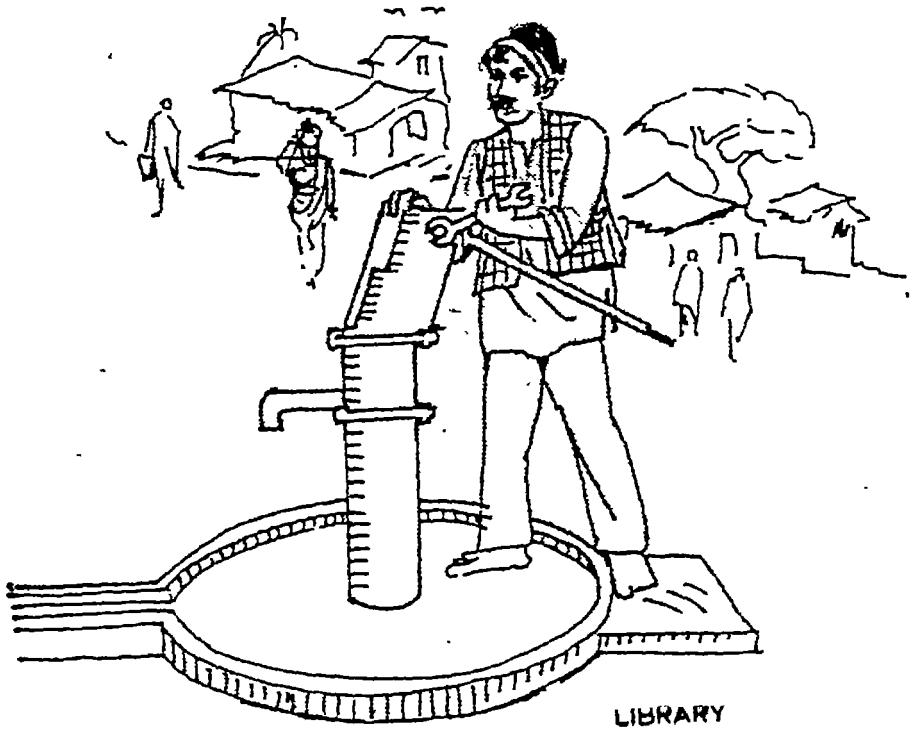
MULTI-MEDIA PACKAGE ON MAINTENANCE AND REPAIR OF HAND PUMPS

TRAINER'S GUIDE



PROJECT SPONSORED BY :

RAJIV GANDHI NATIONAL DRINKING WATER MISSION
MINISTRY OF RURAL DEVELOPMENT, GOVT. OF INDIA

1995

CENTRE FOR RURAL DEVELOPMENT
TECHNICAL TEACHERS' TRAINING INSTITUTE, BHOPAL

MULTI-MEDIA PACKAGE ON MAINTENANCE AND REPAIR OF HAND PUMPS

TRAINER'S GUIDE

By

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P R E F A C E

Under the Rajiv Gandhi National Drinking Water Mission the TTTI Bhopal is charged with the responsibility of developing two Multi Media Packages for guiding trainers in the pursuit of Mission Objectives. These two packages shall be subsequently translated into a number of local languages and used to train trainers, who in turn shall be transferring know how and skills to hundreds of functionaries playing key roles under this mission. The other utility of these packages is to assist the development of a network of outreach and training by which people in far flung and diverse location could be trained in a uniform and standard manner to perform crucial tasks in the mission. Given the dimensions of villages, and beneficiaries, to be covered and given the fact that the impact of the mission has to be sustained for the future, both developing human resources and integrating them through a supportive network become key factors.

The first package relates to **Maintenance and Repair of Handpumps**. Trained trainers would be using this package to train selected youth from rural areas to become hand-pump repair technicians and pursue this profession on an entrepreneural basis, under the support and supervision of the Village Punchayats. The trained trainers are from selected Community Polytechnics located under the vicinity, certain NGOs and some identified engineers/technicians from Public Health Engineering Departments. The package is based on a competency based developing approach and envisages the development of requisite competency in training through intensive skill practice, aided by

transfer of learning through multiple media including handouts, transparencies, slides, charts and video clips.

The second package relates to motivating community support in establishing and sustaining the mission in rural areas. It consists of two parts - one for Trainers, who shall be from community polytechnics, NGOs, and another for trainees who normally will be Surpanches, Village elders, Teachers, Mahila Mandal Leaders and such people of influence.

Since the package is on motivating and obtaining commitment for the mission from such people of influence, the package contains competencies and related media, aided with techniques of involving people in the establishment and maintenance of drinking water and sanitation facilities. It will also assist for the use of special skills like counselling for such people who hesitate in participating in the mission.

The effectiveness of competency based training, which forms the basis of both the packages would depend on serious implementation with requisite effort. The package includes training resources which would aid a complex and difficult venture, and enhance the quality of grass root development, to a large extent. We hope that the packages will be used by trained trainers only, in a planned manner.

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Director
Technical Teachers'
Training Institute
Shamla Hills, Bhopal.

6th February 1996

ACKNOWLEDGEMENTS

Hand Pumps are commonly used for providing safe drinking water in villages. In the past efforts have been made to provide safe drinking water through hand pumps in the rural areas. Because of poor maintenance, hand pump becomes nonfunctional and supply of safe drinking water to villages gets disrupted.

At present, it takes 3 - 4 weeks for any fault rectification. The maintenance time of hand pumps can be reduced and regular safe drinking water can be made available to rural people, if the pumps are maintained and repaired locally by local mechanics. To achieve this task, it is planned to train rural hand pump mechanic all over the country. It is envisaged that these trainers mechanics will to maintain and repair about 25-30 hand pumps within the jurisdiction of a Panchayat.

This competency based multimedia training package has been prepared for trainers. It provides a simple, step by step explanation of the working principles, maintenance and repairs of hand pump and competency/skill assesment of trainees. Practice task have been designed for developing required competencies in trainees.

We would like to express our gratitude to Prof.R.K.Mani, Director, T.T.T.I, Bhopal and Prof.S.C.Saxena, Head Centre for Rural Development, T.T.T.I, Bhopal for providing support and guidance.

We would like to thank Dr. N.K.Banthiya, Head Mechanical Engineering Department, and Continuing Education Centre, Prof.S.D.Patki, Prof. in M.R.D.C for refining this package. We would also like to thank Prof.K.K.Jain, Asstt.Professor, Mechanical Engineering Department for his contributions.

We are thankful to Dr.I.C.Agrawal, HRD Consultant, Rajiv Gandhi National Drinking Water Mission, New Delhi for providing financial support to the project.

Bhopal.
1995.

R.G.Chouksey

S.Lahiri

C O N T E N T S

[A]

TRAINING CURRICULUM

MULTI-MEDIA PACKAGE ON

MAINTENANCE AND REPAIR OF HAND PUMPS

A - TRAINING CURRICULUM

I RATIONALE:

Hand pumps are commonly used in rural areas for providing safe drinking water. Large number of villages do not get safe and adequate drinking water, because of poor operation and maintenance of hand pumps. Often this is due to non-availability of locally skilled hand pump mechanics. Under the aegis of Rajiv Gandhi National Drinking Water Mission, Ministry of Rural Development, Government of India, is seized of this problem, and in order to ensure provision of safe drinking water in rural areas, has initiated a project of Grass Root level training on operation and maintenance of hand pumps. It is envisaged that these trained mechanics will maintain 20-25 hand pumps within the jurisdiction of a Panchayat. The Panchayats are expected to evolve a mechanism to pay an honorarium to these trained mechanics. In order that these grass root level workers are adequately trained, a good number of trainers are to be developed in each district. This module provides a package for such trainers.

II TARGET GROUP:

Faculty of Community Polytechnics, Sub Engineers, Junior Engineers of PHED, Master craftsman from NGO's.

III DURATION:

4 days.

IV COMPETENCIES TO BE DEVELOPED IN TRAINERS.

1. Appreciate the importance of grass root level workers training programme for operation amd maintenance of hand pumps and other water supply systems.

2. Explain the functions of various parts of the hand pump.

w. Practise?

3. Demonstrate of various tools for maintenance and repair of hand pump.

4. Demonstrate the steps undertaken in performing maintenance of hand pump.

5. Diagnose faults and repair of hand pump.

6. Assess the performance of trainees.

V Training Scheme:

S.No.	Title of Module	Theory (Hrs) input	Demon-stra-tion	Practice (Hrs)	Tc
1.	Working Principles of Hand Pump	1	2	2	
2.	Tools and Spare Parts for Hand Pump	1	1	2	
3.	Maintenance and repair of Hand Pump.	1	3	12	
4.	Skill Assessment	--	--	3	
		3	6	19	2

VI Contents:

a) Theory:

i. Working Principle of Hand Pump:

Introduction to hand pump, hand pump as a safe drinking water supply system for rural areas,

working principle of hand pumps, basic features of India Mark II & India Mark III hand pumps, various parts of hand pump and their functions.

ii. Tools and Spare Parts for Hand Pumps:

Village Hand Pump mechanic tools, list of recommended spare parts for hand pump.

iii. Maintenance of Hand Pumps:

Preventive maintenance schedules (Daily weekly, monthly), disassembly and assembly of hand pumps, inspection and servicing of parts, trouble-shooting charts, common problems in the hand pump and their remedies through flow charts.

b) Practice Task:

i. Identification of various parts of hand pump.

ii. Use of Hand tools in hand pump maintenance.

iii. Disassembly and assembly of hand pumps.

iv. Identification of faults, and rectification of faults.

v. Use of trouble-shooting charts.

VII

TIME SCHEDULE FOR SKILL TRAINING PROGRAMME

Day	I 9.30 - 10.25	II 10.30 - 11.25	III 11.30 - 12.30		IV 13.30 - 14.25	V 14.30 - 15.25	VI 15.30 - 16.25	VIII 16.30 - 17.30
FIRST	Working Principles of Hand Pump (Input)	Live demonstration of various parts of Hand pump		L U	Hand Tools for Hand Pump (Input)	Demonstration on Hand Tools and Spares	<---- Practice Task - 1 -------->	
SECOND	<------- Practice Task -2 -->		Maintenance of Hand Pump (Input)	N C	Demonstration on Assembly and Disassembly of Hand Pump.			Practice Task - 3
THIRD	<------- Practice Task -3 ---------->			H	<---------- Practice Task - 4 ---------->			
FOURTH	<------- Practice Task - 5 ---------->				<-------Skill Assignment ---------->			Feed back & Validictary

Practice Task - 1. Identification of various parts of hand pump.

2. Use of Hand tools in hand pump maintenance.

3. Disassembly and assembly of hand pump.

4. Identification of faults, and rectification of faults.

5. Use of trouble-shooting charts.

VIII. Methodology for Developing Competencies/Skills.

The emphasis of this training package is on developing skills and certain competencies amongst the trainees. Therefore due emphasis should be given for imparting training of skills components. Skills are learned by "practice, feed back, practice" cycle. The repeated practice is necessary for developing certain critical skills.

While designing the training package, this has been kept in mind. Opportunities must be provided for practising skills at different time interval.

Skills learning exercise are designed in such a manner that each micro skill is developed first and then it should be combined with the next higher levels skill and thus developing a total competency.

[B]

INSTRUCTIONAL MATERIAL

MODULE No.-1

MULTI-MEDIA PACKAGE ON MAINTENANCE AND REPAIR OF HAND PUMP

MODULE:NO: 1

TITLE: NATIONAL HUMAN RESOURCE DEVELOPMENT PROGRAMME FOR RURAL WATER SUPPLY AND SANITATION SECTOR GRASS ROOT LEVEL WORKERS TRAINING.

COMPETENCY 1:
APPRECIATE THE IMPORTANCE OF GRASS ROOT LEVEL WORKERS TRAINING PROGRAMME FOR OPERATION AND MAINTENANCE OF HAND PUMPS AND OTHER WATER SUPPLY SYSTEMS.

SPECIFIC OBJECTIVES: After going through experiences of this module you will be able to:

i) describe the importance of grass root level workers training programme;

ii) explain duties of rural hand pump mechanic;

iii) explain water cycle;

iv) explain importance of water testing;

v) describe conditions of good surroundings of hand pump and its maintenance.

vi) explain construction of soak pit.

DURATION:

I) Theory input : 1 Hour

NUMBER OF PAGES: 6 TO 28

RESOURCES REQUIRED: i)Transperencies

ii) Slides

CONTENT OUTLINE: National Human Resource Development Programme for Rural Water Supply and Sanitation Sector - Grass Root Level Workers Training.

1.0 Introduction

1.1 Grass Root Level Workers Training

1.2 Duties of Rural Hand Pump Mechanic

1.3 Water Cycle

1.4 Water Testing

1.5 Hand Pump Surroundings

1.6 Construction Details of Soak Pit.

1.7 Evaluation

1.8 Feed Back

MODULE - 1

NATIONAL HUMAN RESOURCE DEVELOPMENT PROGRAMME
FOR
RURAL WATER SUPPLY AND SANITATION SECTOR
GRASS ROOT LEVEL WORKERS TRAINING

1.0 INTRODUCTION:

In India there are about 5.86lacs villages, its population is about 84.39 crores (1991). The Government of India is committed to provide safe drinking water to all the people. Rural people used to drink water from river, pond, well etc. But it is found that these are not safe sources of drinking water. To supply safe drinking water in rural areas about 23.8 lakhs hand pumps has been installed by Government of India and various State Government (1995): It is found through various studies, about 15-20% hand pumps remains out of order. At present it takes 3-4 weeks for fault rectification, which causes disruption in regular safe drinking water supply.

In the field of rural sanitation the situation is much worst. The coverage is only about 3%. There is dire need to strengthen the programme of rural sanitation with the application of science and technology. Well conceived strategies are essential to educate and motivate the rural beneficiaries with a view to seek community participation in building sanitation facilities with contribution from beneficiaries. Here the role of the government is to change from that of PROVIDER to FACILITATOR and MOTIVATOR.

Rural Water Supply and Sanitation (RWS & S) programme involves huge financial investements and creation of very large hardware. Based on economical logistical and socio-cultural considerations, it is unbelievable to ensure the sustainability of projects and cover entire rural population without active community participation. To assign a dominant role to the beneficiaries at the grass root level in operation and maintenance of hand pump and in creation of facilities for rural and environmental sanitation there is need of trained manpower.

With the 73rd constitution amendment, three tier system of Panchayati Raj have been created. The states also passed the necessary amendments in the legislative assembly and decided to transfer responsibility of few departments to Panchayati Raj Institutions. One of the important task transferred to Panchayat is to ensure availability of safe drinking water and rural sanitation. Rural water supply system i.e Hand Pumps were transferred to panchayat from the month of August,1995 in Madhya Pradesh.

To ensure sustainability of RWS & S for entire designated design period and to maximize benefits to rural masses from sectoral investments it is absolutely necessary to motivate educate and involve the beneficiaries. There exists need to provide atleast one trained person at the grass root level to fill the enormous gap between requirement and availability of adequately trained workers through well conceived training programmes incorporating vital topics of community participation, health aspects and holistic approach to water supply and sanitation.

1.1 GRASS ROOT LEVEL WORKERS TRAINING:-

To fill the gaps and cater to the felt need of rural people following 4 types of people will be trained is the Grass Root Level Worker Training Programme.

i) Rural Hand Pump Mechanic
ii) Mason for Sanitation Work
iii) Health & Hygiene Worker
iv) Motivator

1.1.1 Rural Hand Pump Mechanic:-

Rural youth will be trained for operation and maintenance of hand pump. Each rural hand pump mechanic will take care of 25-30 hand pumps covering about a Panchayat and he will get an honorarium. He will taking only minor repair work above ground level initially. After practicing with Public Health Engineering Departments, Hand Pump Mechanic; he can also do repair and maintenance below ground level. The duration of training will be 4 days. In the training emphasis will be given to skill training.

1.1.2 Mason/Sanitation Worker:-

A mason or youth having liking of masonary work will be trained for construction, maintenance and repair of low cost two pit latrines, soak pit and smoke less chulhas. One mason/sanitation worker will be working in a panchayat. His job will be to construct low cost two pit latrines, soak pits and smokeless chulha in rural areas. He will also motivate people to go for low cost sanitation technology.

1.1.3 Health and Hygiene Worker:-

People involved in various health programme teachers, representatives from voluntary organisation and staff of community polytechnics will be trained. The duration of training will be 2 days. They will be trained for health and personal hygiene aspect.

1.1.4 Motivator:-

Important, elderly person of village i.e. Panch, Sarpanch, Gram Sevaka and functionary of voluntary organisations will be trained as motivator. They will motivate people for participation in drinking water and village sanitation programme. The duration of training is 2 days.

This package will be dealing with trainers training of Rural Hand Pump Mechanic.

1.2 DUTIES OF RURAL HAND PUMP MECHANIC:-

The Rural Hand Pump Mechanic is expected to do followings:-

i) Preventive maintenance of hand pumps in a panchayat.

ii) Ensure cleanliness around the hand pump.

iii) Waste water should be disposed in kitchen garden, or soak pits.

vi) Maintenance and repair of hand pump with Public Health Engineering Departments; Hand Pump Mechanic, for major work, repair work, 4-5 times till confidence is gained.

Some of the activities he will do on his own and for some activities he will the seek help of sanitary mason or PHED hand pump mechanic. He should ensure safe drinking water is available to rural people.

The hand pump mechanic must know some basic things regarding safe water supply.

1.3 WATER CYCLE:-

Water cycle explains how water means in the atmosphere. The basic source of water in earth surface is rain water. Rain water falls on earth surface, major portion of it goes as runoff and flows to stream, river and sea. Some portion of rain water infiltrates into the ground and percolates underground. The water in the river, tank and sea evaporates and makes clouds which on suitable temperature falls as rain water. This makes water cycle it is depicted in Fig.1.1.

The underground water passes through various layers of soil and sand it gets filtered. This is safe source of drinking water. By hand pump the underground safe water is brought to ground for drinking purposes.

1.4 WATER TESTING:-

Testing of water has to be done before it is recommended for drinking purpose. Mainly following tests are conducted:-

i) Physical Test

ii) Chemical Test

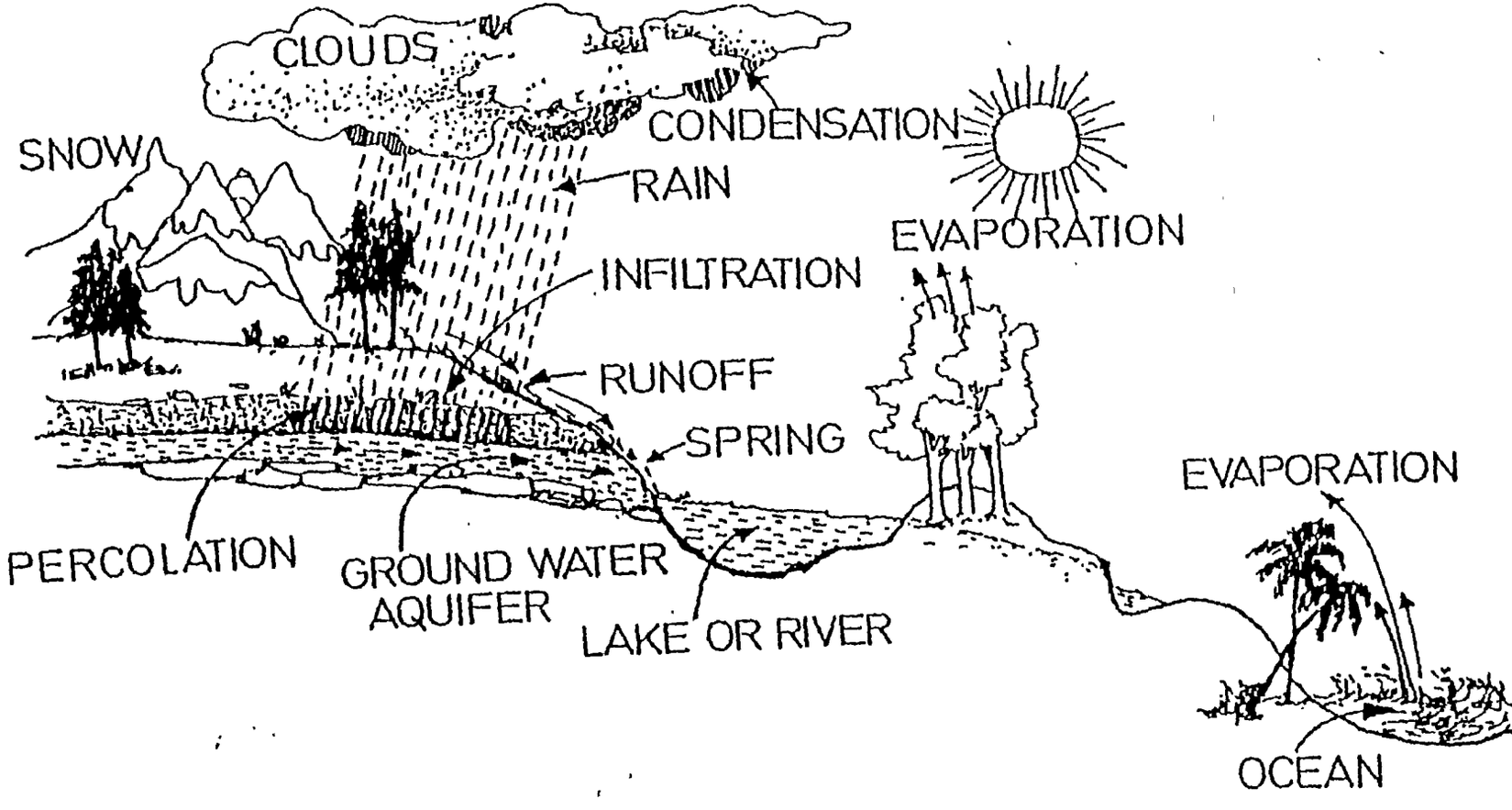


FIG. 1.1 WATER CYCLE

1.4.1 Physical Test:-

In the physical test the colour, odour, taste, total solids and suspended solids are measured. The testing of water is done in Public Health Engineering Department Laboratory. For drinking water IS code 10500 - 1991 is recommended.

If impurities are within permissible limit it is safe for drinking, if they are more than prescribed limit, the water is unsafe for drinking. It should be treated before it is supplied for drinking purpose.

1.4.2 Chemical Test:-

The chemical test is done for pH, Calcium, Chloride, Fluoride, Hardness, Mineral Oil and Phenolic Substances. The traces of Arsenic, Copper Cynide, Iron, Lead, Manganese, Zink, Pesticide like DDT and PCB are determined. IS code 10500, 1991 has been prescribed for Drinking Water Specification. If quantity is more than permissible limit water is not safe for drinking purposes. The water testing can be done from PHED Laboratory.

1.5 HAND PUMP SURROUNDINGS:-

Proper maintenance of Hand Pumps and its surroundings are problem in villages. It is seen in the villages that the hand pumps surroundings are poorly maintained. Platfarms are broken, people wash clothes and take bath in the platform, waste water spreads in the road. The surroundings are muddy. It becomes breeding ground for mosquitos as shown in Fig.1.2,

FIG:1.2 POORE

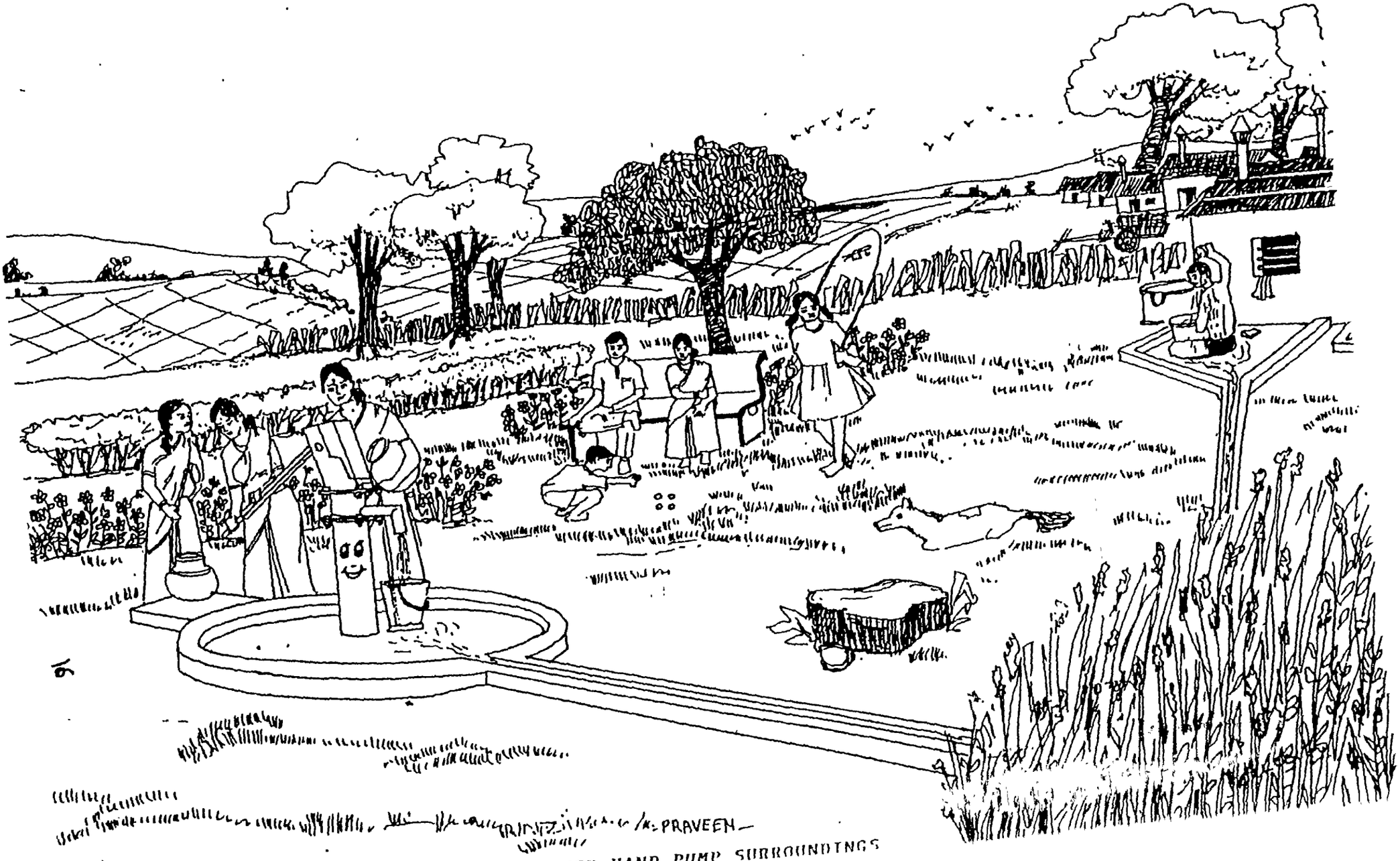


FIG:1.3 WELL MAINTAINED HAND PUMP SURROUNDINGS

A hand pump should be well protected, maintained and it should give an aesthetic appearance. Platform, drains, separate washing platforms and arrangements for waste water disposal into a soak pit will ensure safety and sustainability of the source and will also enhance their utility. The hand pump surroundings should be as shown in Fig.1.3. Around the hand pump there should be plantation for shadow, benches may be placed for waiting. Bathing and washing platform should be made away from hand pump. The waste water should be drained 10-15m away from hand pump. The waste water should be used for irrigating garden or disposed in soak pit.

Rural Hand Pump Mechanic should see the platform and its surrounding are maintained properly as shown in fig 1.3. The waste/drain water is utilized for kitchen garden or disposed in a soak pit. There should be tree plantation and flower plantation near hand pump. The surroundings of hand pump should be so attractive and pleasent people can spend some time around it and have some recreation.

1.6 CONSTRUCTION DETAILS OF SOAK PIT:-

The soak pit is either rectangular or circular. In the hand pumps where we are expecting 200-250 litre of waste water soak pit of 90 cm x 90 cm x 90 cm is made. The soak pit should be made 10-15m away from hand pump. The waste water from hand pump and washing platform should be brought to soak pit by drainage channel.

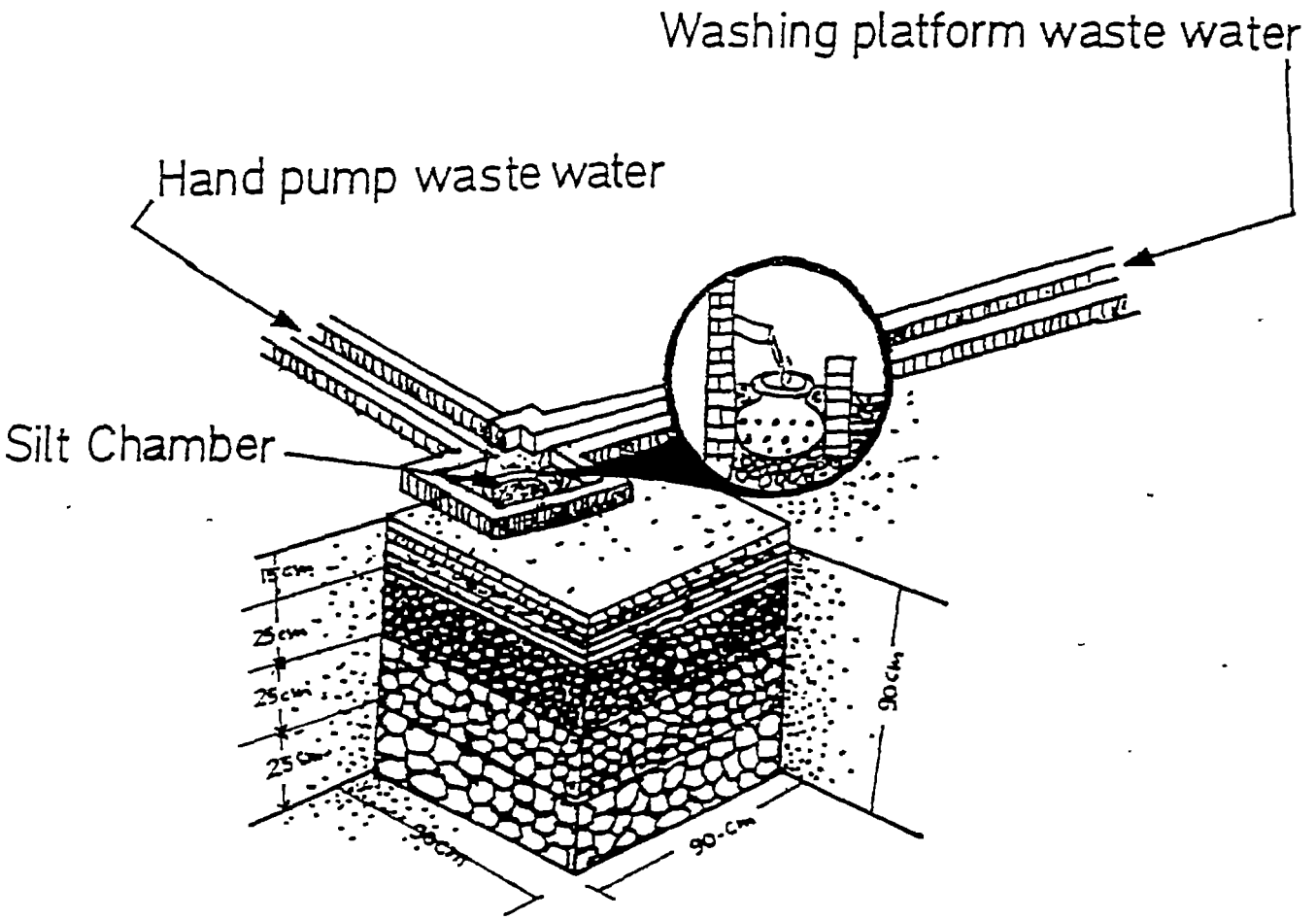


FIG:1.4 SOAK PIT

For construction, a pit of 90 x 90 x 90 cm is dug. First 25 cm layer is filled by big boulders of 12-15 cm diameter second 25 cm layer is filled by 10 - 12 cm diameter bolders, another 25 cm layer is filled by pieces of bricks and small stones details are given in Fig.1.4. Top 15 cm layers is covered by tree branches in layers of 5-6 cm and smaller gravels 5-6 cm layer and remaining 5 cm is covered by dry soil.

On the top a concrete, brick or stone silt chamber of 15 x 15 x 15 cm is made. In the silt chamber, a mud pitcher or mettalic container is placed. It will allow solid waste and impurity of washing to settle at bottom and waste water will go into soakage pit. The mud pitcher or metallic container should be cleaned every week.

1.7. ASSIGNMENTS:

Q.1 Give the importance of maintaining drinking water supply and sanitation system in villages.

Q.2 Why grass root level workers training is required to maintain water supply and sanitation system in villages?

Q.3 To maintain rural water supply and sanitation which type of trained workers are required at grass root level.

Q.4 Give the duties of rural hand pump mechanic.

Q.5 Explain water cycle.

Q.6. What type of tests are conducted for drinking water? From where you will get tested water?

Q.7 In poorly maintained surroundings of hand pump what type of problems are occuring?

Q.8 How Hand Pump surroundings should be maintained?

Q.9 What is the use of soak pit in maintaining hand pump surroundings?

Q.10 Explain the construction of soak pit.

1.8 FEED BACK:

Ans - 1

In the villages it is utmost important to maintain drinking water supply and sanitation systems. Main source of drinking water in villages is handpump. If it goes out of order, it takes 1-4 weeks for fault rectification, which causes disruption in regular safe drinking water supply.

In the field of rural sanitation the situation is much worst. Most of people go out for defecation out side village. It makes village surrounding filthy. It becomes source of many diseases.

So it is quite important to maintain drinking water supply and sanitation system in villages.

Ans - 2.

After 73rd constitutional amendment and enactment of Panchayati Raj system, One of the responsibilities given or will be given to panchayats is maintenance of drinking water supply system and sanitation. The systems can be maintained and whole programme can be made sustainable with the help of local trained people. So the grass root level workers training is required.

Ans - 3

For maintaining rural water supply and sanitation system following 4 types of trained persons are required at grass root level. They are as follows.

i) Rural Hand Pump Mechanic;

ii) Mason for Sanitation Work;

iii) Health and Hygiene Worker;

iv) Motivator.

Ans - 4.

The duties of Hand Pump Mechanic are given below:-

i) Preventive maintenance of hand pumps in a panchayat.

ii) Ensure cleanliness around the hand pump.

iii) Waste water should be disposed in kitchen garden, or soakage pits.

iv) Maintenance and repair of hand pump work with Public Health Engineering Departments, Hand Pump Mechanic for major repair work, 4-5 times till confidence level is gained.

Some of the activities he will do on his own and for some activities he will seek help of mason or PHED hand pump mechanic. But he should ensure safe drinking water is available to rural people.

Ans - 5.

Water cycle explains how water moves in the atmosphere. The basic source of water in earth surface is rain water. Rain water falls on earth surface, major portion of it goes as runoff and flows to stream, river and sea. Some portion of rain water infiltrates into the ground and percolates underground. The water in the river, tank and sea evaporates and makes clouds which on suitable temperature falls as rain water. This makes water cycle it is dipcted in fig.1.1.

Ans - 6.

Testing of water has to be done before it is recommended for drinking purpose. Mainly following tests are conducted.

i) Physical Test

ii) Chemical Test

Water sample can be got tested from Public Health Engineering Department Laboratory.

Ans - 7

In poorly maintained surroundings of hand pump leads following problems;

i) Waste water spreads in the road and creates mud and allow mosquito breeding.

ii) If there is poor drainage and platform is broken, dirty waste water may go undergroung and spoils under ground drinking water.

Ans - 8

A hand pump should be well protected and maintained and it should give an aesthetic appearance. Platforms, drains, separate washing platforms and arrangements for waste water disposal into a soak pit will ensure safety and sustainability of the source and will also enhance their utility as shown in fig.1.3. Around the hand pump there should be plantation for shadow, benches may be placed for waiting. Bathing and washing platform should be made away from hand pump. The waste water should be drained 10-15m away from hand pump. The waste water should be used for irrigating garden or disposed in soak pit.

Ans- 9

Soak pit allows waste water to go into pore space between stones and bolders underground. Arobic bacteria cleans the water and water percoletes in to the ground. It helps in keeping hand pump surroundings dry.

Ans - 10

For construction, a pit of 90 x 90 x 90 cm is dug. The first 25 cm layer is filled by big bolders of 12-15 cm diameter, second 25 cm layer is filled by 10 - 12 cm diameter bolders, another 25 cm layer is filled by pieces of bricks and stones details are given in fig.1.4. Top 15 cm layers is covered by tree branches in layers of 5-6 cm and smaller gravels 5-6 cm layer and remaining 5 cm is covered by dry soil.

On the top a concrete, brick or stone silt chamber of 15 x 15 x 15 cm is made. In the silt chamber, a mud pitcher or mettalic container is placed. It will allow solid waste and impurity of washing to settle at bottom and waste water will go into soakage pit. The mud pitcher or metallic container should be cleaned every week.

MODULE No.-2

MULTI-MEDIA PACKAGE ON

MAINTENANCE AND REPAIR OF HAND PUMPS

MODULE No:2

TITLE : WORKING PRINCIPLE OF HAND PUMP

COMPETENCY 2:

EXPLAIN THE FUNCTIONS OF VARIOUS PARTS OF HAND PUMP

SPECIFIC OBJECTIVES:

After going through experiences of this module you will be able to:

i) describe the importance of hand pump as a safe drinking water device;

ii) explain the working principles of hand pump;

iii) identify various parts of hand pump and explain their functions.

DURATION:

i)	Theory Input	:	1	Hour
	Demonstration	:	1	Hour
ii)	Practical	:	2	Hours
	Total	:	4	Hours

NUMBER OF PAGES: 29 TO 42

RESOURCES REQUIRED:

i) Hand Pump

ii) Transperancies

iii) Video programme

CONTENT OUT LINE:

Working Principles of Hand Pump:

MODULE - 2

TITLE : WORKING PRINCIPLE OF HAND PUMP

2.0 INTRODUCTION:

Hand pump is a very commonly used device in rural areas for safe drinking water. For regular supply of safe drinking water, there is need of hand pump mechanics in rural areas. The rural hand pump mechanic should have knowledge of working principles of hand pumps to keep the pumps in good working condition.

2.1. HAND PUMP AS A SAFE DRINKING WATER SUPPLY SYSTEM FOR RURAL AREAS:

In the villages, surface water sources are rivers, streams, ponds, stepwells, open wells etc. The water from these sources usually carry disease germs in it; so it is not very safe for drinking purpose. It has been reported that by the use of safe drinking water about 80% of water borne diseases can be eliminated.

The underground water is generally free from harmful germs, so it is safe for drinking purposes.

To draw underground water, a device known as hand pump is commonly used in rural areas. It is sealed from top so that harmful germs can not enter and reach underground water. Due to careless handling by village community the pumps frequently go out of order. In absence of hand pump mechanic in villages, it takes 3-4 weeks to carry out the repair by hand pump mechanic team from Public Health Engineering Department. This results in non-availability of safe drinking water in rural area for long periods. For assuring safe drinking water regularly to rural

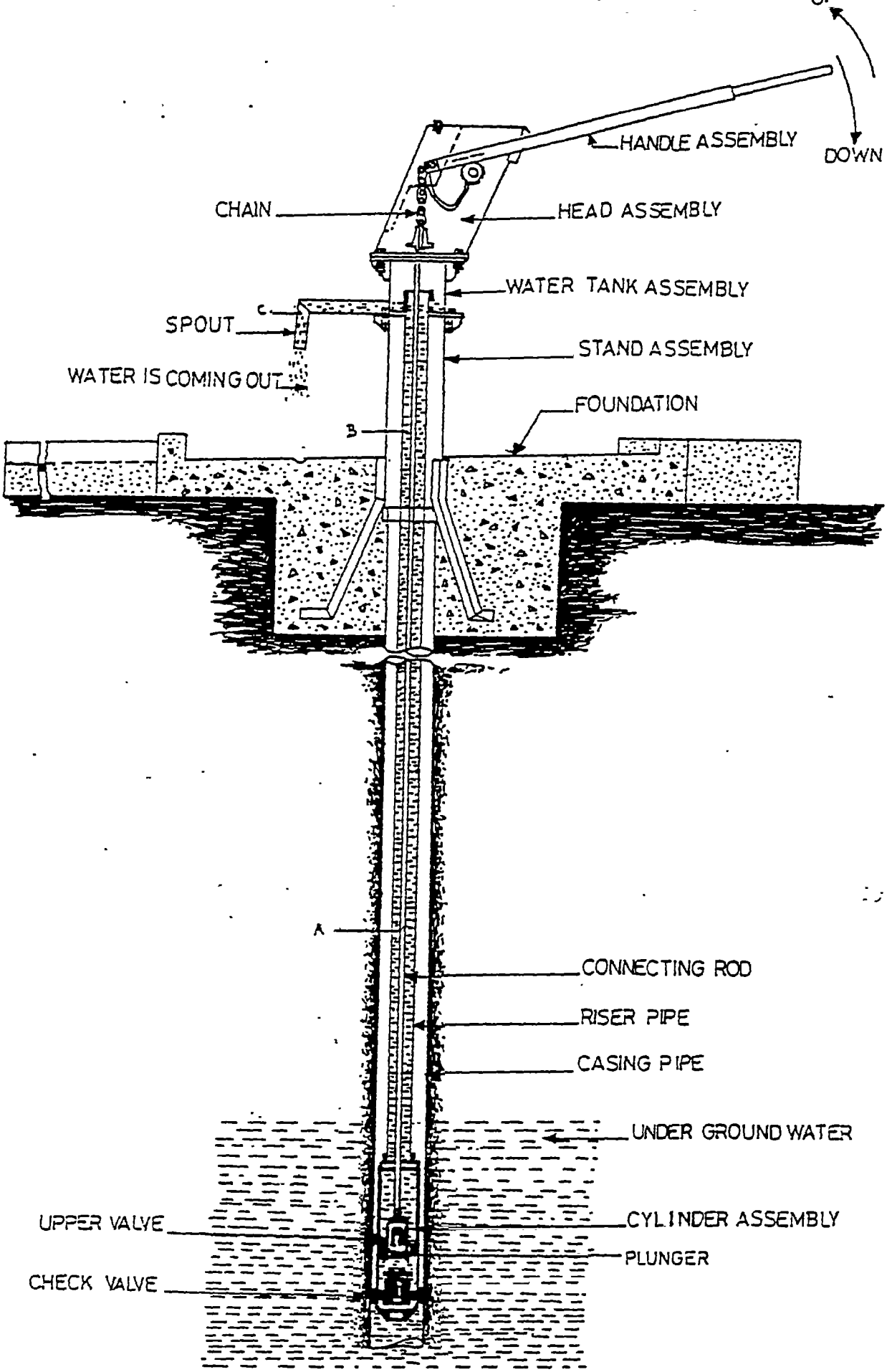


FIG:2.1 WORKING PRINCIPLE OF HAND PUMP

people, hand pump is very useful and important device and it should be maintained locally by rural pump mechanic.

2.2. WORKING PRINCIPLE OF HAND PUMP:

In a hand pump, the connecting rod joins cylinder assembly and handle. As the handle moves down plunger inside the cylinder assembly, moves up. When the plunger moves up it pushes water up and creates vaccum below it, the non-return valve opens and water comes in and fills the space. With the frequent movement of handle, plunger pushes water up and water level increases gradually in the riser pipe as shown in Fig.2.1 at point A,B,C. When water level reaches above spout pipe level, it comes out.

TREATMENT: Use relevant transperancy and slide.

2.3. VARIOUS PARTS OF HAND PUMP AND THEIR FUNCTIONS:

Following are the main parts of hand pumps as shown in Fig.2.2

i) Pump Head Assembly
ii) Cylinder Assembly
iii) Connecting Rod Assembly
iv) Riser Pipe Assembly

A Pump Head Assembly: This is the portion fitted above the ground on casing pipe. It consists of 4 sub-assemblies;

a) Head Assembly

b) Handle Assembly

c) Water Tank Assembly

d) Stand Assembly

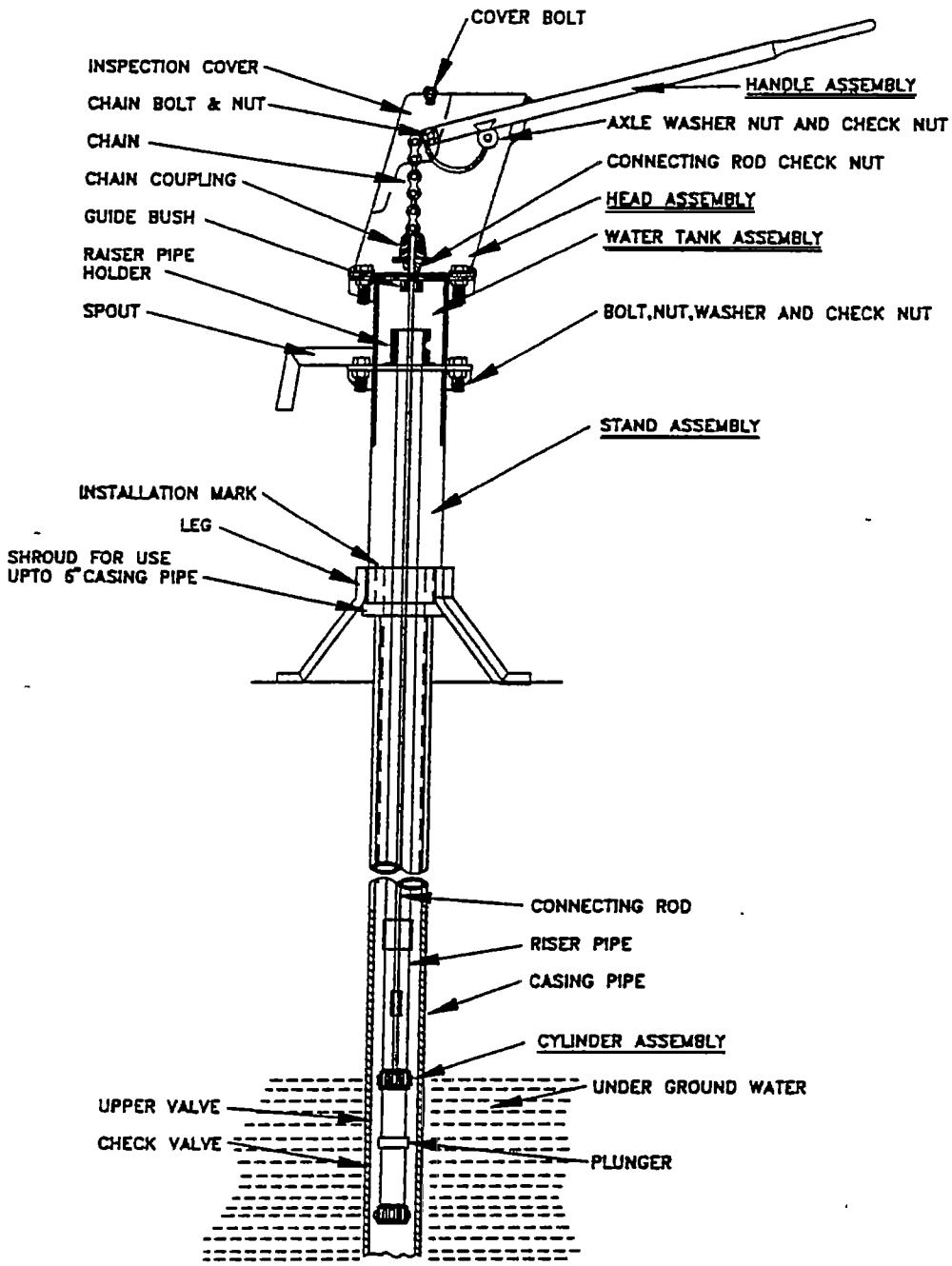


FIG: 2.2 DETAILS OF HAND PUMP ASSEMBLY

a) **Head Assembly:** It is made of 4mm and 6mm plates with machine bushes welded on the side plate and head flange. The structure is welded and strong enough to withstand the stress and strain associated with continuous usage.

b) **Handle Assembly:** The handle assembly is fabricated from 32mm square bars. The machined components and other parts are welded. There are two grease pre-packed bearing housed in the bearing housing with inner ring of ball bearings separated by a spacer. The housing portion where bearings are seated, are reamed to ensure proper alignment and fit. The inner ring of ball bearing should rotate freely after it is fixed in the bearing housing.

The chain assembly consists of a standard roller chain with mild steel coupler welded at one end. The other free end is connected to the handle assembly with high tensile bolt and nyloc nut, which serves the purpose of nut and lock nut. This assembly is strong enough to give satisfactory service for years provided graphite grease is applied on it every month.

c) **Water Tank Assembly:** This assembly is made out of plates, pipes and M.S.bars. Top and bottom flanges are welded on to 150mm diameter pipe. Further reinforcement is provided by welding two numbers plate gussets with the top flange. The spout is also welded on to flange and 150mm pipe.

The riser pipe holder which is accurately machined, is welded on to the bottom flange. Even, if the welded joint fails, the riser pipe will not slip as it will be firmly held by the bottom flange.

d) **Stand Assembly:** It is a pedestal having three legs. This assembly is made out of M.S.plates, pipes and angles. The legs are welded on to the pipe. The flange is welded on to the pipe and two gussets are welded to reinforce the joint.

The legs are grouted firmly in cement concrete upto the top end of the leg.

The casing pipe should be allowed to protrude well above the top end of the leg, to provide perfect sanitary seal.

ii) **Cylinder Assembly:**

It consists of C.I. outer casing with solid drawn brass tube inserted and flared. This provides excellent surface finish for operation of plunger assembly and outer casing provides rigidity and protection from damage. The top and bottom caps are made of cast iron and accurately machined to ensure 100% interchangeability.

The plunger assembly and check valve components are made out of Gun Metal or Naval Brass and accurately machined.

The cup washers and sealing rings are made of chrome tanned leather.

The rubber seats of upper valve and check valve are made of nitrile rubber.
The rubber seat retainer and upper valve seatings are well secured by peening operation.

iii) **Connecting Rod Assembly:** The assembly is made of bright bar. The coupler is welded on one end and 20mm long nut is welded on the other end. This makes the erection easy. This is available in lengths of 3 metres.

iv) **Riser Pipe Assembly:** The riser pipe is 32mm G.I. pipe. The length of each piece of riser pipe is 3 meter.

TREATMENT: (The various parts can be demonstrated by showing transperancies, actual working parts and slides.)

2.4 INDIA MARK II AND INDIA MARK III HAND PUMP

In India commenly two types of hand pumps are used

i) India Mark II

ii) India Mark III

India Mark II hand pump and India Mark III hand pumps are identical in design. India Mark III hand pump is improved version of India Mark II hand pump. India Mark III hand pump are more versatile, rugged, easy to maintain and repair.

The main difference in India Mark II hand pump and India Mark III hand pump is based on depth of water lift. India Mark III is suitable where depth of water is upto 50 m. India Mark II Extra Deep hand pump is suitable where depth of water is more than 50 m. Some of the technical difference are given in the table.

Difference in Indian Mark III and Extra Deep India Mark II Hand Pump.

S.No.	Specification	India Mark III	India Mark II
i	Depth of water to be lifted	20 - 50 M	50 - 90 M
ii	Water Discharge	15 litre/min for 40 strokes	12 litr/min for 40 strokes
iii	Handle length	1170 mm	1310 mm
iv	Handle section	32 mm sq.bar	40 mm sq.bar
v	Raiser pipe	65 mm G.I.Pipe	32 mm G.I.Pipe

2.5 ASSIGNMENTS:

Q.1 Why, water from a hand pump is better than water from other sources ?

Q.2 List the main parts of a Hand Pump.

Q.3 Describe the working principle of a hand pump

Q.4 Fill up the blanks with appropriate words

i) The cylinder assembly houses .....& .....

ii) Connecting rod assembly connects ..... to the ..... assembly.

iii) Riser pipe assembly carries water from .....to ..... assembly.

iv) The plunger assembly and the check valve components are made of.....

Q.5 Describe type of chain used in chain assembly and explain its purpose

_____

_____

_____

_____

_____

2.6 LEARNING EXPERIENCES:

1. Show the various parts of the hand pump and then ask the trainees to identify the given parts.

2. Ask the trainees to explain the functions of various parts in their own words.

2.7 FEEDBACK:

Ans.1 The water from surface sources like river, stream, pond, step well and open well usually contains disease carrying germs. The hand pump draws water from underground deep tube wells which does not contain disease carrying germs.

Ans.2 The main parts of hand pumps are as follows:

i) Head Assembly

ii) Cylinder Assembly

iii) Riser Pipe Assembly

iv) Connecting Rod Assembly

Ans.3

In the hand pump the connecting rod joins cylinder assembly and handle. As the handle moves down the plunger inside the cylinder assembly moves up. When plunger moves up,it pushes water up and creates vaccum below it. The non-return valve opens and water comes in and fills the space. With the frequent movement of handle,plunger pushes water up and water level increases gradually in the riser pipe as shown in Fig.2.1 at-point A, B, C. When water level reaches above spout pipe level, it comes out.

Ans.4 i) Plunger and Check Valve assemblies

ii) Plunger of the cylinder to the chain assembly

iii) Cylinder to the water tank

iv) Gun metal or Naval Brass

Ans.5 The type of chain used in chain assembly is Standard Roller Chain. It connects handle assembly with connecting rod.

MODULE No.-3

MULTI-MEDIA PACKAGE ON

MAINTENANCE AND REPAIR OF HAND PUMP

MODULE No:3

TITLE : COMMON TOOLS AND SPARE USED IN *HAND* PUMPS MAINTENANCE

COMPETENCY: *3*

DEMONSTRATIVE THE USE OF USE VARIOUS TOOLS FOR MAINTENANCE AND REPAIR OF HAND PUMP.

SPECIFIC OBJECTIVES:

After going through experiences of this module, you will be able to:

i) list out the tools for village hand pump mechanic;

ii) use various types of tools;

iii) list spare parts for hand pump.

DURATION:

i) Theory Input : 1 Hour
Demonstration: 1 Hour

ii) Practical : 2 Hour

Total : 4 Hours

NUMBER OF PAGES : *43* TO 52

RESOURCES REQUIRED:

i) Tool Kit

ii) Hand Tools

iii) Spare parts of Handpump

iv) Transparencies

v) Colour Slides

CONTENT OUT LINE:

CHAPTER 3

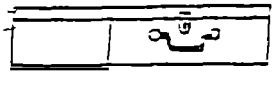
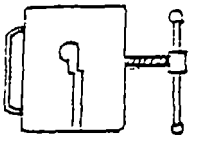
TITLE : COMMON TOOLS AND SPARES USED IN HAND PUMPS MAINTENANCE.

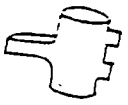
3.1 INTRODUCTION:

For supply of safe drinking water in rural areas, hand pump is an essential device. It needs to be maintained and repaired properly for which tools and spares are required.

Maintenance and repairs of hand pump can be done with the help of standard tools available in hardware shops. But it is cumbersome and at times dangerous and unsafe. It is, therefore, desirable for hand pump mechanic to use specific tools for maintenance and repair of hand pump. They are simple and safe.

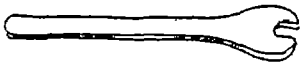
3.2. VILLAGE HAND PUMP MECHANIC TOOLS:

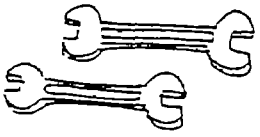
S.No.	Name of Tool	Diagram	Purpose/Use
i.	Tool box/Canvas bag		For carrying tools & essential spares.
ii.	Connecting rod vice		To hold connecting rod while screwing and un screwing.

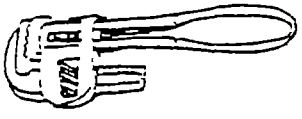
iii. Connecting rod lifter  Raising or lowering the connecting rod.

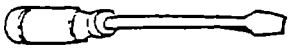
iv. Chain coupler supporting tool  Fixing of chain on to the handle assembly.

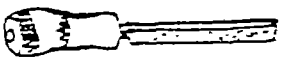
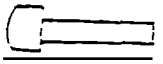
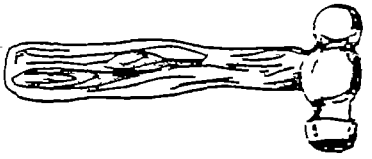
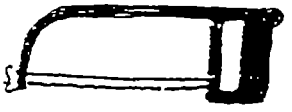
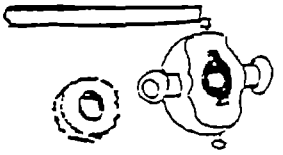
It is placed between chain and the bottom flange of head assembly.

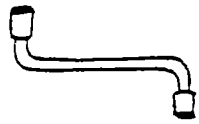
v. Rod coupling spanner  Tightening and un-screwing connecting rod coupler-quickly & easily.

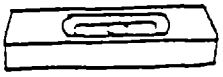
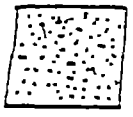
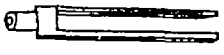
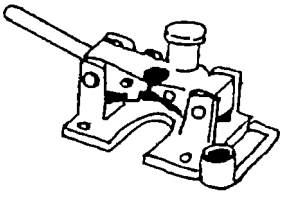
vi. Double-ended spanner  For tightening and unscrewing nut and bolts.

vii. Pipe wrench  Tightening and unscrewing pipes.

viii. Screw driver  Tightening unscrewing screws.

S.No.	Name of Tool	Diagram	Purpose/Use
ix.	Flat File with handle		Filing the rough surface.
x.	Handle axle punch		Used for driving out the handle axle without damage to axle threads.
xi.	Bearing mounting tool		Used for fixing bearing in the bearing housing of handle assembly.
xii.	Ball peen hammer		Used for hammering, job fixing and removing.
xiii.	Hack-saw frame with spare blades		For cutting pipes and other items.
xiv.	Die with die holder		For threading pipe.

S.No.	Name of Tool	Diagram	Purpose/Use
xv.	Crank spanner		Used for tightening or loosening flange bolts, check nuts, chain nyloc nut and anchor bolts, cover bolts,axle nuts etc.
xvi.	Pipe Lifter		Used for lifting pipe.
xvii.	Tank Lifter		Used for lifting water tank.
xviii.	Pipe Vice		Used for holding pipe tightly.
xix.	Brush		Used for cleaning hand pump surface.
xx.	Oil cane		Used for applying mobile oil on moving surfaces.

S.No.	Name of Tool	Diagram	Purpose/Use
xxi.	Spirit Level		Used for checking level of padestal flange.
xxii.	Sand Paper		Used for rubbing hand pump surface for painting and fine smoothing rough surface.
xxiii.	Check valve lifting *adaptor*		*Used for seperating check valve from plunger assembly*
xxiv.	*Box spanner*		***Used for tightening or loosening the push rod.***
xxv.	Self *locking clamp*		***Used for raising or lowering the raiser pipe.***

TREATMENT: The various tools can be shown in the transperancies and slides. The actual tools can also be demonstrated in the classroom.

3.3. List of Recommended Spares parts for Hand Pumps :

The following spares are recommended to be procured and stored for hand pump by village hand pump mechanic.

3.3.1.	**Spares for pump head**	**Qty.**
1.	Hexagonal bolts M12x1.75x40mm long	8 Nos.
2.	Hexagonal nuts M12x1.75	18 Nos.
3.	Washers M12	10 Nos.
4.	High Tensile Bolt M10x1.5x40mm long	1 No.
5.	Nyloc Nut M10x1.5	2 Nos.
6.	Handle axle (stainless steel)	1 No.
7.	Washer (4mm thick) for handle axle	1 No.
8.	Bearing (6204 Z)	2 Nos.
9.	Spacer	1 No.
10.	Chain with coupling	1 No.
11.	Bolt for front cover M12x1.75x20mm long	2 Nos.
3.3.2.	**Spares for cylinder:**	
12.	Nitrile rubber cup washers	4 Nos.
13.	Upper valve rubber seating	2 Nos.
14.	Check valve rubber seating	2 Nos.
15.	Rubber 'O' rings	4 Nos.
16.	Rubber sealing rings	4 Nos.
3.3.3	**Spares for connecting rods and G.I. riser pipes:**	
17.	Hexagonal rod coupling M12x1.75x50mm long	2 Nos.
18.	Pipe sockets (65mm Medium grade hot dip galvanised)	4 Nos.
3.3.4	**Others**	
19.	Graphite grease	
20.	Mobile Oil	
21.	Kerosene Oil	

3.4 ASSIGNMENTS:

Q.1 List the common tools for village hand pump mechanic

_____

_____

_____

_____

Q.2 State the purpose of following pump mechanic tools

i) Connecting rod lifter

ii) Tank lifter

iii) Pipe wrench

iv) Chain coupler supporting tool

v) Bearing mounting tool.

Q.3 Name the essential spare parts for the hand pump head assembly.

_____

_____

_____

3.5 SKILL LEARNING EXPERIENCES:

(1) Each trainer should demonstrate correct use of given hand tools for disassembly of various parts of hand pump.

3.6 FEED BACK:

Ans.1
i) Tool box/Canvas Bag
ii) Connecting rod vice
iii) Connecting rod lifter
iv) Chain coupler supporting tools
v) Rod coupling spanner
vi) Double-ended spanner
vii) Pipe wrench
viii) Screw driver
ix) Flat file with handle
x) Handle axle punch
xi) Bearing mounting tool
xii) Ball peen hammer
xiii) Hack-saw frame with spare blades
xiv) Die with die-holder
xv) Crank spanner
xvi) Pipe Lifter
xvii) Tank Lifter
xviii) Pipe Vice
xix) Brush
xx) Oil cane
xxi) Spirit Level
xxii) Sand Paper

Ans.2 Purposes:

i) Connecting rod lifter - To raise or lower the last (top) connecting rod.

ii) Check valve lifting adopter - It helps in releasing check valve assembly from plunger assembly.

iii) Pipe wrench - Tightening and unscrewing pipe.

iv) Chain coupler Supporting Tool - Fixing of chain on to the handle assembly, it placed between chain coupler and the bottom flange of head assembly.

Ans.3
i) Hexagonal bolts M12x1.75x40mm long
ii) Hexagonal nuts M12x1.75
iii) Washers M12
iv) High Tensile Bolt M10x1.5x40mm long
vi) Nyloc Nut M10x1.5
vi) Handle axle (stainless steel)
vii) Washer (4mm thick) for handle axle
viii) Bearing (6204 Z)
ix) Spacer
x) Chain with coupling
xi) Bolt for front cover M12x1.75x20mm long

MODULE No.-4

MULTI-MEDIA PACKAGE ON

MAINTENANCE AND REPAIR OF HAND PUMP

MODULE NO: 4

TITLE: MAINTENANCE OF HAND PUMPS

COMPETENCY 4:
DEMONSTRATE THE STEPS UNDERTAKEN TO PERFORM MAINTENANCE OF HAND PUMP.

COMPETENCY 5:
DIAGNOSE FAULTS AND REPAIR HAND PUMP

SPECIFIC OBJECTIVES:

After going through the experiences of this module, you will be able to:

(i) do preventive maintenance of hand pump;

(ii) disassemble hand pump;

(iii) check and replace defective parts of hand pump;

(iv) diagnose faults in hand pumps by using trouble shooting charts and flow chart.

(v) assemble hand pump.

DURATION :

i) Theory : 1 Hour
ii) Demonstration : 3 Hours
iii) Practical : 12 Hours

iv) Total : 16 Hours

NO. OF PAGES: 53 TO 98

RESOURCE REQUIRED:

i) Hand pump

ii) Hand Tools

iii) Spare parts

iv) Video Programme

v) Transperencies

vi Slides

CONTENT OUT LINE:

Maintenance of Hand Pumps

MODULE No: 4

TITLE: MAINTENANCE OF HAND PUMPS

4.0 INTRODUCTION:

For supply of safe drinking water, hand pump is an important device. Number of hand pumps, installed in the villages, are nonfunctional because of minor maintenance problems. Due to this there is no availability of safe drinking water. For regular supply of safe drinking water, maintenance of hand pumps should be done by local people themselves. So there is a need of trained hand pump mechanic in villages. To avoid any major breakdown in hand pump, it is required to perform preventive maintenance.

4.1.0. PREVENTIVE MAINTENANCE SCHEDULE:

The Handpumps are to be properly maintained to ensure safe potable drinking water to the rural public. Proper and regular maintenance will prevent breakdowns and ensure continuous working of the hand pumps. The moving parts in the handpumps above the ground level are few and therefore maintenance is very simple.

Handpump is like any other mechanical machine. Any machine is to be kept clean. All parts of a Hand Pump are inspected for formation of rust, insufficient lubrication, loose bolts, nuts, etc., and also for missing parts in time to prevent major failures.

The various schedules of maintenance are recommended at following intervals

4.1.1 Daily:

i) Clean the hand pump and spout pipe by hand.

ii) Check all the flange nuts and bolts and tighten, if required.

iii) Make sure hand pump is firm on in its base, if loose, fix it with the help of mason.

4.1.2 Weekly:

i) Check axle bolt, if loose, tight it.

ii) Make sure lock nut is tight.

iii) Make sure hand pump is firm on its base.

iv) Check flange bolts fastening water chamber to pedastal and make sure, they are tight.

v) Clean out trash from spout pipe.

4.1.3 Monthly:

i) Tighten the handle axle nut and lock nut

ii) Check for loose or missing flange bolts and nuts. Tighten if required.

iii) Open the cover, clean inside the pump.

iv) Check the chain anchor bolt for proper position. Tighten if, necessary.

v) Clean the chain assembly.

vi) Look for rusty patches. If seen, the same may be cleaned with the help of wire brush and apply anticorrosive paint.

vii) Find out whether the handpump base is loose in the base. If it is loose, arrange for new foundation.

4.1.4 Annual:

Examine the pump carefully and check whether:-

i) Discharge is satisfactory;

ii) Handle is shaky;

iii) Guide bush is excessively worn out;

ix) Chain is worn out;

v) Roller chain guide is excessively worn out.

Note: Any defects found should be corrected with help of trouble shooting chart given.

4.2 DISASSEMBLY OF HAND PUMP:

If there is any fault in hand pump, it needs to be disassembled. The given steps should be followed:

i) Loose pump head cover bolt (Fig. 4.1)

ii) Remove inspection cover from head assembly. (Fig. - 4.2)

iii) Insert chain coupling supporting tool. (Fig. - 4.3)

iv) Lift the handle to the top position and disconnect chain from handle by removing the nyloc nut and bolt.(Fig -4.4)

v) Take out handle axle. While removing, use handle axle punch to protect axle thread and remove handle from head assembly. (Fig. - 4.5)

vi) Remove flange bolts from head assembly. (Fig. - 4.6)

vii) Remove head assembly from the water tank (Fig. - 4.7)

viii) Place the connecting rod vice on to the water chamber top flange and tighten vice against connecting rod and allow the head assembly to sit on the connecting rod vice.(Fig.- 4.8)

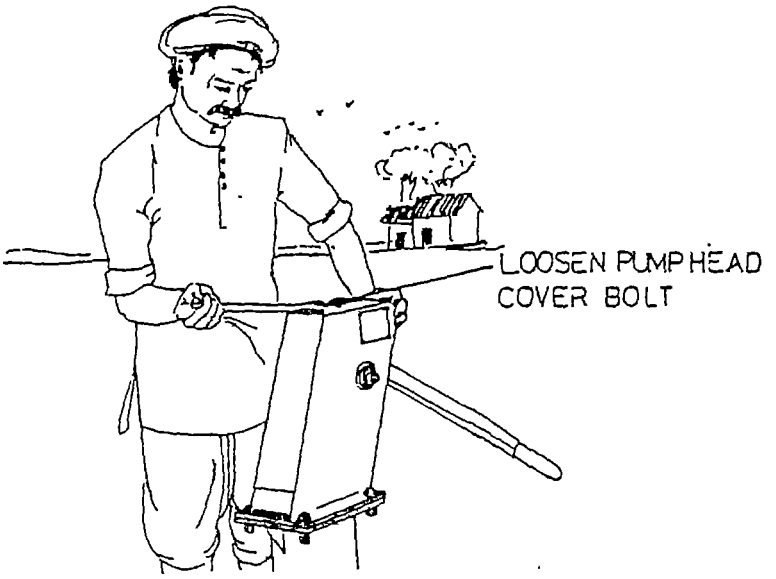


FIG:4.1 LOOSE HAND PUMP COVER BOLT

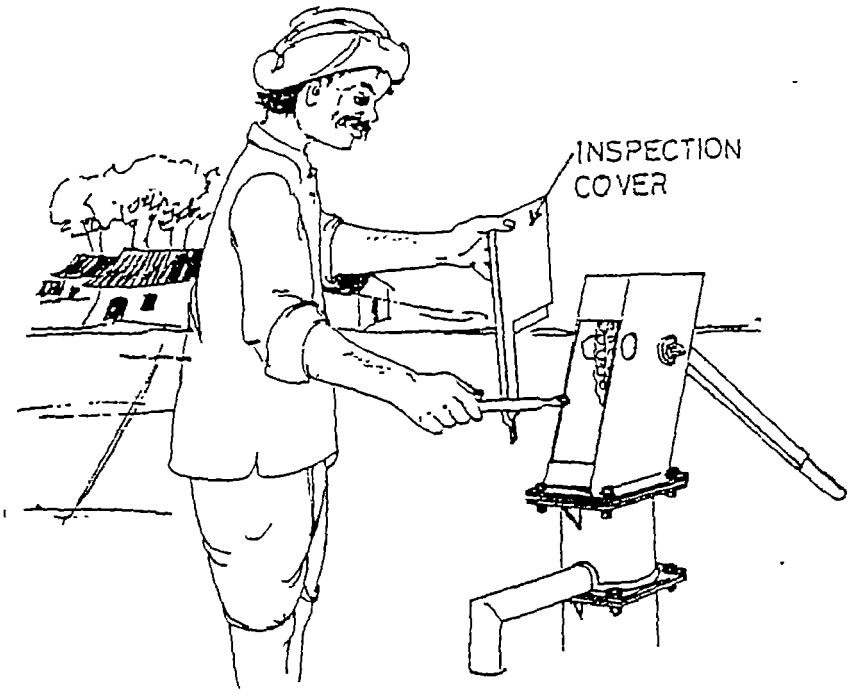


FIG:4.2 REMOVE INSPECTION COVER

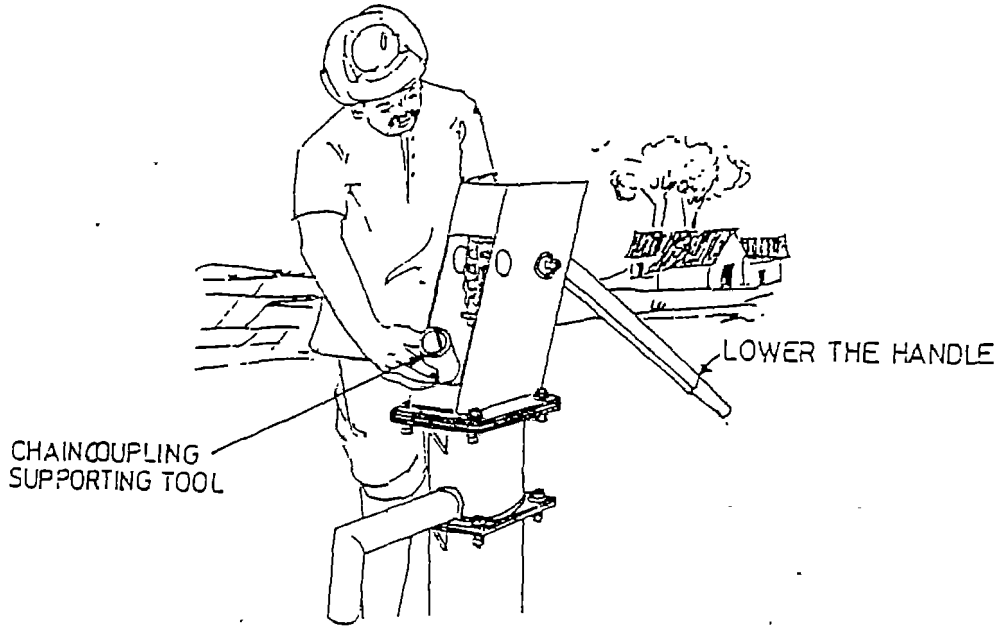


FIG:4.3 INSERT CHAIN COUPLING SUPPORTING TOOL

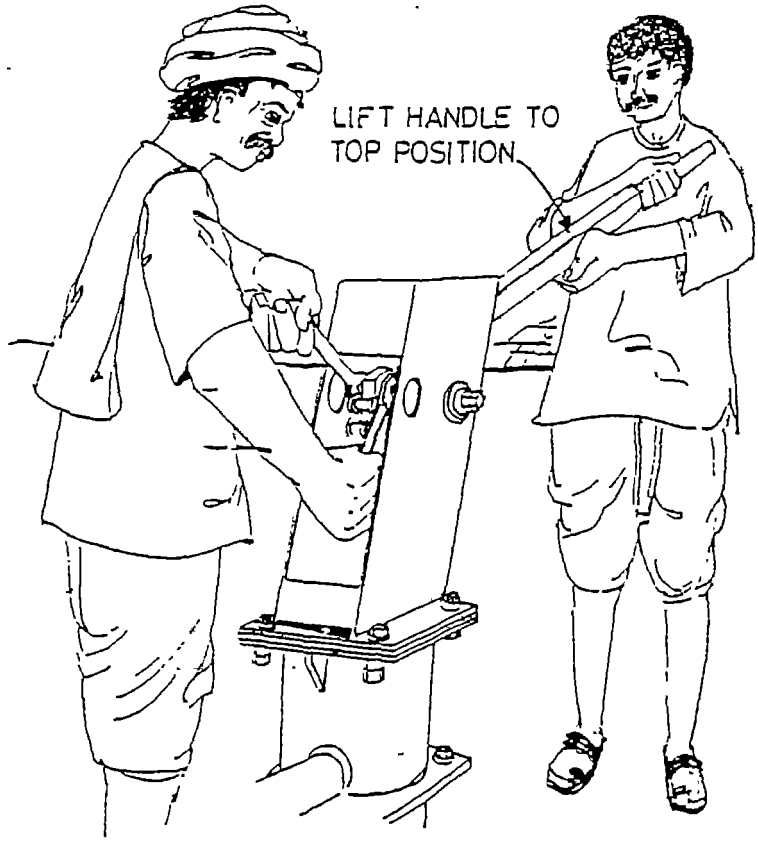


FIG:4.4 .DISCONNECT CHAIN FROM HANDLE

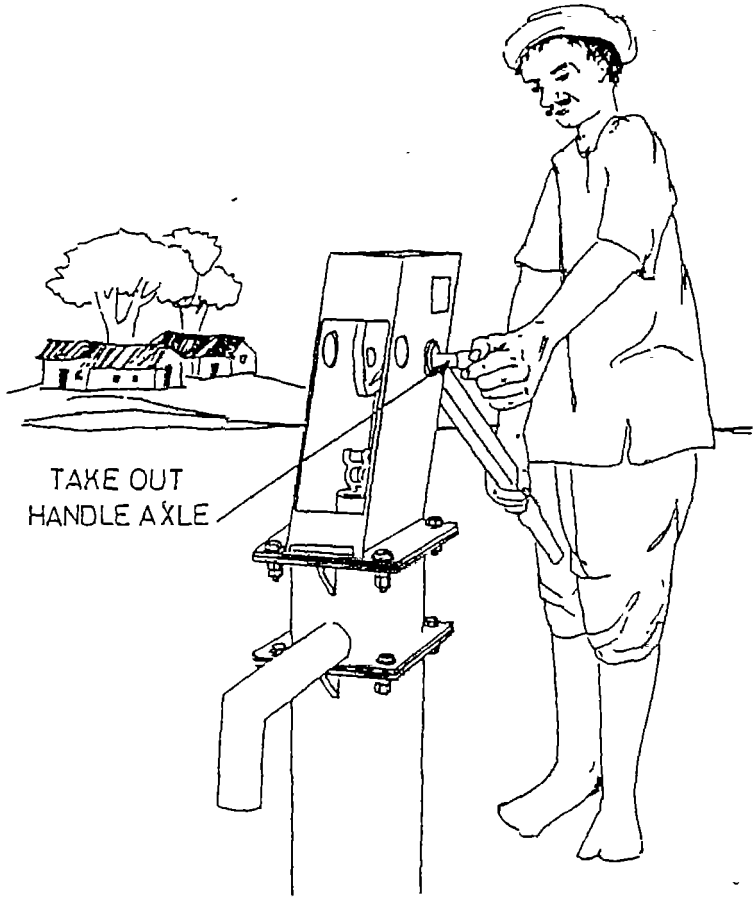


FIG:4.5' .TAKE OUT HANDLE AXLE

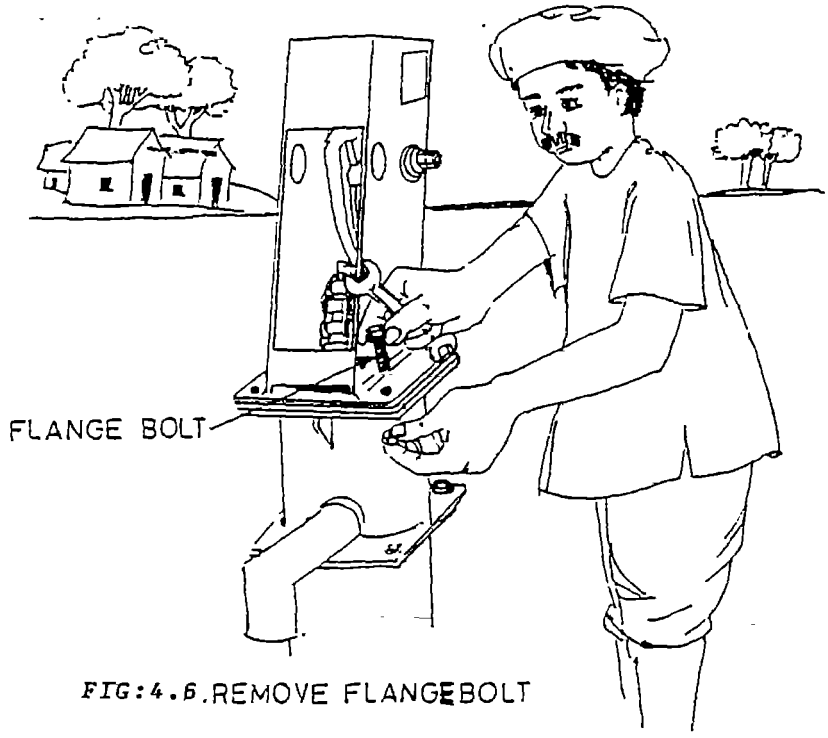


FIG:4.6.REMOVE FLANGEBOLT

FIG:4.7 :REMOVE HEAD ASSEMBLY

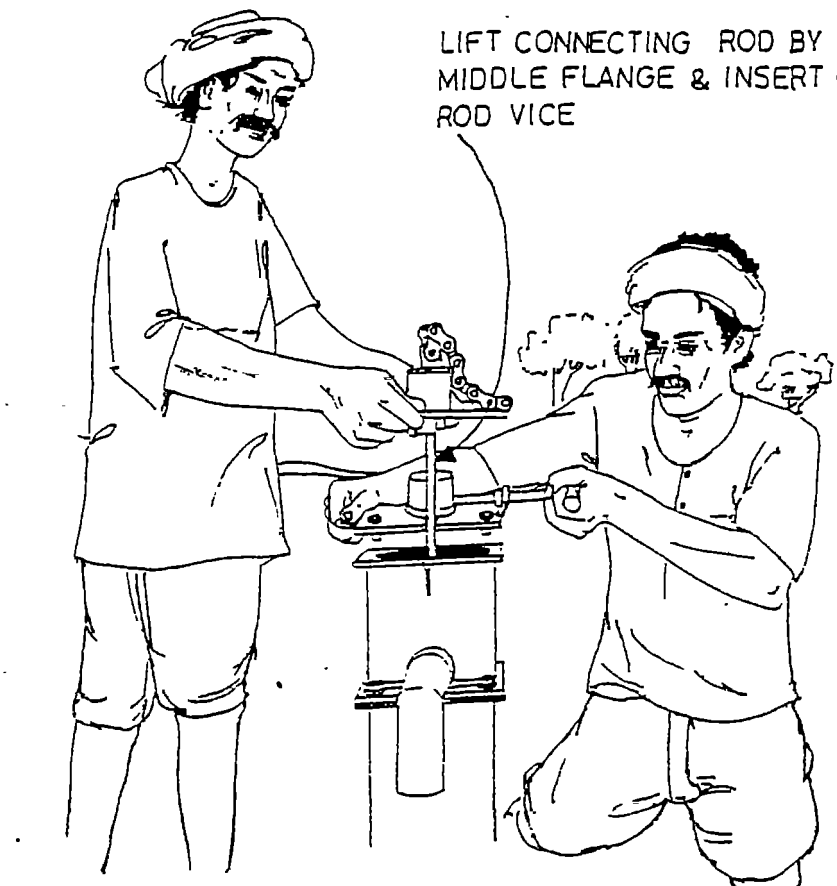


FIG:4.8 ..PLACE THE CONNECTING ROAD VICE

ix) Disconnect the chain assembly from connecting rod (Fig-4.9)

x) Support connecting rod with connecting rod lifter, loosen connecting rod vice and remove. Gently lower connecting rod to sit on check valve. Remove connecting rod lifter. (Fig-4.10)

xi) Loose water tank nuts and bolts and remove water tank bottom flange bolts. (Fig.4.11)

xii) Lift water tank by using tank pipe lifter and lifting spanners. (Fig.4.12)

xiii) Fit self locking clamp and remove water tank. (Fig.4.12)

xiv) Join plunger assembly to check valve by turning the rod lifter in clock wise direction . (Fig.4.13)

xv) To take out water from the pipe, remove the rod lifter. Join the rod lifting adaptor to the connecting rod. Place head assembly over water tank and fix handle to the lifter (Fig.4.14)

xvi) Remove water from riser pipe by pushing down handle suddenly. (Fig.4.15)

xvii) Lift handle upword slowly and disconnect connecting rod lifting adapter and takeout head assembly . (Fig.4.16)

xviii) Tighten the connecting rod lifter to connecting rod and lift connecting rod and fix connecting rod vice (Fig.4.17)

xix) Hold the connecting rod, slowly loosen rod vice and lift rod. Tighten vice and loosen, then remove the first connecting rod. Repeat the process till the last connecting rod with plunger and check valve is pulled out (Fig.4.18)

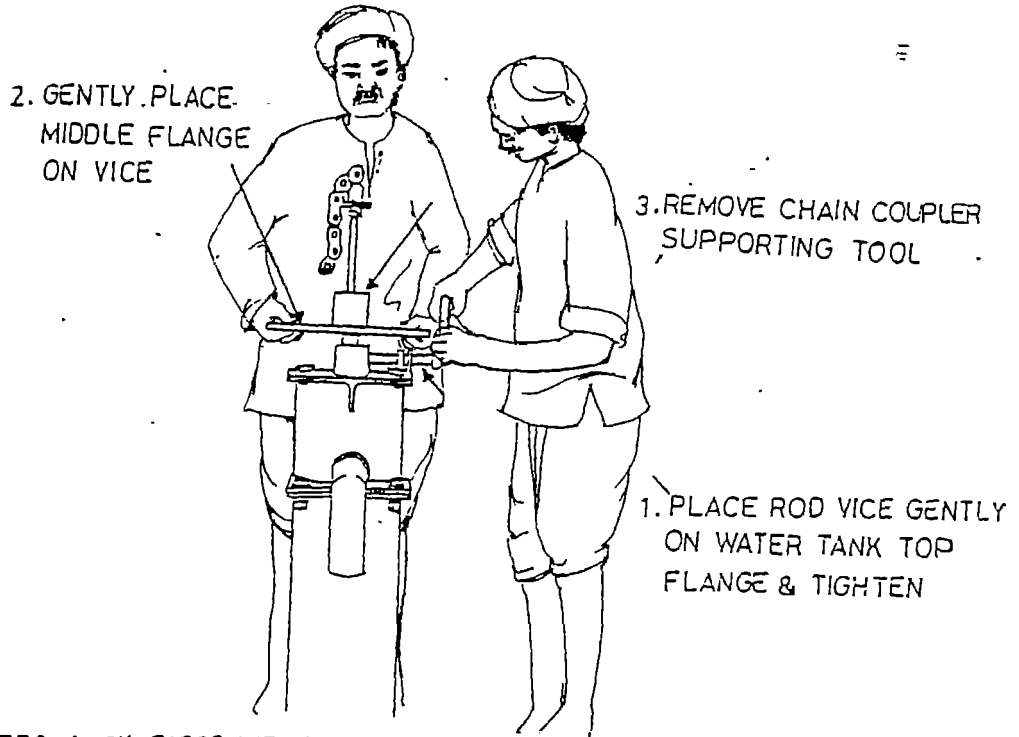


FIG:4.9 DISCONNECT THE CHAIN ASSEMBLY

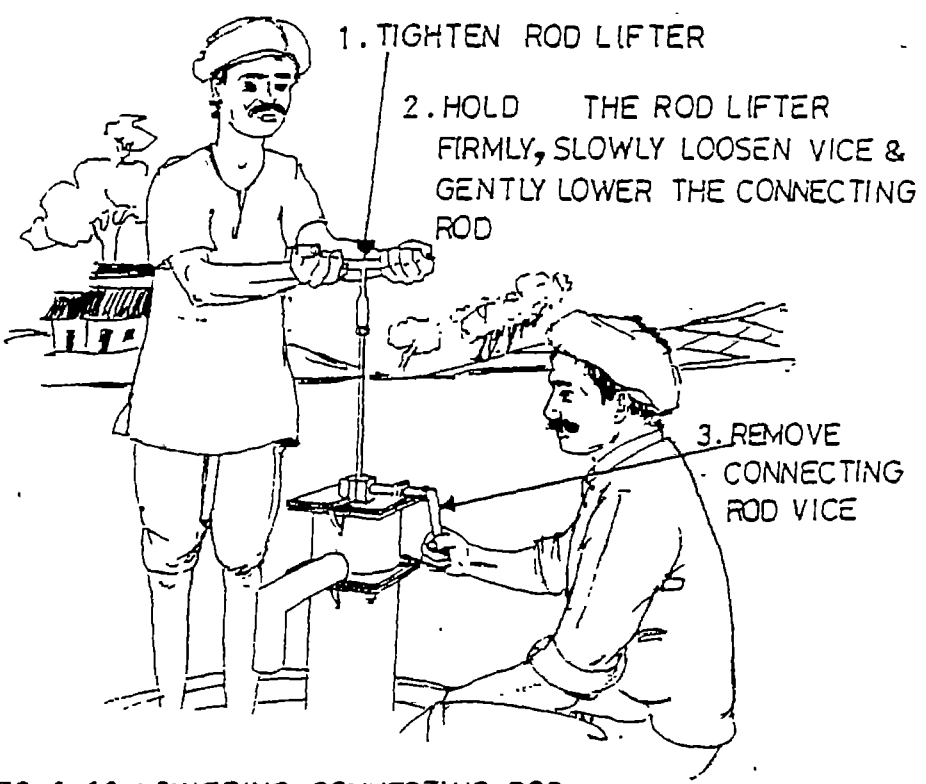


FIG:4.10 LOWERING CONNECTING ROD

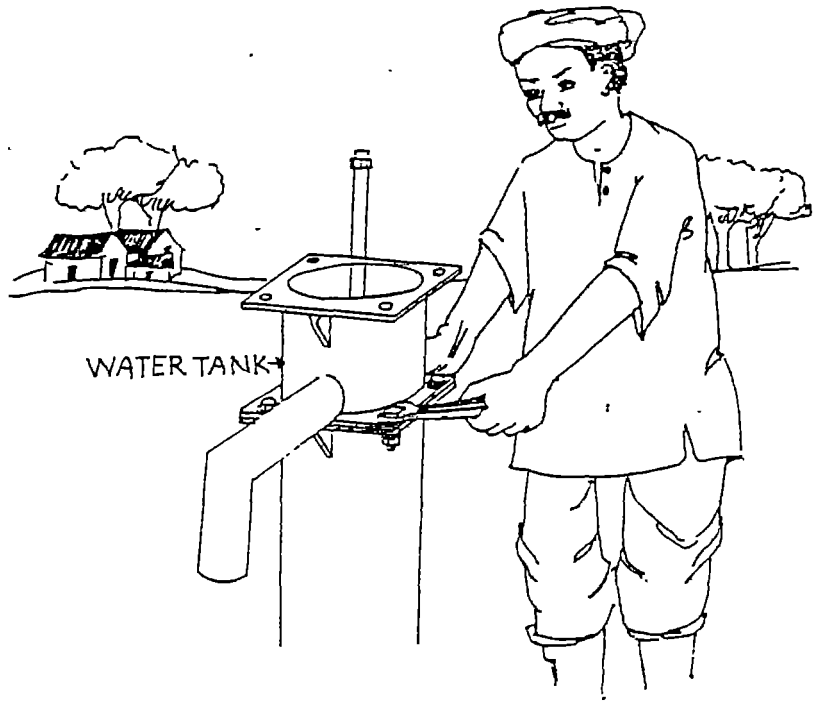


FIG:4.11. LOOSE WATER TANK NUTS& BOLTS

FIG:4.12 :REMOVE WATER TANK

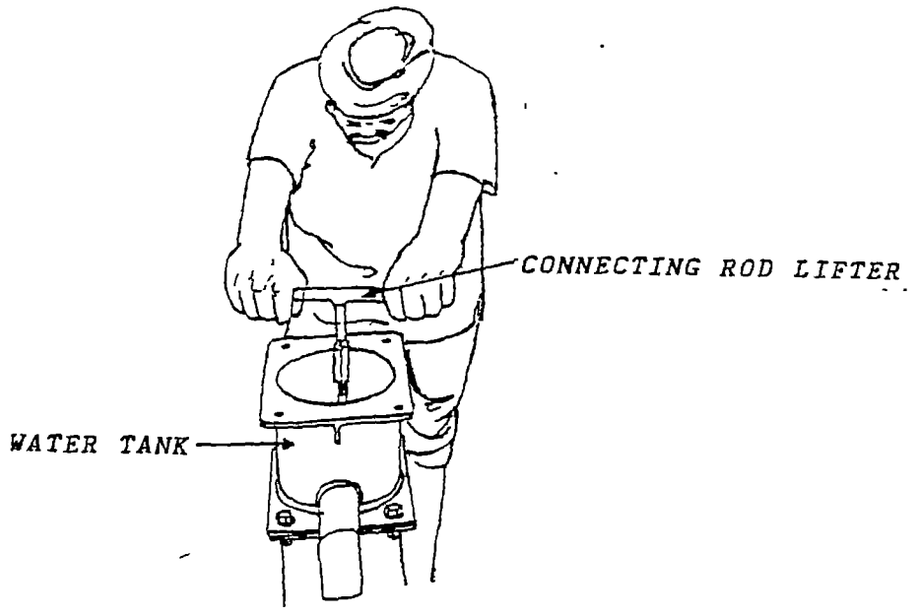


FIG:4.13 JOIN PLUNGER ASSEMBLY TO CHECK VALVE ASSEMBLY

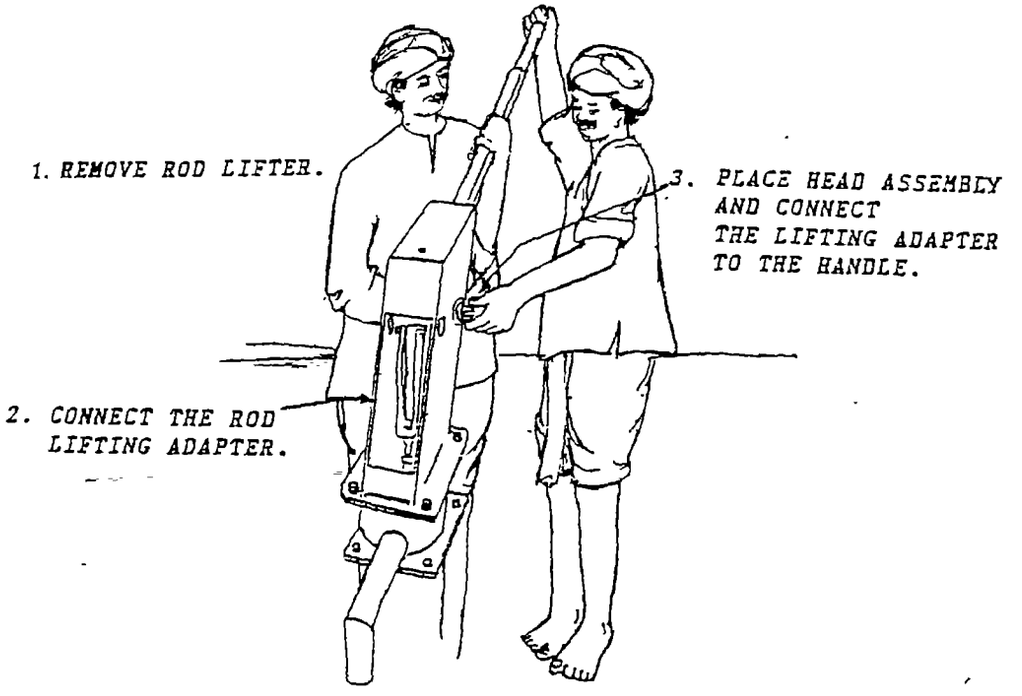


FIG:4.14 FIX HEAD ASSEMBLY & HANDLE

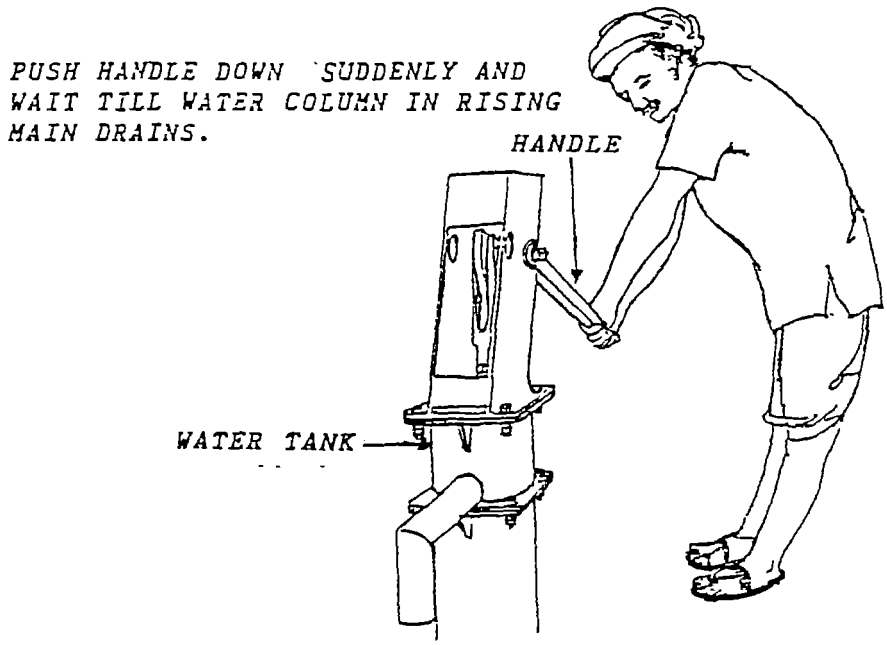


FIG:4.15 REMOVE WATER FROM RISER PIPE

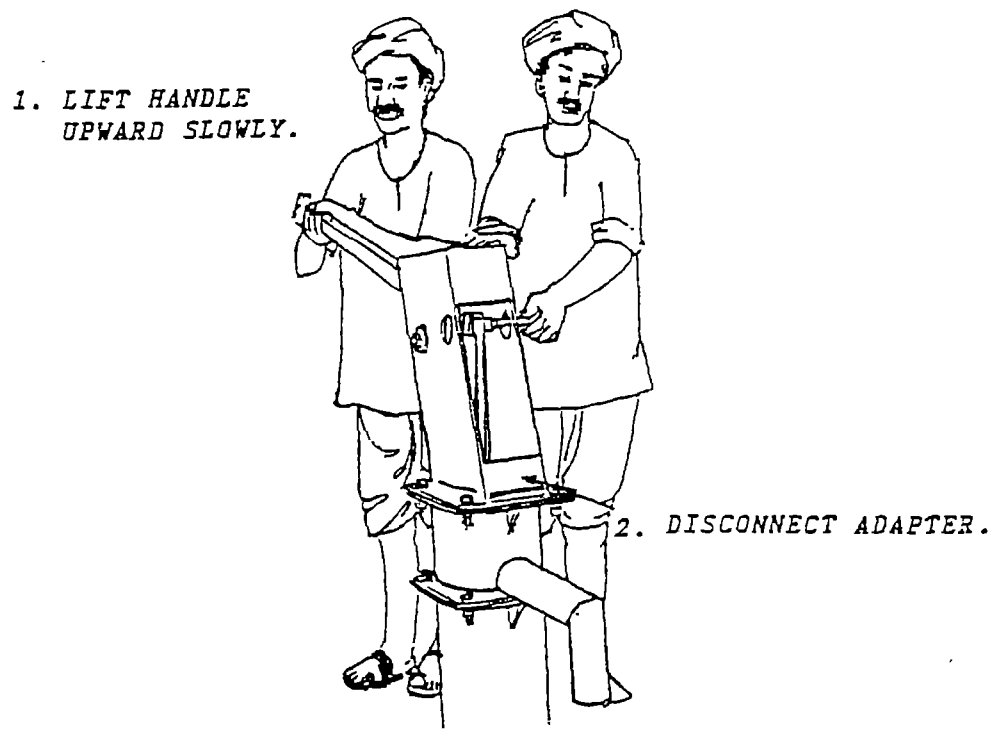


FIG:4.16 REMOVE CONNECTING ROD LIFTING ADAPTER.

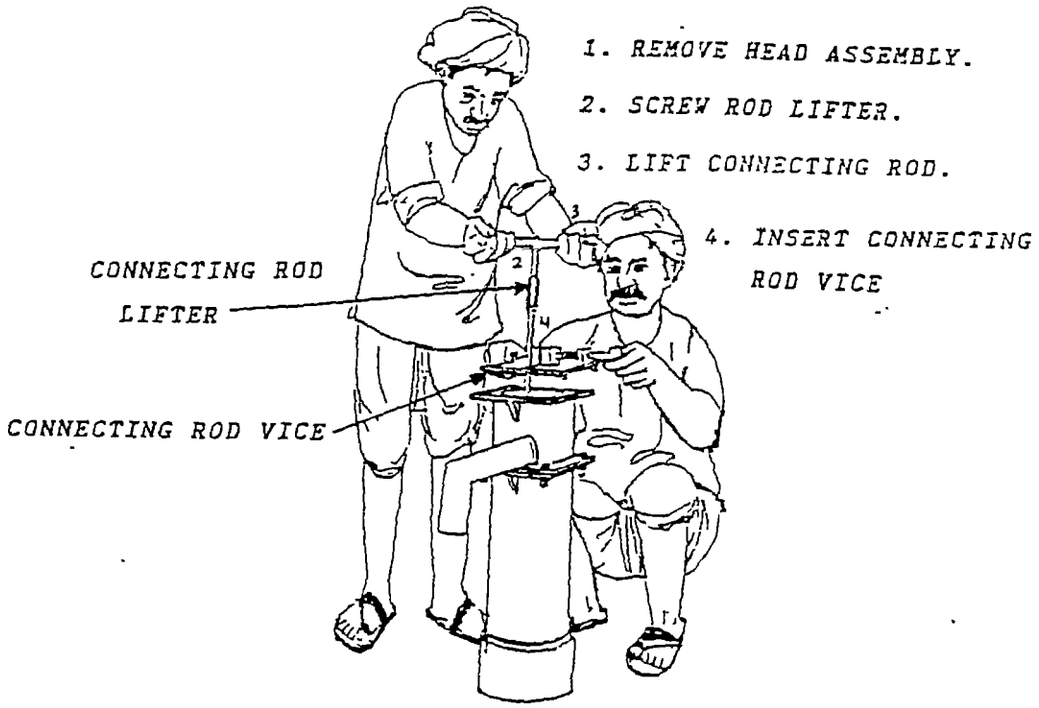


FIG:4.17 FIX THE CONNECTING VICE.

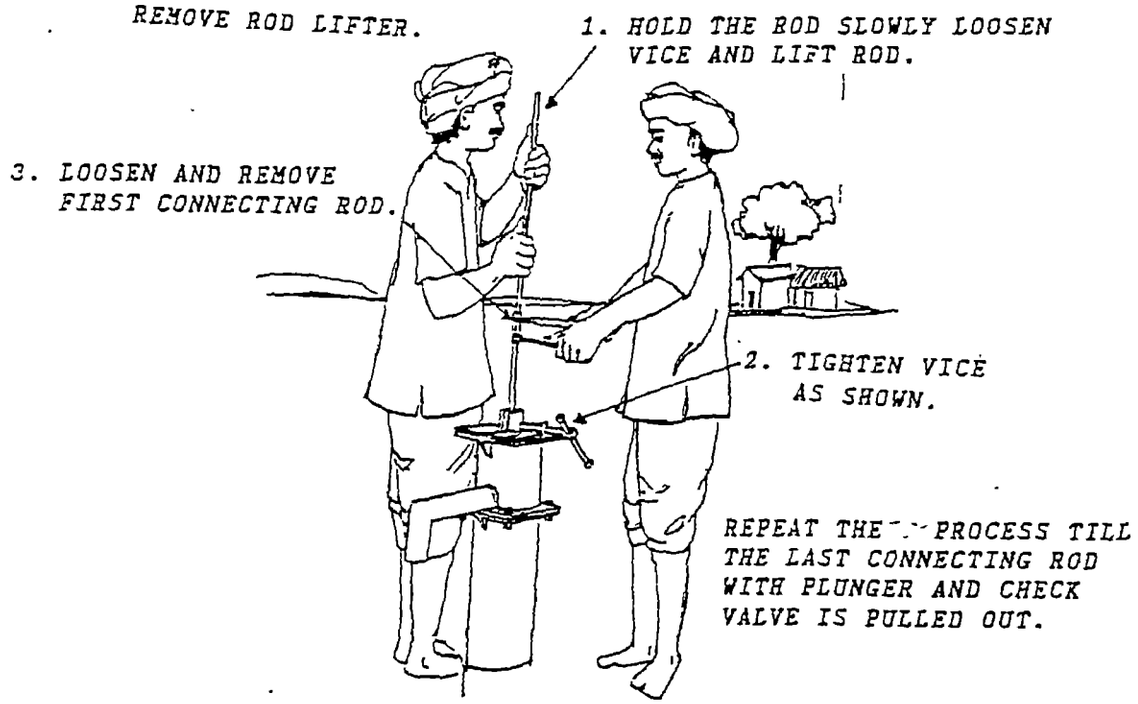


FIG:4.18 REMOVE CONNECTING ROD ONE BY ONE WITH THE HELP OF CONNECTING ROD VICE COUPLER.

xx) Seperate check valve from plunger (Fig.4.19)

xxi) Unscrew plunger from check valve (Fig.4.20)

xxii) Remove all parts of check valve and clean them (Fig.4.21)

TREATMENT: The disassembly process can be demonstrated by actual performance and video clip.

4.3 INSPECTION FOR REASSEMBLY OF HAND PUMP:

I) Inspection of hand pump components:-

Before starting the inspection of hand pump components, first of all inspect the water tank assembly for water leakage or damage. Wash and clean all parts, using a mixture of kerosene oil and water. Inspection should be carried out at site on a firm ground which should be clean.

4.3.1 Stand Assembly:

Stand assembly should be on perfect level. It can be seen by spirit level. If not, should be corrected with the help of mason.

4.3.2 Water Tank Assembly:

Following should be checked:

i) Water tank for leakage and cracks
ii) Coupler for broken threads
iii) Flanges and spout pipe for cracks and leakage

4.3.3 Handle Assembly:

It consists of axle, bearings and chain. It should be ensured that all the parts are clean and free to operate. Apply graphite grease in bearing and chain.

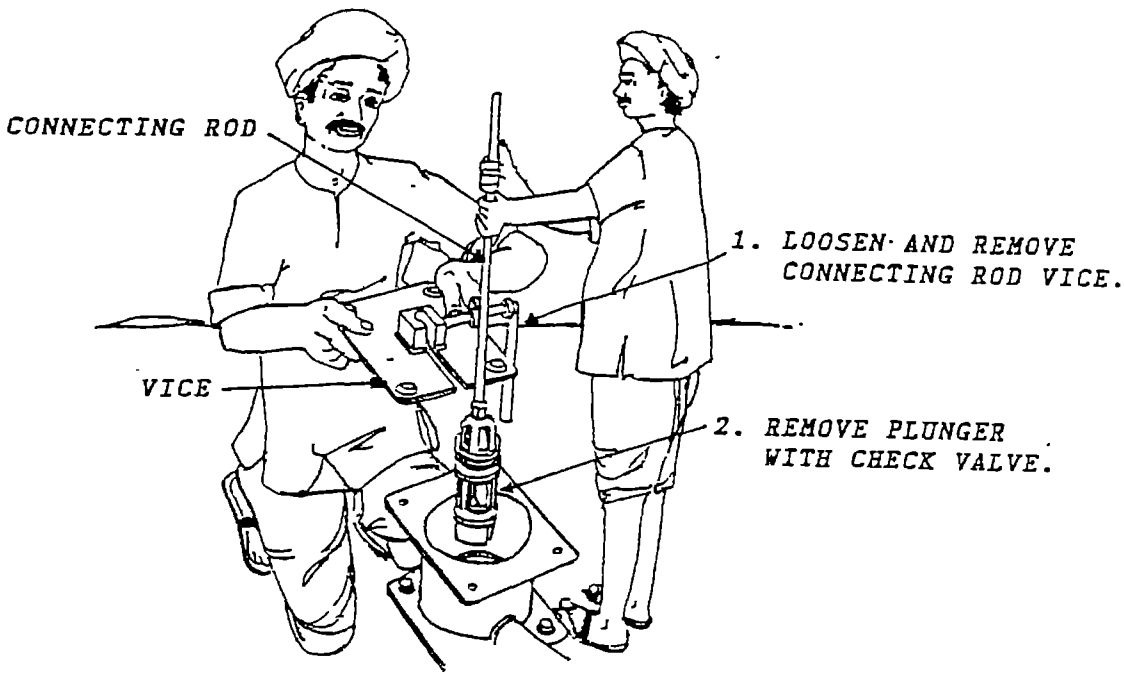


FIG:4.19 SEPERATE CHECK VALVE FROM PLUNGER

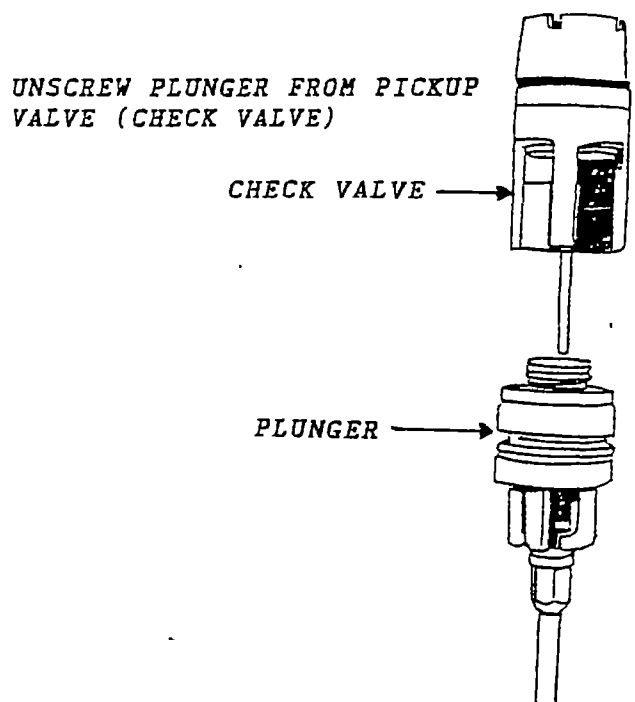
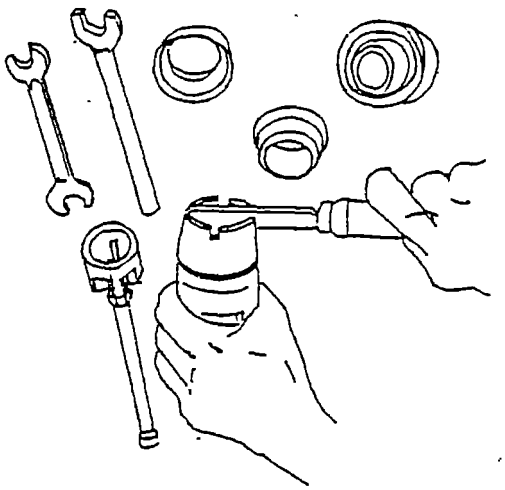


FIG:4.20 REMOVE PLUNGER CHECK VALVE.

DISMANTLE ALL COMPONENTS FROM PLUNGER AND CHECK VALVE ASSEMBLIES AND INSPECT.

REPLACE WORN OUT AND DAMAGED COMPONENTS ASSEMBLE PLUNGER AND CHECK VALVE ASSEMBLIES



AFTER ERECTION CHECK WHETHER THE PUMP IS WORKING WELL IN ALL ASPECTS.

FIG.4.21 REMOVE ALL PARTS OF CHECK VALVE &CLEAN THEM.

4.4. REASSEMBLY OF HAND PUMP:

4.4.1. General:-

Hand pump reassembly should be carried out in a proper sequence. Arrange all lubricants, special tools and parts. Before starting assembly, parts should be:-

- Cleaned and dried
- Lubricated with oil and grease (only moving parts)
- Ensure good condition of parts.
- Check 'O' ring, cup seal etc. besides other parts, replace, if defective.

4.4.2. Assembly of Hand Pump:-

After inspection of various parts, The pump should be assembled in the following steps:

i) Remove cover of casing pipe for fixing stand assembly. (Fig. - 4.22)

ii) Place stand assembly over casing pipe and make sure that it is vertical and check level of flange by spirit level. (Fig. - 4.23)

iii) Fix water tank assembly on the stand flange by tightening the nuts and bolts.(Fig. - 4.24)

iv) Join check valve and plunger (Fig - 4.25)

v) Connect plunger to connecting rod (Fig. - 4.26)

vi) Insert the plunger assembly connected with check value as the riser pipe and connect riser cupler to the water tank. (Fig. - 4.27)

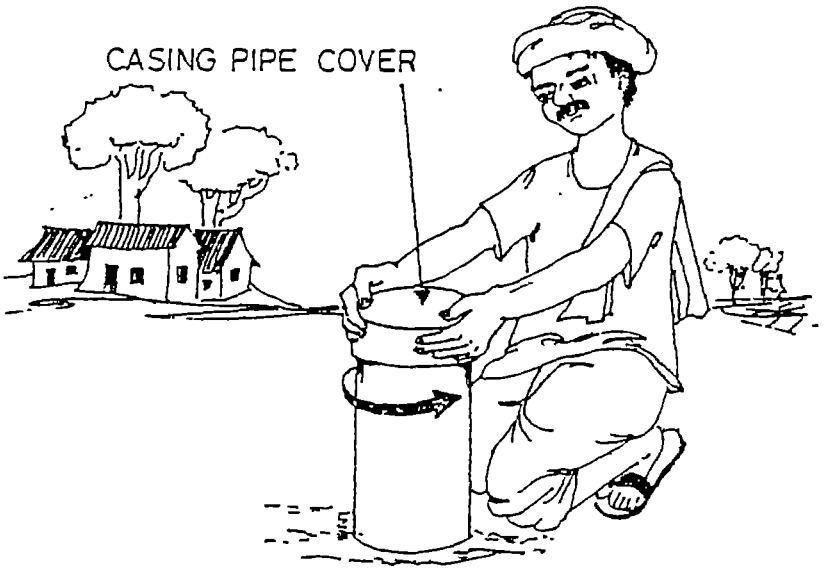


FIG:4.22 REMOVE COVER OF CASING PIPE

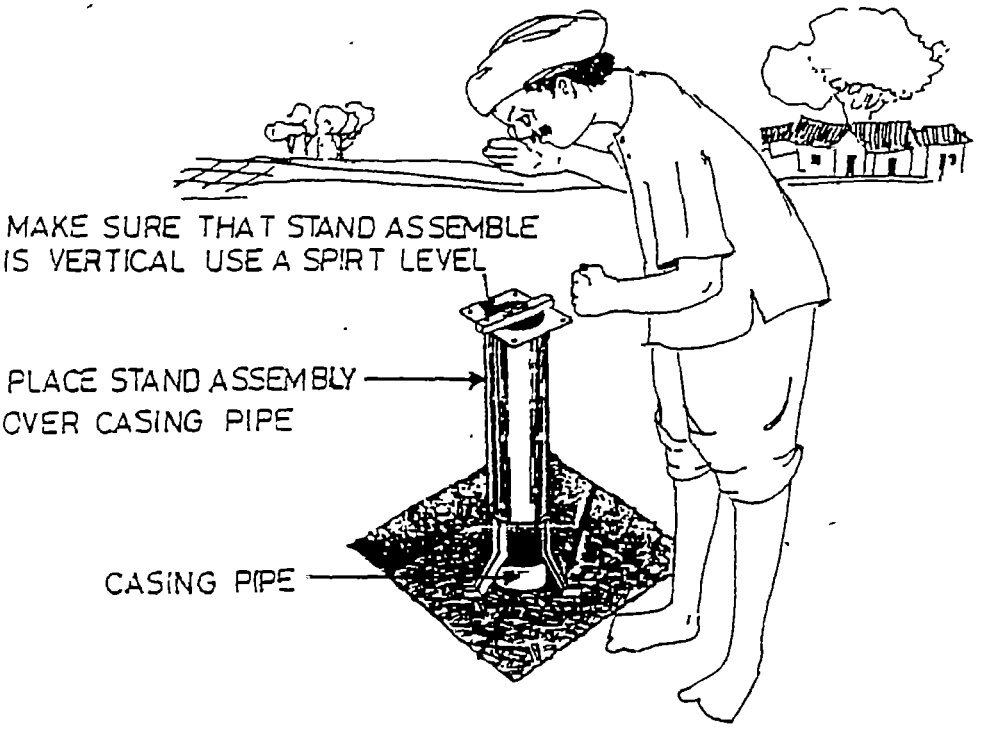


FIG:4.23 LEVELING STAND ASSEMBLY FLANGE

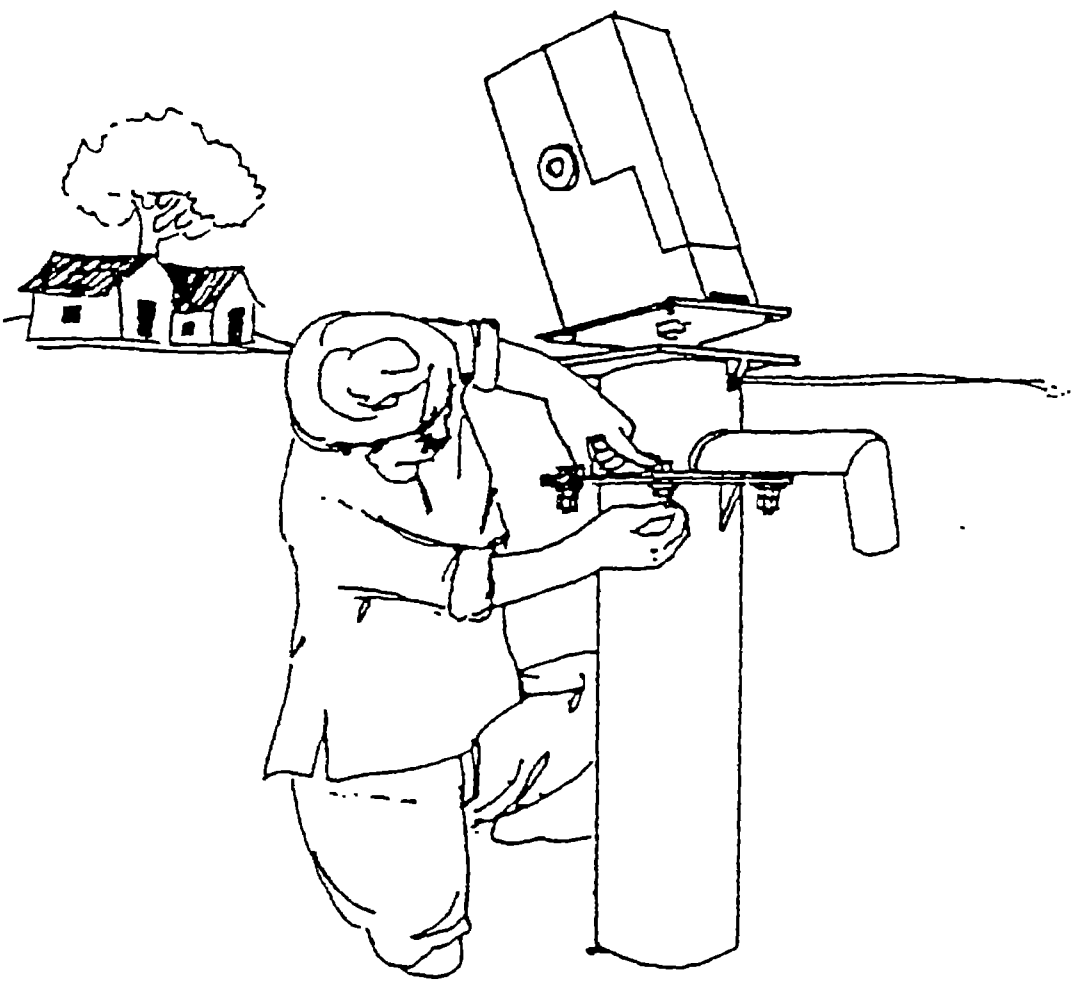


FIG:4.24 FIX WATER TANK ASSEMBLY

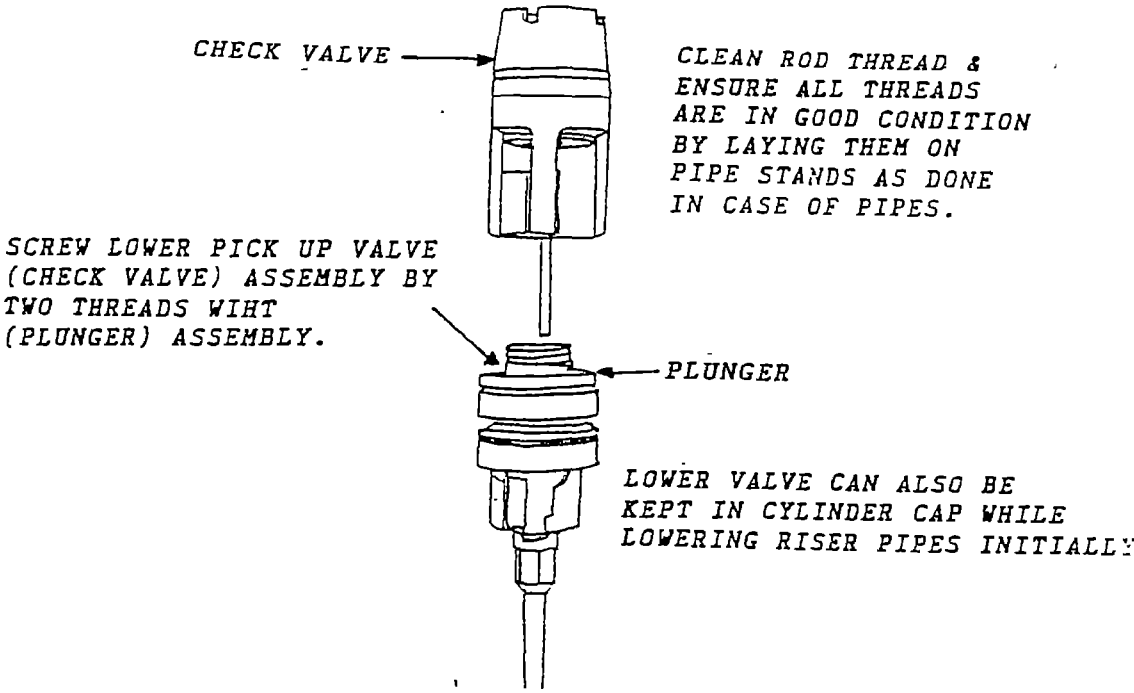


FIG:4.25 JOIN CHECK VALVE WITH PLUNGER.

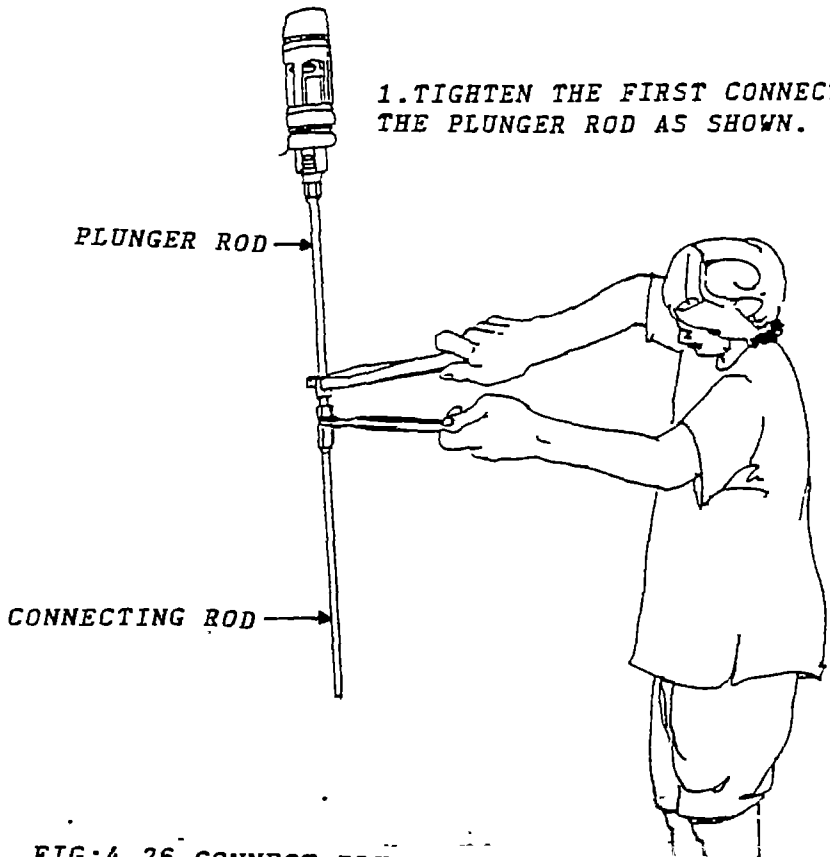


FIG:4.26 CONNECT PLUNGER TO CONNECTING ROD.

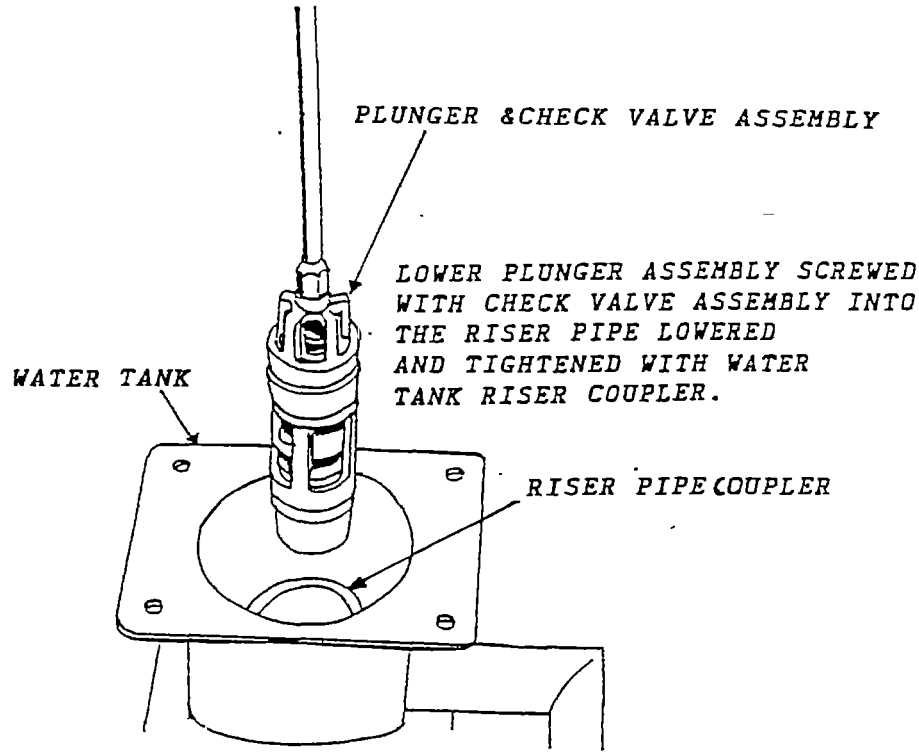


FIG:4.27 INSERT PLUNGER ASSEMBLY IN THE RISER PIPE

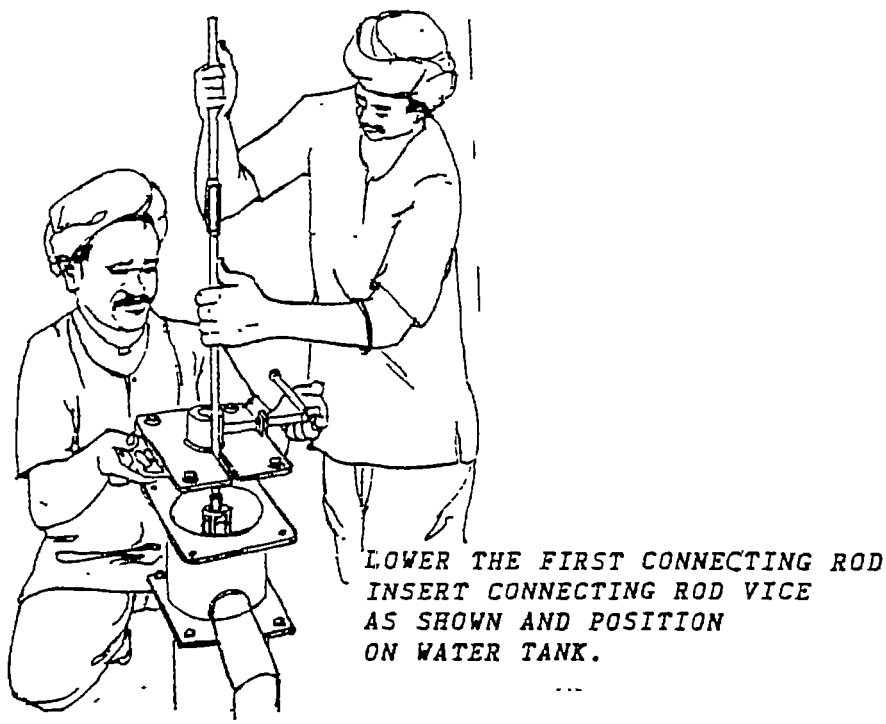


FIG:4.28 INSERT LOWER END OF THE CONNECTING ROD IN THE RISER PIPE.

vii) Insert the lower end of the connecting rod in the riser pipe, to place the connecting rod over the water tank and fix it to the vice. (Fig. - 4.28)

viii) Join the connecting rod pieces as per the requirement and insert in the riser pipe. (Fig. - 4.29)

ix) Remove the connecting rod vice from the water tank by holding the top end of connecting rod. (Fig. - 4.30)

x) Fix the connecting rod lifter to the top end of the connecting rod and to rotate in the direction of arrow so as to seperate the check valve the plunger and ensure that it reaches the bottom plate. (Fig. - 4.31)

xi) Make a mark by hack saw on the connecting rode at the level of water tank. (Fig. 4.32)

xii) Lift the connecting rod assembly, fix the connecting rod vice and tighten the connecting rod. (Fig. - 4.33)

xiii) To cut the connecting rod as per the marking after removing the connecting rod lifter. (Fig. - 4.34)

xiv) Smoothen with the help of file the cut surface of connecting rod. (Fig. - 4.35)

xv) Make necessary threads on the top most end of connecting rod. (Fig. 4.36)

xvi) Fix the middle flange on top of water tank and ensure that all four corners coincides. (Fig. - 4.37)

xvii) Tighten check nut at the top of the connecting rod. (Fig. - 4.38)

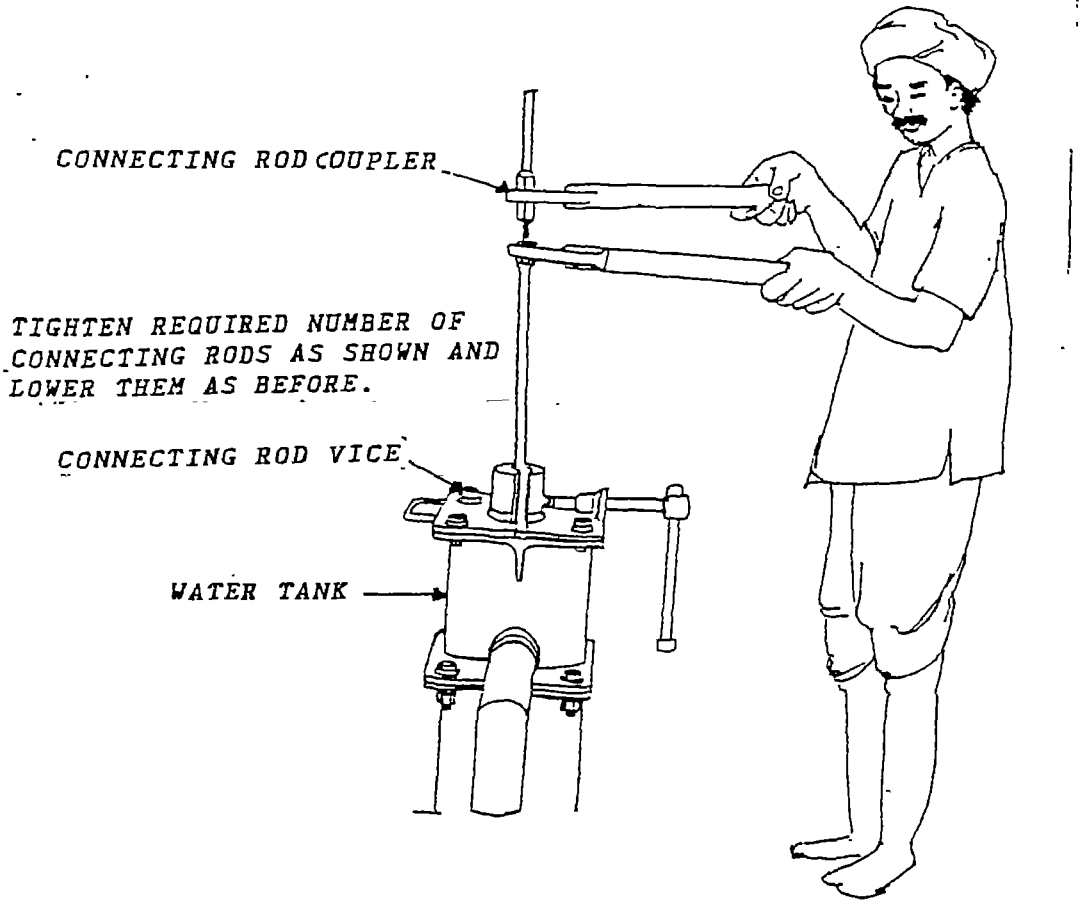


FIG:4.29 JOIN THE CONNECTING ROD AS PER REQUIREMENT.

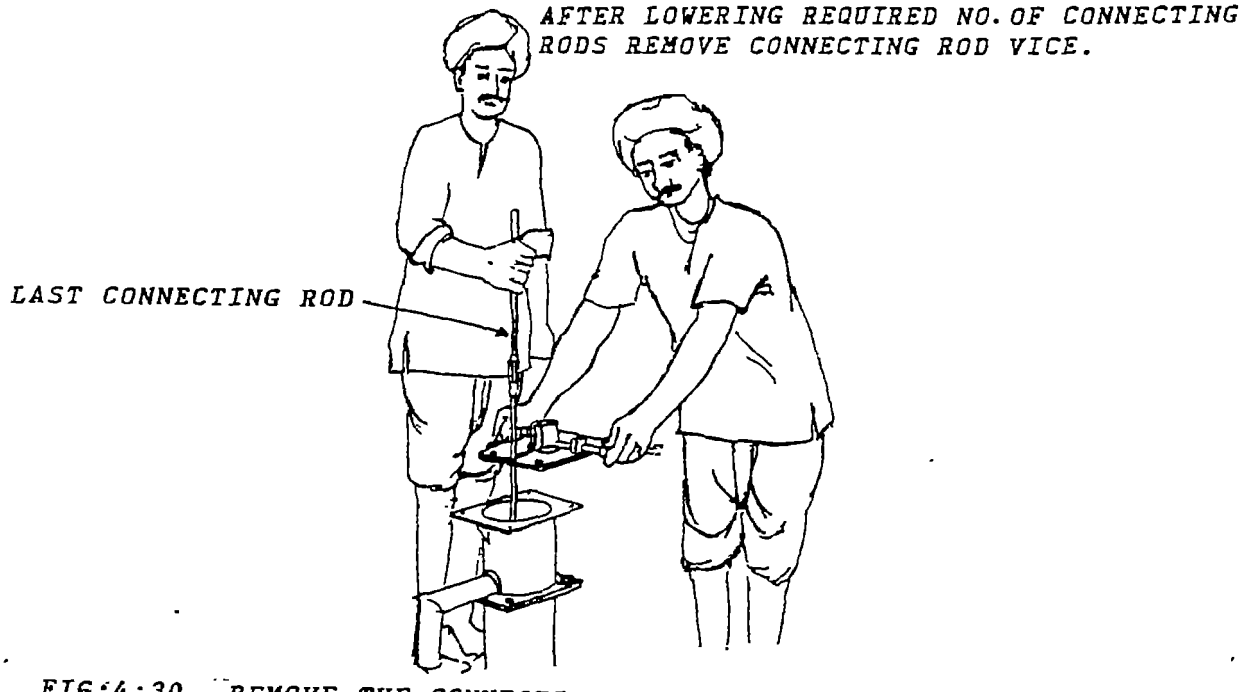


FIG:4:30 REMOVE THE CONNECTING ROD VICE FROM THE WATER TANK.

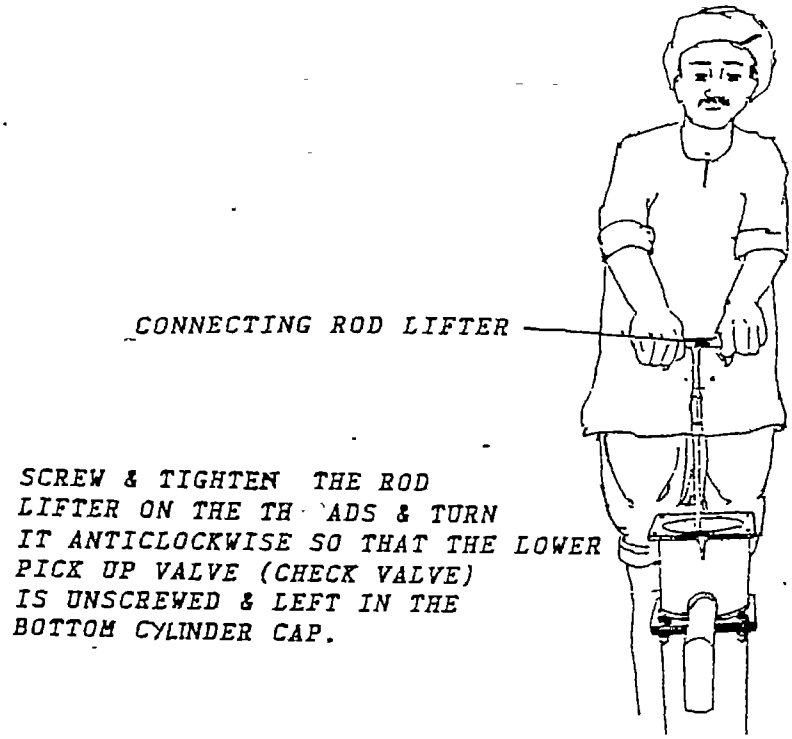


FIG:4.31 FIX LIFTER TO THE TOP END OF CONNECTING ROD.

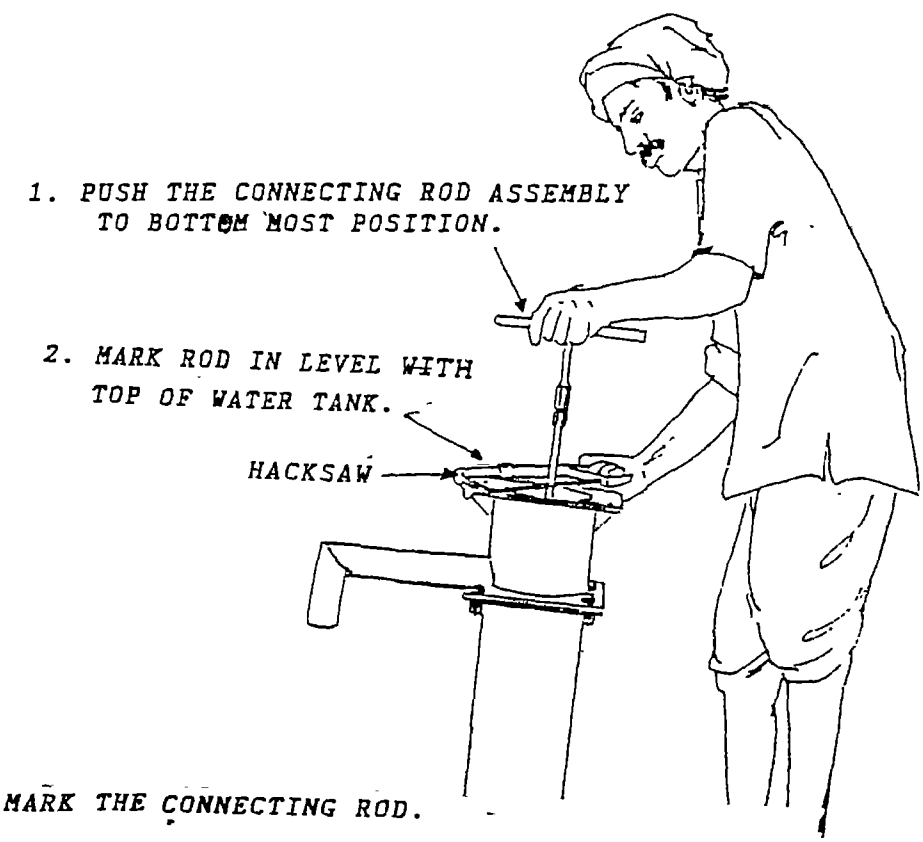


FIG:4.32 MARK THE CONNECTING ROD.

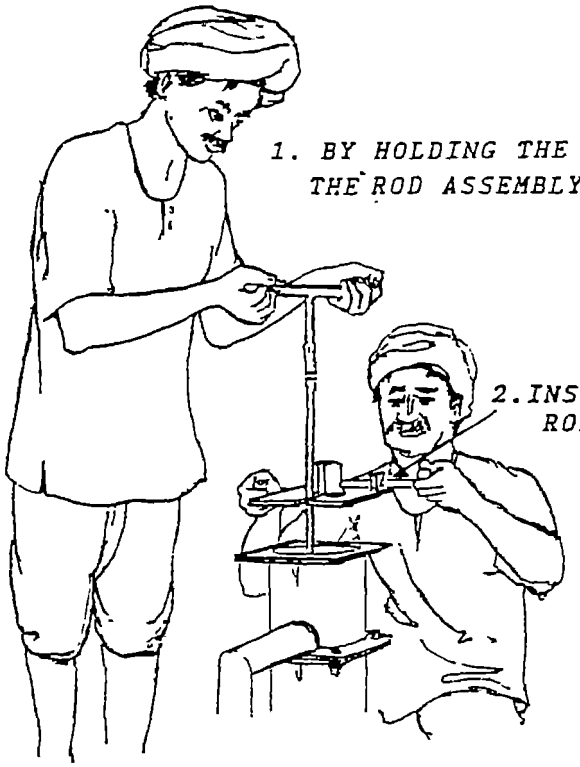


FIG:4.33 TIGHTEN THE CONNECTING ROD

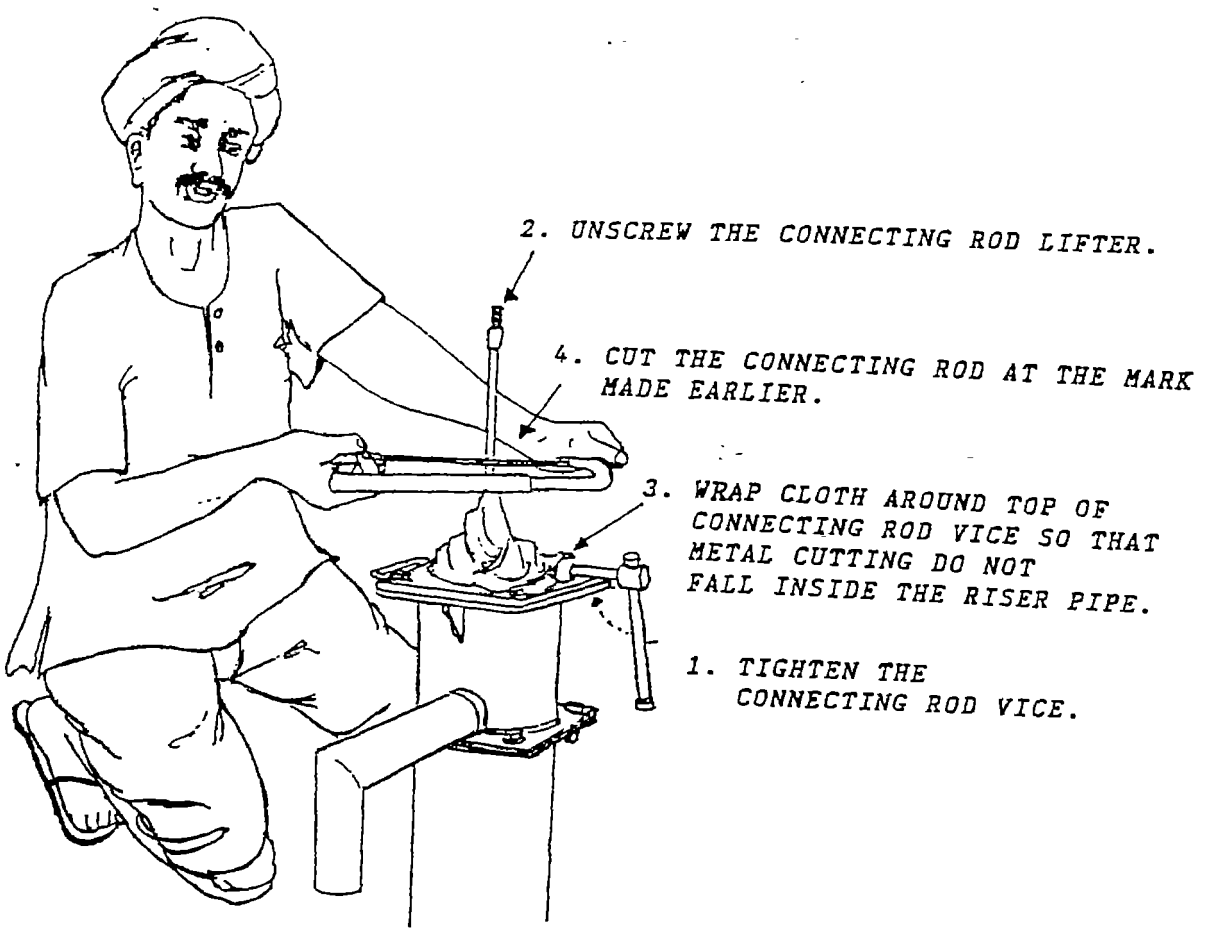


FIG:4.34 CUT THE CONNECTING ROD.

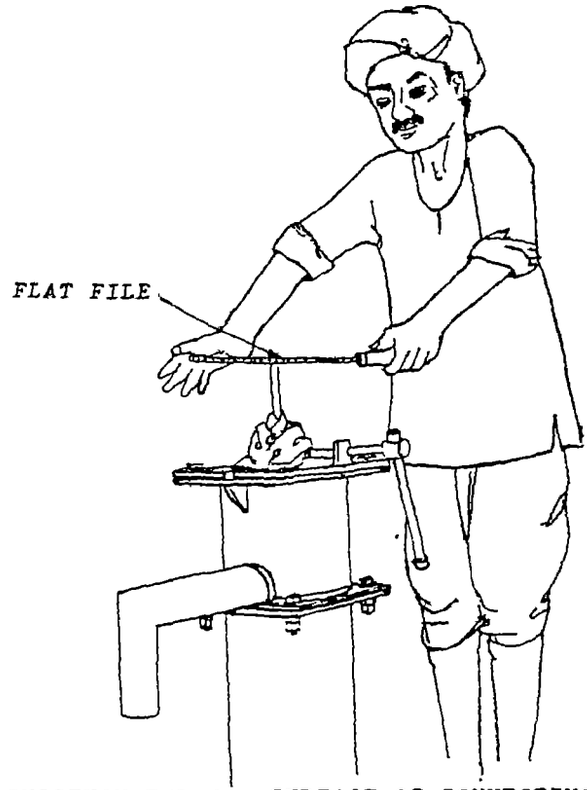


FIG:4.35 SMOOTHEN THE CUT SURFACE OF CONNECTING ROD.

CHECK THE THREADS WITH CHECK NUT. YOU MUST BE ABLE TO SCREW THE NUT ALL THE WAY DOWN BY HAND.

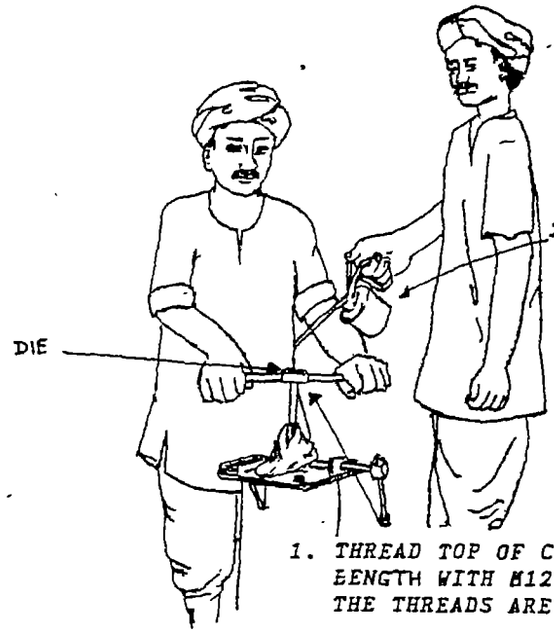


FIG:4.36 MAKE THREADS ON THE TOP MOST END.

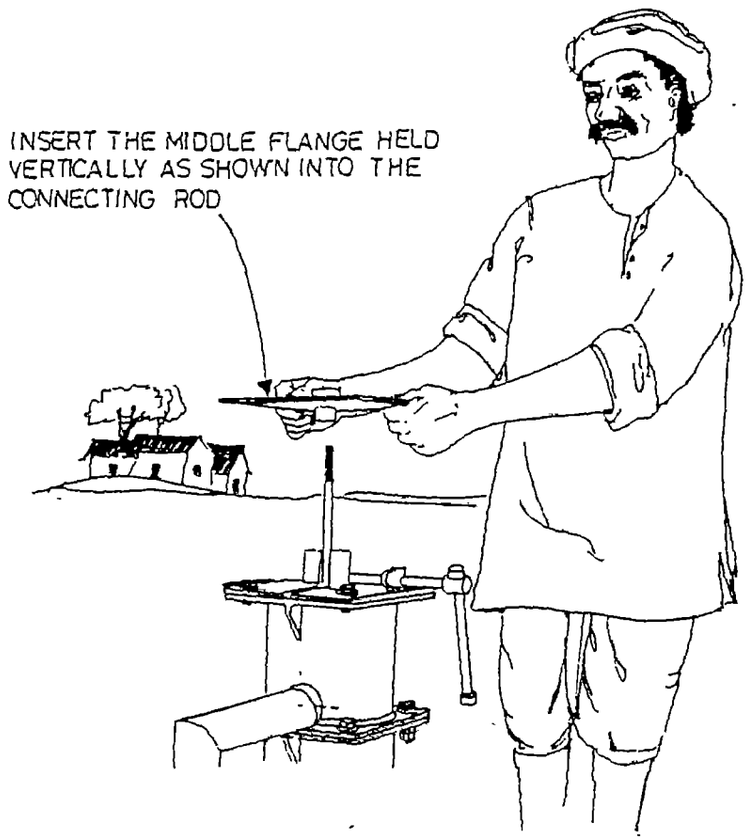


FIG:4.37 FIX MIDDLE FLANGE

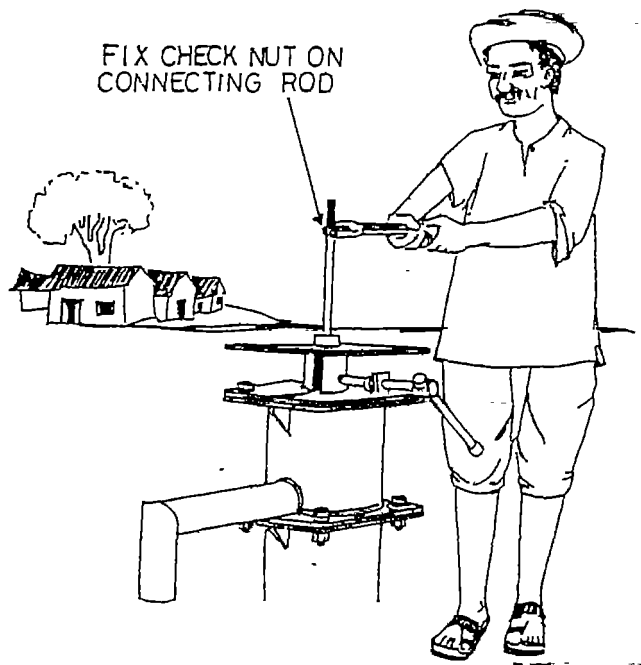


FIG:4.38 TIGHTENING CHECK NUT

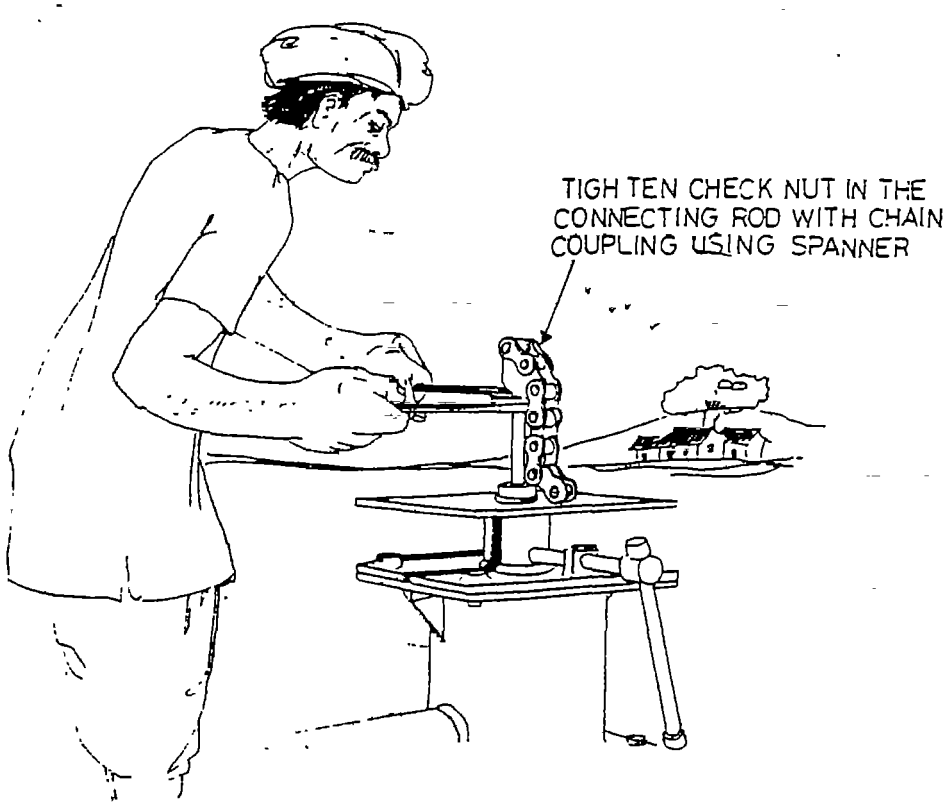


FIG:4.39 FIX CHAIN ON CONNECTING ROD

xviii) Screw chain on to the connecting rod. (Fig. - 4.39)

ix) Place chain coupling supporting tool on middle flange and remove rod vice (Fig.4.40)

xx) Place middle flange and set flanges with water tank, (Fig.4.41)

xxi) Place head assembly over the middle flange and tighten by spanner .(Fig. - 4.42 and 4.43)

xxii) Place handle assembly and insert the handle axle by handle axle punch. (Fig. - 4.44)

xxiii) Lift the handle for fixing chain and tighten chain anchor bolt and nyloc nut fully. (Fig. - 4.45) Remove chain coupler supporting tool by lowering the handle.

xxiv) Lift handle up and apply Graphite grease on the chain, (Fig. - 4.46)

xxv) Lower down handle and fix inspection cover tighten cover bolt fully by crank spanner. (Fig. - 4.47)

TREATMENT: Use transperancy and slide demonstrate assembly of hand pump at site.

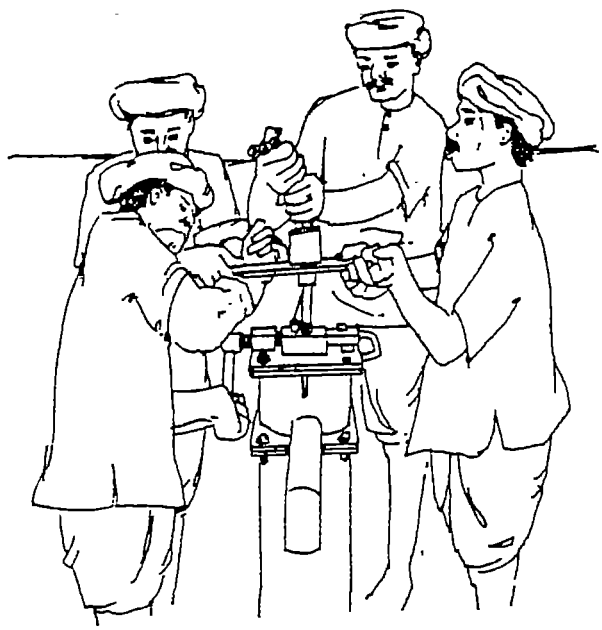


FIG:4.40 FIXING CHAIN SUPPORTING TOOL

FIG:4:41 PUTTING MIDDLE FLANGE OVER WATER TANK

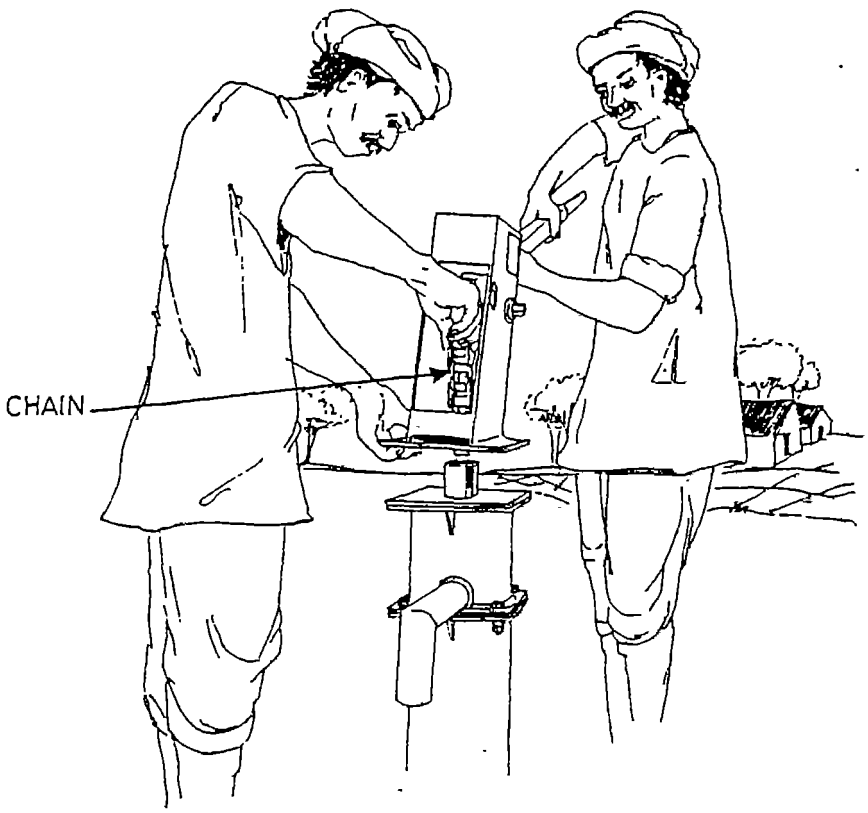


FIG:4.42 FIXING HEAD ASSEMBLY

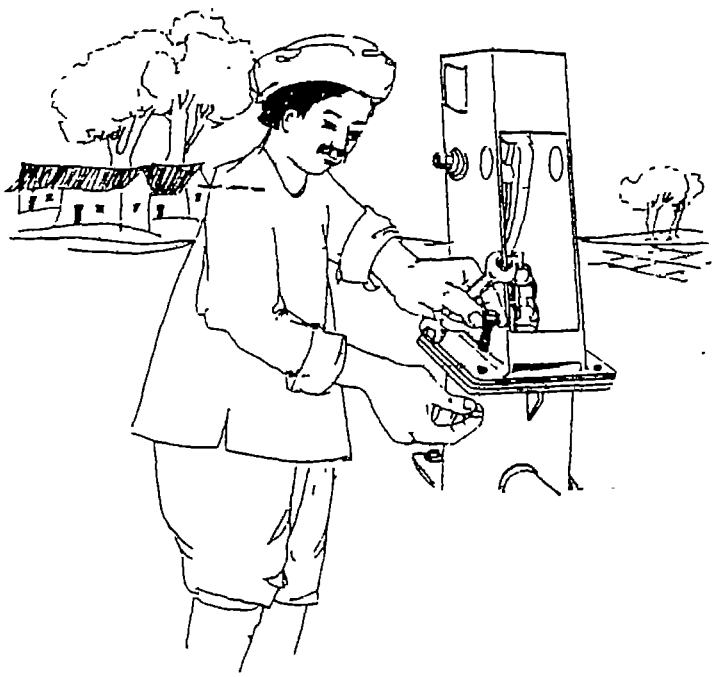


FIG:4.4 3 TIGHTEN HEAD ASSEMBLY

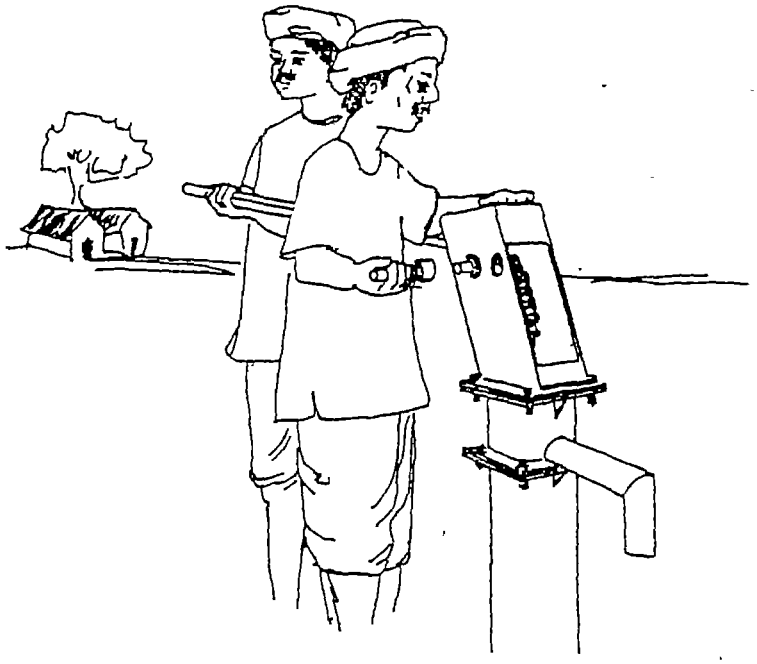


FIG:4.44 FIXING THE HANDLE AXLE

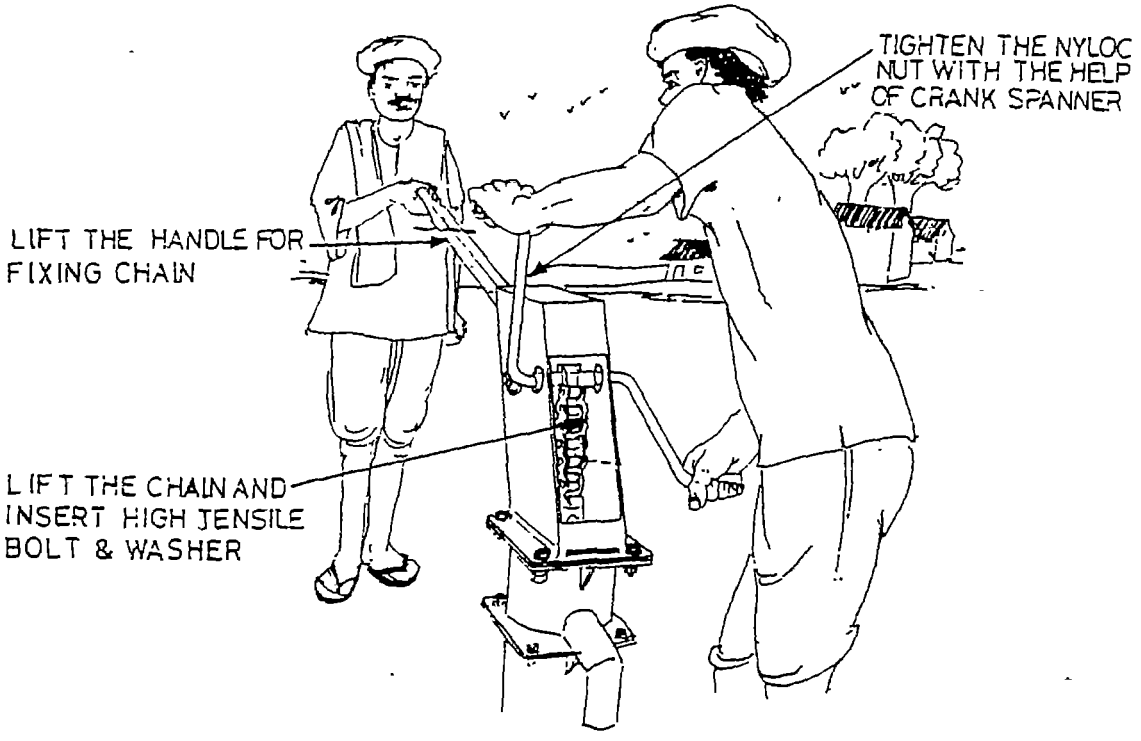


FIG:4.45 LIFT THE HANDLE FOR FIXING CHAIN

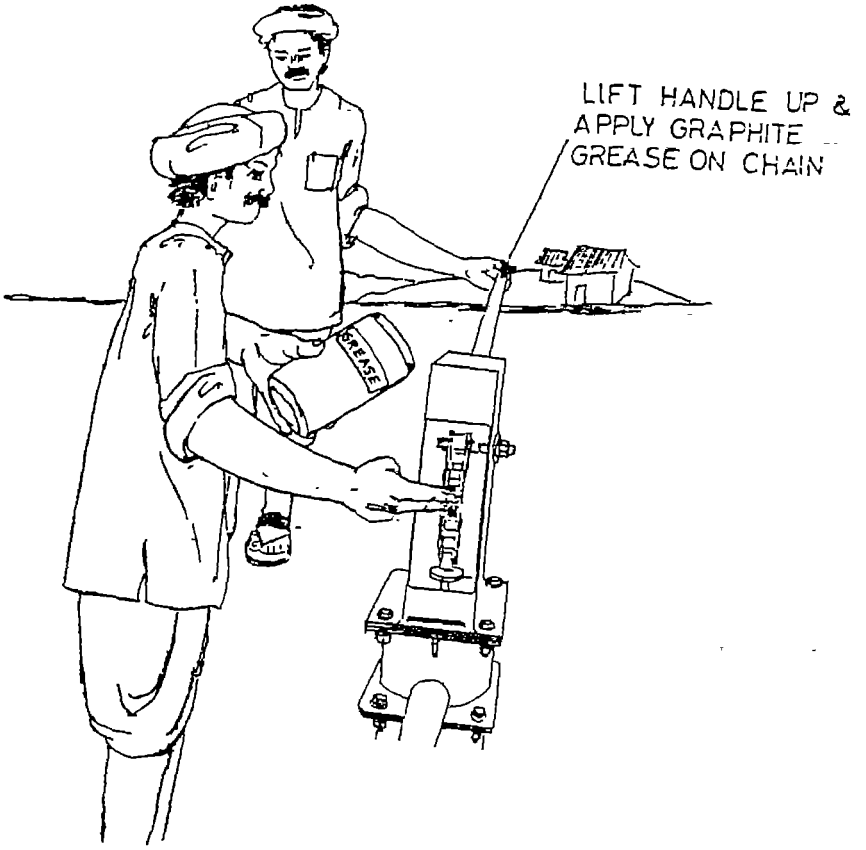


FIG:4.46 GREASING OF CHAIN

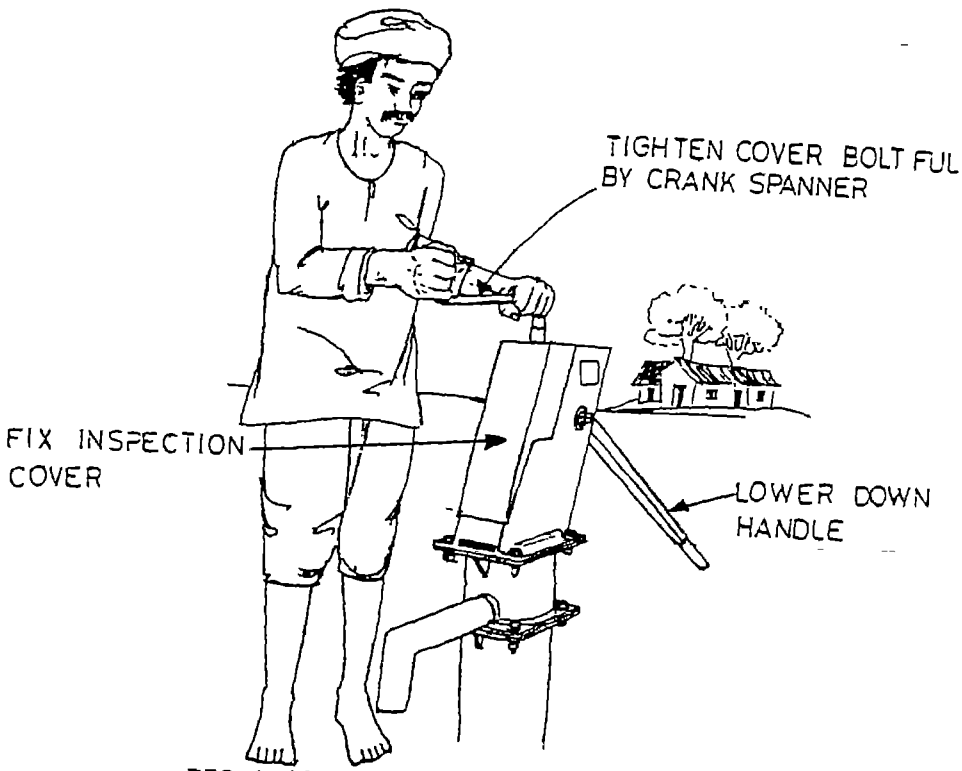


FIG:4.47 FIX INSPECTION COVER

4.5 TROUBLE SHOOTING CHART:

Different people use hand pump differently. Mishandling and continuous use will cause break downs in hand pump. A step-by-step procedure is given to locate the problem. The possible causes along with remedy is given in tabular form:

S.No.	Trouble	Cause	Remedy
1.	Pump/handle shaky	a) Broken flanges	a) Replace the flanges
		b) Loose axle nuts	b) Tighten the axle nuts
		c) Worn out or loose or broken bearings	c) Overhaul the complete or tighten or change bearing.
		d) Worn out axles	d) Replace the axle
		e) Spacer damaged of short in length	e) Replace spacer
2.	No water		
	a) Handle easy to operate	a) Rod is disconnected	a) Join the connecting rod which is disengaged
	b) Handle difficult and heavy to move	b) Pipe disengaged	b) Join the pipes together. If broken or cracked, replace the pipe
	c) Movement of the handle normal	c) i) Cup seals completely worn out	c) i) Overhaul the cylinder
		ii) Valve seats worn out or leather cup worn out	ii) Replace the respective valve assembly
		iii) Water level below cylinder	iii) Add more pipes & rods.

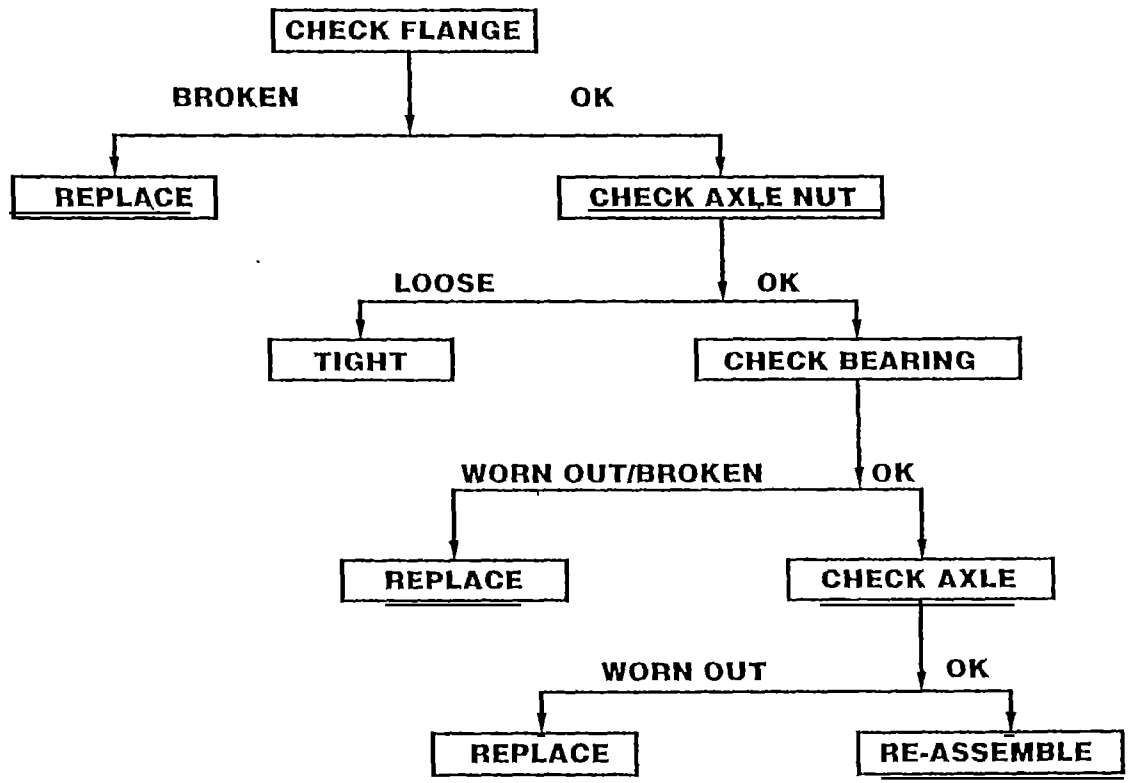
		iv)	Pump cylinder cracked	iv	Fit a new cylinder body
3.	Delayed flow or small flow	a)	Leakage in assembly cylinder bottom check valve or upper valve	a)	Overhaul cylinder. Replace rubber seats
		b)	Leakage in pipe assembly	b)	Replace rising main
		c)	Leather cup washes worn out	c)	Overhead the cylinder replace rubber sheet
4.	Abnormal noise while operating the pump				
	a) Normal Operation	a)	Rod rubbing the guide bush/ pipes on account of pedestal flange not in level	a)	Level the pedestal flange
	b) Inconvenient Operation.	b)	Bent connecting rod	b)	Replace the connecting rod
5.	Folding of Chain during return stroke	a)	Improper erection	a)	Adjust the length of last connecting rod suitably
		b)	Leather cup washers getting jammed inside the cylinder	b)	Overhaul the cylinder and replace leather washer

4.6 COMMON PROBLEMS IN THE HAND PUMP AND THEIR REMEDIES:

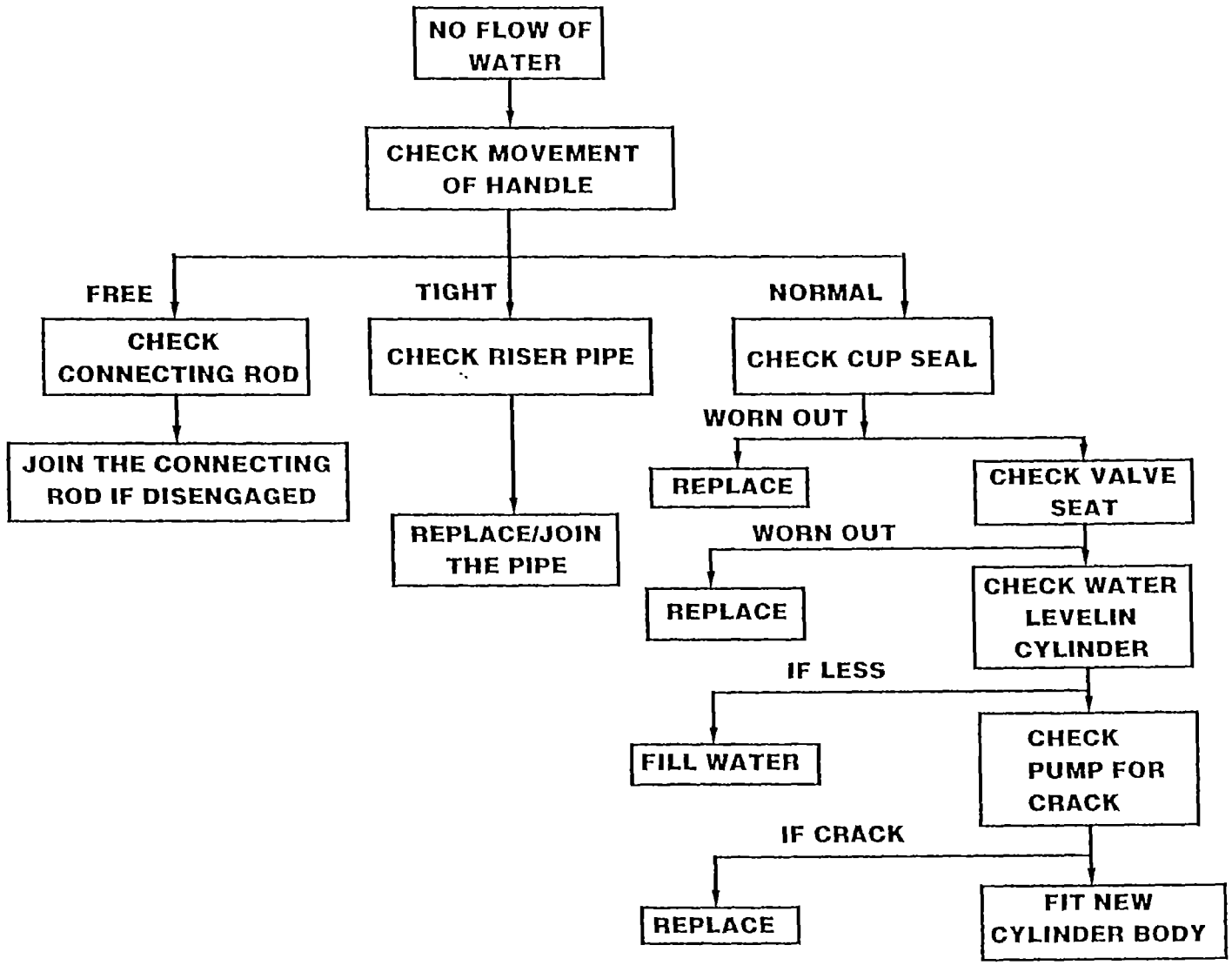
THROUGH FLOW CHARTS:-

HAND PUMP: (TROUBLE SHOOTING)

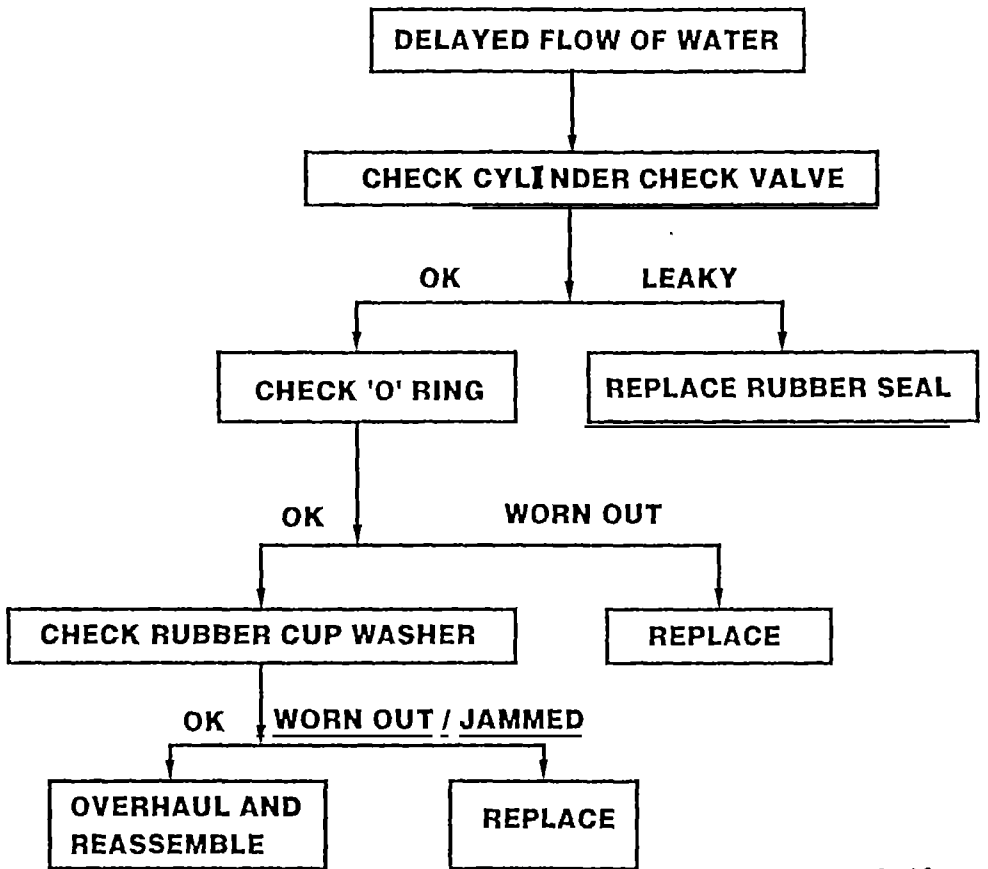
PROBLEM STATMENT NO. 1: HAND PUMP HANDLE SHAKING



PROBLEM STATEMENT NO. 2 : NO FLOW OF WATER THROUGH THE SPOUT PIPE OF HAND PUMP

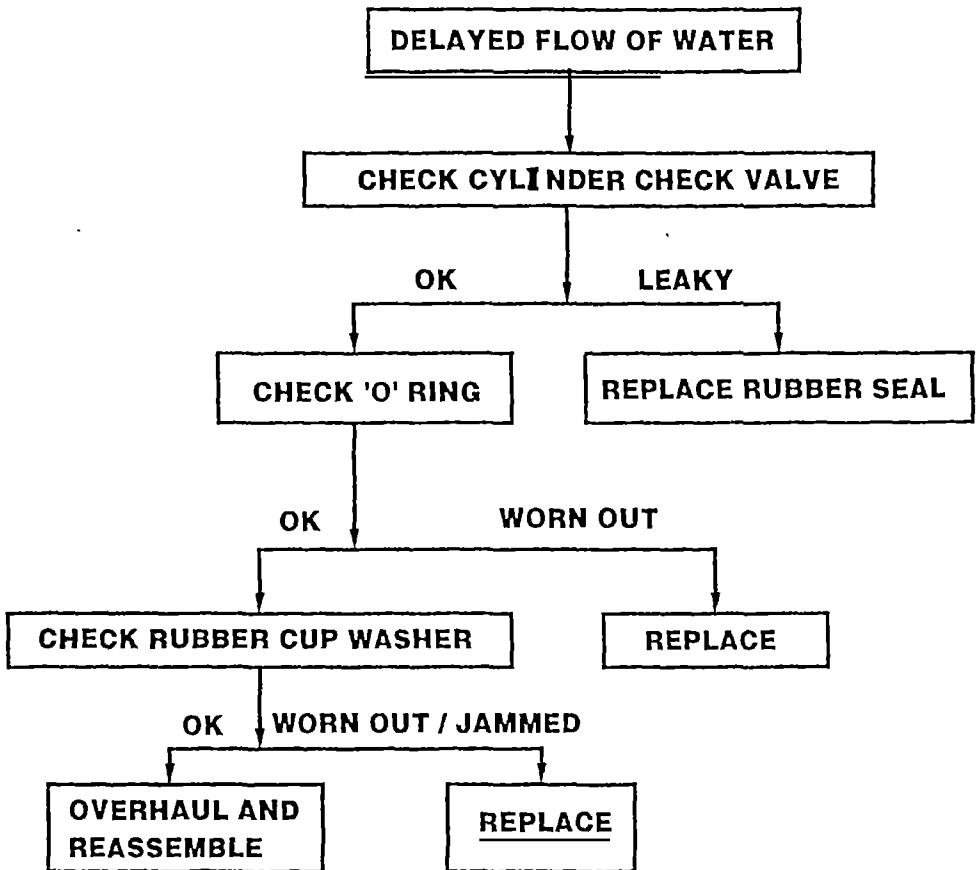


PROBLEM STATEMENT NO.3: DELAYED FLOW OR A LITTLE FLOW OF WATER



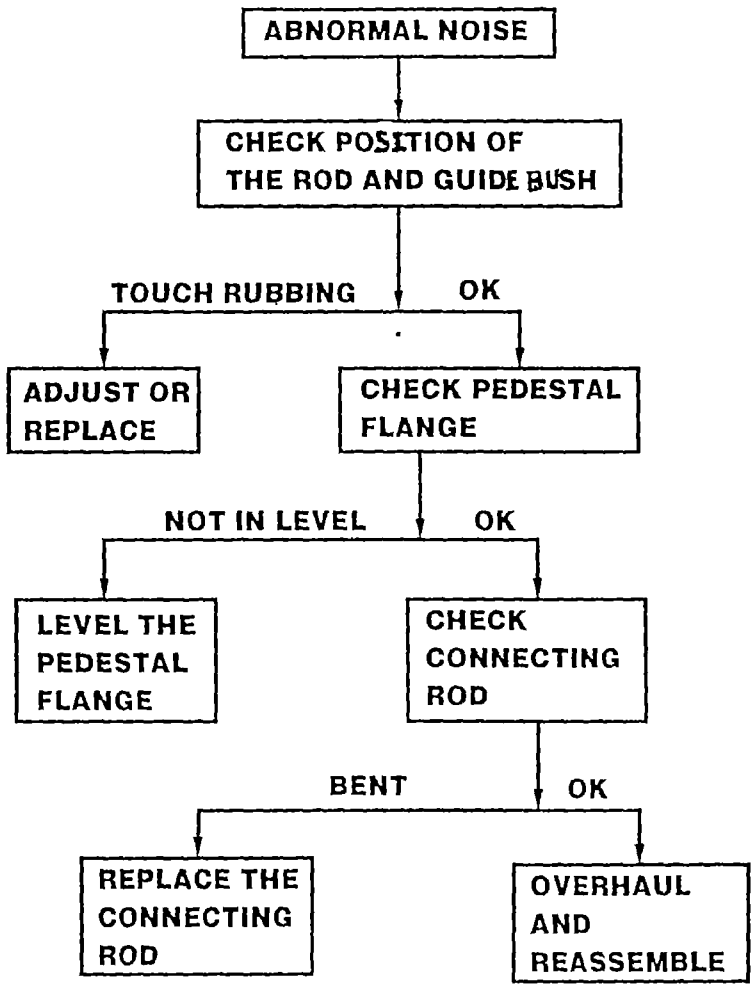
HP. 62

PROBLEM STATEMENT NO.3: DELAYED FLOW OR A LITTLE FLOW OF WATER

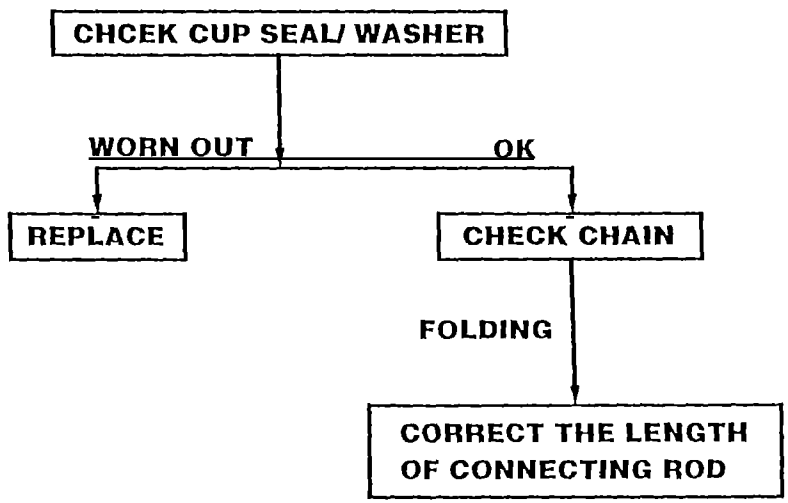


HP. 62

PROBLEM STATEMENT NO.4: ABNORMAL NOISE WHILE OPERATING THE HAND PUMP



PROBLEM STATEMENT NO.5: CHAIN FOLDING DURING RETURN STROKE



4.7 ASSIGNMENTS:-

Q.1. From the given list, select the appropriate checks for weekly maintenance.

(i) Open the front cover, clean inside of the pump.

(ii) Check the handle operation.

(iii) Open out cylinder assembly.

(iv) Check all the nuts and bolts.

(v) Tight handle axle bolt.

(vi) Clean out dust/trash from spout pipe.

(vii) Clean the chain assembly.

(viii) Check the condition of water tank raiser pipe holder.

Ans:

Check No.	Weekly Maintenance

Q.2. If handle is shaky, list the possible causes and give remedial action you would take

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Q.3. If there is no flow of water from hand pump, state the possible causes and their remedial action.

Q.4. State the causes,if you have to pump many times before water comes

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Q.5. Match the appropriate problem statement with cause

Problem statement		Cause
A.	Excessive noise	(i) heavy cylinder check valve.
B.	Delayed flow	(ii) Water level gone down below cylinder assembly.
C.	Shaky handle	(iii) Shaky foundation.
D.	Pump handle works easily, but no flow of water.	(iv) Loose handle in axle nut.

Ans.

Problem statement No.	A	B	C	D
Causes				

4.8 SKILL LEARNING EXPERIENCES:

Each trainee will do the practical excercises under the trainer's supervision in different phases:-

The practice will follow by feed back and practice

i) Trainees practice

ii) Feed back

iii) Follow up practice

The practice - Feed back - practice cycle will be repeated till he acquires requisite competency.

1. Dissassemble hand pump
2. Diagnose fault in hand pump by using trouble shooting charts.
3. Replacement of defective/missing parts.
4. Assembly of hand pump
5. Rectify the following problems in given faulty hand pump.
   - i) Hand pump handle shaking
   - ii) No flow of water
   - iii) Delayed flow or a little flow of water
   - iv) Abnormal noise while operating the hand pump
   - v) Chain folding during return stroke

4.9 FEED BACK

Ans - 1

	Weekly nainte-nanace check
Check Nos	ii, iv, v, vi.

Ans - 2

Possible Causes	Remedies
i) Loose handle axle nut	i) Tighten handle axle nut
ii) Worn out ball bearing	ii) Replace bearing
iii) Boken flanges	iii) Replace flanges
iv) Worn out axle	iv) Replace the axle.

Ans - 3

Possible Causes	Remedies
i) Connecting rod disengaged	i) Join the connecting rod.
ii) Pump cylinder cracked	ii) Replace by new_cylinder body
iii) Cup seal worn out	iii) Replace cup seal
iv) valve seat worn out	iv) Replace valve seat

Ans - 4

Causes

i) Leaky cylinder check valves

ii) Complete stroke not available due to improper erection.

iii) Worn out 'O' rings.

iv) Rubber cup washer worn out.

Ans - 5

Problem statement No.	A	B	C	D
Causes	iii	i	iv	ii

MODULE NO: 5

TITLE: COMPETENCY/SKILL ASESSMENT

COMPETENCY 6:

ASSESS THE PERFORMANCE OF TRAINERS

After going through the experiences of this module, you will be able to:

(i) Prepare check list for testing competencies on repair and maintenance of handpump.

(ii) Assess the performance of the trainees during the given task.

NO. OF PAGES: *99* TO *102*

ONTENT OUTLINE: Competency/Skill Assessment
Rating scale for
Testing competencies

MODULE No.-5

MODULE No: 5

TITLE - SKILL ASSESSMENT

The trainees will be progressively assessed during the training. After completion of training,summative assessment will be done on repair and maintenance of hand pump. The check list for testing competencies on repair and maintenance of hand pump is given below:-

5.1 RATING SCALE FOR TESTING COMPETENCIES ON MAINTENANCE AND REPAIR OF HAND PUMP

S.No.	Competencies	Performance Rating Scale 3	2	1
1.	Check and clean spout pipe.			
2.	Check flange bolts and nuts			
3.	Examine guide bush			
4.	Select tools for disassembly			
5.	Open inspection cover			
6.	Check inside of the pump for trash or dirt.			
7.	Clean chain assembly			
8.	Use chain coupling supporting tool for removing chain			
9.	Select tools for removing the nyloc nut and bolt			
10.	Disconnect chain from handle			

11. Inspect rusty patches in hand pump

12. Clean parts of hand pump before assembly.

13. Diagnose faults in hand pump

14. Select appropriate spare parts of hand pump

15. Select bushes for handle assembly

16. Select bearing for handle assembly

17. Select tools for fixing bearing in handle assembly

18. Check level the pedestal flange

19. Replace defective parts of assembly and components of hand pump

20. Connect plunger assembly to check valve assembly.

21. Connect handle after joining level assembly to water tank.

22. Disassemble all the check valve of and plunger parts.

23. Making thread at the top end of connecting rod.

24. Cutting the connecting rod as per the marking.

25. Tight the chain on connecting rod

26. Fix accurately handle axle

27. Tight check nut on the top of connecting rod

28. Apply proper grease in chain

29. Interprete trouble shooting chart

30. Solve given problem by using trouble shooting chart

Note:- 1. Not performing at all - 1

2. Performing to some extent - 2

3. Performing to a large extent - 3

4. The ranking should be done as below:

S.No.	Rating mark acquired by trainee	Rank
i)	75 - 90	Very Good
ii)	60 - 74	Good
iii)	45 - 59	Satisfactory

5. If ranking is below satisfactory he/she should repeat the training.

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