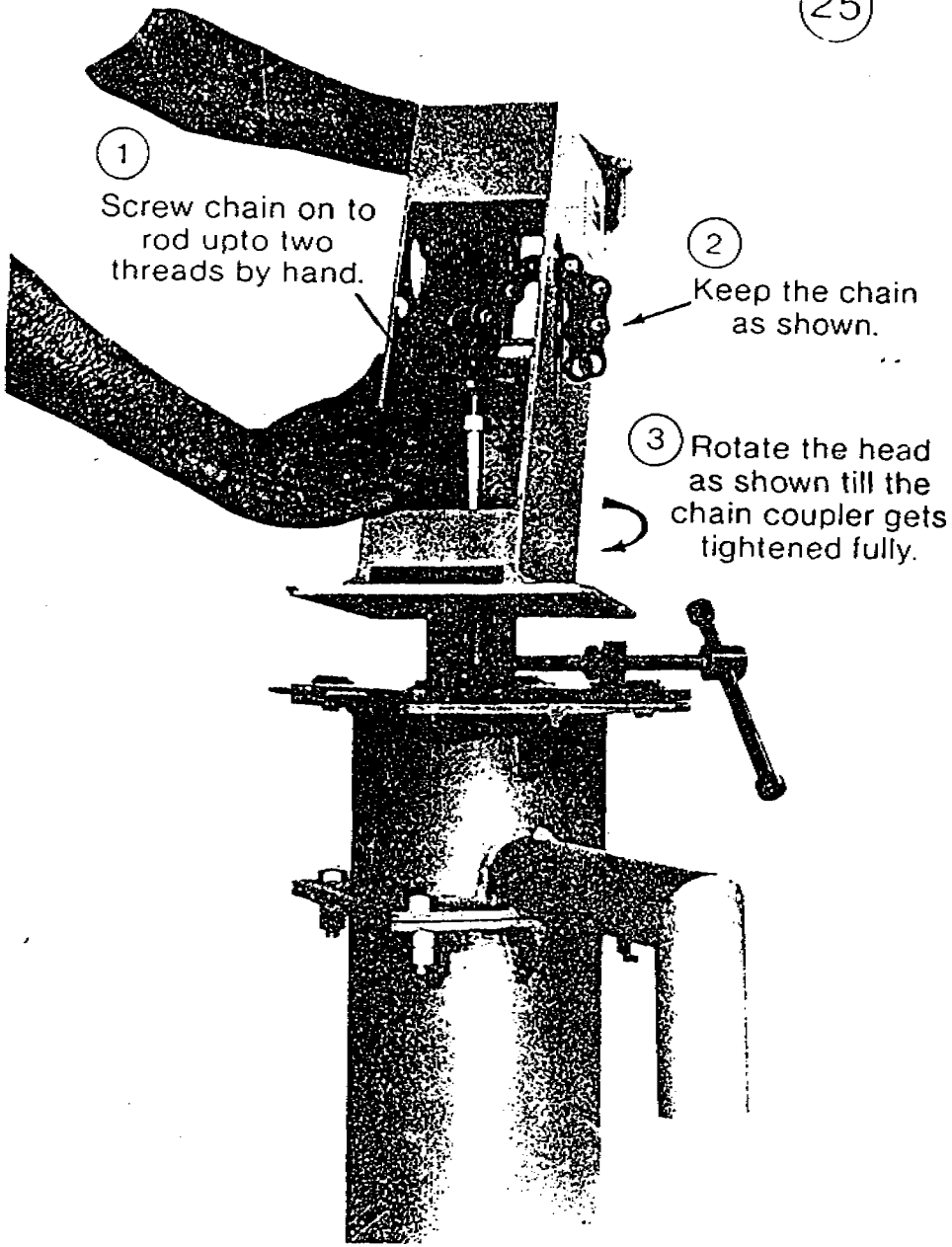
Fix check nut as shown.

2

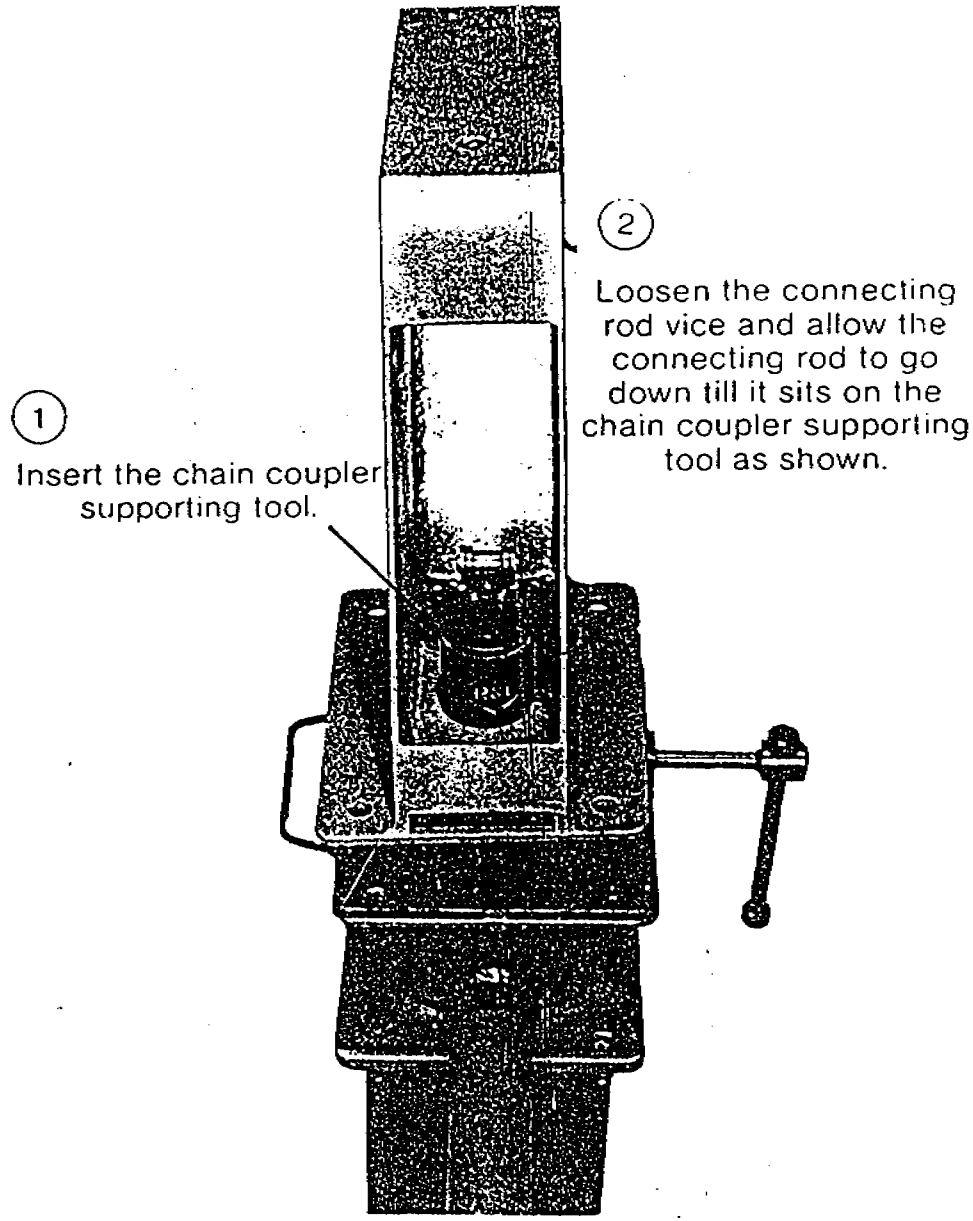
Rod goes through guide bush.

THREAD CHAIN TO CONNECTING ROD

Step 25

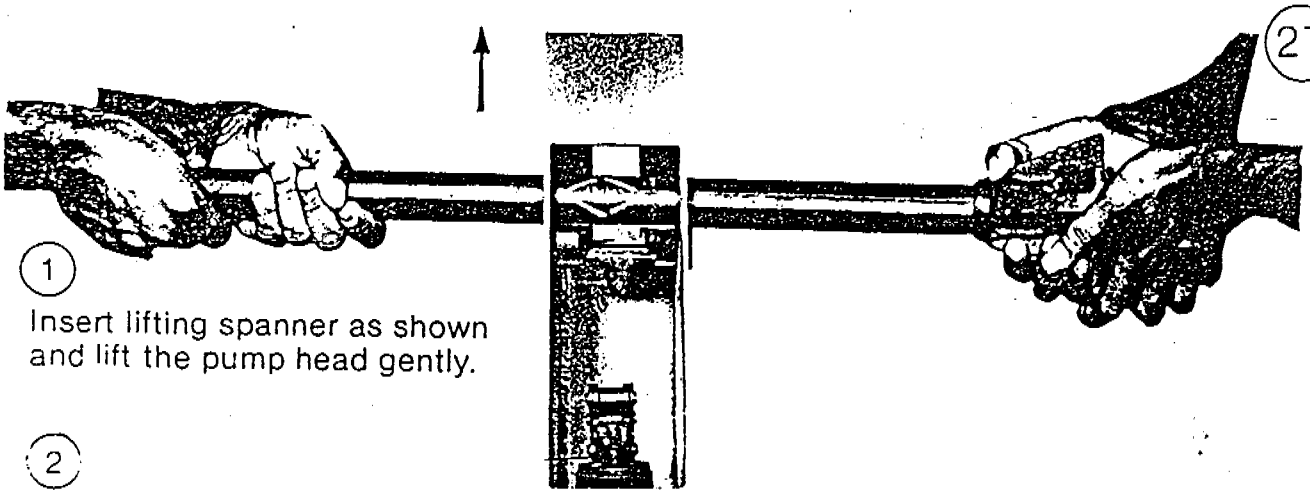


Step 26



PLACE HEAD ON WATER TANK

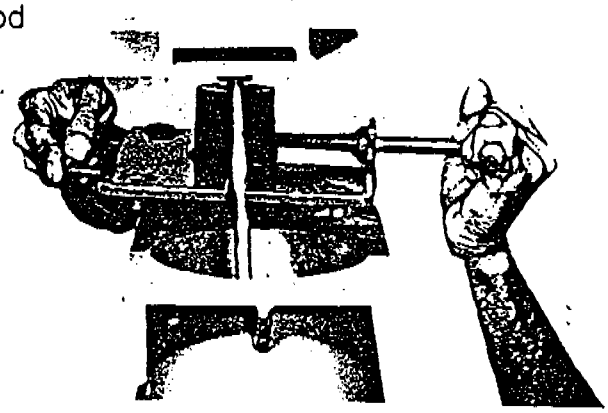
Step 27



1. Insert lifting spanner as shown and lift the pump head gently.

2. Withdraw connecting rod vice as shown.

3. Lower the head till it sits on water tank.



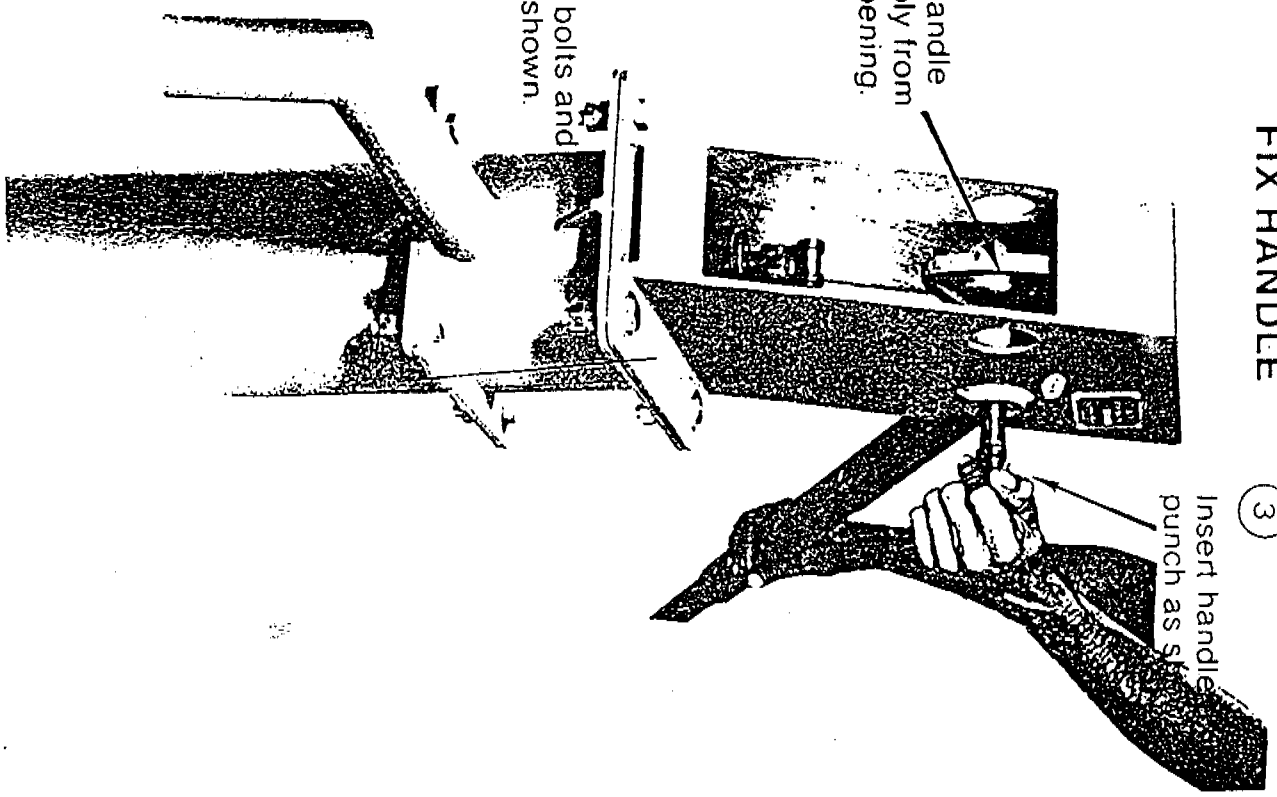
Step 28

FIX HANDLE

1. Tighten all bolts and nuts as shown.

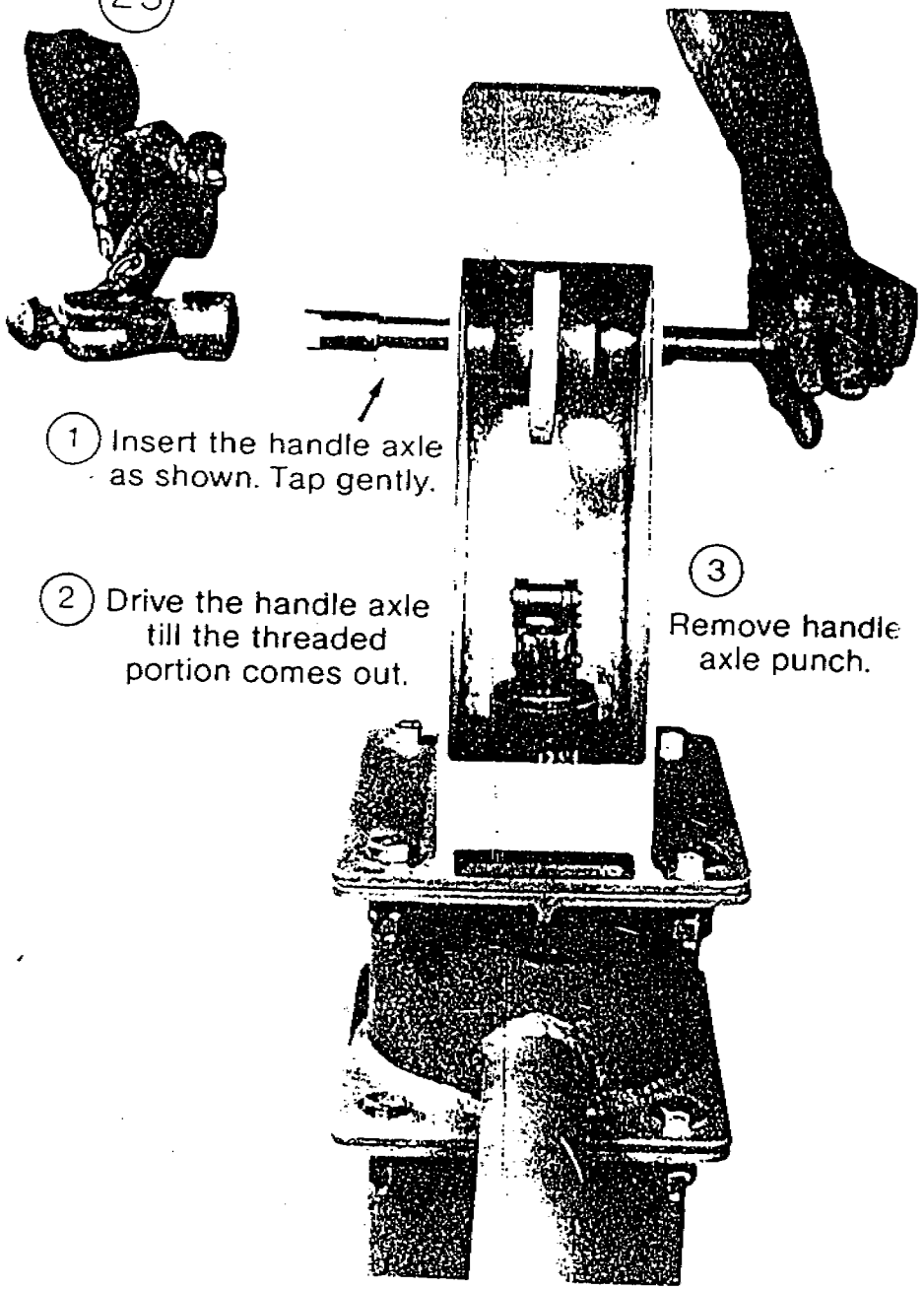
2. Insert handle assembly from front opening.

3. Insert handle punch as shown



Step

29



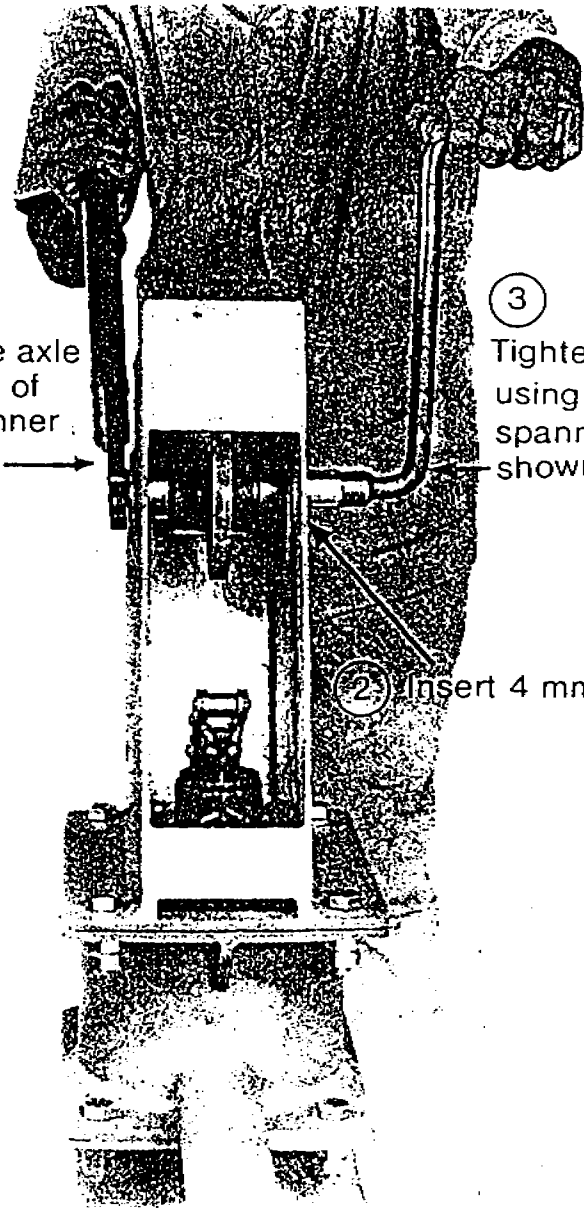
1 Insert the handle axle as shown. Tap gently.

2 Drive the handle axle till the threaded portion comes out.

3 Remove handle axle punch.

Step

30



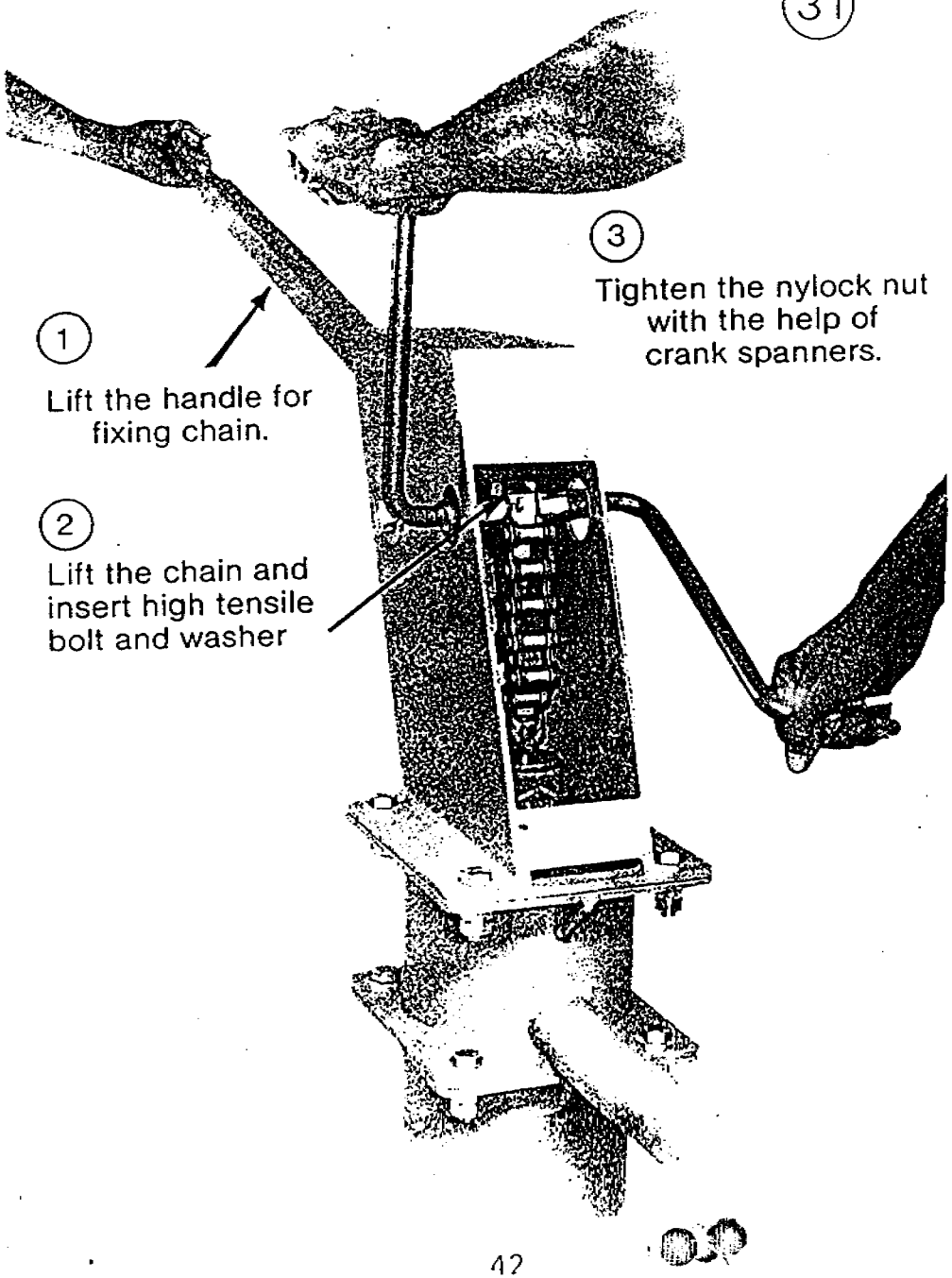
1 Hold the handle axle with the help of Coupling Spanner as shown.

2 Insert 4 mm washer.

3 Tighten nuts by using crank spanner as shown.

CONNECT CHAIN WITH HANDLE

Step 31



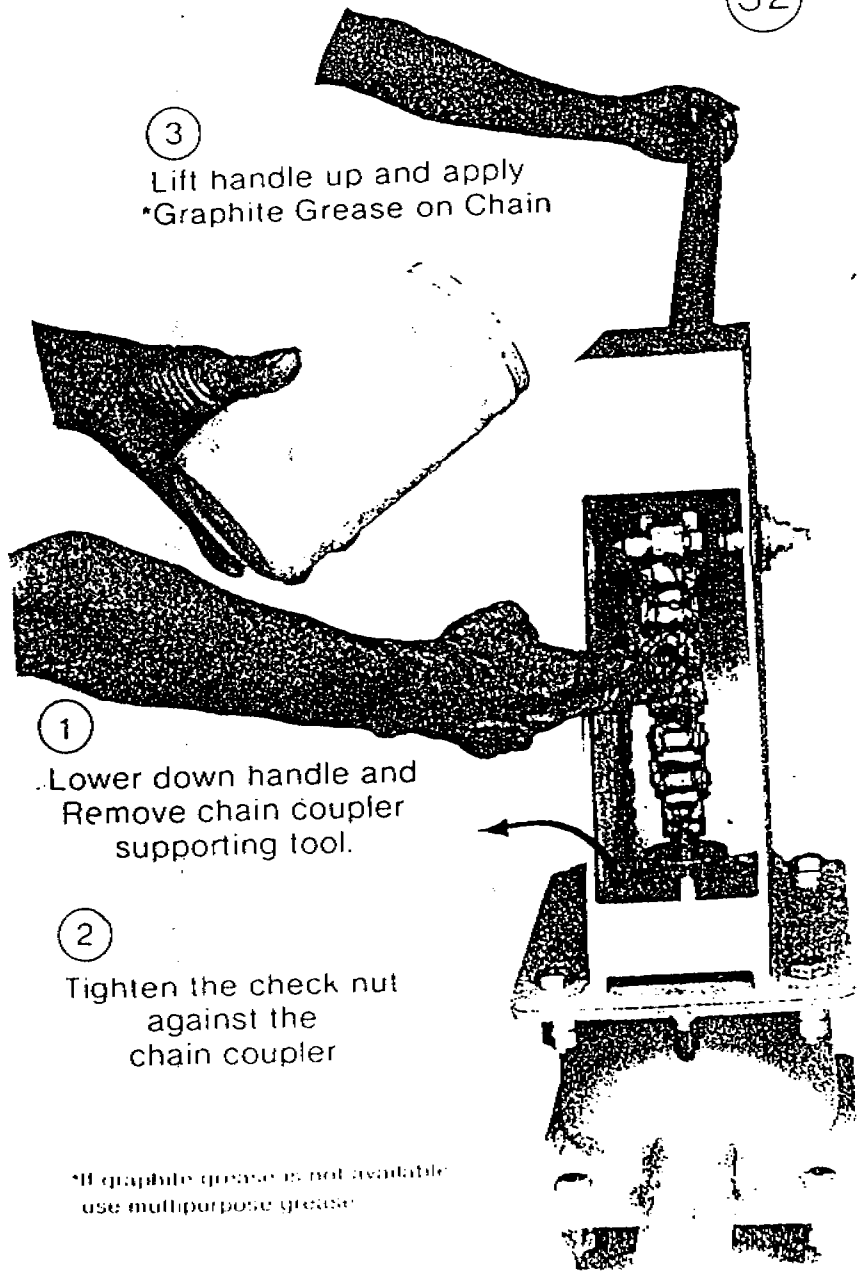
1 Lift the handle for fixing chain.

2 Lift the chain and insert high tensile bolt and washer

3 Tighten the nylock nut with the help of crank spanners.

LUBRICATE CHAIN

Step 32



3 Lift handle up and apply *Graphite Grease on Chain

1 Lower down handle and Remove chain coupler supporting tool.

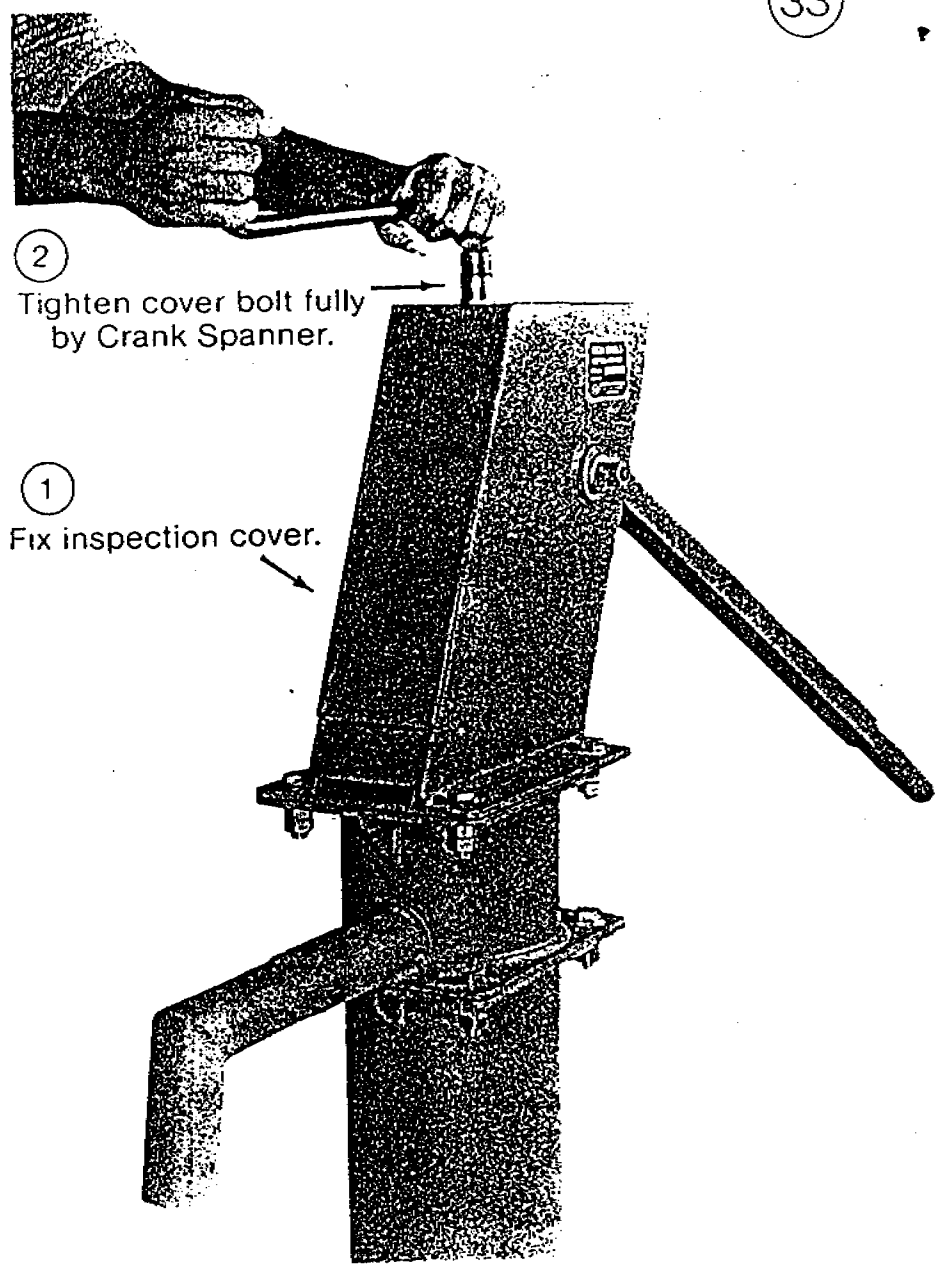
2 Tighten the check nut against the chain coupler

*If graphite grease is not available use multipurpose grease

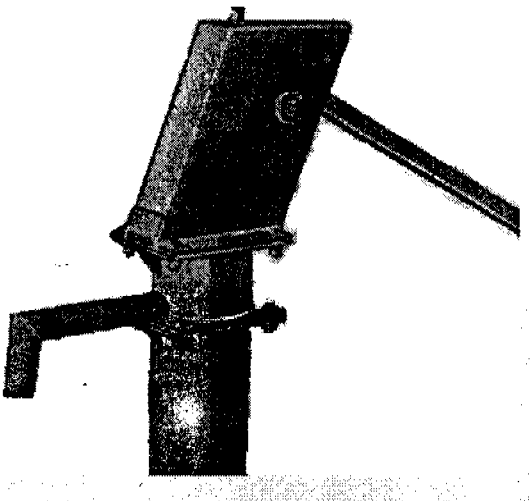
Now make Sure that

- When you pump, the handle touches the top stop and bottom stop of Bracket. If it does not, then remove head and check the setting of the top connecting rod. Refer Page 31.
- Connecting rod moves up and down freely in guide bush. If it does not, then the rod must have got bent while threading.
- You have threaded chain coupling fully on to connecting rod, and you have tightened the lock nut fully.
- You have tightened axle nut and lock nut fully and the handle axle is firmly retained.
- You have tightened chain anchor bolt and nyloc nut fully.
- All the flange bolts & nuts are tight, and you have also tightened the lock nuts fully.
- You have left nothing inside the head.

Step 33



INDIA MARK II HAND PUMP



INSTALLATION OF THE PUMP PEDESTAL AND CONSTRUCTION OF THE APRON

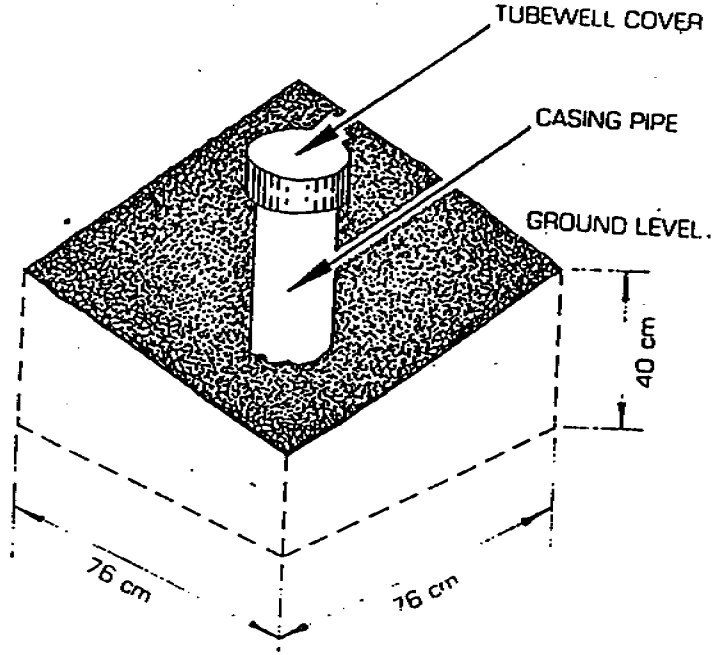
GRZ

UNICEF

PREPARED BY UNICEF WASHE SECTION
FEBRUARY 2005

DIG PIT FOR PUMP PEDESTAL

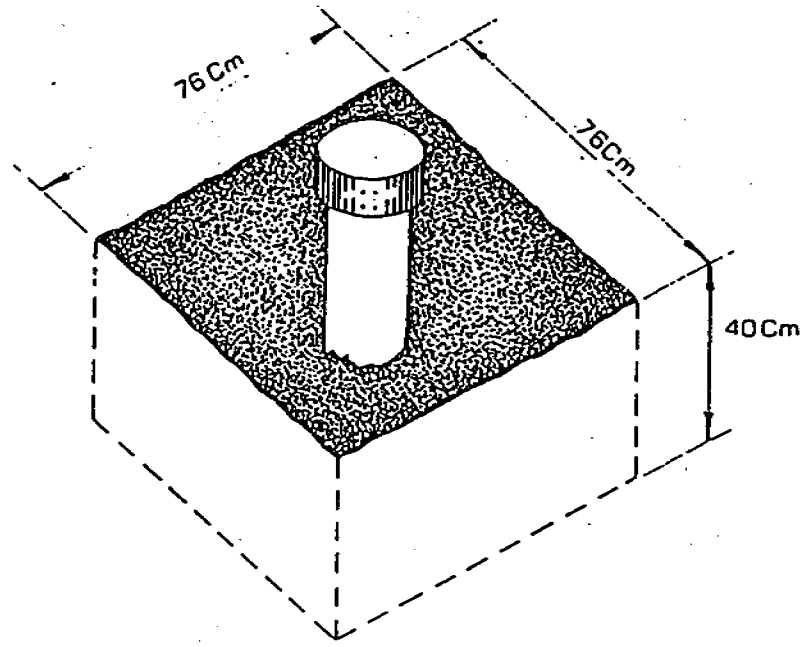
REMOVE TUBEWELL CASING PIPE COVER, MEASURE DEPTH OF TUBE WELL, STATIC WATER LEVEL AND ENSURE THAT IT IS FREE FROM OBSTRUCTIONS



COVER TUBE WELL CASING PIPE
DIG A SQUARE PIT 75 CM BY 76 CM AROUND CASING PIPE AND 40 CM DEEP FROM GROUND LEVEL

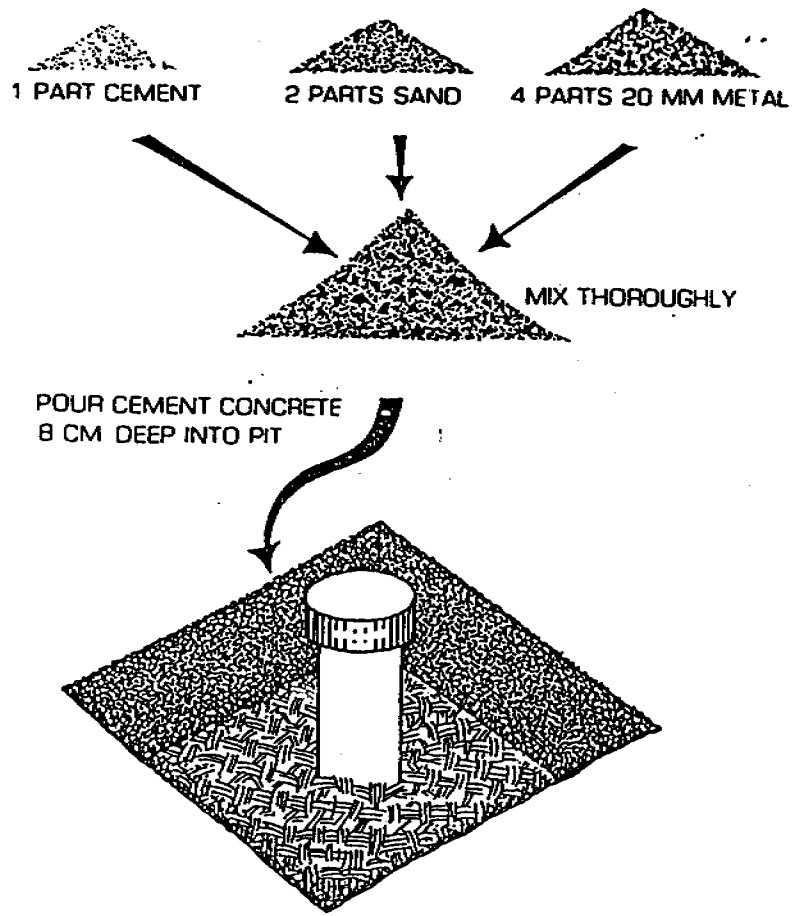
CHLORINATE TUBEWELL

MIX 300 GMS OF BLEACHING POWDER IN 15 LITRES OF WATER IN A BUCKET. STIR WELL AND POUR INTO THE TUBE WELL FOR CHLORINATION.



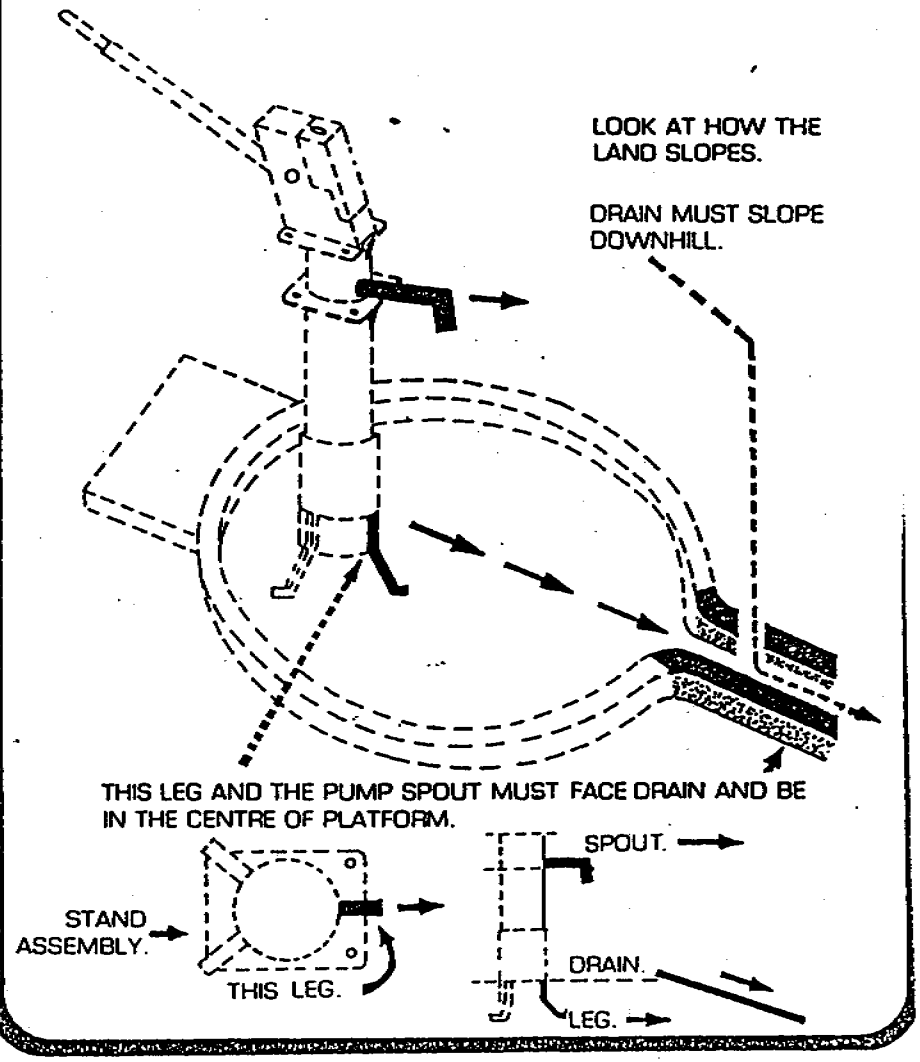
STEP 3 Platform Construction

PREPARE CEMENT CONCRETE MIX



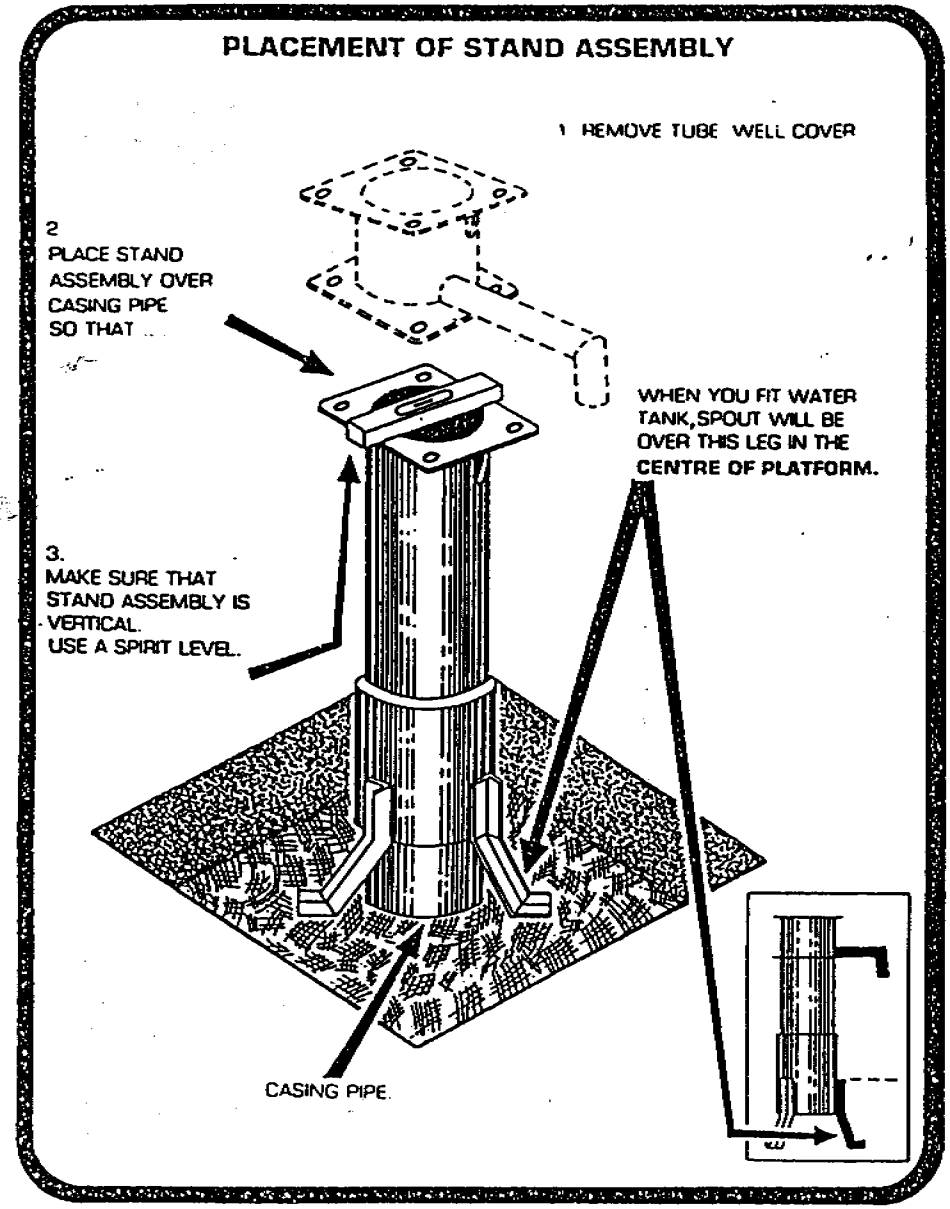
STEP 4 Platform Construction

DECIDE NOW WHERE YOU WILL MAKE THE DRAIN



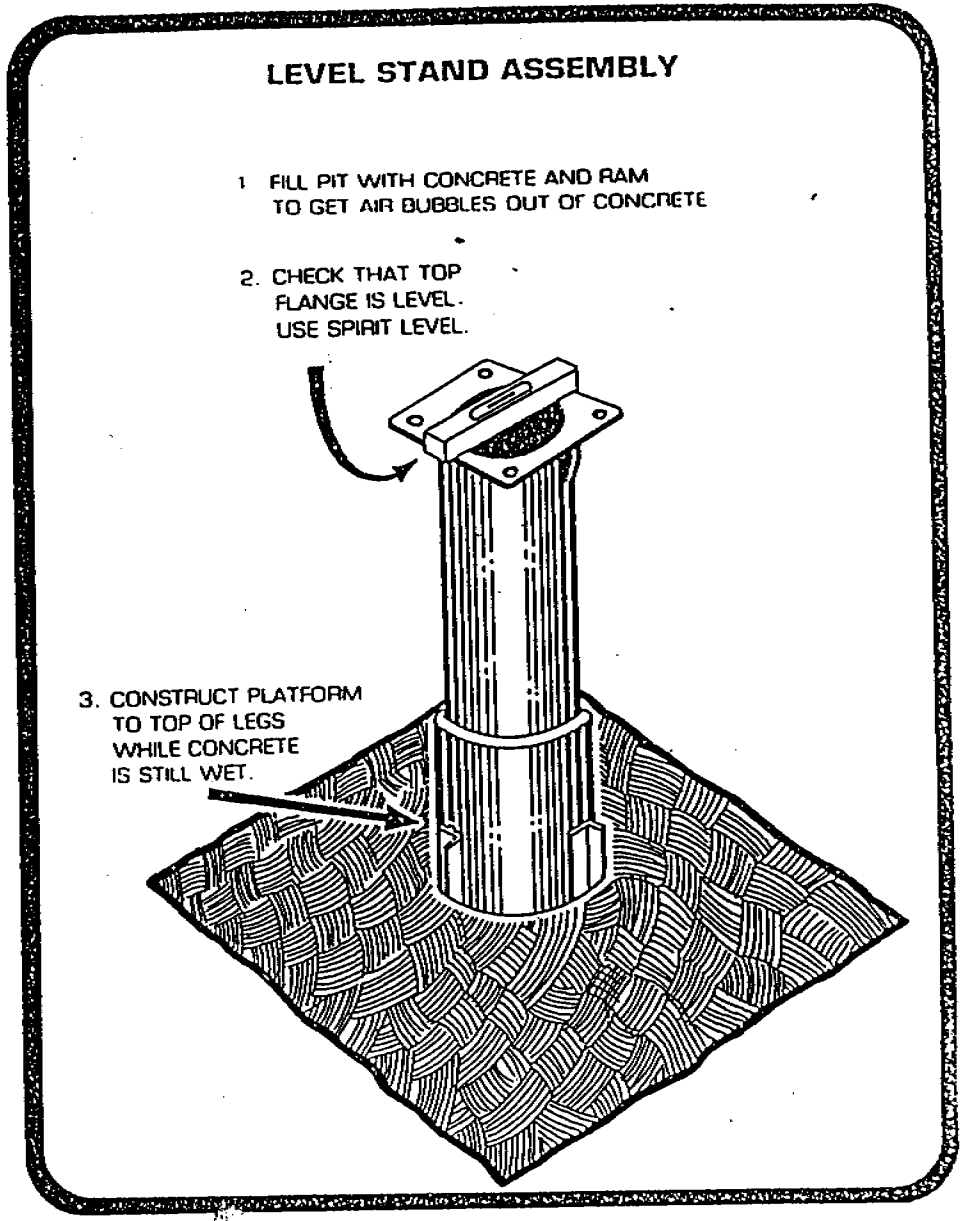
STEP 5 Platform Construction

PLACEMENT OF STAND ASSEMBLY



STEP 6 Platform Construction

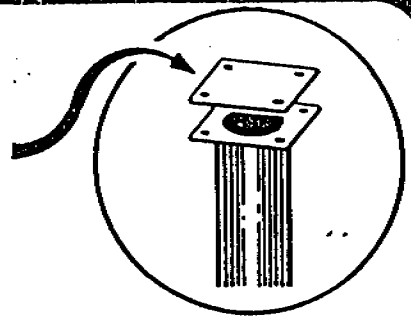
LEVEL STAND ASSEMBLY



STEP 7 Platform Construction

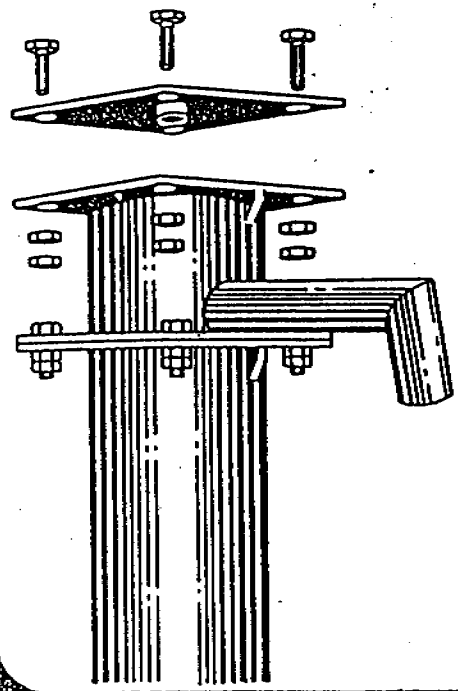
COVER STAND ASSEMBLY

1
COVER STAND ASSEMBLY SO THAT CHILDREN DO NOT PUT STONES IN THE TUBE WELL
- IF YOU HAVE A COVER PLATE, USE IT

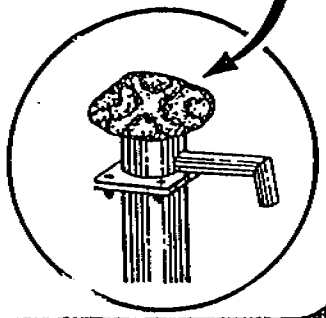


— IF YOU DON'T HAVE A COVER PLATE

PLACE MIDDLE FLANGE OVER WATER TANK AND BOLT IT



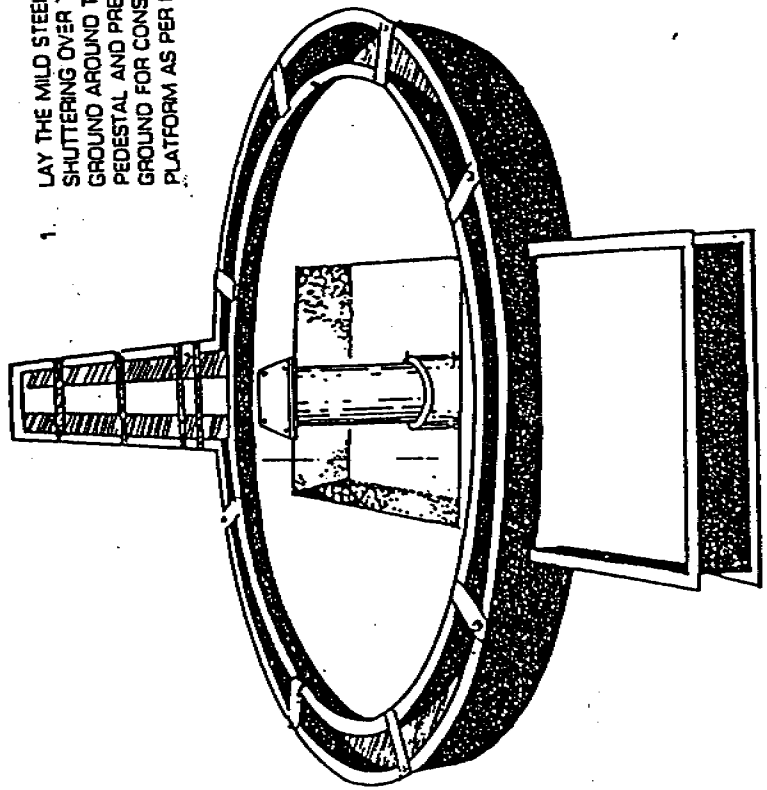
2.
WRAP CLOTH AROUND AS SHOWN.



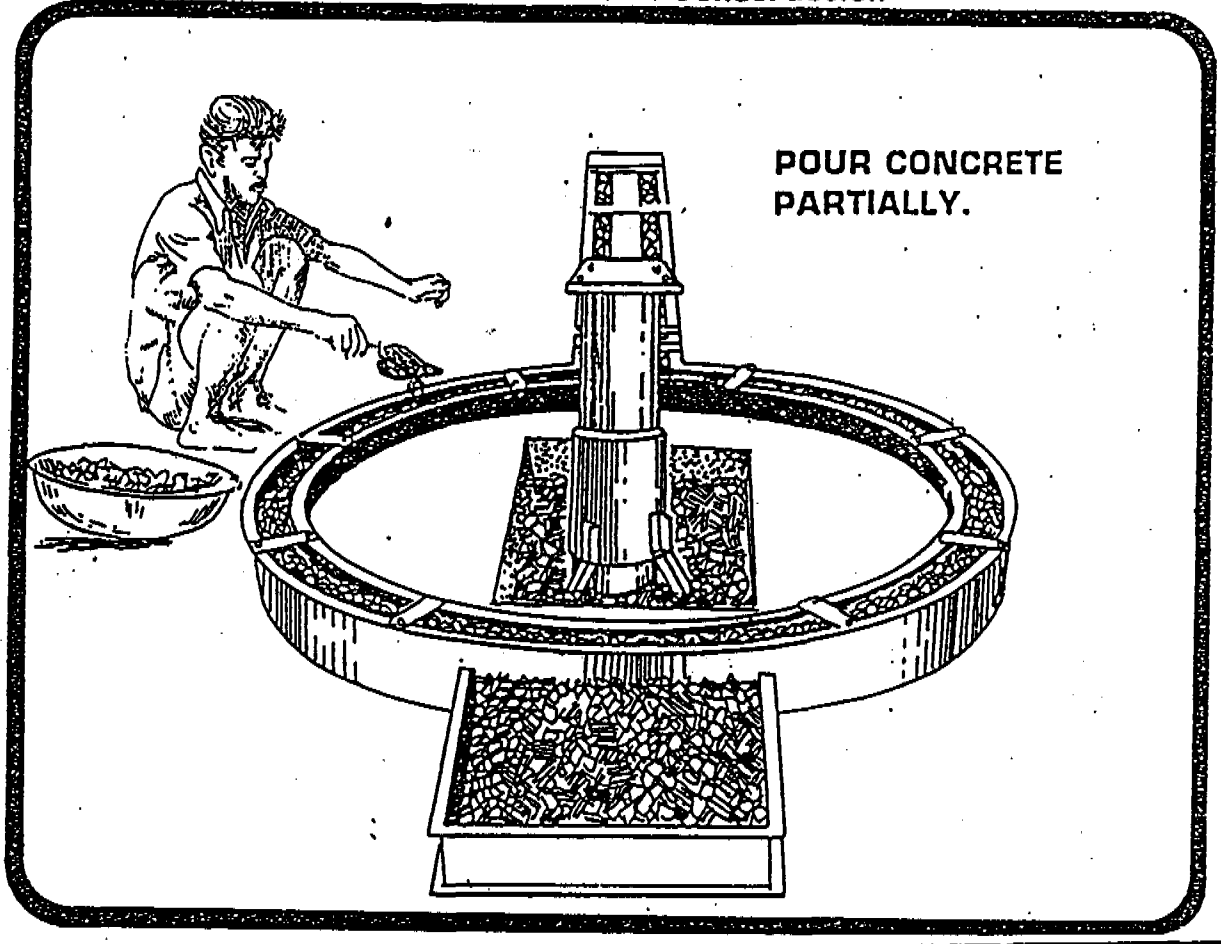
STEP 8 Platform Construction

PLACEMENT OF PLATFORM SHUTTERING

1. LAY THE MILD STEEL PLATFORM SHUTTERING OVER THE LEVELLED GROUND AROUND THE PUMP PEDESTAL AND PREPARE THE GROUND FOR CONSTRUCTING THE PLATFORM AS PER DESIGN



STEP 9 Platform Construction

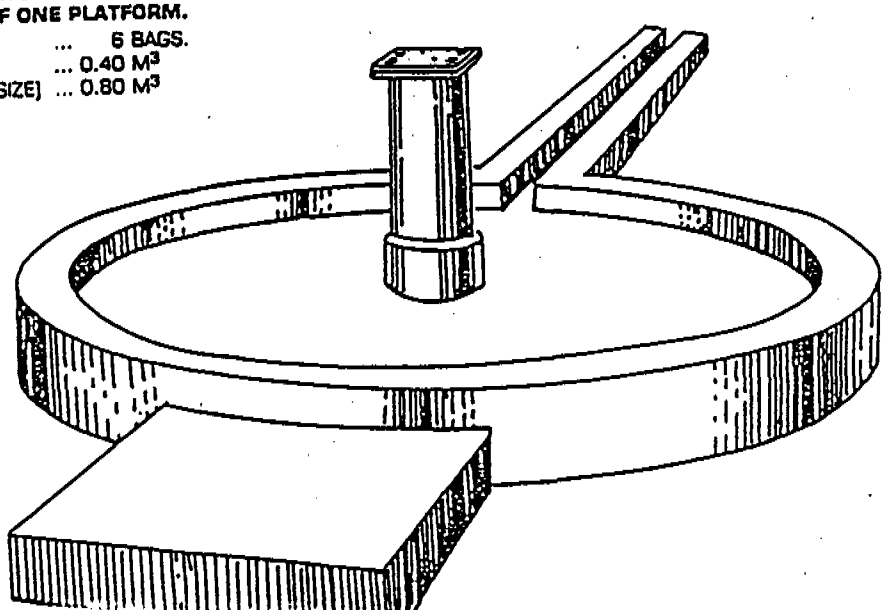


STEP 10 Platform Construction

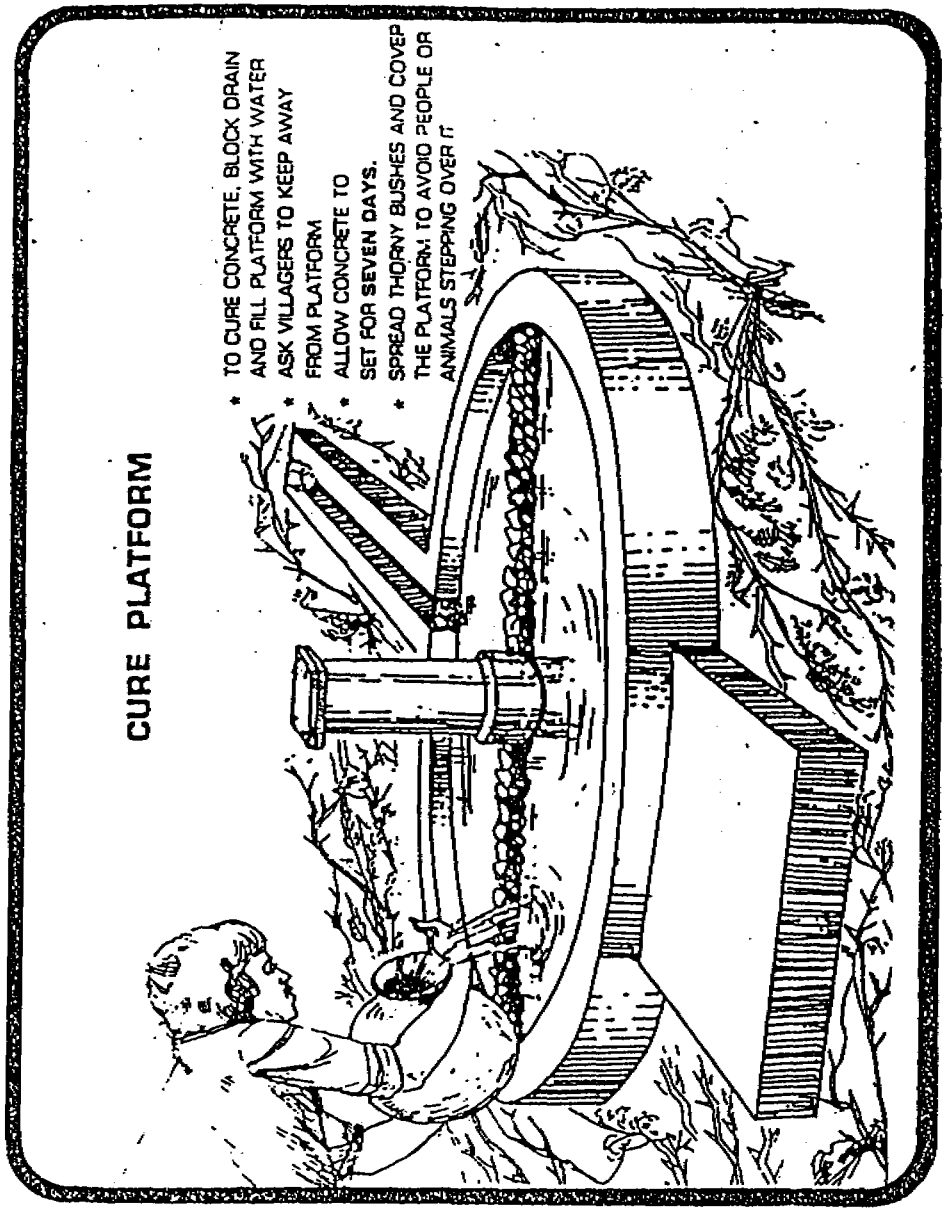
COMPLETE PLATFORM

APPROXIMATE MATERIAL REQUIREMENT FOR CONSTRUCTION OF ONE PLATFORM.

a] CEMENT ... 6 BAGS.
b] SAND ... 0.40 M^3
c] METAL (20 MM SIZE) ... 0.80 M^3



STEP 11 Platform Construction



CHLORINATION

Chlorination is to be done initially during the installation of a hand pump and occasionally when tubewells get polluted. This pollution may happen if there are natural calamities such as floods, or if the hand pump platform gets damaged or destroyed. You will then need to disinfect the tubewells.

How to Chlorinate a Tubewell

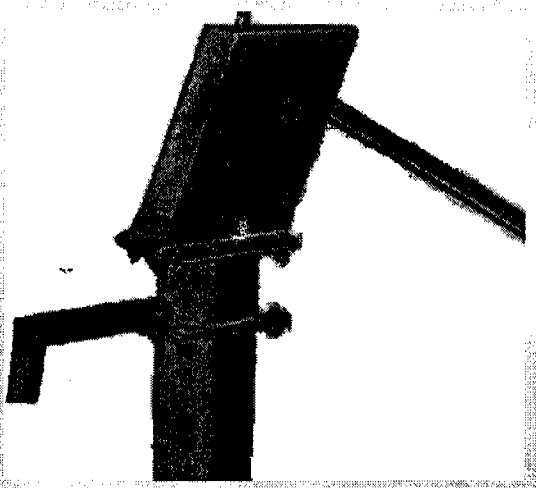
a. Initially during the installation of hand pump.

- Put 300 grams of bleaching powder in 15 litres of water in a bucket.
- Mix it thoroughly.
- Pour the mixture into the tubewell.

b. Occasionally when the tubewell gets polluted.

- Put 300 grams of bleaching powder in 15 litres of water in a bucket.
- Mix it thoroughly.
- Remove four bolts connecting water tank with pedestal. Move water tank with riser pipe assembly to the side.
- Pour Chlorine solution into open end of pedestal.
- Slide water tank and bolt it back to pedestal.
- Tighten the four bolts and nuts fully.
- Pump. Stop pumping when the water smells strongly of chlorine.
- The hand pump must not be used for atleast one hour. But it is better if the hand pump is not used for 6 hours or more. So, ask people not to use the pump until next day.
- Next day, pump till the taste of chlorine is just noticeable in the water.
- Collect sample of the water. Use a sterile bottle. Seal the bottle and label it.
- Send the sample for bacteriological examination.

INDIA MARK II HAND PUMP



INSTALLATION AND MAINTENANCE MANUAL,

GRZ

UNICEF

PREPARED BY UNICEF WASHE SECTION
FEBRUARY 2005

THE INDIA MARK II HAND PUMP

Background Information

The India Mark II hand pump was a result of efforts initiated by UNICEF in co-operation with the Government of India(GoI) in the late 1970's to develop a sturdy and reliable deep well hand pump. In the year 1979 this pump design was adopted on a national scale in India. To overcome certain design weaknesses such as poor service life of leather cup seals and bearings and frequent failure of upper valve assembly, the UNDP/World Bank Water and Sanitation Program in co-operation with GOI and UNICEF initiated in the early 1980's, further experiments and field testing of this pump. As a result of these efforts and close field monitoring over a four and half year period (1983-88) some design improvements to the India Mark II were carried out. These improvements have enhanced the serviceability and reliability of the Mark II. Currently, over 1.8 million Mark II hand pumps are believed to be in operation in more than thirty countries.

WORKING PRINCIPLE

This is a positive displacement reciprocating type hand pump and consists of: a **head assembly** mounted on a **pedestal** fixed in cement concrete, **pump rods** to connect the **handle** and the **plunger assembly**; a **riser pipes** which carries water from the cylinder to the **water tank**; and a **cylinder assembly** normally placed 3-6 meters below the dynamic water level. For construction details see figure overleaf.

When a user operates the handle, the plunger moves up and down. With each upstroke of the plunger, a certain quantity of water is pushed upwards and ultimately it emerges out of the water tank spout and the same quantity of water enters the cylinder through the foot-valve.

DESIGN FEATURES

The design features of the hand pump are briefly described below:

Above-ground Assembly

The above-ground assemblies are fabricated from carbon steel plates and rods and hot dip galvanized for corrosion resistance. Two ball bearings are fired in an accurately machined bearing housing welded on the handle. The weight of the handle balances the weight of connecting rods and this makes for the easier operation of the hand pump. The handle and the connecting rods are connected through a chain link which keeps the pump rods in constant tension, thus minimizing the chances of bending of rods due to buckling. The above-ground structure is designed to withstand abuse and vandalism.

Riser Main

The 32 mm galvanized iron tube (medium class) of 3 m length with heavy duty socket is used as a riser pipe. The pipe sockets are of seamless construction.

Pump rod

This consists of a 12 mm diameter of 3 m long electro-galvanized carbon steel rods with male threads on one end and a coupler with female threads welded on to the other end. For corrosive water stainless steel pump rod option is available.

Cylinder assembly

This consists of a cast iron body with a brass liner fitted snugly inside. The brass liner provides smooth surface for the seal to function and the hard cast iron outer surface helps in minimizing damage due to abrasion between the cylinder and the inside of a borewell in rock formation. The plunger and foot-valve assemblies are made of brass. One of the special features of the cylinder is the use of piston seal and valve seatings made of acrylonitrile butadiene rubber. The field trials have conclusively proved that NBR is highly abrasion resistant material.

The use of stainless steel plunger rod eliminates the galvanic corrosion between the plunger and plunger rod.

APPLICATION

The India Mark II Deep well Hand pump is recommended for community use (150-200) in borewells of diameter 100 mm (N.B.) and above with static water level (SWL) up to 45 meters. It can be used both in lined as well as unlined borewells. The rated discharge of this pump is 15 liters per minute(0.25 l/sec.). This pump is not suitable in corrosive water as it's hot dip galvanized steel rising main is susceptible to corrosive water.

COST

The approximate ex-works price of this pump, for a 30-meter cylinder setting and inclusive of 32 mm NB GI rising main is U.S.$200.00.

OPERATION & MAINTENANCE

The pump is comparatively easy to operate in wells with SWL up to 20 meters. The above-ground repairs can be attended by a village-level mechanic with a few simple tools. To carry out below-ground repairs it is necessary to lift the entire below-ground assembly which means lifting over 150kg of weight and dismantling and making of at least eight threaded joints each in rising main and pump rod. This requires a team of four semi skilled persons, a motorised transport and heavy tools. Special tools have been developed which make the below-ground repairs easier but not easy enough to facilitate repairs at village level without outside assistance. The average frequency of below-ground repairs is one per year and the average spare parts cost U.S.$20 per pump per year.

The average life span recorded for wearing pump components in a hand pump field testing project is:

Piston seal - 2 years.	Chain - 4 years.
Ball bearing - 5 years.	Valves - 4 years.
Pump rod - 8 years.	Rising main - 6 years.

INDIA MARK III DEEP WELL HAND PUMP

BACKGROUND INFORMATION

The United Nations Development Program and the World Bank initiated a global/interregional project for Field and Technological Development of Community Water Supply hand pumps. From the beginning, the project promoted VLOM hand pump designs as a means of overcoming some of the major obstacles to establishing and maintaining a sustainable water supply system. The Coimbatore Hand pump Field Testing Project in India (1983-88) undertaken in collaboration with the Government of India, and UNICEF formed part of this global efforts.

Even though the India Mark II hand pump was regarded as a reliable and sturdy deep well hand pump, the maintenance of it's below-ground components, especially fast wearing components like the piston seal etc, at the village level was not feasible as it needed heavy tools, tackles and four semi skilled persons. To overcome this deficiency, further field testing on this pump was undertaken in the coimbtore project. Intensive work and close field monitoring over a four and half year period resulted in the development of a VLOM derivative of the India Mark II pump, known as the India Mark III deep well hand pump.

To assess it's performance in various geological and usage conditions and it's acceptability by implementors and users, four hand pump demonstration projects were initiated by UNICEF and UNDP/World Bank Water and Sanitation program. Two and half years of monitoring proved that the procedure for below-ground repairs in the India Mark III hand pump has been simplified substantially and that it is now feasible to promote a village based maintenance system.

WORKING PRINCIPLE

The India Mark III is a positive displacement reciprocating type hand pump and consists of: a **head assembly** mounted on a **pedestal** fixed in cement concrete; **connecting rods** connecting the **handle** and the **plunger** in the **cylinder**; a **riser main** which carries water from the cylinder to the **water tank**; and a cylinder assembly normally placed 3-6 meters below the dynamic water level. (For construction details see figure overleaf). When a user operates the handle, the plunger moves up and down. During each upstroke of the plunger, a certain quantity of water is pushed upwards and ultimately emerges from the water tank spout. Simultaneously, the same quantity of water enters the cylinder through the foot valve.

DESIGN FEATURES

The pump has design features such as open top cylinder with a withdrawable plunger and foot valve, and a riser main with it's internal diameter (I.D.) higher than the I.D. of the cylinder. The main pump assemblies are briefly described below.

Above-ground assembly

The above-ground assemblies are fabricated from carbon steel plates and rods and hot dip galvanized for corrosion resistance. Two ball bearings are fixed in an accurately machined bearing housing welded on the handle. The weight of the handle balances the weight of weight of connecting rods and this makes the operation of the hand pump easier. The handle and connecting rod are connected through a chain link which keeps the pump rod always in tension, thus minimizing the bending of rods due to buckling. The above-ground structure is designed to withstand abuse and vandalism.

Riser Main

A 65 mm galvanized iron pipe of 3 m length with heavy duty socket is used as a riser pipe. As the annular space between the pump rod coupler and the rising main is more, the abrasion between them is considerably reduced.

Pump Rod

This consists of a 12 mm diameter and 3 m long electro-galvanized carbon steel rods with male threads on one end and a coupler with female threads welded on the other end. The option of using a 12 mm diameter stainless steel pump rod for corrosive water is also available.

Cylinder Assembly

It consists of cast Iron body with a brass liner fitted snugly inside. The brass liner provides a smooth surface for the seal to function and the hard cast iron outer surface helps in minimizing the damage due to abrasion between the cylinder and the inside of a borewell in rocky areas. The foot valve assembly is seated in a conical receiver of the bottom cap. The plunger and foot valve assemblies can be engaged together by resting the plunger on the foot-valve and rotating the connecting rods clockwise from the ground level. When the plunger and foot-valve assemblies are engaged, the push rod in the foot-valve assembly lifts the piston valve and as soon the foot-valve is lifted by a few mm, the water column in the rising main is dumped. This makes the lifting of the connecting rods and pumping elements a lot easier. The piston seal and valve seatings made of nitrile rubber and are durable.

Application

The India Mark III hand pump is recommended for communities of 150 - 200 persons, and for installation in boreholes of 125 mm and above diameter with static Water Level (SWL) up to 45 meters. The rated discharge of this pump is 15 liters per minute, and can be used in both lined as well as unlined borewells. This pump is not suitable for corrosive water as its hot dip galvanized steel rising main is pron to corrosion in corrosive water.

Cost

The approximate ex-works cost for the pump for a 30 meter cylinder setting, and inclusive of 65 mm GI riser pipes $325.00

Maintenance

All above and below-ground repairs, except the repairs of the rising main, cylinder body and cap can be carried out by village level mechanic with a few simple tools. However, to attend to the repairs on the rising main and cylinder body which are not frequent, 4-5 semi-skilled persons with heavy tools and tackies are required. As the rising main is not removed frequently, the average life of the rising main is much high than in the India Mark II. The average spare parts cost recorded in various demonstration projects over a period of three years, is U.S. $10.00 per pump per year.

The average life span for wearing pump components is estimated as:

Piston seals	- 5 years	Chain	- 4 years
Handle bearings	- 5 years	Valves	- 4 years
Pump rod	- 10 years	Riser pipes	- 12 years