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(PMPC)

IONNETX SET-UP AND OPERATIONS MANUAL

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IonnetX: SET-UP AND OPERATIONS MANUAL

Safety:

The IonnetX Electro-winning System has been designed with safety as the overriding concern. There are fail-safe systems to protect against fire and/or explosion but maintaining the system will also be of importance to prevent any serious event.

Gases. All electro-winning systems, in fact all plating systems, generate hydrogen and oxygen at the electrodes. Hydrogen and Oxygen can form a combustible compound when collected in a confined space. The IonnetX has no confined areas where this mixture could collect, hence there is little possibility of combustion. However, the IonnetX must never be operated without an exhaust system and hood operating in good order. ***The operator must always ascertain that the exhaust system is operating while the IonnetX is in operation***.

Fire: When operating an electro-winning system like the IonnetX, a great deal of electric power is consumed in the process of attracting metal ions to the oppositely charged electrode. When operating correctly, all of this power goes through the solution and actually will heat up the solution as the process continues. This is to be expected. If, for some reason, a short circuit could develop, then all of the current goes without any resistance to the electrodes directly. If not for a circuit breaker or fuse, this current could conceivably create an enormous increase in temperature and could possibly ignite something or melt plastic. Every individual cell in the IonnetX is protected against this type of problem through the use of fuses. ***The operator must never, never, attempt to circumvent this safety measure.***

Heat Build-Up: The use of fuses will prevent a short-circuit from causing any serious event, however a circuit breaker will not trip in all cases where heat can build up. All contact areas (where wires, fuses or connector plugs, or contact forks meet other metal components) are designed to allow the proper amount of current to pass efficiently and without undue heat build-up. The amount of current determines how much contact area is necessary. If you try to send too much current through too little area, heat will be the result: the smaller the area, the more the heat. When a contact area becomes dirty, we are trying to force the same amount of current though a much smaller area. Although a fire is unlikely to occur from this condition, smoldering or melting of plastic could occur. ***The operator must be assured that all contacts are clean.*** This manual will explain how this is done.

OVERVIEW OF IONNETX SYSTEM

The IonnetX system employs the use of the solution velocity and expanded surface area cathodes to create turbulence and low current density, the two most important elements of an efficient plating cell. We do this by pumping the metal-bearing solution through a serpentine path containing our high surface area cathodes, sandwiched by the appropriate anodes, at 65 gallons per minute or higher speed. The solution exits by gravity to the tank containing the metal-bearing solution, and then is constantly re-circulated.

Each system contains 10 individual cells comprising of parallel anode plates sandwiching a flat Ionnet cathode which measures 18" long, 17" high, and ½" thick. These cathodes are held in place by two vertical plastic tubes with slits in them to retain the cathodes in place. (**Cathode Retainers**) Each cell also has a cathode contact assembly (**CCA**) which delivers the current to the cathode from the bus bar and sits in a saddle at the sides of the IonnetX tank, keeping the cathodes exactly in place. Each cathode contact assembly has the female end of a quick disconnect connector attached. When connected to the male counterpart leading to the bus bar, contact to the cathode is complete.

OPTIMUM CELL PLACEMENT

Because the IonnetX is a gravity return re-circulating system, it is always important that the system be mounted at least 6 inches above the solution level of the mother tank containing the metal-bearing solution to be recovered. Often it is possible to mount the IonnetX tank directly above the mother tank. It is also fine to mount the IonnetX tank within close proximity of the mother tank, as long as it is higher than the solution level in the mother tank.

Several drawings are attached to this manual depicting the various set-ups possible.

START-UP OPERATION-Empty IonnetX Tank

Step 1-Attaching Cathode Pad to Cathode Contact Assembly (CCA)

The Cathode Contact Assembly (CCA) is the rack that has two parallel forks perpendicular to the blue plastisol bar attaching them. The CCA makes contact with the IonnetX cathodes. A CCA holder has been furnished for the operation of attaching the pads to the CCA. The CCA is placed vertically with the double set of forks pointing upward and the plastic ends fitting firmly in the saddles on the sides. Making sure that

the forks have been properly prepared (see maintenance procedures) the cathode pad is then slipped between the forks making sure that the shorter side is parallel to the forks. The middle of the CCA, where the female connector is attached, should be approximately in line with the middle of the pad. The pad should be slipped to within ½ inch of the end when it cannot go any further. This process should be done for all ten pads.

Now, while the tank is empty, these cathode-bearing CCAs should be brought to the IonnetX tank and the pads should be guided down the white plastic slotted tubes (cathode retainers) making sure that the extension on the sides of the CCA fits neatly into the saddles on the sides of the IonnetX tank. When this is accomplished you may now plug the male and female connectors together and turn the plug about 90 degrees in order to lock the connection, unless visual inspection of the plug and female receptacle surfaces appear dirty. (see maintenance procedures)

Now that we have the cell ready to accommodate the solution, we must make sure that the solution will not attack the cathodes in any way. In the case of cyanide stripper solution, that can be done by the addition of small amounts of copper sulfate solution and/or glyoxal.

Next, the rectifier must be turned on and set to 3.5 volts. We always start with the rectifier on so that the pads are always with current when they are in solution. Otherwise, in certain applications you risk having the copper dissolved off of the plastic substrate.

Next, the pump is turned on and the solution starts to fill up all of the cells. First the ones near the inlet will fill, then eventually, the last cell prior to exiting will fill. The valve on the last cell should be turned to the position where the solution rises just to the top of the cell but does not cascade over the top. When this occurs, we are almost done. (The valve is the poly-pro cylinder with the stainless steel stud protruding from the diameter. The valve is opened or closed by rotating the cylinder with the stainless steel stud)

After 60 minutes of operation, the current can now be turned up to 75 amps per cell or higher, if necessary. For 10 cells, that equates to 750 amps. We are now finished until the solution is analyzed and shown to be in the single digit ppm range for whatever metals are being recovered.

CHANGING INDIVIDUAL CATHODE PADS WHEN THE CELL IS OPERATING

When it is determined that a cathode pad must be changed for any of several reasons, including bad contact, totally full, dendrite formations, the procedure is quite simple.

First, you must attach a new pad to a new CCA as described previously.

Second, go to IonnetX tank and disconnect the connector plug from the CCA with the pad that must be changed.

Third, before you remove the pad from the cell, you must first shake and jiggle the pad in the cathode retainers in order to prevent the pad from sticking to them. The best way to do this is to hold the cathode retainer with one hand, while you jiggle the CCA with the other. Do this for both cathode retainers. When this has been accomplished, lift the pad out of the cell and place it in the last chamber prior to solution exit. The pad should be placed between the 3 inch long peg and the last anode, so that the hanging cathode does not get sucked into the outlet hole suction and block the exiting solution.

Fourth, now get the CCA with the attached new pad, and, making sure that the CCA is oriented in the same way that all others are, plug in the connector from the bus bar to the CCA. Now you may seat the cathode pad into place as if it was fresh. As soon as this is done, the current running through this lead should be checked with a clamp-on ammeter to make sure it has proper current flow.

If so, you are done.

MAINTENANCE PROCEDURES

In order to keep this system in peek operating condition and to keep it completely safe, several different types of maintenance are required. We will need weekly maintenance procedures, and daily maintenance procedures.

WEEKLY MAINTENANCE

Once each week, all cathodes should be removed from the tank and the inside of the tank should be inspected for any types of particles that may be hanging around. The tank must be completely emptied, first by turning off the main pump. Then the drain valve should be opened and all liquid should be allowed to drain out.

Next the anodes should be inspected for anything that may be on them. If the anodes are “dimensionally stable anodes,” **NEVER, NEVER scrape the anodes in any way with anything but a soft-bristle brush.** These anodes are very expensive and will be degraded if they are abraded. The only exception to this is on the outside of the first and last anode plates. These surfaces are not coated and can be cleaned and scraped with anything that would remove any chemical deposit. If the anodes are stainless steel, you may clean them in any way you see fit.

After this is accomplished, the 1” drain valve should be opened. Now it is important to hose down the cell completely sweeping out any adherent or non-adherent particles that have formed on the plastic cathode retainers or any other part of the tank. This should be done until the tank is completely free of foreign matter. Next, is a very careful inspection of the surfaces of the connector plugs attaching the CCA to the bus bar. If these plugs have any part of the external or internal surfaces covered with a non-conducting film, they can and will build up heat. And this could be serious if left unattended. These surfaces must be cleaned each week if necessary with a wire brush. Also, an electrically conductive cleaning spray should be used on these plugs regularly. And lastly, use a conductive grease to lubricate and protect the connector surfaces.

The last weekly maintenance procedure is a general inspection of all contacts and cables. If there is any sign of a faulty contact or a cable that is degrading, it must be addressed and possibly replaced.

DAILY MAINTENANCE

To assure proper functioning of the system, the current flow in each individual cell should be checked regularly with a clamp-on DC ammeter to determine whether or not the current is in the correct range. Each individual cell should have a current very close to all others. If operating at 750 amps, ideally each cell should have 75 amps register on the ammeter. A slight variation of a few amps is normal, however, more than 10% difference means there is some type of problem. Check contact at pad, contact at connector, and contact at the fuse box if there is a problem.

Alternatively, the fuse may have blown, which would cause the cable to be cool. In this case, it is necessary to find out where the short circuit is, before changing the fuse. It is really this constant attention to current flow going through each individual cell which will keep the performance high and the risk of accident extremely low.

If it has been determined that the fuse must be changed, it is most important to never remove either of the bolts holding the fuse in place, completely. Simply, loosen both bolts until the fuse can be slipped out of the holder, replace in the same configuration with a new fuse and then retighten both bolts. **NEVER OVERTIGHTEN *EITHER* BOLT**. Use the nut driver with lever-arm provided. With one hand, you can tighten this bolt very hard.

IONNETX CELL TROUBLESHOOTING

The following is a guide to some problems you may encounter over the years with the IonnetX cell. Corrective actions are listed for the different items.

I. PROBLEM - Poor Metal Removal Rate

Possible Cause	**Action**
Loose connection on cathode(s)	Reposition cathode connector forks
Transformer/Rectifier set too low	Increase amps
Cathodes full or damaged	Inspect, replace if necessary
Stream constituents	Check influent for strong oxidizers
Pump failure or flow blockage	Evaluate and correct

II. PROBLEM - Poor Cathode Plate

Current density too high	Reduce amperage
Cathodes damaged by standing In effluent with no power	Inspect cathodes

III. PROBLEM - Low Amperage / High Voltage

Loose connections to cathodes	Reposition cathode connector forks
Effluent not conductive	Adjust conductivity with salts
Bus connection loose	Inspect and tighten
Anodes damaged or worn	Inspect anodes, clean or replace

IV. PROBLEM - High Amperage / Low Voltage

Shorting between anodes & cathodes	Check cell bottom for solids or Dendrite bridging, clean if necessary

WARNING: HYDROGEN AND OXYGEN ARE BYPRODUCTS OF ELECTROLYTIC RECOVERY. ENSURE THAT THIS EQUIPMENT HAS PROPER VENTILATION AND USE CHEMICAL SAFETY GOGGLES WHEN WORKING ON OR NEAR THE CELL. DO NOT CHANGE OR REMOVE ANY ELECTRODES WHILE POWER IS ON. AN EXHAUST HOOD IS ESSENTIAL

WARNING: THE POWER SUPPLY MUST HAVE A DC OVERLOAD RELAY CIRCUIT IN ORDER TO INSURE THAT IN THE EVENT OF A SHORT CIRCUIT, THE RECTIFIER WILL BE SHUT DOWN. THIS IS ESSENTIAL. A FIRE COULD POSSIBLY RESULT OF THE DC OVERLOAD RELAY CIRCUIT IS LACKING.

CAUTION: CATHODES MAY BE DAMAGED IF LEFT IN EFFLUENT FILLED CELL WITH THE POWER OFF.

IONNETX DISCLAIMER

All information, recommendations, and suggestions made in this literature which concern the use of IonnetX Cells are based on test data deemed to be reliable. However, each user has the responsibility to determine suitability for their own use of IonnetX products. Since the actual use of the IonnetX cell by others is beyond the control of Precious Metals Processing Consultants, Inc. (PMPC) , PMPC makes no guarantee. The information in this literature is not to be considered complete since additional literature or information may be required when unusual conditions or circumstances exist.