

# All about Water Softener



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# HENC's Introduction

Heaven Engineers & Contractors (P) Ltd. is a professionally managed company with technically qualified team and supporting staff in the field of Engineering, Procurement, and Construction.

Our Founder Director of the company is working in Industry from more than 38 years and having work on many projects as an individual he decided to formally incorporate it as a Pvt. Ltd. in year 2012.

We have proven expertise in infrastructure, sewage treatment plant, industrial projects, sanitary and water supply works, Electrical and Air-conditioning works etc.

In a very short span of time, the company has witnessed exponential growth and has tried to carve a niche for itself at the top. with the most advanced technological expertise in given services, We are trying to keep us abreast with technological developments and are implementing the advanced technology with full awareness.

Today, We are growing at a rapid pace with a vision to become one of top engineering & Contracting companies in INDIA.

## HENC's Area of Expertise

### **WATER**

**Water & Waste Water Treatment Plants**

We provide services for water treatment plants and Sewage treatment plants with various technologies currently available in market. SBR, MBBR UASB MBR or Heavy Metals Treatment.

### **AIR**

**HVAC Contracts**

We provide services in the areas of Comfort Air conditioning, Ventilation , Kitchen Exhaust i.e. Chillers , Ductable's, Packaged and VRF Projects.

We have expertise of solving any of your complex problems regarding transfer of any fluid be it water or chemical. We also provide system solutions and have tie ups with leading manufacturers to supply you world class energy efficient products.

### **System Solutions**

**Pre-fabricated Factory Assembled Systems**



# Purpose

The purpose of this standard is to specify the format, structure, and content of the Manual and its relationship with other documentation and records for the WTP installed by M/s Heaven Engineers & Contractors Pvt. Ltd.

The format presented in this standard provides for the collation and provision of constructed information by the contractor to Heaven Engineers & Contractors Pvt. Ltd.'s Representative, in a single transaction to meet 'Asset in Service and Practical Completion' requirements.

Some of the final information is subject to control by different business units within Heaven Engineers & Contractors Pvt. Ltd. (e.g. Engineering, Asset Management). It is the responsibility of the Heaven Engineers & Contractors Pvt. Ltd.'s Representative to ensure that the related applicable technical standards and guidelines are followed, and that information subject to 'Internal quality control' is sent to the relevant business units for their record keeping and management purposes, in its native form.

Provision of this information should be subject to the providers Quality Management systems quality assurance and / or best practice document control requirements. The Water Quality achieved may or may not meet certain standards desired by individuals other than mentioned in this document.

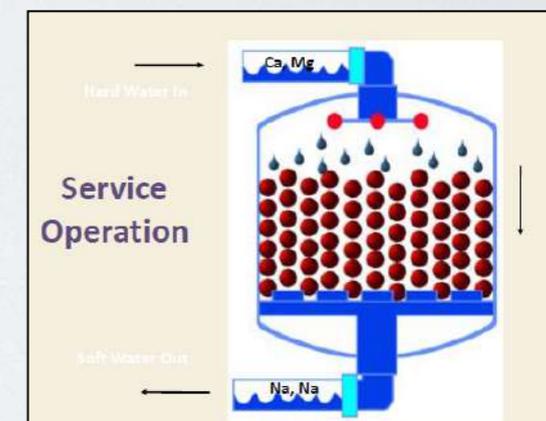
# Principle of Softening Plant

"Hard Water" contains a lot of calcium, Magnesium or there minerals. Which is been acquired by groundwater by dissolving them from surrounding soil and rock.

Water Softeners operate on a simple principle: Calcium and magnesium ions in the water switch places with more desirable ions, usually sodium in a very small amount.

The ion replacement takes place within a tank full of small polystyrene beads, also known as Resin or Zeolite. The negatively charged beads are bonded to positively charged sodium ions. As the water flows past the beads, the sodium- ions swap places with the calcium and magnesium ions, which carry a stronger positive charge.

Over several cycles, calcium and magnesium replace all of the sodium in the beads, after which the unit can no longer soften water. To fix this problem, the softener enters a regeneration cycle during which it soaks the beads in a strong solution of water and salt, or sodium chloride. The sheer amount of sodium in the brine solution causes the calcium and magnesium ions in the beads to give way and the beads are recharged with sodium. After regeneration, the water softener flushes the remaining brine, plus all of the calcium and magnesium, through a drainpipe. Regeneration creates a lot of salty water.



# Basic Design Consideration

The Design is based on Feedback & Analysis of raw water parameter as suggested by a customer in their basic information shared with HENC or our HENC's well trained executive's on site evaluation of raw water parameters. It may vary as per geological consideration of different plant room location and feed water test results.

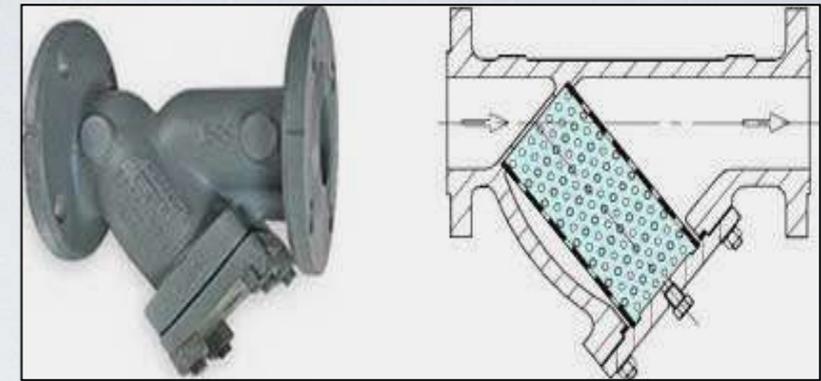
For our basic calculation and understanding let us assume following parameters.

S.N.	Description	value	Unit	Remarks (if any )
1	Feed Water Flow Rate	25	m <sup>3</sup> /hour	Assumed water flow per hour
2	Operating Hours	8	Hours	Desired
3	OBR	200	m <sup>3</sup>	Output between Regeneration (1 x 2)
4	Feed Hardness	450	PPM	Assumed Hardness
5	Output Hardness	Less than 50	PPM	Desired hardness
6	Resin Exchange Capacity	55	g/l	Given by Resin manufacturer
7	Total Resin Required	1636.36	Kg	(OBR x Feed Hardness) / Resin ex. Capacity
8	Salt Regeneration Capacity	150	gm/l	Value considered as gram of NaCl per litre of resin
9	Salt required	245.45	Kg	

# Components of Softener

## A. Y-Strainer :

This product is designed for remove foreign matter from pipe lines and provides protection for pumps, meters, valves, and other similar mechanical equipment, which is called as Strainer. "Y" Type Strainers are named after their shape and normally used for course filtration. But with large filtration area can be used with fine mesh also. The Strainer improves the clearance in the medium, and prolongs the life of valves; protect expensive pumps, meters and other equipments. It is suitable for water, Air, Gas, petroleum, steam and other fluids.



Y-strainer can be installed in either a horizontal or vertical position (Downward flow) with the screen element pointing downward. This allows the strainer screen to collect material in the strainer at the lowest point of the screen.

## B. Pipes & Fittings:

There are various types of Pipes and fitting are used these days in industry, but broadly GI pipes and UPVC pipes are used because of their ease of availability and flexibility in use.

1. Galvanised Iron (**GI**) **Pipes** are manufactured using mild steel strips of Low Carbon Steel Coils. ... The **GI Pipes** are generally used for distribution of treated or raw water in rural or urban areas. These **pipes** are cheaper, light weight and easy to handle. These pipes are generally used with threaded fittings or with butt welded fittings.



2. Regular PVC (polyvinyl chloride) is a common, strong but lightweight plastic used in construction. It is made softer and more flexible by the addition of plasticizers. If no plasticizers are added, it is known as **uPVC** (unplasticized polyvinyl chloride) or rigid PVC.

Advantages of using a UPVC pipes and fittings are that easy very fast to be used and generally all manufacturer manufacture these pipes along with their fittings. All ball valves , Bends, TEEs etc are to be used are available easily in market. One big disadvantage of using such pipes and fittings are they can not be reopen once fitted. They need to be cut down or broken for opening and only part of it can be re used.



3. The **Butterfly valve** is **used** to regulate and control, throttle the flow. They are featured by a fast operation and low-pressure drop. To make an open position from the closed, it requires only a quarter turn. Wafer, lug, Single-Flange, Flange are the regular types of **butterfly valves**. These can be opened for checks and re used.

## C. & D. Pumps

There can be various types of pumps can be used for a softener plant (all centrifugal pumps). It may be called Raw water pumps, Filter feed pumps or softener feed pumps. This can be decided based upon raw water availability (i.e. type of source - ground water or municipal water source.)

1. For a ground water source a submersible pump (raw water pumps ) will be required to extract water from nature earth which can be directly fed to softener filters or a separate sets of pumps (filter feed pumps) can be used to feed water after storage. These may be submersible or surface mounted as per site locations.

2. For municipal water source it is generally collected in to a source tank and then fed with help of filter feed pumps to softener filters. This will be generally surface mounted but can be a submersible pump also as per site convenience.



Type of surface pumps.

These pumps can be selected as per total amount of water that needs to be treated by WTP (softener), in an hour or as per twenty four hour cycle. Which is already explained in basic design consideration. We can also decide for pressure for pumps based on type of source used for treatment. For example A ground water source will require higher amount of pressure then a municipal water stored at ground level. We also must take care for optimum use of energy and should go as low as it is possible in energy consumption.

## E. Pressure Gauge's , Rotameter's and Flow meter's

1. A pressure gauge is a common component in operations from various industries across the world. But not every gauge is created equally or made for every situation.

Gauges with bourdon tubes are the most common pressure measuring devices used today. They combine a high grade of measuring technology, simple operation, ruggedness and flexibility with the advantages of industrial and cost-effective production. Needing no external power supply, bourdon tube gauges are the best choice for most applications.



2. Rotameter's & Flowmeter's are crucial components of most processing systems. They are required to measure accurate amount of flow to be treated. In these environments, a pressure gauge needs to be reliable, accurate and easy to read to help prevent failure in everyday operations. Rota meter is manually calibrated flow measuring instrument with glass Indicators, whereas flowmeter is an electronic, electromagnetic or ultrasonic instrument.



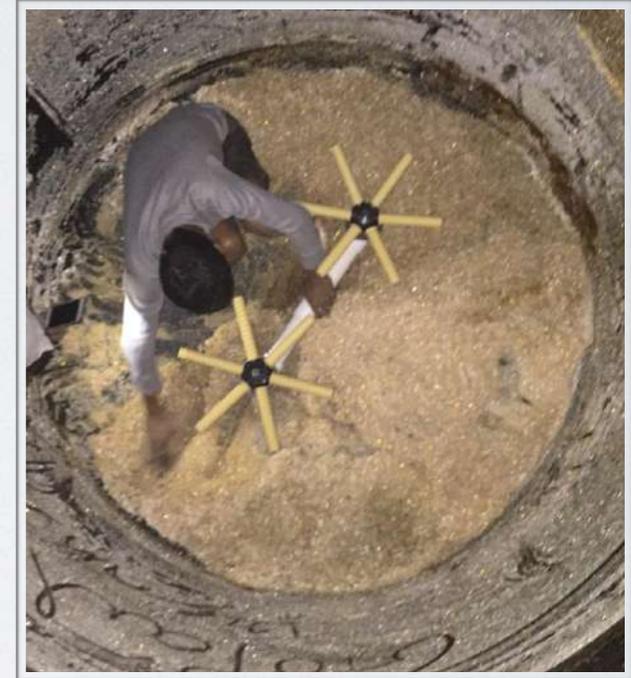
# Pressure vessels's , PP Strainers & frontal piping.

These are cylindrical vessel either made of Mild Steel of dia xx mm & yy mm Height Or same can be of Fibre Reinforced Plastic material. These contains different sizes of media grains, anthracite and Resin. MS Vessel are required to rubber lined or FRP lined for protection against corrosion. Choice of vessel is purely based on ease or availability , life cycle and USE of vessel, but it is generally for bigger volumes MS vessels are considered.

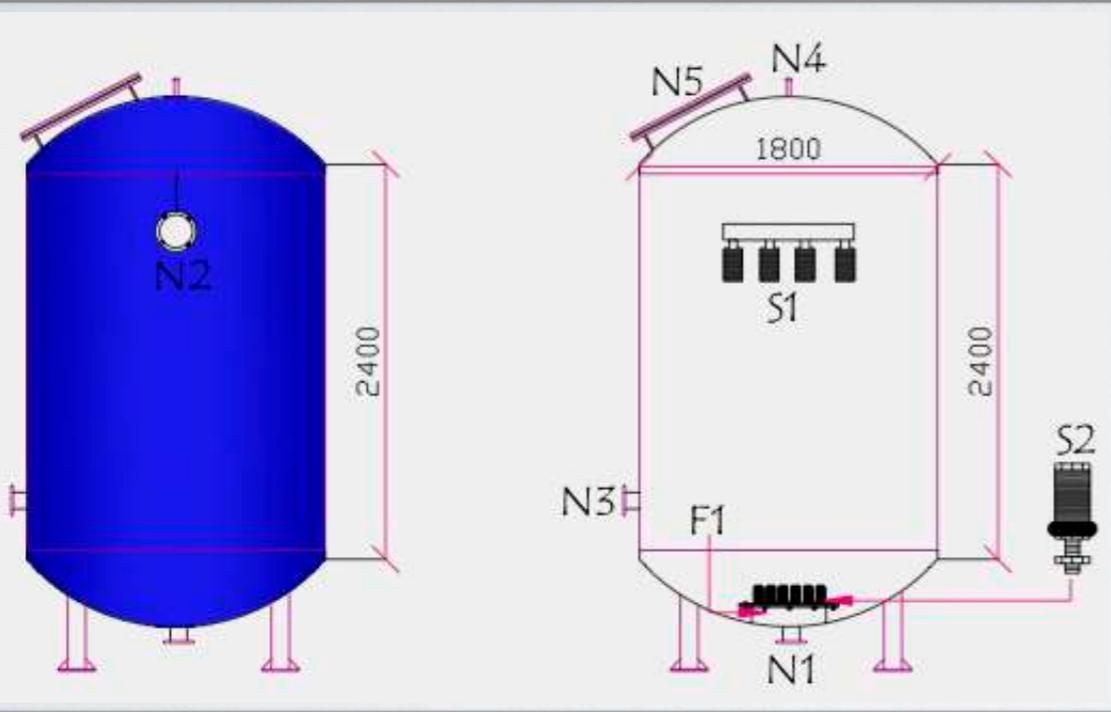
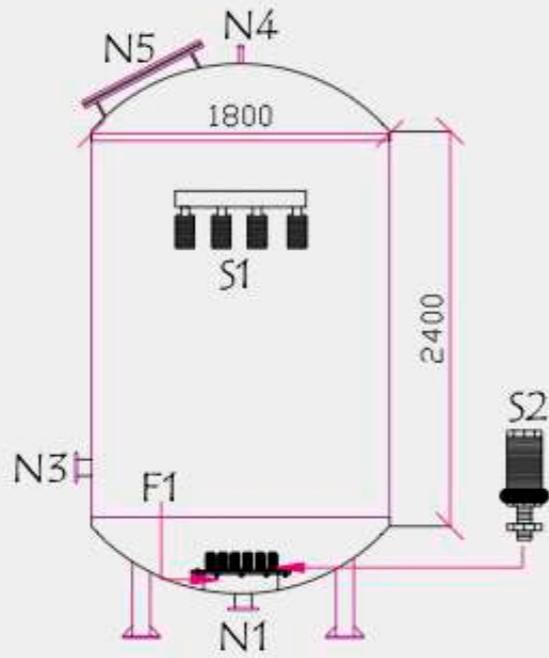


FRP Vessels

Fixing a PP type strainer inside vessel



A Sample internal General Arrangement drawing of MS Vessels with different flanges (N1, N2, N3, N4 and N5) and various Strainers (S1 and S2).



PP Strainers



Raw MS vessels



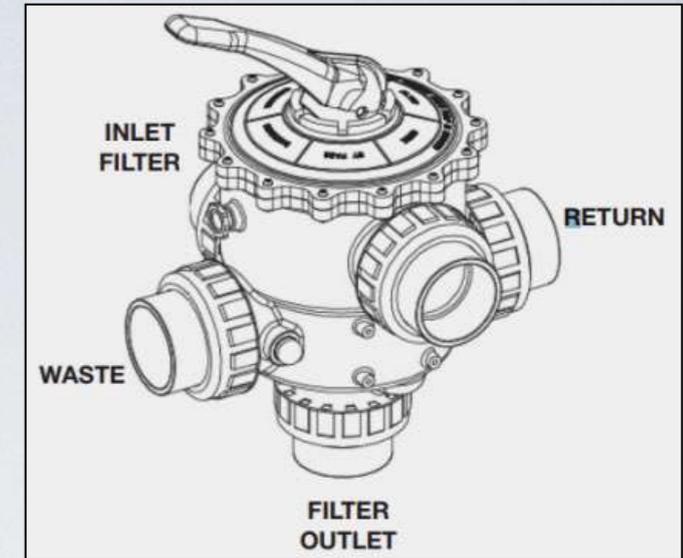
A frontal Pipeline work going on



# Multiport Valves for filters & Softeners.

These valves are one-piece body made from moulded glass-reinforced engineering plastic provides incredible strength and durability. 304 – Grade Stainless Steel or Polypropylene used throughout to withstand harsh water conditions also Multiple valve positions available with the turn of a handle, including: Filter, rinse, bypass, backwash, waste. Sight glass fitted to waste line for easy inspection of the backwash water.

Designed for a 4.5 kg/cm<sup>2</sup> operating pressure. Connecting Multi-Port Valve to Filter System Use care before assembly not to damage union sealing surfaces or O-Ring. Install union O-Rings in groove; tighten union collar hand tight.



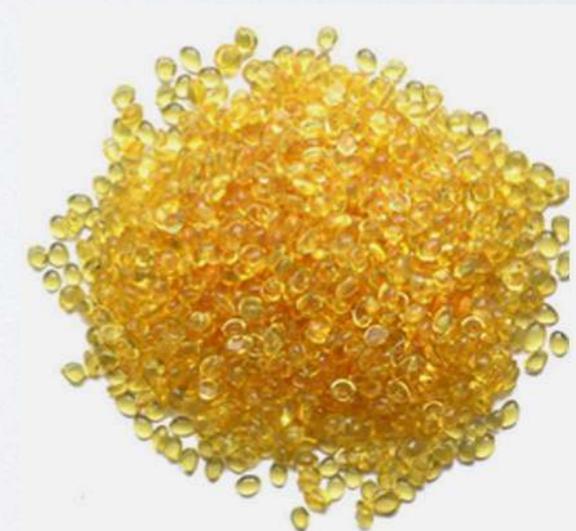
<b>FILTER</b>	<i>PUMP ► SAND TOP/DE BOTTOM ► THROUGH FILTER ► SAND BOTTOM/DE TOP ► POOL RETURN</i> For normal filter action and vacuuming pool through filter.
<b>BACKWASH</b>	<i>PUMP ► SAND BOTTOM/DE TOP ► THROUGH FILTER ► SAND TOP/DE BOTTOM ► WASTE</i> For cleaning filter by reversing flow.
<b>RINSE</b>	<i>PUMP ► SAND BOTTOM/DE TOP ► THROUGH FILTER ► SAND BOTTOM/DE TOP ► WASTE</i> For start-up cleaning and resetting filter bed after backwashing.
<b>WASTE</b>	<i>PUMP ► WASTE</i> For vacuuming directly to waste, lowering pool level or draining pool.
<b>CLOSED</b>	<i>NO FLOW. DO NOT USE WHEN PUMP IS IN OPERATION</i> For shutting off all flow to filter and pool.
<b>RECIRCULATE</b>	<i>PUMP ► POOL RETURN</i> For circulating water without going through filter.

**FOR SLIP FITTINGS:** Use correct solvent/cement when fitting piping or adapters to slide valve. The valve body is ABS plastic, thus any good quality ABS to PVC solvent can be used. Use primer on PVC components only. Allow a minimum of four hours drying time prior to pressure testing or operation. To avoid serious personal injury or property damage, follow cement manufacturer's instructions exactly.

## Resin Beads

Resin is the ion exchange media used commonly in water softening applications. The most widely used resin in the industry is polystyrene-type gel resin. This resin has a very porous, skeletal structure and each bead ranges in size from 0.3-1.2mm, containing approximately 45% moisture. The building blocks of this type of resin are Polystyrene and Divinylbenzene (DVB).

Resin manufacturers used commonly in HENC water softener are : Ion exchange , Purolite and Thermax, Generally preferred with raw water quality and Ion exchange capacity given by resin manufacturer.



## Ultra Violet Systems (UV systems)

UV systems perform a disinfection method that uses short-wavelength ultraviolet C (UVC) light to kill or inactivate microorganisms by destroying nucleic acids and disrupting their DNA, leaving them unable to perform vital cellular functions. UV System is used in a variety of applications, such as food, air, and water purification.

UV devices can produce strong enough UVC light in circulating air or water systems to make them inhospitable environments to microorganisms such as bacteria, viruses, molds and other pathogens. UVGI can be coupled with a filtration system to sanitize air and water.

At some places UV is generally replaced by other methods of disinfections such as dosing of small amount liquid Chlorine (hypochlorite) or Hydrogen peroxide. For such Small quantity dosing pumps are used.

## Dosing Pumps/Systems

A dosing pump is a small, positive displacement pump. It is designed to pump a very precise flow rate of a chemical or substance into either a water, steam or gas flow. A dosing pump will deliver this precise flow rate of chemical or other product by a number of different methods but it generally involves drawing a measured amount into a chamber and then injecting this volume of chemical into the pipe or tank being dosed. Dosing pumps are used in a variety of applications from agriculture, industry, manufacturing to medicine.

A dosing pump is generally quite small and is powered by either a small electric motor or air actuator. They are controlled either by an external control system or more commonly an internal pump controller that can alter the flow rate, the on/off function and also things like alarms and warnings for run dry, degassing and low product levels.

## Brine Exchange Units.

Brine is a high-concentration solution of salt in water. In different contexts, brine may refer to salt solutions ranging from about 3.5% (a typical concentration of seawater, on the lower end of solutions used for brining foods) up to about 26% (a typical saturated solution, depending on temperature). Lower levels of concentration are called by different names: fresh water, brackish water, and saline water.

Brine Exchange Units are used to regenerate Sodium levels of Resin beds after they stop exchanging ions, which is also known as OBR cycle of a softener. It generally consists of a small capacity pump to circulate brine, Brine Tank and a agitator to mix brine solution or salt in water.



# Agitators or Mixers

As they are defined by their names they are used to mix salt solution in a tank in context of a softener, in some cases it is also used in mixing chlorine or other disinfectants.

It consists of an extended shaft generally extended to bottom of brine solution tank connected with a mixing blade or fan, which is driven by a geared motor to reduce the RPM of motor



# Cartridge Filters



Stainless Steel Housing – SS 304 & SS 316 4.0 inch Dia cartridge – Jumbo PP Housing

Stainless steel Cartridge

Pleated cartridge

Cartridge filters are simple, modular filters that are inserted into a housing and can be used to remove particles, or sometime chemicals, from the water. Cartridge filters can be composed of a number for materials. Some may be made from wound strands of a material such as polypropylene.

Specification of such filters is of 5 micron , a 4 inch filter made of spun or fibre housed inside a polypropylene housing of same size.

They can also be housed in a SS 304 or 306 casing depending on raw water quality.

# Soft Water Pumps

A Soft water pump is a specific type of pump used to pump soft water for direct consumption after hardness is treated by passing through all filters. As after softener continuous run water is stored in another tank and consumed as per consumer requirement.

Any centrifugal pump driven by a constant/variable speed electric motor. The number of stages in these feed pumps is determined by the feed quantity and discharge pressure. Sometimes a combination of number of pumps with an air operated system is also used, which is known as hydro-pneumatic pumping systems



# Drainage Pumps

When plants are constructed below the ground levels , all the wastewater is required to be drained with the help of pumps, for such application drainage pumps are used.

Drainage pumps are submersible pumps able to handle drainage of clean and dirty away from areas or sumps to be drained.

A submersible drainage pump is an enclosed unit with a close coupled pump and motor, due to its construction, the pumps is suitable for submersible installations – designed to be partially or completely immersed in water.

A Non-submersible drainage pumps shall not be placed in water. They instead use suction hoses or permanently installed pipe work to move water from one location to another.



# Panel, wires & Cables

A **distribution board** (also known as **panel board**, **breaker panel**, or **electric panel**) is a component of an electricity supply system that divides an electrical power feed into subsidiary circuits, while providing a protective fuse or circuit breaker for each circuit in a common enclosure generally with an INGRESS PROTECTION (IP) of IP 42 or IP 55.

All the values of power consumption is decided and the distribution is provided from this panel. Generally all smaller pumps and motors are single phase supply and where as bigger pumps are of three phase supply.

All the wires and cable are decided once we come to conclusion over motor and panel capacity for a single phase pump a two or three core wire is sufficient whereas of three phase pump it is minimum required a three core for current distribution or more for safety and earth.

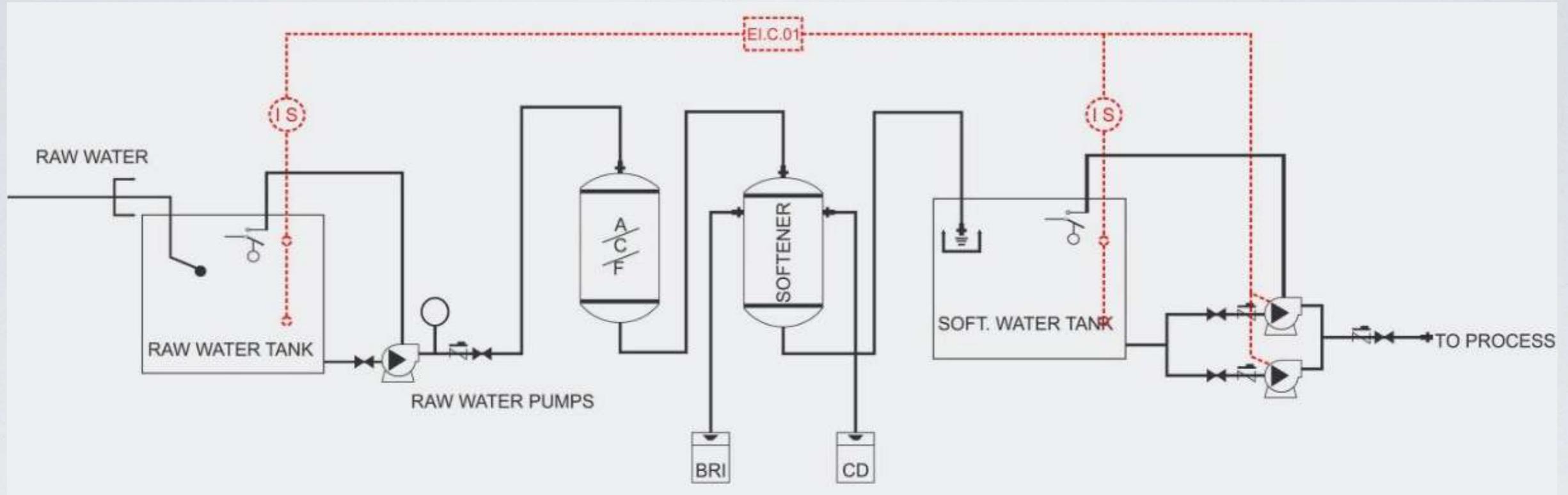
The general make for switch gears in panel is shineider & L&T. Wheres wires and cables polycab, finolex and RR cables.

Optionally a panel can also have sometimes metering device , Auto & Programmable Control option and even some quality checking devices.

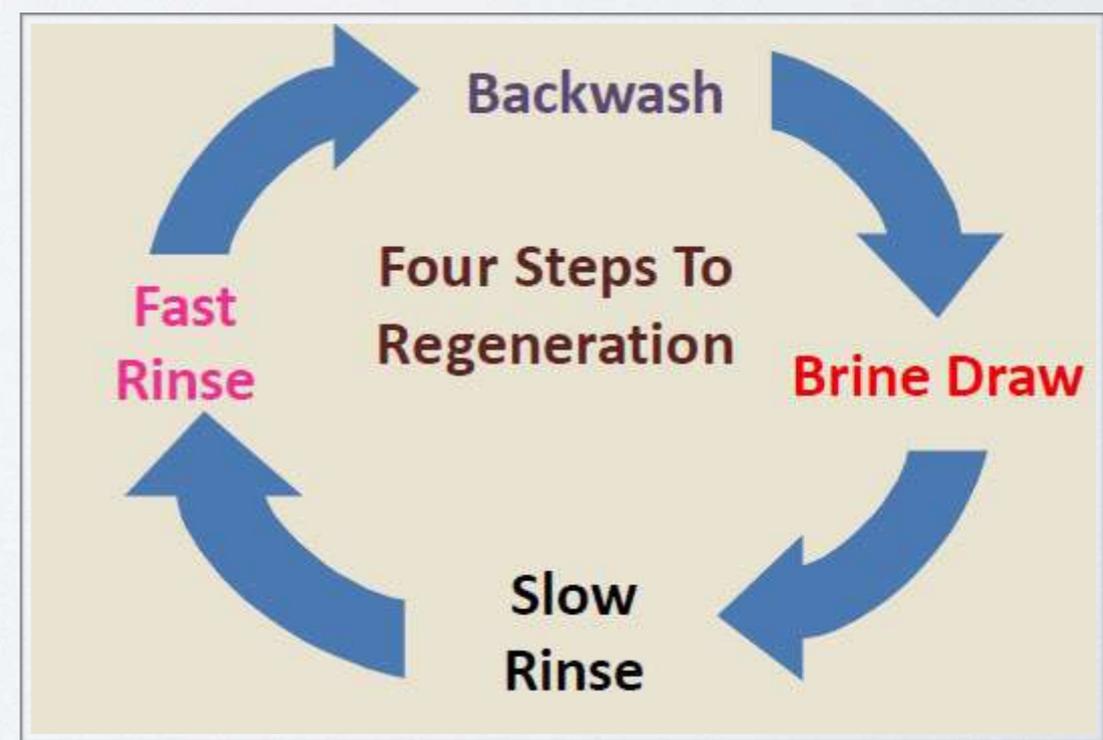
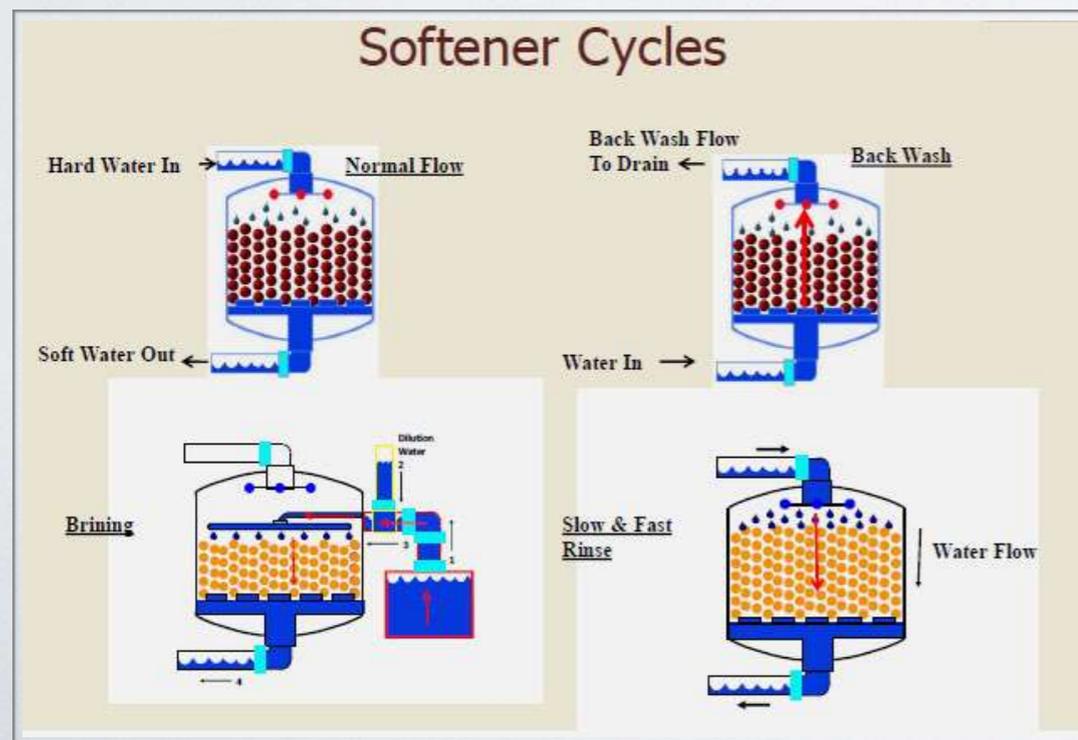


# Flow Diagram For Softener.

A general line diagram or P& ID diagram is presented here below. It may vary for process to process depending upon water quality of raw water, demand of automation & quality of treated water.



# Operation Cycle For Softener.



# Troubleshooting of Softener

## 1. Loss of capacity

- Increased raw water hardness
- Decrease Time between regeneration
- Brine concentration and or / quantity
- Keep brine tank full of salt at all times. Clean it yearly. Salt may be bridged. If using a salt grid plate, ensure refill water is over it.
- Resin Fouling
- Call Dealer
- Poor Distribution, Channeling
- Call Dealer
- Internal Valve Leak
- Call Dealer
- Resin Age or Loss
- Call Dealer.

## 2. Poor Water Quality.

- Check Items listed above first.
- Check if bypass valve is open
- Close valve.
- Channeling
- Check for too slow or high service flow. Check for media Fouling.

## 3. High Salt Usage.

- High salt in brine tank
- Lower brine tank refill time.
- Excessive water in brine tank
- See point no 05 below.
- Constant Flow through the unit.
- Indicates Plumbing Leak.

## 4. Loss of Water pressure.

- Scaling / Fouling of inlet pipe
- Clean or replaced pipe line.
- Fouled resin
- Clean Resin
- Improper Backwash
- Backwash more frequently.

## 5. Excessive Water in Brine Tank and / or Salty Water to Service

- Plugged drain line or drain line control
- Clean or replace injector screen.
- Dirty or damaged brine valve
- Clean or replace brine valve.
- Plugged injector or screen
- Increase pressure to allow injector to perform properly. (20 psig minimum).
- Excessive brine refill cycle time
- Lower brine refill time.
- Low inlet pressure.
- Check items listed in #1

## 6. Softener Fails to Use Salt

- Plugged / restrict drain line
- Clean drain line and / or flow control button
- Injector and / or screen is plugged
- Clean or replace injector and screen
- No water in brine tank
- Check for restriction. Ensure safety float is not stuck. Check brine tank for leaks.
- Water pressure is too low
- Line pressure must be at least 20 psi.
- Brine line injects air during brine draw
- Check brine line connections for air leaks
- Internal control leak
- Call dealer. Check piston, seals and spacers for scratches and dents.

## 7. Continuous Flow to Drain

- Internal control leak
- Call Dealer.
- Valve jammed in backwash, brine or rapid rinse position
- Same as above.
- Motor stopped or jammed
- Check for jammed piston. Replace motor if motor is unresponsive

# Other Instructions

1. Do not place heavy or sharp objects on water softener or cabinet.
2. Use only mild soap and warm water to clean exterior of the unit. Never use harsh, abrasive cleaners.
3. Protect the water softener and drain line from freezing.
4. Keep the system under proper sheds
6. Inspect and clean the brine tank when sediment appears in the bottom of the salt compartment.
7. Always keep the brine tank supplied with good quality salt, a type designed for use in water softeners.
8. Utilities like Water & Power required for commissioning & operation of the plant.
  - Service water supply at the Point of use
  - Required at site puddle Flanges, railings, stairs, etc. if civil construction is not in our scope.
  - Any statutory approval from any authorities, sampling and testing of raw & treated water.
  - Concrete work, grouting, cutting or drilling to brick, stone or concrete work, and making good to same if not in our scope is undertaken by the Civil Contractor.
  - Ample clear and level passage to the tanks and suitable hard standing in close proximity to the installation to enable any lifting gear required to be used at minimum radius.
  - A Project Manager or Site Manager of client will be present during all site installation work.
  - Free access to site, throughout the agreed installation period during all normal hours of work.
  - All proprietary equipment is offered in the manufacturer's standard design, finish and color; this may not necessarily comply with some particular required specifications.
  - It is anticipated that the site will have its own permanent security arrangements and hence, our offer does not include for secure site storage or the general safekeeping at site prior to actual erection of our equipment. The cost of repair to damaged equipment or the cost of replacement items lost at site prior to erection will be charged extra.
  - As our equipment is assembled from proprietary items, these are subject to their Manufacturer's standard test procedures and Type Certificates will be issued if required. Should separate witness tests be required, an additional charge would be applicable. The expenses or fees involved in sending the representative to the Manufacturer's work or place of testing will be at the Purchaser's expense.
  - If civil structure is not in our scope, it has to be constructed to a suitable standard, including but not limited to:
    - That a common datum point will be established by the civil contractor.
    - That the floors of all basins are flat and level to within +/- 25mm of the AOD datum level.
    - That any penetrations are correctly positioned and of the correct size.
    - That the structure is suitable for the loads imposed by the equipment.
9. That the floor slab is suitable for the drilling and fixing of both mechanical and/or resin anchor bolts. Our offer complies with the requirements for the Health and Safety at Work Act, 1974. We have assumed that we would not be the Principal Contractor and have allowed for the support required, in terms of both manpower and paperwork, for the production of the Health and Safety plan and to operate the site in accordance with local equivalent CDM regulations and H&S rules. Although operating on an overseas site, we would expect standards of Health and Safety to be observed and maintained throughout the construction/erection period.
10. Any and all guarantees/warranties are conditional upon all equipment being maintained in accordance with the manufacturer's instructions.