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SANTALPUR REGIONAL WATER SUPPLY SCHEME, GUJARAT, INDIA

OPERATION & MAINTENANCE

Volume II

OPERATION & MAINTENANCE MANUAL

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HASKONING
Royal Dutch Consulting
Engineers and Architects

Barbarossastraat 35
P. O. Box 151
6500 AD Nijmegen
The Netherlands
Telephone +31 (0)80 284284
Telex 48015 hask nl
Telefax +31 (0)80 239346/242101

TABLE OF CONTENTS **PAGE**

LIST OF ANNEXURES

1. INTRODUCTION

1.1 General

This operation and maintenance manual has been prepared for the Santalpur Rural Water Supply Scheme realized within the framework of a bilateral agreement between the Governments of India and The Netherlands. The need for the manual became evident when the regular Review and Support Missions observed the insufficient maintenance of the water supply system, during several years.

Preceding the preparation of this O&M Manual, the existing operation and maintenance practice has been extensively evaluated. The main findings and recommendations resulting from this evaluation, together with a short description of the water supply scheme have been summarized in a separate volume; Volume I: "Evaluation Existing Operation and Maintenance".

The manual consists of three main parts covering the following aspects:

- Organizational aspects;
- Job descriptions (what to do);
- Task descriptions (how to do it);

The manual has been prepared taking into account the existing operation and maintenance, organizational structure, and already identified line positions. According to these line positions job descriptions have been elaborated. The job descriptions include also tasks which can be executed by supporting staff, for example accounting falls under the responsibility of the (Deputy) Executive Engineers but can be executed by a clerk. The manual proposes certain adjustments of the existing job descriptions, but it mainly focusses on the identification of tasks and the detailed description of various tasks. This identification is considered to be one of the most important aspects, to ensure that all personnel knows what to do, and can be made responsible for achievements and deficiencies. The job descriptions give a summary of the tasks to be performed by the staff while the task descriptions give a step by step approach for the execution of tasks.

A key aspect of maintenance is preventive maintenance (PM), it is worthwhile to define this term and contrast it with corrective maintenance. The report 'Preventive Maintenance of Rural Water Supplies' of the World Health Organization gives the following definition:

> " **Preventive maintenance is considered to be systematized and periodic maintenance procedure applied to the components of a system in order to minimize breakdowns, ensure their efficient working, and prolong their respective lives. Such maintenance is not to be confused with corrective action taken to repair or replace system components after a breakdown occurred, as the latter is not subject of a planned procedure but rather a response to an operational requirement.**"

It has been shown conclusively that it is far less expensive, and far more effective to spend time and money on a regular basis for maintenance activities, rather than to wait until equipment deteriorates and breaks down.

Introducing preventive maintenance is often a difficult process. Where budgets and staff levels are fixed, the staff may be too overloaded to take on these additional tasks. The introduction of PM leads to a reduction in repair work, but only after a period of time and agencies may find it hard 'to get over the hump'. Yet in the long run, the injection of more personnel and material resources so that PM can be started and continued, is the only way to achieve improved water supply service.

1.2 How to use the manual

As mentioned above, the task descriptions give all the possible tasks for a certain position. Individual staff members, however, will not always have the complete set of tasks. Therefore, it is necessary to prepare separated manuals for each individual, limited to the tasks assigned to the person. For this purpose checklists have been drafted in order to prepare the individual manuals.

First the position of a person has to be determined, after which the individual tasks have to be indicated on the appropriate checklist. The checklists refer to certain pages for each task. These pages can then be combined into a complete individual manual. Furthermore, check lists concerning logbooks, spare parts, and tools have been prepared which have to be filled in, also. The checklists and an example of this exercise is given in Annex 1 and 2.

Besides the combining of the individual tasks, certain drawings have to be prepared indicating the part of the system assigned to the person. For example, each Linesman should get a detailed drawing (scale 1:2000) indicating the following elements (as far as applicable):

- Location of pipe lines with reference to fixed points like roads or houses;
- Diameter and material of pipe lines;
- Sluice valve locations, size, and identification number;
- Air valve locations, size, and identification number;
- Scour valve locations, and identification number;
- Domestic and bulk water meter location, size, and identification number;
- Location of village level facilities.

The identification numbers should consist of three parts. The first part indicates the appurtenance, the second part identifies the sub division or section, and the last part gives a serial number. Examples of the first to parts of the identification numbers are given below:

1. Abbreviation of appurtenances;
   * Sluice Valve, SV;

* Air Valve, AV;
* Scour Valve, SCV;
* Domestic Water Meter, DM;
* Bulk Water Meter, BM;

2. Abbreviations sub divisions and sections;
   * Sub division Shihori, SH;
   * Sub division Thara, TH;
   * Sub division Radhanpur, RA;
   * Section Varahi, VA;
   * Section Santalpur, SA;

A Mistry who has several Linesmen as immediate subordinates, needs a set drawing consisting of the drawings of each Linesman. An (Add.) Assistant Engineer who is responsible for a number of Mistries, requires the drawings of each Mistry, and so on. Furthermore, as-built drawings of the complete system have to be prepared, scale 1:10,000, for the Deputy Executive and Executive Engineers for quick reference, indicating the approximate location of sluice valves, bulk water meters, manometers, and villages.

Fig 2.1 missing

2. ORGANIZATIONAL AND ADMINISTRATIVE ASPECTS

2.1 Organization

The relation between the various staff positions is indicated in Figure 2.1. The overall responsibility for the O & M of the water supply system is in the hands of the Executive Engineer. The main tasks of the Executive Engineer are evaluation of the performance of the system, and instructing sub-division offices with regard to tuning of the system. Furthermore, if the weekly evaluation of the performance of the water supply system indicates problems in certain areas the Executive Engineer has to instruct the sub-division offices about the required immediate action. An essential part of the task of the Executive Engineer is to assess the condition in the field. By this way there will be a regular check on the actual condition of the main components of the water supply system and direct instructions can be given to improve the condition.

The Deputy Executive Engineers have more or less the same kind of responsibilities as the Executive Engineer, only restricted to part of the water supply system. Furthermore, they are responsible for the immediate and proper execution of major repairs.

The (Add.) Assistant Engineers are responsible for the proper functioning of the Mistries, Karkoons, and for the Operators. Screening of data collected in the field before reporting to the Deputy Executive Engineer is another main task.

The Mistries or Karkoons (same level of position) are responsible for the proper functioning of Linesman and Operators, and the supervision of the execution of major repairs.

The Linesmen and Operators are responsible for operation, preventive maintenance, execution of minor repairs, assistance with the execution of major repairs, and the collection and reporting of data concerning water meters and manometers.

The Mobile Repair Crew is responsible for the execution of major repairs and replacement of equipment, and of course the maintenance of their equipment and vehicle.

The communities served by the water supply system are involved in the operation and maintenance through Paani Panchayats (village committees) and Branch Line Committees, a committee for several villages. These committees are supposed to keep regular meetings to discuss problems and complaints with regard to the water supply, and to encourage participation of the communities in operation and maintenance of village level facilities.

2.2 Staffing and qualifications

Based on the job descriptions a rough estimate has been elaborated covering the required staff for the execution of the operation and maintenance for this scheme.

Regarding the operation and maintenance in the field it has been assumed that the Operators, Linesmen and the Mistries are for hundred percent assigned for these activities.
Starting from the position of the (Additional) Assistant Engineer and above, the time spend on operation and maintenance will be less then 100%.

The indicated time and staffing in the following have to be reviewed after more experience has been gained by using this manual.

Linesman
In order to executed their job properly two types of Linesmen have to be distinguished. One type of Linesman will be only dealing with the transmission lines on which manometers are installed. Because of the frequent readings (every 3 hours) of the manometer(s) this type of Linesmen can therefore only be responsible for about 15 km of transmission line including some sluice valves and bulk water meter, and should not be responsible for any branch lines or village level facilities. The second type of Linesman can be assigned for the operation and maintenance of facilities in one village and also about 15 km of branch lines including sluice valves, domestic and/or bulk water meters or 10 km and facilities of two villages etc..

The Linesmen should be skilled at a certain level and should have a knowledge of reading and writing. These Linesmen should therefore, be trained by the Jalseva Institute in Ghandinagar by means of a basic literacy course, if required, and training on the manual.

Operator
Since the Operators are assigned for one tube well and working in three shifts of 8 hours there will be enough time available to execute all the tasks mentioned.

In order to execute their tasks the Operator should be a skilled labourer.

Mistry
Mistry can be a supervisor either of Linesmen, Operators or a Mobile Repair Crew. Because of the different tasks of these type of labourers, also a distinction has to be made here. One Mistry who is dealing with the operation and maintenance of the distribution system can cover about four Linesmen. However, one Mistry in charge of the production facilities can cover at least six to eight tube wells. The Mistry should have followed a schooling up to the metric pass and should be skilled as well.

(Additional) Assistant Engineer
If one (Additional) Assistant Engineer is the head of 4 Mistries or Karkoons 60% of the available time will be consumed by the execution of the operation and maintenance. If the (Additional) Assistant Engineer is supervising one Mistry or Karkoon then he will spend only 30% of the available time on operation and maintenance. No distinctions have to be made between the distribution system and the production facilities.

The (Additional) Assistant Engineer should have the minimum qualification of a bachelor of Engineer or a diploma holder with at least 5 years experience.

Deputy Executive Engineer
Based on the job description of the Deputy Executive Engineer it turns out that the main administrative activities will be carried out in the office of the Deputy Executive Engineer. About 50% of the time of the Deputy Executive Engineer should be assigned to the execution of the operation and maintenance. This can only be established if there is enough supporting technical staff available in the sub-division office. Roughly it can be stated that 4 (Additional) Assistant Engineers in the field each covering a certain supply area regarding the operation and maintenance, and two supporting technical staff members are required in the sub-division office.

Furthermore, one or more store keeper(s) are required per sub-division, for the administration of the spare parts and tools.

The qualification of Deputy Executive Engineer are in general sufficiently covered either by Diploma holders with an experience record of 8 years, or by a Bachelor of Engineering with about 3 years experience or by an Engineer with a Masters Degree.

Executive Engineer
The Executive Engineer shall spend at least 40% of his time for the execution of the operation and maintenance.

Because the information transferred to the Executive Engineer is screened in the office of the Deputy Executive Engineer less supporting staff in the office of the Executive Engineer is required. In general it can be stated that 1 or 2 supporting technical staff is required in the office of the Executive Engineer.

Concerning the qualifications the same remarks are applicable as stated with the Deputy Executive Engineer.

Mobile Repair Crew
Each sub-division office or section office is provided with a Mobile Repair Crew. The permanent staff of this crew consists of a driver and 2 or 3 fitters and labourers. For some major repair additional labourers will be required.

2.3 Administration

A key element of Operation and Maintenance is the ability to direct personnel to do planned work at the right times. Planning can only be done if sufficient information concerning the performance of the water supply system, and the repair requirements are available at all times. Therefore, the recording and collecting of data from the field is of relevant importance.

These data concern the readings of water meters and manometers which are essential to monitor the performance of the system, to initiate additional maintenance activities, and to tune the distribution

SPARE PART REQUEST FORM

DATE: _____ NUMBER: _____

NAME LINESMAN/OPERATOR: _____

SIGNATURE (DEP.) EX. ENGINEER: _____

PART NUMBER	QTY	DESCRIPTION	UNIT COST	TOTAL COSTS

FIGURE 2.2 SPARE PART REQUEST FORM

system. These particular data are recorded and collected by means of logbooks, which have to be filled in by Linesman and Operators, and have to be analyzed, daily, by (Additional) Assistant Engineers.

On the other hand, the information relates to the need for spare parts to carry out minor repairs or the execution of major repairs. The spare parts can be obtained by filling in a **Spare Part Request Form** (Figure 2.2) by a Linesman or Operator. After endorsement from the Deputy Executive, the item(s) can be collected from the store. It is of course possible for the Deputy Executive to give this responsibility to an (Add.) Assistant Engineer, which is even likely for the section offices.
The execution of major repairs can be planned by means of a **Work Order System.** Using a system of written work orders allows the Deputy Executive Engineer to direct the staff according to plan and priority. The work orders direct the staff, but are not detailed technical instructions. The detailed technical instructions are given in the manuals. Also this task can be assigned to an (Additional) Assistant Engineer the final responsibility remains with the Deputy Executive Engineer. The work order system is discussed in detail in the following section.

2.4 Work Order System

The main purpose for a work order system is to direct maintenance craftsmen to conduct a particular set of tasks at a fixed time. In other words the work order tells people what to do and when. The work order system is divided in two sub systems, one for the distribution system, and one for equipment like pumps and diesel engines. The only difference between these sub systems is that repairs concerning the distribution system are executed by the Board while repair of equipment is executed by rate contractors (Figure 2.3 and 2.4).

Work orders also serve other important functions related to monitoring, scheduling, record keeping, accounting and reporting. If the execution of a repair is experiencing delays in completion, the outstanding work order will be a signal for the responsible Engineer to investigate. Completed work orders, as they return to the office, let the Deputy Executive know that a task is completed and whether any follow-up work is needed. The completed work order is sent via accounting for tabulating and allocating costs. Futhermore, the file of completed work orders form useful data for analyzing equipment and cost history, and the development of new standards with regard to the time required for the execution of certain repairs and the involved costs.

The work order cycle will start with a work request written by an Operator or Linesman, observing a problem. The work request will be checked by the immediate superior and delivered to the responsible (Additional) Assistant Engineer, as soon as possible. Telephones or wire less, if they are available can help speed the problem notification, but a written work request form should always follow. The **Work Request Forms** (Figure 2.5 and 2.6) are designed to provide all the necessary data for the preparation of a work order.

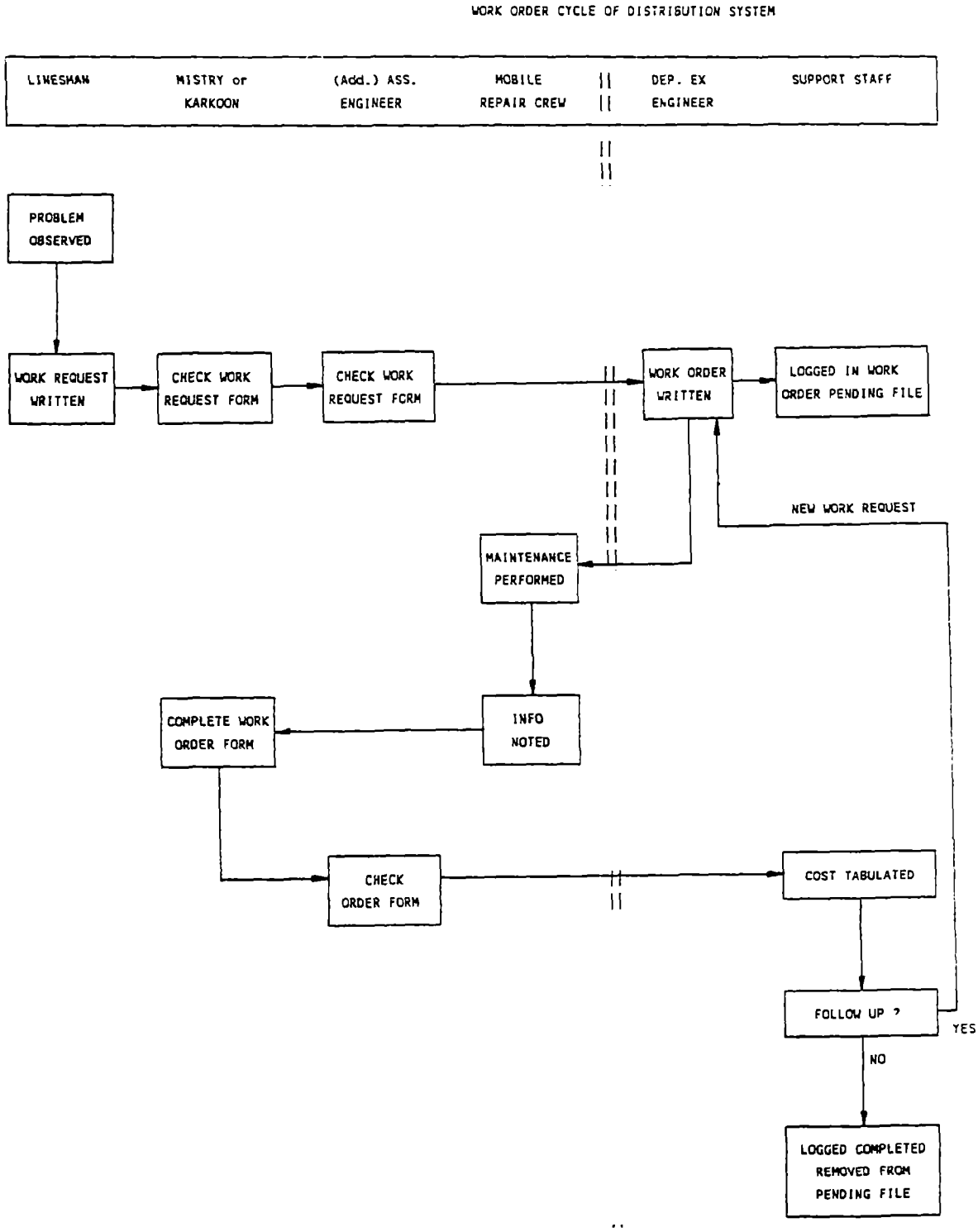


FIGURE 2.3 Work Order Cycle of Distribution System

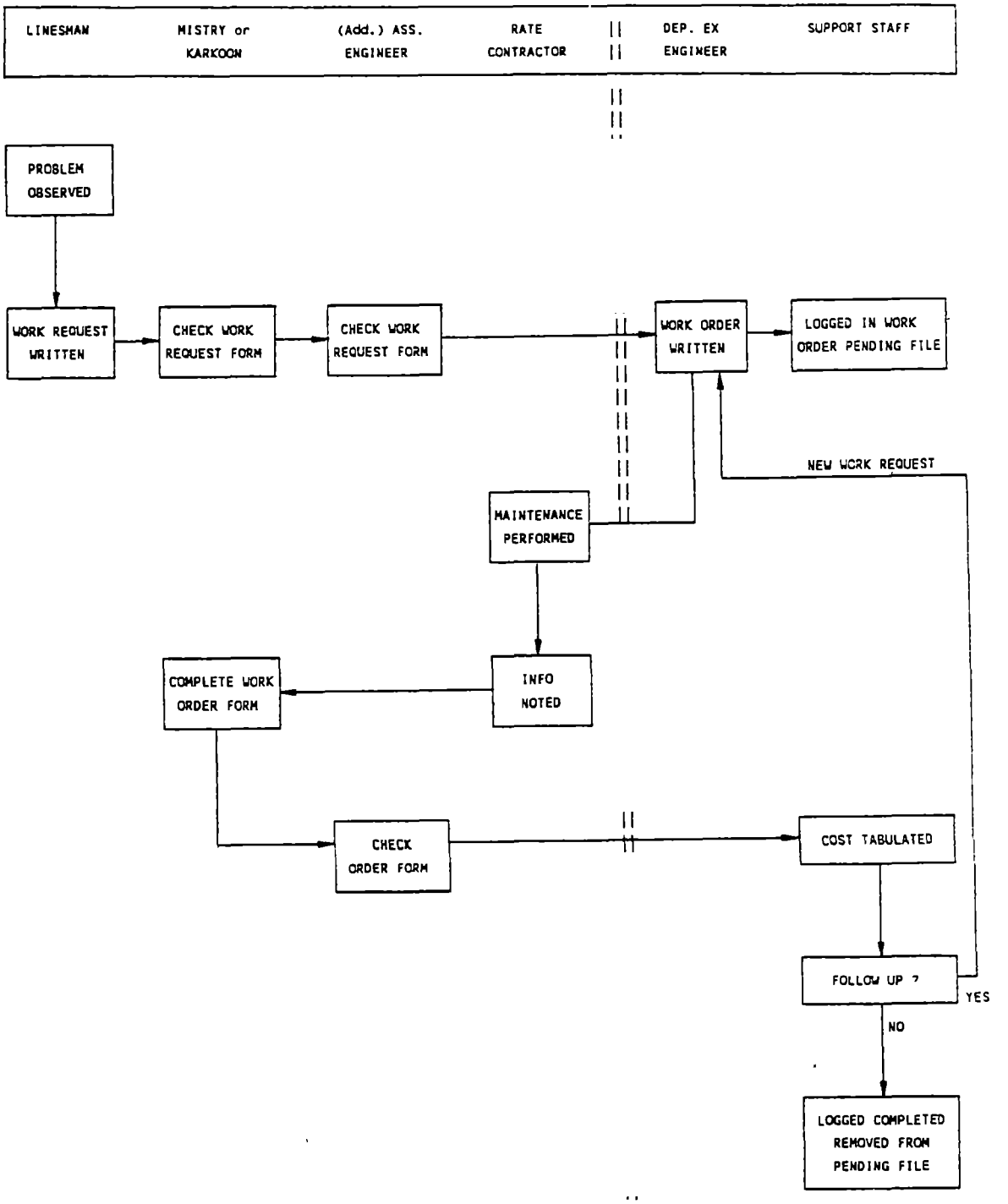


FIGURE 2.4 Work Order Cycle of Equipment

SANTALPUR REGIONAL WATER SUPPLY SCHEME (FRONT SIDE)

WORK REQUEST FORM FOR DISTRIBUTION SYSTEM

NAME LINESMAN: _____ DATE AND TIME: _____

NATURE PROBLEM: _____

_____

IDENTIFICATION NUMBER (if any): _____

EXACT LOCATION: _____

CAUSE OF PROBLEM: _____

_____

NAME MISTRY or KARKOON: _____ SIGNATURE: _____

SANTALPUR REGIONAL WATER SUPPLY SCHEME (BACK SIDE)

WORK REQUEST FORM FOR DISTRIBUTION SYSTEM

SPECIFICATIONS: (Diametre, material etc.)

_____

_____

_____

_____

_____

_____

_____

_____

FIGURE 2.5 Work Request Form for Distribution System

SANTALPUR REGIONAL WATER SUPPLY SCHEME (FRONT SIDE)

WORK REQUEST FORM FOR EQUIPMENT

NAME OPERATOR: _____ DATE AND TIME: _____

NATURE PROBLEM: _____

_____

IDENTIFICATION NUMBER: _____ SERIAL NUMBER: _____

MANUFACTURER: _____

CAUSE OF PROBLEM: _____

_____

NAME (ADD.) ASS. ENGINEER: _____ SIGNATURE: _____

SANTALPUR REGIONAL WATER SUPPLY SCHEME (BACK SIDE)

WORK REQUEST FORM FOR EQUIPMENT

SPECIFICATIONS: (material material numbers)

_____

_____

_____

_____

_____

_____

_____

FIGURE 2.6 Work Request Form for Equipment

SANTALPUR REGIONAL WATER SUPPLY SCHEME WORK ORDER FORM (FRONT SIDE)

WORK ORDER NUMBER:_____ DIVISION/SECTION: _____

DATE: _____ ORIGINATOR: _____ PRIORITY:_____

TO BE EXECUTED BY: CONTRACTOR/MOBILE REPAIR CREW NAME CONTRACTOR: _____

SUPERVISION BY: (ADD) ASS ENGINEER/MISTRY/KARKOON NAME SUPERVISOR: _____

IDENTIFICATION NUMBER: _____ SERIAL NUMBER: _____

MANUFACTURER: _____

EXACT LOCATION: _____

NATURE OF WORK: _____

_____

_____

TARGET COMPLETION DATE AND TIME: _____

WORK PERFORMED: _____

_____

_____

MATERIALS USED: _____

_____

_____

_____

LABOR USED: _____

_____

_____

COMPLETION DATE AND TIME: _____ FOLLOW UP: YES/NO

SIGNATURE SUPERVISOR:_____

FIGURE 2.7A Work Order Form (Front Side)

SANTALPUR REGIONAL WATER SUPPLY SCHEME WORK ORDER FORM

(BACK SIDE)

LABOR USE			MATERIAL USE		VEHICLE/ EQUIP. USE			OTHER COSTS
PERSON	HRS	COST	ITEM	COST	ITEM	KM	COST	
SUB TOTALS								

TOTAL COSTS: RS. _____

FIGURE 2.7B Work Order Form (Back Side)

Once the need for repair work has been established the Deputy Executive will write the **Work Order** (Figure 2.7A and 2.7B). The work order should be prepared in duplicate using carbon paper. Then the work order has to be entered into the formal **Work Order Logbook** (Figure 2.8), file one copy in the **Pending Work Order File**, and send the other copy to the rate contractor or the supervisor who has to instruct the mobile repair crew.

The Engineer preparing the work order must decide the priority of the work, this can be done by assigning a number from a system such as the following:

1 Emergency--Immediately;
2 Important;
3 Routine;
4 During slack periods only.

The priority will depend on the nature of the work and its urgency relative to ongoing work. The work order logbook, which indicates previous and current activities, will be useful to assign these priorities.

Once the work order has been issued the supervisor or contractor should first consult the equipment history file, distribution maps, or other records on the hardware to be repaired. Thereafter, the Mobile Repair Crew has to collect the necessary tools, equipment, spare parts and materials from the store or other sources. The repair crew will also have to complete a **Requisition Form** (Figure 2.9) to obtain these items from the store. A copy of the form should be attached to the work order, outlining the items and the associated costs. As soon as the work is finished the supervisor should complete the work order form by describing the work done, labour and material used, and the need for follow-up. Any unused supplies or spare parts should be returned to the store and a **Spare Part Credit Form** (Figure 2.10) should be attached to the work order.

Whenever all the work and data recording are completed, the supervisor should return the work order to the sub-division office. There the support staff should immediately review the form and total up the costs, and update the work order logbook. Next the work order should be removed from the pending work order file and if necessary, a new work request should be written if follow-up is required.

WORK ORDER LOGBOOK

SUB-DIVISION/SECTION OFFICE: _____

WORK ORDER No	DATE WRITTEN	SUPERVISOR	WORK LOCATION	WORK DESCRIPTION	PRIORITY	COMPLETION DATE	TOTAL COSTS

FIGURE 2.8
WORK ORDER LOGBOOK

REQUISITION FORM

DATE: _____ NUMBER: _____

RECIEVED BY: _____ WORK ORDER NUMBER: _____

PART NUMBER	QTY	DESCRIPTION	UNIT COST	TOTAL COSTS

SIGNATURE (DEP.) EX. ENGINEER: _____

FIGURE 2.9
REQUISITION FORM

SPARE PART CREDIT FORM

DATE: _____ NUMBER: _____

DELIVERED BY: _____ WORK ORDER NUMBER: _____

PART NUMBER	QTY	DESCRIPTION	UNIT COST	TOTAL COSTS

SIGNATURE STORE KEEPER: _____

FIGURE 2.10 SPARE PART CREDIT FORM

3. JOB DESCRIPTIONS

JOB DESCRIPTION EXECUTIVE ENGINEER

REPORTS TO: SUPER INTENDING ENGINEER

IMMEDIATE SUBORDINATES: DEPUTY EXECUTIVE ENGINEERS

DUTIES AND RESPONSIBILITIES:		FREQUENCY
1.	Collecting data from sub-division offices;	Weekly
2.	Evaluation performance water supply system;	Weekly
3.	Tuning of the water supply system;	Weekly
4.	Check repair requirements water meters;	Weekly
5.	Coordinating spare part and equipment purchase;	Weekly
6.	Instruction of sub-division offices;	Whenever required
7.	Assessment condition in the field;	Monthly
8.	Monitoring water quality in the distribution system;	Monthly
9.	Preparation status report and submit it to Super Intending Engineer;	Quarterly
10.	Prepare operation and maintenance budget for coming year, based on experience of previous year;	Yearly
11.	Prepare and establish rate contracts for repair of pumps, diesel generating sets, and water meters.	Yearly

JOB DESCRIPTION DEPUTY EXECUTIVE ENGINEER

REPORTS TO: EXECUTIVE ENGINEER

IMMEDIATE SUBORDINATES: (ADD.) ASSISTANT ENGINEER

	DUTIES AND RESPONSIBILITIES:	FREQUENCY
1.	Collecting data from (Add.) Assistant Engineer, and/ or Mistry;	Daily
2.	Monitoring of sub-divisional distribution system;	Daily
3.	Monitoring tube wells:	
3A	Production quantity;	Daily
3B	Water quality;	Monthly
4.	Reporting to Executive Engineer:	
4A	Data Analysis Report Distribution;	Weekly
4B	Data Analysis Report Production;	Weekly
4C	Stock Form	Weekly
4D	Status Report Distribution;	Monthly
4E	Status Report Production;	Monthly
5.	Monitoring spare parts, consumption articles, and equipment stock;	Whenever required
6.	Planning major repairs of equipment:	Whenever required
6A	Diesel generating set;	
6B	Pump;	
6C	Water meter;	
7.	Planning major repairs of distribution system	Whenever required
8.	Instruct staff on tuning sub-divisional distribution system (based on Task DEE-2);	Whenever required
9.	Instruct staff on operation of tube wells (based on Task DEE-3A and DEE-3B);	Whenever required
10.	Assessment conditions in the field:	
10A	Sub-divisional distribution system;	Monthly
10B	Production facilities;	Monthly
11.	Monitoring water quality in distribution system (residual chlorine, bacteriological);	Monthly
12.	Attend meetings of BLC's;	Once per two months

JOB DESCRIPTION (ADDITIONAL) ASSISTANT ENGINEER

REPORTS TO: DEPUTY EXECUTIVE ENGINEER

IMMEDIATE SUBORDINATES: MISTRIES AND/OR KARKOONS

DUTIES AND RESPONSIBILITIES:		FREQUENCY
1.	Collecting data from Mistries and/or Karkoons;	Daily
2.	Screening data distribution water meters;	Daily
3.	Screening data tube well water meters;	Daily
4.	Screening data manometers;	Daily
5.	Meetings with the Mistries and/or Karkoons to plan and coordinate daily activities with regard to the execution of major repairs, and operation and tuning of the water supply system;	Daily
6.	Check functioning and condition chlorinator (see Task OP-10), and instruct the operator, if necessary;	Daily
7.	Assessment condition in the field:	Weekly
7A	Distribution system;	
7B	Production facilities or booster stations;	
8.	Water sampling from the source;	Monthly
9.	Residual chlorine test;	Monthly
10.	Bacteriological water sampling;	Monthly
11.	Check and pass on spare part and work request forms to Deputy Executive Engineer;	Whenever required
12.	Collect and pass on approved spare part request forms to respective Mistry or Karkoon;	Whenever required
13.	Supervision water table and draw down test (see Task OP-7), and report to Dep. Ex. Engineer;	Monthly
14.	Manage and check execution of major repairs:	Whenever
14A	Distribution system;	required
14B	Diesel engines;	
15.	Report to Deputy Executive Engineer;	
15A	Data Analysis Report Distribution Water Meters;	Daily
15B	Data Analysis Report Tube Well Bulk Water Meters;	Daily
15C	Data Analysis Report Manometers;	Daily
15D	Status Report Distribution;	Weekly
15E	Status Report Tube Wells;	Weekly
15F	Status Report Booster Station;	Weekly
16.	Attend meetings of the BLC's.	Once per

JOB DESCRIPTION MISTRY

REPORTS TO: (ADD.) ASSISTANT ENGINEER

IMMEDIATE SUBORDINATES: LINESMAN/OPERATOR

DUTIES AND RESPONSIBILITIES:		FREQUENCY
1.	Collection of data from Linesmen:	Daily
1A	Bulk/domestic water meters;	
1B	Manometers;	
2.	Collection of data from Operator;	Daily
3.	Report (Additional) Assistant Engineer;	
3A	Logbook manometer;	Daily
3B	Logbook summary tube well bulk water meter;	Daily
3C	Logbook summary distribution data;	Daily
3D	Logbook tube well bulk water meter;	Weekly
4.	Attend Meetings with (Add.) Assistant Engineer;	Daily
5.	Assess condition of the distribution system in the field;	Weekly
6.	Check condition of pump house, generator room, pump, and diesel generating set;	Weekly
7.	Supervision of Mobile Repair Crew, recruit labourers, complete work order, and return work order to (Add.) Assistant Engineer;	Whenever required
8.	Instruct Linesmen about tuning of sluice valves;	Whenever required
9.	Instruct Operators about operation of the pumps;	Whenever required
10.	Inform Paani Panchayat about special circumstances that disrupt the supply of drinking water (execution major repairs, special maintenance, etc.);	Whenever required
11.	Check and submit request forms to (Add.) Assistant Engineer:	Whenever required
11A	Spare part request form;	
11B	Work request form;	

JOB DESCRIPTION LINESMAN

REPORTS TO: MISTRY, KARKOON or (ADD.) ASSISTANT ENGINEER

IMMEDIATE SUBORDINATES: -

DUTIES AND RESPONSIBILITIES:		FREQUENCY
1.	Visual inspection;	Thrice per week
2.	Reporting on repair and spare parts requirements to Mistry/Karkoon or (Add.) Ass. Engineer by filling in and submitting work or spare part request forms;	Whenever required
3.	Execution minor repairs of village level facilities;	Whenever required
4.	Execution minor repairs of pipe lines:	Whenever required
4A	Small hole in PVC pipe;	
4B	Leaking Gibault coupling;	
5.	Checking valves:	Quarterly
5A	Sluice valves;	
5B	Air valves;	
6.	Cleaning of stand posts and cattle troughs;	Weekly
7.	Cleaning of cistern;	Quarterly
8.	Reading, recording, and maintaining water meters:	Daily
8A	Bulk water meters;	
8B	Domestic water meters;	
9.	Reading and recording manometer;	Every three hours
10.	Report data to Mistry, Karkoon or (Add.) Assistant Engineer:	
10A	Logbook for manometer;	Daily
10B	Logbook for domestic water meter;	Daily
10C	Logbook for bulk water meter;	Daily
11.	Operate sluice valve before cistern (this will not be required after the system has been tuned);	Whenever required
12.	Assist Mobile Repair Crew with execution of major repairs;	Whenever required
13.	Report to Mistry, Karkoon or (Add.) Ass. Engineer in case of emergency;	Whenever required
14.	Attend meetings of Paani Panchayats;	Monthly
15.	Attend meetings of BLC;	Once per

JOB DESCRIPTION OPERATOR

REPORTS TO: MISTRY OR KARKOON

IMMEDIATE SUBORDINATES: NONE

	DUTIES AND RESPONSIBILITIES:	FREQUENCY
1.	Operation of pump;	Daily
2.	Reporting on spare part and repair requirements to Mistry or Karkoon by filling in and submitting spare part and work request forms;	Whenever required
3.	Maintaining diesel generating set:	
3A	Run diesel engine and check functioning;	Daily
3B	Check belt;	Monthly
3C	Clean air cleaner;	Every 50 hrs(1)
3D	Clean oil filter;	Every 200 hrs(2)
3E	Clean fuel filter and tank;	Every 200 hrs(2)
3F	Change oil;	Every 400 hrs(3)
3G	Check oil level in fuel injection pump;	Every 400 hrs(4)
4.	Operate diesel generating set;	Whenever required
5.	Reading, recording, and checking bulk water meter;	Daily
6.	Report the amount of water produced to the Mistry or Karkoon (and weekly submit the completed logbook for tube well bulk water meters);	Daily
7.	Execute water table and draw down test;	Monthly
8.	Cleaning pump house and generator room ;	Daily
9.	Check valves;	Monthly
10.	Operation and maintenance chlorinator;	Daily

(1) Every 50 working hours but at least once per month.
(2) Every 200 working hours but at least quarterly.
(3) Every 200 working hours but at least once per year.
(4) Every 400 working hours but at least once per year.

JOB DESCRIPTION MOBILE REPAIR CREW

REPORTS TO: MISTRY OR KARKOON

IMMEDIATE SUBORDINATES: NONE

DUTIES AND RESPONSIBILITIES:		FREQUENCY
1.	Repair of PVC pipe line:	Whenever required
1A	Repair PVC pipe with repair socket;	
1B	Repair PVC pipe with repair collar;	
2.	Repair of AC pipe line:	Whenever required
3.	Repair of single air valve:	Whenever required
3A	Change ball;	
3B	Change gasket;	
4.	Repair of double air valve:	Whenever required
4A	Change ball(s) of double air valve;	
4B	Change gasket(s) in double air valve;	
4C	Change gasket of connection of double air valve;	
5.	Replacements of valves:	Whenever required
5A	Replacement single air valve;	
5B	Replacement double air valve;	
5C	Replacement sluice valve;	
5D	Replacement non-return valve;	
6.	Replacements of water meters:	Whenever required
6A	Replacements of bulk water meter;	
6B	Replacements of domestic water meter;	
7.	Replacements of manometer;	Whenever required
8.	Replacement of pump;	Whenever required
9.	Collection of spare parts for major repairs from the proper store;	Whenever required
10.	Collection of spare parts for minor repairs if they are not in store at the subdivision or section offices, then they have to be collected from another store of the division. After collection hand them over to the Mistry or Karkoon concerned;	Whenever required
11.	Maintenance vehicle (refer to operation and maintenance manual).	Whenever required

JOB DESCRIPTION PAANI PANCHAYAT

REPORTS TO: BRANCH LINE COMMITTEE

IMMEDIATE SUBORDINATES: -

DUTIES AND RESPONSIBILITIES:		FREQUENCY
1.	Arrange and conduct meetings with the Linesman, the two female and male members, and the Sarpanch;	Monthly
2.	Presenting passed resolutions to the Branch Line Committee, through the Sarpanch;	Once per two months
3.	Create awareness among the village population concerning health and sanitation aspects in order to maintain village level facilities by providing labour input and/or basic materials;	Frequently
4.	Highlight the problems and suggest solutions with regard to supply hours and duration of supply hours for the population and cattle;	Whenever required
5.	Take steps to avoid wastage and misuse of water, and to stimulate re-use of spillage water;	Whenever required
6.	Inform the population with regard to all aspects related to water supply;	Frequently
7.	Assist the PANCHAYAT with issues related to water supply and sanitation;	Whenever required

ANNEX 1. CHECKLISTS

CHECKLIST FOR DEPUTY EXECUTIVE ENGINEER, SUBDIVISION: .....

NAME: .....

NO	TASK NAME	PAGE NUMBERS FROM	TO	APPICABLE YES/NO	FREQUENCY
1.	Collecting data from (Add.) Assistant Engineer and/or Mistry			YES/NO	DAILY
2.	Monitoring of sub-divisional distribution system	DEE- 1	DEE-2	YES/NO	DAILY
3.	Monitoring tube wells:				
3A	Production quantity;	DEE- 3		YES/NO	DAILY
3B	Water quality;	DEE- 4		YES/NO	MONTHLY
4.	Reporting to Executive Engineer:				
4A	Data Analysis Report Distribution;			YES/NO	WEEKLY
4B	Data Analysis Report Production;			YES/NO	WEEKLY
4C	Status Report Distribution;			YES/NO	MONTHLY
4D	Status Report Production;			YES/NO	MONTHLY
5.	Monitoring spare parts, consumption articles, and equipment stock	DEE- 5	DEE-6	YES/NO	WHENEVER REQUIRED
6.	Planning major repairs of equipment:				WHENEVER
6A	Diesel generating set;	DEE- 7	DEE-8	YES/NO	REQUIRED
6B	Pump;	DEE- 7	DEE-8	YES/NO	
6C	Water meter.	DEE- 7	DEE-8	YES/NO	
7.	Planning major repairs of distribution system	DEE- 9		YES/NO	WHENEVER REQUIRED
8.	Instruct staff on tuning sub-divisional distribution system (based on Task DEE-2)			YES/NO	WHENEVER REQUIRED
9.	Instruct staff on operation of tube wells (based on Task DEE-3A and DEE-3B)			YES/NO	WHENEVER REQUIRED
10.	Assessment conditions in the field:				
10A	Sub-divisional distribution system;	DEE-10		YES/NO	MONTHLY
10B	Production facilities.	DEE-11		YES/NO	MONTHLY
11.	Monitoring water quality in distribution system	DEE-12		YES/NO	MONTHLY
12.	Attend meeting BLC's			YES/NO	ONCE PER TWO MONTHS

CHECKLIST FOR (ADD.) ASSISTANT ENGINEER, SUBDIVISION: ..... SECTOR: .....
NAME: .....

NO	TASK NAME	PAGE NUMBERS FROM	TO	APPICABLE YES/NO	FREQUENCY
1.	Collecting data from Mistries and/or Karkoons			YES/NO	DAILY
2.	Sreening data distribution water meters	ASE- 1		YES/NO	DAILY
3.	Sreening data tube well water meters	ASE- 2		YES/NO	DAILY
4.	Sreening data manometers	ASE- 3		YES/NO	DAILY
5.	Meetings with the Mistries and/or Karkoons to plan and coordinate daily activities with regard to the execurtion of major repairs, and operation and and tuning of the water supply system			YES/NO	DAILY
6.	Check functioning and condition chlorinator (see Task OP-10) and instruct operator, if necessary			YES/NO	DAILY
7.	Assessment condition in the field:				
7A	Distribution system;	ASE- 4		YES/NO	WEEKLY
7B	Production facilities or booster stations;	ASE- 5		YES/NO	WEEKLY
8.	Water sampling from the source	ASE- 6		YES/NO	MONTHLY
9.	Residual chlorine test	ASE- 7		YES/NO	MONTHLY
10.	Bacteriological water sampling	ASE- 8		YES/NO	MONTHLY
11.	Check and pass on spare part and work request forms to Deputy Executive Engineer			YES/NO	WHENEVER REQUIRED
12.	Collect and pass on approved spare part request forms to respective Mistry or Karkoon			YES/NO	WHENEVER REQUIRED
13.	Supervision water table and draw down test (see Task OP-7), and report to Dep. Ex. Engineer			YES/NO	MONTHLY
14.	Manage and check execution of major repairs:				WHENEVER
14A	Distribution system;	ASE- 9		YES/NO	REQUIRED
14B	Diesel engines;	ASE-10		YES/NO	
15.	Report to Deputy Executive Engineer:				
15A	Data Analysis Report Distribution Water Meters;			YES/NO	DAILY
15B	Data Analysis Report Tube Well Bulk Water Meters;			YES/NO	DAILY
15C	Data Analysis Report Manometers;			YES/NO	DAILY
15D	Weekly Status Report Distribution;			YES/NO	WEEKLY
15E	Weekly Status Report Tubewells;			YES/NO	WEEKLY
15F	Weekly Status Report Booster Station;			YES/NO	WEEKLY
16.	Attend meeting BLC's			YES/NO	ONCE PER TWO MONTHS

CHECKLIST FOR MISTRY OR KARKOON, SUBDIVISION: ..... SECTOR: .....

NAME: .....

NO	TASK NAME	PAGE NUMBERS FROM	TO	APPICABLE YES/NO	FREQUENCY
1.	Collection of data from Linesmen:				DAILY
1A	Bulk/domestic water meters;	MIS- 1		YES/NO	
1B	Manometers;	MIS- 2		YES/NO	
2.	Collection of data from Operator	MIS- 3		YES/NO	DAILY
3.	Reporting data to (Add.) Assistant Engineer:				
3A	Logbook manometer;			YES/NO	DAILY
3B	Logbook summary tube well bulk water meter;			YES/NO	DAILY
3C	Logbook summary distribution data;			YES/NO	DAILY
3D	Logbook tube well bulk water meter;			YES/NO	WEEKLY
4.	Attend meetings with (Add.) Assistant Engineer			YES/NO	DAILY
5.	Assess condition of the distribution system in the field	MIS- 4		YES/NO	WEEKLY
6.	Check condition of pump house, generator room, pump, and diesel generating set	MIS- 5		YES/NO	WEEKLY
7.	Supervision of Mobile Repair Crew, recruit labourers, complete work order, and return work order to (Add.) Assistant Engineer			YES/NO	WHENEVER REQUIRED
8.	Instruct Linesmen about tuning of sluice valves			YES/NO	WHENEVER REQUIRED
9.	Instruct Operators about operation of the pumps			YES/NO	WHENEVER REQUIRED
10.	Inform Paani Panchayat about special circumstances that disrupt the supply of drinking water			YES/NO	WHENEVER REQUIRED
11.	Check and submit request forms to (Add.) Assistant Engineer:				WHENEVER
11A	Spare part request form;	MIS- 6		YES/NO	REQUIRED
11B	Work request form;	MIS 7		YES/NO	

CHECKLIST FOR LINESMAN, SUBDIVISION: ..... SECTOR: .....

NAME: .....

NO	TASK NAME	PAGE NUMBERS FROM	TO	APPICABLE YES/NO	FREQUENCY
1.	Visual inspection	LM- 1		YES/NO	THRICE PER WEEK
2.	Reporting on repair and spare part requirements to Mistry/Karkoon or (Add.) Assistant Engineer by filling in and submitting work or spare part request forms			YES/NO	WHENEVER REQUIRED
3.	Execution minor repairs of village level facilities	LM- 2		YES/NO	WHENEVER REQUIRED
4.	Execution minor repairs of pipe lines:				WHENEVER
4A	Small hole in PVC pipe;	LM- 3		YES/NO	REQUIRED
4B	Leaking Gibault coupling;	LM- 3		YES/NO	
5.	Checking valves:				QUARTERLY
5A	Sluice valves;	LM- 4		YES/NO	
5B	Air valves;	LM- 5		YES/NO	
6.	Cleaning of stand posts and cattle troughs	LM- 6		YES/NO	WEEKLY
7.	Cleaning cistern	LM- 7		YES/NO	QUARTERLY
8.	Reading, recording, and maintaining water meters:				DAILY
8A	Bulk water meters;	LM- 8		YES/NO	
8B	Domestic water meters;	LM- 9		YES/NO	
9.	Reading and recording manometers	LM-10		YES/NO	EVERY THREE HRS.
10.	Report data to Mistry, Karkoon or (Add.) Assistant Engineer:				
10A	Logbook for manometer;			YES/NO	DAILY
10B	Logbook for domestic water meter;			YES/NO	DAILY
10C	Logbook for bulk water meter;			YES/NO	DAILY
11.	Operate sluice valve before cistern (this will not be required after the system has been tuned)			YES/NO	WHENEVER REQUIRED
12.	Assist Mobile Repair Crew with execution of major repairs			YES/NO	WHENEVER REQUIRED
13.	Report to Mistry, Karkoon or (Add.) Assistant Engineer in case of emergency			YES/NO	WHENEVER REQUIRED
14.	Attend meetings of Paani Panchayat	LM-11		YES/NO	MONTHLY
15.	Attend meetings of BLC's			YES/NO	ONCE PER TWO MONTHS

CHECKLIST FOR OPERATOR, SUBDIVISION: ..... SECTOR: .....

NAME: .....

NO	TASK NAME	PAGE NUMBERS FROM	TO	APPICABLE YES/NO	FREQUENCY
1.	Operation of pump	OP- 1		YES/NO	DAILY
2.	Report on spare part and repair requirements to Mistry or Karkoon by filling in and submitting spare part or work request forms			YES/NO	WHENEVER REQUIRED
3.	Maintaining diesel generating set:				
3A	Run diesel engine and check functioning;	OP- 2	OP- 3	YES/NO	DAILY
3B	Check belt;	OP- 4		YES/NO	MONTHLY
3C	Clean air cleaner;	OP- 5		YES/NO	EVERY 50 HOURS
3D	Clean oil filter;	OP- 6		YES/NO	EVERY 200 HOURS
3E	Clean fuel filter and tank;	OP- 7		YES/NO	EVERY 200 HOURS
3F	Change oil;	OP- 8		YES/NO	EVERY 400 HOURS
3G	Check oil level in fuel injection pump;	OP- 9		YES/NO	EVERY 400 HOURS
4.	Operate diesel generating set	OP-10		YES/NO	WHENEVER REQUIRED
5.	Reading, recording, and checking bulk water meter	OP-11		YES/NO	DAILY
6.	Report the amount of water produced to the Mistry or Karkoon (and weekly submit the completed logbook for tube well bulk water meters)			YES/NO	DAILY
7.	Execute water table and draw down test	OP-12		YES/NO	MONTHLY
8.	Cleaning of pump house and generator room			YES/NO	DAILY
9.	Check valves	OP-13		YES/NO	MONTHLY
10.	Operation and maintenance chlorinator	OP-14	OP-15	YES/NO	DAILY

CHECKLIST FOR MOBILE REPAIR CREW, SUBDIVISION: ..... SECTOR: .....

NO	TASK NAME	PAGE NUMBERS FROM	PAGE NUMBERS TO	APPICABLE YES/NO	FREQUENCY
1.	Repair of PVC pipe line:				WHENEVER
1A	Repair of PVC pipe with repair socket;	MRC- 1	MRC- 2	YES/NO	REQUIRED
1B	Repair PVC pipe with repair collar;	MRC- 3	MRC- 4	YES/NO	
2.	Repair of AC pipe line	MRC- 5	MRC- 6	YES/NO	WHENEVER REQUIRED
3.	Repair of single air valve:				WHENEVER
3A	Change ball;	MRC- 7		YES/NO	REQUIRED
3B	Change gasket;	MRC- 8		YES/NO	
4.	Repair of double air valve:				WHENEVER
4A	Change ball(s) of double air valve;	MRC- 9		YES/NO	REQUIRED
4B	Change gasket(s) in double air valve;	MRC-10		YES/NO	
4C	Change gasket of connection of double air valve;	MRC-11		YES/NO	
5.	Replacement valves:				WHENEVER
5A	Replacement single air valve;	MRC-12		YES/NO	REQUIRED
5B	Replacement double air valve;	MRC-13		YES/NO	
5C	Replacement sluice valve;	MRC-14	MRC-15	YES/NO	
5D	Replacement non-return valve;	MRC-16		YES/NO	
6.	Replacement of water meters:				WHENEVER
6A	Replacement of bulk water meter;	MRC-17	MRC-18	YES/NO	REQUIRED
6B	Replacement of domestic water meter;	MRC-19		YES/NO	
7.	Replacement of manometer	MRC-20		YES/NO	WHENEVER REQUIRED
8.	Replacement of pump	MRC-21		YES/NO	WHENEVER REQUIRED
9.	Collection of spare parts for major repairs from the proper store			YES/NO	WHENEVER REQUIRED
10.	Collection of spare parts for minor repairs			YES/NO	WHENEVER REQUIRED
11.	Maintenance of vehicle (refer to operation & maintenance manual)			YES/NO	WHENEVER REQUIRED

CHECKLIST FORMS

NAME: _____

POSITION: _____

FORM TITLE	APPICABLE YES/NO	NUMBER
WORK REQUEST FORM FOR DISTRIBUTION	YES/NO	
WORK REQUEST FORM FOR EQUIPMENT	YES/NO	
SPARE PART REQUEST FORM	YES/NO	
REQUISITION FORM	YES/NO	
SPARE PART CREDIT FORM	YES/NO	
TRANSFER ORDER	YES/NO	
PURCHASE REQUEST	YES/NO	
LEDGER FORM	YES/NO	
STOCK FORM	YES/NO	
WORK ORDER FORM	YES/NO	
	YES/NO	
	YES/NO	
	YES/NO	
	YES/NO	
	YES/NO	
	YES/NO	
	YES/NO	
	YES/NO	
	YES/NO	
	YES/NO	
	YES/NO	
	YES/NO	
	YES/NO	
	YES/NO	
	YES/NO	
	YES/NO	

CHECKLIST LOGBOOKS

NAME: _____

POSITION: _____

LOGBOOK TITLE	APPICABLE YES/NO	NUMBER
DOMESTIC WATER METER	YES/NO	
BULK WATER METER	YES/NO	
TUBE WELL BULK WATER METER	YES/NO	
MANOMETER	YES/NO	
SLUICE VALVE(S)	YES/NO	
SUMMARY DISTRIBUTION WATER METERS	YES/NO	
SUMMARY TUBE WELL BULK WATER METERS	YES/NO	
SUMMARY MANOMETER DATA	YES/NO	
CHLORINATOR	YES/NO	
DIESEL ENGINE	YES/NO	
TUBE WELL PUMP	YES/NO	
WATER TABLE AND DRAW DOWN TEST	YES/NO	
WEEKLY TOTALS DOMESTIC AND BULK WATER METERS	YES/NO	
WORK ORDER	YES/NO	
TUNING SLUICE VALVES	YES/NO	
REPAIR WATER METER	YES/NO	
	YES/NO	
	YES/NO	
	YES/NO	
	YES/NO	
	YES/NO	
	YES/NO	
	YES/NO	
	YES/NO	
	YES/NO	

CHECKLIST TOOLS

NAME: _____ POSITION: _____

TOOL NAME	APPICABLE YES/NO	NUMBER	REMARKS
VALVE KEY	YES/NO		
ADJUSTABLE WRENCH	YES/NO		
SPANNER	YES/NO		
PIPE SPANNER	YES/NO		
SHOVEL	YES/NO		
BRUSH	YES/NO		
WIRE BRUSH	YES/NO		
STEEL PIN	YES/NO		
HACKSAW	YES/NO		
PEN	YES/NO		
JAR	YES/NO		
BESOM	YES/NO		
PAINT BRUSH	YES/NO		
SREWDRIVER	YES/NO		
KNIFE	YES/NO		
GHAMELA	YES/NO		
CHISEL	YES/NO		
HAMMER	YES/NO		
TROWEL	YES/NO		
ELECTRIC MEASURING TAPE	YES/NO		
WATERING-CAN	YES/NO		
FUNNEL	YES/NO		
BOWL	YES/NO		
MARKED STRAIGHT EDGE	YES/NO		
STRING	YES/NO		
	YES/NO		

CHECKLIST SPARE PARTS, CONSUMPTION ARTICLES AND EQUIPMENT

NAME: _____ POSITION: _____

TOOL NAME	APPICABLE YES/NO	NUMBER/ AMOUNT	REMARKS
MANOMETER	YES/NO		
DOMESTIC WATER METER	YES/NO		
BULK WATER METER	YES/NO		
SLUICE VALVE	YES/NO		
SINGLE AIR VALVE	YES/NO		
DOUBLE AIR VALVE	YES/NO		
NON-RETURN VALVE	YES/NO		
PACKING	YES/NO		
GASKET	YES/NO		
WASHER (rubber)	YES/NO		
WASHER (steel)	YES/NO		
SOLVENT CEMENT	YES/NO		
CEMENT	YES/NO		
FINE SAND	YES/NO		
BLEACHING POWDER	YES/NO		
GIBAULT COUPLING	YES/NO		
RUBBER RING GIBAULT COUPLING	YES/NO		
PVC REPAIR COLLAR	YES/NO		
PVC REPAIR SOCKET	YES/NO		
REPAIR CLAMP	YES/NO		
RUBBER SHEET	YES/NO		
AC PIPE	YES/NO		
PVC PIPE	YES/NO		
AMMONIUM	YES/NO		
BITUMIOUS PAINT	YES/NO		
MOTOR OIL (HD type-3, SAE 30)	YES/NO		

CHECKLIST SPARE PARTS, CONSUMPTION ARTICLES AND EQUIPMENT (CONTINUED)

NAME: _____ POSITION: _____

TOOL NAME	APPICABLE YES/NO	NUMBER/ AMOUNT	REMARKS
DIESEL	YES/NO		
TAIL PIECE	YES/NO		
T-PIECE	YES/NO		
AIR VALVE T-PIECE	YES/NO		
BEND (CAST IRON)	YES/NO		
REDUCER	YES/NO		
BEND (PVC)	YES/NO		
HOIST/TRIPOD	YES/NO		
DEWATERING SET	YES/NO		
TUBE WELL PUMP	YES/NO		
BOOSTER PUMP	YES/NO		
DIAPHRAM PRESSURE GAUGE	YES/NO		
MOISTURE GLASS TUBE	YES/NO		
NIDDLE VALVE	YES/NO		
COPPER 'U' BEND	YES/NO		
PVC 'U' BEND	YES/NO		
PRIMARY FILTER	YES/NO		
SECONDARY FILTER	YES/NO		
MIXING CHAMBER	YES/NO		
DIAPHRAM VALVE	YES/NO		
SOLUTIONIZER	YES/NO		
CONNECTION NIPPLE	YES/NO		
CHLOROSCOOP	YES/NO		
	YES/NO		
	YES/NO		
	YES/NO		

ANNEX 2. EXAMPLE OF PREPARATION INDIVIDUAL MANUAL

INTRODUCTION

In this Annex of an example of an individual manual of a Linesman is given. The imaginairy Linesman has been assigned to a certain village, and 10 km of pipe line. The pipe line and the village level facilities consist of the following features:

1. Sluice valve;
2. Single air valve;
3. Domestic water meter;
4. Cistern;
5. Stand post;
6. Cattle trough.

Based on this information first of all the checklist for Linesman has been completed, but also the lists for forms, logbooks, tools, and spare parts, consumption articles and equipment. Thereafter the **Task Descriptions** relevant for this particular Linesman have been copied and combined to an individual manual.

CHECKLIST FOR LINESMAN, SUBDIVISION: Rathaspur II SECTOR: Santalpur

NAME: Mr. Shukla

NO	TASK NAME	PAGE NUMBERS FROM	TO	APPICABLE YES/NO	FREQUENCY
1.	Visual inspection	LM- 1		YES/[illegible]	THRICE PER WEEK
2.	Reporting on repair and spare part requirements to Mistry/Karkoon or (Add.) Assistant Engineer by filling in and submitting work or spare part request forms			YES/[illegible]	WHENEVER REQUIRED
3.	Execution minor repairs of village level facilities	LM- 2		YES/[illegible]	WHENEVER REQUIRED
4.	Execution minor repairs of pipe lines:				WHENEVER
4A	Small hole in PVC pipe;	LM- 3		YES/[illegible]	REQUIRED
4B	Leaking Gibault coupling;	LM- 3		[illegible]/NO	
5.	Checking valves:				QUARTERLY
5A	Sluice valves;	LM- 4		YES/[illegible]	
5B	Air valves;	LM- 5		YES/[illegible]	
6.	Cleaning of stand posts and cattle troughs	LM- 6		YES/[illegible]	WEEKLY
7.	Cleaning cistern	LM- 7		YES/[illegible]	QUARTERLY
8.	Reading, recording, and maintaining water meters:				DAILY
8A	Bulk water meters;	LM- 8		[illegible]/NO	
8B	Domestic water meters;	LM- 9		YES/[illegible]	
9.	Reading and recording manometers	LM-10		[illegible]/NO	EVERY THREE HRS.
10.	Report data to Mistry, Karkoon or (Add.) Assistant Engineer:				
10A	Logbook for manometer;			[illegible]/NO	DAILY
10B	Logbook for domestic water meter;			YES/[illegible]	DAILY
10C	Logbook for bulk water meter;			[illegible]/NO	DAILY
11.	Operate sluice valve before cistern (this will not be required after the system has been tuned)			YES/[illegible]	WHENEVER REQUIRED
12.	Assist Mobile Repair Crew with execution of major repairs			YES/[illegible]	WHENEVER REQUIRED
13.	Report to Mistry, Karkoon or (Add.) Assistant Engineer in case of emergency			YES/[illegible]	WHENEVER REQUIRED
14.	Attend meetings of Paani Panchayat	LM-11		YES/[illegible]	MONTHLY
15.	Attend meetings of BLC's			YES/[illegible]	ONCE PER TWO MONTHS

CHECKLIST FORMS

NAME: Mr Shukla

POSITION: Linesman

FORM TITLE	APPICABLE YES/NO	NUMBER
WORK REQUEST FORM FOR DISTRIBUTION	YES/[illegible]	10
WORK REQUEST FORM FOR EQUIPMENT	[illegible]/NO	—
SPARE PART REQUEST FORM	YES/[illegible]	10
REQUISITION FORM	[illegible]/NO	—
SPARE PART CREDIT FORM	[illegible]/NO	
TRANSFER ORDER	[illegible]/NO	
PURCHASE REQUEST	[illegible]/NO	
LEDGER FORM	[illegible]/NO	
STOCK FORM	[illegible]/NO	
WORK ORDER FORM	[illegible]/NO	
	YES/NO	
	YES/NO	
	YES/NO	
	YES/NO	
	YES/NO	
	YES/NO	
	YES/NO	
	YES/NO	
	YES/NO	
	YES/NO	
	YES/NO	
	YES/NO	
	YES/NO	
	YES/NO	
	YES/NO	
	YES/NO	

CHECKLIST LOGBOOKS

NAME: Mr Shukla

POSITION: Linesman

LOGBOOK TITLE	APPICABLE YES/NO	NUMBER
DOMESTIC WATER METER	YES/[illegible]	10
BULK WATER METER	[illegible]/NO	✓
TUBE WELL BULK WATER METER	[illegible]S/NO	✓
MANOMETER	[illegible]/NO	✓
SLUICE VALVE(S)	YES/[illegible]	10
SUMMARY DISTRIBUTION WATER METERS	[illegible]/NO	✓
SUMMARY TUBE WELL BULK WATER METERS	[illegible]/NO	✓
SUMMARY MANOMETER DATA	[illegible]/NO	✓
CHLORINATOR	[illegible]/NO	✓
DIESEL ENGINE	[illegible]/NO	✓
TUBE WELL PUMP	[illegible]/NO	✓
WATER TABLE AND DRAW DOWN TEST	[illegible]/NO	✓
WEEKLY TOTALS DOMESTIC AND BULK WATER METERS	[illegible]/NO	✓
WORK ORDER	[illegible]/NO	✓
TUNING SLUICE VALVES	[illegible]/NO	✓
REPAIR WATER METER	[illegible]/NO	✓
	YES/NO	
	YES/NO	
	YES/NO	
	YES/NO	
	YES/NO	
	YES/NO	
	YES/NO	
	YES/NO	

CHECKLIST TOOLS

NAME: Mr Shokla POSITION: Linesman

TOOL NAME	APPICABLE YES/NO	NUMBER	REMARKS
VALVE KEY	YES/[illegible]	2	For diametres @80mm/100mm
ADJUSTABLE WRENCH	YES/[illegible]	2	
SPANNER	[illegible]/NO	—	
PIPE SPANNER	[illegible]/NO	—	
SHOVEL	YES/[illegible]	/	For repair works
BRUSH	YES/NO	—	
WIRE BRUSH	YES/[illegible]	/	—
STEEL PIN	YES/[illegible]	/	
HACKSAW	[illegible]/NO	—	
PEN	YES/[illegible]	/	
JAR	YES/[illegible]	/	
BESOM	YES/[illegible]	/	
PAINT BRUSH	YES/[illegible]	/	
SREWDRIVER	YES/[illegible]	/	
KNIFE	YES/[illegible]	/	For cutting rubber sheet
GHAMELA	YES/[illegible]	/	
CHISEL	YES/[illegible]	/	
HAMMER	YES/[illegible]	/	
TROWEL	YES/[illegible]	/	
ELECTRIC MEASURING TAPE	[illegible]/NO	—	
WATERING-CAN	[illegible]/NO	—	
FUNNEL	[illegible]/NO	—	
BOWL	[illegible]/NO	—	
MARKED STRAIGHT EDGE	[illegible]/NO	—	
STRING	[illegible]/NO	—	
	YES/NO		

CHECKLIST SPARE PARTS, CONSUMPTION ARTICLES AND EQUIPMENT

NAME: Mr Skukla POSITION: Linesman

TOOL NAME	APPICABLE YES/NO	NUMBER/ AMOUNT	REMARKS
MANOMETER	[illegible]/NO	/	
DOMESTIC WATER METER	[illegible]/NO	/	
BULK WATER METER	[illegible]/NO	/	
SLUICE VALVE	[illegible]/NO	/	
SINGLE AIR VALVE	[illegible]/NO	/	
DOUBLE AIR VALVE	[illegible]/NO	/	
NON-RETURN VALVE	[illegible]/NO	/	
PACKING	YES/[illegible]	2	FOR SLUICE VALVE ϕ 80 and 100 mm
GASKET	[illegible]/NO		
WASHER (rubber)	YES/[illegible]	4	For domestic water meter
WASHER (steel)	[illegible]/NO	/	
SOLVENT CEMENT	YES/[illegible]	/	
CEMENT	YES/[illegible]	5 kg	
FINE SAND	YES/[illegible]	20 kg	
BLEACHING POWDER	YES/[illegible]	5 kg	
GIBAULT COUPLING	[illegible]/NO	/	
RUBBER RING GIBAULT COUPLING	[illegible]/NO	/	
VC REPAIR COLLAR	[illegible]/NO	/	
[illegible] REPAIR SOCKET	[illegible]/NO	/	
[illegible]IR CLAMP	YES/[illegible]	2	
[illegible]R SHEET	YES/[illegible]	1	
[illegible]	[illegible]/NO	/	
[illegible]	YES/[illegible]	2 m	2 pieces 60 cm of ϕ 80 and 100 mm
	[illegible]/NO	/	
PAINT	YES/[illegible]	1 kg	
[illegible]D type-3, SAE 30)	[illegible]/NO	/	

CHECKLIST SPARE PARTS, CONSUMPTION ARTICLES AND EQUIPMENT (CONTINUED)

NAME: Mr. Shukla POSITION: Linesman

TOOL NAME	APPICABLE YES/NO	NUMBER/ AMOUNT	REMARKS
DIESEL	[illegible]/NO	✓	
TAIL PIECE	[illegible]/NO	✓	
T-PIECE	[illegible]/NO	✓	
AIR VALVE T-PIECE	[illegible]/NO	✓	
BEND (CAST IRON)	[illegible]/NO	✓	
REDUCER	[illegible]/NO	✓	
BEND (PVC)	[illegible]/NO	✓	
HOIST/TRIPOD	[illegible]/NO	✓	
DEWATERING SET	[illegible]/NO	✓	
TUBE WELL PUMP	[illegible]/NO	✓	
BOOSTER PUMP	[illegible]/NO	✓	
DIAPHRAM PRESSURE GAUGE	[illegible]/NO	✓	
MOISTURE GLASS TUBE	[illegible]/NO	✓	
NIDDLE VALVE	[illegible]/NO	✓	
COPPER 'U' BEND	[illegible]/NO	✓	
PVC 'U' BEND	[illegible]/NO	✓	
PRIMARY FILTER	[illegible]/NO	✓	
SECONDARY FILTER	[illegible]/NO	✓	
MIXING CHAMBER	[illegible]/NO	✓	
DIAPHRAM VALVE	[illegible]/NO	✓	
SOLUTIONIZER	[illegible]/NO	✓	
CONNECTION NIPPLE	[illegible]/NO	✓	
CHLOROSCOOP	[illegible]/NO	✓	
	YES/NO		
	YES/NO		
	YES/NO		

- TASK DESCRIPTION SHEET -

TASK NAME: Visual inspection **TASK NUMBER:** LM-1

FREQUENCY: Thrice per week

DESCRIPTION

Inspect pipe lines in the area assigned to you, and pay special attention to unnatural wet area along the pipe line route and try to find out the cause of such areas, if necessary excavation of wet areas has to be carried out to determine the cause.

Futhermore, particular attention should be given to the following aspects, as far as they are incorporated in the system:

1. Village level facilities:
   - Check if the domestic water meter is functioning, properly;
   - Check if there is any leakage, if necessary attend to it (see also TASK 7B);
   - Check the toolbox, are all the tools in good condition ?, are there tools missing ? (refer to tool list);
   - Check the availability of spare parts (refer to spare part list);
2. Check all bulk water meters, if they are functioning properly, if there is any leakage or corrosion;
3. Check all manometers, if they are functioning properly, if there is any leakage or corrosion;
4. Check all sluice valves for leakage;
5. Check all air valves for leakage.

If major leaks are detected or the cause of an unnatural wet area can not be explained notify the Mistry/Karkoon or (Add.) Ass. Engineer by filling in and submitting a work request form, immediately after completion of the inspection, indicating the nature and the location of the leak.

SPECIAL INSTRUCTION

If minor repairs have to be executed, refer to the following TASK DESCRIPTIONS:

- LM-3 for village level facilities;
- LM-5A for sluice valves;
- LM-5B for air valves;
- LM-4A for small holes in PVC pipes;
- LM-4B for leaking Gibault couplings.
- LM-8A for bulk water meters;
- LM-8B for domestic water meters;

REQUIREMENTS:PARTS,TOOLS,EQUIPMENT

* Detailed Map of the Distribution System

- TASK DESCRIPTION SHEET -

TASK NAME: Execution minor repairs of village level facilities

TASK NUMBER: LM-3

FREQUENCY: Whenever required

DESCRIPTION

A. Replacement of tap (missing or leaking):
1. Inform villagers, beforehand, concerning interruption of service;
2. Close the sluice valve in the pipe from the cistern to the stand post;
3. Remove tap with two adjustable wrenches, one on the pipe and the other on the tap (by using only one wrench the pipe to which the tap is connected might be damaged);
4. Install new tap with 2 adjustable wrenches;
5. Open the valve in the supply pipe;
6. Check if tap is leaking, if this is the case start again with 2.

B. Touch up plaster of stand post, cattle trough and cistern:
1. Inform villagers, beforehand, concerning interruption of service and close the sluice valve in the pipe from the cistern to the standpost;
2. Clean the spot to be repaired with a wire brush;
3. Keep the spot wet for some time (about 15 minutes);
4. Prepare a stiff mixture of cement mortar of 1 part cement and two parts of fine sand in a Ghamela;
5. Press the mortar firmly on the spot to be repaired;
6. Float the surface with a piece of plank and smooth it with a trowel;
7. The mortar should dry for 2 to 3 hours before the stand post can be used and keeping it wet for 3 days.

C. Repairing of cracks in stand post, cattle trough and cistern:
1. Inform villagers, beforehand, concerning interruption of service;
2. Open crack with hammer and chisel, at least 2 cm deep and 1.5 cm wide;
3. Clean the crack a wire brush;
4. Keep the spot wet for some time (about 15 minutes);
5. Prepare a stiff mixture of cement mortar of 1 part cement and two parts of fine sand in a Ghamela;
6. Press the mortar firmly in the crack;
7. Float the surface with a piece of plank and smooth it with a trowel;
8. The mortar should dry for 2 to 3 hours before the installation can be used, again. Keep the mortar wet for three days, except for the cistern which can be used after drying.

SPECIAL INSTRUCTION

Try to motivate Paani Panchayat to participate in the execution of minor repairs and if possible they could also contribute some basic materials.

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

* Two Adjustable Wrenches	* Chisel
* One Ghamela (bowl)	* A piece of Plank
* One Trowel	* Washers(for water meter)
* Cement	* Fine Sand
* Wire Brush	* Hammer

- TASK DESCRIPTION SHEET -

TASK NAME: Execution minor repairs of pipe lines

TASK NUMBER: LM-4

FREQUENCY: Whenever required

DESCRIPTION

A. Small hole in PVC pipe:

1. Inform villagers, beforehand, concerning interruption of service;
2. Close the upstream sluice valve, and also the downstream sluice valve (if any) with a valve key;
3. Put the specially manufactured clamp in position around the pipe;
4. Prepare a rubber sheet. Take care to cut the right size;
5. Fix the rubber sheet on the hole and put the clamp around it and keep it in place with your hands;
6. Tighten the bolts and nuts with an adjustable wrench;
7. Open the upstream valve;
8. Check if there is still any leakage and if necessary tighten the bolts and nuts;
9. Open the downstream sluice valve, if any;
10. Report to Mistry/Karkoon or (Add.) Ass. Engineer by filling in and submitting a work request form if the clamp remains leaking.

B. Leaking Gibault coupling:

1. Tighten the bolts and nuts of the Gibault coupling with two adjustable wrenches;
2. Report to Mistry/Karkoon or (Add.) Ass. Engineer by filling in and submitting a work request form if the Gibault coupling remains leaking.

SPECIAL INSTRUCTION

1. If the clamp remains leaking but it is only a small leak, the sluice valve(s) can be kept open to continue the supply until it is repaired properly. However, if it is a larger leak the sluice valve(s) have to be closed to prevent excessive losses. In both cases the Mistry/ Karkoon or (Add.) Ass. Engineer has to be informed immediately.
2. If required, Linesmen of neighbouring villages and/or the Paani Panchayat can be requested for assistants for the execution of the repair to get the leak repaired, as soon as possible.

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

* Repair Clamp
* Rubber Sheet
* (Sharp) Knife
* Two Adjustable Wrenches
* Valve Key

- TASK DESCRIPTION SHEET -

TASK NAME: Checking valves, Sluice valves

TASK NUMBER: LM-5A

FREQUENCY: Quarterly

DESCRIPTION

1. Fully close the sluice valve with valve key;
2. Fully open the sluice valve with valve key;
3. Note down number of turns required to close and open the valve in the logbook, and compare this with previous result. If there is a big difference do it once more again and note down the number of turns;
4. Check the condition of the concrete of the sluice valve chamber. Pay special attention to the concrete cover, if this cover and/or the sluice valve are damaged regularly the cover should be replaced by a mild steel cover equipped with a lock;
5. Take off the cover of the sluice valve chamber;
6. Clean the sluice valve chamber, remove dirt and leaves;
7. Check the sluice valve for leakage. If the connection of the sluice valve with the pipe is leaking, tighten the bolts and nuts with an adjustable wrench. If the sluice valve is leaking from the top continue as follows:
   - Remove the gland with an adjustable wrench;
   - Remove the packing with a screwdriver;
   - Fix in a new packing;
   - Fix the gland back with an adjustable wrench;
8. Check the sluice valve body, bolts and nuts for corrosion;
9. Remove any corrosion with a wire brush;
10. Repaint sluice valve with bituminous paint and paint brush, if corrosion had to be removed;
11. If necessary, report the following to Mistry/Karkoon or (Add.) Ass. Engineer by filling in and submitting a work request form :
    - Sluice valve chamber has to be repaired or replaced;
    - Cover of the sluice valve chamber has to be replaced with a mild steel cover equipped with lock;
    - Sluice valve remains leaking even after execution of minor repairs;
    - The number of turns required to close and open the sluice valve differs from previous results (sluice valve has to be replaced).

SPECIAL INSTRUCTION

1. Close and open the sluice valve slowly, do not over tighten valves, and do not apply excessive force while operating the valve. The valve should always be operated with the proper valve key without using any extra leverage;
2. The minor repair of the sluice valve should also be conducted if leakage is detected during Visual Inspection.

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

* Wire Brush
* Adjustable Wrench
* Logbook for Sluice Valve
* Pen
* Packing
* Paint Brush
* Bituminous Paint
* Screwdriver
* Valve Key (for different diameter valves)

- TASK DESCRIPTION SHEET -

TASK NAME: Checking valves, Air valves

TASK NUMBER: LM-5B

FREQUENCY: Quarterly

DESCRIPTION

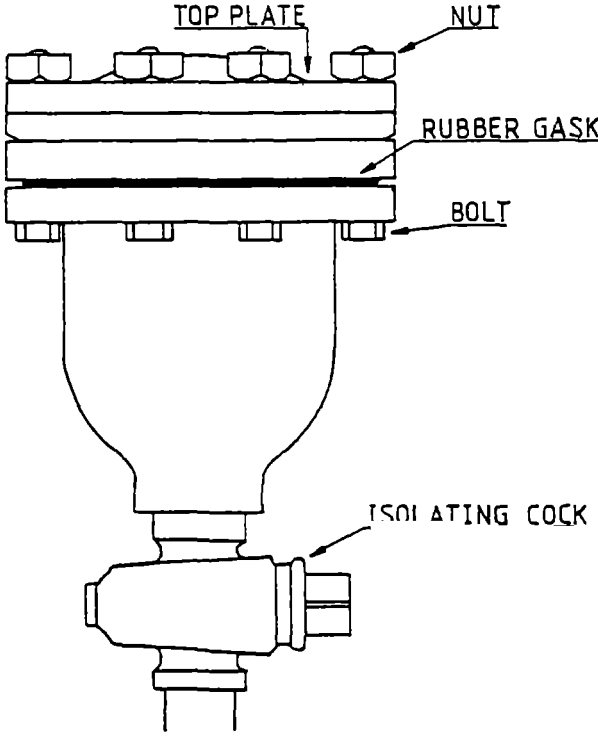
1. Clean the area around the air valve and remove bushes within a range of one metre;
2. Remove leaves, dirt, dust etc. from the air valve;
3. Check that the ball of the air valve (Figure LM-5B.1) can be moved freely as follows;
   - Remove top plate by loosening the bolts and nuts with an adjustable wrench;
   - If it is a **Double Air Valve** (Figure LM-5B.2) try to move both balls with a steel pin, other wise there is only one ball to be moved;
   - Replace the top plate;
4. Check the air valve for leakage along the connection with the pipe (only for Double Air Valve). If this is the case tighten the bolts and nuts with an adjustable wrench.
5. Check the air valve body, bolts and nuts for corrosion;
6. Remove any corrosion with a wire brush;
7. Repaint air valve with bituminous paint and paint brush, if corrosion had to be removed.
8. If necessary, report the following to Mistry/Karkoon or (Add.) Ass. Engineer by filling in and submitting a work request form :
   - The ball(s) can not be moved freely;
   - The double air valve remains leaking even after tightening the bolts and nuts;
   - The **Small Orifice Air Valve** is leaking.

SPECIAL INSTRUCTION

REQUIREMENTS:PARTS,TOOLS,EQUIPMENT

* Adjustable Wrench
* Wire Brush
* Steel Pin (which fits trough small orifice)
* Paint Brush
* Bituminous Paint

SINGLE AIR VALVE



SINGLE AIR VALVE
[WITHOUT TOP PLATE]

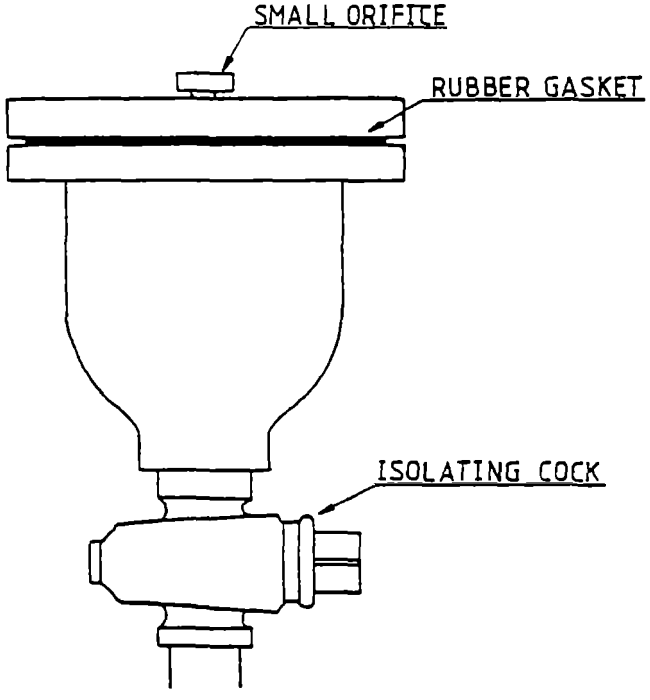


FIGURE LM-5B.1
SINGLE AIR VALVE

LM-6

- TASK DESCRIPTION SHEET -

TASK NAME: Cleaning of stand posts and cattle troughs

TASK NUMBER: LM-6

FREQUENCY: Weekly

DESCRIPTION

Cleaning stand post:

1. Check general cleanness of the stand post and surrounding area;
2. Advise and encourage the villagers to keep the stand post and surrounding proper and nice, if necessary;
3. Check whether the villagers utilize the spillage water from the stand posts for gardening. If this is not the case, advise the Paani Panchayat to take this issue up. If necessary put forward suggestions on how to use the spillage water;
4. Remove dirt, leaves, dust, etc. from the stand post and surrounding;
5. Attend to clogged drain and soak away, if necessary.

Cleaning of cattle trough:

1. Take care that the cattle trough is empty or almost empty, to reduce wastage to a minimum and close the supply valve;
2. Advise and encourage the villagers to keep the cattle trough and surrounding proper and nice, if necessary;
3. Drain the cattle trough by opening the drain valve;
4. Remove dirt, leaves, dust, etc. from the cattle trough;
5. Close the drain valve and open the supply valve and close it again when the trough is full.

SPECIAL INSTRUCTION

During cleaning of the stand post also check if there are any crack that have to be attended to. For proper repair of cracks see TASK LM-3.

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

* Besom

- TASK DESCRIPTION SHEET -

TASK NAME: Cleaning cistern TASK NUMBER: LM-7

FREQUENCY: Quarterly

DESCRIPTION

1. Inform villager before hand, concerning the interruption of the service;
2. Close the sluice valve in the supply pipe to the cistern with the valve key. Catch some of the water from the stand post in a jar (50 liters) for cleaning the cistern and yourself;
3. Open drain valve to completely empty the cistern. Use part of the water for preparation of chlorinated water (50 mg/l). Before entering the cistern, take off your shoes and wash your feet with chlorinated water (water can also be taken from the cattle trough, if necessary);
4. Brush the floor, wall and ceiling with a wire brush;
5. Check the floor, and wall for cracks, if there are any follow task description LM-3C;
6. Remove all dirt and dust from the cistern;
7. Clean the floor, wall, and the ceiling with chlorinated water, and afterwards with plain water. Take care the drain valve is still open;
8. Close the drain valve;
9. Open the sluice valve in the supply pipe to the cistern.

SPECIAL INSTRUCTION

Pay special attention to the spillage water from the cistern, take care it is properly drained and that no pools are formed.

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

* Wire Brush
* Jar
* Valve Key
* Bleaching Powder

- TASK DESCRIPTION SHEET -

TASK NAME: Reading, recording, and maintaining of water meters, Bulk water meters

TASK NUMBER: LM-8A

FREQUENCY: Daily

DESCRIPTION

1. Note down the date and the time;
2. Read the bulk water meter as follows (Figure LM-8A), if it is a water meter with six dials:
   - Note down the lowest whole number indicated by the pointer on the scale marked * 100.000;
   - Note down the lowest whole number indicated by the pointer on the scale marked * 10.000;
   - Note down the lowest whole number indicated by the pointer on the scale marked * 1.000;
   - Note down the lowest whole number indicated by the pointer on the scale marked * 100;
   - Note down the lowest whole number indicated by the pointer on the scale marked * 10;
   - Note down the lowest whole number indicated by the pointer on the large scale.

   If it is a digital bulk water meter, read the numbers, directly;
3. Calculate the daily amount by subtracting the reading of the previous day from the reading, and note it down;
4. Check for leakage along the connection of the bulk water meter, if leakage is detected, tighten bolts and nuts with adjustable wrench. If leakage remain notify Mistry/Karkoon or (Add.) Ass. Engineer by filling in and submitting a work request form.

SPECIAL INSTRUCTION

If the water meter is not recording notify the Mistry/Karkoon or (Add.) Ass. Engineer by filling in and submitting a work request form, as soon as possible to get it replaced.

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

* Logbook for Bulk Water Meter
* Sandpaper
* Valve Key
* Pen
* Two Adjustable Wrenches

- TASK DESCRIPTION SHEET -

TASK NAME: Reading, recording, and maintaining of water meters, Domestic water meters

TASK NUMBER: LM-8B

FREQUENCY: Daily

DESCRIPTION

1. Note down the date and the time;
2. Read the digital on the domestic water meter and note it down;
3. Calculate the daily amount by subtracting the reading of the previous day from the reading, and note it down;
4. Check for leakage along the connection of the domestic water meter, if leakage is detected, tighten connection with 2 adjustable wrenches. If leakage remains adjust as follows:
   - Close the sluice valve just before the meter with the valve key;
   - Loosen the connection with 2 adjustable wrenches;
   - Take out the water meter and remove the washers at both sides;
   - Smoothen surfaces where the washers were fixed and the contact surfaces attached to the pipe with sandpaper and fix new washers;
   - Put the domestic water meter back;
   - Tighten the connection, first by hand, and thereafter with 2 adjustable wrenches (take care that the thread is not damaged);
   - Open sluice valve with the valve key and check if connection is leaking. If it is leaking tighten the connection with 2 adjustable wrenches. If connection still leaks notify the Mistry/Karkoon or (Add.) Ass. Engineer by filling in and submitting a work request form.

SPECIAL INSTRUCTION

If the water meter is not recording notify the Mistry/Karkoon or (Add.) Ass. Engineer by filling in and submitting a work request form, as soon as possible to get it replaced.

REQUIREMENTS:PARTS,TOOLS,EQUIPMENT

* Logbook for Domestic Water Meter
* Sandpaper
* Valve Key
* Pen
* Washers
* Two Adjustable Wrenches

LM-11

- TASK DESCRIPTION SHEET -

TASK NAME: Attend meeting of Paani Panchayat TASK NUMBER: LM-14

FREQUENCY: Monthly

DESCRIPTION

The meeting with the Paani Panchayat is an opportunity to discuss problems with regard to the water supply at village level. However, it is also possible initiate participation of the people in the maintenance of the village level facilities. Pay special attention to the following aspects:

- Cleanness of stand post and cattle trough;
- Drainage of spillage water from stand post and cattle trough;
- Assistance of the people with the execution of minor repairs, either through labour and/or supply of basic materials, like taps and washers;

Try to put forward suggestions to involve the people in these aspects.

SPECIAL INSTRUCTION

REQUIREMENTS:PARTS,TOOLS,EQUIPMENT

ANNEX 3. TASK DESCRIPTIONS EXECUTIVE ENGINEER

EXE-1

- TASK DESCRIPTION SHEET -

TASK NAME: Evaluation performance water supply system

TASK NUMBER: EXE-2

FREQUENCY: Weekly

DESCRIPTION

Based on the data of water meters (tube well and distribution bulk water meters, and domestic water meters) and manometers, and the Weekly Data Analysis Reports Distribution and Production prepared by the Deputy Executive Engineers, it is possible to get a detailed understanding of the performance of the water supply system. Also, the Monthly Status Reports Distribution and Production will give information on the functioning of the water supply system. This will form the basis for the tuning of the distribution system and instructions for the sub-division and section offices. However, tuning can not be taken up until pressure can be maintained in the system through out the day. Only then it is possible to fix the required setting of sluice valves.

From the data it will be possible to prepare an overall water balance of the distribution system and the hydraulic grade lines for selected days (refer to Task ASE-2 and ASE-4). Whenever problems are identified (excessive leakage, too high consumption, and lack of service etc. in certain areas) appropriate action should be initiated.

Excessive leakage:

1. Confine the problem area as much as possible with the available data from water meters and manometers;
2. Instruct the Deputy Executive Engineer to start a visual inspection of the problem area, immediately;
3. If from the visual inspection it becomes clear that major repairs are required instruct the Deputy Executive Engineer, immediately;
4. If the problem can not be located by the visual inspection, while the data of water meters and manometers still indicate excessive losses and or pressure drop it might be necessary to install additional water meters to further confine the problem area. When the area has been further confined visual inspection should be initiated, again.

The process described above might have to be repeated several times until the area is limited enough to execute detailed visual inspection, and the problem can be located.

Too high consumption:

Instruct Deputy Executive Engineer to investigate the reason for the high demand. It might be that water is being used illegally or people are taking more water then allocated to them.

Whatever the reason of the high demand is, it has to be attended to. Illegal water use is prohibited at all times and this should also be enforced. If villages are taking too much water the Paani Panchayat has to be convinced through the Deputy Executive Engineer that this has serious effects on the water availability for other people. If no improvement of this situation can be achieved it should be considered to disconnect the village from the distribution system.

EXE-2

- TASK DESCRIPTION SHEET -

TASK NAME: Evaluation performance water supply system

TASK NUMBER: EXE-2

CONTINUED

DESCRIPTION

Lack of service in certain areas:
Whenever there is a lack of water supply in an area, arrangements for an alternative supply (tanker supply) have to be made, immediately. Therefore this should be reported by the Deputy Executive Engineer to the Executive Engineer as soon as the information reaches him. However, this is a short term action, and an investigation has to be made to find out the cause of the problem.
Basically there are two possibilities that might cause this problem:

1. Local cause, pipe burst or some similar reason, in the branch supplying the village, if the water pressure at the connection of the branch with the main is sufficient;
2. Insufficient pressure at the distribution main, so that water can not reach the village;

If it is a local problem, immediate visual inspection should be initiated to locate the defect.

If it is a pressure problem the procedure described under the heading **Excessive leakage** should be followed.

SPECIAL INSTRUCTION

Action described above should be under taken immediate, and it should be checked daily whether there is any progress, and if appropriate attention and priority is being given to these problems.

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

* Weekly Data Analysis Report Distribution and Production
* Monthly Status Report Distribution and Production
* Map of the Distribution System

EXE-3

- TASK DESCRIPTION SHEET -

TASK NAME: Tuning of the water supply system TASK NUMBER: EXE-3

FREQUENCY: Weekly

DESCRIPTION

Tuning of the distribution system can only be achieved if the prevailing pressures in the system don't differ too much from day to day. The system should be sufficiently upgraded, so that pressure can be maintained during the whole day. Only then will it be possible to start fixing sluice valves in such a way that the water can be supplied to the cisterns evenly over the day. This has to be based on the weekly evaluation of the functioning of the water supply system (Task EXE-2) and can only be achieved by trial and error, as described below:

1. Instruct the concerned Deputy Executive Engineer to open a sluice valve for a certain number of threads, this will be the starting point for every sluice valve. This is limited to the sluice valves of the main transmission pipe line and the main branches. Fine tuning at village level is the responsibility of the sub divisions;
2. Note down the number of threads, and monitor the supply of water for at least three days;
3. If the daily amount of water supplied is too much the sluice valve has to be closed one more thread. If the amount is too little open the sluice valve one more thread. Return to number 2.;
4. If the amount is sufficient (refer to demand figures) the exercise can be stopped by noting down the number of threads the sluice valve has been opened in the logbook. However, the amount of water supplied should be checked, regularly.

SPECIAL INSTRUCTION

Whenever the demand in an area changes due to increase of population or connection of additional villages the tuning has to be carried out, again.

REQUIREMENTS:PARTS,TOOLS,EQUIPMENT

* Logbook Tuning Sluice Valves
* Map of the Distribution System

EXE-4

- TASK DESCRIPTION SHEET -

TASK NAME: Check repair requirements water meters

TASK NUMBER: EXE-4

FREQUENCY: Weekly

DESCRIPTION

The water meters which have been replaced because of malfunctioning will be transferred weekly to the divisional office. Each week it should be assessed whether enough water meters have been collected to send them for repair. The minimum number of water meters to be send for repair will depend on the available spare water meters and the time required for repair.

1. Collect the work requests and enter them into the logbook 'repair water meters';
2. If ten or more meters have to be repaired, prepare a work order for transfer of the water meters to the water meter repair shop, and instruct a driver about the transport, otherwise continue with number 4.;
3. Enter the work order in the work order logbook, and in the pending work order file;
4. Check whether earlier send meters have already been returned. If this is the case continue with number 5. If it is not the case while they should have been returned already, contact the water meter repair shop to urge the quick repair of the meters.
5. Complete work order form and work order logbook and remove the work order from the pending work order file;
6. Return water meters to respective sub division and complete the logbook 'repair water meters'.

SPECIAL INSTRUCTION

1. The logbook for incoming water meters should state for each meter the manufacturer, size, from which sub-division it was received, and the date of arrival. Furthermore, the returning water meters have to be entered in this logbook, also.
2. Establish and review rate contract yearly.

REQUIREMENTS:PARTS,TOOLS,EQUIPMENT

* Work Request Form
* Work Order File
* Logbook Repair Water Meters

EXE-5

- TASK DESCRIPTION SHEET -

TASK NAME: Coordinating spare part and equipment purchase

TASK NUMBER: EXE-5

FREQUENCY: Weekly

DESCRIPTION

Whenever spare parts, equipment or other articles have to be purchased the Deputy Executive Engineer will submit a purchase request form. Futhermore, each sub division will submit a **Stock Form** which indicates the remaining stock of each article and the required minimum level. Special attention should be given to the timely dispatching of these matters as these articles are essential for proper maintenance.

1. Collect purchase request and stock forms;
2. Check whether one of the articles for which a purchase request has been submitted is readily available in one of the other stores. If this is the case continue with number 3., otherwise continue with number 4.;
3. Prepare a Transfer Order and submit it together with the purchase request to the respective Deputy Executive Engineer, and instruct him to transfer the articles together with the purchase request form;
4. File the purchase request in the pending purchases file and purchase the respective article. Whenever the article is delivered, transfer them together with the purchase request to the sub division office.

SPECIAL INSTRUCTION

1. Delivery of spare parts and equipment should also be checked weekly and whenever necessary contact with the supplier or zonal office in order to try to ensure timely delivery.
2. Pay special attention to the purchase of synthetic rubber.

REQUIREMENTS:PARTS,TOOLS,EQUIPMENT

* Stock Form
* Purchase Request Form
* Transfer Order

EXE-6

- TASK DESCRIPTION SHEET -

TASK NAME: Assessment condition in the field TASK NUMBER: EXE-7

FREQUENCY: Monthly

DESCRIPTION

General
Select every month one of the sub-divisions for the field visit, and dependent on which division is visited continue with either A. or B. described below

A. Distribution system:

1. Study the monthly status report distribution prepared by the Deputy Executive Engineer of the concerned sub-division. Also take into account the results of Task EXE-2;
2. Check in the field some of the bulk water meters and manometers (if they are recording or if there is any leakage);
3. Visit some villages in the area (at least five) and check the following:
   - General cleanness of stand posts and cattle troughs, with special attention to drainage facilities;
   - Functioning of domestic water meters, and if there is any leakage;
   - Inform with the Paani Panchayat whether there are any problems with the water supply;
4. Inspect the transmission line and the major branches (visual inspection) to check whether there is any leakage, pay special attention to sluice and air valves;
5. Visit booster station(s) if included in the system, otherwise continue with number 6., and check the following:
   - General cleanness of the pump house and generator rooms;
   - Functioning of the bulk water meters and manometers;
   - If there is any leakage;
   - Condition of electrical control panel;
   - If the logbooks are being filled in properly. Pay special attention to the execution of regular maintenance as described in Task OP-3;
6. Whenever required instruct the Deputy Executive Engineer, (Add.) Assistant Engineer, Linesmen and or Mistry concerning the improvement of the situation;
7. Write a status report on the conclusions of the field visit, action undertaken to improve the situation, and required action for the future. This status report is the basis for the **Quarterly Status Report** that has to be prepared for the Super Intending Engineer.

EXE-7

- TASK DESCRIPTION SHEET -

TASK NAME: Assessment condition in the field TASK NUMBER: EXE-7

CONTINUED

B. Production facilities:

1. Study the monthly status report production prepared by the Deputy Executive Engineer. Also take into account the results of Task EXE-2, and check the following aspects:
   - General cleanness of the pump house and generator rooms;
   - Functioning of the bulk water meters and manometers;
   - If there is any leakage;
   - Condition of electrical control panel;
   - If the logbooks are being filled in properly. Pay special attention to the execution of regular maintenance as described in Task OP-3A to OP-3G;
   - Whether there are sufficient spare parts and supplies available (diesel, motor oil, etc.);
2. Instruct the Operators and/or Mistry based on the conclusion of the field visit, if required;
3. Write a status report on the conclusions of the field visit, action undertaken to improve the situation, and required action for the future. This status report is the basis for the **Quarterly Status Report** that has to be prepared for the Super Intending Engineer.

SPECIAL INSTRUCTION

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

* Monthly Status Report Distribution or Production
* Weekly Data Analysis Report Distribution or Production
* Map of the Water Supply System

EXE-8

- TASK DESCRIPTION SHEET -

TASK NAME: Monitoring water quality in distribution system

TASK NUMBER: EXE-8

FREQUENCY: Monthly

DESCRIPTION

Residual chlorine

Whenever the residual chlorine test indicate that the chlorine content is not within the range of 0.2 to 0.5 mg/l it will be reported by the Deputy Executive Engineer, immediately. Basically there are three options, if the chlorine content is not according to the standards:

1. Increase the chlorination at Shihori;
2. Decrease the chlorination at Shihori;
3. Install additional chlorinators elsewhere.

The last option should only be executed if the other possibilities fail to bring result or if already the maximum chlorine content is being added while the chlorine content still doesn't reach the required level.

Bacteriological quality

If the bacteriological analysis indicate a health hazard a sanitary survey should be started right away, in order to determine the source(s) of contamination. For this reason, the Deputy Executive Engineer will report it, as soon as possible. A detailed description of a sanitary survey is given in Annex 12.

SPECIAL INSTRUCTION

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

ANNEX 4. TASK DESCRIPTIONS DEPUTY EXECUTIVE ENGINEER

DEE-1

- TASK DESCRIPTION SHEET -

TASK NAME: Monitoring of sub-divisional distribution system

TASK NUMBER: DEE-2

FREQUENCY: Daily

DESCRIPTION

Based on the data of water meters and manometers, and the analysis of the (Add.) Assistant Engineer reported in the Data Analysis Reports on Distribution Water Meters and Manometers, for the various sections of the sub-divisional distribution system it is possible to get a detailed understanding of the functioning of this system. Also, the Weekly Status Reports on Distribution and Booster Station will give information on the condition of facilities. This will form, together with the work requests the basis for the planning of activities of the Mobile Repair Crew and other maintenance staff.

From all these data it will be possible to prepare a water balance of the sub division distribution system and the hydraulic grade line (see Task ASE-2 and ASE-4). Check whether additional activities are required, to remedy problems in certain areas. If problems occur in a certain area while no repair activities are requested, the following steps should be taken:

1. Confine the problem area as much as possible with the available data from water meters and manometers;
2. Instruct the (Add.) Assistant Engineer and the Mistry or Karkoon that immediate visual inspection of the problem area has to be started;
3. If from the visual inspection it becomes clear that major repairs are required prepare work orders, immediately;
4. If the problem can not be located by the visual inspection, while the data of water meters and manometers still indicate excessive losses and or pressure drop it might be necessary to install additional water meters to further confine the problem area. When the area has been further confined visual inspection should be initiated, again.

The process described above might have to be repeated several times until the area is limited enough to execute detailed visual inspection, and the problem can be located.

Besides, these analysis a weekly **Data Analysis Report Distribution** has to be prepared of which a copy has to be submitted to the Executive Engineer.

Tuning of the distribution system can only be achieved if the prevailing pressures in the system don't differ too much from day to day. Whenever, the system has been sufficiently upgraded, so that pressure can be maintained during the whole day. Only then will it be possible to start fixing sluice valves in such a way that the water can be supplied to the cisterns evenly over the day. This can only be achieved by trial and error, as described below:

DEE-2

- TASK DESCRIPTION SHEET -

TASK NAME: Monitoring of sub-divisional distribution system

TASK NUMBER: DEE-2

CONTINUED

DESCRIPTION

1. Instruct the concerned (Add.) Assistant Engineer to open a sluice valve for a certain number of threads, this will be the starting point for every sluice valve. This is limited to the sluice valves at village level, other sluice valves will be tuned by the Executive Engineer;
2. Note down the number of threads, and monitor the supply of water for at least three days;
3. If the daily amount of water supplied is too much the sluice valve has to be closed one more thread. If the amount is too little open the sluice valve one more thread. Return to number 2.;
4. If the amount is sufficient the exercise can be stopped by noting down the number of threads the sluice valve has been opened in the logbook. However, the amount of water supplied should be checked, regularly.

SPECIAL INSTRUCTION

The Weekly Data Analysis Report Distribution consisting of the following elements:

- Total amounts of water which passed the various domestic and bulk water meters;
- Weekly water balance of the whole sub division distribution system and its parts (as far as possible);
- Maximum and minimum hydraulic grade lines of each day;
- The amounts of water supplied to the various villages related to the demand;
- Statement concerning special circumstances which influence the functioning of the sub division distribution system, and reasons for malfunctioning.

REQUIREMENTS:PARTS,TOOLS,EQUIPMENT

* Data and Analysis Report Distribution Water Meters
* Data and Analysis Report Manometers
* Weekly Status Report Distribution
* Weekly Status Report Booster Station
* Detailed Map of the Sub-divisional Distribution System
* Logbook Tuning Sluice Valves

DEE-3

- TASK DESCRIPTION SHEET -

TASK NAME: Monitoring tube wells, Production quantity

TASK NUMBER: DEE-3A

FREQUENCY: Daily

DESCRIPTION

The daily water production of each tube well and the well field can be easily determined from the readings of the bulk water meters as summarized in the Data Analysis Report Tube Well. Also, the Weekly Status Report Tube Well should be taken into account. These data should be compared with the required production. If the water production is not up to the standard one of the following problems might have occurred:

1. Pump failure, which can be corrected easily by replacing the pump with a spare pump. If this has been done immediately, there should be no significant reduction of the production. Check whether the pump was replaced immediately. If this is not the case, find out why not, and instruct the (Add.) Assistant Engineer, the Mistry or Karkoon or the Operator responsible for the tube wells, accordingly;
2. Power failure, also this should not cause any reduction of the daily water production because alternative power is available at each tube well. If power failure is anyhow the cause of reduced production, it means the diesel generating set hasn't been kept in working condition. Try to find out why not, and instruct the (Add.) Assistant Engineer, the Mistry or Karkoon or the Operator responsible for the engine, accordingly;
3. General reduction of the capacity of the well field. This issue goes beyond the scope of this Operation & Maintenance Manual, but should always be kept in mind. If this is the case also the data of the monthly water table and draw down test should indicate a decline of the water table and an increase of the draw down. No remedial action can be proposed here, but it should be reported to the Executive Engineer, immediately.

Prepare a weekly data analysis report, and submit a copy to the Executive Engineer.

SPECIAL INSTRUCTION

The Weekly Data Analysis Report Production consists of the following elements:

- Data on the daily production per tube well;
- Data on daily production of the well field;
- Statement concerning special circumstances which influence the functioning of the tube wells, and reasons for malfunctioning.

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

* Data Analysis Report Tube well Bulk Water Meters
* Weekly Status Report Tube wells
* Results Water Table and Draw Down Test

DEE-4

- TASK DESCRIPTION SHEET -

TASK NAME: Monitoring tube wells, Water quality

TASK NUMBER: DEE-3B

FREQUENCY: Monthly

DESCRIPTION

1. Collect results from the laboratory analysis. Check whether water sampling is carried out regularly;
2. Compare results of the analysis of the laboratory with the prevailing Indian Standards for drinking water;
3. If one of the quality parameters exceeds the standards, it should be checked whether blending water from various tube wells can result in satisfactory drinking water;
4. Inform The Executive Engineer whenever one of the quality parameters exceeds the standards, and if possible suggest remedial action;

SPECIAL INSTRUCTION

REQUIREMENTS:PARTS,TOOLS,EQUIPMENT

* Chemical Analysis Report

DEE-5

- TASK DESCRIPTION SHEET -

TASK NAME: Monitoring spare parts, consumption articles, and equipment stock

TASK NUMBER: DEE-5

FREQUENCY: Whenever required

DESCRIPTION

The purpose of monitoring of the stock of spare parts, equipment and consumption articles is to ensure that all the items required for proper operation and maintenance are available when needed. For each article a so called **Ledger Form** has to be filled in and kept. On these forms the incoming and out going quantities are registered. The out going articles are linked with a spare part request form (for minor repairs) or a requisition form (for major repairs). Incoming articles are based on a spare part credit form or a purchase request.

The procedure of out going articles can be summarized as follows:

1. Collect spare part request forms and/or requisition forms;
2. Enter the data on the respective ledger form;
3. Enter the spare part form or requisition form number under the heading **ISSUED**, together with the quantity issued;
4. Calculate the balance by subtracting the quantity from the previous balance;
5. Compare the balance with the minimum level, if the balance is higher than the minimum level continue with number 7., otherwise continue with number 6.;
6. Fill a purchase request form for consumption articles or spare parts giving all the details mentioned at the top of the ledger form, and submit a copy to the Executive Engineer. The original has to be filed in the purchase request file;
7. File the spare part request form or requisition form in their respective file;

The procedure of incoming articles can be summarized as follows:

1. Collect spare part credit forms and/or purchase request forms of articles that have been delivered;
2. Enter the data on the respective ledger form;
3. Enter the respective form number under the heading **RECEIVED**, together with the quantity;
4. Calculate the balance by adding the quantity to the previous balance.
5. File the spare part credit and/or purchase request form in the incoming articles file.

DEE-6

- TASK DESCRIPTION SHEET -

TASK NAME: Monitoring spare parts, consumption articles and equipment stock

TASK NUMBER: DEE-5

CONTINUED

SPECIAL INSTRUCTION

1. Establish the minimum level for the spare parts, and consumption articles based on the required quantities and the time required for purchasing and receiving spare parts and consumption articles.
2. Chlorine gas should not be kept in store for longer periods. Whenever the chlorine cylinder in use, is almost empty (say it has still a supply for three days) an empty cylinder should be send for refilling. This cylinder should not be stored under the sun.
3. Weekly the balances of the various items should be entered on the **Stock Form** which has to be submitted to the Executive Engineer;

REQUIREMENTS:PARTS,TOOLS,EQUIPMENT

* Purchase Request Form
* Spare Part Credit Form
* Ledger Form
* Stock Form
* Spare Part Request Form
* Requisition Form

DEE-7

- TASK DESCRIPTION SHEET -

TASK NAME: Planning major repairs of equipment

TASK NUMBER: DEE-6

FREQUENCY: Whenever required

DESCRIPTION

General
Whenever equipment like pumps, diesel generating sets, and water meters are out of order and replaced they have to be repaired by a rate contractor, as soon as possible. Rate contractors are already employed for pumps and diesel generating sets, for the water meters there is at present, no arrangements for repair are available.

A. Diesel generating set:
Whenever there is a breakdown or regular overhaul is required the rate contractor has to be notified, immediately. Because the installations can not be moved easily, the contractor has to repair or overhaul the installation in site.

1. Collect work request forms related to the diesel engines;
2. Prepare a work order;
3. Instruct the (Add.) Assistant Engineer;
4. Check the prompt and correct overhaul or repair;

B. Pump:
After a pump breakdown, the pump has to be replaced immediately by a spare pump and has to be repaired.

1. Collect work request forms related to the diesel engines;
2. Prepare a work order;
3. Instruct the (Add.) Assistant Engineer;
4. Check the prompt and correct overhaul or repair and complete the work order whenever the pump is returned;

C. Water meter:
Replaced water meters have to be repaired in Ahmedabad. Therefore, they have to be transferred to the division office, from where they can be send for repair. Weekly the water meters have to be transported by the responsible Mobile Repair Crew.

1. Collect work request forms for all water meters;
2. Transfer the water meters and the work request forms to the Executive Engineer;

- TASK DESCRIPTION SHEET -

TASK NAME: Planning major repairs of equipment

TASK NUMBER: DEE-6

CONTINUED

SPECIAL INSTRUCTION

1. If a rate contractor does not preform satisfactory, it should be considered to eliminate the contract, at least if an alternative is available;
2. At all times, the timely execution of the work should be stressed, and checking has to be carried out regularly.

REQUIREMENTS:PARTS,TOOLS,EQUIPMENT

* Work Request Form
* Work Order Form

DEE-9

- TASK DESCRIPTION SHEET -

TASK NAME: Planning major repairs of the distribution system

TASK NUMBER: DEE-7

FREQUENCY: Whenever required

DESCRIPTION

1. Collect work request forms;
2. Check the execution of major repairs of the previous day and the file pending work orders;
3. Prepare work orders together with the (Add.) Assistant Engineer for all repairs and determine the priority of the work based on the pending work orders of the **Pending Work Order File** and the **Work Order Logbook;**
4. Enter the work order in the work order logbook, and file a copy in the pending work order file;
5. Hand over the work orders to the concerned (Add.) Assistant Engineer.

SPECIAL INSTRUCTION

1. In case of emergency the Executive Engineer has to be notified, as soon as possible.
2. In case a repair requires shutdown of tube wells the Deputy Executive Engineer of the Shihori sub-division has to be notified.

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

* Work Order Form
* Work Order Logbook
* Pending Work Order File

DEE-10

- TASK DESCRIPTION SHEET -

TASK NAME: Assessment condition in the field Sub-divisional distribution system

TASK NUMBER: DEE-10A

FREQUENCY: Monthly

DESCRIPTION

1. Select a section of the sub-divisional distribution system for field visit. For example every week an area assigned to one (Add.) Assistant Engineer or Mistry, so that the whole distribution system can be covered within one month;
2. Study Weekly Status Report Distribution and/or Booster Station prepared by the (Add.) Assistant Engineer;
3. Check the condition of bulk water meters and manometers, if are they recording or if there is any leakage;
4. Select some villages in the area, especially villages where problems have been reported and check the following:
   - General cleanness of stand posts and cattle troughs, with special attention to drainage facilities;
   - Functioning of domestic water meters, and if there is any leakage;
   - Inform with the Paani Panchayat whether there are any problems with the water supply;
5. Check if the tool box of the Linesmen are complete (refer to tool list), and if sufficient spare parts and materials (taps, washers for water meters, etc.) available;
6. If a booster station is incorporated in the distribution system, also Task DEE-10B number 2. and 3. have to be executed. Otherwise, continue with number 7.;
7. Whenever required instruct the (Add.) Assistant Engineer, Linesmen and or Mistry concerning the improvement of the situation;
8. Write a status report for each field visit on the conclusions of the field visit, action undertaken to improve the situation, and required action for the future. The status reports are the basis for the preparation of the **Monthly Status Report Distribution** of which a copy has to be submitted to the Executive Engineer.

SPECIAL INSTRUCTION

1. Refer wherever required to lists (tool list, spare part list, etc.) to check whether everything is complete.
2. The Monthly Status Report consists of a written report covering the conclusions of the various field visit (functioning of facilities, general cleanness of facilities, whether people are satisfied with the service, etc.), and the actions already undertaken to improve the situation, and suggestions for actions to be initiated by the Executive Engineer.

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

* Weekly Status Report Distribution and or Booster Station

DEE-11

- TASK DESCRIPTION SHEET -

TASK NAME: Assessment condition in the field Production facilities TASK NUMBER: DEE-10B

FREQUENCY: Monthly

DESCRIPTION

1. Study the Weekly Status Report Tube Wells prepared by the (Add.) Assistant Engineer;
2. Check the following aspects in the field:
   - General cleanness of the pump house and generator rooms;
   - Functioning of the bulk water meters and manometers;
   - If there is any leakage;
   - Condition of electrical control panel;
   - Delivery pressure of the pump;
   - If the logbooks are being filled in properly. Pay special attention to the execution of regular maintenance as described in Task OP-3A to 3G;
   - The output of the generator (let the operator start the diesel engine) and the temperature, and oil pressure of the diesel engine;
   - Whether toolbox complete (spanners, wrenches, lubricator pump, etc.);
   - Whether there are sufficient spare parts and supplies available (diesel, motor oil, etc.);
   - The condition of the chlorinator and if the right amount of chlorine is being supplied.
3. Instruct the Operators and/or Mistry based on the conclusion of the field visit, if required;
4. Write a status report for each field visit on the conclusions of the field visit, action undertaken to improve the situation, and required action for the future. The status reports are the basis for the preparation of the **Monthly Status Report Production** of which a copy has to be submitted to the Executive Engineer.

SPECIAL INSTRUCTION

1. Refer wherever required to lists (tool list, spare part list, etc.) to check whether everything is complete.
2. The Monthly Status Report consists of a written report covering the conclusions of the various field visit (functioning of facilities, general cleanness of facilities, etc.), and the actions already undertaken to improve the situation, and suggestions for actions to be initiated by the Executive Engineer.

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

* Weekly Status Report Tube Wells

DEE-12

- TASK DESCRIPTION SHEET -

TASK NAME: Monitoring water quality in distribution system

TASK NUMBER: DEE-11

FREQUENCY: Monthly

DESCRIPTION

Residual chlorine
Monthly the results of the residual chlorine tests will be submitted by one or more (Add.) Assistant Engineers. Whenever the residual chlorine test indicate that the chlorine content is not within the range of 0.2 to 0.5 mg/l it has to be reported to the Executive Engineer, immediately. Then the Executive Engineer can take appropriate action. Basically there are three options:

1. Increase the chlorination at Shihori;
2. Decrease the chlorination at Shihori;
3. Install additional chlorinators elsewhere.

Bacteriological quality
Monthly the results of the bacteriological analysis will be submitted by one or more (Add.) Assistant Engineers. If the bacteriological analysis indicate a health hazard a sanitary survey should be started right away, in order to determine the source(s) of contamination. For this reason, it is of relevant importance to inform the Executive Engineer, as soon as possible.

SPECIAL INSTRUCTION

Select at least one village for the monthly tests, and instruct the (Add.) Assistant Engineer where the tests have to be executed.

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

ANNEX 5. TASK DESCRIPTIONS (ADDITIONAL) ASSISTANT ENGINEER

ASE-1

- TASK DESCRIPTION SHEET -

TASK NAME: Screening data distribution water meters

TASK NUMBER: ASE-2

FREQUENCY: Daily

DESCRIPTION

Bulk water meters and domestic water meters:

1. Check whether the collected data have been submitted completely. Check if the data differs from previous day, and if the case try to find out why (major repair, pipe burst, etc.);
2. Enter the date and the readings in the logbook. Take care to enter the readings at the right identification number of the meter;
3. Check whether villages have been supplied with the correct daily amount of water. If this is the case try to find out why;
4. Make a water balance as far as possible of the section of sub-divisional distribution system, and determine if there are any substantial losses (Figure ASE-2.1). If this is the case continue with number 5., otherwise with number 6.;
5. Make a water balance of branches or other limited parts of the sub-divisional distribution system, and determine the losses (Figure ASE-2.2);
6. Prepare a **Data Analysis Report Distribution Water Meters** for the Deputy Executive Engineer stating among others: percentage of losses in the sub-divisional distribution system, percentage of losses in branches, location of losses, and special circumstances like execution of major repairs etc.;
7. At the end of each week, the weekly totals for each water meter have to be calculated and the procedure as described above (number 1. to 7.) has to be carried out for these totals;
8. Hand over the data analysis report to the Deputy Executive Engineer.

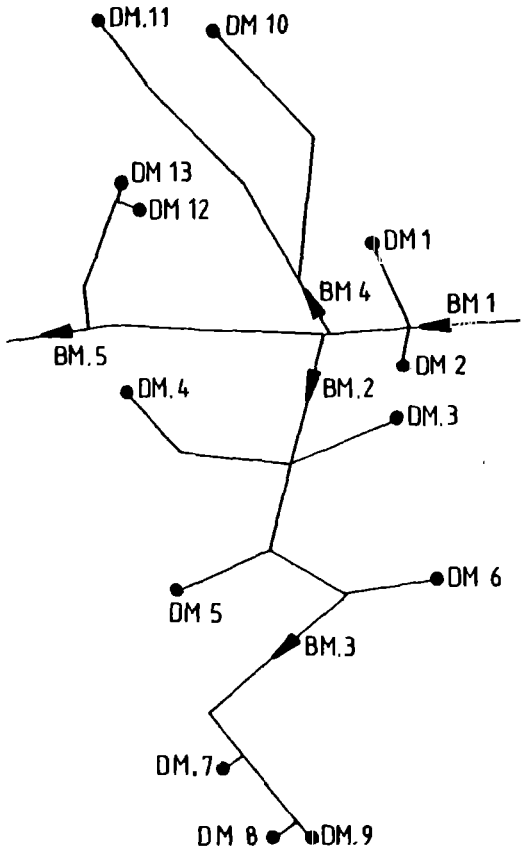
SPECIAL INSTRUCTION

1. While analyzing the data of the water meters also take into consideration the data of the manometers;
2. In case of an emergency, immediately instruct the Mistry or Karkoon, and the Mobile Repair Crew to under take remedial action.
3. Data Analysis Report Distribution Water Meters consists of the following elements:
   - The Logbook Summary Distribution Data;
   - The calculation of losses including figures as indicated in Figure ASE-2.1 and ASE-2.2.
   - Reasons for losses, and special circumstances for higher or lower water supply to villages (like on going repair).
4. This task can only be executed partly, until sufficient domestic water meters have been installed.

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

* Logbook Summary Distribution Water Meters
* Pen
* Detailed map of the sub-divisional distribution system, including identification numbers of water meters.

IMAGINARY DIVSIONAL DISTRIBUTION SYSTEM



LEGEND

- PIPE LINE
- BULK WATER METER
- DOMESTIC WATER METER

BASIC DATA VILLAGES			METER READINGS (m3/d)			
VILLAGE NUMBER	NUMBER OF PEOPLE	DEMAND (m3/d)	DOMESTIC METERS NUMBER	(m3)	BULK METERS NUMBER	(m3)
1	500	22.5	DM.1	20.0	BM.1	2800.0
2	200	9.0	DM.2	10.0	BM.2	400.0
3	1500	67.5	DM.3	70.0	BM.3	150.0
4	600	27.0	DM.4	30.0	BM.4	187.0
5	500	22.5	DM.5	25.0	BM.5	1500.0
6	1000	45.0	DM.6	45.0		
7	1500	67.5	DM.7	70.0		
8	500	22.5	DM.8	45.0		
9	500	22.5	DM.9	25.0		
10	1500	67.5	DM.10	70.0		
11	2000	90.0	DM.11	100.0		
12	500	22.5	DM.12	20.0		
13	400	18.0	DM.13	20.0		
TOTAL	11200	504.0	TOTAL	550.0		

EXAMPLE 1 (BALANCE OF WHOLE SYSTEM)

A.WATER IN: 2800 m3 (BM.1)

B.WATER OUT: 1500 m3 (BM.5)

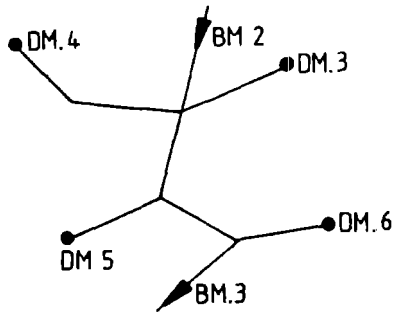
C.TOT CONSUMPTION: 550 m3 (DM.1+DM.2+.....+DM.13)

D.LOSSES: 750 m3 (A-B-C)

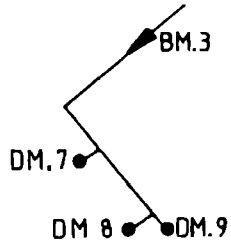
LOSSES ARE: 26.8 % ([D/A]*100%)

FIGURE ASE-2.1
EXAMPLE 1

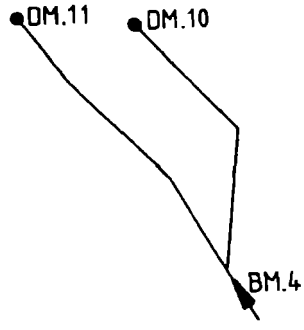
EXAMPLE 2 (BALANCES OF PARTS OF THE SYSTEM)



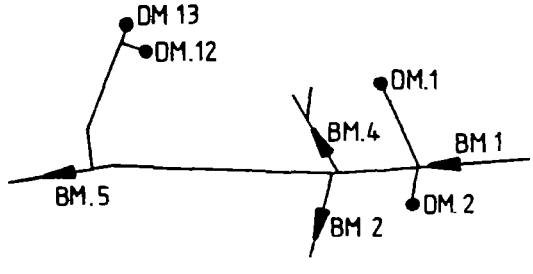
A.WATER IN:	400 m3	(BM.2)
B.WATER OUT:	150 m3	(BM.3)
C.TOT CONSUMPTION:	170 m3	(DM.3+DM.4+DM.5+DM.6)
D.LOSSES:	80 m3	(A-B-C)
LOSSES ARE:	20.0 %	([D/A]*100%)



A.WATER IN:	150 m3	(BM.3)
B.WATER OUT:	0 m3	(-)
C.TOT CONSUMPTION:	140 m3	(DM.7+DM.8+DM.9)
D.LOSSES:	10 m3	(A-B-C)
LOSSES ARE:	6.7 %	([D/A]*100%)



A.WATER IN:	187 m3	(BM.4)
B.WATER OUT:	0 m3	(-)
C.TOT CONSUMPTION:	170 m3	(DM.10+DM.11)
D.LOSSES:	17 m3	(A-B-C)
LOSSES ARE:	9.1 %	([D/A]*100%)



A.WATER IN:	2800 m3	(BM.1)
B.WATER OUT:	2087 m3	(BM.2+BM.4+BM.5)
C.TOT CONSUMPTION:	70 m3	(DM.1+DM.2+DM.12+DM.13)
D.LOSSES:	643 m3	(A-B-C)
LOSSES ARE:	23.0 %	([D/A]*100%)

FIGURE ASE-2.2
EXAMPLE 2

ASE-2

- TASK DESCRIPTION SHEET -

TASK NAME: Screening data tube well water meters

TASK NUMBER: ASE-3

FREQUENCY: Daily

DESCRIPTION

1. Check whether the collected data have been submitted, completely. Check if the data differs from previous day, and if the case try to find out why (pump breakdown, pipe burst, etc.);
2. Enter the date and the readings in to the logbook. Take care to enter the readings at the right tube well number which belongs to the meter;
3. Prepare a data analysis report for the Deputy Executive Engineer;
4. Hand over data analysis report production to the Deputy Executive Engineer.

SPECIAL INSTRUCTION

1. The Data Analysis Report Tube Well Bulk Water Meters consists of the following elements:
   - Logbook Summary Tube Well Bulk Water Meters;
   - Remarks for the reason of lower production and a comparison of the actual production with the required production.
2. Weekly the Mistry will submit the complete logbook for tube well bulk water meter. Compare these data with the earlier received data, and check whether the weekly production has been calculated correctly. These logbooks (for each tube well) have to be added to the Data **Analysis Report Production** once per week.

REQUIREMENTS:PARTS,TOOLS,EQUIPMENT

* Logbook Summary Tube Well Bulk Water Meters
* Pen

ASE-3

- TASK DESCRIPTION SHEET -

TASK NAME: Screening data manometers TASK NUMBER: ASE-4

FREQUENCY: Daily

DESCRIPTION

1. Check whether the collected data have been submitted, completely. Check if the data differs from previous day, and if the case try to find out why (major repair, pipe burst, etc.);
2. Enter the date and the minimum and maximum readings of the most upstream manometer in to the logbook together with the time of these readings. For these hours note down the readings of the other manometers, as well. Take care to enter the readings at the right identification number of the manometer;
3. If there are more than one manometer continue with number 4. otherwise with number 6.;
4. Draw a hydraulic grade line on a sheet with the length profile of the main pipe line for both hours entered in the logbook, and compare these with the design hydraulic grade line:
   - If the hydraulic grade line is more or less the same as for the design grade line than there should be no problem.
   - If the slopes of the grade lines are more or less the same but the pressures are much lower than there is a problem in another sub-division (Figure ASE-4.1). If this is the case try to find out the reason.
   - If the slopes are different there must be a problem either with excessive losses or increased demand (Figure ASE-4.2). If this is the case try to find out the reason.
5. Prepare a **Data Analysis Report Manometers** for the Deputy Executive Engineer;
6. Hand over the report to the Deputy Executive Engineer.

SPECIAL INSTRUCTION

1. While analyzing the data of the manometers also take into consideration the data of the water meters.
2. The Data Analysis Report Manometers consists of the following elements:
   - Logbook Summary Manometer Data;
   - Reasons for pressure drops, and special circumstances (like on going repair).

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

* Logbook Summary Manometer Data
* Pen
* Detailed map of the sub-divisional distribution system, including identification numbers of manometers.

HYDRAULIC GRADE LINE

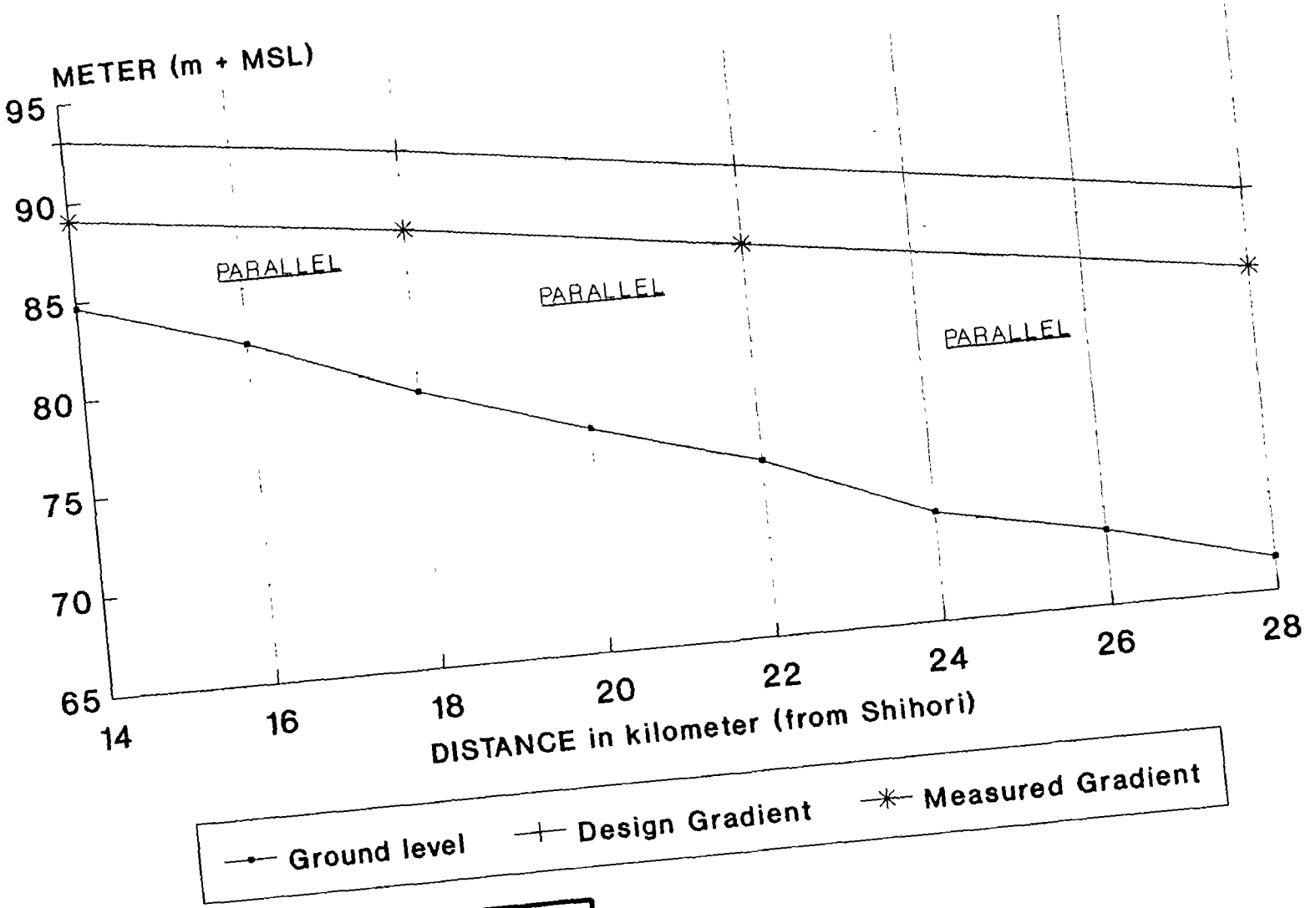


FIGURE ASE-4.1
EXAMPLE 1

HYDRAULIC GRADE LINE

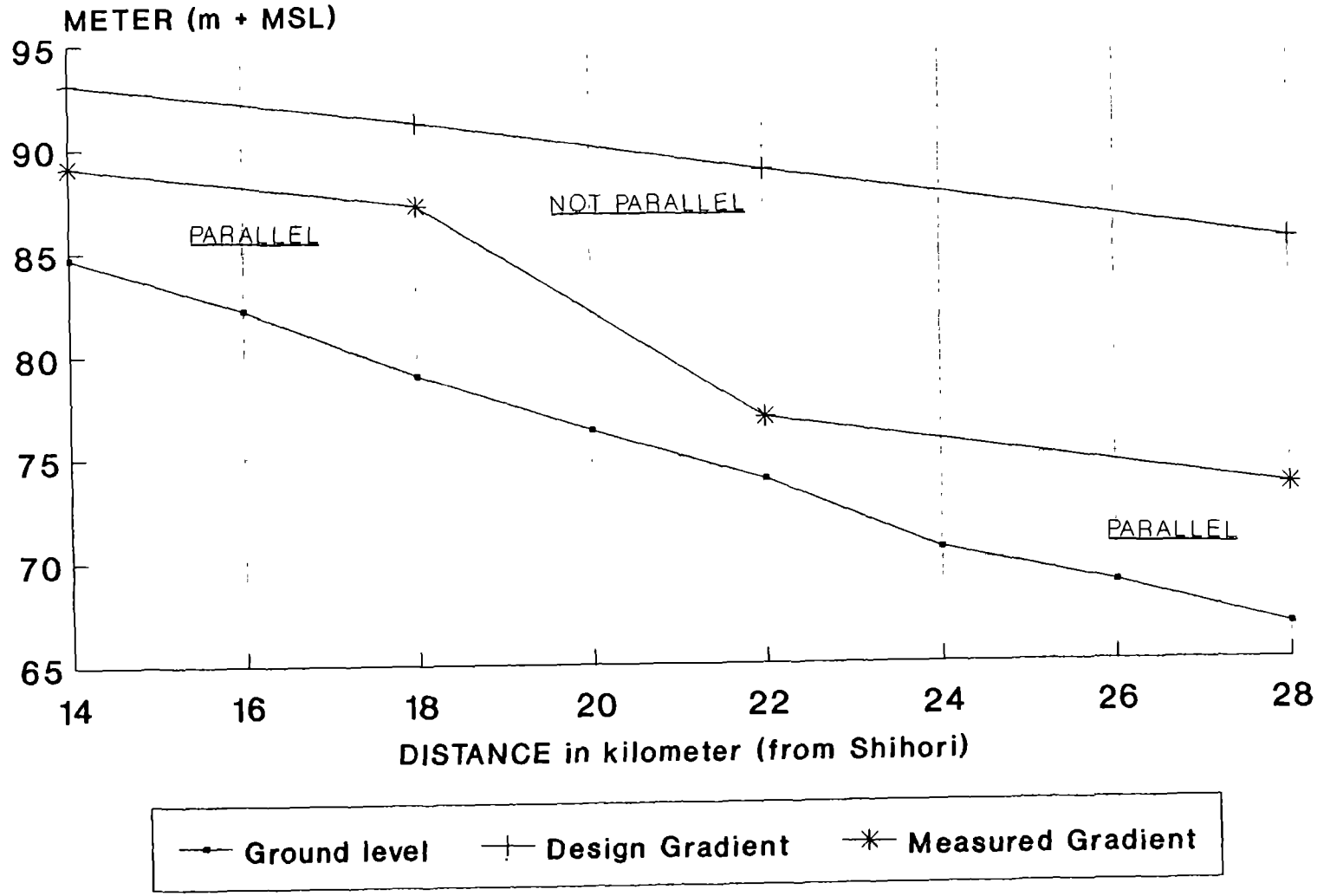


FIGURE ASE-4.2
EXAMPLE 2

ASE-4

- TASK DESCRIPTION SHEET -

TASK NAME: Assessment condition in the field Distribution system TASK NUMBER: ASE-7A

FREQUENCY: Weekly

DESCRIPTION

1. Select a section of the sub-divisional distribution system for field visit. For example every week an area assigned to one Mistry or Karkoon, keeping in mind that all parts have to be inspected once per month.
2. Check the condition of all bulk water meters, if are they recording or if there is any leakage;
3. Visit all villages in the area and check the following:
   - General cleanness of stand posts and cattle troughs, with special attention to drainage facilities;
   - Functioning of domestic water meters, and if there is any leakage;
   - If the villagers are satisfied with the supply of water;
4. Check if the tool box of the Linesmen are complete (refer to tool list), and if sufficient spare parts and materials (taps, washers for water meters, etc.) available;
5. Whenever required instruct the Linesmen and or Mistry concerning the improvement of the situation;
6. Prepare **Status Report Distribution** on the conclusions of the field visit and submit it to the Deputy Executive Engineer;

SPECIAL INSTRUCTION

1. Refer wherever required to lists (tool list, spare part list, etc.) to check whether everything is complete.
2. The Weekly Status Report Distribution consists of only of a written report covering the conclusions of the field visit (functioning of facilities, general cleanness of facilities, whether people are satisfied with the service, etc.), and the actions already undertaken to improve the situation, and suggestions for actions to be initiated by the Deputy Executive Engineer.

REQUIREMENTS:PARTS,TOOLS,EQUIPMENT

* Notebook
* Map of the distribution system
* Pen

ASE-5

- TASK DESCRIPTION SHEET -

TASK NAME: Assessment condition in the field Production facilities or booster stations

TASK NUMBER: ASE-7B

FREQUENCY: Weekly

DESCRIPTION

Check the following aspects:

1. General cleanness of the pump house and generator rooms;
2. Functioning of the bulk water meters and manometers;
3. If there is any leakage;
4. Condition of electrical control panel;
5. Delivery pressure of the pump;
6. If the logbooks are being filled in properly. Pay special attention to the execution of regular maintenance as described in Task OP-3A to 3G;
7. The output of the generator (let the operator start the diesel engine) and the temperature, and oil pressure of the diesel engine;
8. Whether toolbox complete (spanners, wrenches, lubricator pump, etc.);
9. Whether there are sufficient spare parts and supplies available (diesel, motor oil, etc.)
10. Instruct the Operators and/or Mistry based on the conclusion of the field visit, if required;
11. Prepare **Status Report Tube Wells or Booster Station** on the conclusions of the field visit and submit it to the Deputy Executive Engineer;

SPECIAL INSTRUCTION

1. Refer wherever required to lists (tool list, spare part list, etc.) to check whether everything is complete.
2. The Weekly Status Report Tube Wells or Booster Station consists of only of a written report covering the conclusions of the field visit (functioning of facilities, general cleanness of facilities, etc.), and the actions already undertaken to improve the situation, and suggestions for actions to be initiated by the Deputy Executive Engineer.

REQUIREMENTS:PARTS,TOOLS,EQUIPMENT

* Notebook
* Map of the distribution system
* Pen

ASE-6

- TASK DESCRIPTION SHEET -

TASK NAME: Water sampling from the source TASK NUMBER: ASE-8

FREQUENCY: Monthly

DESCRIPTION

1. Fill the bottle(s) of neutral, practically colourless glass (of good quality) with water from the source and rinse them thoroughly, at least three times;
2. Fill the bottle(s) again but now completely, and close the bottle(s) immediately with the ground-glass stopper;
3. Transport the bottles to the laboratory in Mehsana with as little delay as possible, while keeping the bottles cool. They don't have to be kept in ice but keep them protected from the sun.
4. Analyses the results (conform Indian Standards) form the laboratory together with the Deputy Executive Engineer and take appropriate action, if required;

SPECIAL INSTRUCTION

1. The analysis should commence as soon as possible, but in any case not later than 24 hours after sampling;
2. From each tube well a sample of 2 liters should be taken.
3. Take care that all the bottles are marked clearly with Tube Well identification number and date.

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

* Sample Bottles

ASE-7

- TASK DESCRIPTION SHEET -

TASK NAME: Residual chlorine test TASK NUMBER: ASE-9

FREQUENCY: Monthly

DESCRIPTION

The samples should be taken from the following sites:

- The first village cistern connected to the distribution system after the ground level reservoirs at Shihori headworks;
- Ground level reservoir at Dhokavada;
- At least one village in each sub-division. The village will be selected by the Deputy Executive Engineer.

If the residual chlorine of one or more samples is not with in the range of 0.2 to 0.5 mg/l it has to be reported, immediately.

1. Fill the test tube with water from the sample point, and rinse the tube. Repeat this three times;
2. Fill the test tube again with water from the sample point. Take care not to fill it completely;
3. Add three drops of chlorine reagent;
4. Shake the test tube thoroughly until there is a uniform colour;
5. Put the test tube in the chloroscoop and compare the colour of the test tube with the colours of the chloroscoop;
6. Note down the estimated chlorine content together with the date and sample location and report the results to the Deputy Executive Engineer.

SPECIAL INSTRUCTION

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

* Chloroscoop
* Test tube
* Notebook
* Pen

ASE-8

- TASK DESCRIPTION SHEET -

TASK NAME: Bacteriological water sampling TASK NUMBER: ASE-10

FREQUENCY: Monthly

DESCRIPTION

Samples should be taken from the following sites:
- Ground level reservoir at Shihori head works;
- Elevated storage reservoir at Varahi (if again in use);
- Ground level reservoir at Dhokavada;
- At least one village in each sub-division. The village will be selected by the Deputy Executive Engineer.

Take samples and preform the analysis in accordance with the detailed manual of the Millipore kit, or any other kit for bacteriological analysis.

Note down the results of the analysis together with the date and the sample location, and report them to the Deputy Executive Engineer.

SPECIAL INSTRUCTION

1. At least twice per year samples should also be taken from storage facilities within the household, to check whether drinking water is handled properly by the people served by the system;
2. When analysis indicate a health hazard or there is an outbreak of waterborne or water related diseases, a sanitary survey should be undertaken. This survey should be begun immediately to identify source(s) of contamination. First attention should be given to the most common cause of contamination: **Failure of chlorination.**

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

* Millipore Kit or other bacteriological test equipment
* Manual Millipore Kit
* Notebook
* Pen

ASE-9

- TASK DESCRIPTION SHEET -

TASK NAME: Manage and check execution of major repairs, Distribution system

TASK NUMBER: ASE-14A

FREQUENCY: Whenever required

DESCRIPTION

1. Whenever a major repair has to be executed the Deputy Executive Engineer will write a work order which will be entered in the pending work order file and work order logbook;
2. Hand over the work order to the Mobile Repair Crew and instruct the Mistry (supervisor) and the Mobile Repair Crew about the execution of the repair;
3. The Mistry will send the work order back after completion of the job stating the date of completion and the material used;
4. Check by means of the work order logbook whether the Mobile Repair Crew has executed all the repairs planned during a certain day. If not, try to find out the cause of this delay;

SPECIAL INSTRUCTION

1. Always analyze the reports of the Mistry or Karkoon, and the Linesman, carefully. If any emergency has occurred, undertake immediately remedial action, if necessary without approval, beforehand, of the Deputy Executive Engineer;
2. Whenever a major pipe burst has to be repaired or a sluice valve has to be replaced, check in the field if the work is executed properly (before back filling of excavations!!).

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

* Work Order Logbook

ASE-10

- TASK DESCRIPTION SHEET -

TASK NAME: Manage and check execution of major repairs, Diesel engines

TASK NUMBER: ASE-14B

FREQUENCY: Whenever required

DESCRIPTION

1. Whenever a major repair has to be executed the Deputy Executive Engineer will write a work order which will be entered in the pending work order file and work order logbook. The work order will be handed over to the responsible (Add.) Assistant Engineer;
2. Contact the rate contractor immediately to make an appointment for the execution of the repair;
3. During the repair executed by a rate contractor, check the following:
   - Use of proper spare parts for replacement;
   - Execution of all tasks which have to be done during a overhaul (refer to detailed manual for the diesel engine);
   - If engine is functioning properly after the repair;
3. Fill in the completion date on the work order, and indicate which spare parts have been used, and the time spend. Return the completed work order to the Deputy Executive Engineer.

SPECIAL INSTRUCTION

Always analyze the reports of the Mistry or Karkoon, and the Linesman, carefully. If any emergency has occurred, undertake immediately remedial action, if necessary without approval, beforehand, of the Deputy Executive Engineer;

REQUIREMENTS:PARTS,TOOLS,EQUIPMENT

* Work Order Logbook
* Pen

ANNEX 6. TASK DESCRIPTIONS MISTRY AND KARKOON

MIS-1

- TASK DESCRIPTION SHEET -

TASK NAME: Collection of data from Linesmen, Bulk/domestic water meters

TASK NUMBER: MIS-1A

FREQUENCY: Daily

DESCRIPTION

1. Request the Linesman for the logbook of domestic water meters, and bulk water meters;
2. Check if entries and calculation of the amount of water have been made correctly. Instruct the Linesmen, if necessary;
3. Note down the date, the serial number of the meter, the time of the reading, and the calculated amount in your logbook;
4. Report data to (Additional) Assistant Engineer.

SPECIAL INSTRUCTION

1. The collection of these data are a daily activity. Therefore, it is important to make arrangements with each Linesman to meet at a certain spot and time;
2. Inform with Linesman if any spare parts or materials are required for the execution of minor repairs. If necessary, fill in the spare part request form together with the Linesman.

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

* Logbook Summary Distribution Water Meters
* Pen

MIS-2

- TASK DESCRIPTION SHEET -

TASK NAME: Collection of data from Linesmen, Manometers TASK NUMBER: MIS-1B

FREQUENCY: Daily

DESCRIPTION

1. Request the Linesmen for the logbook of the manometer;
2. Check if entries have been made correctly. Take special care that the right scale (kg/cm^2) has been read. Instruct the Linesman, if necessary;
3. Take out the double entry form.
4. Report data to (Additional) Assistant Engineer.

SPECIAL INSTRUCTION

1. The collection of these data are a daily activity. Therefore, it is important to make arrangements with each Linesman to meet at a certain spot and time;
2. Inform with Linesman if any spare parts or materials are required for the execution of minor repairs. If necessary, fill in the spare part request form together with the Linesman

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REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

MIS-3

- TASK DESCRIPTION SHEET -

TASK NAME: Collection of data from Operator TASK NUMBER: MIS-2

FREQUENCY: Daily

DESCRIPTION

1. Request the Operator for all the logbooks;
2. Check if entries have been made correctly (meter readings, daily maintenance, running hours, etc.) and if daily maintenance has been executed. Instruct the Operator, if necessary;
3. Check if the calculation of the water production is correct;
4. Note down the date, the tube well number, and the water amount produced during 24 hours in the logbook;

SPECIAL INSTRUCTION

1. Also check the general condition (if it is proper) of the pump house, generator room, and the diesel generating set. Pay special attention to the water meter, manometer, valves, and electrical installation. Instruct the Operator, if necessary.
2. Inform with Operator if any spare parts or materials are required for the execution of minor repairs. If necessary, fill in the spare part request form together with the Operator.
3. Weekly the Logbook for Tube Well Bulk Water Meter should be collected from the Operator and submitted to the (Add.) Assistant Engineer.

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

* Logbook for Tube Well Bulk Water Meter
* Logbook Summary Tube Well Bulk Water Meters
* Pen

MIS-4

- TASK DESCRIPTION SHEET -

TASK NAME: Assess condition of the distribution system in the field

TASK NUMBER: MIS-5

FREQUENCY: Weekly

DESCRIPTION

Join every week two or three of the Linesmen (dependent on the size of the area covered by a Linesman) during visual inspection of the distribution system. Pay special attention to the condition of the following aspects:

1. Village level facilities:
   - Check general cleanness of stand posts, cattle troughs, and drainage and utilization of spillage water;
   - Check functioning of domestic water meters, and if there is any leakage;
   - Inform with villagers and Paani Panchayat if any problem arose since the last visit;
   - Check the toolbox of the Linesmen and spare part availability;
   - Check if the logbooks are being kept, properly;

   If necessary, fill in a spare part request form together with the Linesman;
2. Bulk water meters, check functioning, leakage, and corrosion;
3. Manometers, check functioning, leakage, and corrosion;
4. Sluice valves, check functioning, leakage, corrosion, and the sluice valve chamber and cover;
5. Air valves, check functioning, leakage, corrosion, and if the ball(s) can move freely;
6. Carry out visual inspection along the pipe lines together with the Linesman.
7. Whenever necessary, instruct the Linesman to improve his performance. If major problems have been detected, report to the (Add.) Assistant Engineer or Deputy Executive Engineer by filling in a work request form together with the Linesman, immediately.

SPECIAL INSTRUCTION

1. In case of an emergency, the problem has to be attended to, immediately. Try to inform the (Add.) Assistant Engineer or Deputy Engineer, but if they are not available inform the Mobile Repair Crew. However, a work request form should be completed afterwards.
2. Refer to tool and spare part list to check whether everything is complete.

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

* Work Request Form
* Spare Part Request Form
* Pen
* Map of Distribution System
* List of Tools
* List of Required Spare Parts

- TASK DESCRIPTION SHEET -

TASK NAME: Check condition of pump house, generator room, pump, and diesel generating set

TASK NUMBER: MIS-6

FREQUENCY: Weekly

DESCRIPTION

Check the following aspects:

1. General cleanness of the pump house and generator rooms;
2. Functioning of the bulk water meters and manometers;
3. If there is any leakage;
4. Condition of electrical control panel;
5. Delivery pressure of the pump;
6. If the logbooks are being filled in properly. Pay special attention to the execution of regular maintenance as described in Task OP-(3A to 3G);
7. The output of the generator (let the operator start the diesel engine) and the temperature, and oil pressure of the diesel engine;
8. Whether toolbox complete (spanners, wrenches, etc.);
9. Whether there are sufficient spare parts and supplies available (diesel, motor oil, etc.)
10. Whenever necessary, instruct the Operator to improve his performance. If major problems have been detected, report to the (Add.) Assistant Engineer or Deputy Executive Engineer by filling in a work request form together with the Linesman, immediately.

SPECIAL INSTRUCTION

Refer wherever required to lists (tool list, spare part list) to check whether everything is complete.

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

* Notebook
* Pen

- TASK DESCRIPTION SHEET -

TASK NAME: Check and submit request forms to (Add.) Assistant Engineer, Spare part request form

TASK NUMBER: MIS-11A

FREQUENCY: Whenever required

DESCRIPTION

1. Check if the spare part request form has been filled in, completely. If necessary, complete the spare part request form together with the Linesman or Operator;
2. Submit spare part request form to the (Additional) Assistant Engineer, who has to get approval from the Deputy Executive Engineer;
3. Whenever approval has been granted, collect the spare parts from the store and hand them over to the Linesman or Operator. If spare parts are not available in the store the Mobile Repair Crew will collect from another store of the division and hand it over, as soon as possible;
4. Instruct the Linesman or Operator about execution of repair, if necessary.

SPECIAL INSTRUCTION

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

* Spare Part Request Form
* Pen

MIS-7

- TASK DESCRIPTION SHEET -

TASK NAME: Check and submit request form to (Add.) Assistant Engineer, Work request form

TASK NUMBER: MIS-11B

FREQUENCY: Whenever required

DESCRIPTION

1. Check if work request form has been filled in, completely. Also check whether the repair can be executed by the Linesman or Operator. If this is the case fill in a spare part request form together with the Linesman or Operator and continue with Task MIS-13A number 2. to 4.
2. If necessary, complete the work request form together with the Linesman or Operator;
3. Submit work request form to the (Additional) Assistant Engineer, who has to get approval from the Deputy Executive Engineer;

SPECIAL INSTRUCTION

1. IN CASE OF EMERGENCY, IMMEDIATE ACTION HAS TO BE TAKEN. IF THE (ADD.) ASSISTANT ENGINEER OR DEPUTY EXECUTIVE ENGINEER CAN NOT BE CONTACTED ORGANIZE THE EXECUTION OF THE REPAIR, IMMEDIATELY. COLLECT REQUIRED SPARE PARTS AND EXECUTE THE REPAIR WORKS WITH THE MOBILE REPAIR CREW.
2. If the execution of a repair completely disrupts the water supply to one or more villages, inform the (Additional) Assistant Engineer that alternative (tanker) supply has to be arranged. Also, inform the concerned Paani Panchayat(s) about the problems and the arrangements for supply of drinking water.

REQUIREMENTS:PARTS,TOOLS,EQUIPMENT

* Spare Part Request Form
* Work Request Form
* Pen

ANNEX 7. TASK DESCRIPTIONS LINESMAN

- TASK DESCRIPTION SHEET -

TASK NAME: Visual inspection TASK NUMBER: LM-1

FREQUENCY: Thrice per week

DESCRIPTION

Inspect pipe lines in the area assigned to you, and pay special attention to unnatural wet area along the pipe line route and try to find out the cause of such areas, if necessary excavation of wet areas has to be carried out to determine the cause.

Futhermore, particular attention should be given to the following aspects, as far as they are incorporated in the system:

1. Village level facilities:
   - Check if the domestic water meter is functioning, properly;
   - Check if there is any leakage, if necessary attend to it (see also TASK 7B);
   - Check the toolbox, are all the tools in good condition ?, are there tools missing ? (refer to tool list);
   - Check the availability of spare parts (refer to spare part list);
2. Check all bulk water meters, if they are functioning properly, if there is any leakage or corrosion;
3. Check all manometers, if they are functioning properly, if there is any leakage or corrosion;
4. Check all sluice valves for leakage;
5. Check all air valves for leakage.

If major leaks are detected or the cause of an unnatural wet area can not be explained notify the Mistry/Karkoon or (Add.) Ass. Engineer by filling in and submitting a work request form, immediately after completion of the inspection, indicating the nature and the location of the leak.

SPECIAL INSTRUCTION

If minor repairs have to be executed, refer to the following TASK DESCRIPTIONS:

- LM-3 for village level facilities;
- LM-5A for sluice valves;
- LM-5B for air valves;
- LM-4A for small holes in PVC pipes;
- LM-4B for leaking Gibault couplings.
- LM-8A for bulk water meters;
- LM-8B for domestic water meters;

REQUIREMENTS:PARTS,TOOLS,EQUIPMENT

* Detailed Map of the Distribution System

- TASK DESCRIPTION SHEET -

TASK NAME: Execution minor repairs of village level facilities

TASK NUMBER: LM-3

FREQUENCY: Whenever required

DESCRIPTION

A. Replacement of tap (missing or leaking):

1. Inform villagers, beforehand, concerning interruption of service;
2. Close the sluice valve in the pipe from the cistern to the stand post;
3. Remove tap with two adjustable wrenches, one on the pipe and the other on the tap (by using only one wrench the pipe to which the tap is connected might be damaged);
4. Install new tap with 2 adjustable wrenches;
5. Open the valve in the supply pipe;
6. Check if tap is leaking, if this is the case start again with 2.

B. Touch up plaster of stand post, cattle trough and cistern:

1. Inform villagers, beforehand, concerning interruption of service and close the sluice valve in the pipe from the cistern to the standpost;
2. Clean the spot to be repaired with a wire brush;
3. Keep the spot wet for some time (about 15 minutes);
4. Prepare a stiff mixture of cement mortar of 1 part cement and two parts of fine sand in a Ghamela;
5. Press the mortar firmly on the spot to be repaired;
6. Float the surface with a piece of plank and smooth it with a trowel;
7. The mortar should dry for 2 to 3 hours before the stand post can be used and keeping it wet for 3 days.

C. Repairing of cracks in stand post, cattle trough and cistern:

1. Inform villagers, beforehand, concerning interruption of service;
2. Open crack with hammer and chisel, at least 2 cm deep and 1.5 cm wide;
3. Clean the crack a wire brush;
4. Keep the spot wet for some time (about 15 minutes);
5. Prepare a stiff mixture of cement mortar of 1 part cement and two parts of fine sand in a Ghamela;
6. Press the mortar firmly in the crack;
7. Float the surface with a piece of plank and smooth it with a trowel;
8. The mortar should dry for 2 to 3 hours before the installation can be used, again. Keep the mortar wet for three days, except for the cistern which can be used after drying.

SPECIAL INSTRUCTION

Try to motivate Paani Panchayat to participate in the execution of minor repairs and if possible they could also contribute some basic materials.

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

* Two Adjustable Wrenches	* Chisel
* One Ghamela (bowl)	* A piece of Plank
* One Trowel	* Washers(for water meter)
* Cement	* Fine Sand
* Wire Brush	* Hammer

- TASK DESCRIPTION SHEET -

TASK NAME: Execution minor repairs of pipe lines

TASK NUMBER: LM-4

FREQUENCY: Whenever required

DESCRIPTION

A. Small hole in PVC pipe:

1. Inform villagers, beforehand, concerning interruption of service;
2. Close the upstream sluice valve, and also the downstream sluice valve (if any) with a valve key;
3. Put the specially manufactured clamp in position around the pipe;
4. Prepare a rubber sheet. Take care to cut the right size;
5. Fix the rubber sheet on the hole and put the clamp around it and keep it in place with your hands;
6. Tighten the bolts and nuts with an adjustable wrench;
7. Open the upstream valve;
8. Check if there is still any leakage and if necessary tighten the bolts and nuts;
9. Open the downstream sluice valve, if any;
10. Report to Mistry/Karkoon or (Add.) Ass. Engineer by filling in and submitting a work request form if the clamp remains leaking.

B. Leaking Gibault coupling:

1. Tighten the bolts and nuts of the Gibault coupling with two adjustable wrenches;
2. Report to Mistry/Karkoon or (Add.) Ass. Engineer by filling in and submitting a work request form if the Gibault coupling remains leaking.

SPECIAL INSTRUCTION

1. If the clamp remains leaking but it is only a small leak, the sluice valve(s) can be kept open to continue the supply until it is repaired properly. However, if it is a larger leak the sluice valve(s) have to be closed to prevent excessive losses. In both cases the Mistry/ Karkoon or (Add.) Ass. Engineer has to be informed immediately.
2. If required, Linesmen of neighbouring villages and/or the Paani Panchayat can be requested for assistants for the execution of the repair to get the leak repaired, as soon as possible.

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

* Repair Clamp
* Rubber Sheet
* (Sharp) Knife
* Two Adjustable Wrenches
* Valve Key

- TASK DESCRIPTION SHEET -

TASK NAME: Checking valves, Sluice valves

TASK NUMBER: LM-5A

FREQUENCY: Quarterly

DESCRIPTION

1. Fully close the sluice valve with valve key;
2. Fully open the sluice valve with valve key;
3. Note down number of turns required to close and open the valve in the logbook, and compare this with previous result. If there is a big difference do it once more again and note down the number of turns;
4. Check the condition of the concrete of the sluice valve chamber. Pay special attention to the concrete cover, if this cover and/or the sluice valve are damaged regularly the cover should be replaced by a mild steel cover equipped with a lock;
5. Take off the cover of the sluice valve chamber;
6. Clean the sluice valve chamber, remove dirt and leaves;
7. Check the sluice valve for leakage. If the connection of the sluice valve with the pipe is leaking, tighten the bolts and nuts with an adjustable wrench. If the sluice valve is leaking from the top continue as follows:
   - Remove the gland with an adjustable wrench;
   - Remove the packing with a screwdriver;
   - Fix in a new packing;
   - Fix the gland back with an adjustable wrench;
8. Check the sluice valve body, bolts and nuts for corrosion;
9. Remove any corrosion with a wire brush;
10. Repaint sluice valve with bituminous paint and paint brush, if corrosion had to be removed;
11. If necessary, report the following to Mistry/Karkoon or (Add.) Ass. Engineer by filling in and submitting a work request form :
    - Sluice valve chamber has to be repaired or replaced;
    - Cover of the sluice valve chamber has to be replaced with a mild steel cover equipped with lock;
    - Sluice valve remains leaking even after execution of minor repairs;
    - The number of turns required to close and open the sluice valve differs from previous results (sluice valve has to be replaced).

SPECIAL INSTRUCTION

1. Close and open the sluice valve slowly, do not over tighten valves, and do not apply excessive force while operating the valve. The valve should always be operated with the proper valve key without using any extra leverage;
2. The minor repair of the sluice valve should also be conducted if leakage is detected during Visual Inspection.

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

* Wire Brush
* Adjustable Wrench
* Logbook for Sluice Valve
* Pen
* Packing
* Paint Brush
* Bituminous Paint
* Screwdriver
* Valve Key (for different diameter valves)

- TASK DESCRIPTION SHEET -

TASK NAME: Checking valves, Air valves

TASK NUMBER: LM-5B

FREQUENCY: Quarterly

DESCRIPTION

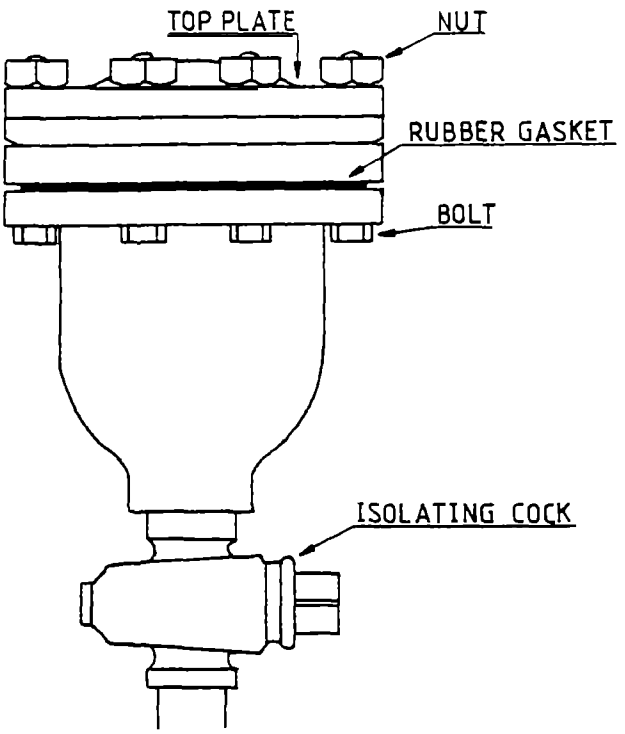
1. Clean the area around the air valve and remove bushes within a range of one metre;
2. Remove leaves, dirt, dust etc. from the air valve;
3. Check that the ball of the air valve (Figure LM-5B.1) can be moved freely as follows;
   - Remove top plate by loosening the bolts and nuts with an adjustable wrench;
   - If it is a **Double Air Valve** (Figure LM-5B.2) try to move both balls with a steel pin, other wise there is only one ball to be moved;
   - Replace the top plate;
4. Check the air valve for leakage along the connection with the pipe (only for Double Air Valve). If this is the case tighten the bolts and nuts with an adjustable wrench.
5. Check the air valve body, bolts and nuts for corrosion;
6. Remove any corrosion with a wire brush;
7. Repaint air valve with bituminous paint and paint brush, if corrosion had to be removed.
8. If necessary, report the following to Mistry/Karkoon or (Add.) Ass. Engineer by filling in and submitting a work request form :
   - The ball(s) can not be moved freely;
   - The double air valve remains leaking even after tightening the bolts and nuts;
   - The **Small Orifice Air Valve** is leaking.

SPECIAL INSTRUCTION

REQUIREMENTS:PARTS,TOOLS,EQUIPMENT

* Adjustable Wrench
* Wire Brush
* Steel Pin (which fits trough small orifice)
* Paint Brush
* Bituminous Paint

SINGLE AIR VALVE



SINGLE AIR VALVE
[WITHOUT TOP PLATE]

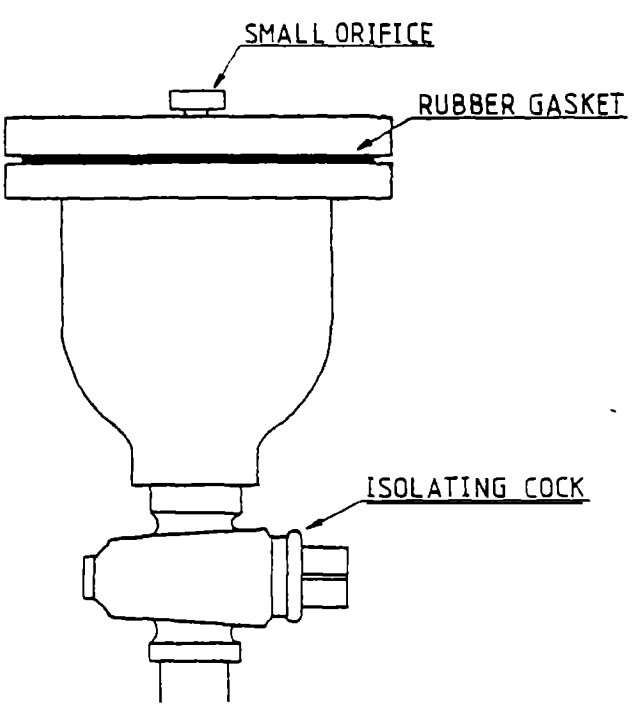
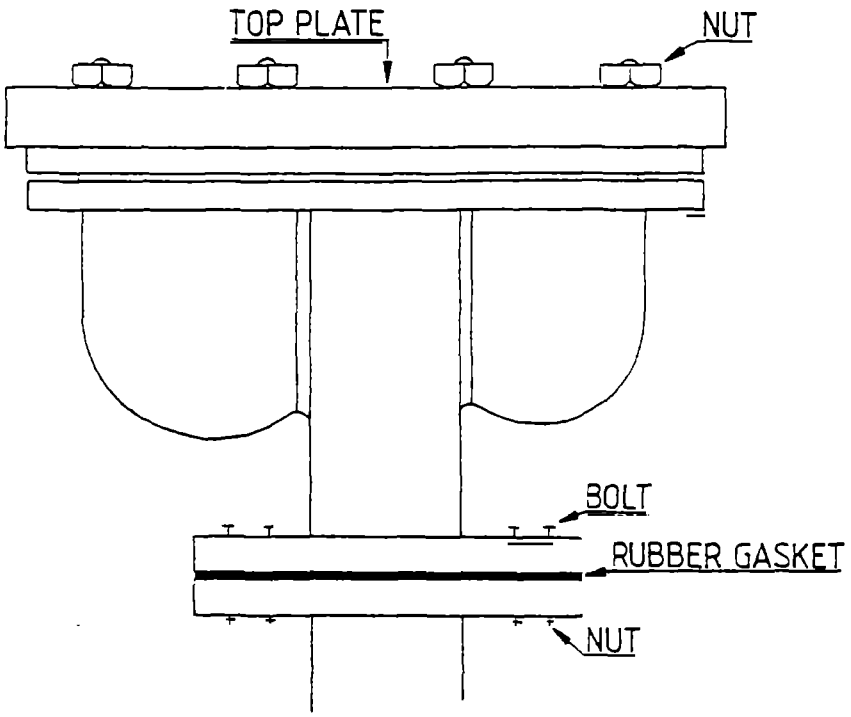


FIGURE LM-5B.1
SINGLE AIR VALVE

DOUBLE AIR VALVE



DOUBLE AIR VALVE
[WITHOUT TOP PLATE]

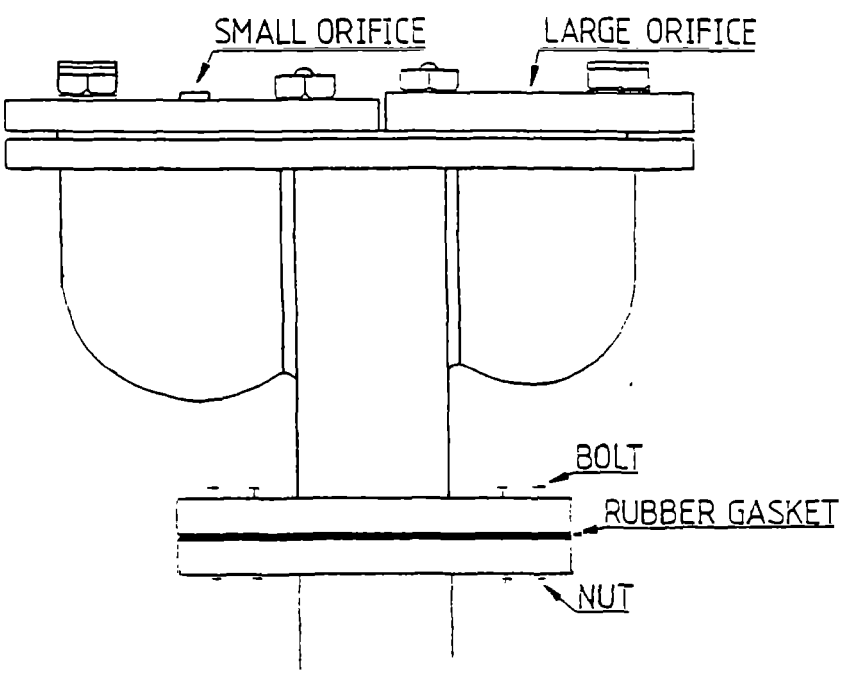


FIGURE LM-5B.2
DOUBLE AIR VALVE

- TASK DESCRIPTION SHEET -

TASK NAME: Cleaning of stand posts and cattle troughs

TASK NUMBER: LM-6

FREQUENCY: Weekly

DESCRIPTION

Cleaning stand post:

1. Check general cleanness of the stand post and surrounding area;
2. Advise and encourage the villagers to keep the stand post and surrounding proper and nice, if necessary;
3. Check whether the villagers utilize the spillage water from the stand posts for gardening. If this is not the case, advise the Paani Panchayat to take this issue up. If necessary put forward suggestions on how to use the spillage water;
4. Remove dirt, leaves, dust, etc. from the stand post and surrounding;
5. Attend to clogged drain and soak away, if necessary.

Cleaning of cattle trough:

1. Take care that the cattle trough is empty or almost empty, to reduce wastage to a minimum and close the supply valve;
2. Advise and encourage the villagers to keep the cattle trough and surrounding proper and nice, if necessary;
3. Drain the cattle trough by opening the drain valve;
4. Remove dirt, leaves, dust, etc. from the cattle trough;
5. Close the drain valve and open the supply valve and close it again when the trough is full.

SPECIAL INSTRUCTION

During cleaning of the stand post also check if there are any crack that have to be attended to. For proper repair of cracks see TASK LM-3.

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

* Besom

- TASK DESCRIPTION SHEET -

TASK NAME: Cleaning cistern TASK NUMBER: LM-7

FREQUENCY: Quarterly

DESCRIPTION

1. Inform villager before hand, concerning the interruption of the service;
2. Close the sluice valve in the supply pipe to the cistern with the valve key. Catch some of the water from the stand post in a jar (50 liters) for cleaning the cistern and yourself;
3. Open drain valve to completely empty the cistern. Use part of the water for preparation of chlorinated water (50 mg/l). Before entering the cistern, take off your shoes and wash your feet with chlorinated water (water can also be taken from the cattle trough, if necessary);
4. Brush the floor, wall and ceiling with a wire brush;
5. Check the floor, and wall for cracks, if there are any follow task description LM-3C;
6. Remove all dirt and dust from the cistern;
7. Clean the floor, wall, and the ceiling with chlorinated water, and afterwards with plain water. Take care the drain valve is still open;
8. Close the drain valve;
9. Open the sluice valve in the supply pipe to the cistern.

SPECIAL INSTRUCTION

Pay special attention to the spillage water from the cistern, take care it is properly drained and that no pools are formed.

REQUIREMENTS:PARTS,TOOLS,EQUIPMENT

* Wire Brush
* Jar
* Valve Key
* Bleaching Powder

- TASK DESCRIPTION SHEET -

TASK NAME: Reading, recording, and maintaining of water meters, Bulk water meters

TASK NUMBER: LM-8A

FREQUENCY: Daily

DESCRIPTION

1. Note down the date and the time;
2. Read the bulk water meter as follows (Figure LM-8A), if it is a water meter with six dials:
   - Note down the lowest whole number indicated by the pointer on the scale marked * 100.000;
   - Note down the lowest whole number indicated by the pointer on the scale marked * 10.000;
   - Note down the lowest whole number indicated by the pointer on the scale marked * 1.000;
   - Note down the lowest whole number indicated by the pointer on the scale marked * 100;
   - Note down the lowest whole number indicated by the pointer on the scale marked * 10;
   - Note down the lowest whole number indicated by the pointer on the large scale.

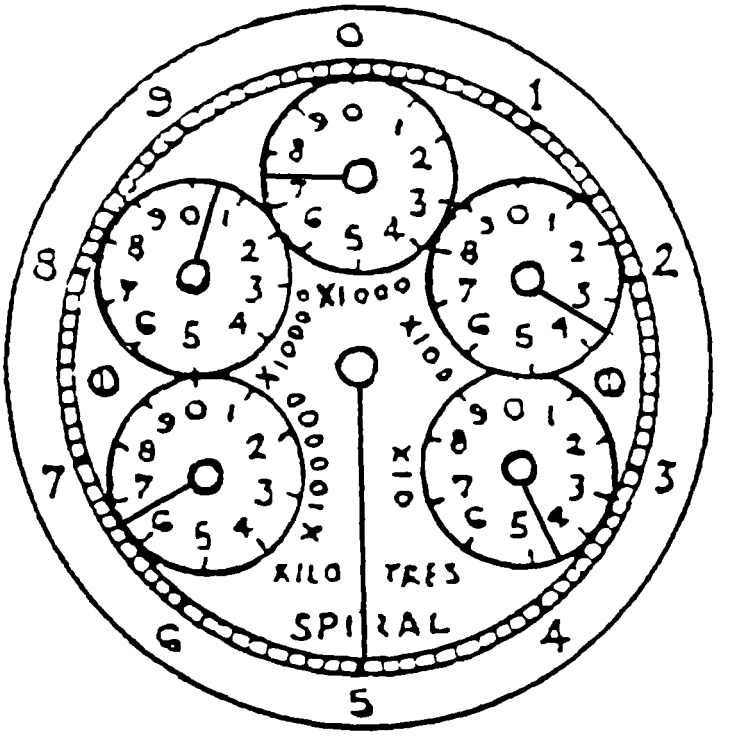
   If it is a digital bulk water meter, read the numbers, directly;
3. Calculate the daily amount by subtracting the reading of the previous day from the reading, and note it down;
4. Check for leakage along the connection of the bulk water meter, if leakage is detected, tighten bolts and nuts with adjustable wrench. If leakage remain notify Mistry/Karkoon or (Add.) Ass. Engineer by filling in and submitting a work request form.

SPECIAL INSTRUCTION

If the water meter is not recording notify the Mistry/Karkoon or (Add.) Ass. Engineer by filling in and submitting a work request form, as soon as possible to get it replaced.

REQUIREMENTS:PARTS,TOOLS,EQUIPMENT

* Logbook for Bulk Water Meter
* Sandpaper
* Valve Key
* Pen
* Two Adjustable Wrenches



(1) READ INNER SCALE (LEFT UNDER) MARKED *100000
- POINTER BETWEEN 6 AND 7
- NOTE DOWN 6

CONTINUE WITH INNER SCALES, READING THEM CLOCK WISE

(2) READ SCALE MARKED *10000
- POINTER BETWEEN 0 AND 1
- NOTE DOWN 0

(3) READ SCALE MARKED *1000
- POINTER BETWEEN 7 AND 8
- NOTE DOWN 7

(4) READ SCALE MARKED *100
- POINTER BETWEEN 3 AND 4
- NOTE DOWN 3

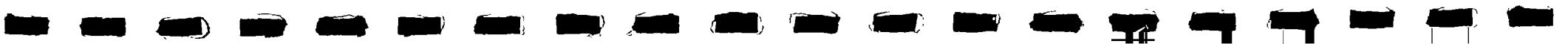
(5) READ SCALE MARKED *10
- POINTER BETWEEN 4 AND 5
- NOTE DOWN 4

NOW ALL INNER SCALES HAVE BEEN READ, CONTINUE WITH OUTER SCALE

(6) READ LARGE SCALE (OUTER RING)
- POINTER EXACTLY ON 5
- NOTE DOWN 5

CONCLUSION: READING = 607345 KILOLITERS = 607345 m3

FIGURE LM-8A
Bulk Water Meter



- TASK DESCRIPTION SHEET -

TASK NAME: Reading, recording, and maintaining of water meters, Domestic water meters

TASK NUMBER: LM-8B

FREQUENCY: Daily

DESCRIPTION

1. Note down the date and the time;
2. Read the digital on the domestic water meter and note it down;
3. Calculate the daily amount by subtracting the reading of the previous day from the reading, and note it down;
4. Check for leakage along the connection of the domestic water meter, if leakage is detected, tighten connection with 2 adjustable wrenches. If leakage remains adjust as follows:
   - Close the sluice valve just before the meter with the valve key;
   - Loosen the connection with 2 adjustable wrenches;
   - Take out the water meter and remove the washers at both sides;
   - Smoothen surfaces where the washers were fixed and the contact surfaces attached to the pipe with sandpaper and fix new washers;
   - Put the domestic water meter back;
   - Tighten the connection, first by hand, and thereafter with 2 adjustable wrenches (take care that the thread is not damaged);
   - Open sluice valve with the valve key and check if connection is leaking. If it is leaking tighten the connection with 2 adjustable wrenches. If connection still leaks notify the Mistry/Karkoon or (Add.) Ass. Engineer by filling in and submitting a work request form.

SPECIAL INSTRUCTION

If the water meter is not recording notify the Mistry/Karkoon or (Add.) Ass. Engineer by filling in and submitting a work request form, as soon as possible to get it replaced.

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

* Logbook for Domestic Water Meter
* Sandpaper
* Valve Key
* Pen
* Washers
* Two Adjustable Wrenches

- TASK DESCRIPTION SHEET -

TASK NAME: Reading and recording manometer TASK NUMBER: LM-9

FREQUENCY: Every three hours

DESCRIPTION

1. Note down the date (only for the first reading of the day) and the time in the logbook;
2. Read the manometer in kg/cm^2, take care to read the right scale;
3. Make double entries in the logbook, one set of the entries remains in the logbook while the other has to be handed over to the Mistry/Karkoon or (Add.) Ass. Engineer, daily.
4. Check whether there is any leakage and try to adjust it with an adjustable wrench. If it remains leaking notify the Mistry/Karkoon or (Add.) Ass. Engineer by filling in and submitting a work request form;

SPECIAL INSTRUCTION

1. If the manometer is not recording notify the Mistry/Karkoon or (Add.) Ass. Engineer by filling in and submitting a work request form, as soon as possible to get it replaced.
2. If time is available, more readings can be taken.
3. Manometers installed at sub division or section offices can be read more often.

REQUIREMENTS:PARTS,TOOLS,EQUIPMENT

* Logbook for Manometer
* Pen
* Adjustable Wrench

LM-11

- TASK DESCRIPTION SHEET -

TASK NAME: Attend meeting of Paani Panchayat TASK NUMBER: LM-14

FREQUENCY: Monthly

DESCRIPTION

The meeting with the Paani Panchayat is an opportunity to discuss problems with regard to the water supply at village level. However, it is also possible initiate participation of the people in the maintenance of the village level facilities. Pay special attention to the following aspects:

- Cleanness of stand post and cattle trough;
- Drainage of spillage water from stand post and cattle trough;
- Assistance of the people with the execution of minor repairs, either through labour and/or supply of basic materials, like taps and washers;

Try to put forward suggestions to involve the people in these aspects.

SPECIAL INSTRUCTION

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

ANNEX 8. TASK DESCRIPTIONS OPERATOR

OP-1

- TASK DESCRIPTION SHEET -

TASK NAME: Operation of pump TASK NUMBER: OP-1

EQUIPMENT NAME: Submersible pump (KSB or Calama)

FREQUENCY: Daily

DESCRIPTION

1. Close the sluice valve;
2. Switch on the pump and note down the date and time in the logbook. If pump does not start check the switch for burnt contacts. Burnt contacts have to be renewed, if it is found out that the contacts are burnt continuously notify the Mistry by filling in and submitting a work request form;
3. Start the pump again, if the pump still doesn't start notify the Mistry by filling in and submitting a work request form, immediately. Otherwise continue with number 4.;
4. Open the sluice valve gradually until the ammeter indicates the lower current shown on the data sheet;
5. For stopping of the pump: close the sluice valve completely and then switch off the motor. Note down the time in the logbook and calculate the running hours and add it to the total running hours;

SPECIAL INSTRUCTION

1. During operation of the pump check the pressure (compare with value on data sheet) and ensure that the pump performance satisfactory, and the if capacity is reduced, the pump has to be switched off and the Mistry has to be notified by filling in and submitting a work request form.
2. During power cut, close the sluice valve and continue with Task OP-4, and thereafter return to Task OP-1.

REQUIREMENTS:PARTS,TOOLS,EQUIPMENT

* Spare Contacts
* Logbook for Tube Well Pump
* Pen

- TASK DESCRIPTION SHEET -

TASK NAME: Run diesel engine and check functioning TASK NUMBER: OP-3A

EQUIPMENT NAME: Kirloskar diesel engine

FREQUENCY: Daily

DESCRIPTION

1. Check in the logbook whether the diesel engine has already run earlier during the day and if the daily maintenance has been completed. If this is not the case continue with number 2. otherwise stop with this task;
2. Check diesel level in the tank of the engine, if tank is more then half full, refill with funnel from storage tank;
3. Check the oil level (Figure OP-3A):
   - Take out dipstick;
   - Wipe dipstick clean with clean non-fraying cloth;
   - Push dipstick back, as far as possible;
   - Take out dipstick, and read oil level and replace dipstick;

   Oil level on dipstick should extend to upper level. If necessary, top up with motor oil and check oil level again. UNDER NO CIRCUMSTANCE SHOULD THE MAXIMUM OIL LEVEL BE EXCEEDED;
4. Check water level and refill with clean water with the help of watering-can, if necessary;
5. Check oil level in air cleaner, top up if necessary (Figure OP-3A);
6. Clean the battery with damp cloth and check electrolyte level in each cell, as follows (Figure OP-3A):
   - Unscrew the cap;
   - Insert clean wooden stick until it touches the lead plates;
   - Take out the stick and see if stick is wet. The stick should be wet over a length of 10 to 15 mm. If level is low, top up with distilled water, and replace cap;
7. Enter date in logbook and indicate completion of daily maintenance;
8. Start engine, if engine doesn't start check if battery connection are loose, tighten if necessary. After 1 minute try again. If engine still doesn't start notify the Mistry by filling in and submitting a work request form, otherwise continue with number 9. and note down the time in the logbook;
9. Let the engine run at moderate load for five minutes before applying full load. After the engine has been running for half an hour check the oil pressure, temperature, and generator output. If readings are not within the limits indicated on the data sheet or the meters are not working stop the diesel engine and notify the Mistry by filling in and submitting a work request form. Otherwise continue with number 10.;
10. Check the exhaust smoke coming from the exhaust pipe, if it remains dark, shut off the engine and notify the Mistry by filling in and submitting a work request form;
11. After one hour let the engine run idle for at least 3 minutes, and only than switch off the engine;
12. Note down the time and working hours in the logbook and calculate the total working hours since the last overhaul. If total more then 800 hours, notify the Mistry by filling in and submitting a work request form;

- TASK DESCRIPTION SHEET -

TASK NAME:	Run diesel engine and check functioning	TASK NUMBER:	OP-3A

CONTINUED

DESCRIPTION (CONTINUED)

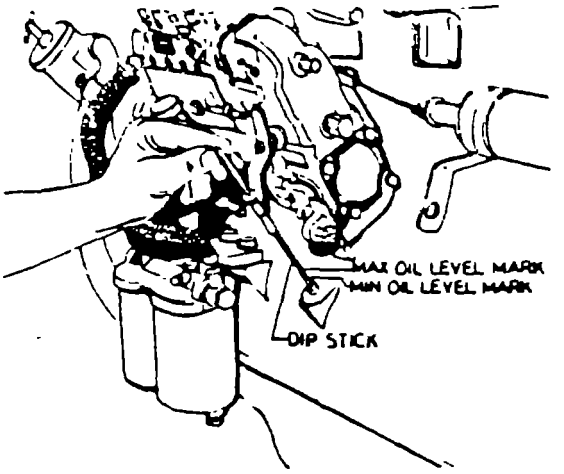
13. Clean the outside parts with a piece of cloth;
14. Check bolts and nuts on the frame that keeps the engine attached to the floor and tighten with adjustable wrench and spanner, if necessary;

SPECIAL INSTRUCTION

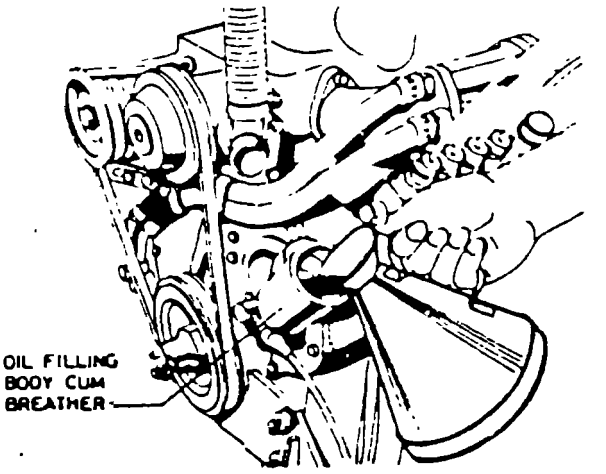
1. There have to be four storage tanks for diesel in the engine building, if a tank is empty contact the Mistry by filling in and submitting a spare part request form to get it refilled.
2. If the motor oil is half finished, notify the Mistry by filling in and submitting a spare part request form for new supply;
3. If the engine doesn't start wait one minute before to try again. NEVER TRY TO START THE ENGINE MORE THAN 4 TIMES AND DO NOT PUSH THE BOTTOM LONGER THAN 5 TO 10 SECONDS.
4. ON NO ACCOUNT SHOULD THE STARTER BE OPERATED WHEN THE ENGINE IS RUNNING.
5. After starting the engine let it run at moderate load for 5 minutes to bring the engine up to its normal temperature before applying full load.
6. Whenever problems occur refer to the detailed Kirloskar Operation and Maintenance Manual.

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

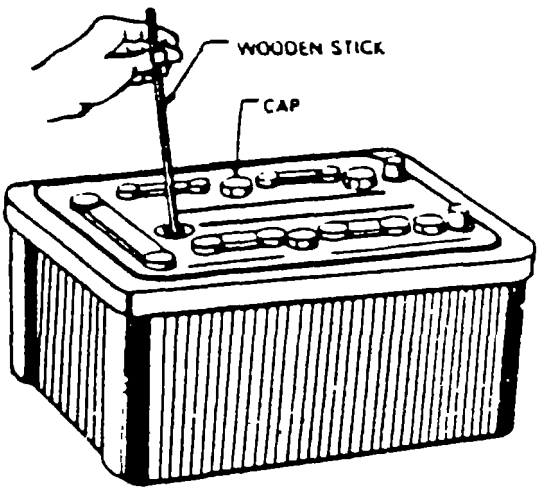
* Logbook Diesel Engine	* Pen	* Sandpaper
* Four Storage Tanks	* Piece of Cloth	* Funnel
* Adjustable Wrench	* Watering-can	* Spanners as required
* Motor Oil (HD type-3, SAE 30)		



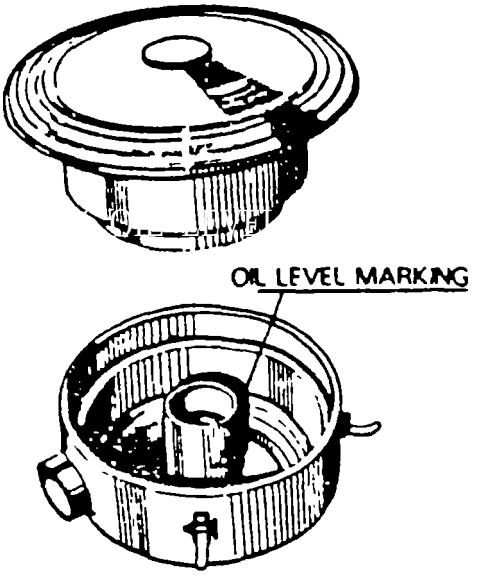
DIPSTICK



TOP UP OIL



CHECK BATTERY



CHECK OIL LEVEL
AIR CLEANER

FIGURE OP-3A

- TASK DESCRIPTION SHEET -

TASK NAME: Check belt TASK NUMBER: OP-3B

EQUIPMENT NAME: Kirloskar diesel engine

FREQUENCY: Monthly

DESCRIPTION

1. Check belt, make sure the belt is not worn out and that it is proper alignment. If the belt is worn out request for replacement by filling in and submitting a spare part request form;
2. Check the belt tension as follows (Figure OP-3B):
   - Pass a string, tight over the outer face of the belt;
   - Press the belt inward as far as possible with a marked straight edge;
   - Read the difference between the belt and the undisturbed string. Reading should be between 8 to 10 mm. If this is not the case the belt tension should be adjusted by a mechanic;
3. Note down in the logbook the date and indicate that belt has been checked, and whether it has to be adjusted, replaced or it is still in order. If belt is not okay notify the Mistry by filling in and submitting a spare part request form to replace the belt. Fill in work request form if the belt tension has to be adjusted.

SPECIAL INSTRUCTION

1. This should be done with the engine off.
2. Whenever problems occur refer to the detailed Kirloskar Operation and Maintenance Manual.

REQUIREMENTS:PARTS,TOOLS,EQUIPMENT

* Logbook Diesel Engine
* Pen
* Marked Straight Edge
* String

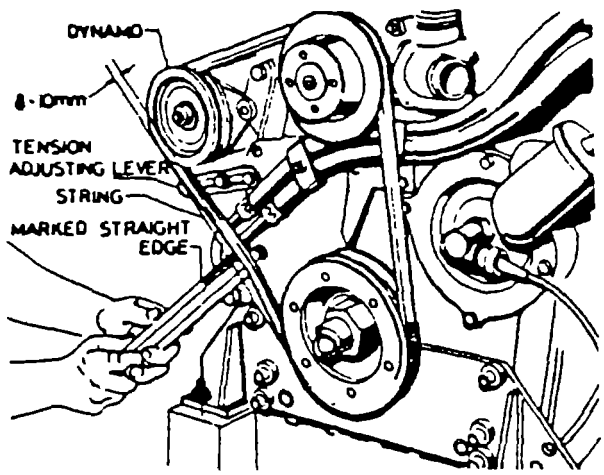


FIGURE OP-3B
CHECK BELT

- TASK DESCRIPTION SHEET -

TASK NAME: Clean air cleaner TASK NUMBER: OP-3C

EQUIPMENT NAME: Kirloskar diesel engine

FREQUENCY: Every 50 working hours but at least monthly

DESCRIPTION

1. Check if the engine has been switched off for at least one hour, so that oil has dripped from the cleaner into the bowl;
2. Dismantle the air cleaner;
3. Pour out the dirty oil from the bowl;
4. Clean all components with clean diesel and a paint brush;
5. Let the diesel drain out completely;
6. Fill the bowl up to the oil level mark with fresh motor oil (Figure OP-3C);
7. Reassemble the components;
8. Fix the air cleaner on the engine;
9. Check the unions and the connections of the air inlet monifold. Tighten them, if necessary;
10. Note down in the logbook the date and indicate that the air cleaner has been cleaned;

SPECIAL INSTRUCTION

1. DUST IN THE COMBUSTION AIR WILL CAUSE PREMATURE WEAR OF THE ENGINE. REGULAR CLEANING OF THE AIR CLEANER IS THEREFORE ESSENTIAL TO ENSURE LONG LIFE.
2. Whenever problems occur refer to the detailed Kirloskar Operation and Maintenance Manual.
3. Take care of proper disposal of used oil and diesel.

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

* Paint Brush
* Diesel
* Spanners
* Bowl for Cleaning
* Logbook Diesel Engine

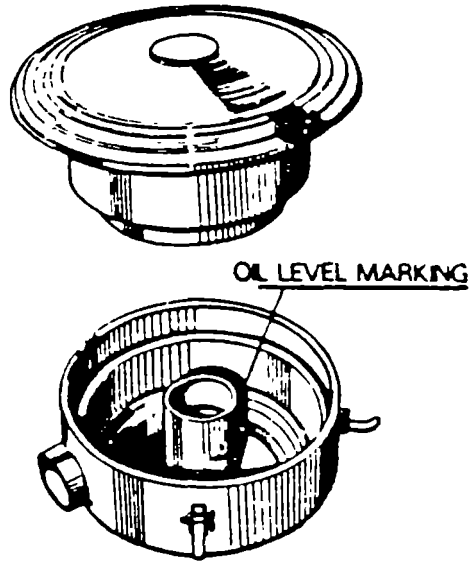


FIGURE OP-3C
AIR CLEANER

- TASK DESCRIPTION SHEET -

TASK NAME: Clean oil filter TASK NUMBER: OP-3D

EQUIPMENT NAME: Kirloskar diesel engine

FREQUENCY: Every 200 working hours but at least quarterly

DESCRIPTION

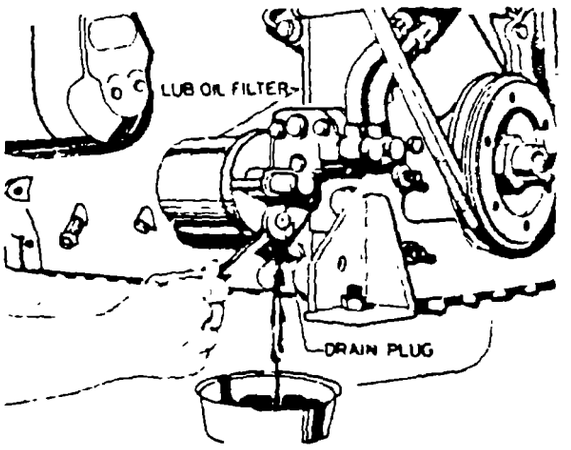
1. Drain the oil from the oil filter by loosening the drain plug (Figure OP-3D);
2. Unscrew the center bolt of the filter and remove the bowl and the discs;
3. Clean the bowl and the discs with diesel oil and a paint brush;
4. Reassemble the filter discs and fix the bowl with the center bolt.
5. Note down in the logbook the date and indicate that the oil filter has been cleaned;

SPECIAL INSTRUCTION

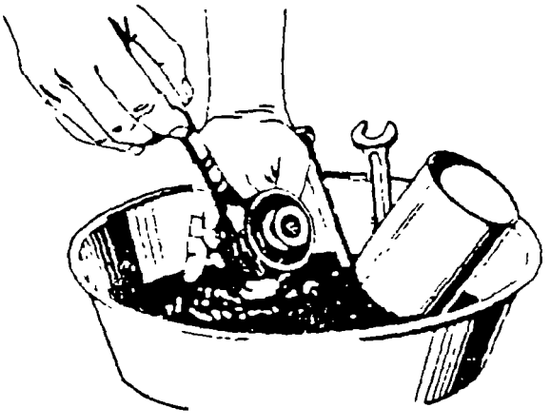
1. DO NOT FORGET TO PUT ONE OF THE WASHERS IN BETWEEN THE TWO DISCS. IF THIS IS NOT DONE THE OIL WILL NOT PASS THE FILTER, AT ALL.
2. Whenever problems occur refer to the detailed Kirloskar Operation and Maintenance Manual.
3. Take care of proper disposal of used oil and diesel.

REQUIREMENTS:PARTS,TOOLS,EQUIPMENT

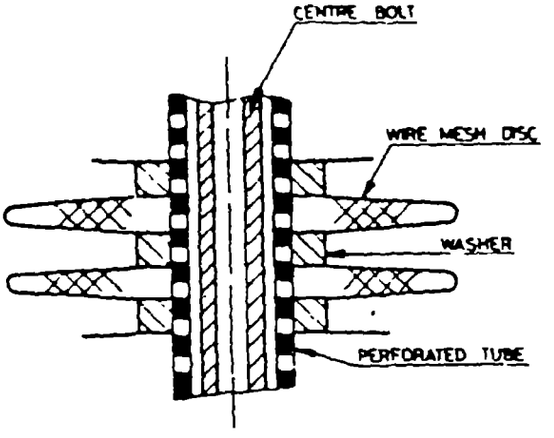
* Paint Brush
* Diesel Oil
* Spanner
* Bowl for Cleaning
* Logbook Diesel Engine



LOOSEN DRAIN PLUG



CLEAN IN DIESEL



FILTER DISCS WITH WASHERS

FIGURE OP-3D
CLEAN OIL FILTER

- TASK DESCRIPTION SHEET -

TASK NAME: Clean fuel filter and tank TASK NUMBER: OP-3E

EQUIPMENT NAME: Kirloskar diesel engine

FREQUENCY: Every 200 working hours but at least quarterly

DESCRIPTION

Fuel filter

1. Drain both the primary and secondary fuel filters by loosening the drain plug (Figure OP-3E);
2. Let all the fuel drain in a can;
3. Tighten the drain plug;
4. Note down in the logbook the date and indicate that the fuel filter has been cleaned;

Fuel tank

1. Drain the fuel tank by loosening the drain plug;
2. Remove the sediments which accumulate at the bottom;
3. Ensure that the breather hole of the tank is not blocked;
4. Fill the tank with clean diesel;
5. Note down in the logbook the date and indicate that the fuel tank has been cleaned;

SPECIAL INSTRUCTION

1. TO AVOID INGRESS AND DIRT FROM ENTERING THE ENGINE, ALWAYS USE PROPER FUEL TANK CAP WITH RUBBER SEALING.
2. Whenever problems occur refer to the detailed Kirloskar Operation and Maintenance Manual.
3. Take care of proper disposal of used diesel.

REQUIREMENTS:PARTS,TOOLS,EQUIPMENT

* Diesel
* Spanner
* Logbook Diesel Engine

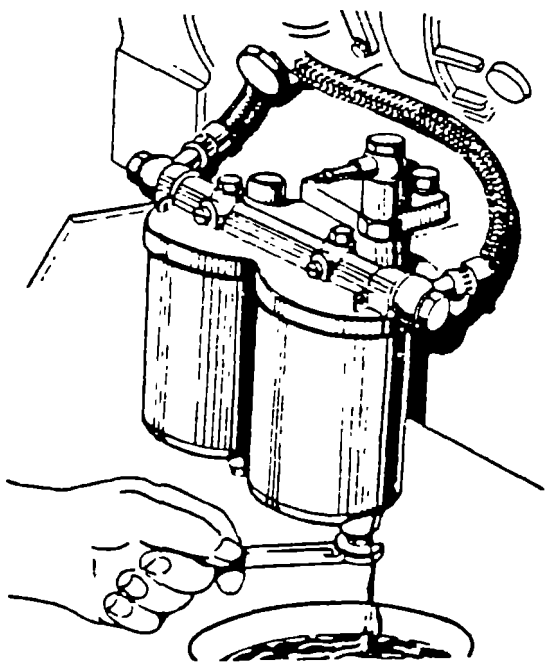


FIGURE OP-3E
CLEAN FUEL FILTER

- TASK DESCRIPTION SHEET -

TASK NAME: Change oil TASK NUMBER: OP-3F

EQUIPMENT NAME: Kirloskar diesel engine

FREQUENCY: Every 400 hours but at least once per year

DESCRIPTION

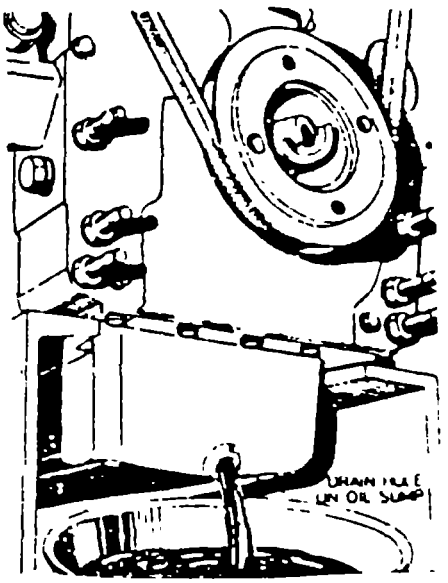
1. Get a can to contain the used oil and put it under the oil drain plug;
2. Remove the oil drain plug with a spanner (Figure OP-3F);
3. Wait until all the used oil has been drained, take care the does not drain on the floor;
4. Flush out by filling the oil container with flushing oil, and let it drain completely out of the engine;
5. Fix the oil drain plug with a spanner;
6. Refill the oil up to the top mark on the dipstick, which should come to about 9.5 litre. DO NOT EXCEED THE TOP MARK ON THE DIPSTICK;
7. Check the oil level and top up, if necessary
8. Note down in logbook the date and that oil has been changed.

SPECIAL INSTRUCTION

1. This can be done best when the engine is still hot, because the oil will drain out easily.
2. Whenever problems occur refer to the detailed Kirloskar Operation and Maintenance Manual.
3. take care of proper disposal of used oil.

REQUIREMENTS:PARTS,TOOLS,EQUIPMENT

* Motor Oil (HD type-3, SAE 30)
* Spanner
* Can for containing used oil
* Flushing Oil
* Logbook Diesel Engine



DRAIN OIL

FIGURE OP-3F
CHANGE OIL

- TASK DESCRIPTION SHEET -

TASK NAME: Check oil level in fuel injection pump

TASK NUMBER: OP-3G

EQUIPMENT NAME: Kirloskar diesel engine

FREQUENCY: Every 400 working hours but at least once per year

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DESCRIPTION

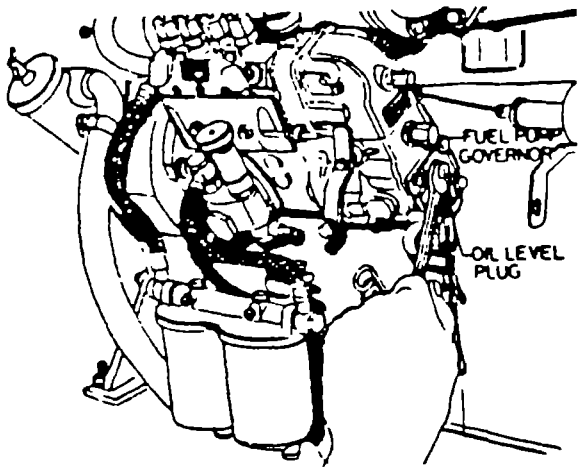
1. Loosen oil level control plug, oil should flow out through the plug after loosening (Figure OP-3G);
2. If required top up oil through breather hole of govenor housing until the oil flows out through the plug;
3. Tighten the oil level control plug;
4. Note down in the logbook the date and indicate that the oil level of the fuel injection pump has been checked;

SPECIAL INSTRUCTION

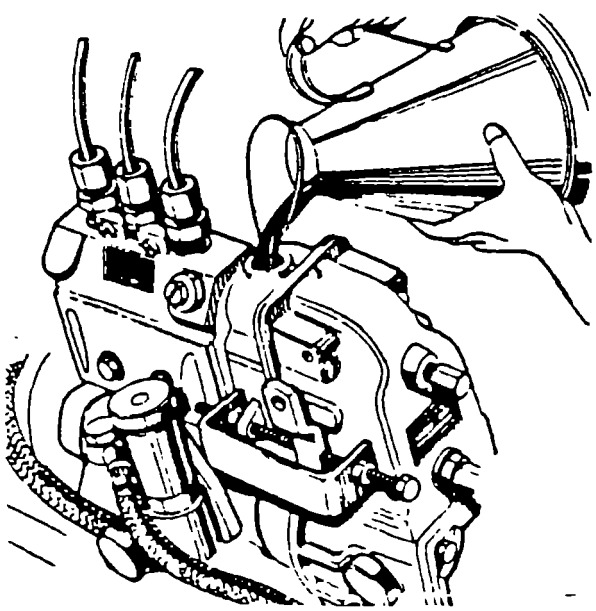
Whenever problems occur refer to the detailed Kirloskar Operation and Maintenance Manual.

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

* Motor Oil (HD type-3, SAE 30)
* Spanner
* Pen
* Logbook Diesel Engine



LOOSEN OIL LEVEL PLUG



TOP UP OIL

FIGURE OP-3G CHECK
OIL LEVEL IN FUEL INJECTION PUMP

- TASK DESCRIPTION SHEET -

TASK NAME:	Operate diesel generating set	TASK NUMBER:	OP-4
EQUIPMENT NAME:	Kirloskar diesel engine		
FREQUENCY:	Whenever required		

DESCRIPTION

1. Check in the logbook whether daily maintenance has been conducted earlier during the day. If this is not the case continue with TASK OP-3A (number 2. to 7.) otherwise with number 2. of this Task;
2. Enter date in the logbook;
3. Start engine, if engine doesn't start clean the battery contact with sandpaper and a piece of cloth and start the engine again. If engine still doesn't start notify the Mistry by filling in and submitting a work request format once, otherwise note down the time in the logbook continue with number 4.
4. Check the generator output, if not according to output registered on data sheet shut off the engine and notify the Mistry by filling in and submitting a work request form. If output of generator is okay start the pump (see Task OP-1);
5. Check the exhaust smoke coming from the exhaust pipe, if it remains dark, shut off the engine and pump, and notify the Mistry by filling in and submitting a work request form;
6. Check every half our the oil pressure, temperature, and the generator output;
7. Stop the diesel engine whenever power returns, stop the pump and switch back to electrical power and start the pump (see Task OP-1, number 1. to 4.);
8. Note down the time and calculate working hours and total working hours in the logbook and calculate the total working hours since the last overhaul. If total more then 800 hours, notify the Mistry by filling in and submitting a work request form;

SPECIAL INSTRUCTION

Notify the Mistry if one or more diesel storage tanks have to be refilled by filling in a spare part request form.

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

* Logbook Diesel Engine	* Lubricator pump	* Pen
* Sandpaper	* Brush	* Piece of Cloth
* Funnel	* Adjustable Wrench	* Watering-can
* Spanners as required		

OP-11

- TASK DESCRIPTION SHEET -

TASK NAME: Reading, recording, and checking bulk water meter

TASK NUMBER: OP-5

FREQUENCY: Daily

DESCRIPTION

1. Note down the date (only at the beginning of the first shift) and the time at the beginning of each shift in the logbook. If the water meter is not recording notify the Mistry by filling in and submitting a work request form;
2. Read the bulk water meter at the beginning and end of each shift and note them down in the logbook;
3. Calculate the amount at the end of the shift by subtracting the reading of at the beginning from the reading at the end, and note it down in the logbook;
4. Check for leakage along the connection of the bulk water meter, if leakage is detected, tighten bolts and nuts with adjustable wrench. If leakage remain notify Mistry by filling in and submitting a work request form.

SPECIAL INSTRUCTION

At the end of the last shift of the day, calculate the daily water produced, and note it down in the logbook.

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

* Logbook Tube Well Bulk Water Meter
* Pen
* Two Adjustable Wrenches

- TASK DESCRIPTION SHEET -

TASK NAME: Execute water table and draw down test

TASK NUMBER: OP-7

FREQUENCY: Monthly

DESCRIPTION

1. Note down the date in the tube well logbook;
2. Measure the water level of the tube well after the pump has been running for at least 2 hours with electronic measuring tape and note it down in the logbook in the column **Dynamic Water Level** together with the date;
3. Switch off the pump (see Task OP-1 number 5.);
4. Wait for 2 hours and measure the water level again and note it down in the logbook in the column **Static Water Level**;
5. Subtract the second measurement from the first and note down the result in the logbook in the column **Draw Down**;
6. If necessary, start the pump according to Task OP-1 number 2. to 4.).

SPECIAL INSTRUCTION

1. This Task should be done under supervision of the (Add.) Assistant Engineer.
2. Check the Dynamic Water Level in relation to the Pump Setting, pump setting should be between 3 to 4 meters lower than the dynamic water level. If this is not the case the Mistry should be notified immediately.

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

* Logbook Water Table and Draw Down Test
* Pen
* Electronic Measuring Tape

- TASK DESCRIPTION SHEET -

TASK NAME: Check valves TASK NUMBER: OP-9

FREQUENCY: Monthly

DESCRIPTION

Sluice valve:

1. Fully close the sluice valve;
2. Fully open the sluice valve;
3. Note down number of turns required to close and open the valve and the date, and compare this with previous result. If there is a big difference open and close the valve again and note down the number of turns, is there still a difference inform the Mistry by filling in and submitting a work request form;
4. Check the sluice valve for leakage if this is the case tighten the bolts and nuts with an adjustable wrench. If the leakage remains inform the Mistry by filling in and submitting a work request form;
5. Check the sluice valve body, bolts and nuts for corrosion;
6. Remove any corrosion with a wire brush;
7. Repaint sluice valve with bituminous paint, if corrosion had to be removed;

Non-return valve;

1. Check the non-return valve for leakage if this is the case tighten the bolts and nuts with an adjustable wrench. If the leakage remains inform the Mistry by filling in and submitting a work request form;
2. Loosen the bolt of the cover of the non-return valve with an adjustable wrench. Take care that the pump is switched off;
3. Remove the cover. Clean your hands and open and close the valve gate at least five times with your hand;
4. Check if the packing between valve body and cover is still all right, replace it, if necessary;
4. Fix the cover and the bolts and nuts, and tighten them;
5. Check the non-return valve body, bolts and nuts for corrosion;
6. Remove any corrosion with a wire brush;
7. Repaint non-return valve with bituminous paint, if corrosion had to be removed;

SPECIAL INSTRUCTION

1. Do not use excessive force to operate the sluice valve and do not over tighten it when closing.
2. This should be done with the pump switched off.

REQUIREMENTS:PARTS,TOOLS,EQUIPMENT

* Wire Brush
* Paint Brush
* Adjustable Wrench
* Bituminous Paint
* Logbook for Sluice Valve(s)
* Pen
* Packing

OP-14

- TASK DESCRIPTION SHEET -

TASK NAME: Operation and maintenance chlorinator

TASK NUMBER: OP-10

FREQUENCY: Daily

DESCRIPTION

1. Enter the date in the logbook;
2. Check the moisture glass tube of the primary and secondary filter. If there is any liquid or dirt in the tubes, unscrew the tube(s) and clean them with water and a special soft brush;
3. Check the mixing chamber for any liquid or dirt. If it has to be cleaned open the diaphragm valve under the mixing chamber, start the water supply and flush water through the solutionizer and mixing chamber. When the cleaning is completed stop the water supply and close the diaphragm valve for flushing;
4. Open the valve of the chlorine cylinder while keeping the niddle valve closed;
5. Check the reading on the diaphragm pressure gauge, if the reading is almost 0 kg/cm2 the cylinder is almost empty and a cylinder has to be refilled as soon as possible. If the reading is between 5 to 6 kg/cm2 the cylinder is almost full. Enter the reading in the logbook;
6. Start the supply of water and the pump;
7. Open the niddle valve slowly until the required dose has been reached on the indicator of the mixing chamber;
8. Check all the connections and pipes for any leakage with the ammonium bottle. If there is any leakage a white gas will develop and continue with number 9. otherwise with number 10.;
9. If a connection is leaking tighten the connection and check again for any leakage. If one of the pipes or valves is leaking close down the chlorinator and replace respective component, and start up the chlorinator as described above;
10. Enter the time in the logbook and check every half hour if the chlorine is still supplied in the right dose;
11. Whenever the supply has to be stopped continue as follows;
    - Close the niddle valve and check the reading on the diaphragm pressure gauge. If the reading is almost 0 kg/cm2 inform the (Add.) Assistant Engineer by filling in and submitting a spare part request form, so that he can get a cylinder refilled;
    - Close the valve on the chlorine cylinder, stop the pump and water supply;
    - Clean the moisture glass tubes of the primary and secondary filters with water and a special brush;
    - Enter the close down time in the logbook;

SPECIAL INSTRUCTION

One chlorine cylinder should last for approximately 3 months. Take care to order the cylinder in time so that the chlorine supply is not interrupted for some time, also do not to order a cylinder to early to avert storing the full cylinder to long.

- TASK DESCRIPTION SHEET -

TASK NAME: Operation and maintenance chlorinator

TASK NUMBER: OP-10

CONTINUED

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

* Ammonium Bottle
* Adjustable Wrench
* Logbook for Chlorinator
* Pen
* Any Spare Part that has to be replaced

ANNEX 9. TASK DESCRIPTIONS MOBILE REPAIR CREW

MRC-1

- TASK DESCRIPTION SHEET -

TASK NAME: Repair PVC pipe with repair socket

TASK NUMBER: MRC-1A

FREQUENCY: Whenever required

DESCRIPTION

1. Close in the pipe burst or leaking connection by closing the nearest sluice valves upstream and downstream of the leak. If possible a scour valve should be incorporated in this section;
2. Empty the pipe line by opening the scour valve, if available;
3. Carry out the excavation, if necessary excess water has to be pumped from the excavation site. At least two full pipe length have to be excavated to ensure the correct slope and position of the pipe after repair;
4. Measure with the repair socket how much length of pipe has to be cut out. Special attention should be given to inspection of the leaking pipe for additional leaks which might make it necessary to replace a longer piece of pipe. If the piece of pipe to be replaced is to long for the repair socket, it should be repaired with repair collars (see Task MRC-1B);
5. Cut out the required piece of pipe with a hacksaw. If the pipe is still full with water it has to be pumped out of the excavation;
6. Remove sufficient sand from under the pipe line ends to be able to move the repair socket on the pipe ends;
7. Clean both the pipe ends and apply solvent cement on both ends and push the longer side of the repair socket on one of the pipe ends;
8. Push the shorter side of the repair socket on the other pipe end so that the gap is closed again;
9. If there is a scour valve in the closed pipe section, fill the section with heavily chlorinated water (150 mg/l) and wait for half an hour. Otherwise continue with number 12.;
10. Flush the pipe section by opening the upstream sluice valve and after that the scour valve. Continue until the water being discharged is free from chlorine smell;
11. Close the scour valve;
12. Check if there is any leakage along the connection. Attend to it if necessary
13. Open the downstream sluice valve;
14. Back fill the excavation. Back filling has to be done in layers which should be compacted separately. The soil fill around the pipe has to be done in layers of 10 cm until halfway the pipe. Thereafter, the back filling can be done in layers of 30 cm. Pay special attention to proper back filling under the pipe and make sure the pipe has the correct slope and position;
15. Hand over the work order form to the Mistry for completion.

- TASK DESCRIPTION SHEET -

TASK NAME: Repair PVC pipe with repair socket

TASK NUMBER: MRC-1A

CONTINUED

SPECIAL INSTRUCTION

1. All pipes and pipe fittings must be thoroughly cleaned of any obvious dirt before being used for repair;
2. Open ends have to be sealed with a plug (if available) or a piece of plastic until joined with the repair socket to prevent any dirt or small animals from entering the pipe line;
3. At all times the excavation should be kept free from water to prevent contamination of the pipe line;
4. Take care not to damage the pipe during the excavation;
5. The Mistry or Karkoon has to inform all villages that will be affected by the repair;

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

* Shovels
* Repair Socket
* Solvent Cement
* Hacksaw
* Brush (for cleaning)
* Bleaching Powder
* Valve Key
* PVC Pipe

MRC-3

- TASK DESCRIPTION SHEET -

TASK NAME: Repair PVC pipe with repair collar

TASK NUMBER: MRC-1B

FREQUENCY: Whenever required

DESCRIPTION

1. Close in the pipe burst or leaking connection by closing the nearest sluice valves upstream and downstream of the leak. If possible a scour valve should be incorporated in this section;
2. Empty the pipe line by opening the scour valve, if available;
3. Carry out the excavation, if necessary excess water has to be pumped from the excavation site. At least two full pipe length have to be excavated to ensure the correct slope and position of the pipe after repair;
4. Cut out the damaged piece of pipe with a hacksaw and make both ends of the pipe line smooth with a wire brush. Make sure all roughnesses are removed;
5. Mark both pipe line ends at half the length of the repair collar;
6. Measure the length required to fill the gap and cut a piece at this length of pipe minus 1 cm;
7. Make both end of the piece of pipe smooth with a wire brush;
8. Remove sufficient sand from under the pipe line ends over a length of about 80 to 100 cm, to be able to move the repair collar on the pipe ends;
9. Clean the pipe line ends and apply ample of lubricant on both ends over a length of at least one repair collar;
10. Slide the repair collar on the pipe line end until the first ring is completely on the pipe end. If this doesn't go smoothly remove the repair collar and apply more lubricant and try again;
11. Slide a piece of PVC pipe of the same diameter as the pipe line with a length of approximately 50 cm in the other end of the repair collars, also applying ample lubricant. This is to keep the second inside rubber ring in the right position during sliding of the repair collar;
12. Slide the repair collar further back on the pipe line end so that the small piece of pipe comes free from the repair collar. The same procedure has to be followed, number 10. to 12., for the other pipe line end;
13. Put in the piece of pipe to fill the gap, make both ends clean and apply ample lubricant on both sides. Take care it is in the right position and slope;
14. Slide both the repair collars on the piece of pipe until the marks on the pipe line ends become visible;
15. If there is a scour valve in the closed pipe section, fill the section with heavily chlorinated water (150 mg/l) and wait for half an hour. Otherwise continue with number 17.;
16. Flush the pipe section by opening the upstream sluice valve and after that the scour valve. Continue until the water being discharged is free from chlorine smell and close the scour valve;
17. Check if there is any leakage along the connection. Attend to it if necessary;
18. Open the downstream sluice valve;

- TASK DESCRIPTION SHEET -

TASK NAME: Repair PVC pipe with repair collar

TASK NUMBER: MRC-1B

CONTINUED

DESCRIPTION (CONTINUED)

19. Back fill the excavation. Back filling has to be done in layers which should be compacted separately. The soil fill around the pipe has to be done in layers of 10 cm until halfway the pipe. Thereafter, the back filling can be done in layers of 30 cm. Pay special attention to proper back filling under the pipe and make sure the pipe has the correct slope and position;
20. Hand over the work order form to the Mistry for completion.

SPECIAL INSTRUCTION

1. All pipes and pipe fittings must be thoroughly cleaned of any obvious dirt before being used for repair;
2. Open ends have to be sealed with a plug (if available) or a piece of plastic until joined with the repair collar to prevent any dirt or small animals from entering the pipe line;
3. At all times the excavation should be kept free from water to prevent contamination of the pipe line;
4. Take care not to damage the pipe during the excavation;
5. The Mistry or Karkoon has to inform any village that is affected by the repair;

REQUIREMENTS:PARTS,TOOLS,EQUIPMENT

* Shovels
* Repair Collar
* PVC Pipe
* Piece of PVC Pipe (50 cm)
* Hacksaw
* Brush (for cleaning)
* Bleaching Powder
* Valve Key

MRC-5

- TASK DESCRIPTION SHEET -

TASK NAME: Repair of AC pipe line TASK NUMBER: MRC-2

FREQUENCY: Whenever required

DESCRIPTION

1. Close in the pipe burst or leaking connection by closing the nearest sluice valves upstream and downstream of the leak. If possible a scour valve should be incorporated in this section;
2. Empty the pipe line by opening the scour valve, if available;
3. Carry out the excavation, if necessary excess water has to be pumped from the excavation site. At least three full pipe length have to be excavated to ensure the correct slope and position of the pipe after repair;
4. Remove the whole damaged pipe length that has to be replaced, either by breaking the pipe or by cutting a piece out. Always a whole pipe length has to be removed because a damaged AC pipe often has crack which are difficult to detect;
5. Remove sufficient sand from under the pipe line ends over a length of about 50 cm, to be able to move the Gibault coupling on the pipe ends;
6. Clean the pipe line ends and mark the ends at half the length of the Gibault coupling;
7. Bring the new pipe length in the gap;
8. Slide the Gibault couplings on the new pipe until the mark on the pipe line ends become visible;
9. Tighten the couplings;
10. If there is a scour valve in the closed pipe section, fill the section with heavily chlorinated water (150 mg/l) and wait for half an hour. Otherwise continue with number 12.;
11. Flush the pipe section by opening the upstream sluice valve and after that the scour valve. Continue until the water being discharged is free from chlorine smell and close the scour valve;
12. Check if there is any leakage along the coupling. Tighten the bolts, if necessary;
13. Open the downstream sluice valve;
14. Back fill the excavation. Back filling has to be done in layers which should be compacted separately. The soil fill around the pipe has to be done in layers of 10 cm until halfway the pipe. Thereafter, the back filling can be done in layers of 30 cm. Pay special attention to proper back filling under the pipe and make sure the pipe has the correct slope and position;
15. Hand over the work order form to the Mistry for completion.

- TASK DESCRIPTION SHEET -

TASK NAME: Repair of AC pipe line TASK NUMBER: MRC-2

CONTINUED

SPECIAL INSTRUCTION

1. All pipes and pipe fittings must be thoroughly cleaned of any obvious dirt before being used for repair;
2. Open ends have to be sealed with a plug (if available) or a piece of plastic until joined with the repair collar to prevent any dirt or small animals from entering the pipe line;
3. At all times the excavation should be kept free from water to prevent contamination of the pipe line;
4. Take care not to damage the pipe during the excavation;
5. The Mistry or Karkoon has to inform any village that is affected by the repair;

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

* Shovels
* Gibault Coupling
* Hacksaw
* Brush (for cleaning)
* Bleaching Powder
* Valve Key
* AC Pipe

- TASK DESCRIPTION SHEET -

TASK NAME: Repair of single air valve, Change ball

TASK NUMBER: MRC-3A

FREQUENCY: Whenever required

DESCRIPTION

1. Close the isolating cock with an adjustable wrench;
2. Loosen the bolts and nuts of the top plate of the air valve with an adjustable wrench;
3. Take off the top plate and the plate with the small orifice;
4. Take out the ball from the valve body;
5. Fix the new ball and check if the rubber gasket between the orifice holder and the valve body has to be replaced. If this is the case continue with number 6. otherwise with number 8.;
6. Take out the gasket and smoothen the contact surfaces of the orifice holder and the valve body of the rubber gasket with a wire brush and afterwards with sandpaper;
7. Fix a new rubber gasket, make sure that the openings of the gasket for the bolts, match the openings for the bolts in the body of the air valve;
8. Fix the holder of the small orifice, the top plate, and the bolts and nuts and tighten them with an adjustable wrench;
9. Open the isolating cock with an adjustable wrench and check whether there is any leakage. Tighten the bolts and nuts, if necessary. If the air valve remains leaking it has to be replaced, see Task MRC-5A;
10. Hand over the work order form to the Mistry for completion.

SPECIAL INSTRUCTION

1. All material must be thoroughly cleaned of any obvious dirt before being used for repair;
2. Open end of the air valve during repair has be sealed until joined again to prevent any dirt from entering the air valve;
3. The Mistry or Karkoon has to inform any village that is affected by the repair;

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

* Adjustable Wrench
* Rubber Gasket
* Sandpaper
* Wire Brush
* Air Valve Ball
* Steel Pin (which fits through small orifice)
* Pen

- TASK DESCRIPTION SHEET -

TASK NAME: Repair of single air valve, Change gasket

TASK NUMBER: MRC-3B

FREQUENCY: Whenever required

DESCRIPTION

1. Assess whether the cause of leakage is the rubber gasket between holder of small orifice and the air valve body. If this is the case continue with number 2. If leakage has a different cause the valve has to be replaced, see Task MRC-5A;
2. Close the isolating cock with an adjustable wrench;
3. Loosen the bolts and nuts of the top plate of the air valve with an adjustable wrench;
4. Take off the top plate and the holder of the small orifice, and remove the rubber gasket;
5. Smoothen the contact surfaces of the rubber gasket with a wire brush and afterwards with sandpaper;
6. Fix a new rubber gasket, make sure the openings of the gasket for the bolts match the openings for the bolts in the body of the air valve;
7. Fix the holder of the small orifice, the top plate, and the bolts and nuts and tighten them with an adjustable wrench;
8. Open the isolating cock with an adjustable wrench and check whether there is still any leakage. Tighten the bolts and nuts, if necessary. If valve is still leaking replace it, see Task MRC-5A;
9. Hand over the work order form to the Mistry for completion.

SPECIAL INSTRUCTION

1. All material must be thoroughly cleaned of any obvious dirt before being used for repair;
2. Open end of the air valve during repair has be sealed until joined again to prevent any dirt from entering the air valve;
3. The Mistry or Karkoon has to inform any village that is affected by the repair;

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

* Adjustable Wrench
* Rubber Gasket
* Sandpaper
* Wire Brush
* Air Valve Ball
* Steel Pin (which fits through small orifice)
* Pen

- TASK DESCRIPTION SHEET -

TASK NAME: Change ball(s) of double air valve

TASK NUMBER: MRC-4A

FREQUENCY: Whenever required

DESCRIPTION

1. Close the nearest sluice valves upstream and downstream of the air valve with the proper valve key;
2. Loosen the bolts and nuts of the top plate of the air valve with an adjustable wrench;
3. Take off the top plate;
4. Loosen the bolts and nuts of the holder(s) of the small and/or large orifice, dependent on which ball has to be replaced;
5. Take off the holder(s) of the orifice:
6. Take out the ball(s) from the valve body;
7. Fix the new ball(s) and check if the rubber gasket(s) between the orifice holder and the valve body has to be replaced. If this is the case continue with number 8. otherwise with number 10.;
8. Take out the gasket(s) and smoothen the contact surfaces of the orifice holder and the valve body of the rubber gasket(s) with a wire brush and afterwards with sandpaper;
9. Fix a new gasket(s), make sure that the openings of the gasket for the bolts, match the openings for the bolts in the body of the air valve;
10. Fix the holder(s) of the orifice, and the bolts and nuts and tighten them with an adjustable wrench. Check whether the ball(s) can move freely with a steel pin;
11. Open the upstream sluice valve with the proper valve key and check whether there is any leakage. Tighten the bolts and nuts, if necessary. If the air valve remains leaking it has to be replaced, see Task MRC-5B;
12. Fix the top plate, the bolts, and tighten them with an adjustable wrench;
13. Open the downstream sluice valve with the proper valve key;
14. Hand over the work order form to the Mistry for completion.

SPECIAL INSTRUCTION

1. All material must be thoroughly cleaned of any obvious dirt before being used for repair;
2. Open end of the air valve during repair has be sealed until joined again to prevent any dirt from entering the air valve;
3. The Mistry or Karkoon has to inform any village that is affected by the repair;

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

* Valve Key(s)
* Air Valve Ball(s)
* Sandpaper
* Wire Brush
* Adjustable Wrench
* Rubber Gasket(s)
* Steel Pin (which fits trough small orifice)

MRC-10

- TASK DESCRIPTION SHEET -

TASK NAME: Change gasket(s) in double air valve

TASK NUMBER: MRC-4B

FREQUENCY: Whenever required

DESCRIPTION

1. Assess whether the cause of leakage is the rubber gasket(s) between holder(s) of orifice and the air valve body. If this is the case continue with number 2. If leakage has a different cause continue either with TASK MRC-4C or Task MRC-5B;
2. Close the nearest sluice valves upstream and downstream of the air valve with the proper valve key;
3. Loosen the bolts and nuts of the top plate of the air valve with an adjustable wrench;
4. Take off the top plate;
5. Loosen the bolts and nuts of the holder(s) of the small and/or large orifice, dependent on which gasket has to be re[laced;
6. Take off the holder(s) of the orifice, and remove the gasket(s);
7. Smoothen the contact surfaces of the rubber gasket(s) with a wire brush and afterwards with sandpaper;
8. Fix a new rubber gasket(s), make sure the openings of the gasket(s) for the bolts match the openings for the bolts in the body of the air valve;
9. Fix the holder(s) of the orifice,and the bolts and nuts and tighten them with an adjustable wrench. Check if the balls can move freely with a steel pin;
10. Open the upstream sluice valve with the proper valve key and check whether there is any leakage. Tighten the bolts and nuts, if necessary. If the air valve remains leaking it has to be replaced, see Task MRC-5B;
11. Fix the top plate, the bolts, and tighten them with an adjustable wrench;
12. Open the downstream sluice valve with the proper valve key;
13. Hand over the work order form to the Mistry for completion.

SPECIAL INSTRUCTION

1. All material must be thoroughly cleaned of any obvious dirt before being used for repair;
2. Open end of the air valve during repair has be sealed until joined again to prevent any dirt from entering the air valve;
3. The Mistry or Karkoon has to inform any village that is affected by the repair;

REQUIREMENTS:PARTS,TOOLS,EQUIPMENT

* Valve Key(s)
* Rubber Gasket(s)
* Sandpaper
* Adjustable Wrench
* Wire Brush
* Steel Pin (which fits trough small orifice)

- TASK DESCRIPTION SHEET -

TASK NAME: Change gasket of connection of double air valve

TASK NUMBER: MRC-4C

FREQUENCY: Whenever required

DESCRIPTION

1. Assess whether the cause of leakage is the rubber gasket of the connection of the air valve with the pipe line. If this is the case continue with number 2. If leakage has a different cause continue either with TASK MRC-4B or Task MRC-5B;
2. Close the nearest sluice valves upstream and downstream of the double air valve with the proper valve key;
3. Loosen the bolts and nuts of the connection of the air valve with the pipe line with two adjustable wrenches;
4. Take off the air valve, and remove the gasket;
5. Smoothen the contact surfaces of the rubber gasket with a wire brush and afterwards with sandpaper;
6. Fix a new rubber gasket, make sure the openings of the gasket for the bolts match the openings for the bolts in the flange of the pipe line;
7. Fix the double air valve and the bolts and nuts, and tighten them with two adjustable wrenches;
8. Open the upstream sluice valve with the proper valve key and check whether there is any leakage. Tighten the bolts and nuts, if necessary. If the air valve remains leaking it has to be replaced, see Task MRC-5B;
9. Open the downstream sluice valve with the proper valve key;
10. Hand over the work order form to the Mistry for completion.

SPECIAL INSTRUCTION

1. All material must be thoroughly cleaned of any obvious dirt before being used for repair;
2. Open end of the double air valve and the connection has be sealed until joined again to prevent any dirt from entering the air valve and pipe line;
3. The Mistry or Karkoon has to inform any village that is affected by the repair;

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

* Valve Key(s)
* Rubber Gasket(s)
* Sandpaper
* Adjustable Wrench
* Wire Brush
* Steel Pin (which fits trough small orifice)

MRC-12

- TASK DESCRIPTION SHEET -

TASK NAME: Replacement single air valve TASK NUMBER: MRC-5A

FREQUENCY: Whenever required

DESCRIPTION

1. Close the isolating cock under the single air valve;
2. Loosen the connection of the single air valve with the isolating cock with two adjustable wrenches. One wrench has top to be put on the upper part of the isolating cock while the other one is used for turning the single air valve;
3. Fix a new single air valve with two adjustable wrenches like described above;
4. Open the isolating cock;
5. Check if there is any leakage. If this is the case replace the gasket in the single air valve (TASK MRC-3B) or otherwise again a new single air valve has to be installed;
6. Check whether the ball can move freely by removing the top plate of the single air valve with an adjustable wrench and try to move the ball with a steel pin. If this is not the case replace the ball (see TASK MRC-3A) otherwise continue with number 7.;
7. Fix the top plate, the bolts and nuts, and tighten them with two adjustable wrenches;
8. Hand over the work order form to the Mistry for completion.

SPECIAL INSTRUCTION

1. All material must be thoroughly cleaned of any obvious dirt before being used for repair;
2. Open end of the air valve and isolating cock has be sealed until joined to prevent any dirt from entering the air valve;

REQUIREMENTS:PARTS,TOOLS,EQUIPMENT

* Single Air valve
* Two Adjustable Wrenches

- TASK DESCRIPTION SHEET -

TASK NAME: Replacement double air valve TASK NUMBER: MRC-5B

FREQUENCY: Whenever required

DESCRIPTION

1. Close the nearest sluice valves upstream and downstream of the double air valve to be replaced with the proper valve key;
2. Loosen the bolts and nuts of the connection of the double air valve with the pipe line with two adjustable wrenches;
3. Take off the air valve, and remove the gasket;
4. Smoothen the contact surfaces of the rubber gasket with a wire brush and afterwards with sandpaper;
5. Fix a new rubber gasket, make sure the openings of the gasket for the bolts match the openings for the bolts in the flange of the pipe line;
6. Fix the double new air valve and the bolts and nuts, and tighten them with two adjustable wrenches;
7. Open the upstream sluice valve with the proper valve key and check whether there is any leakage. Tighten the bolts and nuts, if necessary;
8. Check whether the balls can move freely. Remove the top plate of the double air valve by loosening the bolts and nuts with two adjustable wrenches and try to move the balls with a steel pin. If this is not the case replace the ball(s), see TASK MRC-4A.
9. If the double air valve is still leaking also tighten the bolts of the orifice holders. If necessary, replace the gasket(s) in the valve (see TASK MRC-4B);
10. Fix the top plate, bolts and nuts, and tighten them with two adjustable wrenches;
11. Open the downstream sluice valve with the proper valve key;
12. Hand over the work order form to the Mistry for completion.

SPECIAL INSTRUCTION

1. All material must be thoroughly cleaned of any obvious dirt before being used for repair;
2. Open end of the double air valve and the connection has be sealed until joined again to prevent any dirt from entering the air valve and pipe line;
3. The Mistry or Karkoon has to inform any village that is affected by the repair;

REQUIREMENTS:PARTS,TOOLS,EQUIPMENT

* Valve Key(s)
* Rubber Gasket
* Sandpaper
* Two Adjustable Wrench
* Wire Brush
* Steel Pin (which fits trough small orifice)

- TASK DESCRIPTION SHEET -

TASK NAME: Replacement sluice valve TASK NUMBER: MRC-5C

FREQUENCY: Whenever required

DESCRIPTION

1. Close in the sluice valve to be replaced by closing the nearest sluice valves upstream and downstream of the leak with the proper valve keys. If possible a section with scour valve;
2. Empty the pipe line by opening the scour valve, if available;
3. Carry out the excavation, if necessary to expose one of the Gibault couplings connected to the tail piece. Excess water has to be pumped from the excavation with the de-watering pump set;
4. Install a hoist over the sluice valve (only for larger diameter valves), attach the cables to the sluice valve and tighten the cables. Take care the sluice valve is not being lifted;
5. Open the Gibault coupling at one side of the sluice valve by loosening the bolts and nuts with two adjustable wrenches;
6. Slide the collar of the Gibault coupling on the pipe line end;
7. Loosen the bolts and nuts of the connection of the sluice valve at both sides with two adjustable wrenches;
8. Lift the sluice valve with the hoist, if it is a small diameter valve it can be done without hoist;
9. Remove the gaskets at both sides of the sluice valve and the tail piece at the side where the Gibault coupling has been opened;
10. Smoothen the contact surfaces of the rubber gaskets of both tail pieces with a wire brush and afterwards with sandpaper. Check if the flanges of the new sluice valve are smooth, if not make them smooth in the same way;
11. Fit in the new sluice valve with the hoist, keep cables tightened;
12. Fix a new gasket at the side where the tail piece has been kept in place and fix the bolts and nuts without tightening them, completely;
13. Fix the tail piece at the other side together with a new gasket, and fix the bolts and nuts without tightening them, completely. Take care that rubber rings of the Gibault coupling are in the right position;
14. Check whether the position of the sluice valve is correct, and adjust its position with the hoist, if necessary;
15. Slide the collar of the Gibault coupling back on the joint between tail piece and pipe line;
16. Tighten bolts and nuts at both sides of the sluice valve;
17. Tighten bolts and nuts of the Gibault coupling;
18. If there is a scour valve in the closed pipe section, fill the section with heavily chlorinated water (150 mg/l) and wait for half an hour. Otherwise continue with number 20.;
19. Flush the pipe section by opening the upstream sluice valve with the proper valve key and after that the scour valve. Continue until the discharged water is free from chlorine smell, close scour valve;
20. Check if there is any leakage along the joints and Gibault coupling. Tighten the bolts, if necessary;
21. Open the downstream sluice valve with the proper valve key;
22. Hand over the work order form to the Mistry for completion.

- TASK DESCRIPTION SHEET -

TASK NAME: Replacement sluice valve TASK NUMBER: MRC-5C

CONTINUED

SPECIAL INSTRUCTION

1. All pipes and pipe fittings must be thoroughly cleaned of any obvious dirt before being used for repair;
2. Open ends have to be sealed with a plug (if available) or a piece of plastic until joined to prevent any dirt or small animals from entering the pipe line;
3. At all times the excavation and sluice valve chamber should be kept free from water to prevent contamination of the pipe line;
4. Take care not to damage the pipe during the excavation;
5. The Mistry or Karkoon has to inform any village that is affected by the repair;

REQUIREMENTS:PARTS,TOOLS,EQUIPMENT

* Shovels
* Gibault Coupling
* Two Adjustable Wrenches
* Brush (for cleaning)
* Bleaching Powder
* Valve Key
* Sluice Valve
* Two Gaskets
* Hoist
* De-watering Set

- TASK DESCRIPTION SHEET -

TASK NAME: Replacement non-return valve TASK NUMBER: MRC-5D

FREQUENCY: Whenever required

DESCRIPTION

1. Close the sluice valve installed just after the non-return valve;
2. Put a support under the sluice valve, to prevent that the weight will distort the pipe when the non-return valve has been taken out;
3. Take out the non-return valve by loosening the bolts and nuts with two adjustable wrenches;
4. Smoothen the flanges of the connection with the rising main at both sides of the non-return valve with a wire brush and sand paper;
5. Fix two new gaskets;
6. Fix the new non-return valve by tightening the bolts and nuts;
7. Let the operator start the pump;
8. Check if there is any leakage, tighten bolts and nuts, if necessary;
9. Hand over the work order form to the Mistry for completion.

SPECIAL INSTRUCTION

1. All pipes and pipe fittings must be thoroughly cleaned of any obvious dirt before being used for repair;
2. Open ends have to be sealed with a plug (if available) or a piece of plastic until joined to prevent any dirt or small animals from entering the pipe line;
3. Take care the pump has been switched off.

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

* Two Adjustable Wrenches
* Wire Brush
* Non-return Valve
* Two Gaskets

MRC-17

- TASK DESCRIPTION SHEET -

TASK NAME: Replacement of bulk water meter TASK NUMBER: MRC-6A

FREQUENCY: Whenever required

DESCRIPTION

1. Close in the bulk water meter to be replaced by closing the nearest sluice valves upstream and downstream of the leak with the proper valve keys. If possible a scour valve should be incorporated in this section;
2. Empty the pipe line by opening the scour valve, if available;
3. Carry out the excavation, if necessary to expose one of the Gibault couplings connected to the tail piece. Excess water has to be pumped from the excavation with the de-watering pump set;
4. Install a hoist over the sluice valve (only for larger diameter valves), attach the cables to the sluice valve and tighten the cables. Take care the sluice valve is not being lifted;
5. Open the Gibault coupling at one side of the bulk water meter by loosening the bolts and nuts with two adjustable wrenches;
6. Slide the collar of the Gibault coupling on the pipe line end;
7. Loosen the bolts and nuts of the connection of the bulk water meter at both sides with two adjustable wrenches;
8. Lift the bulk water meter with the hoist;
9. Remove the gaskets at both sides of the bulk water meter and the tail piece at the side where the Gibault coupling has been opened;
10. Smoothen the contact surfaces of the rubber gaskets of both tail pieces with a wire brush and afterwards with sandpaper. Check if the flanges of the new bulk water meter are smooth, otherwise make them smooth in the same way;
11. Fit in the new bulk water meter with the hoist but keep the cables tightened;
12. Fix a new gasket at the side where the tail piece has been kept in place and fix the bolts and nuts without tightening them, completely;
13. Fix the tail piece at the other side together with a new gasket, and fix the bolts and nuts without tightening them, completely. Take care that rubber rings of the Gibault coupling are in the right position;
14. Check whether the position of the bulk water meter is correct, and adjust its position with the hoist, if necessary;
15. Slide the collar of the Gibault coupling back on the joint between tail piece and pipe line;
16. Tighten bolts and nuts at both sides of the bulk water meter;
17. Tighten bolts and nuts of the Gibault coupling;
18. If there is a scour valve in the closed pipe section, fill the section with heavily chlorinated water (150 mg/l) and wait for half an hour. Otherwise continue with number 20.;
19. Flush the pipe section by opening the upstream sluice valve with the proper valve key and after that the scour valve. Continue until the discharged water is free from chlorine smell, close the scour valve;
20. Check if the joints and Gibault coupling for leakage (upstream sluice valve has to be open). Tighten the bolts, if necessary;
21. Open the downstream sluice valve with the valve key, and check if the meter is recording properly. Replace the meter again, if necessary;
22. Hand over the work order form to the Mistry for completion.

- TASK DESCRIPTION SHEET -

TASK NAME: Replacement of bulk water meter TASK NUMBER: MRC-6A

CONTINUED

SPECIAL INSTRUCTION

1. All pipes and pipe fittings must be thoroughly cleaned of any obvious dirt before being used for repair;
2. Open ends have to be sealed with a plug (if available) or a piece of plastic until joined to prevent any dirt or small animals from entering the pipe line;
3. At all times the excavation should be kept free from water to prevent contamination of the pipe line;
4. Take care not to damage the pipe during the excavation;
5. The Mistry or Karkoon has to inform any village that is affected by the repair;

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

* Shovels
* Two Adjustable Wrenches
* Brush (for cleaning)
* Bleaching Powder
* Valve Key
* Bulk water meter
* Two Gaskets
* Hoist
* De-watering Set

MRC-19

- TASK DESCRIPTION SHEET -

TASK NAME: Replacement of domestic water meter

TASK NUMBER: MRC-6B

FREQUENCY: Whenever required

DESCRIPTION

1. Inform the villagers beforehand, on the interruption of the water supply;
2. Close the sluice valve located just before the domestic water meter;
3. Loosen the connection at both sides of the domestic water meter with two adjustable wrenches. One should be put on the GI-pipe and the other one is to turn the connection, otherwise the pipe could be damaged;
4. Take out the domestic water meter and remove the washers;
5. Smoothen the contact surfaces of the washers with the GI-pipe with sandpaper;
6. Fix new washers;
7. Fit in the new domestic water meter;
8. Tighten the connection, first by hand and afterwards with two adjustable wrenches. Take care not to damage the thread of the connection;
9. Open the sluice valve and check for any leakage along the connection and whether the meter is recording properly. Tighten the connection or replace the domestic water meter again, if necessary;
10. Hand over the work order form to the Mistry for completion.

SPECIAL INSTRUCTION

1. All material used for the repair must be thoroughly cleaned of any obvious dirt before being used for repair;
2. Open ends have to be sealed with a plug (if available) or a piece of plastic until joined to prevent any dirt or small animals from entering the pipe line;
3. At all times the domestic water meter box should be kept free from water to prevent contamination of the pipe line;

REQUIREMENTS: PARTS, TOOLS, EQUIPMENT

* Domestic Water Meter
* Two Washers
* Two Adjustable wrenches

- TASK DESCRIPTION SHEET -

TASK NAME: Replacement of manometer TASK NUMBER: MRC-7

FREQUENCY: Whenever required

DESCRIPTION

Replacement manometer:

1. Close the isolating cock under the manometer;
2. Turn off the manometer with two adjustable wrenches. One should be put on the upper part of the isolating cock and the other one is used to turn the manometer;
3. Fix the new manometer with two adjustable wrenches, as described above;
4. Open the isolating cock;
5. Check for any leakage. Tighten the connection with two adjustable wrenches, if necessary;
6. Check if manometer is recording properly. If not replace it again.
7. Hand over the work order form to the Mistry for completion.

Replacement manometer and isolating cock:

1. Close in the manometer to be replaced by closing the nearest sluice valves upstream and downstream of the leak with the proper valve keys;
2. Turn off the manometer and isolating cock with two adjustable wrenches. One should be put on the lower part of the isolating cock to turn it off and the other should be put on the GI-pipe;
3. Fix the new isolating cock on the GI-pipe with two adjustable wrenches. One on the GI-pipe and the other one to turn the isolating cock;
4. Fix the new manometer with two adjustable wrenches. One to hold the isolating cock and the other one to turn the manometer;
5. Open the upstream sluice valve and the isolating cock;
6. Check for any leakage. Tighten the connection with two adjustable wrenches, if necessary;
7. Open the downstream sluice valve;
8. Check if manometer is recording properly. If not replace it again.
9. Hand over the work order form to the Mistry for completion.

SPECIAL INSTRUCTION

REQUIREMENTS:PARTS,TOOLS,EQUIPMENT

* Manometer
* Isolating Cock
* Valve Keys
* Two Adjustable wrenches

- TASK DESCRIPTION SHEET -

TASK NAME: Replacement of pump TASK NUMBER: MRC-8

FREQUENCY: Whenever required

DESCRIPTION

1. Fix the clamp on the delivery pipe just above the well casing (Figure MRC-10);
2. Install the derrick or tripod;
3. Attach the cable to the clamp and tighten the cables;
4. Disconnect the delivery pipe by loosening the connection with the non-return valve with two adjustable wrenches;
5. Lift the a pipe length out of the tube well;
6. Fix the a clamp on the next pipe length, just below the coupling;
7. Lower the delivery pipe until the clamp rests on the tube well casing, and disconnect the pipe length from the delivery pipe with two pipe spanners;
8. Lower the disconnected pipe length until it rests completely on the floor, disconnect the cables from the clamp, and remove the clamp from the pipe;
9. Attach the cables to the clamp resting on the tube well casing;
10. Return to number 5. and continue until the pump set is taken out;
11. Install the pump according to the detailed installation and maintenance manual of the pump;
12. Hand over the work order form to the Mistry for completion;
13. Fill in a work request form for the repair of the pump and submit it with the Mistry.

SPECIAL INSTRUCTION

1. Take care not to damage the electrical wiring during the lifting of the various pipe sections;
2. TAKE CARE TO ATTACH THE CLAMPS PROPERLY, OTHERWISE THE PUMP MIGHT FALL DOWN.

REQUIREMENTS:PARTS,TOOLS,EQUIPMENT

* Two Pipe Spanners
* Two Clamps
* Derrick or Tripod (with chain pulley block and swivel load hook)
* Two Adjustable Wrenches
* Work Request Form

ANNEX 10. FORMS

SANTALPUR REGIONAL WATER SUPPLY SCHEME (FRONT SIDE)

WORK REQUEST FORM FOR DISTRIBUTION SYSTEM

NAME LINESMAN: _____ DATE AND TIME: _____

NATURE PROBLEM: _____

_____

IDENTIFICATION NUMBER (if any): _____

EXACT LOCATION: _____

CAUSE OF PROBLEM: _____

_____

NAME MISTRY or KARKOON: _____ SIGNATURE: _____

SANTALPUR REGIONAL WATER SUPPLY SCHEME (BACK SIDE)

WORK REQUEST FORM FOR DISTRIBUTION SYSTEM

SPECIFICATIONS: (Diametre, material etc.)

_____

_____

_____

_____

_____

_____

_____

SANTALPUR REGIONAL WATER SUPPLY SCHEME (FRONT SIDE)

WORK REQUEST FORM FOR EQUIPMENT

NAME OPERATOR: _____ DATE AND TIME: _____

NATURE PROBLEM: _____

_____

IDENTIFICATION NUMBER: _____ SERIAL NUMBER: _____

MANUFACTURER: _____

CAUSE OF PROBLEM: _____

_____

NAME (ADD.) ASS. ENGINEER: _____ SIGNATURE: _____

SANTALPUR REGIONAL WATER SUPPLY SCHEME (BACK SIDE)

WORK REQUEST FORM FOR EQUIPMENT

SPECIFICATIONS: (material material numbers)

_____

_____

_____

_____

_____

_____

_____

_____

SPARE PART REQUEST FORM

DATE: _____ NUMBER: _____

NAME LINESMAN/OPERATOR: _____

SIGNATURE (DEP.) EX. ENGINEER: _____

PART NUMBER	QTY	DESCRIPTION	UNIT COST	TOTAL COSTS

REQUISITION FORM

DATE: _____

NUMBER: _____

RECIEVED BY: _____

WORK ORDER NUMBER: _____

PART NUMBER	QTY	DESCRIPTION	UNIT COST	TOTAL COSTS

SIGNATURE (DEP.) EX. ENGINEER: _____

SPARE PART CREDIT FORM

DATE: _____ NUMBER: _____

DELIVERED BY: _____ WORK ORDER NUMBER: _____

PART NUMBER	QTY	DESCRIPTION	UNIT COST	TOTAL COSTS

SIGNATURE STORE KEEPER: _____

TRANSFER ORDER

DATE: _____ NUMBER: _____

RELATED PURCHASE REQUEST FORM NUMBER: _____

FROM STORE: _____ TO STORE: _____

PART NUMBER	QTY	DESCRIPTION	UNIT COST	TOTAL COSTS

SIGNATURE EXECUTIVE ENGINEER: _____

PURCHASE REQUEST

DATE: _____ NUMBER: _____

PART/EQUIPMENT NUMBER	QTY	DESCRIPTION	UNIT COST	TOTAL COSTS

SIGNATURE EX. ENGINEER: _____

LEDGER FORM

STORE NAME: _____

SPARE PART/EQUIPMENT NAME: _____

SPARE PART/EQUIPMENT NUMBER: _____

MINIMUM LEVEL: _____ PURCHASE QUANTITY: _____

HOST MACHINE: _____ UNIT COST: _____

	RECEIVED		ISSUED		
DATE	FORM(1) NUMBER	QUANTITY	FORM(2) NUMBER	QUANTITY	BALANCE
	SC/PR				
	SC/PR				
	SC/PR				
	SC/PR				
	SC/PR				
	SC/PR				
	SC/PR				
	SC/PR				
	SC/PR				
	SC/PR				
	SC/PR				
	SC/PR				
	SC/PR				
	SC/PR				
	SC/PR				
	SC/PR				
	SC/PR				

(1) -SC=SPARE PART CREDIT FORM
-PR=PURCHASE REQUEST FORM

(2) FILL IN: -SR=SPARE PART REQUEST FORM
-RQ=REQUISITION FORM
-TO=TRANSFER ORDER

STOCK FORM

STORE NAME: ________________

WEEK NUMBER: ________________

PART/EQUIPMENT NUMBER	DESCRIPTION	BALANCE	MINIMUM LEVEL

SANTALPUR REGIONAL WATER SUPPLY SCHEME WORK ORDER FORM (FRONT SIDE)

WORK ORDER NUMBER:_____ DIVISION/SECTION: _____

DATE: _____ ORIGINATOR: _____ PRIORITY:_____

TO BE EXECUTED BY: CONTRACTOR/MOBILE REPAIR CREW NAME CONTRACTOR: _____

SUPERVISION BY: (ADD) ASS ENGINEER/MISTRY/KARKOON NAME SUPERVISOR: _____

IDENTIFICATION NUMBER: _____ SERIAL NUMBER: _____

MANUFACTURER: _____

EXACT LOCATION: _____

NATURE OF WORK: _____

_____

_____

TARGET COMPLETION DATE AND TIME: _____

WORK PERFORMED: _____

_____

_____

MATERIALS USED: _____

_____

_____

_____

LABOR USED: _____

_____

_____

COMPLETION DATE AND TIME: _____ FOLLOW UP: YES/NO

SIGNATURE SUPERVISOR:_____

SANTALPUR REGIONAL WATER SUPPLY SCHEME WORK ORDER FORM

(BACK SIDE)

LABOR USE			MATERIAL USE		VEHICLE/ EQUIP. USE			OTHER COSTS
PERSON	HRS	COST	ITEM	COST	ITEM	KM	COST	
SUB TOTALS								

TOTAL COSTS: RS. _____

ANNEX 11. LOGBOOKS

LOGBOOK FOR DOMESTIC WATER METER

NAME LINESMAN: ....

IDENTIFICATION NUMBER: DM. .

DATE	TIME	READING (liters)	AMOUNT (liters)	DATE	TIME	READING (liters)	AMOUNT (liters)

LOGBOOK FOR BULK WATER METER
============================

NAME LINESMAN: ....

IDENTIFICATION NUMBER: BM. .

DATE	TIME	READING (m3)	AMOUNT (m3)	DATE	TIME	READING (m3)	AMOUNT (m3)

LOGBOOK FOR TUBE WELL BULK WATER METER (three shifts per day)

DATE LAST OVERHAUL: ..../..../....

IDENTIFICATION NUMBER: BM.

DATE	TIME START	TIME STOP	READING BULK WATER METER (m3) SHIFT BEGIN	SHIFT END	AMOUNT	DAILY TOTAL	NAME OPERATOR

WEEKLY TOTAL (m3) |

LOGBOOK FOR MANOMETER

NAME LINESMAN: .....

IDENTIFICATION NR.: MM. .

DATE: ..../..../....

TIME		READING (kg/cm2)
1.00	AM	
2.00	AM	
3.00	AM	
4.00	AM	
5.00	AM	
6.00	AM	
7.00	AM	
8.00	AM	
9.00	AM	
10.00	AM	
11.00	AM	
12.00	AM	
13.00	PM	
14.00	PM	
15.00	PM	
16.00	PM	
17.00	PM	
18.00	PM	
19.00	PM	
20.00	PM	
21.00	PM	
22.00	PM	
23.00	PM	
24.00	PM	

LOGBOOK FOR MANOMETER

NAME LINESMAN: .....

IDENTIFICATION NR.: MM. .

DATE: ..../..../....

TIME		READING (kg/cm2)
1.00	AM	
2.00	AM	
3.00	AM	
4.00	AM	
5.00	AM	
6.00	AM	
7.00	AM	
8.00	AM	
9.00	AM	
10.00	AM	
11.00	AM	
12.00	AM	
13.00	PM	
14.00	PM	
15.00	PM	
16.00	PM	
17.00	PM	
18.00	PM	
19.00	PM	
20.00	PM	
21.00	PM	
22.00	PM	
23.00	PM	
24.00	PM	

LOGBOOK FOR SLUICE VALVE(S)

TURNS TO OPEN AT DATE OF INSTALLATION: _____

TURNS TO CLOSE AT DATE OF INSTALLATION: _____

FIXED NUMBER OF TURNS TO OPEN (FOR TUNING): _____

NAME LINESMAN/OPERATOR: _____

SUB DIVISION/SECTION OFFICE: _____

SLUICE VALVE IDNR	DATE	FIRST TRY		SECOND TRY	
		TURNS OPEN	TURNS CLOSED	TURNS OPEN	TURNS CLOSED
SV. .					
SV. .					
SV. .					
SV. .					
SV. .					
SV. .					
SV. .					
SV. .					
SV. .					
SV. .					
SV. .					
SV. .					
SV. .					
SV. .					
SV. .					
SV. .					
SV. .					
SV. .					
SV. .					
SV. .					

LOGBOOK FOR SUMMARY DISTRIBUTION WATER METERS

SUB DIVISION/SECTION OFFICE: _____

DATE: ..../..../....

WATER METER IDENTIFICATION NUMBER	TIME OF READING	DOMESTIC WATER METER AMOUNT (liters)	BULK WATER METER AMOUNT (m3)
DM/BM. .			
DM/BM. .			
DM/BM. .			
DM/BM. .			
DM/BM. .			
DM/BM. .			
DM/BM. .			
DM/BM. .			
DM/BM. .			
DM/BM. .			
DM/BM. .			
DM/BM. .			
DM/BM. .			
DM/BM. .			
DM/BM. .			
DM/BM. .			
DM/BM. .			
DM/BM. .			
DM/BM. .			
DM/BM. .			
DM/BM. .			
DM/BM. .			
DM/BM. .			

LOGBOOK FOR SUMMARY TUBE WELL BULK WATER METERS

DATE: ..../..../....

TUBE WELL NUMBER	BULK WATER METER AMOUNT (m3)
TW.	
TW.	
TW.	
TW.	
TW.	
TW.	
TW.	
TW.	
TW.	
TW.	
TW.	
TW.	
TW.	
TW.	
TW.	
TW.	
TW.	

LOGBOOK FOR SUMMARY MANOMETER DATA

SUB DIVISION/SECTION OFFICE: _____

DATE: ..../..../....
TIME MAXIMUM READINGS: .....
TIME MINIMUM READINGS: .....

MANOMETER IDENTIFICATION NUMBER	MAXIMUM READINGS (kg/cm2) [A]	(m) [10*A]	MINIMUM READINGS (kg/cm2) [B]	(m) [10*B]
MM. .				
MM. .				
MM. .				
MM. .				
MM. .				
MM. .				
MM. .				
MM. .				
MM. .				
MM. .				
MM. .				
MM. .				
MM. .				
MM. .				
MM. .				
MM. .				
MM. .				
MM. .				
MM. .				
MM. .				
MM. .				
MM. .				
MM. .				
MM. .				

LOGBOOK FOR CHLORINATOR

REQUIRED DOSE: .... gms/hr
REQUIRED DOSE: .... gms/hr

DATE	TIME START	READING PRESSURE GAUGE (kg/cm2)	TIME STOP

LOGBOOK FOR DIESEL ENGINE

DATE LAST OVERHAUL: ..../..../.... MANUFACTURER: ....

IDENTIFICATION NUMBER: DE. TYPE: ....

						BELT CHECK (MONTHLY)		AIR CLEANER (EVERY 50 HRS OR MONTHLY)		OIL FILTER (EVERY 200 HRS OR QUARTERLY)		FUEL FILTER & TANK (EVERY 200 HRS OR QUARTERLY)		CHANGE OIL (EVERY 200 HRS OR ONCE PER YEAR)		INJECTION PUMP (EVERY 400 HRS OR ONCE PER YEAR)		
DATE	DAILY MAINTENANCE EXECUTED (DAILY)	TIME START	TIME STOP	RUNNING HOURS	TOTAL SINCE LAST OVERHAUL	CHECKED	DATE LAST CHECK	CLEANED	RUNNING HRS SINCE LAST CLEANSING	CLEANED	RUNNING HRS SINCE LAST CLEANSING	CLEANED	RUNNING HRS SINCE LAST CLEANSING	CHANGED	RUNNING HRS SINCE LAST CHANGE	OIL LEVEL CHECK	RUNNING HRS SINCE LAST CHECK	NAME OPERATOR
	YES / NO					YES/NO		YES/NO		YES/NO		YES/NO		YES/NO		YES/NO		
	YES / NO					YES/NO		YES/NO		YES/NO		YES/NO		YES/NO		YES/NO		
	YES / NO					YES/NO		YES/NO		YES/NO		YES/NO		YES/NO		YES/NO		
	YES / NO					YES/NO		YES/NO		YES/NO		YES/NO		YES/NO		YES/NO		
	YES / NO					YES/NO		YES/NO		YES/NO		YES/NO		YES/NO		YES/NO		
	YES / NO					YES/NO		YES/NO		YES/NO		YES/NO		YES/NO		YES/NO		
	YES / NO					YES/NO		YES/NO		YES/NO		YES/NO		YES/NO		YES/NO		
	YES / NO					YES/NO		YES/NO		YES/NO		YES/NO		YES/NO		YES/NO		
	YES / NO					YES/NO		YES/NO		YES/NO		YES/NO		YES/NO		YES/NO		
	YES / NO					YES/NO		YES/NO		YES/NO		YES/NO		YES/NO		YES/NO		
	YES / NO					YES/NO		YES/NO		YES/NO		YES/NO		YES/NO		YES/NO		
	YES / NO					YES/NO		YES/NO		YES/NO		YES/NO		YES/NO		YES/NO		

LOGBOOK FOR TUBE WELL PUMP

DATE LAST OVERHAUL: ..../..../....   MANUFACTURER: ....

IDENTIFICATION NUMBER: TWP.   .   TYPE: ....

DATE	TIME START	TIME STOP	RUNNING HOURS	TOTAL SINCE LAST OVERHAUL	NAME OPERATOR

LOGBOOK FOR WATER TABLE & DRAW DOWN TEST

TUBE WELL NUMBER: __________

PUMP SETTING: ...... m-GL/ ...... m-GL

DATE	WATER LEVEL (m-GL) DYNAMIC (A)	STATIC (B)	DRAW DOWN (m) [B - A]

LOGBOOK WEEKLY TOTALS BULK AND DOMESTIC WATER METERS

SUB DIVISION/SECTION OFFICE: _____

DATE: ..../..../.... WEEK NO.: .....

WATER METER IDENTIFICATION NUMBER	WEEKLY TOTALS (m3) DOMESTIC WATER METER	BULK WATER METER
DM/BM. .		
DM/BM. .		
DM/BM. .		
DM/BM. .		
DM/BM. .		
DM/BM. .		
DM/BM. .		
DM/BM. .		
DM/BM. .		
DM/BM. .		
DM/BM. .		
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DM/BM. .		
DM/BM. .		
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DM/BM. .		
DM/BM. .		
DM/BM. .		
DM/BM. .		
DM/BM. .		
DM/BM. .		
DM/BM. .		

WORK ORDER LOGBOOK

SUB-DIVISION/SECTION OFFICE: ______________________________

WORK ORDER No	DATE WRITTEN	SUPERVISOR	WORK LOCATION	WORK DESCRIPTION	PRIORITY	COMPLETION DATE	TOTAL COSTS

LOGBOOK TUNING SLUICE VALVES

TUNING MAIN/VILLAGE LEVEL SLUICE VALVES

SUB DIVISION/SECTION OFFICE: _____

SLUICE VALVE IDNR	NUMBER OF TURN TO OPEN SLUICE VALVE FIRST TRY	REVISED	REVISED	REVISED
SV. .				
SV. .				
SV. .				
SV. .				
SV. .				
SV. .				
SV. .				
SV. .				
SV. .				
SV. .				
SV. .				
SV. .				
SV. .				
SV. .				
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SV. .				
SV. .				
SV. .				
SV. .				
SV. .				
SV. .				
SV. .				
SV. .				
SV. .				
SV. .				
SV. .				

LOGBOOK REPAIR WATER METERS

WATER METER IDENTIFICATION NUMBER	DATE RECEIVED	ORIGIN	ISSUED WORK ORDER NUMBER	DATE TRANSFER FOR REPAIR	DATE RECEIVED BACK FROM REPAIR
DM/BM. .					
DM/BM. .					
DM/BM. .					
DM/BM. .					
DM/BM. .					
DM/BM. .					
DM/BM. .					
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DM/BM. .					
DM/BM. .					

ANNEX 12. SANITARY SURVEY

SOURCE: IRC, International Reference Centre for Community Water Supply and Sanitation. Small Community Water Supplies

1 sanitary survey

Definition

A sanitary survey is an on-site inspection and evaluation by a qualified person of all the conditions, devices, and practices in the water supply system which pose, or may pose, a danger to the health and well-being of the water consumer. Sanitary surveys may involve all or a part of the water supply system, depending upon their purpose. The importance of a sanitary survey of sources of water cannot be over-emphasised.

No bacteriological or chemical examination, however careful, can take the place of a complete knowledge of the conditions at the sources of supply and throughout the distribution system. Every supply should be regularly inspected from source to outlet by experts, and sampling - particularly for purposes of bacteriological examination - should be repeated under varying climatic conditions, especially after heavy rainfall and after major repair or construction work. It should be emphasised that, when sanitary inspection shows that a water, as distributed, is liable to pollution, it should be condemned irrespective of the results of chemical or bacteriological examination. Contamination is often intermittent and may not be revealed by the chemical or bacteriological examination or a single sample, which can provide information only on the conditions prevailing at the moment of sampling; a satisfactory result cannot guarantee that the conditions found will persist in the future.

With a new supply, the sanitary survey should be carried out in conjunction with the collection of initial engineering data on the suitability of a particular source and its capacity to meet existing and future demands. The sanitary survey should include the detection of all potential sources of pollution of the supply and an assessment of their present and future importance. In the case of an existing supply, a sanitary survey should be carried out as often as required for the control of pollution hazards and the maintenance of the quality of the water.

It is considered that the responsibility of the surveillance authority goes beyond that of merely pronouncing that water as delivered satisfies, or fails to satisfy, a certain quality standard. Surveillance should include the giving of advice on how defects can be removed and quality improved; this, in turn, implies a knowledge of the water supply system, including the treatment processes, and close liaison with the laboratory workers and water supply operators concerned.

When to carry out a sanitary survey

Sanitary surveys should be undertaken:

(1) When developing new sources of water and in sufficient detail to determine, first, the suitability of the source and, second, the degree of treatment required before the raw water can be considered suitable for human consumption. No new public water supply should be approved without a sanitary survey by, or approved by, an agency with surveillance responsibility.

(2) When laboratory analyses of a sample taken from the water system indicate a hazard to health, a survey should be begun <u>immediately</u> to identify source(s) of contamination. First attention should be given to the most common causes of contamination, e.g. failure of chlorination.

(3) When an outbreak of a waterborne disease occurs in or near the area served by the water supply.

(4) When interpreting bacteriological, chemical, and physical analyses of water samples.

(5) When any significant change is noted that may affect the water system, e.g. construction of a new industry on the watershed.

The above sanitary surveys are undertaken once only or at irregular intervals.

(6) Sanitary surveys should also be undertaken on a regular basis. Their frequency and timing will depend on system size and available staff and resources. Treatment plant operators should make their own regular sanitary surveys and note them in the plant logbook. The ideal for the surveillance agency would be to visit each plant at least annually.

Water from large systems affects more people; yet, smaller systems often have proportionately more hazards. Nevertheless, the larger systems should be inspected more frequently because of their larger population at risk and greater cost-effectiveness of surveillance. The smaller systems should also be surveyed, but with realistic frequency. Rural areas offer a special problem with regard to sanitary surveys, principally the physical and economic impossibility of surveying innumerable small water suppliers. Efforts by surveillance agencies must focus primarily on encouragement and stimulation of individuals and community groups to make their own improvements; to provide information on proven techniques; and to provide technical assistance in site selection, design, and construction. Demonstration of proper practice rather than mere condemnation of the improper is to be sought.

Qualifications of surveyors

The professional judgement and competence of the survey officer ultimately determine the reliability of the data and information collected. Routine external surveillance is generally provided by sanitarians and public health inspectors who are not fully trained in the engineering disciplines related to water supply facilities. Observation of numerous programs indicates that successful surveillance programs can be operated using, under close and qualified supervision, secondary school graduates with one-to-two years' technical instruction and on-the-job training experience. Technical assistance should be available to these inspectors, if needed. Larger or more complex systems should be surveyed by senior staff.

The lack of adequate numbers of qualified personnel should not be taken as an excuse for inaction but as a challenge to establish appropriate training programs. Technical assistance and fellowships are available through several international organizations and other agencies.

Most routine sanitary surveys must be made by plant operators. This may necessitate additional operator training. The principal operator should accompany the survey officer during his inspection, not only to remedy any defects uncovered but the survey should also be considered as a training session. In addition to explaining the "why" of various survey activities and of treatment processes, the operator should be shown, where applicable, proper methods for selection of sampling points, for taking of samples for bacterial and chemical analysis, and measurement of residual chlorine.

An absolute minimum requirement for any system, regardless of size, is that some one individual must be designated as responsible for operation of the system; this individual or his designee must be locatable ("on call") at any time during which a system using surface sources and disinfection is in operation; and, for systems employing chlorination, the principal operator must have on hand devices or equipment for measurement or residual chlorine and be competent in their use, including the indicated adjustments in chlorine dosing rates.

Reliability of the water system during both normal and emergency operation, proper maintenance, and design features build in continuity of operation. Examples include provision of two or more wells for systems with groundwater source, standby power source or provision of elevated storage, and valving of the distribution system to allow partial shutdowns for repairs.

Report forms and records

A considerable aid to both surveillance agency personnel and to water supply operators has been the preparation of printed guidelines, checklists, and forms for undertaking sanitary surveys. These are often mimeographed on inexpensive paper in the national language. Several of the publications listed in the references offer excellent guidance in this respect. In addition to their educational value and their utility as checklists, these forms become part of the permanent record and, as such, as useful for enforcement and follow-up actions.

The report must spell out clearly and unequivocally the recommendations made, the actions which must be taken, and deadlines for action. Any confusion between "suggested" or "desirable" and mandatory action must be avoided.

Sampling and monitoring

Purpose

Samples are taken from drinking water systems to determine if the water supplied is safe for human consumption. In as much as it is impossible to analyze all of the water, the small portion or sample must be representative of the larger quantity being used. If the sample is carelessly taken or taken from locations not truly representative of the system, then the purpose of sampling is thwarted. Such sampling may even be dangerous through its creation of a false sense of security.

One sample from a water system is of limited value. Long records of multiple samples are desirable.

Sampling Frequency and Number

Sampling frequency for public water supplies has traditionally been based on a minimum monthly number keyed to the population served by a given water supply, thus requiring fewer bacteriological samples from smaller supplies. However, the frequency of sampling should also take into account the past frequency of unsatisfactory samples; the quality of raw water treated, the number of raw water sources, adequacy and capacity of treatment, the risks of contamination at the sources; and, in the distribution system, the complexity and size of the distribution system, the dangers of epidemics arising, for example, at international ports or pilgrimage centres, and the application of chlorination.

Superficially, chlorination might imply that less sampling is needed. However, field studies in developing countries indicate that chlorination of water supplies is often not practiced in smaller water supplies with naturally protected sources;for example, deep wells. Rather, chlorination is practiced in water supply systems with actual or potential contamination of source or distribution where failure of the chlorination system could result in a serious hazard to the health of the population served. Thus, constant checks on chlorine residual concentration and bacterial quality are needed to ensure that immediate remedial action can be taken, should suspect water enter the distribution system.

Because of the many variables outlined above and the wide range in resources available for surveillance, no universally applicable sampling frequency is possible. In principle, bacteriological examination of chlorinated water should be done daily. This is feasible in the largest supplies; but, in the smaller supplies serving a population of 10,000 or less, daily bacteriological sampling may be impracticable, and reliance may have to be placed on bacteriological analyses at weekly or monthly intervals. In the smallest supplies, total reliance may have to be placed on sanitary surveys and, where chlorination is practiced, frequent determination of chlorine residual concentration.

Guideline recommendations for sample numbers and frequency have been published by WHO in the International Standards for Drinking Water. The actual number and frequency of sampling must be decided by the surveillance agency and must take local conditions into account. The criteria or standards adopted for local use must be clearly spelled out, distributed in writing to appropriate surveillance and waterworks staff, and above all must be attainable for the type and size water supplies specified. Field studies in developing countries indicate widespread use "on paper" of sampling numbers and frequencies adopted in the United States, the United Kingdom, and elsewhere; in actuality, with the exception of a few capital cities, there is little adherence to the standard.

Location of Sampling Points

The samples should not be taken from the same point on each occasion but should be rotated through other areas of zones of the distribtion system. A common habit which may yield misleading results is the collection of samples from the same points month after month, typically, the laboratory tap at the municipal building, the police station, or the residence of a waterworks employee.

A majority of the bacteriological and chlorine residual samples should be taken in known problem areas;for example, from areas with poor results in the past, low pressure zones, areas with high leakage, densely populated areas with inadequate sewerage, open or unprotected service reservoirs, dead-ends on pipelines, and areas on the periphery of the system most distant from the treatment works.

Many urban areas use water from several sources, often three or four, and sometimes 20 or more. Location of sampling points in the distribution system should ensure that water from each source is periodically sampled. Greater frequency should be given to the sources serving larger populations, surface water sources, sources serving older distribution systems, and sources with known water quality problems in the past.

A common method of water distribution in many large cities is by use of tank trucks or "tankers". In some cities, over half the population may receive their drinking water by this means. The watering stations where the tank trucks are filled should be periodically sampled; and the water, as distributed from the trucks, should also be randomly sampled without warning to the driver-purveyor.

Sample Collection

Sample collectors must be instructed in sampling procedures including:

1. Location of point of sampling as described above. Sub-professionals should be specifically instructed as to sampling sites.

2. The use and purpose of dechlorinating compounds such as sodium thiosulphate added to the sample bottle.

3 Measurement of OT, OTA, or DPD residual chlorine. These tests must be performed immediately upon taking of the sample.

4. Proper procedures for collection of samples to ensure that they are representative and that, for bacteriological samples, the sterility of the sample bottle is maintained. Where samples are repeatedly contaminated by the collectors, a complacent attitude may develop with regard to samples showing positive for coliforms.

5. Proper transportation and storage of samples. Samples should reach the laboratory within 30 hours. They need not be iced but should be protected from exposure to heat or sunlight.

Transport of Samples

In many countries, sample collectors often do not have personal vehicles, and special arrangements may have to be made for transport of samples. Use of public carriers, especially buses and even trains, boats, and planes, has been successful in some areas, but not where the sample collector must pay for the charge from his own pocket. Transport of samples should be a key factor in location of regional laboratories.

Co-ordination with Laboratory

The need for co-ordination between sample collectors and laboratory personnel should be obvious; but, unfortunately, many examples exist of samples arriving and remaining at bus-stations for days, arriving at the laboratory on weekends when the laboratory is closed, and similar practices that impair the usefulness of the sample.