

Practical Selection of Periodic Pulse Reverse Rectifiers

Jobs are becoming more difficult to complete to specifications as the complexity of parts increases. Other indictors include metal prices on the rise, nano technology, PCB on the rise again and many other developments in pulse and reverse pulse technology. With electronic power components getting more advanced everyday reverse pulse technology is offering a great solution in today's metal finishing shops. From five years ago or even one year ago there have been many improvements in reverse pulse power supplies. We are seeing very high quality pulses with repeatability. Some manufactures are integrating intelligent pulse optimization systems into their power supplies. All of these functions increase the reverse pulse process from 30% to 40% better than before. Prices of these units becoming more affordable make reverse pulse an even more attractive option to complete those hard to do jobs. With the latest developments in user interface and IPOS in reverse pulse power supplies this integration into your facilities makes an easy transition from your old system to a new system. With today's reverse pulse power supply technology and our global economy could reverse pulse be one of the solutions for your shop?

The constant improvement of electronic components has resulted in many advantages for pulse and pulse reverse power supplies. Some advantages include output currents getting higher to meet the larger scale production facilities needs. With the latest designs there is no more 300Hz ripple that we have seen in the DC supplies. The integration of intelligent pulse optimization systems imbedded into the core software. This enables us to see pulse shape monitoring to achieve repeatability and self optimizing control loops to adapt to bath characteristics. All of these functions give a repeatable waveform and the ability to repeat the process and adjust for changing bath conditions.

When working with a delta I 10000A with a slew rate of 100us or less, inductance must be addressed in order to maintain a repeatable pulse form. In order to understand the problem a little better inductance is defined as the following. "The property of a circuit or circuit element that opposes a change in current flow, thus causing current changes to lag behind voltage changes. It is measured in henrys." With this in mind there has to be consideration on how to compensate for this in the control of the power supply. IPOS and the latest designed power supplies are using separate voltage and current loops simultaneously this keeping the over and under shoot to a minimum. The next thing to be consider is the connection between the power supply and the plating cell. Depending on the current and the placement of the rectifier either coax cable or twisted pair should be considered. If the distance is not that significant



twisted pair would be sufficient. If the distance is significant coax cable should be consider. Coax cable has a lower inductance compared to twisted pair.

Most rectifier suppliers should have two types of cooling available when choosing reverse pulse. The first type is air cooled. The size of the rectifier will determine whether the unit will be convection or forced air cooled. The other option will be water cooled. Things to consider when choosing air cooling are the environment it will be placed in, ambient temperature, and cable length. If choosing water cooled, you are able to place the power supply right next to the plating cell to achieve lower inductance. However water temperature, and water quality needs to be considered.

Human interface is one of the most important aspects of pulse and pulse reverse power supplies. A few options that should be in the interface to ensure smooth operation of the power supply are the following:

- Current density calculator
- Batch programming stored in power supply
- Operator screen / Password protection
- Data logging
- Clear parameter setup
- Ah counter

The current density calculator calculates the effective current of the waveform being used. For example, it you would run a rack of parts at 20ASF with 50 square feet on the rack. Depending on your duty cycle, forward and reverse ratio, your forward and reverse currents will not equal 1000 amperes. In order for the user not to have to calculate every load going into the plating, the user interface should have this function built in. Once the unit and process has been setup the operator simply inputs the total amount of area going into the plating cell and the interface does the rest.

Batch programming is used in many different applications. Batch programming allows you to use multiple waveforms during one process. Here are a few things to consider if batch programming is need for your application. First you would need the current density calculator within the batch for every waveform. You should also consider that the batch is stored inside the power supply, not in a PC or PLC. If the power supply should lose communication or if the PC PLC should go down, your parts in the tank will not come out the proper way. If this data is stored inside the power supply your process will continue to run without any communication or external source.



When dealing with day to day operation, some type of operator screen should be considered for a successful operation of a reverse pulse power supply. An operator screen is a good idea due to the many different parameters available in a everse pulse rectifier and the effects on a process. This screen should only have current density adjustments, file selection, and should not have access to manager functions within the supply. This will ensure that the correct waveform for your process is run every time.

Data logger should be used for storing data. If something should change in your process you can verify during that cycle of parts weather or not your rectifier was set and running correctly. Different pulse regimes can change your results drastically. This gives the plant manager the ability to see what has been done for the day and if all of the parts were ran correctly.

As pointed out above there are many things to consider when choosing a pulse rectifier for your process. If all of these points are evaluated to what your process needs you will have a successful reverse pulse process. The entire system is not just dependent on the pulse shape, but also on the integration and interface of the pulse supply.

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