

# Manual

Operation & Maintenance manual for Softener Plant By AES.

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## **1. INTRODUCTION:-**

Raw water obtained from various sources like rivers, lakes, sea and deep artistic bore wells may contain various types of impurities like suspended matters (TSS) of both organic and inorganic nature, dissolved Minerals salts (TDS), dissolved gases and Micro-Biological contamination etc. Treatment of water implies changing its physical and chemical parameters to the accepted level as per the end consumer's requirements. Hence the selection of treatment scheme and components depends upon quality of water available and quality of water desired. Now a day, proper treatment of water attracts global attention due to increased awareness of environmental and ecological pollution.

This manual provides guidelines for operation and maintenance of water treatment plant designed, manufactured and installed in utility area.

This manual contains operation and maintenance guideline for Softener Plant. The distribution scheme of Raw Water, Filter water, Soft water. The operational philosophy and the related Operating Procedures of necessary doing are described in the manuals.

The safety points and the interlocking of equipment for safe and desired use are mentioned in this manual. The chemical reaction, working philosophy is illustrated in the manual .The main objective of preparing the manual to equip the operating personal technically competent.

## **2. OBJECTIVE:-**

The objective of Water system manual is to have a systematic and authentic description of existing water treatment plant, complying with the Atharva requirements.

### **3. SCOPE:-**

The scope of Water system manual is to have a systematic and authentic description of existing water system at utility area, complying with the Atharva requirements.

It also includes drawings of water system, list of Operating Procedures pertaining to the operations and controls of water system and drawings of schematic representation of water distribution system.

#### **4. SOURCE OF WATER SUPPLY:-**

##### **❖ RAW WATER-**

Raw Water is obtained from sources as under :-

- i) Bore well or well water

#### **5. WATER SYSTEM DISCRPTION:-**

##### **1) SOFTENER SYSTEM:-**

- WATER SOFTENER

## **1.0 PROCESS DESCRIPTION FOR SOFT WATER SYSTEM:-**

### **❖ SOFTENER-**

The water from bore well is fed to Softener through Manual diaphragm valve of softener at the flow rate of 5m<sup>3</sup>/hr. Softener is vertical down flow unit of MSRL along with frontal piping with manual diaphragm Valve. Softener removes hardness from water by ion exchange process. It basically consists of Sodium based Ion exchange resins.

When unit has delivered its specified output or treated water quality deteriorates, whichever is earlier the unit is isolated for regeneration. The regeneration involves brine injection and rinsing of resin Bed.

A regeneration tank of LDPE is provided to prepare the brine solution. Specified quantity of 20% NaCl (brine) solution is injected by means of external ejector.

Total hardness in the raw water mainly comprises of calcium & magnesium.

### **The general reaction-taking place during normal operation is: -**



(Note: - 'R' represents resin)

After Sodium ion on the Cation resin bed gets totally exhausted, 20% concentrated Brine solution is passed through the resin bed. This process regenerates the cation resin by restoring the Sodium ion on resin.

**General reaction taking place during regeneration is:-**



(Exhausted Resin) (Regenerate) (Effluent) (Regenerated Resin)

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## 1. Installation

1. Install the SOFTENER vessel on leveled floor.
2. Connect inlet, outlet and drain piping from Manual valves
3. Fill media in the vessel from the top opening. Filling should be done in following steps.

### SOFTENER:-

- i) Check if the bottom distributor is fitted properly.
- ii) Fill water in the vessel up to about 500 mm height.
- iii) Start filling resin in the vessel.
- iv) Fit the top distributor on vessel and fit the piping on the vessel.
- i) Reassemble the piping, butterfly valve etc.
- ii) Softener is ready for start up.

## Start Up

1. Softener unit goes under Regeneration mode as it gives desired Output Between Regeneration (OBR) (Observe the total flow in Flow meter supplied at the outlet of Softener unit).
2. To regenerate the softener follow the procedure in the 'Operating Instructions'
3. Do not pressurize the filter beyond 3.5 kg/cm<sup>2</sup>
4. Keep sufficient stock of spares for trouble-free operation.

➤ **Trouble shooting**

<b>Sr No</b>	<b>Observation</b>	<b>Causes</b>	<b>Remedy</b>
01	Hardness leakage	a)OBR crossed	Regenerate
		b) Regeneration ineffective.	Regenerate properly as per guidelines given (steps / salt qty.)
		c) Improper sealing in valves	Replace / repair valve.
		d) Resin fouling	Carry out de-fouling treatment.
		e) Faulty testing chemicals	Try replacing reagents with new.
		f) Very high / low flow rates	Operate at designed flow rate.
02	Output between regeneration (OBR) reduced	a) Regeneration ineffective.	Regenerate properly as per guidelines given (steps / salt qty.)
		b) Increase in inlet hardness	--
		c) Resin fouling	Carry out de-fouling treatment.
		d) Resin qty reduced	Top up resin. Arrest resin leakage through strainers etc.
		e) Loss of exchange capacity of resin	Replace resin. Diagnose cause for reduction in E/C and rectify.
03	Low flow rate	a) Air lock in pump suction	Priming of pump.
		b) blockage in piping	Check entire length of pipes and remove blockage.
		c) Strainer choking	Clean strainer. Remove fines.
		d) Valves not fully open	Check and rectify.
04	Resin loss	Distributors damaged	If resin being lost in service or fast rinse, rectify top distributor. If resin being lost during regeneration, unload resin and rectify bottom distributor.



## **SAFETY TIPS**

This manual contains number of safe practices and safety tips. Additional warnings are placed throughout the Manual.

### **ELECTRICAL SAFETY TIPS**

- HIGH VOLTAGE to avoid sever personal injury.
- NEVER operate the water treatment plant with electrical control panel door open
- NEVER operate the water treatment plant with damaged parts
- NEVER operate the water treatment plant unless properly trained.
- NEVER override, bypass or remove water treatment plant safety devices or interlocks.
- NEVER perform electrical trouble shooting procedures on the water treatment plant unless you are a qualified electrician.
- ALWAYS follow Lock-Out Tag- Out procedures whenever performing any type of service or maintenance procedure on water treatment plant
- ALWAYS read the manual before operating or performing any maintenance procedures on the water treatment plant

### **CHEMICAL SAFETY TIPS**

- NEVER operate the water treatment plant unless properly trained.
- NEVER handle any chemicals without referring instructions covering proper handling, storage and use of the chemical.

## **MOVING PARTS SAFETY TIPS**

- NEVER attempt any maintenance procedures with water treatment plant running.
- NEVER operate the water treatment plant with the pump-motor fan guard removed.

## **OPERATING PRESSURE SAFETY TIPS**

- NEVER remove any components from the water treatment plant while under pressure, including, but not limited to pressure gauges, plumbing fittings, and valves.

## **OPERATING PROCEDURES OF WATER SYSTEM**

Following are the operating procedures governing the water generation system.

## REGENERATION OF NITRATE REMOVAL UNIT

The Nitrate removal plant is regenerated in the steps as follows:

- a) Sodium Chloride measuring and injection
- b) Slow Rinse
- c) Fast rinse

Regeneration should be done whenever the leakage from Nitrate removal plant is higher than desired limits as per your requirements.

- **Solution preparation.**

Prepare salt solution in the 2000 lit brine tank by salt 304Kg water. Use soft water for preparing the solution.

- **Brine Injection**

Ejector is attached to the inlet and will start sucking the salt solution.

Note the time required for sucking the entire solution. (It should be between 30 to 50 minutes).

- **Slow Rinse**

After the brine solution is sucked, it will continue the same step as above for 20 to 30 minutes to displace all the salt solution from resin.

- **Fast Rinse**

After slow step will change the step to 'Rinse' position .Check the Nitrate up to the and do the setting till the Nitrate is reduced to commercial zero.( $<5$  ppm). Approximate time required is about 15 – 20 minutes.

- **Service**

When the desired water quality is achieved in the rinse step keep checking the outlet Nitrate at regular intervals to determine the regeneration requirement.

## **2) CHECKING OF HARDNESS**

1. Take 25 ml of water sample.
2. Add a speck of Hardness Reagent A.
3. Add more speck if the colour is fine.
4. Add 15 to 20 drop of Hardness Reagent B.
- 5 If blue colour appear Hardness is absent.
6. Add Hardness Reagent R drop by drop (shake after each drop) till colour changes from red to blue.
- 7.Count the number of drops added.
8. One drop equal to 5 ppm.
9. Calculate Hardness as No. of drop of Reagent R \* 5 ppm.