UFS Corporation

Getting Started Guide

External Dialysis System

Version 1b

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Getting Started Guide

Welcome to UFS Corporation

This manual is intended to be an overview of a typical Standard Cell Circulation System (EDS) and how it works. It is presented to the owners, system designers, installers, and members of the paint-finishing department where the equipment is to be used. It is important that you keep this documentation in an easily accessible place for future reference.

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Introduction

This manual provides the user with general information needed to install, operate, and maintain the External Dialysis System (EDS). For experienced end users you may refer to the EDS Quick Start Guide. The Description and Function and Installation Sections describe the function of the EDS and the various system input requirements. Installation and operation of the EDS are discussed in the following sections. Finally, the remaining sections describe the servicing of the EDS. It is recommended that the user also carefully review the TECTRON™ Membrane Electrode (ME) Cell or One+ C Cell "Getting Started Manual" (if so provided), as well as the major component manuals that are supplied with each product.

While every EDS contains the same basic components and embodies a similar design, the physical dimensions and component selection depend upon the user's paint system. There are several different models that vary in the amount of electrode surface area and also how much automation is included. The EDS will work in a support or auxiliary role to supplement the neutralizer removed from the E-coat paint bath by the Membrane Electrode System or it can act alone to remove the neutralizer. The user will find at the end of this manual drawings and specifications that apply to their particular system.

Description and Function

The function of the EDS is to remove the neutralizer agents from the E-coat bath. It does this by passing Ultrafilter (UF) permeate through an electro-dialysis cell. For anodic E-coat paints, the dialysis cell would have an ion-exchange membrane that is selective only to cations and for cathodic E-coat paint the membrane would be selective only to anions.

The neutralizer is able to pass over into the electrolyte fluid that circulates inside the dialysis cell. The conductivity will typically increase with time and operation and it lowered by adding deionized (DI) water to the EDS tank when the conductivity level rises above a preset level (or by manually adding fresh DI water). This dilutes the electrolyte concentration in the EDS tank and causes the electrolyte tank to overflow to drain, thereby removing the excess neutralizer from the E-coat bath.

Refer to the EDS Flow Diagram (refer to appendix for drawing 997xxx). Some of the permeate stream (at least 2 gpm) is directed to the process tank of the EDS. In the process tank is a Membrane Electrode Cell and opposing electrode, which are placed close together. Once a voltage gradient is applied across the anode and cathode, electric current begins to flow and cause the migration of the neutralizer into the dialysis cell. Eventually the conductivity of the electrolyte fluid inside the dialysis cell will begin to rise and DI water is added (either automatically or manually) to dilute the electrolyte and lower the conductivity.

The voltage needs to be carefully adjusted not to exceed recommended amp output, which is 5 amps/SF of Electrode surface area inside the Dialysis Cell. For example if the electrode surface area is 2.25 SF then the recommended current flow will be 5 amps/SF x 2.25 SF = 11.25 amps. The EDS can operate at higher current (i.e. amps) output, but attention must be paid to the operating temperature of the electrolyte fluid. The maximum operating point is 10 amps/SF, or 22.5 amps for the example earlier.

The EDS is meant to operate 24/7, but should be stopped when ever the UF machine is not producing permeate. From time to time there may be a build up of paint solids on the opposite plate from the electro-dialysis cell. If this happens you will notice the current is reduced. The resolution is to turn off the Rectifier and exchange the plate with a clean one and then resume operation. You can then clean off the used plate and get it ready for use again.

Included in the Shipment

Included in the shipment are the following items: skid with the system; loose items (DC rectifier; 2 plates [opposing the Membrane Electrode Cell]; electrolyte flow meter assembly; electrolyte tank drain/overflow assembly; Certification & Inspection Report for the system; and Getting Started Guide included on a CDROM

Unpacking Instructions

Use a Phillips head screw driver to remove any wood screws or hold down clamps. Do not use a crow bar to pry wood pieces apart. The first step is to remove the cellophane from the unit. Step 2 is to unscrew the top wood cross members and set aside. Cut the banding that secures the tank. Next is to remove any loose items from inside the tank and set aside. Next remove the wood uprights at each corner. The unit can now be gently removed from its wooden skid. Remove any packaging that is protecting open pipes, or pressure gages (if ordered), etc. Use the match mark drawing placed on the tank cover to re-assemble as required. Lastly review all the steps and make sure the unit is fully unpacked and ready for the connection of services.

System Requirements

The necessary requirements that enable the EDS to function properly are: DI water, electrical power (motor & starter, conductivity monitor/controller, and Solenoid Valve [note some items are optional or extra and may not of been included with your order]), proper drain, proper electrical ground, and suitable location. In some cases a customer supplied lock or customer-supplied restricted entrance based upon the local electrical code or your company's safety policy may be required.

DI Water

The incoming flow rate of the deionized (DI) water should be in the range of 40-60% of the electrolyte pump capacity. This will ensure an orderly mixing of the DI water and the electrolyte solution, such that the conductivity can be lowered at a predictable rate. The incoming pressure of the DI water should not exceed 80 psi which is the upper limit for the Solenoid Valve (if ordered). It is also possible to use Reverse Osmosis water for make-up purposes too.

Electrical

An electrical line of the proper voltage and number of phases should be brought to the EDS. The user must supply the appropriate motor starter, start switch, and disconnect switch, if so required, (usually the electrolyte pump does not require a separate starter) at a location of their choosing and in compliance with national & local electrical codes. Likewise, line power must be supplied to the other items: DC rectifier, conductivity monitor/controller (if provided), control panel (if provided). Lastly, the grounding stud on the two tanks (usually on the drain and it may have been provided loose) should be connected to a local ground with the proper sized cable (not provided).

Proper Drain

There is a tee fitting that combines the gravity overflow and the bottom Electrolyte tank drain. This should be connected to a suitable local drain. It is important that there be no reduction in pipe size of the overflow drain line to avoid unnecessary piping restrictions that could cause the tank to overflow out the top of the tank.

Suitable Location

A close and level location should be identified near the E-coat paint tank. The EDS should be placed as close as possible to the paint tank to minimize the friction loss in the local piping from the UF machine and to the post rinse or permeate storage tank. It must be placed above the rim of the E-coat tank in order for the permeate to flow back into a post rinse tank. Note: allow a minimum of ¼" (vertical fall) per foot of horizontal distance for the permeate return piping to the post rinse tank.

Installation

This section details the sequence of installation steps to be taken to ensure a good working installation. The installation sequence consists of setting the system skid, re-assembly of any PVC piping supplied loose, checking all other fittings and pipe connections and then completing the electrical installation as required.

Refer to both the Match mark drawing of your product, flow schematic, panel wiring drawing, and other product drawing(s) located in the Appendix as you read on below.

Setting the Skid

1. Carefully remove the crating materials from the unit, making sure to locate any items that may have shipped loose. Remove all exposed nails from the packing crate.
2. Set the unit on a flat, level support on a mezzanine level above the rim of the post rinse tank. The overflow of the permeate tank of the EDS will flow by gravity back to the post rinse tank.
3. Locate the DC rectifier on a nearby wall or other nearby structure

PVC Piping

1. Follow installation match mark locations for piping re-assembly of the EDS.

2. Install an incoming piping to deliver permeate to the permeate tank. This line should have a valve to regulate the flow. A permeate piping return leg from the permeate tank to the post rinse is also required. Use only clean pipe since modifications to a live UF system have to be made and it will not be possible to clean the piping in a conventional sense. It maybe necessary to take the UF machine off line or divert the UF permeate to drain while the changes to the permeate discharge piping are being made.
3. Add a DI water make-up line above the electrolyte tank and place a valve to regulate the amount of DI water that is added. An optional item is a solenoid valve that automatically adds water when the conductivity rises above the set point (if ordered). If this was ordered, then install it downstream of an isolation valve in parallel with another valve so that if the solenoid valve fails it can be isolated and there is a manual valve for DI water additions.
4. Connect the drains of the permeate and electrolyte tank to an appropriate drain connection.

Electrical Installation

Think and act in a safe manner. Always disconnect power and use a lockout before you work on the E-coat system or any of the related sub systems. Observe any confined space conditions. Use the appropriate safety equipment and clothing for the task.

Install per local and national electrical/safety codes.

1. The electrolyte pump is supplied with a short 120 VAC three prong cord. Locate an outlet box close to the EDS unit so the cord will extend properly.
2. Install an appropriate lockout panel (supplied by the customer) ahead of the DC Rectifier. This will be used to turn power (and use a padlock as required by the plant's safety code) off to the DC rectifier when serving is done.
3. The DC rectifier also has a 120 VAC input (note the output of the rectifier is 25 amps, so size the incoming wire to handle ~33 Amps). Ground the rectifier per the manufacturer's instructions found in the Appendix. Refer to the DC Rectifier's manufacturer in the Appendix for complete instructions to install, test, and debug this piece of equipment before it is connected to the Membrane Electrode Cell and cathode plates. Set the unit in a constant current (or sometimes called Current Limit mode) of 0.2 amp or so for this checkout phase (typically this means the voltage potentiometer is set to the maximum voltage and the maximum current will only be 0.2 amps, which is almost zero for testing purposes).
4. For catholic E-coat paints - make sure the anode connection point of the rectifier (+ output) is connected to the Electrode in the Membrane Electrode Cell and the cathode connection point of the rectifier (- output) is connected to the stainless steel 'opposing' plate. For anodic paints, the anode connection point (+) is attached to the stainless steel 'opposing' plate and the cathode connection point (-) is attached to the Electrode in the Membrane Electrode Cell. Make these connections (cables are not included) only when the DC rectifier has been tested and found to be working satisfactorily.
5. Bring 110 VAC power to the EDS Control Panel if so ordered (this is an option and can contain the following components: temperature controller, conductivity controller, permeate flow, low permeate tank level, and low electrolyte tank level).
6. The EDS Control Panel (if ordered) besides controlling solenoid valves (i.e. cooling & conductivity) will also shut down the DC rectifier too in the event of: high temperature, low tank level, or no incoming permeate flow). Please refer to the wiring diagram to

insure all the appropriate control connections have been made since the DC rectifier has to be shipped loose.

7. Connect the DI Water Solenoid to the conductivity controller, if these items were ordered. Be sure to connect the to the proper terminal trip points. (See wiring drawing in the Appendix).
8. Connect the cooling water to the solenoid valve, if so ordered. Be sure to connect the to the proper terminal trip points. (See wiring drawing in the Appendix).
9. If ordered, UFS has set the conductivity set point prior to shipping for each customer. Please see the included Inspection & Certification Report for the set-point.
10. **NOTE:** If the conductivity sensor cable needs to be extended, Call UFS to exchange the existing sensor for one with a longer cable (there will be a modest charge due to the longer cable length). UFS does not recommend that the cable be spliced to make it longer.
11. The low tank switches (permeate and electrolyte, is so ordered) are typically already connected to the EDS Control Panel. (see attached drawing TBD) **NOTE:** These switches typically have a max rating of 20 VA. If not then be sure to connect the to the proper terminal trip points. (See wiring drawing in the Appendix).
12. Attach ground wire from the drains of the permeate and electrolyte tanks to an appropriate earth ground.

Installation Checklist

Start-up and commissioning is comprised of flushing the entire electrolyte system, checkout, and initialization of all equipment and components. Use the check boxes by each action item as a guideline and only proceed in the sequence shown below.

System Check-Out Checklist

☐ Remove any hold-downs, packing materials or restraints used to protect equipment during shipment.

☐ Compare all electrical, process piping, drain piping, and ground connections to and from the EDS with the general arrangement shown on the Product drawing, match mark drawing, flow schematic, and electrical wiring diagrams for accuracy and completeness.

☐ Fully rotate all control valves to ensure proper operation. Turn all valves OFF.

☐ The Membrane Electrode Cell(s) should and filled with DI water and leak checked for 45 minutes. Do not add any process fluid to the permeate tank while this leak test is being conducted.

System Flushing, Leak Check, and Cleaning Checklist

☐ Open the drain valves for the permeate and Electrolyte tanks. With a DI water hose gently rinse out the inside of each tank to remove dust and dirt. Flush out any new piping that was installed, but not in such a way that dirt is allowed to enter the post rinses or paint tank. When finished allow the tanks to drain completely before closing the both drain valves. Fill the Electrolyte tank with DI Water until some DI water is high enough to leave via the overflow connection. Leak check the piping, valves, etc as required. Fix as required before proceeding.

☐ Open the permeate inlet valve so that 2 - 4 gpm of permeate is allowed to enter the permeate tank. You may have to throttle another valve in order to get the required permeate flow. Once the permeate tank is full enough, insure the permeate fluid that is overflowing goes into the appropriate post rinse tank.

☐ Plug in the electrolyte pump and begin the circulation of electrolyte fluid. Add enough neutralizer to increase the conductivity to about 1,000 – 4,000 microSiemens/cm (confirm this figure with your E-coat paint company). Check for leaks and fix or repair before proceeding.

☐ Make a photo copy of the EDS Process Log sheet (located in the Appendix).

☐ Checkout the operation of the low tank level switches (if ordered). Make sure that the appropriate signal is being sent to the control panel. Typically when the float is in the 'up' position the switch is in the 'normal' position. If the float is able to fall down then that signifies the tank level is low and the DC rectifier should turn off.

☐ Check out the operation of the permeate inline flow meter (if ordered). If this flow meter detects a low permeate flow condition (less than 1.5 gpm) then the DC Rectifier should be turned off. Use a valve ahead of this flow meter to simulate a low permeate flow condition and make sure the DC rectifier turns off.

☐ Check to make sure the cooling water solenoid valve (if ordered) turns on when the electrolyte temperate is 100 deg F.

☐ Check to make sure the DC rectifier is turned off (if the control panel is ordered) when the temperature of the electrolyte exceeds 120 deg F.

☐ Open up the DI water valve to the Electrolyte tank and fill this up. Once it begins to overflow, insure the overflow goes to drain. Close the valve.

System Start-up Checklist

☐ Open the DI water valve to allow a trickle of DI water to enter the Electrolyte tank. If you ordered the Electrolyte conductivity controller then this step is not necessary. Without the Electrolyte conductivity controller the electrolyte conductivity will be continuously diluted (and cooled too) by the addition of fresh make up water.

☐ Close the lock out panel switch for the DC rectifier after you insure it safe to do so. Verify the DC rectifier is in constant current mode and the voltage control is maximum (i.e the unit will only supply that voltage required to raise the current flow to the set point on the dial. Set the constant current limit to a low value like 0.2 amps. Turn on the DC Rectifier and observe the voltage and current flow. Let it operate at very low current for a minute or two before increasing the current limit. Make the first record in the log sheet for the present day and time. Note the current and voltage and take a sample of the (using a drain port, or something with easy and safe access) electrolyte and measure its conductivity in the lab and record the conductivity on the log sheet.

- ☐ Raise the current limit to about 5 amps and let it operate for 30 minutes. Make another addition to the log sheet after the 30 minutes are up. Take another electrolyte sample and measure the conductivity and record the data and the time of the sample.

- ☐ The design current rating for this system is set a 5 amps/SF, which equates to about 12 amps. This system can operate at a higher current level (as long as the temperature stays below 120 deg F), but the life of the Membrane Electrode Cell will be shortened. The maximum current rating is 25 amps, which is over 10 amps/SF of electrode current density. Take another electrolyte sample and measure the conductivity and record the data and the time of the sample.

- ☐ Confirm the electrolyte conductivity is increasing (you may have to stop the addition of fresh DI water to the Electrolyte tank during this initial testing since any additions of fresh DI with dilute the conductivity). A rising conductivity in the Electrolyte indicates that ions are being pulled out of the permeate, which is desired.

- ☐ Use a PVC Pipe to gently push each Low Level Float (if so ordered) to its full down position. Check to make sure the DC rectifier shuts down properly.

Maintenance

Periodically inspections of the EDS should include checking the pump suction strainer to make sure it is clean, ensuring that there are no obstructions blocking either the supply or the return pipes to the electrolyte tank, and confirming that the conductivity set point is adjusted properly. For further information on normal operation and maintenance procedures, the user should read the component operation manuals supplied in the Appendix.

Trouble Shooting

Please see the trouble shooting section in the Appendix

Spare Parts and Accessories

The Major Component List is shown in the Appendix. This list includes the user serviceable items in your EDS system.

Safety

A safe work environment is of utmost importance to UFS Corporation; therefore, we recommend that our customers:

Design and implement a comprehensive health and safety program that includes training on working with electrical and chemical equipment.

Design and implement a lockout, tagout program for maintaining ED equipment.

Conduct on going training for ED employees that encompasses system installation, operation, and maintenance for UFSc components and other ED equipment.

Post adequate warnings at the job site including labels and tags on energized circuits.

Use proper techniques to lift heavy objects and wear the appropriate clothes and safety equipment for the task at hand.

Upon request, MSDS sheets for appropriate chemicals are available from UFS Corporation.

Warranty

We warrant all equipment manufactured by UFSc to be free from defects in material and manufacture at the time of shipment for a period of one (1) year from the date of shipment. We will furnish without charge, but not install, replacements for such parts as we find to have been defective.

This warranty shall not apply to any equipment which has been subjected to misuse, neglect or accident, or has been altered or tampered with, or if corrective work has been done thereon without our specific written consent. No allowances will be made for such corrective work done without such consent. Improper maintenance, deterioration by chemical action, and wear, do not constitute defects.

Equipment manufactured by others, and included in our offering, is not warranted in any way by us but carries only the manufacturer's warranty, if any. All ME Electrodes (and or cathodes), of any material, are not warranted by us in any way since they by nature are sacrificial and will erode or corrode away with time.

All warranty claims must be submitted within ten (10) days of discovery of defects or shall be deemed waived. All parts returned for inspection must be sent prepaid. No representative of our company has any authority to waive, alter, vary or add to the terms hereof without prior approval in writing. The foregoing is in lieu of all other warranties (including that of merchantability), whether express or implied.

Liability

It is expressly understood that our liability, including that for breach of contract, negligence, strict liability in term, or otherwise for our products is limited to the furnishing of such replacement parts, and that UFSc will not be liable for any expense, injury, loss or damage, whether direct or consequential, including but not limited to loss of profits, production, increased cost of operation, or spoilage of material, arising in connection with the sale or use of, or inability to use, our equipment or products for any purpose, except as herein provided.

Appendix

Trouble Shooting, Bulletin 990182

External Dialysis System (EDS) Flow Schematic, 997311

Typical EDS Product Drawings

Field Re-Assembly Installation (using match mark) Guide

Optional Control Panel Wiring Drawing

EDS Spare Parts List

Manufacturer’s Manuals (including DC rectifier)

External Dialysis Logsheet

Date (Start/End)	Time	Volts (V)	Amps (A)	pH	Electrolyte Conductivity