



ELGRESSY
ENGINEERING SERVICES LTD.



E.S.T *User Manual*

Electrochemical System for Scale Removal
& Disinfection Water Treatment

Motor Version

About This Document

The Elgressy EST unit is electrolysis equipment involving the chemical decomposition of salts by electrical current. The unit has been designed and manufactured for safe operation by the user.

**This user guide is intended for service technicians of the EST system.
It must be read carefully before installing and operating the unit.**

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1. How to Use This Document

This document consists of six parts. The following list provides general guidelines as to how this document is organized as well as the procedures you are expected to encounter throughout your handling of the EST system.

Part 1: Getting to Know the EST System and Its Environment (chapters 2-5)

- Chapter 2. The EST System: An Overview
- Chapter 3. Technical Specifications
- Chapter 4. Components of the EST System
- Chapter 5. Peripheral Systems

Part 2: Installation (chapter 6)

The installation process consists of seven steps:

- Step 1: Preparing the Installation Site
- Step 2: Unpacking and Positioning the System
- Step 3: Setting Up the System
- Step 4: Connecting the System to Water
- Step 5: Setup Electrical Connections

Part 3: Operation (chapters 7-9)

- Step 1: Understanding the Operating Principle (chapter 7)
- Step 2: Activating the EST system (chapters 7 and 8). This is done in two stages:
 - Stage 1: Starting The EST System
 - Stage 2: Adjusting System Settings
- Step 3: Monitoring the EST system (chapter 7)

You will also need to be acquainted with the following procedures (chapter 7):

- Shutdown Procedure
- Opening the EST Unit
- Closing the EST Unit

Part 4: Maintenance (chapter 9)

There are two types of maintenance operations you will be required to carry out:

- EST Bi-weekly Maintenance
- EST Semi-annual Maintenance

For this purpose, you will use these operational procedures (chapter 7):

- Shutdown Procedure
- Opening the EST Unit
- Closing the EST Unit

Part 5: Troubleshooting the EST System (chapter 10)

This part provides you with instructions for possible malfunction symptoms.

Part 6: The SCP (SCP Option (chapter 11)

If you have ordered this add-on, you will need to know:

- The SCP Operating Principle
- How to install, operate and adjust the SCP add-on (detailed in the section Getting the SCP Add-on to Work)
- SCP Maintenance operations

Safety Warning

The EST is electrolysis equipment involving the chemical decomposition by electrical current. The unit has been designed and manufactured for safe operation by the user.

This document discusses only the EST system. Any handling of the electrical system, the panel, electrical connection and other items connected to electricity must be done by a registered authorized electrician.

For a safe and long lasting operation, please follow all instructions detailed in this manual.

Throughout the installation, operating or maintenance procedures, if in doubt, please contact the manufacturer or service company.

2. The EST System: An Overview

The EST treatment system provides controlled electrolysis, in a controlled reaction chamber, to prevent scaling and control bacteria, algae and slime formation, that arise in cooling water systems of various sizes and types. It can be applied to numerous facilities including air conditioning systems, process cooling, ammonia cooling and compressed air cooling.

EST eliminates the need for costly and hazardous chemicals to treat cooling water, chemicals that are eventually drained as wastewater. Because it uses no chemicals, the EST system discharges only clean water, and, consequently, results in considerable savings in water, sewage and other costs.

The EST anti-scale treatment unit is used alone in most facilities to prevent general scale formation. Other units in the system, SCP and can be added to enhance the EST performance.

SCP Optional Add-on

The SCP system was developed to prevent the crystallization of scale. The SCP contains a sacrificial electrode that releases metal ions into the water in a very controlled manner. The electrolytic reaction chamber is hydraulically connected to the EST system, but electrically controlled from the flow meter of the make-up water to the system.

The ions released into the water perform as antiscalant thus facilitating a more effective treatment of scale precipitation and prevention of silica crystallization in water systems. The SCP electrolytic system consists of an anode specially composed of materials that interrupt the silica scale crystallization.



3. Technical Specifications

Tank

Design Pressure	6 bar (88psi)
Operating Pressure	Maximum of 6 bar (88 psi).
Material	Carbon steel, epoxy painted on external side.

Tank Internals and Accessories

Electrodes	Proprietary and patented metallurgy.
Scraper	Patented Polypropylene shaft and scraper are operated by motor.
Min. operating pressure	2 bar (29.5 psi).
Valves	Inlet & drain – 2" ball (EST-10, 1.5"), air operated, double acting, with limit switch for inlet valve only. Connections – threaded to BSP. Air intake – Pressure reducing valve with pressure gauge, connection – 6 mm quick joint. Air release/intake valve, ARI ¾", Model AV-10 rated for 140psi, PN-10.
Solenoid Valves	24 volts for inlet and outlet.
pH meter	Thermo dlpfa PH-500 or equivalent.
Flow meter	Arad Dalia equipped with pulse reading switch or magflow meter.

Electrical and Control Systems

Operation	110V; 60Hz for the USA. 220V; 50Hz for Europe/China/Far East.
Control:	Lambda, 24V DC. 3.1A.
Electrolysis Power Supply:	Lambda GEN-750
EST-25:	Maximum of 30V DC; 16amp or 25amp, according to application
EST-15:	Maximum of 30V DC; 16amp or 25amp, according to application
PLC for Automatic control:	SAIA PCD-3 wide area, equipped with cellular modem.
Interactive Display:	Delta TO2
Electrical connection required:	3ph, 380V, 25Amp

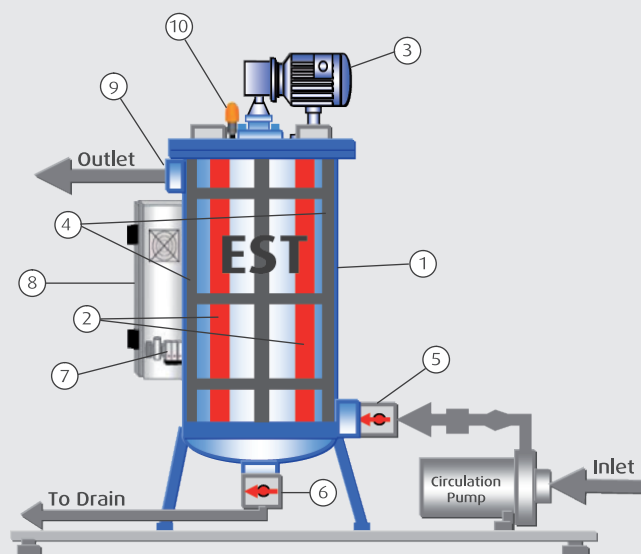
4. Components of the EST System

This chapter describes the components of the EST system. For better understanding, you should use drawing 1, which maps out the components of system. Accordingly, components are numbered in this chapter in correlation with the numbering on the drawing.

1. Reaction tank (serves as cathode).
2. Electrodes (anodes), according to your EST model:
 - EST-25:** 2 or 3 electrodes, depending on your site's requirements
 - EST-15:** 2 electrodes
 - EST-10:** Electrode
3. Scraper motor for scraper operation.
4. Scraper made of polypropylene, mounted inside the reaction tank.
5. Water inlet valve. The inlet valve is air operated. All valve connections are threaded to BSP. The valve's size is dependent on the EST model:
 - EST-25:** 2"
 - EST-15:** 2"
6. Drain valve. The valve is air operated and includes a restriction valve to slow the air flow into the valve hence slowing the valve motion. All valve connections threaded to BSP. For all EST models the valve's size is 2".
7. Automatic control electrical panel with a stabilized current (drawings are attached to the panel). The panel includes the following:
 - 7.1 Power supply for 30V and up to 25 amps of direct current.
 - 7.2 PLC to control the operation of the unit including the circulation pump.
 - 7.3 Interactive display unit for local control of the unit.
 - 7.4 Contactor to circulation pump.
 - 7.5 pH meter
 - 7.6 Main Electrical connection: 380V, 25 Amp.
8. Water outlet, allowing water to flush from the reaction tank. The water outlet is 2" in diameter and it is threaded to BSP.
9. Air release/intake valve, ARI ¾" for protection of the tank.
10. Flow meter for Cooling Tower make-up water inlet.

Drawing 1 - Parts of the EST

1. Reaction tank
2. Electrodes
3. Scraper motor
4. Scraper
5. Water inlet valve
6. Drain valve
7. Air intake
8. Power supply
9. Water outlet valve
10. Air release/intake valve



The EST is installed as part of a more complex system. This system includes:

- Circulation pump to pump water from the cooling tower sump to the EST. This is not part of the EST supply but must be supplied by the user.
- Recommended pump sizing is dependent on your system's model. Note that Pump head must be suitable for the system:

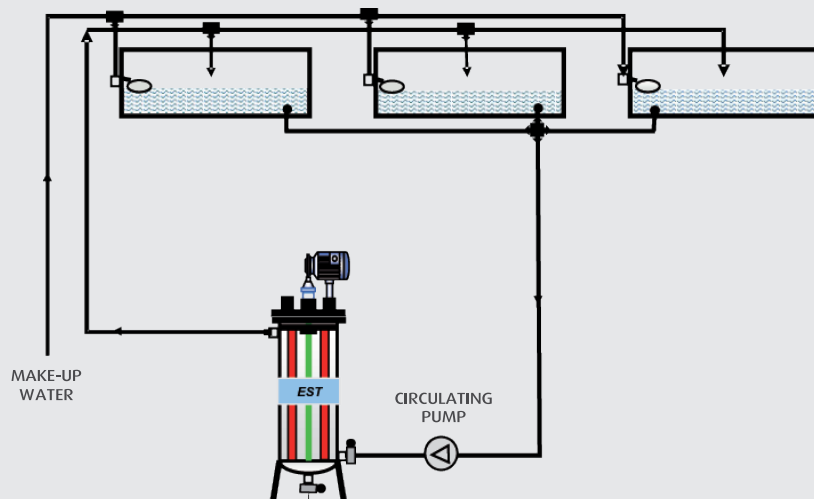
EST-25: 25-35m³/hr

EST-15: 15-25m³/hr

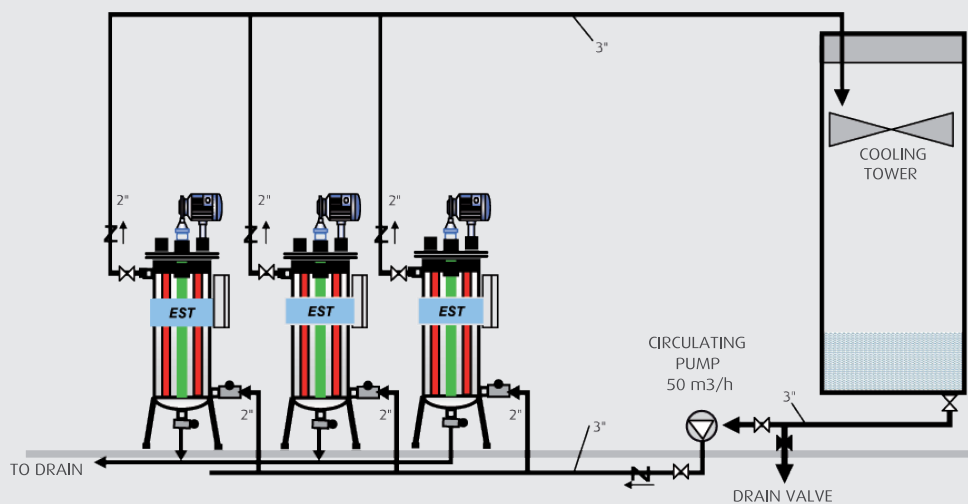
- Filter or centrifugal separator connected at the outlet of the EST to prevent suspended solids from returning to the cooling water main cycle. This is not a must but nice to have.
- Optional SCP system to treat high silica problems.
- Piping system to connect all equipment – must be supplied by the user according to the EST supplier instruction.
- Additional instruments may include: flow-meter for the EST circulation, conductivity meter, deposit monitor, and Electrode for the pH meter. The meter is supplied with the unit. These are good to have but not essential.

For a flow scheme of the entire system, including EST, refer to drawing 2.

Drawing 2A - One EST unit with multiple cooling towers



Drawing 2B - One cooling tower with multiple EST units in parallel



6. Installation Procedure

Important!

Before installing the EST, make sure the peripheral systems are all in place and that you fully understand how the EST must be connected.

Step 1: Preparing the Installation Site

No special preparation is required for installing the EST units, as the EST unit can be installed on a concrete floor or any other flat surface. However, it is recommended to elevate the EST on small concrete blocks to raise it above the floor.

It is highly recommended to shelter the EST from the weather. If the EST system cannot be located indoors, ensure it is placed under a water-proof cover to shelter it from rain. Also protect the system from freezing temperatures.

Make sure that the EST is installed in a ventilated area.

Step 2: Unpacking and Positioning the System

The system is packed in a **wooden box** and is shipped in a horizontal position.

To unpack the system:

1. Remove the top cover of the wooden case. The EST top side is indicated on the wooden box.
2. Remove any loose parts and set them aside.
3. Turn the box vertically, in order to remove the unit from it. Place the legs of the unit securely on the floor.

Important!

On occasion specific instructions are shipped with the system, which must be followed in addition to instructions detailed in this user guide.

Step 3: Setting Up the System

The EST is shipped with all internal parts mounted in it.

1. If you have not yet done so, position the unit(s) in their designated location. It is highly recommended to secure the base to the floor by bolts. It is also recommended that each unit be lifted about 10cm (4 inches) above the floor on small concrete blocks so that the unit's legs will not be damaged by possible dripping or water accumulation on the floor. Unit must be leveled appropriately.

Note:

Where more than one unit is supplied for a single application, connect the EST units in parallel (see **drawing 2B**).

When one EST serves few cooling towers, connect the towers in parallel (see **drawing 2A**).

Please consult with the supplier for specific details.

The units are ready for operation.

Step 4: Connecting the System to Water

When performing this step, it is recommended you use drawing 2 to facilitate the connection of the EST system to its peripheral system.

1. Connect piping as applicable according to the scheme in **drawing 2**.

Note

When employing the EST system in a cooling tower, the EST must be connected to a dedicated circulation line, using its own circulation pump from and to the cooling tower (see **drawing 2**).

2. Connect incoming water line (from the pump discharge) to the inlet valve (5). It is recommended to allow for a sample point at this location in order to monitor incoming water.

Important!

The pump should be positioned below the water surface of the tower basin.

3. Connect the treated water line to the outlet connection (9). It is recommended to allow for a sample point at this location in order to monitor treated water.
4. Connect the drain valve (6) to the drainage system. It is recommended to allow for a sample point at this location in order to monitor the drained water.

Note

If more than one unit is supplied for a single application, the units should be connected in parallel as per drawing 2b.

Important!

The return pipe from the system to the cooling tower basin has to be above the surface of the water in the tower basin in order to provide an air gap.

Tip!

Where the outlet line from the EST must be connected to a pressure line, it is recommended to add an actuated outlet valve. As a minimum a non- return valve should be used.

5. In case an actuated outlet valve is required at your site, connect the air lines to the outlet valve actuator in parallel to the inlet valve actuator, using the same solenoid that operates the inlet valve, so that the inlet and the outlet valves operate together.

Important!

When connecting the outlet of the EST to a pressurized line, be sure to add a relief valve to the piping upstream just before the outlet valve. The relief pressure rating should be 6 bar.

Tip!

It is recommend that you add a filter of at least 80-100 microns, suitable to the line size at the outlet of the EST. A cyclone type separator, such as the Hydrocyclon Sand Separator of Netafim USA (www.netafim.com) may be used.

6. Connect the air supply to the air intake (item 7 on **drawing 1**). The air intake is equipped with a filter and water trap.

Step 5: Setup Electrical Connections

When performing this step it is recommended that you refer to the electrical panel drawing. This drawing can be found in a designated pocket on the inside of the panel.

1. Open the door sheltering the power supply box.
2. Remove the plastic cover at the bottom to expose the electrical connections.
3. Some of the screws may have become loose during the shipping. Verify that all visible wires are tightly screwed and tighten those which are not.
4. If not already connected, connect the electrode(s) to the power supply using the wires supplied with unit. The connection point is on the left side of the power supply control panel. Note that the (-) side of the power supply unit is already connected to the tank.

5. Connect the electrical feed to the appropriate connections in the power supply unit.
For 1 phase system use connections (L, N, E) on the right side.
For 3 phase system connect to **TB3** R, S, T, N, and the earthing to the earthing bar.
6. Connect the circulation pump to the **TB2**, points 3, 4, 5.

7. Operation

Operating Principle

The EST unit operates using the electrolysis principle. Water flows through the tank continuously as electrical current flows between the cathode (the tank) and the anode (electrodes inserted in the tank) and causes the dissociation of the salts in the water into ions. The cations are attracted to the tank wall, while the anions are attracted to the anodes.

The cations include, among others, the calcium, which is the scale builder in the water. This calcium combines with carbonates present in the water and “controlled scale” is produced on the wall of the tank. The qualities of this controlled scale prevent it from adhering firmly to the tank wall, thus allowing for its scraping and flushing.

In some cases, SCP must be added to enhance the EST effect. The SCP is an electrolysis unit that releases controlled metal ions into the water. These ions affect the scale in such a way that settlement of it will be prevented.

The operation of the EST unit is cyclic. At a predetermined time the system automatically scrapes and flushes the tank to remove the scale that has been produced on its walls. While flushing, the top motor revolves the scraper to achieve a better cleaning of the tank walls. When the flushing has finished, the inlet valve opens, the drain valve closes, the scraper motor stops and the normal flow of water through the unit is resumed.

When the cooling tower or any other system serviced by the EST unit is out of service or shut down for more than a few hours, the EST must also be stopped and disconnected and drained.

Important!

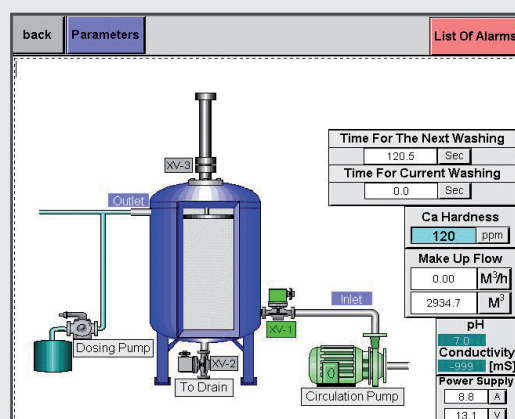
Never leave the EST full of standing water and connected to the electricity for more than 3 hours. This could produce hydrogen, which is a potentially dangerous element.

Operating monitoring and control facilities

The EST unit is controlled automatically by a PLC. It is possible to monitor the machine operation and make adjustments to the settings using an interactive display or an interactive HMI on any computer.

Drawings 3 & 4 show the screen and the parameter table.

Drawing 3 - HMI



The HMI screen shows the system and its connections. Also one can see on the screen all system display information. The drawing also shows the circulation pump and optional dosing pump for acid dosing when the case calls for one.

The table on the right hand side of the screen shows:

- The Water Make up flow to the cooling tower (m³/hr) and the total quantity (M³).
- Inlet Calcium hardness as measure in the water at EST start up and inserted manually.
- EST circulation pump flow as inserted by the supplier.
- Next Flushing time – represent the time until the next Flushing starts.
- pH and Conductivity as measure by electrodes where applicable. When no measurement is done this display will show “000”.
- Power supply data as measured by the system, Amps and Volts.

On the top of the screen there is a “PARAMETERS” button. Clicking on this button with will open a parameter screen as shown in drawing No 4. This screen is used to adjust parameters.

A second button is for “alarms”. Pushing this button will open the alarm list where active alarms are shown and where alarms can be acknowledged.

In addition, the system is equipped with an Interactive Display unit mounted on the door of the panel. This unit monitors the machine operation locally and can be used to adjust parameters and control the system.

Drawing 4 - Parameters screen

back		Parameters	
Washing			
Washing Cycle	70.0	Min	
Scraping Time	50.0	Sec	
Flushing Time	30.0	Sec	
Forcing Wash			
Power Supply			
Current	8	A	
Low Alarm	3.0	V	
Normal	4.0	V	
Dosing Pump pH			
High pH-On	8.0		
Normal pH-Off	7.5		
Scrapper			
Time On/Off	10.0	Sec	

Operation Procedure

There are two stages in operating the EST system:

Stage 1: Starting The EST System in which you turn the system on and verify it is working properly.

Stage 2: Adjusting System Settings, in which you adjust any settings you feel are inadequate for your site’s specific considerations. This step is not imperative for the operation of the EST unit, but is highly recommended for optimal use of the EST system.

Stage 1: Starting The EST System

1. Before start-up, stop any blow down other than the blow down from the EST unit (such as blow down from the cooling tower). It is absolutely necessary that all blow down is controlled by the EST.
2. Verify that the direction of the dedicated circulation pump impeller rotation is correct.
3. Discontinue any chemical additives to the cooling tower.
4. Verify the EST unit is connected to power and is working (the operation green light should be on). If it is not yet connected, turn it on using the main breaker. The pump and unit will start operating.

5. Activate manual flushing. See section Using the display to **adjust settings**:

To activate the display press F1.

The display operation is self explanatory. After pressing F1, follow the instructions on the display unit for any change you wish to make.

EST-System			
Current	0.0	F1	F2
Volt	0.0	Parameters	Alarm

Washing	F1	pH
Power Supply	F2	F4
Forced Wash	F3	

Flushing the EST Unit in chapter 8 for detailed instructions. After one manual flush the system will resume automatic normal operation.

The system is now operating, and will flush automatically according to factory settings.

Stage 2: Adjusting System Settings

The setting of the various parameters has been adjusted in the factory before shipping. This is a standard setting and can be changed from either the interactive display on the panel door or from a computer.

1. Verify the current of the unit is at maximum allowed by the power supply. If necessary, adjust it. See section Adjusting Current and Voltage in chapter 8 for detailed instructions.

Note

It is impossible to adjust the current when the water conductivity is very low, as the voltage tends to turn to maximum (30V). This may happen when starting the system. In such cases, you must wait until the tower water concentrates and the voltage drops before you can make any adjustments.

2. Verify timers are adjusted adequately. If necessary, adjust them as desired. For detailed instructions, see section Adjusting Timers in chapter 8.

Monitoring EST Operation

There are three items that should be monitored on a regular basis:

- Power supply panel
- System parameters
- Electrodes

Power Supply Panel

The power supply panel contains four indicator lights:

- 3 phase lights - R,S,T indicates that the system is operating.
 - The red light indicates failure.
- Ph/Conductivity meter – indicate pH or conductivity if electrode has been installed.
Interactive display unit, normally in sleeping position.

It is recommended to check that these are live once a day. To wake up the display – press F1.

System Parameters

System parameters are displayed and adjusted on the Interactive display mounted on the panel.

Electrodes

The electrodes are guaranteed for 3 years. However, it may happen that an electrode is corroded during normal operation. When this happens the electrical current it will pull will be lower than the current pulled by the other electrodes in the system. Thus, you must measure the current on each electrode. The total current of the system should be divided equally between the electrodes +/- 0.2 amps. If the difference is bigger than this, you should suspect a problem in the electrode that pulls the least amount of amps in the system.

A faulty electrode must be replaced. Refer to the sections Shutdown Procedure, Opening the EST Unit, and Closing the EST Unit in this chapter below for detailed procedures.

Shutdown Procedure

Typically, you would not need to shut down the system, other than for troubleshooting or maintenance purposes.

1. Flush the EST manually according to the manual flush procedure described in the Manual Flushing subsection in chapter 8.
2. Switch off the power to the EST. This will disconnect the power supply, all electrical facilities including the EST circulation pump.
3. Drain the tank using the manual switch on the drain valve solenoid.
4. If you need to clean the tank, or if you anticipate the unit to be idle for a few hours, you must drain the tank. To do so, push the manual knob of the outlet valve's solenoid and hold until the tank is empty.
5. If the shutdown has been performed due to unusual circumstances or for a long period of time, open and clean the tank. This should be done by authorized personnel.

Opening the EST Unit

1. Disconnect the EST unit from its power source.
2. Dismantle the electrode(s). The electrodes are attached to the lid by a screw located in the connection box. In order to separate the electrodes from the lid, open the connection box, disconnect the electrical wire and unscrew the electrodes. Let the electrodes fall into the tank.
3. Take off the lid of the tank including the scraper motor together with the scraper adaptor as marked on the drawing. **To do so:**
 - (a) Open the lid bolts.
 - (b) Lift the lid high enough to pull the adaptor out of the tank and place carefully aside.
 - (c) Pull the electrodes and put aside.

Tip!

It is best to prepare a cushioned surface, or a sponge on which you can place these parts, avoiding any harm.

- (d) Pull the scraper and place aside.

Closing the EST Unit

(Refer to drawing No.5)

1. Verify the unit is disconnected from power source.
2. Mount the scraper. **To do so:**
 - (a) Slide the scraper into the tank and put it in its place. The bottom tip of the scraper must fit the hole drilled for it in the scraper base.
 - (b) Slide the electrodes into the tank inside the scraper.

- (c) Put the tank gasket on its place.
- (d) Put the lid with the scraper adaptor on a 150mm spacer on the tank.
- (e) According to the type of electrode, place the electrode gaskets in their place correctly to prevent water leaking through the electrodes' connection. Double check that they are indeed in place.
- (f) Screw the electrodes back to place.

Important!

During the process of electrodes installation ensure the electrode(s) do not touch the walls of the tank or get scratched by touching any metal pieces.

Tip!

Every time you dismantle the electrodes, you must replace the gaskets.

- (g) Remove the spacer and slide the lid to its place making sure that the scraper adaptor fits into place. If it does not fit, you will not be able to close the lid. Fasten the bolts around the lid.

Note

the adaptor ties into the scraper shaft with a split piece. Half of it is on the scraper shaft and the other half on the adaptor shaft.

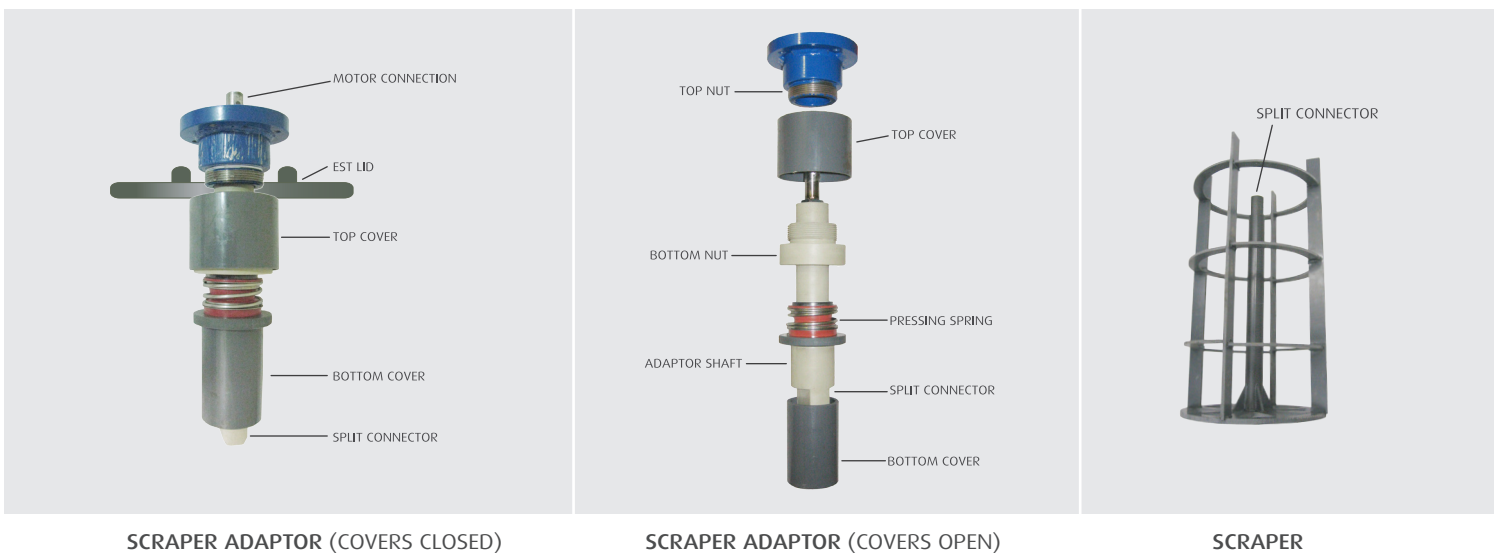
- (h) Connect to electricity. Note that the direction of rotation for the motor should be clockwise.

Dismantling the EST scraper motor

In case there is a need to fully remove the scraper motor from the lid you must open the top nut. This will release the parts on the top side of the lid. Note that the gear fits into the top nut and will slide out easily.

Opening the bottom nut will release the adaptor from the lid.

Drawing 5 - Mounting of the EST's lid



8. System Settings

The EST is factory set for standard operation. However, in some cases the flushing time, the current or the scraping time must be adjusted to improve the system results.

Using the display to adjust settings:

To activate the display press F1.

The display operation is self explanatory. After pressing F1, follow the instructions on the display unit for any change you wish to make.

Flushing the EST Unit

When flushing begins, the pump stops, the inlet valve (**part 5 on drawing 1**) closes and the drain valve (**part 6**) opens. The top motor (**part 3**) then activates the scraper (**part 4**) which begins to scrape the scale from the tank's walls.

After a previously set period of time (T2- see below), the water inlet valve (part 5) opens and the circulation pump starts to allow for the flushing of the scale. The drain valve remains open for a previously set time. Subsequently (after T3 is reached – see below), the drain valve closes, the motor stops and the EST resumes normal operation.

The EST is set for automatic flushing. It is possible to override this automatic flushing and perform Manual flushing.

Manual Flushing

To initiate a manual flush, press **F9** on the display unit.

Adjusting Timers

Three timers control the EST.

T1 - the period of time between flushings. This timer is called "Washing Cycle" timer.

T2 - the duration of the draining. This timer is called "Draining Time" timer. To adjust these timers press F1 to initiate the display and follow the instructions on it. Normal draining time is 0.5 minute.

T3 - the duration of the flushing. This is called "Flushing Time" timer. To adjust these timers press F1 to initiate the display and follow the instructions on it. The minimum flushing time is 0.5 minute and the maximum is 15 minutes.

Scraping Time:

An internal timer fixes the movement of the scraper. This timer is not accessible from the Interactive display but it can be accessed from the HMI. This timer is normally set to 6 seconds and in most cases should not be tempered with. However, if it is needed the setting may be changed via the HMI.

Washing Cycle	F1	###.#	min
Scraping Time	F2	###	sec
Flushing Time	F3	###	sec

Adjusting Current and Voltage

Prior to shipping, voltage is set to its maximum, while current settings may change according to the conductivity (resistivity) of the water at your site. When starting the system, you must check both current and voltage are adequate (see below). To do so press F1 on the display unit and follow the instruction on it.

Typically, you will not need to adjust the voltage, but only the current. When starting the system, the voltage will adjust itself according to the water conductivity and will be lower than 30V. If the current at this stage is not at the maximum allowed by the power supply (see table below), it must be adjusted. Increasing the current will also increase the voltage, according to the mathematical equation describing the relationship between current and tension: $V=IR$, where V=voltage, I=current, and R=resistivity.

Both current and voltage should be set to the maximum possible, according to your EST system:

Model	Maximum Voltage	Maximum Ampere
EST-25	50V DC	16 or 25amp, according to your site's configuration
EST-15	50V DC	16 or 25amp, according to your site's configuration
EST-10	50V DC	12 amp

Using the computer HMI to adjust the settings

The system can be adjusted using a web HMI (Human Machine Interface). To log on to the HMI you need to connect your computer to the internet as per instructions that will be provided upon supply of the system.

The interactive HMI will be shown on the screen of the logged-in computer. Refer to **drawings 3 & 4**.

The main screen shows the operation of the unit. Pressing the button "Parameters" will open the parameters screen. In order to adjust parameter, put the cursor on the value window and insert the desired parameter.

Calibrating Air Pressure

The air intake system includes a manometer, so you can easily verify that air pressure is sufficient. The calibrating valve is located at the head of the air filter. It has been pre-calibrated for suitable pressure. If for any reason you need to increase air pressure, turn the valve clockwise.

The air intake system is also equipped with an air filter, which contains a drainage nozzle. To drain the water in the air filter cup, simply push the knob. Draining the water will leave the cup empty as it should be.

9. Maintenance

The system requires two maintenance procedures: bi-weekly and semi-annually.

EST Bi-weekly Maintenance

There is no required order in which you must perform the following operations. However, be sure that you perform them every two weeks.

While the EST system is working, do the following:

- Perform a manual flush to verify the system is working properly (see the section Using the display to **adjust settings**):

To activate the display press F1.

The display operation is self explanatory. After pressing F1, follow the instructions on the display unit for any change you wish to make.

Flushing the EST Unit in chapter 8 for detailed instructions:

- The inlet valve has closed.
- The drain valve has opened.

- All timers have started counting (this is shown on the HMI screen on your computer).
- verify that the scraper motor is revolving.
- Read amps and voltage (for details refer to the section Monitoring EST Operation in chapter 7). It is highly recommended to measure the amps on each of the electrodes.
- When the system stopped flushing, verify that the scraper stopped.
- Using the manometer on the air intake system, verify that the air pressure is sufficient.
- The EST air intake system is equipped with an air filter, which contains a drainage nozzle. Drain the water in the air filter cup by pushing the knob.
- If the system includes the SCP option, the SCP drain will open when the EST inlet closes. Thus, when doing manual flushing to the EST, watch also the drainage of the SCP that will occur when the EST inlet valve closes.
- Turn off the EST system and then do the following:
 - Verify that the connecting bolts of the electrodes are tightly secured. This is important in order to prevent water from seeping onto the top side of the electrodes.
 - Verify that the external tips of the electrodes are impeccably clean. If stained or damaged, contact your supplier to investigate the cause and how to repair or replace them.

Turn the system back on to resume normal operation.

EST Semi-annual Maintenance

At least twice a year the system requires a thorough cleaning. Semi-annual maintenance should be performed only by the manufacturer's authorized representative.

1. Shut down the EST system (refer to the Shutdown Procedure in chapter 7 for detailed instructions).
2. Disconnect the system from the source of power.
3. Disconnect the system from the water and air supply.
4. Disconnect the electricity from the electrode(s).
5. Open the EST unit. For detailed instructions refer to the section Opening the EST Unit in chapter 7.

Important!

Take extra care to avoid damaging the electrodes during this operation.

6. Verify that the electrode(s) are clean. They must appear clean even after a long period of operation. If they are not clean, contact the electrode manufacturer.
7. Manually clean the internal wall of the tank from any scale traced.
8. Clean the scraper disc from any residue.
9. Upon completion of this thorough cleaning, return the cover and fasten the bolts to its place. For detailed instructions refer to the section Closing the EST Unit in chapter 7.
10. Re-connect the EST system to the electricity and process streams.
11. Start-up the EST unit. For detailed instructions refer to the Operating in chapter 7.

10. Troubleshooting the EST

EST Red Light On

The red light is activated when the system or part of it fails. An alarm list is available on the HMI and it will indicate the type of alarm and list the alarm cause.

Low Voltage

Minimum voltage value is set on the parameter table in the HMI. If the voltage will be lower than the set value, the system will indicate a low voltage alarm. The cause of such a situation may be high salt concentration. To correct this situation, increase the number of flushings per day.

Excessive High Voltage

When measuring voltage (by either an external voltmeter or the voltmeter on the unit, where available), occasionally, you may find the system has reached an excessively high voltage, up to the maximum of 30V. When this occurs, the current will no longer be constant and will tend to reduce and cannot be adjusted in the normal manner.

Excessively high voltage may result in two cases:

- Upon start-up, if the water has a very low content of salts and conductivity is very low. If this is the case, check that indeed the all other drains except for the EST drain are closed, reduce the number of flushings per day, allow the EST system to continue working and check the voltage again every few of hours. If voltage reading has not returned to normal within 48 hours, contact your service company.
- Scale has accumulated on the tank wall and has not been properly removed. Verify that the scraping system is operating properly. **To do so:**
 - (a) Activate a manual flush (refer to the section Using the display to adjust settings:

To activate the display press F1.

The display operation is self explanatory. After pressing F1, follow the instructions on the display unit for any change you wish to make.

Flushing the EST Unit Press F9.

- (b) Listen for any unusual noises. Typically, if a problem occurs in the scraping system it will generate uncharacteristic noises.
- (c) Check air pressure.

Malfunctioning of Inlet or Drain Valve

Malfunctioning of the inlet valve, the drain valve may be caused by a faulty solenoid, which interrupts normal air flow, thus failing to activate the valves.

Verify air pressure is as specified under chapter 3. Technical Specifications. To do so, use the manometer on the air intake system.

If air pressure is sufficient, verify that the solenoid valves controlling air flow to the inlet and outlet valves are functional.

The solenoid valves are located on the outer side of the panel. Each solenoid valve has a switch that can be used for manual control of the system by either pushing or turning it.

- Push the switch to allow a single pulse of air pressure. This would cause the matching valve to operate. If the valves had not started their operation, the solenoid valve is faulty and must be replaced.
- If you are still uncertain, you may turn the solenoid valve's switch to change its operation from automatic to manual. By doing so the open or closed position of the solenoid is constant until changed again manually. When this test is finished, you must make sure the solenoid has been turned back to it's automatic position.

Note

It is strongly advised that you only push the necessary switch rather than turn it, so as to avoid leaving the system in a non-automated operating mode.

If all the above are in order, check for blockage in the valve or the pipe leading to it.

Leakage of water from the air release valve.

Remove the air release valve and check that the ball inside can move freely. If faulty – replace air release valve.

In sufficient drain – Check functioning of drain valve (see above). Check water pressure to the system.

11. The SCP Option

The EST system may be supplied with the SCP unit, according to your order. The main purpose for SCP unit is to prevent silica settlement and enhance the performance of the EST.

The SCP is equipped with a self sacrificing anode that dissolves into the water and creates a coagulation/flocculating agent. The silica particles, as well as other particles, attach themselves to the flocculating agent, creating flocks that settle in a quiet flow area, mainly in the tower basin or in the EST and the SCP tanks. The solids created are softer than the original solids and are removed more easily.

SCP Operating Principle

The SCP is a very simple electrolysis system. It comprises an 8" vessel, one electrode, 2" inlet nozzle, 2" drain air operated valve and a power supply. The power supply is very simple, designed for 10amp, 20V DC. All other specifications are similar to those of the EST system.

Getting the SCP Add-on to Work

Connect the SCP to water either before or after the EST.

As the SCP is normally not equipped with automatic solenoid valve, the air to its drain valve (if air actuated), must be connected to the EST's inlet valve by the air tubes so that it will drain during the EST flushing at the same time when the EST inlet valve is closed.

To start the SCP, open its electrical panel and switch the main breaker on. The SCP will start operating. The current and the voltage must be adjusted. Two options exist:

A. Automatic adjustment:

This can be done if the a flow meter on the make-up water inlet is existing and has a 4-20 ma signal. In such a case, the signal must be connected to a designated place in the SCP panel and automatic control over the current will be exercised.

B. Manual adjustment:

1. Open the panel to detect a potentiometer marked as "Amp Adj."
2. Turn the potentiometer by hand, watching the 10 red leds on the panel. Each led corresponding to 1amp. Adjust the current to specific instructions provided to you by the manufacturer.
3. Adjust the voltage to maximum using the "Volt Adj." button that is also located on the panel.

SCP Maintenance

The SCP add-on requires only two maintenance operations:

- As the anode of the SCP is a sacrificial anode, dissolving slowly into the water, you must verify with the manufacturer the life span of the anode. Be sure to replace the anode in time. A "Fault" indicating light on the panel gives pre-warning of the anode being close to its end.
- If not connected to the EST's drain valves, the SCP must be manually drained once a week.

12. Drawings

Drawing 1 – Parts of the EST.

Drawing 2 – EST and SCP water connections:

- Drawing 2A- One EST unit with multiple cooling towers.
- Drawing 2B- One cooling tower with multiple EST units in parallel.

Drawing 3 – HMI.

Drawing 4 – Parameters screen.

Drawing 5 – Mounting of the EST's lid.