Vol. 5 Oxford V.U.E., Inc. Issue 1

News & VUEs

SERVICE AFTER THE SALE

The Vis-U-Etch™ 5 system has now been on the market for several years and earned a great reputation during that time. Besides our mandate to keep looking for ways to make our system better, we know that a great system is only as good as the customer support that goes with it.

We have made many arrangements with selected chemical and equipment manufacturers in many countries to be able to provide our customers with personal local support. This support has included such items as factory visitation and machine upgrades as well as continued training for new employees that come along later.

Etchant control is an easy thing for your Vis-U-Etch™ 5 and the reliability of this system is second to none but even under the best circumstances things can go wrong.

By calling Oxford V.U.E., Inc. to find out who we recommend, you are doing yourself a big favor. We can make sure that no one is misrepresenting our product to you, chemical compatibility is assured and customer satisfaction is held to the highest level possible.

It really matters to us to keep you happy long after the sale and taking advantage of our relationship with our selected companies gives you the quality and service you deserve.

Call us today or send an e-mail request to: **pculpovich@oxfordvue.com** for all the details.

IPC EXPO 2000

As we begin a New Year, we think about what we've accomplished so far and what the new year will bring.

1999 was a very successful year for us and we are looking forward to an even better 2000. We promise to continue our dedication to building superior products, continuous improvement and superior customer service.

At the upcoming IPC show, April 4-6, 2000, in San Diego, California, we will be in booth 1520. This will put us next to Circuit Research Corp. and J.A.M. Technology and we will be across the isle from Dalux Equipment America. All have distributed our Vis-U-Etch™ 5 cupric chloride regeneration system.

While visiting, you will see the latest improvements in the Vis-U-Etch™ 5 cupric chloride regeneration system. We will also have a brand new control system on display, the VUE-Ferric™, for regenerating ferric chloride.

If you are planning to come to IPC Expo 2000 and would like a VIP Invitation, we will have a limited amount available. To get yours, send an e-mail with your name and address information to me at: **pculpovich@oxfordvue.com** or call the telephone number listed below or send your request by mail to:

Phil Culpovich
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We look forward to seeing you!

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INPUT CHEMICAL FAILURE PROTECTION (PART 1)

Earlier this year, we started shipping controllers with an automatic shutdown system for activation when either the acid or oxidizer tank became empty. This system prevents dilution of the etchant by acid or oxidizer if either tank becomes empty. Basically, when the acid or oxidizer empty (low) warning light comes on, a relay prevents any chemical add in automatic. The warning lights have always been there and most company employees are diligent in watching for any errors such as these. The problem that occurs when you didn't watch the error lights is that the etchant would be diluted with the opposite chemical of the one that ran out. Since this inhibiting feature was added, the end result now is that the etchant is allowed to starve for both chemicals and turns black instead. When someone does finally correct the empty barrel situation, the pumping switch is set to the manual position to prime the line and clear the error before automatic operation can resume. This method is much safer because regeneration can occur without the worry of a chlorine smell. Before this feature was added, the diluted etchant would still recover in automatic but due to the excess of one chemical already in the etchant, a chlorine smell was sometimes evident.

INPUT CHEMICAL FAILURE PROTECTION (PART 2)

The newest improvement to the Vis-U-Etch™ 5 cupric chloride regeneration control system is the addition of an automatic input chemical failure shutdown and flashing warning system.

Besides the empty barrel shutdown system explained above, we have also now added a flow error input chemical failure shutdown with a flashing beacon and horn to further alert the user to these problems.

Under normal operation, the acid and oxidizer flow error lights will come on for a couple of seconds after each chemical is finished pumping, whether in automatic or manual mode. This provides a good bulb and circuit check for the flow error system. If the error comes on and stays on during or after pumping, this indicates that an input chemical failure has happened and needs immediate attention to prevent chemical imbalance. As identified in the previous article, operators do not always pay attention to warning lights until a chemical imbalance occurs and a chlorine smell is evident.

What the new system does is to lock out automatic chemical additions if the flow error for acid or oxidizer is on for more than five seconds and to activate the warning beacon and horn. A new circuit board has been added to the inside of the electronic section that shows what caused the automatic shutdown. There are four red LED's on the board indicating acid empty, oxidizer empty, acid flow error

and oxidizer flow error. When any of these conditions occur, the automatic addition of chemistry is stopped and the warning beacon and horn is activated. The etchant will turn black if left uncorrected for a length of time. When the problem that caused the failure is identified, corrected and the system is once again primed in manual mode, the operator pushes the reset switch and the pumping switches can be returned to automatic operation.

This system is very beneficial because it prevents the possibility of chlorine gas forming due to operator negligence and it forces the person in charge to fix the error before automatic operation can resume.

In keeping with our long-standing policy of making all upgrades backward compatible, we have created a kit which can be purchased containing both types of chemical failure protection systems. Before ordering, please write down your electronic and chemical section serial numbers so that we can check to see if you need both systems or just the flow error and warning beacon system. Both upgrades take about one hour to install. The warning beacon and flow error system by itself takes about thirty minutes to install. Some drilling and soldering is required. If you elect to have the upgrades performed by Oxford V.U.E., Inc., a service call can be arranged.

TEFLON® VALVE CORES

During the past few months, we have been experiencing some difficulties with valves containing Teflon® valve cores. The reason we chose the model of valves that are used in the Vis-U-Etch™ 5, is due to the ease in which they can be serviced or replaced. There have been some problems with the original valves due to the Viton® cores having a reliability problem. We decided to keep the original valves but to have new Teflon® cores made for them. Unfortunately, there was a design change in the valve assembly that we were unaware of and we had some Teflon® cores fail. At this time, we believe that most or all of the first revision valve cores have been replaced under warranty. If you have any new, Teflon® core, valves in stock which have not already been used in your Vis-U-Etch™ 5, we can replace them with the new design when shipped back to us. Please contact us first and ask for Phil Culpovich or Dave Flynn to obtain a return authorization.

This should not only take care of your immediate valve problem but the new design should last significantly longer than the off-the-shelf version. The original prototype Teflon® cores that we tested are still in use after more than two years of operation. We did not want to go back to using the Viton® cores because we knew the Teflon® cores could be made to last longer. If you have valves currently in use that are due for replacement cores, you can purchase Teflon® cores as replacements.

Keep in mind that the Teflon® cores are to be used ONLY in the acid and oxidizer valves. The original Viton® cores must be used in the spent valves.

Vol. 5 Oxford V.U.E., Inc. Issue 1

News & VUEs

WYE STRAINERS

Sometimes the incoming acid and oxidizer to the Vis-U-Etch™ 5 is not free of debris. For this reason, we have now started shipping all new Vis-U-Etch™ 5's with a _" wye strainer to be attached to the inputs for these chemicals. The problem that generally occurred without the wye strainers is that debris would become lodged in the flow detector paddle wheel(s) and/or valve seat(s).

If caught in the flow detector, the corresponding flow error light would come on indicating a problem. With the new Input Chemical Failure Alarm system, this would cause a shut down and require cleaning before automatic operation can resume.

If caught in the valve seat, the Input Chemical Failure Alarm would also activate because the valve would not be allowed to close fully and the corresponding flow error would occur. More importantly, the Teflon® valve seal can become damaged requiring replacement and voiding the warranty.

With this new setup, the reliability of the input chemical delivery components has dramatically increased.

The only drawback to this, if you could even call it one, is that you will have another maintenance item to check in the event of a flow error failure. The upside is that the wye strainer is easier and less expensive to clean than replacing valves.

OWNER'S MANUAL

Over the last four years, the Vis-U-Etch™ 5 has undergone several changes in design to improve performance and reliability.

Since the introduction of our latest light cell design and companion meter upgrade, the original calibration procedure can no longer be followed. In order to eliminate any confusion, the following paragraphs are reprinted from the revised owner's manual on the new calibration procedure. Please be sure to check our website to read or download the latest version, which also includes the information about the new Input Chemical Failure Alarm System.

ETCH RATE AND ETCH FACTOR

Two items that get discussed any time the conversation centers around etching are etch rate and etch factor. There are many things that affect both but in order to gain a better understanding of how to achieve the desired improvements you want there are a few basics to remember that you can work with.

First we'll talk about etch rate. We frequently hear the question of how fast is our etchant. To answer this and the etch factor question, I'll use the same simple illustration. Let's assume that we have a single fixed nozzle etcher with a fixed tray to set our copper on.

When the copper panel is placed on the tray and the spray is turned on, the area directly under the spray nozzle starts to

etch very quickly. In direct testing with this method, a one-ounce copper panel will be etched to the substrate in well under a minute under the spray. What is more important to consider, though, is that the area just _" away from the direct spray contact area, although etchant also flows across it, etches only about half as fast. The main reason for this is that the etchant directly hitting the copper changes from cupric chloride to cuprous chloride and stops etching. In order to continue etching, fresh cupric must be delivered to move aside the spent cuprous.

You can test the etch rate of your etcher under the spray nozzle by placing a copper panel on the conveyor and running it into the etch chamber. Turn on the spray pump (not oscillating) for a given number of seconds and see how long it takes to get to the substrate under the nozzle. This is also a great indicator of how much of your etch chamber is actually etching and how much etching doesn't happen between nozzles. To illustrate my point, let's assume we have a three foot long etch chamber with one nozzle every foot. If we compare the etch rate of that etcher with another three foot long chamber with spray nozzles every six inches, you'll find that the conveyor moves twice as fast to etch the same amount of copper because of the increased spray contact area. Recently during the installation of a new Vis-U-Etch™ 5, we modified an old etcher by almost doubling the number of spray nozzles per spray bar. Under the original spray pattern, it took the conveyor approximately 112 seconds to finish etching a one-ounce panel. After adding the additional nozzles, the conveyor sent the panel through in just 71 seconds, a decrease of more than 36% of the time needed to finish etching the panel. While visiting the Productronica show in Munich, Germany last month, I was delighted to see that many of the latest etcher designs involved increasing the number of nozzles per square foot or nozzle density.

The type of nozzles used is very important. Usually, full cone type nozzles etch faster than flat fan type nozzles because they deliver more volume of etchant. Fan type nozzles are becoming more popular though because of the higher etch factors needed.

In order to help remove cuprous from the panel more quickly, oscillating spray bars are often used. If the nozzle density is too low, oscillation can really improve the etch rate. If the nozzle density is as high as possible, the puddling effect of cuprous is less and the difference between oscillating and non-oscillating spray bars is less pronounced.

When oscillation is used, one of the most commonly overlooked items is the rate of oscillation. Oscillation is intended to move the cuprous puddle off the panel as quickly as possible. Depending on the size of the panel and the speed of the conveyor, you must set the oscillation rate so the "wave" of etchant moves quickly off the panel but not to quickly that it gets pushed back on. To set this rate correctly you can do this test. Increase the conveyor speed for some test panels so that some of the copper remains. Start with your oscillation rate at 20 back and forth cycles per minute.

Run each panel through the etcher, one at a time, adjusting the oscillation rate by 2 cycles per minute higher between panels. What you will see is the etch rate increases and decreases like a sine wave. Pick the rate that works best for each size and thickness of your panels. Thickness changes the conveyor speed so the oscillation rate can change.

Many etchers are designed specifically to run very thin core material. To prevent cores from flipping up and getting caught inside the etch chamber, various types of top rollers are used. This can create an etch rate problem because the more interference with the spray nozzles the slower the topside etch rate becomes. The bottom is less affected because cuprous doesn't puddle underneath it just falls off.

If spray pressure is increased, etch rate increases. More pressure means faster delivery of fresh cupric and faster removal of cuprous. This becomes very important when the spaces between the traces on your panel are very small. Now higher pressure is needed to "dig" out spent cuprous and replace it with fresh cupric. Many new etchers can operate as high as 40-50 PSI. The consideration for higher pressure will be limited by the hole sizes of your panels when these are etched. Obviously you don't want higher pressure breaking the tents and etching the inside of the holes.

If etchant temperature is increased, etch rate increases. Higher temperatures speed up chemical reactions. The only limitation here is in the material the etcher is made of. It is generally best to run the temperature as high as the warranty of your equipment allows without exceeding it. If you are not sure about the cooling capability of your etcher set the temperature lower to be safe. Check with your etcher manufacturer to see what is the maximum recommended operating temperature.

Now it's on to etch factor. Etch factor is essentially how straight your sidewalls are or how little under cutting is occurring. Etch factor is governed by several things.

The first is the reason you bought your Vis-U-Etch™ 5 to begin with. Other controllers operate using Oxidation-Reduction Potential (ORP) probes to control oxidizer and conductivity (Normality) probes to control the acid content. In order to function properly, Normality probes generally must have at least .5N free acid in the etchant. As you increase the free acid content, the etch factor goes down because having free acid on the panel allows the cuprous that forms to be regenerated on the surface of the copper panel. Since cupric chloride will etch copper in any direction, free acid in the spaces between traces will also etch sideways after regenerating in the space. The Vis-U-Etch™ 5 uses light transmission to sense changes in the clarity of the etchant. This allows us to operate at <0.04N, effectively zero free acid. At 0N, no regeneration occurs on the panel surface. The only way etching can continue is to spray more etchant from the nozzles.

That brings me to the next point. The direction the etchant hits the panel is one of the most important items in determining etch factor. Two things influence the direction. One is the type of

spray nozzle. As discussed in the etch rate part of this article, there are two types of nozzles used, full cone and flat fan. While it's true full cone nozzles generally deliver more etchant and a faster etch rate, they also spray the etchant at an angle other than 90° to the surface. Flat fan type nozzles spray much closer to 90° to the panel surface.

You can try this experiment using the one nozzle etcher I talked about in our first example. Place a thick piece of copper under the spray nozzle. Set the angle of the nozzle at 45°. Watch how the copper etches. You'll see that the hole it creates through the panel is approximately 45°. This is because cupric chloride from the nozzle first hits the panel surface going downward, etching where it contacts. Spraying at an angle means that the path of the etchant through the metal is going sideways too.

The 45° scenario may sound a little extreme but think about how the oscillation in your etcher works. There are two types of oscillation (when used) found in most etchers.

The first is the swing type. This construction has nozzles mounted to a spray bar that turns back and forth in an arc. This points the spray at the panel within an arc that is only 90° to the panel at one spot in the arc. This angled spray lowers the etch factor.

The second type is horizontal reciprocation. This method is becoming more popular because the nozzles are mounted to spray bars that keep them pointing 90° to the panel. The whole rack of nozzles moves from side to side. Since etchant always sprays as close to 90° as possible to the panel, you get the highest etch factor or straightest sidewalls.

Most things in life are more easily understood when viewed in their simplest form. The single nozzle etcher sounds like a silly idea until you consider that it makes you focus your attention on the most important thing: how the spray contacts the panel.

CALIBRATION

Calibration of the Vis-U-Etch™ 5 is preset at the factory at 7 turns and should not generally be changed. Both calibration potentiometers are located in the Electronic Section on the motherboard and are labeled "In" and "Out" which corresponds with the input and output meters. Both are 10–turn potentiometers and should be set between 5 turns and 7 turns clockwise from the counter-clockwise stop. This setting will provide proper operation under most operating conditions. Should it become necessary to make a slight change to the setting, you can adjust both potentiometers in equal amounts up or down. Do not set outside of the 5~7 turn range. Too low of a setting will cause regeneration to start too early and release too much chlorine gas to be used in the cuprous to cupric reaction. A noticeable chlorine gas smell will come from the etchant and can become dangerous if operated in this manner. Too high of a setting will cause the etchant to become darker before regeneration and potentially end up with "runaway" chemical adds. This can also end up releasing unwanted chlorine gas. For these reasons we suggest not changing

the settings at all but if you must, increase or decrease in _ turn increments only and wait for at least 4~5 regeneration cycles before determining if the new setting is acceptable.

It is normal for the output meter to operate in a range approximately _-_ meter lower than the input meter. This is due to the LED type construction of the light cells and their extreme sensitivity to changes in the etchant (color, clarity and pressure). If the input meter is below _ scale, the output meter will not show any bars and is considered "off-scale". This is a normal phenomenon. When the regeneration cycle begins and the proper chemical is added, a sufficient response on the output meter indicates that the light cell and meter are functioning normally.

Under certain circumstances the meters will track more closely together. This is OK also. At no point is it acceptable for the output meter to track higher than the input meter when regeneration is not occurring (i.e. input meter above the "regen" or ".2" reading).

LIGHT CELLS

The light cells in your Vis-U-Etch™ 5 are designed for continuous use without the need for cleaning or recalibration. There are certain times, though, when cleaning may be necessary. If the etchant is allowed to become grossly out of balance or if the filters are not cleaned, it is possible that a coating may form on the light cell surface.

Cleaning may be necessary if the monitor that the light cell is connected to (Input or Output) does not respond much to regenerated etchant (Input) or either acid or oxidizer additions when needed (Output).

To clean a light cell:

First, turn off all valves/pumps in the etch in line from the etcher to the Vis-U-Etch™ 5. Disconnect the electrical connector to the light cell in question. Loosen both unions for the light cell and let the small amount of etchant drip out. Remove the light cell.

The inside surface can be cleaned using water or water with a small amount of hydrochloric acid. ***Be very careful around the glass rod lens in the center, it will break easily if bumped.*** Once cleaned, put new o-rings on both unions and coat them with silicone grease (Not sealer). Put a small amount of silicone grease on the union threads as well to aid in removal later. Do not over-tighten!

Position the light cells as follows: The input and output cells should have the glass rod lens attached at the top, pointing down. The bubble detector light cell should have the glass rod lens attached at the bottom pointing up. If not installed this way, the input and output cells will be more susceptible to bubbles and the bubble detector will not function properly. The positions can be verified when the Vis-U-Etch™ 5 is turned back on by observing the light cells. The input and output light cells will have the green light from the LED's visible on top and the bubble detector will have its light on the bottom.