SERFILCO® . . . technical bulletins

COVERING FILTRATION & PURIFICATON OF:

WASTE SOLUTIONS (Plating & Industrial)

ANODIZING & SEAL SOLUTIONS

PHOSPHATING SOLUTIONS

CARBON TREATMENT

WATER

ACIDS

CLEANERS

PHOTO RESIST

PLATING BATHS

FLUX - ZINC CHLORIDE

TODAY, the three R's of the industry are **RECYCLE, RECLAIM & RE-USE.**
This reflects our intense concern for our environment and for the conservation of natural resources.

With our long history of experience in all phases of industrial, institutional and commercial filtration and pumping, we can prove the economic value of clarification and purification as applied to your product or service.

SERFILCO's modern filtration technology *CAN HELP YOU* -
reduce waste, lower manufacturing costs and enhance product integrity.

Look to SERFILCO for *ALL* your Filtration & Pumping needs!

INDEX

PREVENTING PLATING REJECTS

starts with your cleaning tank ...

...and doesn't stop until the final rinse!

WATER

WATER must be pure if you want to avoid unnecessary problems with your chemicals and final rinsing. Filtration is a first step, which might be followed by softening with ion exchange, carbon or reverse osmosis and final trap filtration.

CLEANERS (Acid and Alkaline Solutions)

SKIMMERS to remove surface oils, greases and dirt. Pumps then transfer the liquid to a filter purification chamber, coalescer or still tank for their separation and removal. Prevents parts being plated from carrying contaminants from tank to tank, thereby reducing amount of solids and organics getting to the plating tank (reduces plating tank carbon treatment).

FILTERS are often overlooked on these tanks, but extended life and less dumping of the cleaners justifies at least coarse particulate removal which will attract most of the oils also.

CARBON following filtration for adsorption of oily substances.

COALESCERS separate oil from water with pre-soaked elements which agglomerate the oil droplets and float them to the surface for periodic discharge. Especially helpful on parts where fabrication has left difficult-to-remove drawing compound, cutting oil, etc.

STILL TANK provides dormant area to overflow and allow gravity separation of free oils, greases. Easily accomplished by providing a weir (or use a bulkhead fitting) at the solution level and pumping at a slow rate from the auxiliary tank to the main tank so that the excess will float the oil away from the parts being plated.

PLATING SOLUTIONS

FILTRATION FOR CLARIFICATION - Although drag-in of particulate matter may be minimized, plating surface results reflect the actual condition of the bath; therefore, high turnover rates through the filter are required for total solids removal before roughness can occur. Various filter media should be considered according to the requirements of the application.

FILTER MEDIA - Depth type and pleated cartridges, sleeves, bags and roll media for use in SERFILCO equipment and many competitive systems.

ABSOLUTE MEDIA - Pleated membrane cartridges, nominal and absolute sub-micron, in series with other types of filter media for the purpose of achieving a higher degree of clarity when required for specific types of electronic and plating applications.

PURIFICATION MEDIA - Carbon for adsorption of organic impurities is used on many plating solutions, available in cartridge, powdered or granular form. Latter offered in refillable canisters.

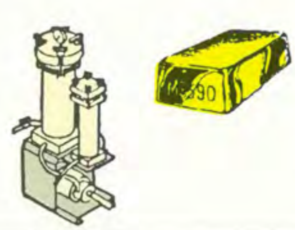
CARBON CHAMBERS FOR PURIFICATION - Adsorption of undesirable organics can be achieved continuously or intermittently by directing a small portion of the filtered liquid through a granular bed of carbon. Emergency purification can be achieved with a pre-coated surface using a powdered grade.

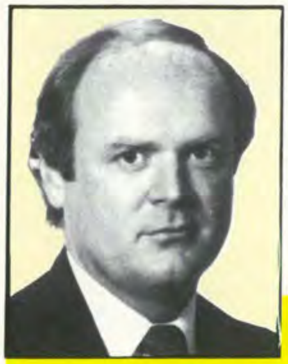
CONTROLLERS FOR CHEMICAL ADDITION - Acid adjustment for pH balance and Brightener Feeder to control additions via a shunt from the rectifier. Assures optimum quantity without waste or unnecessary drag-out to waste treatment. Energizes a metering pump in direct relation to amp-hours used. Totalizes amp-hours to evaluate metal consumption.

PUMP FOR CLEANER AGITATION - Intank or out-of-tank pumps for agitation in place of air. It is the cleanest way to move solution to achieve better throwing power into recess and accomplish plating at a faster rate.

RINSE TANK CONDUCTIVITY INSTRUMENTS - To control the amount of water necessary to maintain a maximum level of concentration of dissolved metallics in plating rinse water.

PRECIOUS METAL RECOVERY SYSTEMS - Ion exchange columns and electrolytic cells for silver and gold are available for recovering precious metals from rinse tanks and spent solutions.





FILTERED THOUGHTS

by Robert J. Audette
Serfilco, Ltd., Glenview, IL

Introduction

"To err is human; to filter, divine."

—Joe Shakespeare, electroplater

Every plater, if he (or she) will admit it, has to agree with Joe the Plater. There is nothing quite like a smooth, mirror-finished piece — that special look. The knowledge that, chances are, the piece will stay bright and shining for a long time, or at least until it hits the smog, the sea spray or a woman's ear.

To make it last, anything that can be done, should be done. Quality and reliability are elusive animals. If our friend, Joe the Plater, has any chance whatsoever to stay in business and grow in business, then he must tame the quality control beast. His tools are his wits and his suppliers' wits. For his work to achieve the goal of ageless glitter, he must bring every trick to bear. It's no magic when the product shines, it's the direct result of chemical and mechanical efforts. And wits.

Quality and reliability are certainly two very good reasons for Joe to give his best shot, but more important is Joe's customer. After all, doesn't the paying customer deserve the best? Who does plating please if it's not the businessman whose reputation is on the line to a customer of his own? What if that businessman is called in by his customer to see a pile of corroded chairs, bumpers, bicycles, broaches, or a stack of memory discs suffering from Alzheimer's disease? Chances are Joe might soon be looking for a new line of work.

Meanwhile, back at the tank, those nickel ions being pushed and shoved around could care less if Mary Jane in Peoria junks her dingy necklace because it feels like sandpaper. Who could blame a copper ion for not taking the rap for a faulty circuit board? If an airplane falls from the sky because mounting bolts rusted, fatigued and cracked, you can't haul a cadmium ion into court.

All of this illustrates that the responsibility for good plating lies with the plater. He has to be able to fall back on his bath chemistry and there is just no way that those floating ions can perform in the presence of a rowdy crowd of low-class solid contaminants clogging up the works. How annoying it must be for a nickel ion to reduce to metal and join the lattice only to find a hunk of crud in its spot. As if to make matters worse, the damage done by that little aberation gets worse and worse as layer after layer of atoms take their places on the grid. It's like building a brick wall and tossing in an occasional bowling ball, only worse, because here we're talking in three dimensions. Pits, voids, porosity, tarnishing, roughness—it's fairly obvious that a little dirt can have a lot to do with Joe's downfall.

Enough of cursing the darkness. Enter the white knight. Slayer of particulate dragons, enemy of wanton crud. It's Joe's trump card — the tank filter! When the chemistry's right and the power's rectified, and it's still not happening, bring on the filter.

Filtration of electroplating solutions is not a cure-all for plating woes, but it remains a critical part of the whole effort to achieve success in plating. It's a part that cannot be overlooked or understated. A little filtration is better than no filtration, but a lot of filtration is often the only way to assure the level of quality required on many plated items.

In this series of articles, we shall attempt to acquaint the reader with some of the means to achieve that most elusive beast of all, "zero rejects". It is the striving for this goal, and the understanding of the tools available to the plater to achieve this goal, that is really at the heart of our efforts. If, by example, we can in some way make it understood that better filtration is better, then we shall have achieved our goal.

Our investigations will take us back to the beginning, to the cleaning cycle. We'll search for the sources of dauntless debris, the potential origins of future quality problems. We'll offer a plan of attack to snag the insidious invaders before they make a mess of your creations. And hopefully, we might help you lick a lingering quality control problem that has you taxed to the limit.

You may already know something about filter media, tank turnover rates and dirtholding capacity, but perhaps we can give you some new insights into how these concepts might actually help you achieve zero rejects in your own operation.

Joe the Plater would be pleased.

Next month we will discuss sources of contaminants and the need for proper filtration in the cleaning line. **MF**

FILTERED THOUGHTS

by Jack Berg
Serfilco, Ltd., Glenview, IL

Start at the Cleaning Line

"Give me a clean part, a clean electrolyte and I could probably give you a plated part according to specifications."

—Joe the Plater

Obviously not always true, but it certainly is a step in the right direction. These days, even statistical process control might be needed to meet requirements. Once the degree of quality has been established, platers can proceed accordingly. Some platers tell us of their experiences which result in 5% rejects or more, others as low as 1%. The plating may be the same, but if the specs vary, the reject rate will follow accordingly. It all reverts to cost and intention. What steps is the plater willing to take to achieve the desired results?

Quality control people tell us you can't take shortcuts. All specifications have plus or minus tolerances. Each tolerance must be met so as not to interfere with the next, in stepwise fashion. How can we apply this approach to plating, and in particular, what does it have to do with cleaning? Remember, you can't make deer skin gloves from a sow's ear, therefore you can't expect to get good plating if the parts are not cleaned properly.

Dirty parts are bound to be carrying contaminants to the plating tank. Cleaning, as you know, is the step before plating which helps to prepare the part to be plated. Chemicals used in cleaning dissolve, loosen and free impurities and contaminants from the substrate, but it is the rinsing cycle of the cleaning process which determines whether or not parts are actually clean when they enter the plating tank.

As a practical exercise, check to see if your parts are actually free of particulate matter prior to the plating steps:

Take your parts right off your line after cleaning and rinse them in clean, filtered water. Compare water quality before and after rinsing. You probably won't detect a measurable level of change, but then multiply even the slightest increase in particle count times the number of parts being plated and you can quickly determine why failures begin to appear after a certain period of time.

What are some other sources of contamination?

1. Tank ventilation passes large quantities of air over the surface of plating tanks (Fig. 1). This air carries with it all sorts of unwanted contaminants from other operations near and even far away from the plating line. The electrolytes, aided by wetting agents, pick up anything that drops in along the way.

2. Agitation with air creates a similar problem (Fig. 1). The solution acts as a fume scrubber, absorbing fumes, oil mist vapors, sandblast dust and any other contaminant that gets past the intake screen. (Some call it a filter, but in most cases, it is nothing more than a coarse mesh media such as you might find in a heating system in a private residence.) The use of denser filter media at this point would help, providing it didn't affect the performance of the blower. The use of a compressor to provide pressure to pass air through dense me-

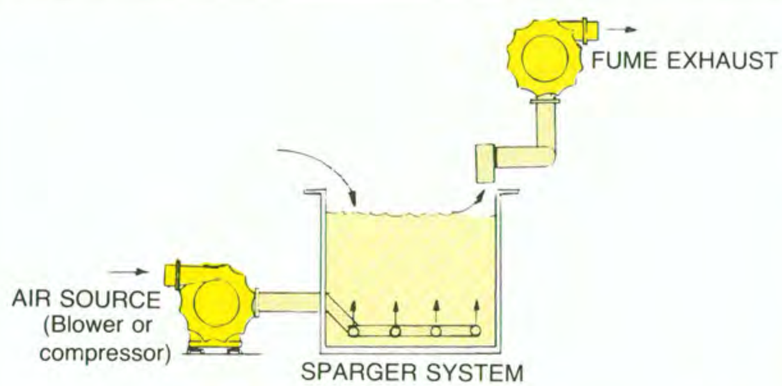


Fig. 1. Tank ventilation and air agitation can carry unwanted contaminants from other operations.

dia is considered by most to be impractical even though such filter media provides the further benefit of stopping oil vapors which might be present. The use of pumps as a means of solution agitation will be discussed next month.

3. Sources of contamination such as sludge from anodes cannot be overlooked. Considerable attention must be given to the purity of the materials used.

4. Finally, water can be a source of solids contamination. Whether it is city purified from the tap or recovered, following waste treatment, the water will most certainly contain some particulate matter.

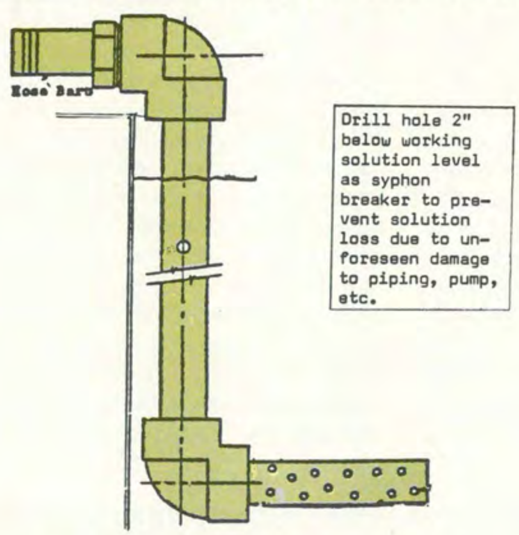
The plater has basically two options to counteract these occurrences of contamination. One, of course, is to remove the impurities after they get into the electrolyte. The other option is to isolate as much of the solids and other impurities as possible before they get to the electrolyte and disturb your plating process. Let's take a closer look at the second option with regard to the cleaning line.

Filtration of cleaners can be important for several reasons. First, it can add some life to the cleaner, which is a cost reduction capable in most instances of paying for the equipment necessary to do the job. Second, filtration will reduce the possibility of solids and oils from being carried down the line to the plating baths. This means that the plating filter will require less service and will be operating at higher average flow rates (a subject which will be discussed in detail in a future article). Also, less oil carry-in means less need for the use of carbon for adsorption. This can translate into substantial savings on brighteners which might be removed by carbon treatment.

The best way to filter a cleaner is to connect the pump to a floating skimmer and suction pipe assembly (Fig. 2). The oily substances will be drawn to the skimmer while the heavier particles will be carried to the filter via solution movement and retained in the filter media. Carbon may be used for additional adsorption.

Next month we'll take a close look at the other options to counteract contamination and reduce rejects—filtration of plating electrolytes. **MF**

SUCTION OR DISPERSION PIPING*SYSTEM WITH STRAINER AND SYPHON BREAKER



*CPVC with screwed connections offering maximum flexibility and ease in installation. Assemblies may be purchased as described or modified as necessary. May also be used on the return line by eliminating the strainer and replacing same with a longer length of pipe with openings along the full length. Double the price shown per foot of pipe with holes drilled.

SKIMMER ASSEMBLY

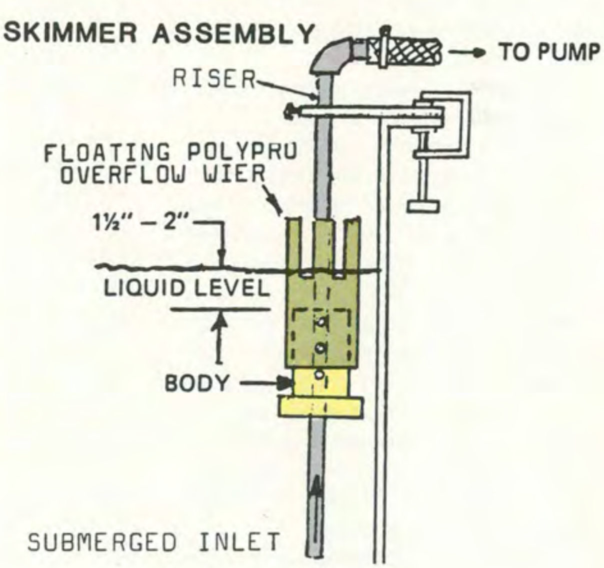


Fig. 2. Floating skimmer and suction pipe assembly for filtering cleaner solutions

FILTERED THOUGHTS

by Jack Berg
Serfilco, Ltd., Glenview, IL

Achieving Zero Rejects

"Cleanliness is next to Godliness, and next to impossible, too."

—Joe the Plater

Last month we discussed particle contamination originating from air and water sources in the plating environment. Now it is appropriate to move down the line to the plating baths themselves.

Even if parts enter the plating electrolyte completely clean and free of solid contaminants, they still face the likelihood of encountering floating debris in the plating bath. How do these invaders find their way into our sacred solutions? A host of mechanisms exist:

1. Random dirt — simply by falling from ceilings, hoists, racks, etc, dust and debris work their way into your electrolytes.

2. Anodes — encountered when bags break, sludges form, etc.

3. Bath chemistry — reaction products can precipitate in the plating bath.

The combination of input from all of these sources, as well as drag-in of solids from prior steps, can produce a "dirt loading" that will require extreme vigilance to eradicate. From the plater's standpoint, this influx of solid contamination represents a serious threat to his chances of achieving "zero rejects". His only recourse is continuous filtration of the plating bath. The question is: "How much filtration is enough filtration to assure quality?"

The Olympics impressed upon us the number 10 as relating to perfection. The movies gave us their idea of the perfect 10. I suggest that platers also might consider that it may take 10 or more tank "turnovers" per hour to achieve the perfect plate (Fig. 1).

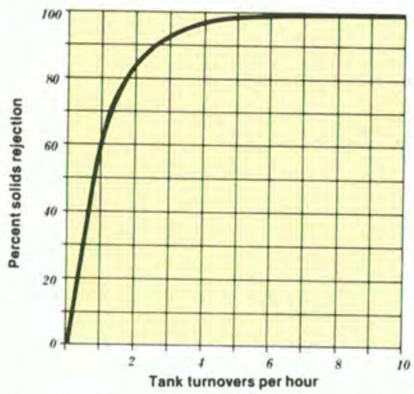


Fig. 1. Effect of turnover rate on solids rejection.

What exactly is meant by the word "turnover"? In merchandising, it can relate to inventory cycles over a given time period. To a plater, it refers to the recirculation rate at which a tank of plating solution is passed through a filter. Why is such a high turnover rate necessary? The answer lies in the degree of clarity of electrolyte which results from frequent passing of a contaminated solution through a dirt-retaining medium. A filter providing clear solution helps to create the level of perfection in an electrolyte necessary for good plating.

Turnover is the vehicle which provides the velocity or movement of solution. Turnover is measured in terms of flow rate. The higher the flow rate, the greater the velocity. The movement of solution creates the velocity necessary to carry the particulate matter to the filter.

WHY IS VELOCITY SO IMPORTANT?

1. Velocity enables fresh solution to be constantly brought to the work, replacing depleted solution and carrying new metal ions to be deposited; therefore, velocity helps to increase the speed of plating.

2. Velocity prevents temperature stratification (layers of hot or cold solution).

3. Velocity can help prevent burning of the surface in high current density areas.

4. Velocity can help direct solution to specific areas such as recesses or interior surfaces to achieve a more uniform deposit.

5. Velocity created by a pump may also be used instead of air agitation, eliminating the possibility of contaminants entering the electrolyte from the effects of air movement. (This has been discussed in a previous article.)

HOW DOES VELOCITY WORK WITH A FILTER?

The movement of solution, measured as velocity, has carrying power. For instance, it is said that the topsoil of a 40-acre farm moves down the Mississippi River every five minutes during the spring thaw. Thus, the higher the velocity, the greater the carrying power. Platers who years ago had to transfer their solutions from tank to tank to remove the solids from the bottom of the tank no longer must go through this process. Velocity carries the impurities to a filter to be separated from the electrolyte. In a future article, we will examine the effect of various media used with the filter to effect this separation.

WHAT VELOCITY SHOULD BE USED?

Obviously, the higher the turnover rate, the greater the benefits. Note, for example, in Fig. 2, the amount of solution which would pass through a filter

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FiLTERED THOUGHTS

by Jack Berg
Serfilco, Ltd., Glenview, IL

Filter Media

Filtration has evolved from being that "necessary evil" into being an important tool without which, in many cases, quality plating couldn't be accomplished. In earlier discussions, suggestions were offered on how to minimize sources of particle contamination up and down the plating line.

We have tried to emphasize how solution velocity and turnover rate can lead toward increased bath cleanliness. Platers know from experience, however, that "perfectly clean" is impractical. Therefore, all steps must be taken to achieve the degree of solution clarity necessary to reach the goal of "zero rejects". Platers have learned that surface treatments considered good can still end up failing after a period of time. Because of these experiences, platers know that they must improve their techniques or suffer the consequences of reduced work.

If we assume that solids removal from the plating line can and should be accomplished, then the only question remaining is, "What are the best choices of filter media and turnover rate necessary to achieve the desired results?"

1. Should the filter media be very dense, stopping every possible particle which could cause roughness on the plated surface of codeposition, which later could show up as rust or imperfection?

2. Should the filter media be coarser, allowing higher flow rates to achieve higher turnover rates?

Perhaps the best way to answer these questions is with another question. What is the size range of the particles and how many are there? (Perhaps if Custer had asked this question, he'd have lived longer.)

If the answer is few and small, a very dense media is recommended (0.1 to 10 μ). If large and many, a coarse media is best (15 to 100 μ), letting the solids form part of the filter process.

In either case, the media must be able to hold the amount of solids that will be entering the plating tank during a certain length of time, that being the time between media changes. Years ago "surface area" was the measurement used (we prefer to call it "dirt holding capacity"). Therefore, it can be assumed that any filter, if sized properly, can provide the necessary dirt holding capacity required.

For extreme situations requiring the utmost in clarity, absolute type submicron (0.1 or 0.2 μ) surface type media might be employed. No doubt many other precautions would be used to reduce the dirt load. Therefore, if solid particles can be assumed to be at a minimum, flow at a high turnover rate in excess of 10 times per hour could be maintained without flow reduction from the solids which get past the first line of defense. If such filter media plugs up too frequently, then a pre-filter consisting of slightly coarser media might be added at an ever higher flow rate, with the denser media following on a bypass for the best results (Fig. 1).

For less stringent requirements, and yet where quality is still very important, filter media of 1 to 10 μ with a nominal retention rating will provide good results; however, the most important consideration is if you can get the solids out of the plating tank before they are co-deposited on the surface. This is again an example of the need for high flow rates. This doesn't increase the size of the filter because the dirt load hasn't changed. What it does is demand that you use pumps capable of higher flow rates so that your filter media is in contact with the solution over and over, increasing your chances of finding and stopping even the finest particles.

Higher flow rates will always allow you to employ coarser filter media, yet achieve a high degree of clarity with the solutions. When possible, oversizing your filter adds additional dirt holding capacity, when operating any filter with less flow per unit area, the result is also less pressure drop across the media. This provides for a more permeable cake of contaminants, thus allowing for a bigger build-up of solids and subsequent reduction of operating costs. **MF**

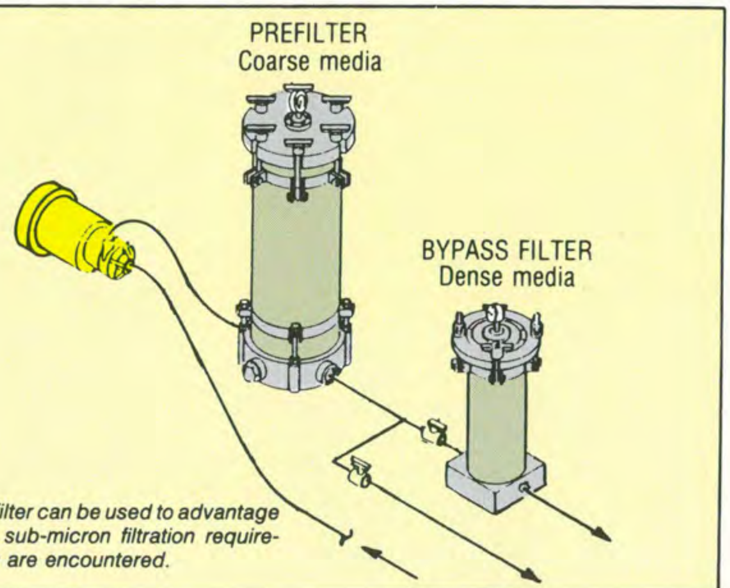

Fig. 1. A prefilter can be used to advantage when sub-micron filtration requirements are encountered.

FILTERED THOUGHTS

by Jack Berg
Serfilco, Ltd., Glenview, IL

Filtration of Water

WHY PRE-FILTRATION IS IMPORTANT

Clean water is an essential raw material for any plating or anodizing process. Water from natural sources such as a well, lake, etc, probably needs softening for calcium removal or carbon treatment for the reduction of organic impurities. Certain applications require that the water be essentially free from all ions. This can be accomplished with ion exchange and/or reverse osmosis treatment.

Softening, carbon purification, reverse osmosis or ion exchange are not basically filters in themselves, although they sometimes function as such. Each will operate to its maximum efficiency only if the water is filtered first, so as to be free of solids, usually with 15-μm media. Otherwise, solids will coat over the resin in a softener or ion exchange bed and also the carbon, or membrane, in a purification unit, preventing efficient adsorption. Following these units, trap filters of 1- or 3-μm density are recommended to prevent migration of resin or carbon media.

The quality of water required will vary depending upon its ultimate use such as makeup water for an electroplating solution or for rinsing. Solids entering the plating tank with the makeup water may amount to only 5% of the total to be filtered, but if they are removed at the source, you will find it is easier to service a water filter than plating filter. It is also easier to replace the filter media in the prefilter to a deionizer than it is to regenerate and wash the resin bed. Filtration is especially important in the reverse osmosis process, since solids will plug the pores in the membrane and decrease its efficiency.

CONSERVE WATER . . . SAVE MONEY

Since the cost of water is continually rising, its efficient use is of increasing importance. This is also necessary in order to conserve our limited water resources. Considerable reduction in rinsewater volume can be achieved with multiple counter-current flow rinse tanks, spray rinsing of parts and longer draining time of plating barrels. Conductivity meters can monitor and automatically control the dissolved solids concentration in a rinse tank by means of a signal to a solenoid valve on the water inlet. The reuse of water is also feasible with ion exchange or reverse osmosis treatment, which removes contaminants. In order to operate efficiently, these processes require filtered water free of solids.

SIMPLE TO ACCOMPLISH

Filtration of either in-line water supplies or recirculatory systems may be accomplished with depth-type cellulose acetate cartridges providing particle retention from 100 down to 1 μm, or cleanable cartridges of the surface type, or cartridges with absolute ratings of 0.25 to 1 μm. Precoat filters which can be manually cleaned or backwashed are also suitable for this purpose. New floating media filters with automatic cleaning are available. The choice of filter is usually dependent upon the amount of solids, the particle retention desired, available space and initial investment considerations.

Filter chambers are available in both nonmetallic and metallic construction to house the media. Pumps provide adequate pressure to achieve the flow through the media on an economical basis before servicing of the filter is required. Generally one 10" cartridge per 5 gpm is adequate; however, for the most economical use of the cartridge, 2 or 3 gpm are recommended.

Figure 1 is a typical curve showing element life as related to pres-

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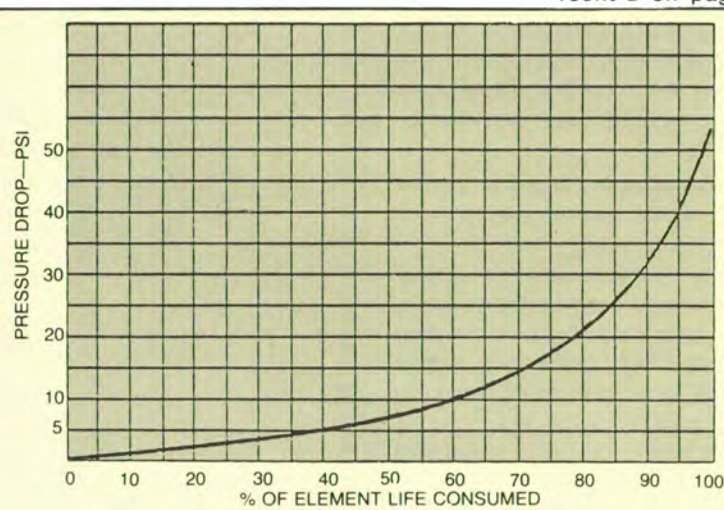


Fig. 1 Element life as a function of applied pressure drop.

FILTERED THOUGHTS

by Robert J. Audette
Serfilco, Ltd., Glenview, IL

PPM

One in a million. One red bowling ball in a sea of 999,999 green bowling balls. That's a ppm (part per million).

On a smaller scale, a one-gram chunk of dirt floating around in a million grams of water (or in a million milliliters (ml) of water, since one ml of water weighs one gram) is also a ppm.

In the world of filtration, we usually speak of ppm in terms of milligrams of solids per liter of solution (mg/L). Therefore, 50 ppm of suspended solids in a given solution means that if you were to filter a liter of this solution, the residue collected would weigh 50 mg (0.050 grams), or about 0.0018 oz.

These extremely small quantities of suspended solids in a plating bath are capable of significantly affecting deposit characteristics. In a paper presented at the World Filtration Congress in Sept. 1982,[1] a group of Japanese researchers demonstrated that only 10 to 50 ppm of suspended solids in a bright nickel plating bath was sufficient to dramatically affect several deposit characteristics. These included loss of brightness, increased pitting and roughness and a general deterioration of appearance of the plated surface. The researchers prepared a "standard" contaminated solution based on analysis of a typical filter cake from a bright nickel bath:

Nickel oxide solids	30%
Iron oxide solids	50%
Ferric hydroxides	20%

They plated various test panels in solutions containing different concentrations of these contaminants and found that the adverse effects upon the aforementioned deposit characteristics were most pronounced as the ppm of suspended solids rose from zero to 50 ppm; above that level very little additional deterioration of properties resulted. Clearly a little dirt goes a long way toward creating havoc with a plated finish. The report went on to recommend holding suspended solids below 10 ppm for best results.

Another interesting piece of data mentioned in the Japanese study was the average amount of suspended solids introduced into a typical nickel bath during the course of the plating day. They found that, on average, approximately 14 ppm of suspended solids are introduced into the bath per hour (from anodes, cathodes, chemicals, airborne dust, etc.). This represents about 14 grams of foreign particles per 1000 liters of solution (265/gallons), or about 2 oz/hr for a 1,000-gallon bath!

How large are these particles? The Japanese found that the average suspended particles in a typical nickel bath were on the order of 3 to 7 μm in size (the unaided eye cannot detect particles smaller than 40 μm, or about 0.0016" in diameter). When you consider that a typical nickel deposit might be on the order of 10 to 20 microns, it seems obvious that foreign particles of this size can significantly alter physical properties if occluded in the deposit.

Filtration is the only way to effectively remove these particles, but how much filtration is enough filtration? If one assumes an influx of two ounces of suspended solids per hour into a 1,000-gallon nickel bath, then the filter must be sized to keep those particles from building up. The Japanese found that at this particular rate of contaminant inflow, a bath would require approximately 2½ to 3 tank turnovers per hour in order to hold suspended solids below 10 ppm.

Let's assume a turnover rate of 2½ times per hour, or 2500 gallons per hour. This rate assures that particles have very little chance to settle to the bottom of the tank before they are removed by the filter. This filtration rate, assuming that 15-μm wound polypropylene depth-type cartridges are used, would require approximately 20 to 30 ten-inch cartridges in a filter chamber. This assumes a flow rate of no more than two gallons per minute per cartridge in order to minimize passage of the solids through the media. The larger the number of cartridges, and therefore the larger effective surface area available to retain particles, the more efficient will be the bath filtration.

Note that 15-μm cartridges are adequate, even though the average particle size may be much smaller. Keep in mind that as dirt is trapped on the polypropylene fibers of the media, it serves to effectively bind off flow of subsequent particles, so that finer and finer filtration occurs with time. When the pressure required to force liquid through the media reaches a given value, for example 30 psi, the cartridges are changed.

(cont'd on page D 11)

FILTERED THOUGHTS

by Jack Berg
Serfilco, Ltd., Glenview, IL

"No See-Ums"

When is a filtered solution not a filtered solution? When the filter is not capable of removing particulate matter from the electrolyte as quickly as it occurs. Previously, articles in this series have stressed the importance of preventive maintenance, that is, minimizing the chance of solids entering the electrolyte in the first place. Other articles have stressed the need for high turnover rate and proper filter media selection to remove solids, but when can the plater feel safe that this has been accomplished?

There are, of course, analytical instruments which can indicate the parts per million in a liquid sample at any given time. There is other equipment available which can indicate the size of these particles, but it is seldom that any plater would find it practical to use such instruments. Instead, he relies on salt spray tests or other types of climate control testing to analyze the quality of his work in order to meet a certain standard. Test results are often only made available long after the parts have left the plating tank and are well on the way to the customer and, in some cases, have even been put to use.

The plater might have parts returned to him which show evidence of surface deterioration. Such deterioration may often be the result of inclusions of contaminants having been codeposited with the metal ions. These inclusions may help to initiate the failure of the surface coating to maintain the properties for which it was originally deposited. This, I feel, is proof that the electrolyte which was used in those instances was obviously not as free of particulate matter as it should have been. In fact, I feel there is a direct relationship between parts per million contamination and percent of rejects. Some might refer to this particulate matter as "no see-ums", because it is just as irritating as the small micro-organisms which attack the human skin in Florida. If nothing is done about them they will simply continue to cause an irritation. It is not until they are eradicated that the problem is alleviated.

The same is true of your electrolyte, where fine particulate matter in the form of "no see-ums" is present and is causing perhaps endless hours of frustration, loss of customers or a lack of acceptance by the customer.

PARTICLE SIZE AND REMOVAL

The size and number of particles which exist in all electrolytes is rarely known. First of all, the amount in minus the amount out equals the "net" left at any given time. Will such particles cause you a problem? Perhaps a better understanding of the relationship between particle size and reject rate would help to produce better results.

First, the supplier of the proprietary solution often recommends that a certain size filter media (measured in microns) be used. These recommendations can sometimes lead to confusion, because filter media of a given micron rating does not remove 100% of all particles larger than say 5, 10 or 30 microns, as the rating would indicate. It is fair to say that most filter media removes a certain percentage of such particles sized above this rating number. Usually industry standards would vary between 85 and 95% efficiency of this number.

The supplier would be better to state that particles of a certain size, say 10 microns, if present in the electrolyte, would cause deposit deterioration if codeposited with the metal ions.

Now, we have a better target to achieve. We know what size particle is injurious to our deposit and therefore we can set out a plan to remove these particles. Keep in mind that it is first of all better to prevent these impurities from getting into the electrolyte, because once in the tank, they must be removed before they have a chance to codeposit, causing the defect. (This is why tank turnover rates are so important.)

It is therefore necessary for the plater to determine the particle size he wants to remove, then select the media which will give him the most solids-holding capacity. Then, knowing the efficiency of the media, multiply it by flow rate so that all of the solution passes through the filter in a certain period of time such as one hour or one minute. The acceptable turnover

(cont'd on page D 11)

Achieving Zero Rejects (from page D 6)

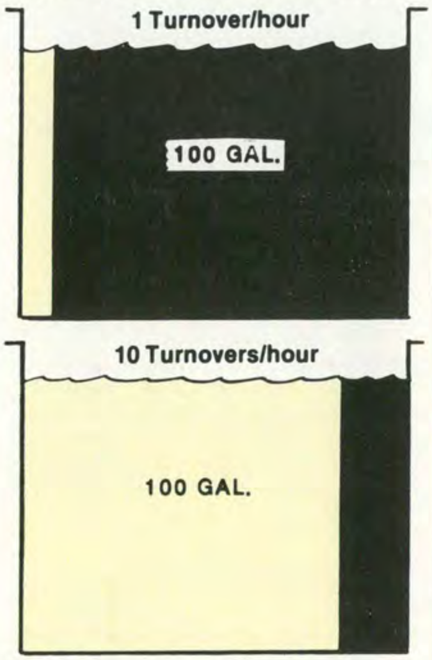


Fig. 2. Comparison of filtered volumes for 100 gallons of solution after five minutes' filtration at respective turnover rates.

in five minutes if a once per hour turnover rate is used, as compared with that which would pass through at a ten times per hour rate. (Assume a 100-gallon solution.)

1 turnover/hour:

$$1 \times \frac{100 \text{ gal}}{\text{hr}} \times \frac{1 \text{ hr}}{60 \text{ min}} \times 5 \text{ min}$$

= 8.3 gallons filtered

10 turnovers/hour:

$$10 \times \frac{100 \text{ gal}}{\text{hr}} \times \frac{1 \text{ hr}}{60 \text{ min}} \times 5 \text{ min}$$

= 83 gallons filtered

The point here is that if nearly the entire solution is turned over every hour, the plating bath will exhibit a high degree of clarity and purity. The net result should be fewer rejects caused by occlusion of particulate matter in the deposit.

In modern electroplating, no area which can result in improved quality should be overlooked. The plater can use the principles of high tank turnover and solution velocity to his advantage in his quest for zero rejects.

Next month, we will consider how turnover rate affects the choice of filtration system and filter media. **MF**

Filtration of Water (from page D 8)

sure drop. In actual service, a narrower spread of pressure drop is usually encountered, such as an initial pressure drop of two or three lbs and a final drop of 30 lbs. As can be seen from the curve, it can be very advantageous to size a filter for a low initial pressure drop. For example, if a filter is sized for an initial drop of five lbs, 40% of the potential life of the elements used in it will be lost.

IMPROVE QUALITY . . . PREVENT PARTS REJECTS

Filtration can prevent spotting of parts when deionized water is used for final rinsing after anodizing or plating. Filtration prevents spray nozzles from plugging up causing a distorted spray. Even water used for flushing pump seals should be filtered to prevent gritty particles from causing premature seal failure and leakage of the solution being pumped. Water used in cooling towers or in wash spray booths are other frequent applications. All water used in industrial processes should be filtered to prevent clogging of control parts, which can disrupt operation of the entire system.

PPM (from page D 9)

Getting back to our hypothetical 1,000-gallon nickel bath, experience has shown that a typical 15-μm (10") cartridge can hold 6 to 8 oz of suspended solids before a media change is required. Backtracking mathematically, we see that a particle influx of 2 oz/hr would cause a loading of solids of about one lb per eight-hour day. Thirty cartridges would hold approximately 15 lb of dirt, therefore cartridge life would be about three weeks between turnovers. Since most installations report cartridge lifetimes of 4 to 6 weeks, we might assume that the influx of particulate matter to an average bath is considerably below 1 lb/1000 gal/day. Let's attribute that to good housekeeping!

By minimizing those unwanted ppm of particulate matter, and by proper filtration to remove those ppm which inevitably exist, the plater assures himself of a better chance to produce a quality finish. **MF**

Reference

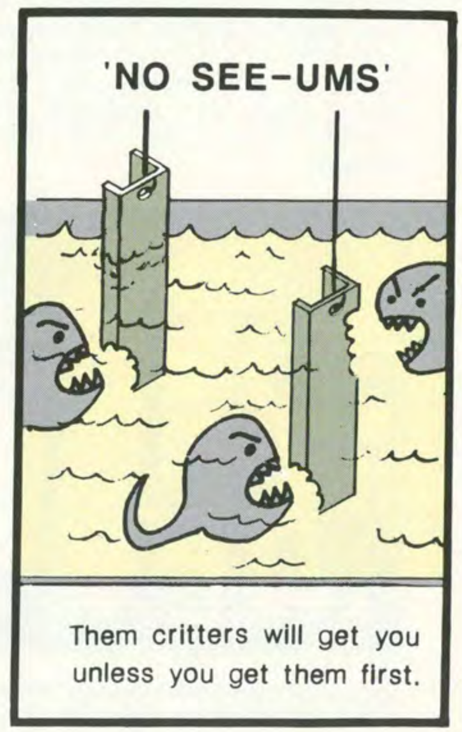
1. A. Yagishita et al, Filtration and Separation (Jan/Feb. 1983).

No See-Ums* (from page D 10)

rate depends upon the introduction of solids to the electrolyte, which relates to the frequency of parts being plated. Therefore, it would stand to reason that all particles introduced with one batch of work be removed before the next batch and so forth. By knowing your filter media efficiency and increasing your flow rate as necessary, you should be able to achieve quality, dirt-free deposits.

If you have still not achieved the results you are looking for, you may have to go a step further and provide a form of submicron particle retention downstream of your present equipment in order to remove the last remaining particulate matter before it has a chance to codeposit on your work.

The goal of filtration is to achieve the solution clarity you need to provide the quality plating your customer demands. **MF**



CORRECT FILTER SIZING KEEPS OPERATING COSTS AND REJECTS DOWN

Proper sizing of a filter on a plating bath can reduce costly operating charges in both labor and material, and reduce costly plating rejects. The experience of Keystone Automotive Plating Corpora-tion sheds some interesting light on proper filter sizing. Keystone's Chicago plant, one of 16 Keystone operations nationwide, recently replaced an undersized filter with a larger one that does everything a filter is supposed to do: operate for long service cycles between cartridge element changes to cut labor and material costs, reduce plating roughness and thus rejects, and provide more tank turnovers per hour for better plating efficiency.

The filter, a Guardian Model CVL600S made by SERFILCO, Ltd. of Glenview, IL, provides a pumping capacity of 6000 GPH, re-placing a 4200 GPH unit. It also doubles as a means of pumping out the 2000 gallon semi-bright tank that it serves when the tank needs cleaning. A built-in slurry tank provides an easy method of adding chemicals to the tank, properly filtered and ready to go to work. It is also used to prime the pump. The Guardian uses 15-micron depth filter cartridges; the previous filter used sock filter elements.

"We expanded our plating line," said Jim Kerrigan, Keystone's Service Manager and general production supervisor, *"and the old filter proved to be too small for the job. The biggest problem was the frequency of filter element changes and the high labor and materials costs involved. It was necessary to change the elements at least once a day. Yearly cost of this operation was approximately $1,885.00".*

Keystone was also experiencing an intolerable reject level caused by plating roughness. *"It was frequently impossible to change the filter elements in time to prevent the deposition of solids on the metal,"* said Kerrigan, *"so some rejects came through despite our vigilance."*

Kerrigan says rejects on typical bumpers, which account for most of their production, were running an average of 6-7 per day, and on the worst days the figure would climb to 15.

"We recycle rejects through the entire operation," said Kerrigan, *"and our cost per recycled bumper is about $10 for material and $12 for labor. At $22 per bumper, that's $132 per day at a reject level of 6, or $154 at a level of 7."*

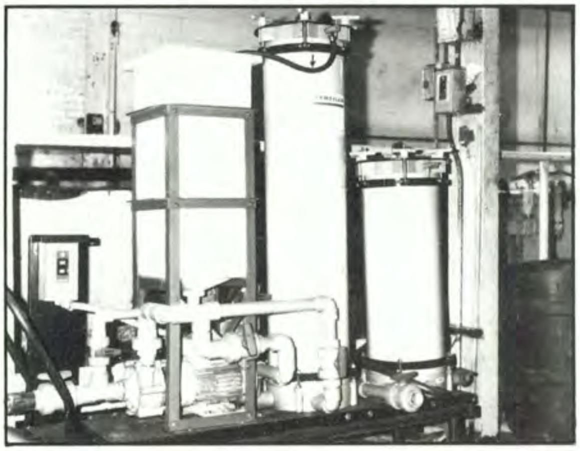
A lot of things cause rejects, Kerrigan stated, but if only one of the rejects per day was caused by faulty filtering that resulted in plating roughness, the figures work out like this: $22 per bumper times 22 working days per month is $484 per month in reject costs or $5,808 per year.

Roughness Rejects Eliminated

"Although we still get rejects," said Kerrigan, *"our rejects caused by plating roughness have been reduced to zero. By adding our labor and material savings from fewer filter element changes, ($1,885 per year), to savings from eliminating plating rejects, ($5,808 per year), we have achieved a yearly saving of $7,693 - more than enough to pay for the new filter."*

The situation has worked out so well that Kerrigan plans to replace the filter currently in use on the bright nickel plating tank with another Guardian at this and other plants in their organization.

Tank turnovers per hour is an important way to judge solution filtration efficiency. The old filter provided a tank turnover of slightly more than two per hour. The new Guardian provides 600 GPH



Use of a slurry tank provides an easy means of adding solution to the semi-bright tank served by the filter.

Plating rejects have dropped considerably since installing a filter big enough to do the job, and Jim Kerrigan reports no rejects caused by plating roughness.

flow for a tank turnover rate of 3 per hour, almost a 50% increase.

Just as important is the amount of filter surface area available for solution clean-up. The old filter used paper sleeve elements with a total surface area of 70 square feet. The Guardian filter at Keystone uses 60 diamond pattern string-wound polypropylene cartridges. Each is 2-1/2 inches in diameter and 10 inches long, which gives an outside surface area of 78.5 square inches per cartridge (diameter times 3.1416 times length).

But the actual filtering takes place over an area infinitely larger than that. As solution passes through the openings between windings and migrates toward the center tube of the cartridge, it passes through several layers of filter surface area formed by the windings. As a result, the solids filtering capacity of the Guardian in use at Keystone is equal to 210 square feet of flat surface area, a 3-fold increase over the old filter.

An extremely efficient design, the string-wound cartridge also forces the solution to pass through progressively smaller openings formed by the winding process, which traps progressively smaller particles. Thus the string-wound cartridge is a true depth filter. Filtering efficiency is enhanced by a carbon chamber that removes organic impurities from the plating solution.

Cartridges Changed Twice In One Year

The Guardian has been in operation for about one year. The first set of cartridges lasted eight months. The second set is still in use. The filter accepts sixty 10-inch cartridges (or it can use an equivalent of twelve 30-inch and twelve 20-inch cartridges), and filter element change time is about the same as the old filter. *"The difference is changing once a day or twice a year,"* said Kerrigan.

Cartridge change is simple and easy. The cartridge elements mount on CPVC supports. To replace cartridges, the filter top cover is removed to provide access to the cartridges. The top set is lifted out and discarded. The center supports for the rest of the cartridges is then lifted up to give access to the rest of the cartridges. New cartridges are slipped over the supports and lowered into the chamber.

The need for cartridge changes is signalled by an increase in system operating pressure. *"We normally run the system at 12 to 28 PSI,"* said Kerrigan, *"and take action when pressure reaches 28 PSI. At this point we backwash the filter and flush out a considerable amount of trapped solids to extend the operating time. We may backwash several times before a cartridge change. When backwashing fails to restore normal operating pressure, we change."*

One advantage to changing this type of cartridge is that there is no solution loss.

Fast Tank Pump-out Expedites Tank Cleaning

Keystone uses the new filter to pump out both the semi-bright and the bright nickel tank whenever they need cleaning, because it does so in a fraction of the time previously required. Tank pump-out used to take 3 to 4 hours; the Guardian pump does it in 28 minutes.

Using PVC piping and fittings, Kerrigan has installed a quick-disconnect fitting to the outlet side of the Guardian filter's pump. The pump is driven by a 3-HP motor with a flow rate of 6000 GPH, using 1-1/2-inch piping. To empty a tank, he disconnects the discharge hose going to the solution tank, connects one that goes to a holding tank, and starts the pump. After the tank is cleaned, he reconnects the discharge hose for normal operation and connects his pump suction hose to the holding tank discharge. He then pumps the solution back through the filter to the plating tank.

The semi-bright tank is pumped out for routine cleaning once a month, the bright nickel tank once every two months. Quick pump-out is most important when troubles arise, such as an anode bag rupturing, which quickly causes plating roughness. *"At that time, we want to pump out quickly to stop rejects, and to put the tank back into production as soon as possible,"* said Kerrigan.

"An advantage to this procedure," said Kerrigan, *"is that the solution is filtered as it leaves the plating tank and again as it is pumped back from the holding tank. The solution is thus clean and ready to resume plating immediately.*

"The most important benefit to having a filter properly sized," said Kerrigan, *"is the long time between filter element changes. With our savings on labor, material and rejects, we were able to pay back the cost of the filter in one year. But our main job is to keep the plating line running, production down time is the most costly of all manufacturing operations. A properly sized filter is a must."*

LOWER REJECT RATES for LINCOLN PLATING

Keys are: better parts cleaning - improved filtration . . .

A two-pronged approach has been taken by officials of Lincoln Plating, Lincoln, Nebraska, to reduce reject rates and lower labor costs at the same time.

Lincoln is one of the largest job shops in the Midwest. It plates a variety of parts, ranging from tubular shapes for furniture to auto bumpers and engine valves.

Lincoln substantially modified its metal cleaning procedures to eliminate a stubborn problem related to fingerprinting and oily soils. At the same time new filters were installed to increase solution turnover rates and lessen plate roughness. Both steps have improved quality, lowered reject rates and saved labor.

This improved cleaning has cut reject rates associated with cleaning from two percent to less than one-tenth percent; better filtration has halved reject rates caused by roughness - from one percent to one-half percent.

Lincoln's most troublesome recent problem involved nickel-chromium plating of square tubing. "*We had a problem with fingerprint smearing,*" said Mike Griebel, Lincoln's quality assurance manager. "*This occurred during racking and was compounded by the oil the furniture manufacturer applies as a rust preventive.*"

New Approach

Lincoln personnel learned that part of the problem was related to the use of highly alkaline cleaners in removing oils. The problem was that in some cases these highly alkaline solutions actually "set up" the oils and grease rather than removing them.

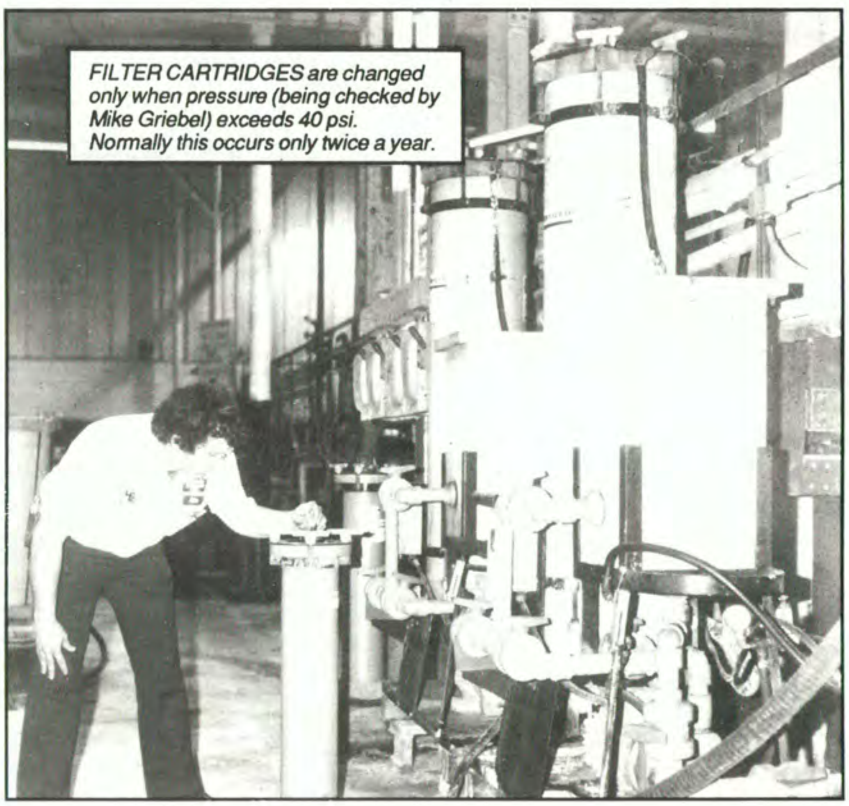
Replacement of the highly caustic soak cleaner with Allied-Kelite Chemdize 740, (a non-silicated, non-caustic cleaner), assured that "set up" no longer occurred. An electrocleaner also was replaced - by Isoprep®177, a heavy-duty alkaline cleaner and desmutter.

Lincoln was then advised to add an acid rinse containing ARP®28, an Allied-Kelite fluoride additive commonly used on zinc die-castings.

Sum total of the changes has been the elimination of the smears as well as the oil and grease problems. A reduction of semi-bright nickel plating time (from 20 to 10 min.) and bright nickel plating time also has been reduced from 30 to 20 minutes.

"Eliminating the hand sponging cuts labor cost, but it has some unseen benefits as well," said Mr. Griebel. *"Sponging parts over a caustic tank is a job no one wants. So morale in the plating department has been improved by the changes."*

Cleaning cycle time has been cut to 15 min., half what it used to be, and three hours per shift of hand sponging is no longer necessary. Cleaning is now handled by two men rather than three. The third man does racking, plating and inspecting.



FILTER CARTRIDGES are changed only when pressure (being checked by Mike Griebel) exceeds 40 psi. Normally this occurs only twice a year.

Reducing Roughness

Anyone who has plated tubular products knows the problem: try as you may, you won't entirely remove residues left from forming, grinding and cutting. Cleaning steps are meant to do that, but inevitably some of the contamination is dragged into the plating tanks, resulting in shelf roughness.

Lincoln has pursued this problem, installing two new SERFILCO Guardian filters rated at 5000 gph each to filter nickel solutions. At the high flow rates now possible these units are capable of keeping solutions almost completely free of particulate matter. Even small particles - down to 10 microns - are trapped before they can cause roughness.

The new filters lower labor costs, since media changes are normally required only about twice a year, while paper filters used previously had to be changed weekly. Mr. Griebel said four filters (two used for the tubular products line, one for a sulfamate nickel tank and another on a bumper plating line) had required four hours of labor per week to change media. At a theoretical wage rate of five dollars per hour, and for 208 man hours per year, that would cost $1,040 annually. At the same wage rate, the new filters are serviced for 40 dollars annually - a saving of $1,000.

Lincoln now has two 6000 gph Guardian filters and two others rated at 4800 gph. The larger units have twelve 30-inch cartridges and twelve 20-inch cartridges. The smaller units have eighteen 30-inch cartridges each.

These filters provide ample capacity for holding the contamination removed from solutions in the six months between servicing. The string-wound polypropylene "depth-filtering" cartridges resist fouling and thus last longer because they trap larger particles near their surfaces and progressivley smaller particles as the solution is forced toward the core.

Filter Often

A good rule in filtration is to filter well and filter often. High-capacity pumps provide the "often." Two 6000 gph Guardians on 1500-gallon tanks provide solution turnover rates of four times hourly. A 4800-gallon unit on a 1000-gallon tank offers 4.8 times/hr.; the other 4800 gph unit on a 750-gallon tank turns over solution at 6.4 times/hr. Before these filters were installed, the highest flow rate on any tank was two times/hr.

Rejects Costly

Rejects are never easy to correct. At Lincoln, for example, reject bumpers must go to another line for stripping and chemical reactivation. If nickel must be removed, the bar has to go to the polishing department, where nickel is polished off. *"It normally takes 30 to 40 min. to polish it,"* said Mr. Griebel. *"The lower reject rates have cut our rework costs."*

Rigid Specifications for Sulfamate Nickel

In its sulfamate nickel plating tanks, Lincoln plates automotive engine intake and exhaust valves. *"The customer is particular and specifications are rigid,"* Mr. Griebel explained. *"We need to have everything go well to produce the quality required."*

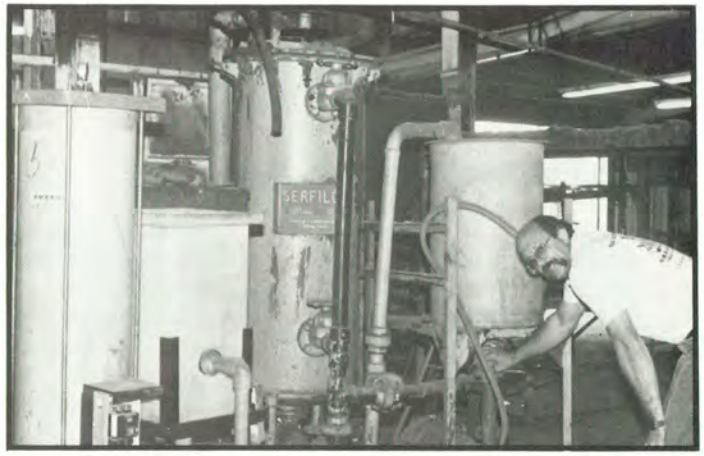
Lincoln uses Allied-Kelite SNR® 24 sulfamate nickel solution to deposit low-stress nickel and help assure a smoothness by filtering the solution 4.8 times/hr. This 4800 gph filter also has a carbon chamber to remove organics.

"This combination of careful plating and good solution maintenance has paid off," said Mr. Griebel. *"Our reject rates are very low and the customer is satisfied."*

FINAL INSPECTION is done by an operator wearing gloves to help detect roughness. Better cleaning and improved filtration have reduced roughness and lowered reject rates.

Reprinted from Product Finishing Magazine.

These Three Platers Have One Advantage In Common:



Headnall Inc.
Compton CA

Columbia Metal
Finishing
Los Angeles CA

San Diego Plating
San Diego CA

SERFILCO

Each of these platers benefits in different ways by using Serfilco filters. Specifically:

San Diego Plating: *Labor savings.* Old bag filters needed cleaning every week at a labor cost of $19.50 per week. Serfilco Guardian filters need cartridge change only every 3 months at a labor cost of $83.85 per year. Yearly savings: $930. And Guardian provides high solids rejection, ultra-smooth plating.

Columbia Metal Finishing: *Low maintenance.* In 7 years of operation, Serfilco Sentry filters have required only one change of pump seals and one diaphragm replacement. And cartridge changes take only 1½ hours.

Headnall Inc: *Long life.* Sentry filters have been on the job for 15 years; maintenance costs have been minimum. Both cleanable sleeves and depth cartridges are used, with granulated carbon, to keep plating quality high.

These cases are typical of Serfilco customer experience. They focus on the reasons successful platers use Serfilco filter systems — high reliability, low maintenance, low labor costs . . . and always superior plating quality.

You too can have advantages in common with these platers. Switch to Serfilco .

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F-78

DEPTH FILTRATION AT KRUEGER

Increased Tank Turnovers with Improved Plating Quality

Adding depth filtration to precoat filters helps Krueger Co. of Green Bay, WI achieve some sparkling turnarounds in roughness plating control, maintaining plating production speed and significantly reducing the labor cost of filter media changing.

Krueger has a tough plating problem to deal with - nickel and chrome plating of tubular parts. The company plates 12,000 to 15,000 sq. ft. (1,110 to 1,390 sq. meter) of metal per day, running three shifts, five days a week (seven days in the summer). The material, used in the manufacture of metal furniture, is not cleaned prior to arriving in the plating department; it comes straight from the bending and forming operation.

Adding to the problems faced by plating supervisor Maury Kurschner and his crew is the stringent quality control requirement Krueger management levies on plating; maximum allowable rejects are 0.8 percent.

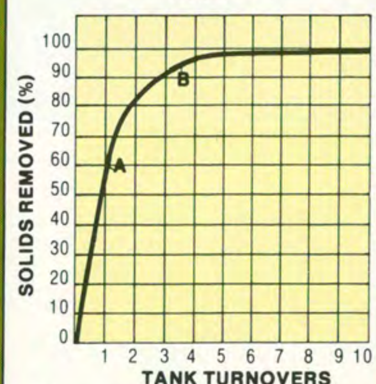
"As we modified our filtration setup to accommodate production changes," said Kurschner, *"we found that the precoat filters would not give enough filtration capacity on the bright and semibright nickel tanks to keep up with plating speed. We could only get one tank turnover per hour, not enough to control roughness. To increase our tank turnovers we decided to go to depth filtration for the economy of higher flow rates per dollar invested and the labor savings of filter changes."*

To get the additional filtering capacity needed, Kurschner added a 6,000 gph (22,700 l/hr) SERFILCO Sentry depth filter to his semibright plating tank, backing up a 6,000 gph (22,700 l/hr) and a 4,500 gph (17,000 ltrs/hr) precoat filter. Each depth filter is loaded with seventeen 30 in. (77 cm) micron (0.2 mil) depth cartridges with polypropylene fibers wound on a polypropylene core.

Tank Turnover

The increased filtering capacity immediately enabled the company to increase tank turnovers on the bright and semibright baths from one to three per hour. Each of these tanks is 5,000 gal (19,000 l) in capacity, and each is now served by a total of 16,500 gph (62,500 l/hr) filtering capacity. Thus, 16,500 gal. (62,500 l) filtering capacity divided by tank size of 5,000 gal. (19,000 l) equals 3.3 tank turnovers per hour.

FIG. 1



At Krueger, solids removal went from Point A at 1 tank turnover per hour to Point B, at 3.3 tank turnovers per hour. Solids removal went from 60 to over 95 percent.

"Increased tank turnovers enable us to remove 96 to 97% of solids from the bright and semibright tanks," said Kurschner. The effect on plating improvement can be seen in Fig. 1, which plots solids removed versus tank turnovers. Kurschner moved plating quality from Point A to Point B on the graph.

"Our objective was to improve plating quality on an order consistent with cost," said Kurschner. *"To improve plating quality beyond a certain point would not be economical, because the curve tends to flatten on the high end. Beyond this point, there is a dimminishing return effect; increased tank turnovers will not produce a corresponding increase in plating quality".*

The bottom line is music to management's ear as well. Krueger's plating department now consistently has a reject rate of only 0.4 to 0.5 percent, comfortably below management's mandate.

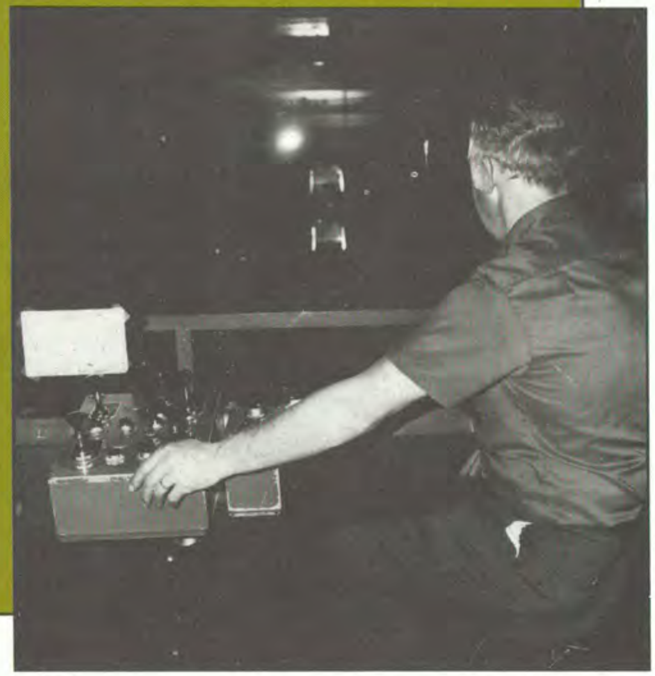
Reduced Labor Costs

The labor cost to change filter media has been markedly reduced. Before the addition of depth filtration, the two precoat filters required a media change every two weeks, on a schedule of one filter per week on an alternate basis. Time required to do this was four man-hours.

The depth filters last six to eight weeks, and, because they trap particulate matter so effectively, the precoat filters also get longer service

Depth filters increase semibright and bright plating quality at Krueger Co.

Tubular Work over nickel plating tank.



Operator views plating line through control booth

between media changes - the same six to eight weeks. At media change time, it requires the same four man-hours to change the precoat filter media, but only one hour to re-cartridge the depth units. Thus, using an arbitrary seven-week change interval as an example. Krueger spends 11 man-hours every seven weeks compared to four man-hours every week for media changes, a savings in labor that can easily be translated into dollars by any plater.

"An additional advantage to the depth filters is no solution loss," Kurschner points out. *"The depth units have a removable top lid, and spent cartridges are removed and fresh ones installed from the top with no need to empty the filter chamber."*

Filters are changed according to pressure; when system pressure builds up to 40 psi (277 kPa), the media are changed. Kurschner stresses: *"We don't delay making the media changes, plating quality drops very rapidly if you don't change as soon as that point is reached."*

Product Variety

Krueger is one of the largest U.S. producers of contract and institutional furniture, the largest producer of folding chairs and one of the largest makers of folding tables. Its volume exceeds some better known furniture manufacturers. Products include chairs, settees, lounges and modular beam type seating. Products are sold to many markets - schools, colleges, theaters, auditoriums, convention halls, insurance companies, airports, offices, sports arenas and shopping centers.

It has pioneered new designs, and its Vertebra line of upright seats have the ability to move with the position of the occupant, providing better back support in all body positions.

In addition to steel, Krueger craftsmen work in polypropylene, upholstered, fiberglass, aluminum and wood furniture. With the exception of some of the wood and aluminum products, all furniture seating goes on steel legs or steel beams. Although the company does wet painting and black powder coating, plating is still the preferred finish, specified for about 70% of production.

Maury Kurschner, plating supervisor, inspects a chair frame for surface roughness

Most of the seating comes from the 195,000 sq ft (18,000-sq m) plant in Green Bay, where half a million chairs per year are manufactured. A second plant in Tupelo, MI of 250,000 sq ft, (23,000 sq m) makes tables, steel folding chairs and other items. The Green Bay facility plates items made in Tupelo and Krueger's fleet of 19 semitrailer trucks constantly move between the plants.

Thorough Operation

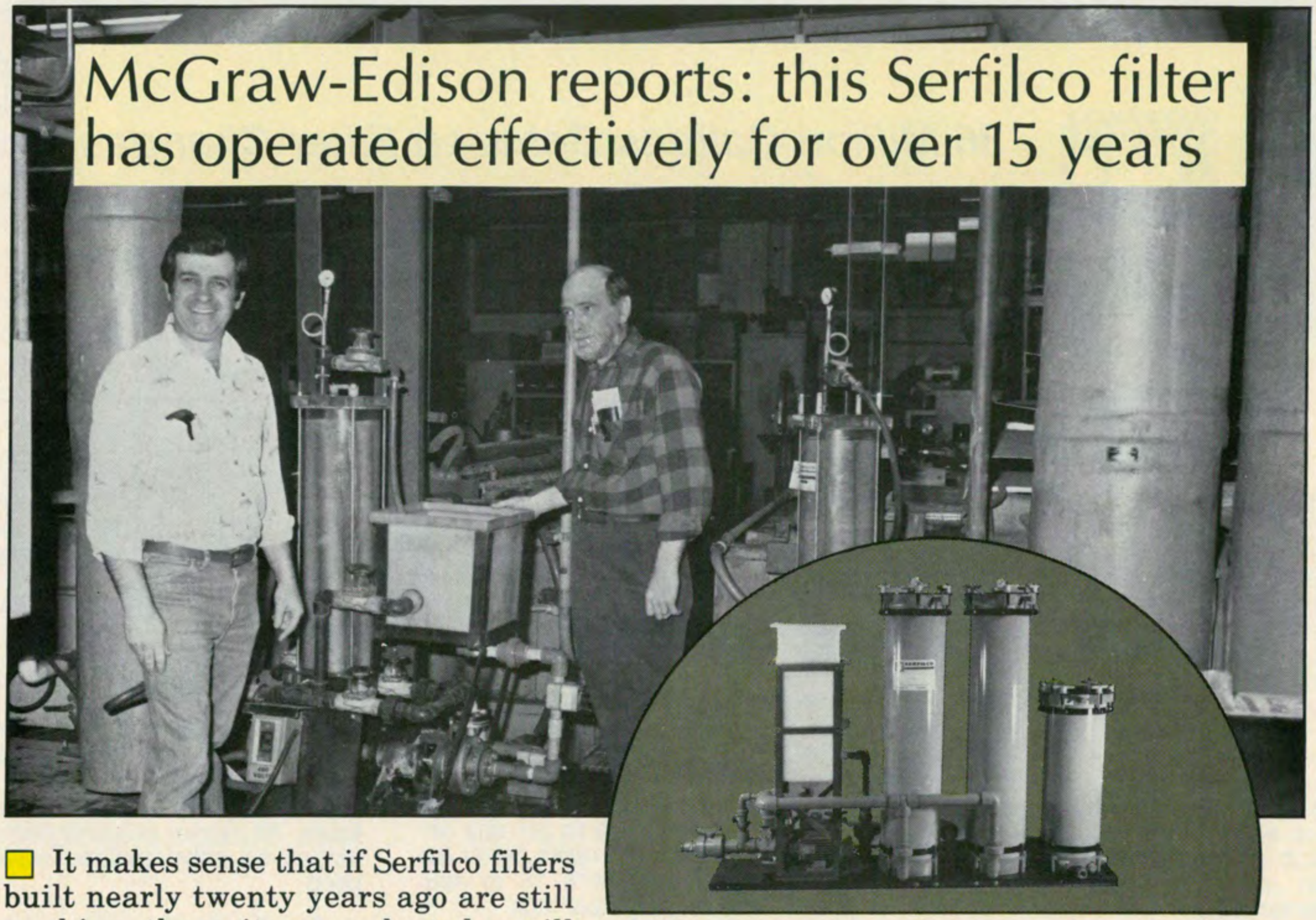
Plating straight tubular products is difficult enough; at Krueger the chair frames and legs are usually bent into sharp corners and turns. Kurschner has persuaded the company designers to provide vent holes at bends and corners for easier expulsion of oil and other manufacturing residue, but the parts still pose a tough plating job.

To make sure the company's high standards are met, the plating department is large, extensive and thorough. Parts go through 23 cleaning, plating and rinsing operations.

Parts exiting these operations are ready for final assembly. The entire operation is computer-controlled. An observation deck above the tanks on one end of the plating room is equipped with manual controls so an operations monitor can manually override any operation.

Reprinted from Industrial Finishing Magazine.

McGraw-Edison reports: this Serfilco filter has operated effectively for over 15 years



this new improved model should last into the 21st century

It makes sense that if Serfilco filters built nearly twenty years ago are still working, the units we make today will last even longer.

The Serfilco filter shown above on the left has been filtering plating solutions at the McGraw-Edison power transformer and switchgear plant in Canonsburg, Pennsylvania for over 15 years. Every 12 months the filter cartridges are changed, and the filter is ready for another year of steady, dependable, maintenance-free operation. McGraw-Edison personnel can concentrate on other matters, not worry about filters.

Today at Serfilco we are making filtrations systems that are much better. We make full use of today's new materials and advanced designs to create systems that handle the most corrosive solutions and stand up to the toughest environments. And we don't forget old-fashioned craftsmanship. We fully expect that products now being manufactured will outlast those made in years past.

You may wonder why at Serfilco we think about your filtration needs in the year 2000 and beyond. The 21st century seems a long way off.

But twenty five years ago, so did 1987

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36 Million Gallons Between Filter Changes

Samsonite's plating department maintains effective filtration for six months to a year . . .

Don't skimp on filtration. Any plating troubleshooter will give you this advice.

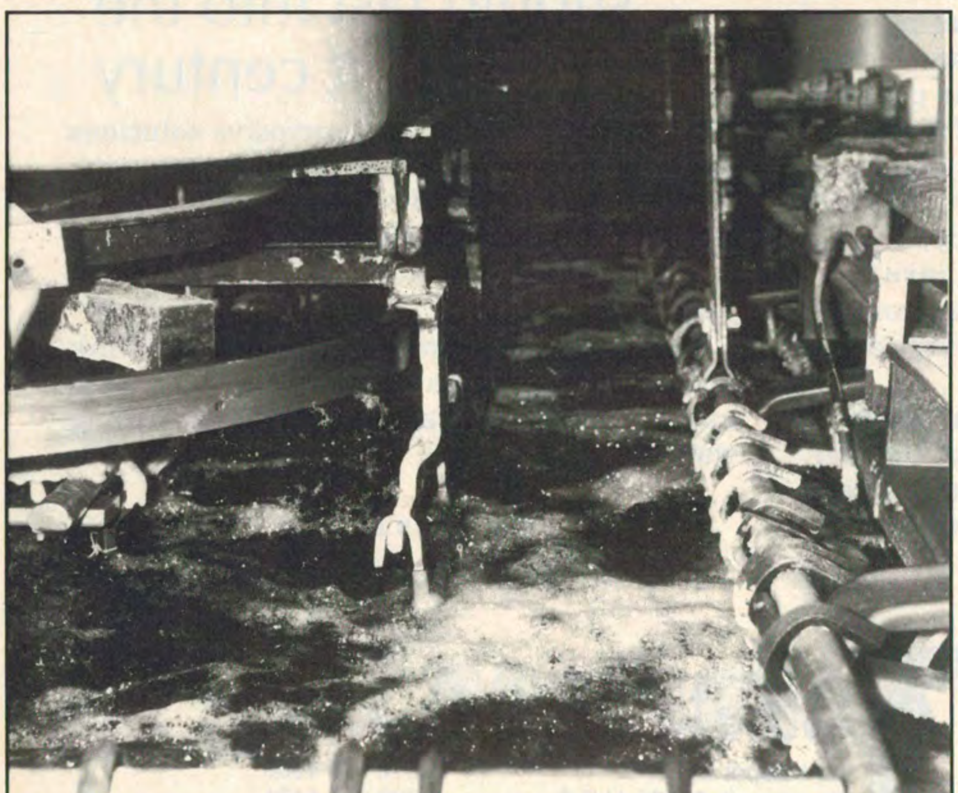
But in spite of all the words to the contrary, you'll still see skimpy filter chambers on large plating tanks, batch filtration where there should be continuous filtration and clogged filters that really aren't filtering at all.

If you'll listen to the platers at Samsonite Corporation in Denver, Colorado, however, you'll use big filters with high flow rates and lots of filter area. According to them the result is consistently clean solutions with less labor required for filter maintenance.

Samsonite plates luggage hardware in its Hardware Plant, part of a five-building complex on 100 acres on Denver's northeast side. Three metals are used for luggage hardware - steel, zinc and magnesium. The first two are plated.

The Udylite Cyclemasters take parts through the plating cycles - one through copper-nickel-chromium for zinc die castings and the other through nickel-chromium for steel. The two lines plate 150,000 parts per day on two shifts. About 100 racks per hr go through the facility, with 16 to 400 pieces - about six sq ft per rack.

Plating baths at Samsonite are filtrered through filtration equipment that recirculates solution through filter cartridges.

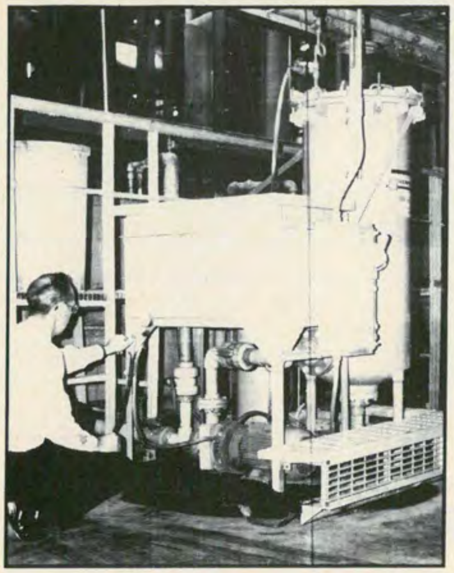


Filtration of the nickel and copper baths is necessary to maintain quality. *"Samsonite's emphasis is always on quality, first and foremost,"* said Bill Crist, production manager at the Hardware Plant.

In the acid copper solutions, for example, particles enter the bath because a few parts fall from the plating racks into the tank, where they dissolve; atmospheric dust also contributes. To remove these particles, 30-micron polypropylene cartridges on polypropylene cores are used.

The 3,100-gal copper solution is recirculated through an R1750 Sentry filter (made by SERFILCO, Ltd., Glenview, IL) at the rate of 6,500 gph, to provide more than two tank turnovers per hour, 24 hrs a day, five days a week. This unit has two chambers. Samsonite loads 35 30-inch cartridges and 35 20-inch cartridges in each chamber to provide adequate area for dirt removal.

Plating supervisor, Chuck Leighton, (above) inspects the unit used for acid copper. After adjustments were made for high altitude when the unit was installed in 1974, it has performed with little attention.



Bill Crist, production manager at Samsonite, checks pressure. This check plus occasional checks for leaks and vibrations are the only attention given between cartridge changes.

Inspection is part of the plating operation. Roughness and other appearance defects would be cause for rejection.

The large filtration unit makes it possible to change filter media infrequently - once a year in the case of the copper solution - while keeping solutions clear. *"Infrequent cartridge changes have several benefits,"* said Mr. Crist. *"One obviously is a savings in cartridge cost, but even more important is the labor cost. We estimate that it costs 50 dollars in labor per cartridge change, and since the change is so infrequent we can schedule it when no production downtime will be required."*

An identical R1750 filter, also made by SERFILCO, recirculates solution from a 2,500-gal nickel plating tank. The cartridges are changed at six-month intervals.

The filter for acid copper filters over 36 million gallons (6,500 gph x 24 hr x 231 working days) before the cartridges must be changed. For nickel the figure is about 18 million gal between changes.

At cartridge replacement time, the cartridges for copper are simply removed, replaced with new cartridges, and the unit is then put back into service with the cartridges "dry." For nickel plating, a filter aid is applied to further insure against roughness in the plate. Once every four weeks the nickel filter is backwashed to flush out precipitated iron. The copper filter normally does not require backwashing.

A paper filter is used for the nickel bath used for die castings. *"When the line was installed we felt that a wound cartridge filter would clog too frequently,"* said Mr. Crist. *"since then we have changed the type of anode used and now a cartridge would be feasible."*

FILTERS: The Best Solution

Bath Contaminants Have No Place In Quality Finishing Practices

Editor's Note: Quality finishing cannot be accomplished with dirty solutions. Efficient filtering must be incorporated into good finishing practices, no matter what type of finishing is being done. In the following article, internationally famous filter and pump expert, Jack H. Berg, reviews filtering as it applies to the various plating baths. The principles, however, relate to practically all solution filtering, be it plating, painting or cleaning. The marketplace for filters and accessories is broad and offers each finisher more than one solution to his filtering problem.

By **Jack H. Berg,** President
SERFILCO, Ltd., Glenview, IL

The cost of adequate filtration is negligible compared to the value of quality work that passes through a properly filtered solution.

Basic facts

Plating requires many critical process steps involving either solvent or water solutions that become contaminated with soluble and insoluble impurities, which must be removed to maintain acceptable quality standards for finished parts. For liquids, the most efficient method of particle removal is by means of wound depth tubes, which offer the widest choice of fiber materials with porosities from 1 - 100 μ (1μ = 1 micron = 4×10^{-5} inches = 40μ in.) to meet all filtration requirements. With a capacity of one cartridge per 50 gal. (189.5 L) and flow rate of at least two tank turnovers per hour, particulates are continuously separated before they can cause rejects.

Dirt load, size and kind of suspended solids must be considered in the selection of proper cartridge porosity, which should be as coarse as possible for maximum dirt holding and flow, but dense enough to achieve the high degree of clarity required.

Organic and inorganic contaminants are best removed by adsorption with activated carbon in a separate chamber. To prevent surface loading of carbon, carbon adsorption should be done after filtration.

The purification system must be sized sufficiently large to minimize maintenance. Pump selection must take into consideration location, head and flow requirements, corrosion and temperature conditions. All components are assembled into a functional package with valves and other accessories for maximum efficiency.

The electronics industry uses many liquids in the various processes required to manufacture printed circuit boards or other electronic components. Quality water is most essential because it is used for solution makeup, rinsing and cooling. Various water treatments may be required, including softening, deionizing and/or purifying with carbon, all of which may employ prefiltration for solids removal to prevent surface loading of the resin or carbon. This may be followed by several stages of trap filtration down to and including submicron sizes if absolute clarity is required.

All of the electroplating solutions, such as copper, tin-lead solder, tin nickel and nickel, the precious metal baths, such as gold and rhodium; plus all of the electroless plating solutions, such as nickel or copper, require filtration for removal of solids. Some of these solutions require activated carbon to remove organic impurities; carbon purification is sometimes handled with filtration equipment.

The need for filtration/purification of plating baths in the manufacture of printed circuits cannot be overemphasized, especially where copper is used for through-hole plating to achieve continuity through each hole to facilitate soldering and assembling of components. Any void in the plating in the hole caused by contaminants reduces the area available to carry electric current. A complete void would totally prevent contact with the hole. Rejects would also be caused when tin-lead or tin-nickel are used as a resist in the etching process because any voids would allow etching in unwanted areas. Nickel, gold and rhodium plating baths may or may not be as critical, depending upon the requirement of a finished product. Contaminants in any of these solutions would result in a rough plate on circuits or connector tabs.

As recently as 20 years ago filtration was looked upon as a necessary evil. The basic problems were these: filters required frequent cleaning; leakage from pumps was a common problem; the materials of construction were limited, often expensive, requiring complicated assemblies.

Modern filtering

Today, filter cleaning is less frequent; some filters run two to four months without cleaning. Leakage is a thing of the past. Materials of construction are available that resist the attacks of all plating solutions.

What happened in those intervening years? A developing technology has been applied to the problem of proper filtration for the plating industry. New materials of construction have led to better pumps and filters.

Let's explore how these major problems have been solved. First, what makes a filter run longer? Obviously, it's less drag-in from better cleaning, or more dirt-holding capacity, brought about by new methods of holding the dirt in the filter. Perhaps the most significant change in filtration in recent years is the use of depth filter cartridges to distribute the dirt below the surface.

Just as important, however, is the use of depth cartridges that are coarser and can achieve the same degree of solution clarity as denser media, but do it cheaper. This is achieved through the use of high flow rates to constantly circulate the plating solution through the filter, over and over, until the desired clarity is achieved and maintained.

Second, the problem of leakage has been virtually eliminated through the use of several new pump designs: magnetic-coupledpumps;in-tankseal-less pumps; out-of-tank horizontal centrifugal pumps with double, water-flushed, mechanical seals. This design uses two seals in the pump with 2.1 gal. (8L) per hour of water running between them. This eliminates the formation of crystals of salts on the seal faces, which would otherwise cause abrasive wear, and it thus prevents the pump from sucking air or being difficult to prime. The leakage problem hs been reduced through the use of "O"-ring seals, which are installed as a back-up on all screwed fittings.

Third, nonmetallic materials of construction for pumps make them resistant to chemical attack and eliminate corrosion from stray currents. Many pumps and filters are made with CPVC, which withstands 212°F (100°) and is used regularly on chrome, acid copper, hot electroless nickel, all standard nickels, even the new noncyanide chloride solutions and highly alkaline solutions.

Complete PVDF filtration systems are also available and recommended for high purity applications like semiconductor and memory disc manufacturing.

Other developments and application of equipment have also helped the plating industry. One major development is the use of a separate carbon chamber for removal of organics, making it possible to use the coarser filter media to achieve maximum solids reduction. Thus, placing the carbon chamber downstream from the filter feeds only clean solution to the carbon, prolonging carbon life. Because the carbon is in a separate chamber, it can be changed as necessary without changing the filter, which usually does not require changing at the same time.

Sizing the filter

Technological developments, however, are of no value unless the equipment available to the user is properly applied. Of particular importance is sizing the filter and selecting the right pump. This means that the filter media must be dense enough to remove undesirable impurities at a flow rate high enough to have all of the plating solution pass through the filter at sufficient intervals so that the solids will be trapped. It follows from this that the filter must have a high enough solids holding capacity to maintain flow rate.

Unfortunately, in practice these requirements are not always met. The average plating solution is probably turned over at the rate of once per hour, which is half the desired turnover rate. To achieve the ultimate in clarity, turnovers of up to 10 times per hour might be required, but this decision has to take into account the requirement of the application.

Flow rates

Flow rate is the only means of carrying solids to a filter or bringing fresh solution into contact with carbon. The rate of flow is referred to as turnover - total volume pumped per unit time in relation to the size of the tank. A pumping rate of 200 gph on 100-gal. (758L/hr on a 379-L tank) is two turnovers/hour. Dirt holding capacity is essential and can be attained with throw-away wound cartridges of different porosities or filter surfaces coated with filter aid; porosities of 100μ (4000μin.) are typical.

If flow rate means average, then it is not the initial flow rate. For example, if the initial flow rate is 1055 gal. (4000L) per hour and the flow rate drops through usage to 211 gal. (800L) per hour before the filter is cleaned or replaced, then the average flow rate is about 633 gal. (2400L) per hour, depending on the type of filter media used. When sizing for flow rate, one should consider the average flow rate.

The importance of sufficient flow rate cannot be overemphasized. One will never reach the point where the increasing density and decreasing flow rate are acceptable, because plating bath solutions are never 100% free of solids at all times, even through they may be free of certain size particles. The better the dirt removal, the longer the plating bath can be operated before a general cleanup with batch filtration must be employed, in practice, contaminants are not introduced at a steady rate. Some contaminants are introduced with the parts to be plated, and contamination is thus immediately increased when the part is immersed. Filtration reduces this, but contamination increases again when more parts enter the bath.

If the plater could keep an accurate reject count he could watch rejects increase to a point at which he would dump the bath or batch. He could filter and transfer it to another tank, then filter the solution on its return to the plating tank. The amount of clarity he would obtain would depend on the porosity of the media selected. Based on these considerations, the plater could check his percent of solids, compare it to previous data and estimate the percentage of rejects he could expect. The same considerations could be applied to solutions used in applications other than plating.

Depth-type filters

One common type of filter media used in the plating industry is the depth-type filter cartridge, which is available in different porosities/densities to achieve particle retention from 4000 to 20µin. (100 to 0.5µ) on a nominal basis. Depth cartridges are wound from cotton, polypropylene or other synthetic fibers to achieve compatibility with the chemicals in the plating solution.

The fibers are wound to form a surface of diamond-shaped openings. Each succeeding layer of fibers locks fibers of the preceding layer in place. As layers are built up, the circumference of the cartridge increases, causing the diamond-shaped openings to become larger and larger. The flow of liquid being filtered goes from the outside to the inner core; the larger particles are removed first, and each succeeding layer, with smaller openings, traps succeedingly smaller particles, according to the porosity of the particular cartridge. In other words, the deeper into the filter, the finer the filtration; hence the term depth filtration.

Cartridges measuring 2.46 in. (6.25 cm) in diameter by 9.85 in. (25 cm.) in length can hold more solids than 3.5 sq. ft. (0.325 sq. meters) of surface area, depending on sizing of the dispersed solids. Sometimes additional use may be obtained by soaking in acid. Depth-type cartridge filters offer the same fine particle retention as some filter aids, but are also offered in very coarse porosities - as high as 4000 µin. (100µm). This flexibility of the depth cartridge is why it is popular. The user has the option to select coarse cartridges when increased solids-holding capacity is required, or finer cartridges.

Remember the basic considerations mentioned earlier: Select the filter media, whether wound cartridge or precoat, with the density required to give the combination of solids-holding capacity and flow rate to turn the tank over according to the frequency required. It is impossible to give a single rule for every instance. Each case is different and involves a set of calculations based on the size of the tank, the size of the pump needed to maintain the flow rate, the type of media and its porosity, the turnover, the type of plating solution that will affect the solids to be filtered out and other such considerations. But it is clear that selecting filter media should be done with as much care as exercised in selecting plating chemicals.

Carbon filtration

It is possible that batch treatment may become necessary because of the buildup of organics; bypass or sidestream carbon purification can prevent this buildup. A safe level of solution clarity can be maintained at a reasonable cost with this method. All that is needed is a bypass chamber sized to provide a flow rate high enough to bring the contaminated solution into contact with the carbon. This is much more economical than providing full batch carbon treatment.

There are other benefits too. Sidestream or bypass purification is preferred to precoating the filter with filter aid and carbon, because the carbon in a filter increases the pressure differential across the filter and thus reduces flow rate. In addition, carbon on a filter reduces the amount of contaminants that the filter can retain prior to servicing. The reduction in flow rate means that the solids or organics will not be removed from the tank as efficiently.

Effects of pressure

Specifying a pump with enough pressure is important. The pump should be capable of providing enough pressure to maintain the desired flow rate at all times, even though the filter media becomes progressively clogged. A pump often is recommended to maintain 28 psi (195 kPa) or 70 ft. (21.4m) total dynamic head (TDH) throughout the service cycle of the filter. Unfortunately, small systems may employ a pump capable of developing only 8 to 10 psi (55 to 70 kPa).

Thus, flow rate, filter media porosity and pressure all work together to affect solids retention by the filter in a given period of time. It is possible to use coarser filter media that offers a higher flow rate, even though the particle retention effi-ciency is less. This is because the two together provide more solids removal, compared to the combination of low flow rate and dense filter media.

In general, the coarsest possible filter media should be selected to give the best clarity. Often, if the filter chosen does not provide the clarity wanted, the plater may select a denser media that loads up faster and in the end removes less solids. On the other extreme, it is possible to go to a coarse media and not get any filtering at all, even though the flow rate is very high.

A judgement must be made, with all aspects of the application considered. The bottom line is to achieve the highest solids removal, because this maintains the cleanest tank and gives the fewest rejects.

Some of these points are difficult to explain and often overlooked. Most filters in use today are undersized and therefore inefficient. In an industry where most products are bought on specification, it is important to determine exactly which combination of components gives the right results and to write specifications accordingly.

Filter servicing

Infrequent servicing of filters adversely affects flow rates. One and one-half times the flow rate can be achieved if the filter is serviced when the flow rate has been reduced by one half, as compared to letting the flow rate fall to zero. Water should be filtered before it is added to solutions. Agitation air should also be filtered.

High-pressure air for agitation often is recommended because equipment is available to remove all suspended water and oil, and carbon can remove the oil vapors. Air from low-pressure blowers, on the other hand, can only be filtered with rather coarse media, which allows too many particles to pass into the plating solution. This means that the solution filter must be able to pick them up.

Other considerations

In designing a system, don't forget the accessories. Valves may be added to control or direct flow. A chamber for priming the pump or for mixing slurries for precoating filters may be desired. Put in a pressure gauge to indicate the condition of the filter, as filter clogging is related to pressure drop. Always allow enough space for filters and pumps to be mounted for servicing.

Specifying the right components for filtering a plating (or any) solution is not to be taken lightly. Neither is it easy. It requires knowledge, some calculations and a lot of patience.

Reprinted from Industrial Finishing Magazine.

SERFILCO
ANSWERS YOUR QUESTIONS
ABOUT PLATING FILTRATION

Q. Exactly what can the proper filter do for me?
A. A lot. It can reduce plating roughness, reduce plating time from increased agitation, provide better throwing power, remove solution surface scum, eliminate tank pump-out, and prepare your solution for organic impurity removal.

Q. How can all these benefits be accomplished?
A. It's important to pump the solution at a high enough flow rate so that the solution passes through the filter frequently, for optimum clarity. If dirt load is high, increase the amount of filter surface or select a type of media that better meets the specific situation.

Q. What are some of the media choices?
A. There are surface types such as flat sheets of paper cloth, or cylindrical types, such as tubes of fiber, ceramic, or sintered metal. There are also bags, discs, sleeves and, of course, depth cartridges.

Q. What might best work for me?
A. It depends on your particular problem, and an individual analysis is required. Generally speaking, the coarser the filter the better, because it means increased dirt holding capacity, less frequent cleaning or changing of media, and less restriction to flow.

Q. Exactly what is coarse filtration?
A. It refers to the openness of the weave or winding of the filter media. Coarseness is a relative term; even very dense media might be referred to as coarse in an individual context. A 0.45 micron filter traps fine particles but it would be referred to as coarse compared to a 0.25 micron filter. A 10 micron is coarse compared to a 5 micron, and so on. Generally speaking, 15 micron works very well for most plating baths.

Q. How can I best use coarse media?
A. Increase your tank turnover rate to compensate for the lower particle removal efficiency. This can be done by increasing the flow rate of the solution through the filter, or increasing the size (capacity) of the filter, or both. The result is higher particle removal and a cleaner solution.

Q. What happens if I filter too fine?
A. Too many people think that a fine filter automatically provides more efficient filtering. Fine filters tend to plug quickly, much sooner than a coarse filter. This reduces flow rate which in turn reduces tank turnover which results in reduced solution clarity. The concentration of contamination will increase to the point where ultimately batch treatment may be required. Batch filtration was a common practice in years past; with modern filtration techniques, it's not necessary to shut down for batch treatment. Filters and plating baths can stay in operation indefinitely with no loss of solution clarity or plating efficiency.

Q. What if I need carbon for purification of my solution?
A. Chambers for purification provide for the most convenient adsorption of organic impurities with the use of granular carbon. Adsorbency of the granular carbon is assured of reaching the maximum when the solutions are prefiltered for the removal of solids prior to passing the liquid over the carbon; this makes it possible for only clean solution to come in contact with the granular carbon, which prevents the carbon surface and pores from becoming coated or plugged with solids. Carbon adsorbency is thus assured of retaining its maximum efficiency until all of the adsorbency afforded by the granular carbon is used right down to the very core.

Q. Is granular carbon as adsorptive as powdered carbon?
A. Yes - tests have shown that. Surface area of activated carbon is the internal pore surface area which is compared to a complex network of caverns and accomplishes the adsorptive phenomena. Surface area of SERFILCO Hi-Surf 8x30 mesh is 1000 sq. meters per gram. Surface area of one commonly used powdered carbon is 650 sq. meters per gram.

SUBJECT:
Attended
vs.
UN-attended
Filters

13 Months
on Acid Copper*

4 Months
on Zinc*

8-9 Months
on
Pyro-Copper*

5 Months
on
Bright Nickel*

*Names on request

Now possible because "depth" media is employed to provide the most economical solids holding capacity which, when coupled with high tank turnover rates, assures quality deposits for months and months.

Filters for plating solutions fall into two categories - those which you attend and those which you do not have to attend which, like the soda people say, would be the "un" attended filters.

Webster describes ATTEND - "to accompany; to be present with or at; to give medical care to; v.i. to be present, to pay attention; to take care of; to wait on."

To purchase the un-attended filtration system is dependent upon only one thing; the amount of solids to be retained. Such solids would be those which remained on the part or through the cleaning and rinsing process and yet dropped off into the plating solution. Or, they might be those particles which enter the plating tank from the make-up water supply, or plant air which is used for agitation, sludge from the anodes, or air-borne dust which might settle on the surface.

Therefore, if the plater wants an "un" attended filter, he would certainly choose one which offers the solids holding capacity necessary to provide him the desired time between attention.

These particles range in size from those which can be seen to those which can't, and yet could cause roughness on the parts he is plating. If the plater selects filter media to retain the very small particles, he will find that it has very little dirt holding capacity for the larger particles; therefore, the coarser the filter media he selects, the more dirt holding capacity it has. Coarser filter media offers less restriction to flow and, therefore, the pumping rate is increased. This is good because it now makes it possible to work with a less efficient filter media, since the increased flow rate will compensate by recirculating the liquid through the filter more frequently until all of the fine particles have been stopped. (This is especially good on zinc, tubular parts or other difficult to filter applications).

Contributing to the ability to stop the fine particles is the fact that the coarse media doesn't actually stay coarse. Density increases as particles are retained giving a finer and finer particle retention in the media, until replacement is necessary.

Therefore, any cartridge filter can be changed from one requiring attention to one requiring less attention by simply employing coarser filter media. Cartridge type filters offer the greatest flexibility to achieve this, since the media varies from sub-micron to over 100 micron particle retention.

Specify on your next installation, "un-attended" filtration by simply increasing the size of the filter, which provides for more solids holding capacity.

HOW TO PICK FILTRATION SYSTEMS

The size and the amount of dirt in the plating or other solution will determine the number of cartridges or surface area necessary, with one cartridge, or 2/3 sq. ft. of surface for each 50 gallons (200 liters) of solution used as a rule of thumb.

Determine the materials of construction compatible with the liquid to be in contact with the equipment. Use CPVC whenever possible because it is suitable for most chemical solutions even at temperatures approaching boiling. PVDF is available for highest temperature, chemical compatibility and purity. Polypropylene is also widely used but limited to 185°F (85°C). Acrylic is limited to 160°F (71°C) and lacks the overall chemical resistance, but allows visual inspection of the solution and filter media. Ethylene propylene "O" rings are standard on most equipment, with Viton offered on the highly corrosive systems. Pump shafts are CPVC sleeved for non-metallic solution contact, supplied in titanium which has excellent chemical resistance to most plating solutions, or in other alloys for special applications.

Determine whether carbon will be required and if so, what is the easiest method to use. Small tanks usually employ SERFILCO 3-in-1 carbon or CARBO-FYNE cartridges in place of standard depth type filter tubes. Carbon cartridges, refillable canisters or bulk carbon may be employed in separate chambers for series or bypass flow. Larger tanks may employ bulk carbon in easy refillable canisters in chambers downstream of the filter for series or bypass flow. Suitable media is available for precoating with cleanable sleeves when the filter is used with filter aid and activated carbon continuously.

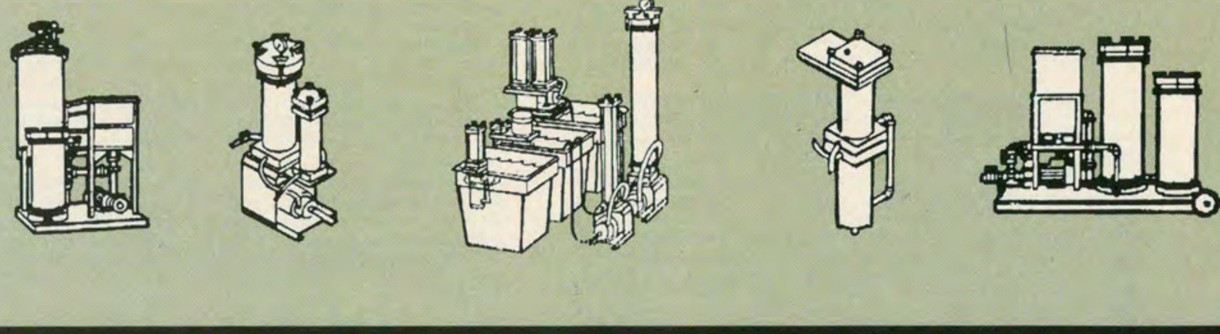
Determine whether an in-tank or external unit will be most convenient to use with regard to mounting location and available space. Please keep in mind that although in-tank filters can be precoated, it may cause the plater some problems since this piece of equipment is not designed for this purpose. Therefore, if carbon treatment is required the customer would be limited on an in-tank unit to the use of carbon cartridges or carbon canisters.

When using out-of-tank pumps, we recommend seal-less magnetic coupled pumps on the small to medium size tanks.

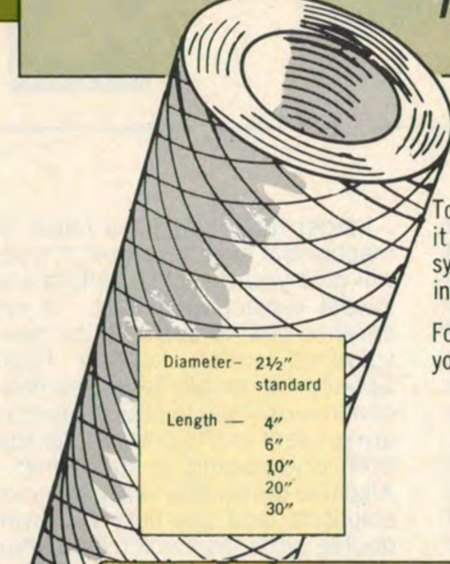
Larger tanks require a pump with a mechanical seal, an external type seal will give you the best performance at lowest replacement cost. A special ceramic seal is available for use with solutions which contain fluorides. Specify the double seal assembly with continuous water flush where abrasives are present and to prevent the solution from crystallizing in the pump seal. Also use the double seal on electroless solutions, and any time you want the double protection which they afford for complete containment of the solution being pumped. Special metals are not required due to the fact that they are not in contact with the liquid.

Review the list of optional equipment which is available with each system........

Motor starters provide safe starting on-the-spot on/off overload protection. A slurry tank provides for chemical addition, easy pump priming, and a convenient means for precoating. Flow control valves help maintain pump prime and control agitation. Wheels for portability make it easy to move the filter. A suction pipe with strainer and siphon breaker is recommended to prevent solution loss during shutdown.



FILTER TUBE SELECTION CHART
for Electroplating Solutions



HOW TO SELECT THE PROPER FILTER TUBE

To be assured of trouble-free filtering, clearer solutions and better plating at lower cost, it is important that the proper filter tube be selected and installed in your filtration system. The choice of fiber material—the core material—and the porosity of the windings, must be compatible with the solution to be filtered and the dirt load involved.

Follow these three steps to make the proper selections for the particular type of solution you are planning to filter.

1. **Select fiber that is compatible with the solution to be filtered.**
2. **Select core material that is compatible with the solution to be filtered.**
3. **Select porosities which vary from 1 micron, which is extra dense, to 100 microns which would be extra coarse.***

FILTER TUBE FIBER & CORE SELECTION GUIDE

SYMBOLS—FIBER—(U) Polypropylene, (C) Cotton, (M) Modacrylic, (R) Rayon
CORE—(A) 304 Stainless Steel, (S) 316 Stainless Steel, (U) Polypropylene, (T) Tinned Steel

	FIBER **	CORE
ACID TYPE (Fluoborates)		
Copper, Iron, Lead, Tin, Cadmium, Indium, Nickel, Tin-lead alloys, Zinc	Polypropylene or Mod.	U
ACID TYPE (Not Fluoborates)		
Copper—Less than 8 oz./gal. sulfuric acid Electroless Baths, Chromium, Nickel, Copper, Gold	Polypropylene, Cotton or Dynel	U or S
Tin—Over 8 oz./gal. sulfuric acid	Polypropylene or Mod.	U
Chromium (Hard, Decorative or Black)	Polypropylene or Mod.	U
Gold, Indium, Rhodium, Palladium	Polypropylene or Mod.	U
Iron (Chloride—190°F) Iron—Ammonium Sulfate or Sulfamate	Polypropylene or Mod.	U
Nickel (Watts type and Bright)	Polypropylene or Cotton	U
Nickel (Hi-Chloride)	Polypropylene or Cotton	U
Nickel (Sulfamate), Electropolishing, Tin-Nickel	Polypropylene or Mod.	U
Electrotype Copper & Nickel (Low acid type)	Polypropylene or Cotton	U or S
Zinc	Polypropylene or Cotton	U or S
ALKALINE TYPE		
Tin (Stannate), Palladium, Zinc	Polypropylene or Cotton	U or T
CYANIDE TYPE		
Brass, Cadmium, Copper, Zinc, Bronze	Polypropylene or Cotton	U or T
Brass, Cadmium when operated as high speed baths at temperatures above 140° F	Polypropylene or Mod.	U or T
Gold, Indium, Platinum, Silver, Arsenic, Tin-copper alloys, Tin-zinc alloys	Polypropylene or Cotton	U or T
PYROPHOSPHATE TYPE		
Copper, Iron, Tin, etc.	Polypropylene or Cotton	U or S

** Verify fiber compatibility with the solution by an immersion test. Generally, the modacrylic (Dynel) is required on fluoride solutions, depending on concentration and temperature.

FILTER TUBE POROSITY CHART

Tube Porosity	Micron	Winding No.
Extra Coarse	100	8R
Very Coarse	75	10R
Coarse	50	11R
Medium	30 (25)	13R
	20	15R
Fine	15	17R
Extra Fine	10	19R
	7	21R
	5	23R
Dense	3	27R
Medium Dense	2	—
Extra Dense	1	39R

*(When selecting the porosity of depth type cartridges, bear in mind that the coarser the cartridge, the more dirt it will retain before replacement is necessary. The coarser the cartridges, the lower the pressure drop will be and the higher the flow rate will be from the given pump, making it possible to get the dirt into the filter quicker. This in turn often makes it possible to use even coarser cartridges to accomplish the same degree of clarity that was before thought only possible with a dense cartridge.)

A—50, 75 or 100 micron cartridges should be used during initial cleanup of a dirty tank where no filter-aid is to be used with the filter.

B—15 and 30 micron cartridges are average porosity and most commonly used where continuous filtration will be employed. The 30 micron would more likely be used on an alkaline solution and the 15 micron on an acid solution. Again, much depends on the dirt load encountered by the filter on a day to day basis.

C—15 micron cartridges may also be used as the support membrane for any commercially available filter-aid (see precoating instructions). This cartridge after precoating may be manually washed and re-coated for re-use. In some cases, depending upon the type of contaminant and ability of the filter-aid to retain it, backwashing of this cartridge may be successful.

D—3 micron cartridges may be used where light dirt load exists making them economical to use for the particular application. They may also be precoated and backwashed as necessary using preferably a coarse filter-aid (usually non-fibrous) for best backwashing results. They too will have to be eventually replaced as some filter-aid and dirt and even carbon may become trapped in them, gradually increasing the pressure differential.

NOTE:

Normal sizing of the filter chamber for electroplating solutions requires one cartridge for each 50 gallons of solution or only 30 gallons on the more difficult to filter solutions such as zinc. Life expectancy would average approximately six 40 hour work weeks. This long life can be expected even on zinc, since the coarser cartridge has compensated for the slimyness of the sludge to achieve a greater dirt holding capacity. Each cartridge when operated without filter-aid, has the depth dirt holding capacity of 3½ sq. ft. of equal porosity surface and requires very little labor and no solution loss at the time of change.

Any Serfilco Electroplating Filtration System using 15 micron cartridges or denser may be precoated. Systems containing 12 or more cartridges are offered with either backwash piping or integral piping with slurry tank and backwash piping, greatly adding to the convenience in the operation of the filter. Filter chambers having only 1, 2, 3 or 6 cartridges are not provided with valve, piping or slurry tank since we feel that the cost of these additional items would not be warranted for the size of the tank. The cartridges can more easily be removed manually for cleaning.

Powdered carbon may be used with filter aid. Granular carbon may be used with separate chambers mounted downstream of filters handling only clean solution with suitable trap filters provided.

FILTER MEDIA/CARTRIDGE CONSUMPTION

Filter cartridge dirt holding capacity is increased if flow rate velocity through each cartridge is decreased. Therefore, it reduces the number of filter cartridges required to handle a given dirt load.

The following comments and charts should be used as a guide.

SERFILCO standard suggests 1 cartridge (10" - 25 cm) per 50 gallons (200 L) plating solution.

When 2 cartridges per 50 gallons (200 L) are employed, cartridge consumption is reduced by 29%.

When 4 cartridges per 50 gallons (200 L) are employed, cartridge consumption is reduced by 50%.

Oversizing by a factor of 4 doubles the dirt holding capacity per cartridge. Since the chamber holds 4x the number of cartridges, the filter is opened only 1/8 as often, reducing the labor by 87-1/2% for cartridge changing.

ECONOMICS OF FILTER CHAMBER OVERSIZING

Oversizing Factor	Number of Cartridges in Chamber*	Dirt Holding Factors per Cartridge	Time Between Cartridge Change	Cartridge Consumption/cost reduced by:	Labor Cost Downtime Solution loss reduced by:
1	C	D	T	0	0
2	20	1.40	3T	29%	67%
3	30	1.70	5T	42%	80%
4	40	2D	8T	50%	871/2%

*Based on average sizing (i.e. 1x10" (25cm) cartridge per 50 gallons (200 L).

For example -

using a 12 cartridge filter	instead of a 9 cartridge filter	reduces cartridge consumption by - 13%
" 9	" 6	" 18%
" 6	" 3	" 29%
" 9	" 3	" 42%
" 12	" 3	" 50%
" 15	" 3	" 55%

Increasing the size of your filter chamber is particularly worthwhile since most filter chambers are offered in larger sizes at only a slight increase in cost.

. . . plus savings in time and prevention of solution loss.

FILTER MEDIA/CARTRIDGE NEUTRALIZING FOR DISPOSAL

Two methods of cartridge disposal: (1) Incineration and (2) Chemical Treatment are suggested, incineration being the most expensive.

A suggested method of chemical treatment is to first drain the filter chamber of plating solution. Second, fill the chamber with water and recirculate through a slurry tank, if available, or a 55 gallon drum. Drain the chamber again. This should remove 90% of the cyanide by simple dilution. Lastly, fill the chamber with an alkaline solution of bleach (pH 11) and recirculate to destroy the remaining free cyanide. The cartridges can then be disposed of with the sludge from the plant's waste treatment system.

The time required to complete the reaction depends on the cyanide solution concentration, the type or density of the cartridge treated and the recirculation rate through the cartridge, normally 100 GPH per 10" cartridge. This time should be determined by a thorough analysis of the treated cartridge.

Pump and filter systems with slurry tanks are ideally set up for this procedure without any modification. Other systems could easily be modified to facilitate this operation.

Precoat filters may be treated by backwashing into the plant's waste treatment system. However, keep in mind that these put an additional load on the sludge handling system because of the volume of filter aid used. Paper disc filters can be treated by the same method as cartridges, with or without filter aid, carbon, etc.

Generally, precoat systems require servicing four or five times more often than cartridge filters and result in greater solution loss as well as chemical treatment cost.

CARBON PURIFICATION vs. SOLIDS REMOVAL

Carbon purification is a process whereby the liquid to be purified is exposed to activated carbon for the purpose of removing organics such as oil or lubricants. The process by which this is accomplished is called adsorption. Platers have for years employed powdered carbon either precoated directly on to the surface of the filter, or added to the solution in a separate treatment tank when batch purification is employed.

Powdered carbon is, just as the name implies, an extremely fine powder and as such will, if not properly and completely removed, be as harmful a contaminant as the organic it was intended to remove. Filtration in the 1 to 5 micron range is required to adequately remove powdered carbon.

The use of powdered carbon in the filter reduces the dirt holding capacity and restricts the flow so much that it retards the ability of the filter to remove solids from the plating tank.

Granular carbon is sized and graded in relatively large pieces with gradings such as 8 x 30 or 12 x 30 which means the entire volume will pass through an 8 mesh screen but will not pass through a 30 mesh screen. This makes granular carbon relatively easy to keep from migrating throughout the liquid and is typically restrained with a 250 micron trap filter.

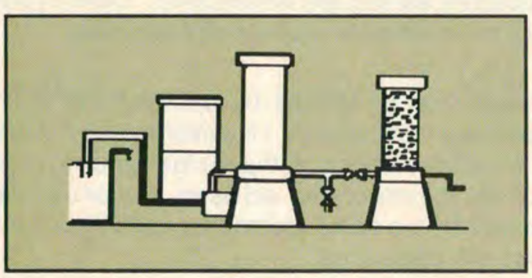
Granular carbon has greater adsorbancy than powdered carbon, however, reaction time with granular carbon is much slower. The organic is adsorbed in the interior latticework of the carbon granule. This makes it critical to prefilter the liquid to avoid particulate blinding off the entrance pores of the carbon granule.

The preferred method of combining filtration and carbon treatment to insure a low particulate level and a low organics contaminant level is to filter the solution at as high a flow rate as practical for optimum clarity and to treat with carbon at a much slower rate for maximum exposure. Flow rate through the carbon bed is determined by the surface area exposed to the direction of flow. Flows through a carbon bed are typically in the 5% to 20% range when compared to the flow requirements for filtration. Minimum bed depths are 20 inches.

The ideal combined filtration-carbon treatment system will have a pump and filtration system sized to 2 to 10 turnovers per hour of the solution and on the discharge of the filter a valved split in the flow will allow 80% to 95% of the flow to return directly to the tank. The other 5% to 20% will be gently introduced on top of a granular carbon bed and allowed to slowly traverse down through the bed, out the bottom and back into the tank.

We have found a good "rule of thumb" for carbon sizing to be 1 pound of carbon for each 100 gallons to be treated. Under normal operating conditions this allows several weeks of treatment before the carbon must be replaced.

Any plater who has ever changed a filter with powdered carbon will agree that the use of granular carbon is the preferred method of purification. SERFILCO carbon purification chambers are available for use with all makes and types of filtration systems and can easily be installed with an adapter kit, per the illustration shown below, to the filter now being used.



At SERFILCO,

we take the time

to listen to your

problems and show

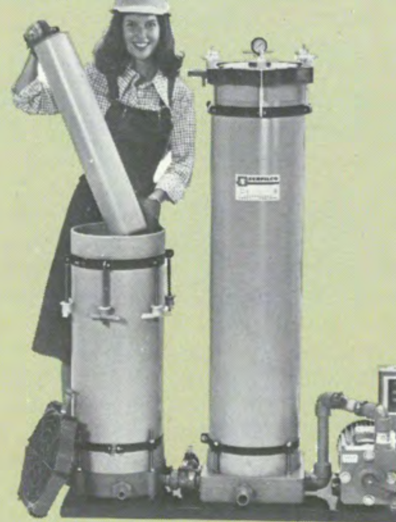
you how to solve them!

ACTIVATED CARBON PURIFICATION

Virtually all plating solutions will require purification through the adsorption of impurities by activated carbon. Solutions containing wetting agents require the most use of carbon since, when oil is transferred into the bath, it is dispersed throughout the solution and clings to the parts, causing peeling or spotty work. Solutions not containing wetting agents have a tendency to float oil to one corner depending on the recirculation pattern set up by the pump.

The choice of purification method depends on tank size, amount of carbon required, and other filtration equipment which may be available. Generally, carbon cartridges are used on tanks up to a few hundred gallons; bulk or canister type granular carbon for several thousand gallons. The granular carbon is also used as a separate purification system on the larger tanks to supplement surface filters, depth cartridges or certain automatic filters. Quality of carbon is important. If needed, a sulfur-free grade of granular carbon is available.

Any filter surface or depth cartridge will operate longer without cleaning or replacement, if powdered carbon is not applied directly to it. Carbon used in an auxiliary method such as a granular carbon bulk cartridge or granular carbon canister is the recommended approach. A carbon chamber in series, handling a portion of the total flow on a shunt following the filter used for solids removal and serving as a prefilter to the carbon is the most effective and desirable method of operation. Thereby, continuous filtration can be combined with a selective, separate and more efficient method of carbon treatment.



Separate carbon chamber downstream of filter for purification includes built-in trap cartridge

CARBON CARTRIDGE

A 2-3/4" diameter by 10" long carbon cartridge contains approximately 4 to 8 oz. of activated carbon, depending upon its style of construction and whether it is granular or powdered carbon. The cartridges are also available in 20" and 30" lengths and fit most chambers using replaceable cartridge filter media. Those using granular carbon have an outer prefilter and an inner trap or polishing filter which sandwich the activated carbon granules. Cartridges which incorporate powdered carbon provide an inert matrix binder which prevents release of the carbon fines, yet maintain porosity and maximize carbon exposure to the passing fluid. They replace a conventional depth tube quickly and easily and are ideal for in-tank or submersible filtration systems where precoating with filter aid and powdered carbon would be impractical. Carbon cartridges are the most convenient method of bath purification.

ACTIVATED CARBON PURIFICATION, cont'd.

"MAXI-CARB" CARTRIDGE

New and much larger powdered carbon disposable cartridges are now exclusively available from SERFILCO. Two sizes have been developed: 5" diameter by 28" long which contains 3 lbs. of activated powdered carbon and 5" diameter by 48" long containing 5 lbs. They are designed to be interchangeable with similar size refillable bulk granular carbon canisters. The large cartridges provide higher flow rates, quicker adsorptive capabilities, cleaner handling and 1-2 micron particle retention.

CARBON CANISTER

Ready-to-use plastic 5" dia. x 28" long and 5" dia. x 48" refillable containers hold 7 lbs. and 14 lbs. respectively of granular activated carbon and are placed in-line to the plating tank. A built-in 3 micron trap filter prevents migration of carbon particles. Prefiltering ahead of the purification chamber prevents solids from coating the carbon surface, assuring maximum adsorbency. Carbon in the canister can be replaced when its adsorption capacity is reached. This method of separate purification has the most flexibility. With a bypass valve, any amount of the filtrate can be treated as needed. Smaller refillable MINI-CANISTERS (2-3/4" dia. x 4", 6", 10", 20" or 30" lengths) are also available. They can be installed in a chamber or provided with hose adapter for attachment to filter discharge hose.

BULK CARBON

Granular carbon is provided loosely in a purification chamber or in a bag within a purification chamber. This method maximizes the amount of carbon exposed to the solution and offers the longest operating life before replacement is necessary.

CARBON PRECOAT

Powdered carbon is deposited on the precoated surface of the support membrane, which may be cloth, paper, or a depth type filter tube (which becomes a surface medium when precoated). For conversion to an easily cleanable surface filter media, the filter tube can be replaced with a sleeve assembly. Use a slurry tank or pail to first recirculate the liquid through the filter, then add filter aid until clear and, finally, a mixture of equal amounts of filter aid and powdered carbon. This purification method is used continuously or intermittently. It is considered by many to be the quickest way to effect adsorption due to the large surface area offered by powdered carbon. A filter cartridge may be a depth or surface media, and then precoated immediately prior to the addition of carbon. The same method is employed for batch treatment. Granular carbon can be used, but the rate of adsorption is not as rapid as for powdered carbon although, pound for pound the adsorbency is comparable.

BATCH PURIFICATION

Complete batch purification in a separate treatment tank is only necessary if day-to-day in-tank carbon purification proves inadequate. Just as in the case of batch treating for solids removal, the warm solution is pumped into an auxiliary tank. Average powdered carbon dosage is 10 lbs. to treat 1,000 gal. of warm plating solution. Powdered carbon is added in the required amount and agitated for an hour. Sprinkle an adequate amount of filter aid over the top of the solution. As it settles, carbon will cling to it and after settling, the solution may be decanted by inserting a suction hose near the top of the solution, gradually lowering it as the solution is pumped through a filter precoated with filter aid. Periodic checks of the discharge filtrate should be made to ensure that no carbon gets back to the plating tank. A very important consideration when batch carbon treating is to determine that the method of transfer filtering back to the plating tank provides adequate solids holding capacity.

IN THE SERFILCO DUAL SYSTEM, TWO FILTERS LAST LONGER THAN TWO

Serving Industry Worldwide

SERFILCO, LTD.

1234 Depot Street
Glenview, IL 60025 U.S.A.
FAX: 312-998-8929
312/998-9300
800-323-5431
Telex: 289557 SERFC UR

Serfilco's Dual Filter System makes your filter media or cartridge last longer than two single chambers. That's important when you can't afford to shut down a plating operation to replace or clean filter elements, yet still need to meet critical clarity standards.

The reason is that one filter chamber protects the other. A roughing filter in the first chamber traps particles and solids that can clog the fine filter in the second chamber.

Result: you clean or replace the more expensive fine filter less often — a savings that adds up to many dollars.

The Dual System lets you customize to meet your needs, too, by installing the cartridge or media of your choice. Select cartridges with 75 to 100 microns nominal ratings, or as fine as 0.35 micron absolute.

Or use activated carbon in the second chamber to carbon treat your plating solution as you go, and eliminate shutdowns for batch carbon treatment.

Need more flow? Connect the two chambers in parallel, and you've got it.

Requirements change? Keep the hardware as is and alter the media to adapt the system to an entirely new use. For example, with resin it becomes an ion exchanger.

You can use the pump on the base, or mount it over the plating tank.

With the Dual System, you become a partner in design with Serfilco, creating a system to meet your needs exactly, as they change.

Yet the bottom line is always the same: The Serfilco Dual System gives you the ultimate in clarity in your plating chemicals, process water, rinse water, and all solutions.

And that's something Serfilco will never change.

PURIFICATION of ELECTROPLATING SOLUTIONS
GRANULAR vs POWDERED CARBON

FACT #1

Granular carbon can have more adsorptive surface area than powdered carbon.

Surface area of activated carbon is the internal pore surface area which is compared to a complex network of caverns and accomplishes the adsorptive phenomena. Surface area of SERFILCO Hi-Surf 8x30 mesh is 1000 square meters per gram. Surface area of some powdered* carbon is 650 sq. meters per gram.

FACT #2

Granular carbon and powdered carbon have the same adsorptive potential.

Organic impurities in the solution can, therefore, be removed with either granular or powdered carbon. For example, a standard contaminant for measuring carbon adsorbency is carbon tetrachloride**. SERFILCO Hi-Surf adsorbs a maximum of .55 lbs. of carbon tetrachloride per 1.0 lb. Powdered carbon adsorbs a maximum .44 lbs. of Carbon Tetrachloride per 1.0 lb.

FACT #3

Powdered carbon adsorbs faster than granular carbon.

The smaller the individual particle of carbon is, the faster the molecules that are to be adsorbed can find their way into this network. For equal contact time and equal weights powdered carbon will, therefore, adsorb more impurities than granular carbon. However, with proper carbon and system design, a granular carbon purification chamber can adsorb impurities equal to that of powdered carbon.

FACT #4

Granular carbon purifies by an adsorption wave front.

A granular carbon adsorptive column will have a height to diameter ratio from 2 to 1 up to 6 to 1. With the impure liquid entering at the top of the column, there is a saturated zone and then an adsorptive zone. The length of this adsorptive zone is a function of the particular compound, the adsorptive system, pressure, flow, temperature, etc. Liquid exiting this adsorptive zone will be free of impurities. As saturation occurs, the adsorptive zone will move downward through the carbon column until it reaches the bottom at which point the exiting solution could be impure so the carbon should be replaced.

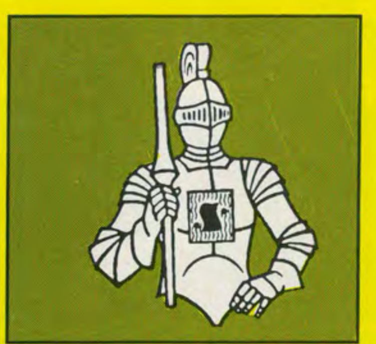
FACT # 5

Granular carbon purification systems are external to the filter system.

Installed on the filter discharge, only filtered solution contacts the carbon. This permits efficient use of the carbon as a purifier since it is not used as a filter. The adjustable low flow rate permits the effluent to be highly purified. With 5% to 10% of the filter flow rate directed through the carbon, purification is accomplished by extended contact time.

*Powdered carbon commonly used for continuous and batch treatment of plating solutions. Surface area and adsorbency may vary between manufacturers.

**Testing performed with commercially available organic solvent for standardization. Adsorptive reaction with plating bath organics, impurities, additives, temperature, etc. cannot be predetermined or duplicated for test.



FACT #6

Granular carbon purification systems are simple to operate.

Control valves on filter discharge offer complete flexibility and adjustment of flow through filter and carbon. Carbon chamber may be serviced while filter is in operation, and purification rate can be controlled as conditions require. Filtered solution can be discharged directly to the plating tank, proportional through the carbon or total flow through the carbon.

FACT #7

SERFILCO granular carbon purification chambers have trap filters.

To prevent carbon granules from being carried into the plating tank, trap filter cartridges are provided at the discharge of the purification chamber. Purified solution is, therefore, filtered twice prior to contacting carbon and also upon exiting the carbon chamber.

FACT #8

Granular carbon purification chambers can be added to any existing filter system.

Adapter kits with 1 or 2 flow control valves, fittings, pipes and hose are available. Carbon chambers containing 1 to 1000 lbs. of activated granular carbon for flow rates of 1 to 200 GPM are offered. Purification systems with separate pumps are also available where complete independence of filter system is required.

FACT #9

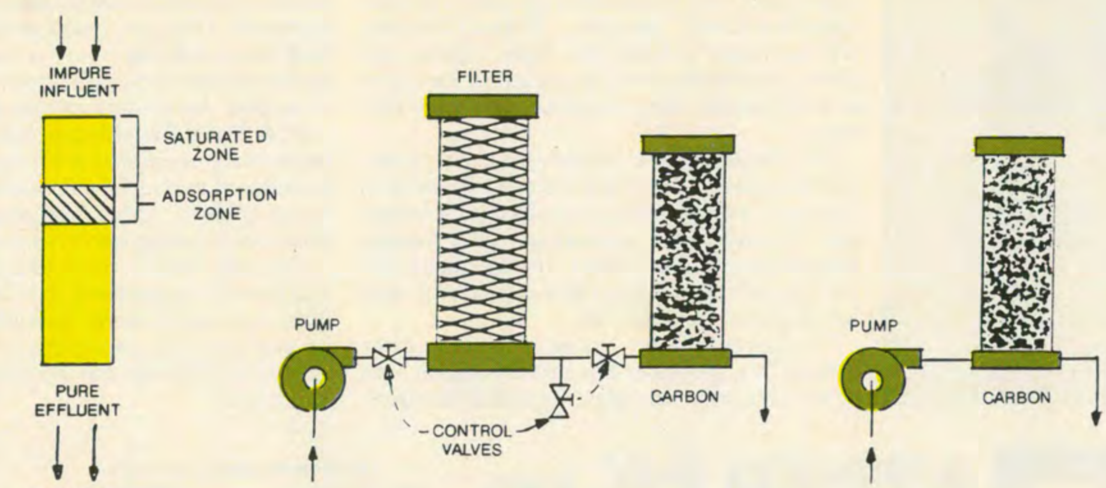
Granular carbon systems can reduce pollution.

The avoidance of backwashing or disassembling and cleaning a powdered carbon precoat filter can significantly reduce solution loss and required waste treatment. Granular carbon systems have resulted in the significant reduction of batch treatment frequency and in some cases its total elimination.

FACT #10

SERFILCO granular carbon is manufactured to precise specifications.

It is processed for the purification of plating solutions, industrial process streams and waste water effluents. Pretreatment acid washing to remove extractables is not required. Because of its hardness, granular carbon requires minimum flushing time to remove fines generated by shipping and handling.



CARBON ADSORPTION COLUMN

"WE'VE BEEN GETTING RESULTS THIS GOOD FOR EIGHT YEARS WITH SERFILCO"

Serfilco Sentry filter, typical of the type used by PCA.

Armand Amezaga, General Manager of PCA Metal Finishing, Fullerton CA, bought three Serfilco Sentry™ filters eight years ago because they (a) lowered rejects from 10 to less than 1%, (b) cut filter cleaning labor costs $3327 per year, and (c) saved $780 per year by eliminating plating solution loss.

"In eight years we have saved thousands of dollars with Serfilco," said Amezaga.

Lower costs were only one factor in the decision to convert to Serfilco. "Quality improvement was reason enough, even if costs were the same," he said. "Without quality, we don't stay in business. Now, rejects are down drastically, visible quality of the plate is much better, and roughness is almost history."

The Serfilco filters replaced a set of plate-and-bag filters that were cleaned 70 times a year, each time with 2-3 gallons of solution lost. Cleaning and repacking was a messy, labor-intensive job. Now, the Serfilco's require cartridge change twice a year with less labor and no solution loss.

To improve quality more, Amezaga later added purification chambers which use granular carbon for easier removal of organic impurities without the usual black mess.

"The bottom line is that we simply could not do the quality plating we do today with the old filters," he said. "We do specialized plating on aluminum, mostly on automotive wheels and components. In a highly competitive market, our products must stand out."

Why are Serfilco filters superior? Depth cartridge filtration is one reason; 50-micron cartridges provide excellect dirt-holding capacity, yet provide fine particle retention because of the depth design plus solids already retained. They provide more flow, up to 5 tank turnovers per hour on two brite nickel tanks and one semi-brite nickel tank. Carbon chambers use 10-micron trap cartridges.

PCA Metal Finishing is not unusual. We have many examples of the same quality improvement and labor savings that come from using Serfilco. Many customers, like PCA, have been getting good results for years.

You can, too. Convert to Serfilco and you will be just as satisfied as PCA. Eight years from now (even more, probably!) you'll still be glad you changed to Serfilco.

And you'll have the benefit of saving all that money.

SERFILCO®, LTD.

1234 Depot Street
Glenview, IL 60025
U.S.A.

312/998-9300
800-323-5431
Telex: 289557 SERFC UR

EASTERN REGIONAL OFFICE
One Lark Avenue 717/656-2161
Leola PA 17540
TELEX 285564 ASM UR

WESTERN REGIONAL OFFICE
5005 S. Hampton Street 213/588-0801
Los Angeles, CA 90058

MEMBER mfsa

F101

FILTRATION OF NICKEL SOLUTIONS

Nickel deposits, due to their lustrous finish, are often plated for decorative purposes in tanks suitable for rack or barrel operation. Agitation is usually recommended and organic compounds are added to get the best leveling and brightness. Other nickel solutions are used for engineering and salvage applications or electroforming, which demand a near perfect plate. These contain anti-pitting agents instead of organic brighteners. Bright and semi-bright nickel electrolytes require the continuous or periodic removal of organic breakdown products from brighteners by use of activated carbon. Carbon purification may be desirable for fresh Watts and sulfamate nickel solutions prior to the addition of wetting agents. Initial and continuous carbon treatment with at least two tank turnovers per hr. are suggested. (Hull cell tests will reveal the need for batch carbon treatment or change of carbon.) The nickel-iron plating baths must be filtered and purified like any other bright nickel solution.

Electrolytic purification by "dummy" plating to remove undesirable metallic impurities, such as copper, is frequently employed in conjunction with filtration equipment by either pumping from a separate tank or weir filled with overflow solution, or by recirculating through the slurry tank for this purpose.

FILTRATION

Solids can be removed from the bath by recirculating the solution through a filter which employs filter media with an average particle retention of 15 micron down to sub-micron with, or without filter aid. Flow rates per hour will also vary from two up to ten times the volume of the tank. One tank turnover per hour is not sufficient in most cases to remove all the solids in suspension before they settle to the bottom. Sedimentation in the plating tank requires periodic cleaning and down time of the tank. Coarser, or slightly denser, media may be used depending upon the dirt load and degree of clarity required. With a higher flow rate, a coarser filter media will attain the same degree of clarity as a denser media at a lower flow rate. The coarser cartridge has higher dirt holding capacity and longer life.

PROPER FILTER TUBE SELECTION

Filter media of cotton or polypropylene fibers can be used on most nickel baths. Cotton would be preferred on sulfamate solutions, and polypropylene on high chloride and fluoborate baths. Actually, polypropylene fibers on a polypropylene core are becoming the most universal tube materials because of their suitability for all the nickel solutions and also for their resistance to acid used to dissolve accumulated iron precipitate from the media. This can be done by flushing with hydrochloric acid (can be spent acid from other operations) or by acid soaking the cartridges while using alternate sets. In this way, one set is always ready for reuse in the filter. Be sure to flush any new synthetic fiber cartridges by running warm water through the filter just prior to using, to remove the slight organic residue which is left from the winding process.

LOW COST OPERATION

Because of their depth principle of construction, each filter tube can hold as much dirt as would collect on 3-1/2 sq. ft. of surface media of the same density. When sized on the basis of two cartridges for each 100 gallons of solution, the filter will usually operate for six to eight 40 hour work weeks before filter tube replacement is necessary. Very little labor is required to replace the filter tubes and the solution loss should be at a minimum. On a 1,000 gallon tank based on the use of 24 cartridges at $2.02 each plus $6.00 for labor, divided by 6 weeks of "unattended" operation, the filtration cost would amount to only about $9.00 per week. This will go up or down depending upon the dirt load, and the filter tube porosity used.

Where exceptionally heavy dirt loads are anticipated (such as on replating of auto bumpers where cleaning is usually incomplete) or in plating of tubular items, three filter tubes should be used per 100 gallons.

SERFILCO filters may be operated with filter aid in the same manner as other surface type filters - where each cartridge is equal to 1/2 sq. ft. of area. In place of the cartridges, sleeves made of polypropylene may be used. Slurry tanks are available on the Guardian and Sentry systems and can also be provided on the small "Space-Saver" series.

Precoated filters using two cartridges for every 100 gallons of solution will usually run for about one week before servicing is required. The operator can extend this **"unattended"** time by adding additional filter aid at periodic intervals through the slurry tank to help maintain a fresh porous surface on the filter media. On large systems having slurry tanks with agitation, a slurry feed pump may be used so that some solution with filter aid is continuously added to the filter media surface (body feed). As a result, an equal mixture of solids and filter aid is maintained to keep the cake, which is forming, as porous as possible. The slurry feed pump may enable the filter to run for many weeks.

Some of the larger SERFILCO rubber-lined systems, which have maximum distance between the cartridges, have been known to run for three to six months. Here again, periodic flushing with spent acid to remove precipitated iron hydroxide is possible. Often, the filter media can be rejuvenated to a like-new condition after the iron precipitate is dissolved. Larger systems such as the SERFILCO Guardian and Sentry can be set up with valving for backwashing which can minimize the need for opening the filter. Some filters are precoated and backwashed weekly, others bi-weekly.

Filtration of nickel solutions, cont'd.

PURIFICATION METHODS

When powdered carbon is used in the filter, 15 micron or denser filter tubes should be used. Filter sleeves may also be used and they are desirable because they can be washed and reused. Both cartridges and sleeves must first be precoated with filter aid to prevent migration of carbon fines from either powdered or granular carbon, and also to make it possible to clean the cartridges for reuse either by manual rinsing or backwashing.

For periodic or continuous carbon treatment on a bypass, plastic canisters containing from 1 to 14 pounds granular carbon are efficient and easy to refill. Larger bulk carbon chambers holding 50 to 100 lbs. carbon are also available with and without prefiltration. They contain a built-in trap filter tube with 3 micron retention for carbon fines. The precoated cartridge also becomes its own built-in trap filter preventing migration of filter aid and carbon into the solution. Since the cartridge is sufficiently dense to resist pressure differentials of 50-60 psi, breakthroughs are eliminated.

SUGGESTED FILTRATION SYSTEMS

CPVC or acrylic are used on the small filter chambers, PVC lined glass reinforced polyester on the Guardian and rubber lined steel shells on the Sentry filtration systems. Since all the plastic filter chambers up to 60 cartridges are closed with "O" rings and four external hold-down rods, leakage is not a problem.

SERFILCO filtration systems are offered in both in-tank and out-of-tank pump and filter arrangements. Usually, solutions such as nickel sulfamate, tin-nickel or Watts nickel, which do not require continuous carbon purification, may use an in-tank pump and filter system such as the Admiral series. The standard bright nickel solutions, high chloride or other, with or without air agitation, would use the larger out-of-tank systems such as the Guardian or Sentry series which have slurry tanks available for convenient use of filter aid in carbon. It is always desireable, especially on the larger systems, to add a slurry tank. Even though constant carbon purification may not be intended, it can be used for periodic batch carbon treatment, addition of chemicals through the filter to the plating tank, and it can also be set up so that the constant or intermittent dummying of the solution can be done in the slurry tank - if an overflow line is provided in the tank for this purpose.

PUMP SELECTION

The choice of horizontal centrifugal pumps in the small tank series is between the sealless magnetic coupled pump and CPVC horizontal pumps which have mechanical seals and titanium shafts. Water lubricated double seals provide long, maintenance-free seal life. If a vertical pump is preferred, the series "E" sump pumps installed either in or out-of-tank are relatively mainte-nance free, since they have no seals or bearings.

SERFILCO systems, therefore, offer a variety of filter and pump combinations to meet every operating condition of the nickel plating process. The customer has a choice of flow rates, various pumps, and different filter and purification chambers. Even the filter media is available in different porosities to meet the dirt load. Also, cartridges can be precoated for cleaning, or backwashing and reuse. Cartridges, in turn, may be replaced with plastic sleeves which can be precoated and cleaned for reuse. To make the system the most functional and yet easy to operate, bypass piping, valves, slurry tank, dummy arrangement, precoat, and body feed accessories are available.

While choice of materials, especially in the pump seal or filter media, will have a bearing on the service problems, the size of the system is the most significant factor to be considered for **"unattended"** filtration.

Zinc Solutions CAN Be Filtered

(and should be . . . . especially low cyanide)

• Remove floating oil - prevent rejects • Cut brightener costs 20-50% - yet get brighter, smoother deposits • Increased agitation allows for faster plating • Eliminate tank cleaning or downtime!

Heres how:
SERFILCO systems feature high flow rates with coarse throw-away filter cartridges, usually operating "UNATTENDED" for 10 to 12 weeks without servicing.

High flow rates provide frequent tank turnover and obtain more uniform temperature control. High pressure pumps increase agitation and throwing power, and obtain the most economical use of the filter media.

ALL UNITS SOLD ON A SATISFACTION GUARANTEED BASIS!
This type of filter also suitable for cadmium, copper, silver, iron or tin!

COPPER, BRASS, BRONZE AND CADMIUM, TIN AND SILVER, etc

Filtration of alkaline zinc and alkaline tin baths require the use of coarse media. Other alkaline plating solutions such as copper, brass, bronze and silver are contaminated to a lesser degree and are usually easier to filter; therefore, finer media may be used.

Many electroplaters have doubled and tripled their zinc plating ca pacity because of the toxicity and high cost of cadmium. The newer zinc plating solutions are capable of depositing zinc faster, brighter and much more uniformly. However, control of solution variables becomes more critical to produce lustrous deposits economically. Alkaline non-cyanide baths have low efficiencies compared to the highest-high cyanide and then acid zinc.

HOW TO CONTROL SOLUTION VARIABLES

Continuous filtration is the first step in the fight for good control of solution variables. Despite the difficulty of filtering most alkaline solutions, such as cyanide plating baths, it is the only effective method for solids removal. The slimy nature of the sludge makes it necessary to use a coarse filter media in order to reduce pressure loss and prolong cartridge life. The new low and non-cyanide zinc baths require much better cleaning of parts and closer bath control. Although metallic contamination is less of a problem, floating oil can build up in the plating tank and must be skimmed off to avoid adhesion failures. Periodic carbon treatment to remove organic impurities will increase deposit brightness and reduce brightener consumption. Actually, it would be better if their problem was corrected by skimming the cleaners and carbon treating the pre-rinses.

PROPER FILTER TUBE AND HIGH FLOW RATE ASSURES RESULTS

SERFILCO polypropylene or cotton filter tubes, with ratings of 50, 75 and 100 micron, using high flow rates provided by high pressure centrifugal pumps of 2 and preferably 3 times the tank gallonage per hour, make it possible to continuously filter any zinc solution. Although particles finer than 50 micron will pass through the filter initially, they will eventually be filtered out as the progressively denser network of fibers retains the coarser particles. Virtually all particles are removed as the cartridge becomes loaded. A high flow rate is required to keep the solids in suspension and carry them to the filter intake. The agitation will tend to keep the solids from settling to the bottom of the tank and on the cooling coils, thus helping to maintain uniform temperature. The high pressure centrifugal pump will also pack more solids into each cartridge.

Three cartridges per 100 gallons of solution provides adequate filter capacity on zinc plating solutions. Pumps which develop high pressures are desirable because of the heavy sludge loads. In-tank pumps could be used, but offer no advantages. Because of the high alkalinity, seals with water lubrication are recommended on centrifugal pumps to prolong seal life. Slurry tanks should be considered for ease of pump priming, chemical addition, precoating, and if necessary, for carbon treatment. See technical bulletin article covering activated carbon purification.

ADVANTAGES OF CONTINUOUS FILTRATION WITH HIGH TURNOVER RATES.

1. Brighter deposits are obtained with a reduction in brightener cost of 20-25%.
2. Throwing power is increased and faster plating rates are possible.
3. Solution agitation provides easier chemical and temperature control.
4. Cooling coils and heat exchangers can function more efficiently with little or no carbonate scale removal required.

TWO WAYS TO CLEAN OLD SOLUTIONS

Two methods can be used to clean an old zinc solution containing solids. The zinc plating solution is pumped to a separate auxiliary tank for the purpose of settling out the sludge. The plating tank is cleaned of all sludge before the clear solution off the top of the auxiliary tank is filtered back. It is sometimes desirable to add a non-fibrous type filter aid to the solution when it is in the auxiliary tank. Care should be taken in selecting diatomaceous earth, as some will contain silicates, which may dissolve in the plating solution if left in contact too long. If no auxiliary tank is available, an existing solution may be filtered by recirculation only, but frequent changes of coarse cartridges will be required until clarity is obtained.

With a new zinc solution, or one that has been filtered clean of solids, it is not uncommon to continuously filter these solutions for 8-12 weeks without filter cleaning or cartridge replacement if the filter has been properly sized.

FILTRATION OF ACID AND NEUTRAL ZINC BATHS - - *CONTINUOUS FILTRATION A MUST*

There are two types of acid baths: chlorides and sulfates. The latter produces a mat deposit primarily used on steel strip and wire. The bright zinc chloride baths are becoming increasingly popular and recently even non-ammonia, neutral zinc baths have appeared. All of these require continuous filtration. They are susceptible to contamination, particularly with iron, which must be periodically precipitated by hydrogen peroxide treatment. The gelatinous iron hydroxide (pH 5.5) is difficult to filter since it quickly plugs most dense media.

Continuous filtration of all acid zinc baths is recommended. The system should be sized (4 cartridges (10") per gallons), in order to minimize filter maintenance. Using 10 or 15 micron porosity polypropylene cartridges has been found suitable. Special "fibrilated" filter tubes (Purefybe medium porosity) are easier to clean and have longer life in this application. A slurry tank with backwash piping is also desirable for acid cleaning of the filter media. A tank turnover rate of twice per hour is suggested. Non-metallic materials should be used whenever possible. Water flushed double mechanical seals are required with horizontal pumps using Viton "O" rings and seals (M2 x M1).

HELPFUL TIPS

With good rinsing the iron drag-in can be reduced. All fallen steel parts should be removed from the tank as quickly as possible since they dissolve in the acid baths. Organic contamination is also common. If oil and grease are allowed to accumulate they will cause adhesion failures. Any oil on the surface of the solution must, therefore, be skimmed off. Periodic carbon treatment to remove organic contamination may be necessary.

FILTRATION OF ZINC CHLORIDE FLUX USED IN HOT DIP GALVANIZING

Prior to hot dip galvanizing the clean and pickled parts are immersed in an ammoniacal zinc chloride flux. In order to be active, the flux must contain a certain amount of ferrous ion, however, any excess is oxidized with hydrogen peroxide to ferric ion, which precipitates as the hydroxide. As the hydrous ferric sludge builds up in the tank, the solution must be clarified. Continuous cartridge filtration has been found to be much more effective than the wasteful decantation of the solution. A filter containing nine 10" polypropylene (15 micron porosity) cartridges per 1,000 gallons of flux is suggested.

Plating Acid Zinc requires . . .
A PLAN FOR GOOD FILTRATION

"Good filtration of the plating solution is a must when converting from cyanide to acid zinc plating." So says Bill Wiggins, President of Automation Plating Corporation in Glendale, California, who recently converted one of his cyanide plating lines to acid zinc.

Automation is a job shop specializing in small parts plating for the automotive, aircraft, furniture, baby care, computer and air movement industries. Wiggins is the third generation of his family to run Automation, and is involved with the plating industry as a member of the board of directors of the National Association of Metal Finishers. The Glendale plant covers 40,000 square feet, has 32 employees, and does both zinc and cadmium plating, using rack and barrel techniques on both.

"Acid zinc plating produces iron precipitates in the plating solution that can soon load the bath," said Wiggins, *"and cause high rejects from iron deposits on plated parts. To prevent this, you need efficient filtration of the solution."*

Added Filtration Equipment

To put this philosophy into action, when his line was converted, Wiggins also installed a Model CVL600 Guardian filter made by SERFILCO, Ltd., Glenview, IL. The filter is connected in a closed loop to a 1400-gallon solution tank and constantly circulates and filters the solution. Flow rate of the filter is 6000 GPH, providing a maximum tank turnover capability of 4-1/2 times per hour on the plating solution. Right now, Automation is turning the tank two times per hour on the recommendation of Pavco, Inc., the solution manufacturer.

The filter chamber holds 60 10-inch depth cartridges or their equivalent; Automation actually uses 20-inch and 30-inch cartridges that are quicker to install and slightly more cost effective. Cartridges are wound polypropylene string on a polypropylene core. Winding produces the depth filtration capability. As solution passes from the outside of the cartridge to the inner tube it passes through progressively smaller diamond-shaped openings. Large particles are trapped in the large openings, smaller particles in the small openings. Cartridges used by Automation are rated at 25 micron.

At present, cartridges are changed once a month, but this time could be lengthened as more experience is gained with the system. Filters are not used on the remaining cyanide lines.

"This is our first time using acid zinc," commented Wiggins, *"our purpose is to search out a more economical way of plating that will also produce high plating quality."*

More specifically, Wiggins listed these objectives:

- to reduce energy (electricity) costs,
- to eliminate the cost of cyanide destruction,
- to increase the quality of plating, from both appearance and plating uniformity point of view,
- to reduce rejects, and
- to increase rate of production.

Converting to Acid Zinc

The line used to set up the acid zinc operation is a 13 tank barrel plating line. All tanks, with the exception of the acid zinc solution tank, are 200 gallons capacity. Like the rest of the shop, it is run on two 10-hour shifts, 4 days a week. Wiggins worked closely with both SERFILCO and the plating solution manufacturer, Pavco, Inc., Cleveland, to set up the line and to establish operating parameters.

Here is the sequence of plating for a typical part:

1. Load parts into barrel.
2. Soak cleaner.
3. Rinse in room temperature water.
4. Electro cleaner for dirt removal.
5. Rinse in room temperature water.
6. Hydrochloric acid to remove scale from metal and activate the surface for better zinc adhesion later.
7. Rinse in room temperature water.
8. Zinc plate for 40 minutes in high temperature tolerant chloride mixed bath, then drain.
9. Double water rinse at room temperature.
10. Transfer parts from barrel into dip baskets.
11. Bright chromate dip.
12. Rinse in room temperature water.
13. Rinse in hot water (140°F).
14. Spin dry.
15. Pack for shipment to customer.

Objectives of Automation

All plating is done in polypropylene barrels. Once a barrel is loaded, all operations are performed automatically.

Has Automation achieved its objectives? *"In general, yes,"* said Wiggins. *"We're getting better quality; visual inspection shows parts to be brighter, and coverage is better. We have also eliminated the cost of cyanide destruction on that one bath, which was costing us about $171.00 per week, or $8,892.00 per year."*

"Production has increased too," he said. *"Automation can now plate parts quicker by loading more into the barrels."*

"We used to load 100 pounds per barrel," said Wiggins, *"and now we load 115 to 120, so we plate quicker at less voltage and amperage. An interesting note is that our production rate is up about the same amount our electrical usage is down."*

Wiggins stated that with the acid zinc process, he can now plate more kinds of

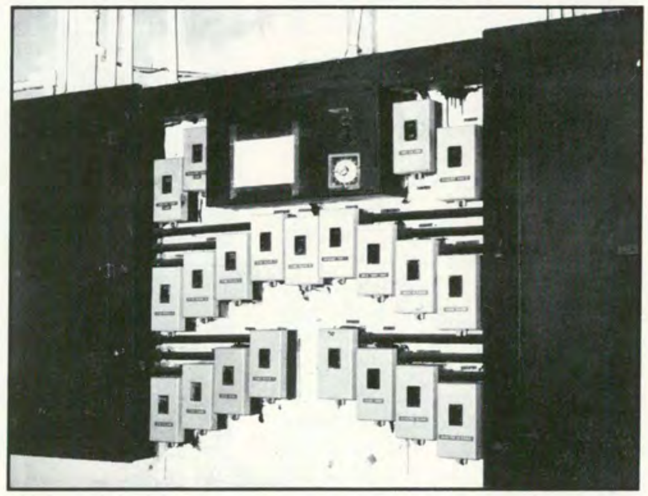
High efficiency filtration such as this depth filter system is important when doing acid zinc plating, according to Bill Wiggins, president of Automation Plating Coroporation in Burbank, CA.

Some of the many parts plated by Automation, which serves a variety of industries. With acid zinc plating, the company can now plate more kinds of metals, which opens up new markets for them.

Automation Plating can load more per barrel following their conversion from cyanide to acid zinc plating.

After plating, parts are dumped from barrels into baskets for the next step. Quality is high now, and coverage on the parts is better.

To insure that parts are dry for shipping, they are spun dry at high speeds.



Wiggins reports that about 15 to 20% is being saved on electrical usage after converting to acid zinc.

metals. *"We intend to explore this marketing advantage,"* he said, *""which means that we can expand our customer base. Exactly what effect that will have on the economics of our acid zinc process is unknown, but the general effect will be healthy."*

Rejects, which were not a problem under the cyanide plating process, are about nil with acid zinc.

Are there any disadvantages to converting? *"It's a little more difficult to control acid zinc,"* said Wiggins, *"so we make a chemical analysis of the plating solution once a day, and check pH twice a shift. We feel we are at an optimum point on water, chemical and electricity usage, but we need to make a closer analysis of electrical consumption, to tie usage into the acid zinc process.*

"And even though we have eliminated the cost of cyanide destruction, the cost of the acid zinc plating solution is higher, so it approaches a trade-off in that regard. The biggest advantages are better quality, less electricity usage, and higher production. We intend to continue monitoring the process to define our operating costs more closely."

Wiggins says that close contact with *the chemical manufacturer and the filter supplier are a must. "You need to choose your products and chemicals carefully, and avail yourself of the advice that's available from manufacturers,"* he said.

Reprinted from Finisher's Management Magazine, April 1984

DEPTH FILTRATION SLASHES REJECTS - LOWERS MAINTENANCE COSTS

MICHEAL F. GUSTIN, Plant Manager, Precision Anodizing and Chrome, Inc. with CP Staff

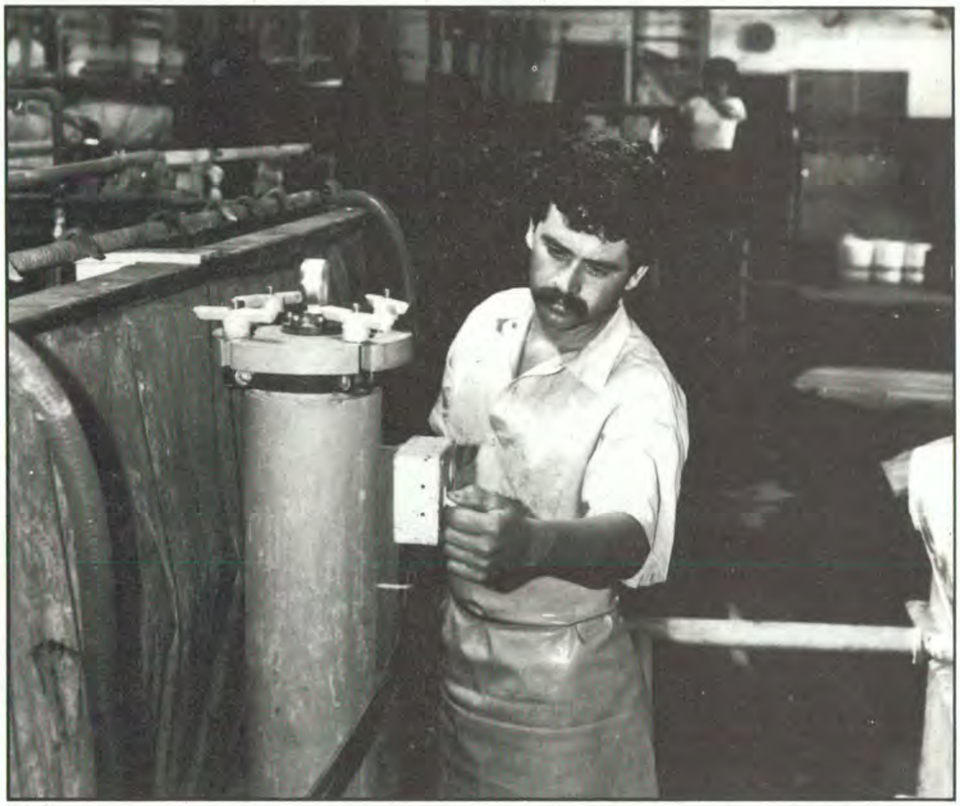
Depth filtration with tank turnovers of 2.6 to 3.0 times per hour has effectively stopped the problem of contamination in plating baths at Precision Anodizing and Chrome, Inc., Anaheim, CA, with the results that rejects have dropped from 10 to less than one per cent. Replacing the old plate-and-bag filters with cartridge filter systems has lowered filter maintenance costs while simplifying filter element changes.

The contaminants were principally iron in the acid zinc and nickel baths, buffing compounds (organic), and oil from metal forming operations.

Precision is a job shop handling a wide variety of parts, mostly steel frames and structural components for motorcycles, bicycles, and exercise/ recreational equipment; gas valves; automotive and truck parts; and more. Many of the parts are tubular, a familiar problem to most platers since oil and drawing compounds in hard-to-reach areas come out in the plating bath and contaminate them.

Problems evidenced themselves as roughness on the plated part, cloudiness caused by the organic contaminants, and pitting. Reject parts were redone in house, which consisted of complete stripping and replating, a cost that had to be borne by Precision.

The switch to depth filter cartridge filtration was not done overnight. Precision has used a small filter with nine 10-inch cartridges for about 10 years; a few years ago a carbon chamber was added to handle the problem of organics contamination.



This small depth filter started Precision on the road to converting all filters to depth cartridge units.

Plating Improvement, Lower Rejects

The results proved to be uniformly and consistantly good; parts plated in the baths served by that filter were better than others. A year ago, Precision replaced one of the plate-and-bag filters with a 48-cartridge depth filter which now serves a 2300-gal. bright nickel bath. The filter has a capacity of 6000 gph, so tank turnover is 2.6 times per hour.

Recently, another depth filter, this one with 36 cartridges, replaced the final plate-and-bag filter and now serves a 1400-gallon bright nickel tank. It has a capacity of 4200 gph, for a tank turnover rate of 3.0 times per hour. The data collected by the industry on tank turnovers and plating quality have been reflected at Precision. Results closely follow the performance curves that have been developed as a result of studies on plating quality as affected by tank turnover frequency.

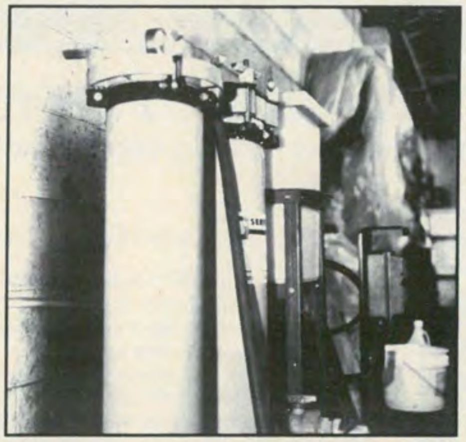
Tank turnovers coupled with depth filtration are an even more powerful combination. Depth cartridges have intrinsic high dirt holding capacity, which improves with operation because solids already retained enhance the ability of the cartirdge to trap impurities.

The filters at Precision use 20-micron cartridges when they are used on bright nickel baths. When they are used on copper cyanide, 10-micron cartridges are used. Even better results would be achieved with finer cartridges, but a balance between economics and plating quality must be achieved, and this comes only from experience.

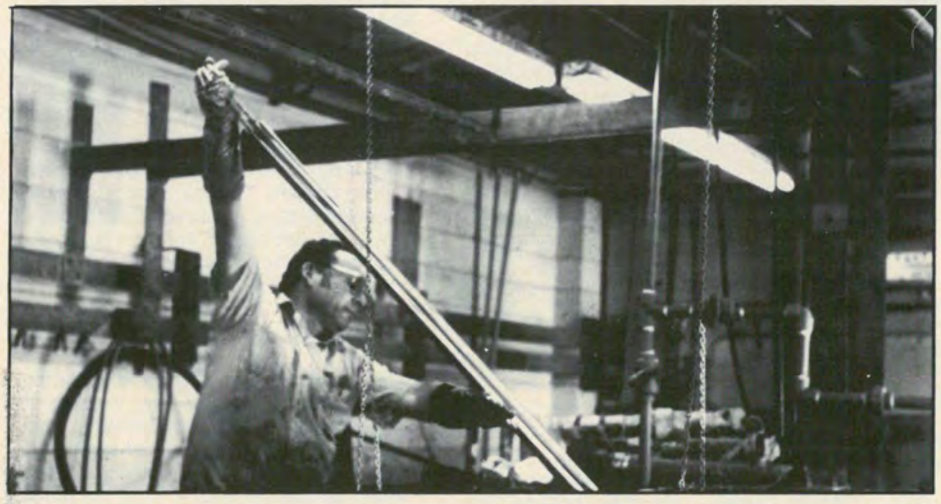
Lower Filter Maintenance Costs

Costs on filter cleaning and element changes have been lowered about 90% at Precision. The old filters were cleaned and repacked every two weeks, requiring three man-hours at $10.00 per hour direct and indirect labor costs. That was $30.00 per time, for a yearly cost of $780.00. Maintenance consisted of removing the plate and bag assemblies, hosing them down, repacking them with carbon, and reinstalling them.

Cartridges on the 36-cartridge unit and the 48-cartridge unit are now replaced only once a month, requiring about 20 minutes each. On the small 9-cartridge unit, the cartridges are replaced every three months; it takes 15 minutes. Thus, nine man hours per year are spent recartridging. At the same labor rate of $10.00 per hour, that is $90.00 per year, a savings of $690.00 per year in filter maintenance labor cost.



The 36-cartridge unit was recently placed on line, completing the conversion to depth cartridge filtration.



Tubular parts, such as the one being held below, sequesters contaminants that come out in the plating bath.

The cost of the replacement depth cartridges is cancelled out by the materials and solution loss cost experienced on the old plate-and-bag filters.

One reason the filters can be recartridged more quickly is that 20-inch cartridges are used in conjuction with 10-inch elements. This also holds down cartridge cost, since one 20-inch element costs less than two 10-inch elements.

Although the company does not keep ongoing records on the cost of rejects (the accounting would be horrendous) estimates are that the combination of savings through lower maintenance and fewer rejects is enough to pay back the cost of converting to depth filtration in about two years' time. The small unit was paid off several years ago, the second unit will soon be paid back, and the third in another year, at that rate.

All filters are fitted with carbon chambers to handle the organics problem; the two large filters have slurry tanks.

Plating Quality - A Constant Vigilance

Although Precision does no work for the government, much of its plating is done to Mil Specs, because that is the standard used by most of its customers. The company does Type K and II, and Class I, II, and III plating.

To maintain plating quality at high levels, the company uses an independent laboratory to perform analyses each week on plating baths in use. Checks are made for nickel chloride, nickel sulfate, boric acid, brightener level, and trace metals. Hull cell tests are performed to reveal the presence and level of organic contaminants.

Constant checks on quality and better filtration equipment help Precision stay competitive. Staying competitive was the principal reason they converted to depth filtration. Lower costs and attractive paybacks were important factors, as was the need to obtain higher flow rates in less space, but the prime consideration was quality. Depth filtration has made the difference.

All filters, including the small one in use 10 years, are made by SERFILCO Ltd., 1234 Depot St., Glenview, IL 60025.

Reprinted from Chemical Processing, January 1986

ONE FILTER SYSTEM FOR 10 TANKS

Central filtration handles 10 acid copper baths for PC board maker

Single filter system handles acid copper baths through a permanently piped installation that features pushbutton control.

An interesting and unusual application of filtration equipment for plating solutions can be found at Bally-Midway Mfg. Co., makers of Pac-Man and other video games, in Franklin Park, IL. A central filtering system handles ten 800-gallon acid copper plating baths through a pushbutton electrical/pneumatic control console. Highly efficient, it permits cleaning any of the tanks simply by pushing a few buttons.

Its advantage to Bally-Midway is that it permits more frequent cleaning of the plating baths while actually bringing about a reduction in both labor costs and cartridge/carbon replacement.

Acid copper plating is used after the printed circuit boards have been plated with electroless copper solutions, which increase the thickness of metal in through-holes and on copper panels.

"The system is part of our preventive maintenance philosophy," remarks John Smith, foreman of the Printed Circuit Department. *"We anticipate problems before they occur, before the reject curve starts to rise, and before contaminants in a bath start to degrade plating quality."*

To put that philosophy in motion, a year ago, Mr. Smith and his crew replaced several old filters with the system now in use. The heart of this operation is a filter system* permanently installed at the head of the 10-tank array and piped to the tanks with 1.5-inch diameter PVC piping. It replaces several filters that were moved from tank to tank for bath cleaning. The system has the following components:

- A filter with 10-µ depth cartridges in one chamber, 3-µ depth cartridges and activated carbon in another, a slurry tank for pump priming and adding solution to the baths, and a 5,000 gal/hour pump.
- A control console with pump "start" and "stop" pushbutton switches, 20 pneumatic control valves, and 10 sets of buttons for switching any tank on or off line for clean-up.
- Two air-operated diaphragm valves mounted on each acid copper tank to open and close the input and discharge lines that connect the filter to the tanks.

Although this particular application lends itself to this method of filtration, the common practice is to have individual filters wherever possible on each plating tank.

FASTER CLEANING

An immediate benefit was a sharp reduction in the time required to filter-clean the tanks. The plant operates two shifts. *"It used to take 8 hours to filter-clean one of the solutions; now we do it in two,"* said Mr. Smith. *"Put another way, we formerly took 5 days to filter-clean all 10 tanks by cleaning one solution every shift; now every bath is filter-cleaned once a day instead of once a week."*

With the 5,000-gal/hour pump operating for 2 hours per cleaning cycle, the 800 gal. of acid copper plating solution in a tank is run through the filter 12.5 times. The tank is then put back on line for further service, and another tank is switched on line for filter cleaning.

To operate the sytem, the operator starts the pump by pushing the pump "start" button. He then pushes the electrical switch button for the solution to be cleaned. This operates a pneumatic valve on the control cabinet, which sends air pressure at 40 psi to the diaphragm-operated valves on the tank. these valves open the input and discharge lines between tank and filter and the solution begins circulating through the filter chamber.

A safety interlock is built into the system. The tank switch must be pushed within 2 seconds after the pump "start" button is pressed or the pump will automatically shut down. This safeguard prevents the pump from operating against a closed valve. At the same time, an audible alarm sounds to tell the operator that the pump has shut down and he must repeat the start procedure.

Another safety interlock prevents two tanks from going on line simultaneously. Before the operator can put a tank on line, he must push the "off" button for the tank being cleaned before the "on" button on the next tank will operate.

The system was designed and installed by Leonard Tamawa, maintenance foreman, and Ben Krajewski, maintenance engineer at Bally-Midway. It has successfully operated for a year with no malfunctions.

FREQUENT MEDIA CHANGES

"Clean plating baths are directly tied to product quality and circuit operation," says Mr. Smith. *"Small contaminants between circuit lines can easily short out a board and make it inoperative. To keep the baths clean we change media in the filter weekly."*

This operation, which requires about 1 man-hour, consists of removing the depth filter cartridges from the filter chamber and replacing them with clean ones. The filter contains twelve 30-inch, 10-µ cartridges. The carbon chamber contains three 10-inch, 3µ cartridges and 22 lbs. of carbon, all of which is replaced at the same time. Removal is easy. The top of the chamber is held by locking swing bolts that can be loosened by hand - no tools are needed. Carbon is contained in refillabe canisters.

The cartirdges are made of polypropylene, wound in a diamond-shaped pattern over a polypropylene core, giving them highly efficient filtering characteristics. Solution passes through successive layers of windings and progessively smaller openings, trapping large particles on the outside and smaller particles on the inner layers. The design also prevents clogging and prolongs cartridge service life.

Layered windings also put a lot of filtering area to work. At Bally-Midway, the wound cartridges have an effective filtering area of 126 sq ft. In an equivalent-sized filter with surface media, the filtering area would be only 21.6 sq ft; thus, the depth cartridge offers an efficiency improvement on the order of 6 to 1.

SAVINGS REPORTED

Bally-Midway also enjoys a savings in labor costs with the new system. The old filter had to be disconnected, moved and hooked up to another tank once each shift, or twice a day, at a labor cost of 1 man-hour a day, or 5 man-hours a week, 260 man-hours per year. Assuming a wage rate of $8 per hour, that's a yearly savings of $2,080. Labor time for tank switchover on the new system is negligible; it takes only a few seconds to push the buttons.

The company has also reduced the cost of cartridge and carbon replacement. The old filter received new cartridges and carbon every other day (twice one week, three times the next) at an average weekly materials and labor cost of $140. The filter system gets a cartridge/carbon change only once a week, at a cost of $126 in a year's time, that's a savings of $728 (52 weeks x $14). Added to the labor savings, the filter unit is saving Bally-Midway a total of $2,080 every year.

"But the important benefit is the assurance that clean baths will give us consistently high-quality plating," says Mr. Smith. *"Every factory manager wants a better job at lower cost. At Bally-Midway, we've achieved it."*

By Jack H. Berg and Charles Remied

SERFILCO Guardian Model CVL-360

FILTRATION OF ACID COPPER SOLUTIONS

Acid copper plating is commonly found in the lithographic field plating on plastics, printed circuit boards or other electronic applications. It is also widely used in the automotive industry as underplate on bumpers and trim. Recently "high throw" copper sulfate baths have been introduced for through hole plating. Due to the air agitation the bath requires continuous filtration to obtain smooth deposits. Periodic carbon treatment is also necessary to remove organic impurities which can cause deposit irregularities.

RECOMMENDED FILTER TUBE/FLOW RATE

Filtration with 15 micron all polypropylene cartridges at flow rates providing at least twice per hour tank turnover is recommended. This can usually be accomplished with a filtration system sized at the rate of one cartridge for each 50 gallons. Denser cartridges at higher flow rates up to 10 times per hour should be considered where the highest possible clarity and quality are required. Each cartridge will have the dirt holding capacity of approximately 3-1/2 sq. ft. The high dirt holding capacity provided by the depth type cartridges have made it possible to operate filters unattended for 8 weeks or longer.

FILTER SYSTEM RECOMMENDATIONS

Systems consisting of pump and filter combinations are recommended with a separate carbon chamber for continuous purification when necessary. Slurry tank, related piping and valves are useful if the baths have to be batch carbon treated and when being made up before the brightener is added. The slurry tank provides for easier pump priming and addition of chemicals. A carbon canister purification chamber can be adapted to any filter with bypass valve and piping to control the flow through the carbon.

Plastics such as polypropylene, PVC or CPVC, are the most suitable materials for pump and filter construction. SERFILCO CPVC pumps using CPVC sleeved, titanium or Hastelloy shafts are required at high acid concentration.

Space-Saver systems employing the seal-less magnetic coupled pump would be recommended on small tanks with acrylic or CPVC filter chambers. The Guardian systems can be used on tanks from 600 to 4800 gallons and the Sentry series on larger tanks. Any of the intank Admiral systems featuring CPVC chemical sump pumps could also be considered with all-plastic or lined filter chambers.

FILTRATION OF COPPER PYROPHOSPHATE

Air agitated copper pyrophosphate baths require continuous filtration with 2-3 turnovers per hour to remove all particles which can cause modular plating. Continuous carbon treatment to remove organic contaminants is also recommended. The carbon must be changed regularly. About one pound of carbon per 100 gallons should be used to prevent excessive build-up of organics, which causes a brittle copper condition. From time to time batch carbon treatment with the addition of filter aid may be necessary to remove all organic decomposition products. Also, occasional permanganate or peroxide treatment will extend the life of the bath.

PHOTO RESIST FILTRATION

IMPROVE PRODUCT QUALITY, PREVENT REJECTS AND EXTEND THE LIFE OF RESIST SOLUTIONS

- **ABSOLUTE OR NOMINAL PARTICLE RETENTION**
  replaceable or cleanable filter media
- **STAINLESS STEEL CONSTRUCTION**
- **OPTIONAL PUMP SPEED**
  low RPM pumping prevents temperature increase
- **SELF PRIMING PUMP**
  with built-in relief valve and leak-proof mechanical seal
- **EXPLOSION-PROOF MOTOR**

Photo resists are used in the manufacture of printed circuits, integrated circuits, photo-engraving, nameplates, and chemically milled parts. Photo resists are applied to the surface and processed so as to achieve a resist pattern that withstands either etching or plating. In dip coating operations, contamination of the photo resist occurs by drag-in of foreign particles. This particulate material causes pinholes and often destroys resist images. Some materials will eventually dissolve or disintegrate in the photo resist, causing resist failure or discoloration of the resist.

Photo resists are usually polymers dissolved in an organic solvent that either crosslink (negative) or degrade (positive) when exposed to U.V. light. The selection of materials of construction of the components of any filtration system which will come into contact with the resist is important to pump life and resist cleanliness. Generally speaking, 300 series stainless steel is the overall best material. Teflon coated metal may also be used in seals, impellers, gaskets, etc. Nylon can also be used in some instances. Cotton or polypropylene membrane are suitable filter media.

Users of photo resists are usually working with tanks of only a few gallons up to perhaps 50 or 100 gallons. Filtration is sometimes required on a constantly recirculatory basis, but is most commonly done on a batch transfer basis.

Since some integrated and printed circuit work is of extremely fine line separation, the purity of the liquid is dependent upon filter media capable of removing particles in the nominal 1 to 10 micron range or may require submicron media for absolute particle retention to .1 micron.

Filtration on a continuous basis must be done in such a way as to prevent aeration of the liquid; otherwise, bubbles causing misses on the surface of the circuit board will result. High RPM pumps will sometimes generate heat if operated for too long a period of time, and this too can cause deterioration of the photo resist. Thus, a system using a low RPM pump which is self-priming is the most desirable.

FILTRATION OF PRECIOUS METAL SOLUTIONS

Electroplating of precious metals, such as gold, rhodium, and platinum, will be done either for decorative finish or for electrical contact applications. Therefore, quality of finish and functional characteristics of the deposit will vary and choice of clarification and purification will be dependent upon the requirements set forth. Size will vary from relatively small tanks in jewelry manufacturing shops, to tanks holding several hundreds of gallons in large electronic plants manufacturing printed circuit boards.

PURIFY WITHOUT SOLUTION LOSS

Precious metal electroplating solutions are high in cost; therefore, any means of clarification and purification must be done in such a way as to assure the operator that no solution will be lost due to carelessness or malfunction of the equipment. However, in meeting this requirement, the basic objective is sometimes forgotten or overlooked. Many precious metal solutions plate better when good agitation is provided in the plating tank. The more uniform coverage obtained with high flow rates results in substantial cost savings.

A pump used with a filter can provide the pressure needed to achieve the filtration and can also have sufficient pressure to provide for agitation of the solution. However, if the pump is undersize for both jobs, the agitation serves as a bypass for the filter reducing particle pickup by the filter media. This, in turn, leads to progressive contamination of the plating solution. High flow rates through the filter, plus periodic bypass purification through carbon as necessary, can minimize the need for carbon batch treatment of these solutions. This makes it possible to keep the precious metal in the plating tank with less chance of solution loss.

SUGGESTED FILTRATION SYSTEMS

Filtration systems of the intank type, such as SERFILCO's Mermaid, use a submersible, magnetic coupled pump and motor unit and are used on small tanks of up to 150 gallons with either a 1, 2, or 3 cartridge filter. CPVC in-tank pumps are available at flow rates up to 4500 GPH with filter chamber holding 60 cartridges.

OUT-OF-TANK FILTERS CAN BE USED

Although in-tank type filters are considred to be the safest to operate on precious metals solutions, out-of-tank filters can be as safe. The filtration system should be mounted in a plastic tray or tank to assure that no solution will be lost even if a leak should occur. Siphon breakers on the pump suction and filter return lines should be installed as an additional measure to limit the amount of liquid lost by back siphoning.

Out-of-tank filtration systems using magnetic coupled pumps provide for complete containment of the liquid without leakage. They are available with filter chambers from 1 to 60 cartridges with pumping rates up to 3000 GPH. Any of the above systems can be selected, in order to provide up to ten times per hour tank turnovers.

The selection of an in-tank or out-of-tank pump and filter will depend upon space limitations of the work area in the tank, and the ability of the unit to meet the flow and pressure requirements.

RECLAMATION OF PRECIOUS METALS

With gold prices between $300 - $400 per troy ounce plus fabricated charges to the plater, SERFILCO's resin systems have a very rapid payback. The gold plater may take a close look at installing one on his dragout tank if he has no present means of recovery. Even if he has recovery, he may put in a second dragout tank and install one as a backup unit.

CONSIDER THESE:

__Our small unit -__

SERFILCO's system 0326A sells for $927 and has a .15 cu. ft. resin capacity. 1 cu. ft. of standard gold resin has a capacity of 100 troy ounces gold under favorable conditions or down to 50 troy ounces per cu. ft. under worst conditions. Therefore - .15x50 (or 100) = 7.5 or 15 troy ounces capacity!!! For a $927 investment, a plater could get $3,000 - $6,000 return the first time he refines the resin!

OR . . .

SERFILCO's system 0380B which sells for $1,465 and has a resin capacity of 1/2 cu. ft. resin or 25-50 troy ounces gold capacity or $10,000 - $20,000 return the first time the resin is refined!!!

Past experience has been that if a plater has no recovery on his dragout tank at all, even with little or no recesses in the parts plated, his gold loss is 5%!!! If you are barrel plating, your gold loss is 10%!!! These figures are rule of thumb only, but will prove to cover at least 75% of all gold plating operations.

If a plater uses 10 troy ounces of gold weekly, his loss will be 1/2 to 1 troy ounce per week or $200 - $400 per week loss, (based on $400 per ounce of gold). Therefore, payback on our small unit could be 2-3 weeks or on our larger unit, 4-6 weeks. If a plater uses 25-50 ounces of gold a week, the savings will be tremendous.

FOCUS: ELECTROLESS NICKEL PLATING

FILTERS FOR EN

RECOMMENDATIONS ON THE BEST TYPES OF FILTERS FOR ELECTROLESS NICKEL PLATING SOLUTIONS. . .

by JACK H. BERG
President
SERFILCO, Ltd.
Glenview, IL

EN SOLUTIONS can be filtered using out-of-tank vertical centrifugal cantilevered seal-less pumps, as in this installation.

To produce smooth deposits from a plating solution, the plater must have solutions that are free of particulate matter. Crystal clear solutions are even more important when operating electroless plating solutions. Deposition from these solutions will occur on all surfaces in contact with the solution. Thus adequate filtration is vital to the success of any electroless nickel plating operation.

Preventing Unwanted Deposits. In selecting materials of construction for pumps, one may partially control the tendency of electroless nickel plating solutions to plate where no plating is desired by using materials of construction that have by their very nature a lower tendency to allow adherent deposition. Thus materials such as PVDF, CPVC, polypropylene and fluoropolymers are used. If deposition does take place on these plastics, the deposits may be easily removed by stripping with a nitric acid solution.

Types of Pumps. Generally, centrifugal pumps for use with electroless nickel are either vertical,bearing free, for use in-tank or out-of-tank, or horizontal with double-water-flushed mechanical seals. Small magnetic pumps without spindles may also be used, since they have no close tolerances that might cause binding. But pumps with conventional seals and even magnetic seal-less type pumps with ceramic shafts and bushings and thrust washers are to be avoided; electroless plating is likely to occur on the ceramic and carbon components.

Fast Flow. Pumping at rates to cause 10 or more tank turnovers per hour is required to assure uniform deposits. High flow rates through the filter keeps the solution free of particles and helps to maintain a homogeneous composition. The filter also must be chosen to provide particle retention in accordance with the surface smoothness requirement for the type of parts being plated.

Seeding. Particle removal by filtration is vital in dealing with the effects of "seeding" (the spontaneous creation of fine metallic particles in the solution). This may result from a temporary chemical imbalance in the solution. Further deposition will occur on the particles as long as they are suspended in the solution. Therefore, if chemical imbalance does occur and seeding results, the particles must be removed immediately by filtration. Once picked up by the filter, the particles must be removed from the filter media, too, before additional deposition occurs there; ultimately chemical depletion of the solution will result.

Since it may be necessary to remove the filter media quickly and easily, many operators select a bag-type media that can be serviced easily and reused. Open bags with quick disconnects are suitable, but aeration of the solution, causing some degradation, has encouraged the use of bags in closed filter chambers.

Sleeves also may be used in filter chambers, providing for outside-in flow. This tends to keep the pores of the filter fabric from opening. Therefore, such sleeves are preferred for finer particle retention.

Cartridges of the wound-fiber type provide finer nominal micron selection and, therefore, could be used when the cost of the media is justified by the results desired. Pleated cartridges offering absolute retention of submicron particles are also used. But because of their higher cost, they may be installed in separate chambers for bypass filtration when the solution is not active, or they may be put on stream only when results again show the need for this type of filtration.

Filters should never be sized so as to require retaining a large volume of solids; instead they should operate with a minimum of differential pressure, to maximize the flow rates.

Quality Difference. Use of the proper filtration equipment can make the difference between good and mediocre quality and between low reject rates and costly rework. Filtration units for electroless nickel plating should be built of materials that limit the tendency of electroless solutions to plate out on surfaces. They should be sized to provide high turnover rates and the design should facilitate quick cleanout and reuse of filter media.

FILTRATION OF ELECTROLESS SOLUTIONS

Electroless plating solutions are used to deposit metals such as copper and nickel by means of chemical reduction on plastic, metal or ceramic substrates.

PROPER PUMP & SEAL SELECTION IMPERATIVE

Solutions will vary in plating temperature from ambient to 205°F and require non-metallic solution contact or stainless steel construction. As metal can deposit on the components of the filtration system and nitric acid is often used for stripping of the system, special attention must be given to the type of pump seal and plastic used. High temperature resistant plastics such as CPVC, Ryton or Kynar are best for hot solutions.

Since the baths typically increase in specific gravity up to 1.3 with age or cycles, care should be taken in sizing motors for pumps. Also, platers should be aware of the limitations of the materials chosen for the pump to be used for the nitric acid strip solution.

FILTERING REMOVES INSOLUBLE CONTAMINATION

Some solutions require continuous filtration, while for others, periodic filtration is sufficent. All new solutions should be filtered after makeup and pH adjustment. All replenishing solutions added to the bath should first be filtered. Organic contamination can occur due to drag in or stop off lacquers. After lowering the temperature to a non-active condition, the solution can be carbon treated in the conventional method for nickel either by pumping it to storage for carbon and filter aid additon or passing it through the filter after it has been precoated with filter aid. Carbon filter tubes or carbon canisters may also be used with recirculation.

PROPER FILTER SYSTEM SELECTION

The density of filter media should be selected according to clarity required. Generally, 15 micron cartridges of either cotton or polypropylene fibers on a polypropylene core are suitable. Synthetic fiber cartridges, regardless of the manufacturer, should be rinsed by flushing with warm water before placing the filter in service. One cartridge for each 50 gallons of solution and 100 GPH flow per cartridge provides two tank turnovers per hour if operated on a continuous basis. Tank turnovers up to 10 times per hour may be employed where a high degree of clarity is needed. Sizing in this manner will also provide for transfer pumping of solution in 10-30 minutes. With solutions having a strong plate-out tendency, a sleeved or pleated surface type cartridge is also effective in removing metal particles. These are easy to rinse for reuse.

SUGGESTED FILTRATION SYSTEMS

The SERFILCO Labmaster or Space-Saver series filter with a seal-less magnetic pump (without a shaft) using polypropylene or Teflon clad impeller magnets (because of nitric acid) are recommended for small lab or production tanks up to 600 gallons. A magnetic pump can also be used for stripping the system. CPVC or Pyrex is suitable for the filter chamber; CPVC should be considered for the larger high temperature applications up to 3,000 gallons.

SERFILCO Guardian and Sentry filtration systems are available for use on electroless solutions requiring non-metallic solution contact. Filter chambers on the Sentry are high temperature, acid resistant, rubber clad steel shells. These are available for tanks up to 12,000 gallons and may be used in parallel for larger tanks. Each unit features a non-metallic centrifugal pump with special water lubricated mechanical seals which prevents deposition on the seal faces.

The SERFILCO in-tank Admiral series features CPVC construction with non-metallic solution contact. The pumps are self-priming and provide vigorous tank agitation. Very little deposition occurs from most solutions in contact with CPVC. If necessary, these pumps can be mounted out-of-tank.

Filtration systems may be installed ahead of heat exchangers used to heat the solution. However, the flow through the heat exchanger will gradually decrease as the filter becomes loaded with particulates.

ELECTROLESS NICKEL FOR ELECTRONIC APPLICATIONS

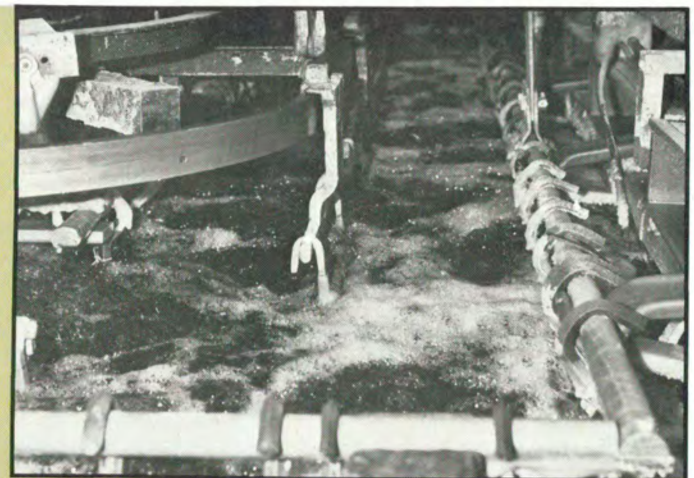
Because of the critical tolerances in some electronics applications, high turnover rates (8-20 times/hour) as well as submicron filtration and carbon treatment are required. Since the dirt load on these systems is not unusual, high flow systems with series filtration utilizing progressively denser media in a series of chambers proves most economical. Continuous carbon treatment may be incorporated in these systems as required.

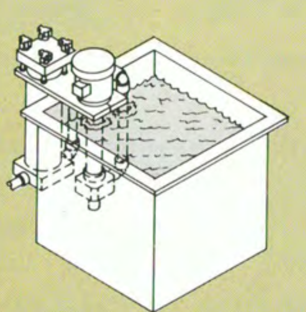
Also, since many of these baths are sensitive to organic contamination, care should be taken in the selection of materials of construction of all components in the system.

HELPFUL PLATING TIPS

The filtration of electroless nickel solutions removes nickel phosphite, which is a by-product of the plating process. Since its solubility is lower in hot solution than cold, hot filtration is more effective. If allowed to accumulate, it adversely affects bath stability and deposit appearance. Cloudiness or precipitation in a used bath is generally due to nickel phosphite. Some platers transfer and filter the hot solution to another tank at the end of each day and throw away the cartridge, even though the cartridge has usable holding capacity, in order to avoid re-introduction of the nickel phosphite. Since the cartridge is going to be thrown away, a denser filter media could be used to get the solution as clean as possible during a single pass through the filter, or on recirculation. Some prefer continuous filtration during plating to maintain maximum solution clarity and consistent plating quality.

SERFILCO REJECTS MORE HERE





tank turnover up to 10 times/hour; particle rejection as low as 0.35 micron

Photo courtesy of General Super Plating

SO YOU REJECT LESS HERE

Clarity of plating, etching and rinse solutions for finishing on plastic can be accomplished only when both particle retention and flow rate are properly matched.

That's why, at Serfilco, we don't merely suggest a certain density filter cartridge for your solutions. Instead by studying your specific application we can recommend the *best* system.

With facts in hand, we can plot solution clarity in ppm versus rejects. Based on the quality level you require, we tailor the system with different flow rates and different cartridge densities.

For the ultimate in clarity, we can turn over a solution tank 10 times per hour and reject particles as small as 0.35 micron. You probably don't need such sophistication; our job is to find out exactly where on the scale of perfection your needs are. Then we design the system that meets them — *all with stock components from inventory*.

Thus when a Serfilco system goes into your plant, you can be sure that the filter has sufficient solids holding capacity to assure adequate flow rate to maintain the clarity you need.

To under-design means you pay the price in high rejects.

Modular products in a system customized to meet your needs exactly — at a fair cost, with low rejects, and high solution clarity.

Seems like an offer you can't reject.

MEMBER mfsa

serving industry worldwide

SERFILCO, LTD.

1234 Depot Street
Glenview, IL 60025 U.S.A.
FAX: 312-998-8929

312/998-9300
800-323-5431
Telex: 289557 SERFC UR

WHEN PLATING ON PLASTICS, KEEP IT CLEAN

No matter how much attention is given to preventing contamination of plating solutions from suspended solids, in-tank sedimentation, drag-in, and air-borne dirt, it is an unavoidable problem. With impurities present during either the pre-treatment, the electroless deposit or the electroplating steps of plating on plastics, the result is certain to be rough deposits causing unacceptably large number of rejects. Since it is impossible, from a practical operating standpoint to prevent contamination, the logical course is to remove the contaminants before they cause plating defects. The most efficient means for accomplishing this is by continuous filtration and/or carbon treatment.

Jack H. Berg, President, SERFILCO, Ltd., Glenview, IL discussing the cleanliness problem as it relates to plating on plastics at an ASEP Annual Meeting, offered some valuable suggestions on the use of carbon and the use and selection of filtering equipment.

CARBON TREATMENT

Drag-in introduces organic impurities into solutions which, therefore, should be continuously purified with activated carbon to assure quality production. Berg reviewed carbon treatment to solve the problems in each step in the plating of plastics. First, the materials of tanks, hoses, racks, pumps, and filters should be carefully selected so that they will not be sources of either metallic or organic contaminants; all water used should be distilled or DI; tanks should be covered when not in use; ambient air should be clean as well as air used for agitation. Berg recommended two air agitated rinse tanks between each pre-treatment step, particularly to get rid of chrome (which will destroy catalysts) and palladium which will decompose electroless baths.

Taking the treatment steps one by one, Berg said that soak cleaner and conditioner solutions probably do not require filtration since plastic parts have relatively "light dirt load". The catalyst activator should be filtered slowly. Carbon treatment is a "NO-NO" for the catalyst. Electroless plating baths should be continuously filtered with two 10 inch (3-5 micron porosity) cotton or flushed polypropylene cartridges per 100 gallons of solution.

Copper baths should be carbon treated periodically. This can now be easily done with the use of refillable carbon canisters. Batch treatment, with powdered carbon, can be used to remove large amounts of oil and grease. For small tanks, "a combination filter and carbon cartridge may be sufficient."

Bright nickel baths should be continuously filtered. An effective method is to pass solution from the filter to an activated carbon treatment. Refillable carbon canisters are available holding 3.8 to 10 lbs. of granular carbon. Bulk carbon is available for large tanks.

A Hull cell test should be used to determine the organic contamination in nickel and copper tanks. Visual examination cannot determine when carbon adsorption capacity is used up. Experience will determine the cartridge life and a regular maintenance schedule should be established for changing cartridges and carbon.

THE FILTER SYSTEM

Factors to be considered in selecting filter equipment are dirt load, flow rate, and frequency of filtration and purification. The **dirt load** should be the heaviest that will occur and filter media selected for particular loads and particle size. The coarsest possible cartridge should be used since it has largest holding capacity; longer life; increased flow rate; and is less expensive. Also with use, openings become smaller, and smaller particles will be removed.

Flow rate refers to the ratio of gallons pumped per hour to tank capacity; for example, 200 GPH into a 100 gallon tank is two turnovers per hour. The flow carries solids to the filter and brings solutions in contact with carbon. It is essential that filters have capacity commensurate with flow rate. Throw-away paper can be used, as can filter surfaces coated with filter aid.

The **frequency of filtration and purification** for the average plating solution is once per hour. Berg recommended at least twice per hour and up to 10 turnovers per hour, if necessary. He emphasized that this turnover rate is to be the average, ***not*** the actual. For instance, starting at 1,000 GPH and reducing to 200 GPH would make the average about 600 GPH or only about one turnover per hour for a 500 gallon tank.

Depth type cartridges are most often used, obtainable for removing particles from 100 to 1/2 micron size and of materials compatible with the chemical solutions.

EQUIPMENT SELECTION

In selecting equipment, the basic considerations are: the clarity necessary for quality production; quantity of solutions and amounts of impurities in solutions; flow rate; type of carbon treatment, continuous or batch; pump specifications; and filter media porosity.

Berg commented with respect to pump specifications that all-plastic pumps may not offer sufficient pressure and may need staged impellers or be used in series. Pumps having magnetic couplings have become popular. There is no shaft opening, so a seal is not required. Some types are submersible. These may not be suitable for electroless solutions because they can "plate out" at the coupling and become immobilized.

Sump-type pumps do not require seals as the liquid acts to seal. These can be used with almost any kind of solution and on some solutions can be used for agitation without filtration. All pump systems, of course, must have the necessary auxiliary equipment such as valves, priming chambers, sufficient installation space and pressure gauges to indicate filter condition.

Reprinted from Finishing Highlights, November/December 1977.

Since printing, flow rate tank turnover has been steadily increased to 10 or more times.

SERFILCO CASE HISTORIES

ELECTROLESS NICKEL

SWINTON ELECTROPLATING

The 650 U.S. Gallon solution at Swinton Electroplating is being filtered by a Guardian CVL1230BFS bag system.

We believe flow is around 5,000 U.S. gallons per hour from a double seal 'HE' pump with No. 4 impeller. Connection from pump to filter is CPVC piping and the system is running well at 90-95°C.

ROBT CORT

5,000 liter solution 92°C (one tank) (1250 gal.)

Plate ball valves (up to 42" diameter) and gate valves for oil and gas pipe line applications.

Have used SERFILCO Guardian Filter CVL 480 with cartridges and CVL 1230 BFS with bags for many years. Both with double seal horizontal pumps, Series 'H' 1-1/2 x 1-1/4 and Series 'HE'.

Removed cartridges for nitric stripping but only monthly stripped pump with nitric.

DURACELL BATTERIES

5,000 liter solution (one tank) (88°C)

2.5 million battery cases per 8 hour day

Have used Series 'H' 1-1/4 x 1 double seal pump for many years with good results except for occasional seal failure, usually resulting from 'run dry' situation since the pump is mounted vertically in the same position as 'E' or 'EH' pump would be installed.

Recently purchased 'EH' pump and 3, CVL480 chambers. All reported to be running well. Pump nitric every day cleaning cartridges in place.

ALLPLATES LTD.

250 liter solution at 95°C

Have used Space-Saver 1618A - Model CL60(2)S-3/4VW-3/4x1/2CTL(M1xM2)-C.5-G3 for 1-1/2 years. Complete satisfaction, nitric strip pump approximately at 6 month intervals. Every 2 weeks remove cartridges and strip.

WEST MIDDLESEX PLATING

250 liter solution - 95°C

Have used Space-Saver 1611 - Model CL10-3/4VW-3/4x1/2CTL(M1xM2)-C.5 for 1-1/2 years with complete satisfaction. Pump nitric every day for stripping.

INGRAM & GLASS

250 liter solution at 92°C

Space-Saver 1612 - Model CL20-3/4VW-3/4x1/2CTL(M1xM2)-C.5 for 1 year complete satisfaction - nitric strip with cartridges in place every 2 days.

All stated that they had bad experiences with other equipment and felt that SERFILCO pumps were the best available for their application.

FILTRATION OF CHROMIUM SOLUTIONS

Chromium deposits from an electroplating solution are used for both decorative and functional engineering applications. They vary from light to heavy in thickness using baths which plate from room temperature up to 140°F. The specific gravity, at about 1.37 is higher than most other plating baths. Pump motors, therefore, should be oversized. In some chromium baths the chemicals are in complete solution, while others contain self-regulating solids. Fluorides may, or may not, be present which would determine the materials of construction. CPVC is the most suitable plastic. Fluorides will attack most ceramic material used for pump seals, however, special fluoride resistant seals are available, as well as Hastelloy® pump shafts. A water flushed double mechanical seal is desirable.

USE PROPER FILTER TUBE

Filtration with 15 micron filter tubes with polypropylene or modacrylic (Dynel) fibers* and polypropylene core, at flow rates providing 1 to 2 tank turnovers per hour is recommended. This can usually be accomplished with any of the filtration systems sized at 1 filter tube for each 50 to 100 gallons. Denser filter tubes at higher flow rates, should be employed where the highest possible clarity and deposit quality are required.

The pump used for agitation can also double as a transfer pump making it possible to pump the solution into a storage tank during inspection and cleaning of the plating tank. With increased agitation, filtration becomes necessary to remove any solids held in suspension. These will include small particles of stop-off lacquers or metallic particles loosened by the initial momentary current reversal, prior to the deposit of the chromium. These particles would otherwise cause misplating or could be incorporated into the deposit, causing roughness.

HEXAVALENT CHROMIUM FILTRATION

Filtration of hexavalent chromium solutions is becoming more and more common due to better materials of construction, especially CPVC. Increased agitation speeds up the plating rate and prevents burning at hot spots. It increases the throwing power in recessed areas and provides a more uniform grain structure with better wear qualities. The flow from the pump may be directed to certain areas of the parts to be plated, or to locations which would otherwise be dead spots in the tank.

TRIVALENT CHROMIUM

These baths require continuous filtration with dense media to remove the fine particulate matter formed during purification. Since the bath has less tolerance to metallic contamination, contact with all metals including lead, must be avoided. A filtration system sized at 2-3 filter tubes or precoated sleeves per 100 gallons will provide adequate dirt holding capacity.

LIMIT SOLIDS FLOW TO FILTER

With self-regulating baths, care should be taken to filter the solution off the top only and to bypass around the filter during agitation of the self-regulating chemicals. Any solids from the self-regulating bath which are picked up by the filter would, in time, be dissolved as required. The purpose in keeping them from the filter in large quantities is to prevent the solids from restricting the flow through the filter and reducing the amount of agitation. However, with an oversized filter the regulating chemicals can be retained on the surface of the filter media without reducing flow too much.

An in-tank CPVC pump and filter is recommended for hard chrome containing fluorides. On small tanks a CPVC seal-less magnetic pump with polypropylene or CPVC filter chamber is also usable. The CPVC has no seals or bearings and, since it is in the tank, no problem of leakage.

*Verify fiber compatibility with the solution by an immersion test. Generally, the modacrylic (DYNEL) is required on fluoride solutions, depending upon concentration and temperature

FILTRATION OF FLUOBORATE BATHS

Copper, Lead, Tin, Lead-Tin, Nickel, also Tin-Nickel*

The fluoborate baths are generally easy to control but for best plating, they should be filtered continuously to remove all foreign particles. Intermittent carbon treatment to remove accumulated organic drag-in is necessary. Be sure to flush all new polypropylene cartridges with hot water to rinse off the organic lubricant from fiber surfaces. As materials of construction, plastics, such as CPVC, should be used wherever possible. Pump seals and shafts must be fluoride resistant and water flushed.

*Refer to general bulletin covering each of these specific baths.

FILTRATION OF PHOTO RESIST

Liquid photo resists are used in the manufacture of printed circuits, photoengraving, nameplates, and chemically milled parts. Photo resists are applied to the surface and processed to achieve a resist pattern that withstands etching or plating. In dip coating operation, contamination of the photo resist occurs by drag-in of foreign particles. The particulate produces pinholes and often faulty resist images. Some particulates will eventually dissolve or disintegrate in the photo resist, causing resist failure or discoloration. Since some printed circuit work has extremely fine line separation, cleanliness of the liquid is critical and requires filter media capable of removing particles in the 1 to 5 micron range and even submicron.

Photo resists are usually polymers dissolved in an organic solvent that either crosslink (negative) or degrade (positive) when exposed to UV light. Material selection for construction of components of any filtration system is important to pump life and photo resist cleanliness. Generally speaking, 300 series stainless steel is the overall best material. Teflon coated metal may also be used in seals, impellers, gaskets, etc. Nylon can be used in some instances. Cotton is a suitable filter media fiber.

Users of photo resists usually work with tanks of a few gallons up to 50 to 100 gallons. Filtration is often required on a constant recirculatory basis, but the batch basis is most common. Filtration on a continuous basis must be done in such a way as to prevent aeration of the liquid; or, bubbles causing misses on the surface of the circuit board will result. High RPM pumps sometimes generate heat if operated for too long a period, also causing deterioration of the photo resist. A system using a low RPM self-priming pump is most desirable. *Therefore, SERFILCO's photo resist filtration system includes a stainless steel filter chamber with a stainless steel gear pump driven by a low RPM explosion-proof motor.*

FILTRATION OF VARIOUS SOLUTIONS FOR ANODIZING

Solutions requiring continuous or periodic filtration are hot water or nickel acetate seals, bright dip, hard coat or the anodizing solution itself, and possibly some rinse and dye tanks.

USE PROPER FILTER TUBE

Filtration with 15 micron polypropylene or cotton filter tubes at flow rates providing at least twice per hour tank turnover should be used. Cleanable sleeves used with precoat and then backwashed if desired may be used in place of filter tubes.

WHEN TO USE CARBON

Carbon with filter aid may be used and also backwashed, but if severe discoloration of the nickel acetate or hot water seal takes place from the various dyes, it cannot be removed economically and the seal solution cannot be used indefinitely. A quick check of treatment feasibility may be made by adding one-half ounce (14g) of activated carbon to a one gallon sample after any given period of use. Filter the carbon from the solution in the laboratory and observe the color. If the seal is greenish black in color, it will very likely require over five pounds of carbon per hundred gallons, costing more than the replacement of the seal solution.

If no dyes are used, it is likely that the seal tank can be run with periodic make-up for a year or more. Usually, the agitation required can be provided by the pump used with the filter. Certain chemical additives, when added to a new seal tank, may load the filter requiring more frequent backwashing or cartridge change. This condition disappears after the solution is stabilized and balanced with use.

Generally, a separate filter should be used on each seal tank with at least one unit being portable. CPVC filter chambers, with either a magnetic seal-less or CPVC horizontal pump, can be selected according to the size of the tank. The latter should have a water lubricated seal to prolong seal life. A portable unit will also serve in a dual capacity as a transfer pump and, when needed, as filter for the anodizing and bright dip solutions, and possibly for the dye tanks.

NICKEL ACETATE SEAL APPLICATION DATA (AUTOMOTIVE AND AIRCRAFT)

Field data for this severely corrosive and high temperature (208-210°F) service indicates the average dirt load of dry solids to be removed to be on the order of .01% (100 ppm TSS) of the weight of the solution after 3 days of heavy operation (1 lb/1200 gallons). We recommend our Guardian and Sentry filter systems with the inclusion of the slurry tank with backwash piping and valves for several significant reasons:

1. The tank can be used to introduce sodium acetate to buffer the water in the seal tank to about pH 5.5, following which a nickel acetate solution of pH 3 can be prepared and added to the tank to prevent precipitation of the nickel at the time of introduction. The filter will remove any solids prior to their entering the seal tank.

2. The pressure gauge indicates the end of the filtration cycle due to solids loading of the depth tubes. The precoat tank is charged with 5-10% nitric acid to dissolve these solids, which consist of aluminum hydroxide, nickel hydroxide...carbonate or phosphate. This feature provides in-place cleaning in less than 1/2 hour and allows reuse of the filter tubes after water flushing.

3. This precoat tank will allow for precoating and carbon addition for organic or dye purification, if desired, since tank life is extended.

4. These filters offer flow rates of up to two tank turnovers per hour, and any floating scum is rapidly picked up before depositing on parts.

5. The tank can be used to prime the pump.

The SERFILCO Admiral series with in-tank pumps can also be recommended, but they do not incorporate the precoating and backwashing features of an external system. They do, however, provide strong rinse tank agitation, if this is important.

ANODIZING SOLUTION AND BRIGHT DIP

These solutions are generally not filtered on a constant basis although some filtration at fairly regular intervals would be helpful to both. Filtration can be accomplished at the time solution is transferred during tank inspection.

DICHROMATE APPLICATION DATA

With regard to the potassium dichromate filtration, the solids to be removed will be aluminum or nickel hydroxides and silica, due to the pH variations. The dirt load will usually be slight.

DYE SOLUTIONS

Continuous or intermittent filtration of these solutions will remove solids which may spot the parts being finished and require additional cleaning. Some dyes generate an insoluble breakdown product which can be removed by filtration.

HARD COAT SOLUTIONS

Because of the critical nature of the finish required, it is best to both agitate and filter the solution. An intake pump will do both efficiently.

DEIONIZED WATER

The incoming water for solution make-up or rinsing should be prefiltered to remove any solids before ion exchange treatment. Cities having average filtration plants will provide a water which should be filtered ahead of the deionizer with 5 to 10 micron range media. Other sources of water which contain larger amounts of solids should have a second filter, as a pre-filter to the one above, using 20, 30 or 50 micron media or an inline precoat backwash system may be employed. The ion exchange column may be added in series, since prefiltration will help to maintain the effectiveness of the resin by eliminating the sludge which would otherwise coat the surface of the resin.

PAINT SPRAY BOOTH SLUDGE DISPOSAL

PROBLEM
One of our customers makes heavy duty machine-tool cabinets, N/C tool handling storage carts, and work stations.

Even a small accumulation of such tools can add up to hundreds of thousands of dollars, so orderly storage of such valuables in expensive cabinetry is justified.

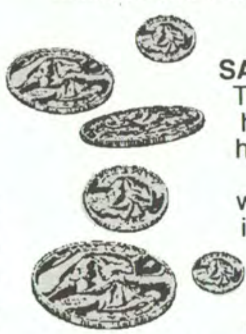
Our customer fabricates this equipment on a production basis. Then all parts are given a phosphate coating, sprayed with a bright enamel and the finish baked on as the parts are conveyed through an oven.

In this plant, management takes pride in product quality, good plant order and high employee morale. The plant is spacious and looks like a nice place to work.

Two Devilbiss, Dynaclean paint spray booths are used. Each booth has a 1500 gallon water tank installed in a pit directly under the booth. A grid covers the tank and a water curtain cascades down one side of the booth into the tank below. A series of baffles lies behind the curtain to trap any particles of paint which might get by the water curtain. This booth does a good job of retaining any overspray and vapors in the enclosure. A Pennwalt #PB-81 additive is used as a titrating agent and causes the particles to agglomerate and settle.

CLEAN-UP IS EXPENSIVE
The customer became concerned about the ever increasing costs for leaving the settled paint sludge in the tanks and the disposal costs for the drums of wet sludge, which were a fire hazard and had to be carted away by a scavenger. Many hours per month were devoted to tank cleaning for each booth. In addition, their scavenger charged them $75 per drum to cart away this very wet sludge.

SOLUTION
To filter the deadened paint from the tank, an overlfow weir was cut into the side of the reservoir and a SERFILCO Disposable Fabric Filter was placed next to it along with a sump pump so that when water was pumped from the filter back to the spray booth, it caused the floating paint to be carried on the surface to the overflow where it passed onto the filter to be picked up and allowed to dry. Continuous filtration is not necessary; therefore, a timer controls the pump to operate only 10 minutes each hour.

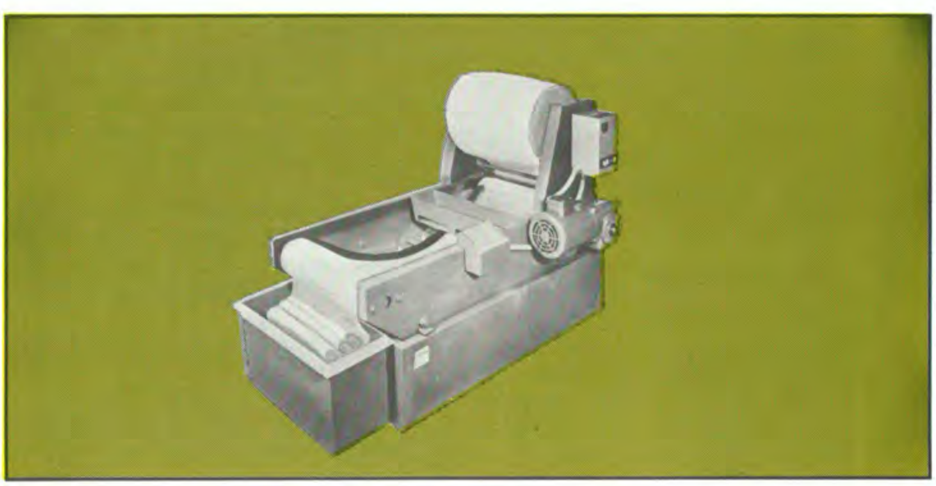


SAVINGS
The use of the filter has eliminated ten hours per month of booth cleaning which has resulted in a yearly savings of $4,742. In addition, the SERFILCO DF-Filter removes the equivalent of two drums per month of this sludge. The sludge coating on the fabric is no more than 1/32" thick and because it indexes infrequently, drops into the tote box as a sludge dry enough to be disposed of with the regular plant trash. It is eventually incinerated. The elimination of the need for special sludge handling has resulted in a savings of $1,800 per year.

THE USE OF ONE MODEL DF-11 FABRIC FILTER SAVES THIS CUSTOMER ABOUT $6,000 PER YEAR.
The Plant Engineer says that an intangible, but important, result is that far less time need be spent on an unpleasant cleaning task that no one likes to do - thus contributing to better employee morale.

The filter will do an even better job when jets are added for greater agitation to direct the floating paint sludge particles in the water tank to move onto the filter bed. The customer may be able to improve this aspect with a few piping changes.

The DF-11 Fabric Filter unit was operated for over one year and its performance carefully evaluated. Its outstanding performance and cost savings has warranted the purchase of a second unit for the other spray booth which has already been ordered.



WASTE TREATMENT OF GALVANIZING FLUX MINIMIZED

Hot dip galvanizing of steel parts or wire is improved by pretreating: by dipping the steel surface in a flux containing zinc chloride and ammonia, then dried in a furnace. However, in order for the flux to be active, it must contain a small amount of ferrous iron (2-4 grams/liter). the amount of ferrous iron will gradually increase from the work being processed and therefore, any excess must be removed by oxidation with hydrogen peroxide. The resulting sludge of Fe (OH_3) must be removed from the solution in order to keep it useable.

One method which was used in the past was that of decanting, but the sludge contained up to 98% liquid and 24 gallons of useable solution were lost for every 25 gallons of settled sludge. Because of the high price of salts, a method of separation had to be chosen which would achieve the greatest amount of useable liquid and minimize waste treatment.

Filtration through 15 micron filter tubes was chosen initially because their larger dirt holding capacity made them more economical to use than settling and decanting the flux. 5 micron media has proven to be more effective.

Two filter systems employing 24 cartridge chambers and flow rates at 2,400 GPH, have been working 8 hours per day for 7 years without problems other than the periodic changing of the filter media.

The filters are being used where fluxing of iron wire is being done in 800 gallon tanks. The dirt holding capacity and flow rates are sufficient because the amount of iron hydroxide released from the wire is relatively small. However, when fluxing pieces which contain large surface areas, such as guard rails or tanks used for electric water heaters, a larger filter would have to be used since the amount of iron hydroxide being released would be significantly greater.

It should be noted that the filtration also improves the adhesion of the zinc coat in the galvanizing process.

FILTRATION OF WATER

WHY PRE-FILTRATION IS IMPORTANT

"Clean" water is an essential raw material for any plating or anodizing process.

Water from natural sources such as a well, lake, etc., probably needs softening for calcium removal or carbon treatment for the reduction of organic impurities. Certain applications require the water be essentially free from all ions. This can be accomplished with ion exchange.

Softening, carbon purification, or ion exchange equipment are not basically filters in themselves, although they sometimes function as such. Each will operate to its maximum efficiency only if the water is filtered first, so as to be free of solids, usually with 15 micron media. Otherwise, solids will coat over the resin in a softener or ion exchange bed and also the carbon, in a purification unit, preventing efficient adsorption. Following these units, trap filters of 1 or 3 micron density are recom mended to prevent migration of resin or carbon media.

The quality of water required will vary depending upon its ultimate use, either makeup water for an electroplating solution or for rinsing. Solids entering the plating tank with the makeup water may amount to only 5% of the total to be filtered, but if they are removed at the source, it will be easier to service a water filter than a plating filter. It is also easier to replace the filter media in the prefilter to a deionizer than it is to regenerate and wash the resin bed.

Filtration is especially important in the reverse osmosis process, since solids will plug the pores in the membrane and decrease its efficiency.

CONSERVE WATER . . . SAVE MONEY

Since the cost of water is continually rising, its efficient use is of increasing importance. This is also necessary in order to conserve our limited water resources. Considerable reduction in rinse water volume can be achieved with multiple counter-current flow rinse tanks, spray rinsing of parts and longer draining time of plating barrels. Conductivity meters can monitor and automatically control the dissolved solids concentration in rinse tank by means of a signal to a solenoid valve on the water inlet. The reuse of water is also feasible with ion exchange or reverse osmosis treatment, which removes contaminants. In order to operate efficiently, these processes require filtered water free of solids.

SIMPLE TO ACCOMPLISH

Filtration of either inline water supplies or recirculatory systems may be accomplished with depth type cotton cartridges providing particle retention from 100 down to 1 micron, or throwaway cartridges of the surface type which are offered in absolute ratings of .25 to 1 micron. Precoat filters which can be manually cleaned or backwashed are also suitable for this purpose. The choice of filter is usually dependent upon the amount of solids, the particle retention desired, available space and initial investment considerations.

Filter chambers from 1 to 445 cartridges in size are available in both non-metallic and metallic construction. Pressure requirements will vary from 30 to 60 psi for inline applications, or where pumps are used for recirculation of water from tanks.

SERFILCO manufactures all plastic (non-metal contact) pumps which provide adequate pressure to achieve the flow through the filter on an economical basis before servicing of the filter is required. Generally 1 cartridge per 5 GPM flow is adequate; however, for most well water, 2 or 3 GPM are recommended.

IMPROVE QUALITY- PREVENT PARTS REJECTS

Filtration can prevent spotting of parts when deionized water is used for final rinsing after anodizing or plating. Another filtration application prevents spray nozzles from plugging up and causing a distorted spray. Even water used for flushing pump seals should be filtered to prevent gritty particles from causing premature packing or seal failure and leakage of the solution being pumped. Water used in cooling towers or in spray booths are other frequent applications. All water used in industrial processes should be filtered to prevent clogging of control parts, which can disrupt operation of the entire system.

FILTRATION OF CLEANERS AND ACIDS

Alkaline soak and electro-cleaners are formulated to remove dirt and soil of all kinds from metal surfaces. They accumulate considerable amounts of solids and organic contaminants. With a heavy dirt load, continuous or periodic filtration with coarse (50+ micron) cartridges is recommended; but, removal of floating scum by skimming is definitely necessary in order to avoid resoiling of parts when they are lifted out of the cleaning tank.

Sedimentation of sludge over a weekend and then decantation of the cleaner will reduce insoluble dirt appreciably. Greasy, oily or painted parts should first be vapor degreased to reduce the organic drag-in as much as possible. Most waxes and buffing compounds are removed by good soak cleaning. Depending on work load, some tank cleaners can be used from several months to a year, provided the solutions are periodically analyzed and replenished.

FILTRATION CUTS COST

Most acid etches and pickles are generally not filtered, the insoluble matter is allowed to settle. However, with filtration, the life of acid solutions can be greatly prolonged. Appreciable reduction, not only in chemical costs, but also in the waste treatment required when acid dumping, is effected. It is most important to remove all oil floating on the surface and periodic carbon treatment may be necessary.

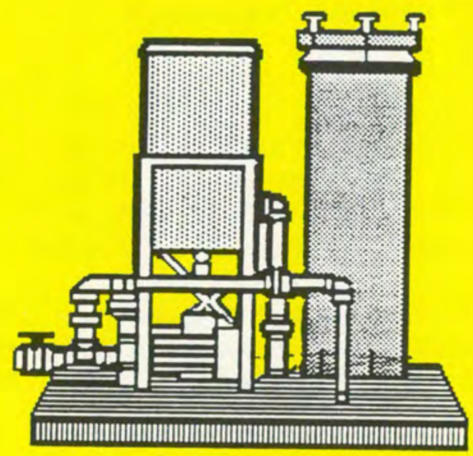
TI-CADMIUM PLATING SOLUTION

FILTRATION and TITANIUM ADDITION

Proprietary Ti-Cad solutions are used in the aircraft and other industries requiring cadmium deposits with superior corrosion resistance properties on high strength steel parts.

A SERFILCO filtration system is available for plating tanks of virtually any size. Suitable materials of construction include polypropylene, CPVC and PVC unplasticized PVC vessels; Teflon and neoprene "O" rings and seals.

The bath is usually operated at room temperature and a relatively light dirt load can be expected because of good cleaning of the parts and the nature of the bath. Tank turnovers of 1-2 times per hour are recommended.



MEDIA REQUIREMENT
A special requirement of this bath is a larger than usual surface area in the filter, since the filter media must be precoated. A mixture of titanium paste and filter aid is recirculated from the slurry tank into the filter. Hydrogen peroxide is added periodically to dissolve the titanium as required.

A general rule of thumb which is being used in the industry, is that one pound of titanium paste is used with one pound of a coarse filter aid such as #545 Johns-Manville or #FW60 Eagle Pitcher. The above amounts would be applicable to 10 sq. ft. of filter area. Since six pounds of paste are needed for each 1,000 gallons of solution, 60 sq. ft. filter surface would be required for a 1,000 gallon bath, and others are sized proportionately.

PREPARATION
Prepare a mixture containing 1 pound TITAN PASTE, 5 fluid ounces 35% hydrogen peroxide, and 2 ounces sodium hydroxide to 1 gallon of deionized water. Blend thoroughly, and allow to age overnight, or for a minimum of 8 hours, (slurry should be covered to prevent contamination, but must be vented to allow escape of gases). Adhere to this mixture ratio for initial charge of the filters, and all subsequent additions required. The initial charging of the filter should allow at least 1 pound of TITAN PASTE per 10 sq. ft. of filtration area.

Each gallon of TITANIUM STOCK SOLUTION should be mixed thoroughly with 32 to 48 ounces of filter aid, and slowly added through the filter slurry tank. For the original charge of a new bath, an additional quantity of 5 fluid ounces of hydrogen peroxide per 100 gallons of solution should be stirred directly into the plating bath to assist in initial build-up of titanium content.

Note: This hydrogen peroxide addition is not necessary with subsequent additions of TITANIUM STOCK SOLUTION to the filter cake.
For safety's sake, it is suggested that the vent valve back to the slurry tank should be left in a slightly open position, which would automatically release any gases which might be formed during the addition of the hydrogen peroxide.

OPERATIONAL PROCEDURE
Once the filter is precoated, it will usually operate for months with only periodic hydrogen peroxide addition to bring the titanium up to its required level in the solution. After the titanium paste has been depleted, the filter is cleaned and a new cake of filter aid and paste prepared.

The filter should be set up for constant operation and could be maintained with recirculation on the slurry tank if the operator does not wish to recirculate on the plating tank. This will provide constant pressure across the filter media and prevent the cake from falling.

FILTRATION OF ZINC AND IRON PHOSPHATING SOLUTIONS

DESCRIPTION

Phosphating is the treatment of bare steel which produces a clean surface, ideally suited for the further surface coating of paint or other materials.

Phosphate coatings may be either zinc, iron or manganese phosphate in a phosphoric acid solution with suitable accelerators. During the process the reactive metal is immersed (or sprayed) in the metal phosphate phosphoric acid bath, iron is dissolved at the surface and a phosphate coating is precipitated, which is a protective coating as well as a base for further coating.

Chlorate accelerated baths have a high sludging tendency while nitrate accelerated baths have a medium to low sludging tendency.

PROBLEM

The operation of these baths requires even application of solution and good chemical control. Lack of sludge removal results in poor quality and lost production in maintenance. The sludges generated do not harm the phosphate process as such, but are detrimental to operations at elevated temperatures. These sludges tend to foul and plug heat exchangers, circulating pumps, strainers, spray nozzles etc., and must be periodically removed.

SOLUTION

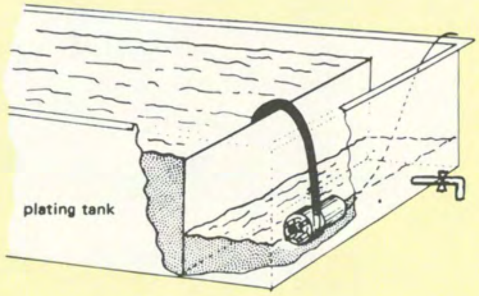
SERFILCO offers a disposable fabric filtration system for continuous removal of the sludges with automatic indexing of the media as required for "un-attended" operation, reducing or eliminating down time for maintenance and cleaning and facilitating chemical control of the bath.

Zinc phosphate baths require acid resistant materials, such as 316 SS, and tend to generate more sludge than the iron phosphate bath which can be handled with carbon steel and cast iron. Two or more tank turn overs per day using medium porosity media (25-40 micron) has proved effective. Tapered bottom phosphate tanks aid in conveying the sludge to the pump. Either in-tank or out-of-tank pumps may be used to transfer the sludge laden solution to the filter. Filtrate may be returned to the tank by gravity or a return pump in the filter reservoir.

SUBMERSIBLE MAGNETIC COUPLED PUMP APPLICATIONS

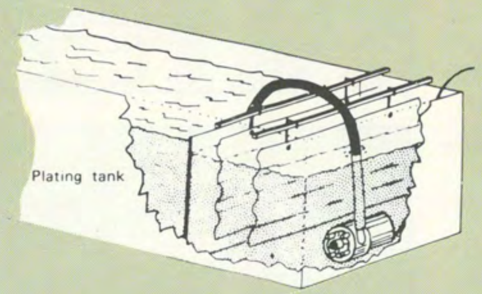
SKIM-CLEANER FOR PLATING TANKS

SERFILCO series AS Submersible Pump is placed on bottom of the tank (1) separated from main tank by a weir, or in an auxiliary (2) tank placed next to the main tank. An overflow pipe is provided to direct solution to the auxiliary tank. This type of layout would be ideal for skimming electroplating tanks. This is especially adaptable for zinc or cleaning solutions where the scum is stored in the auxiliary tank until dumped.



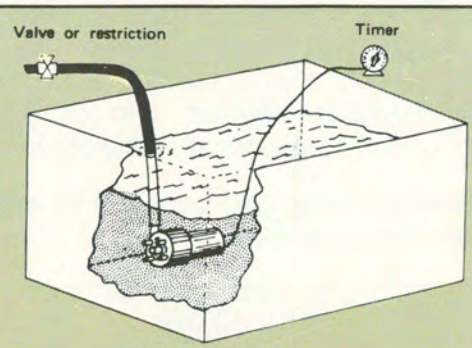
RECIRCULATE ELECTROPLATING SOLUTIONS

The SERFILCO Submersible Pump can be used to recirculate nickel electroplating solution through a dummy tank by placing the pump and motor in the main nickel tank and overflow from the dummy tank back to the plating tank. (See page 62)



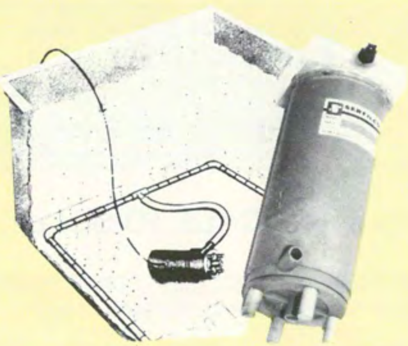
TIMED TRANSFER SYSTEM

SERFILCO Submersible Pump may be used as a chemical feeder.



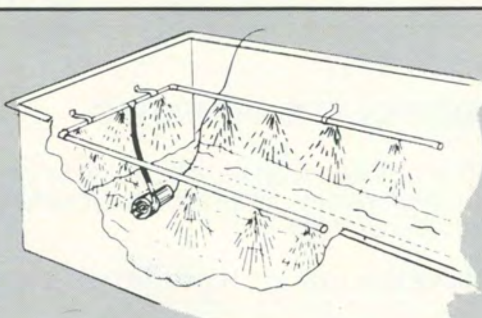
IN-TANK DISPERSION SYSTEM

SERFILCO Submersible Pump may be placed on bottom of tank and connected with a hose to a pipe dispersion system.



SPRAY WASHER

The SERFILCO Submersible Pump may be used as simple spray washer.

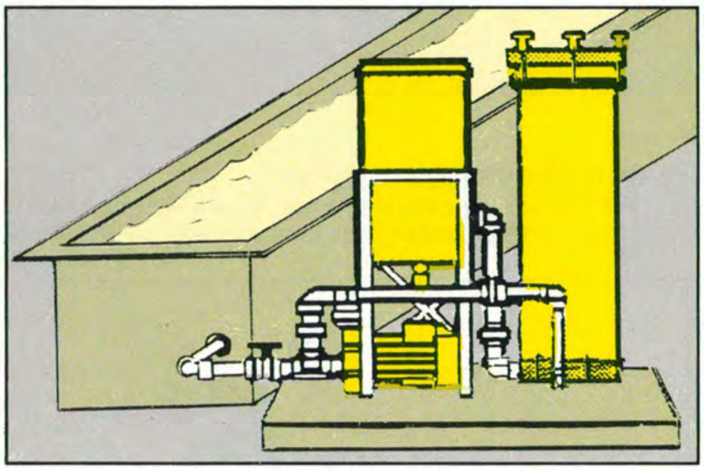


WHEN IS A SLURRY TANK *<u>NOT</u> A SLURRY TANK?*

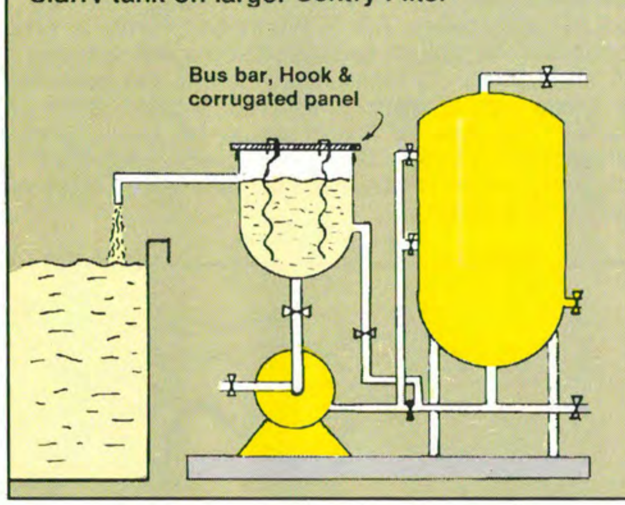
Useful applications for your slurry tank on your filtration system

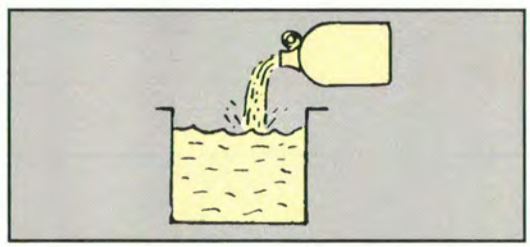
The basic purpose of a slurry tank is to provide a convenient way of adding filter aid (precoating) to a filter support membrane and to provide the means of adding additional filter aid and carbon from day to day as required. Smooth precoating requires the use of necessary shut-off valves.

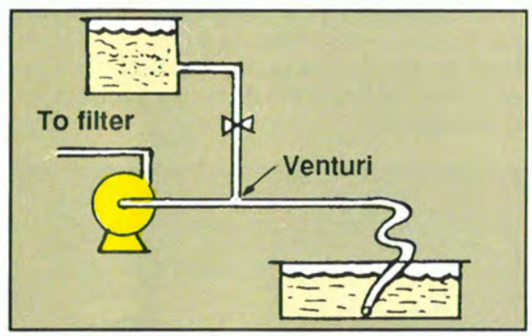
But **-- a slurry tank can be used to serve other functions as well.**

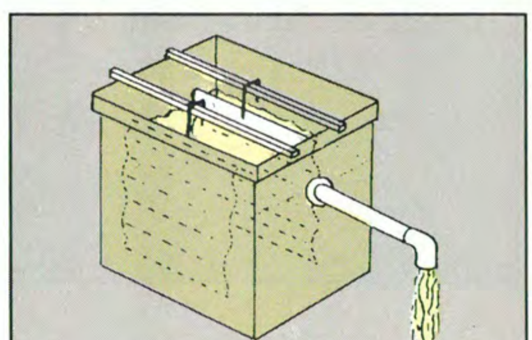


Slurrv tank on larger Sentry Filter









1. ADDING CHEMICALS TO SOLUTIONS

Chemical additions to the solutions can be made directly through the filter by placing the chemicals in the slurry tank first.

2. PUMP PRIMING

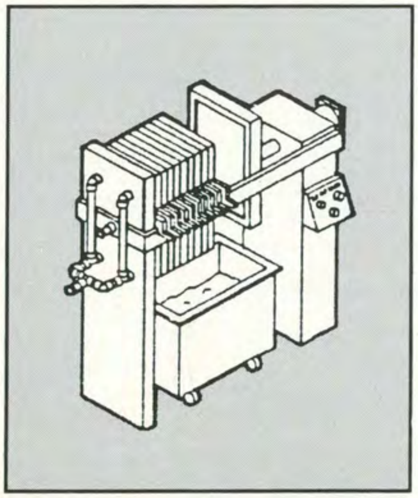
Pumps can be primed by first recirculating solution from the slurry tank to the pump -- and then back again to the slurry tank. A venturi is set up on the suction side of the pump which will remove the air from long lengths of suction hose. This, in a sense, makes the pump self-priming (see Operating Instructions on Guardian and other large filter systems).

3. ELECTROLYTIC DUMMYING

A small flow of solution can be recirculated by way of the slurry tank. Plating at low current densities can be accomplished by placing corrugated or other objects in the slurry tank.

A simple overflow pipe and bulkhead fittings can be attached to any slurry tank (if higher than plating surface) to make the flow self-regulating when overnight operation is used.

FILTRATION OF PLATING AND OTHER INDUSTRIAL WASTE



SLUDGE DEWATERING

The most common device used to dewater concentrated sludge is the ***Recessed Plate Filter Press.*** All non-metallic solution contact is preferred. Center feed and four corner discharge and blow-down manifold is a basic configuration. Smaller units of a few cubic feed capacity are available with a manual hydraulic system. Larger units incorporate a semi-automatic hydraulic opening and closing system along with semi-automatic plate shifter. Sludge volume reductions of over 95% can be achieved.

SERFILCO -

Protector of the industry

FINAL EFFLUENT CLARIFICATION

Many waste treatment systems designed in the past are not meeting today's standards. Because of increased loading or stricter requirements, a final polishing filter is required on the clarifier discharge.

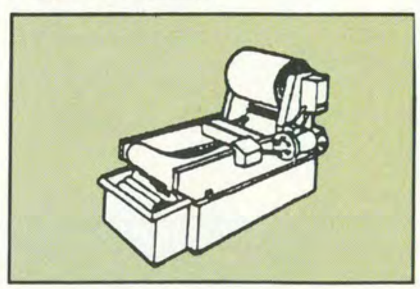
The ***Sentinel 'BWM'* Filter** offers an efficient automatic method of polishing this stream. The unique upflow design com-

bined with a cross flow backwash cycle that utilizes unfiltered water from the clarifier has many advantages over traditional methods. No source of clean water for backwashing is required; therefore, the clarifier discharge flow is not interrupted during backwash. The system has the capacity for submicron filtration, and it is completely automatic, reusing the permanent filter media.

COOLANT CLARIFICATION

A Cartridge/Bag Filtration System consisting of a tank with hanging, washable primary bags and a chamber with a disposable final trap filter removes all particular matter from water used for cleaning of printed circuit boards.

Other types of cleaning operations, parts washers or water wall spray booths, cooling towers, polishing and deburring operations and grinders can be clarified with an ***Automatic Disposable Fabric Filter.***

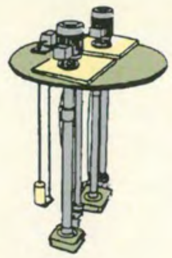


CHEMICAL DESTRUCT WASTE TREATMENT

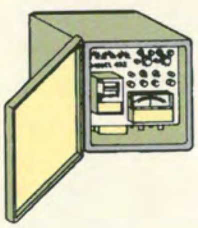
With the stringent discharge requirements and the need to minimize sludge, many waste treatment systems will need to be updated. Serfilco offers many items to help meet these standards for either small batch treatment or continuous systems. The chemistry and therefore the instrumentation for these systems are similar, be it simple pH adjustment and flocculation for cleaners or two-step cyanide destruct and chrome reduction systems.

AUXILIARY EQUIPMENT

VERTICAL PUMPS -
PUMP STATIONS - Single and duplex for tanks and sumps designed to accommodate a variety of chemical handling, transferring and waste treat applications.



pH/ORP MONITOR - CONTROLLER - RECORDER -



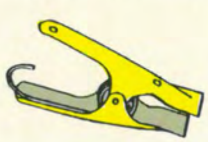
Used to identify level of pH in waste streams and record same for purposes of meeting federal or local requirements. Controllers activate chemical metering pumps to maintain pH limits for plating solution or waste treat.

"DRI-STOP"
PRESSURE SENSING SWITCHES -
Sense either pressure or pressure drop for chemical and water duty to protect pumps and pump seal systems.

HEATERS -
To elevate and maintain solution temperatures. Heaters are quartz, steel or stainless steel. Heat exchangers are TFE.

PIPE AND HOSE ADAPTERS -
Injection molded CPVC and PVDF available as straight or elbow. 'O' ring seal to assure leak-free operation.

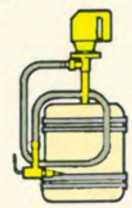
STAINLESS STEEL SPRING CLAMPS -



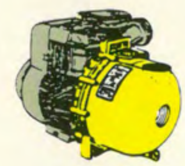
Useful, especially in chrome plating to hold the rack to the bus bar to make certain that constant contact is made at all times. Also for holding PC boards to racks. Spring clamps also available with hose clamp for securing hoses to the tank.

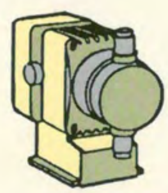
POLYPROPYLENE BALLS -
Reduce heat loss and fuel costs for heated tanks or fume emission.
Available for use in plating tanks, hot cleaners, hot rinses, anodizing seal, etc.

FOR DRUMS, CARBOYS & BARRELS -
Manual syphon; hand lever, double acting piston or rotary gear, and centrifugal pumps with electric or air driven motors.



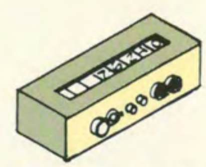
PUMPS -
Portable standby for emergency pump-out, self-priming, horizontal.



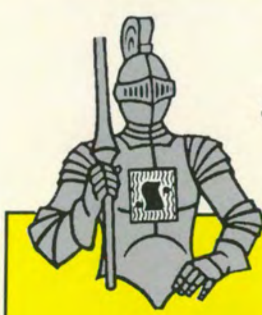


METERING PUMPS -
For chemical addition to cleaners, plating solutions, waste treatment; continuous injection or operate from an ampere-hour or ph controller.

BRIGHTENER FEEDER
Used to replenish chemicals or brighteners which are depleted during the plating process.



Replenishes exactly at the time of consumption. Automatically adjusts to varying load size and plating current. Is capable of adding one or two chemicals simultaneously, but in different proportions.



SERFILCO always brings you:

Top Quality -

Superb Craftsmanship -

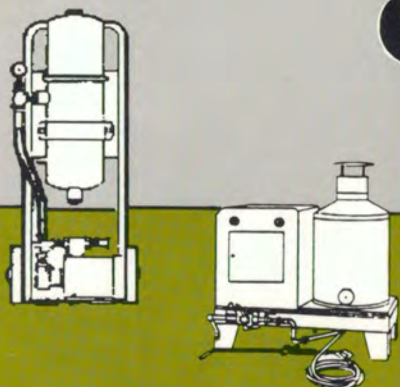
&

SERVICE - before & after the sale!

Request these additional catalogs from SIR FILCO

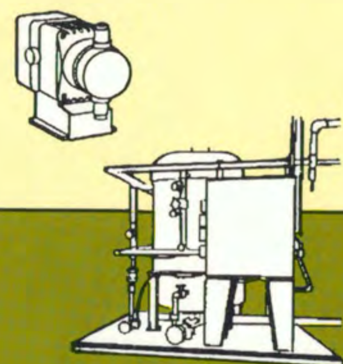
PLANT MAINTENANCE

Catalog will cover compressed air filters and dryers, coalescers for water/oil separation, cleaning equipment; featuring pressure, steam or chemicals. Filtration systems of pressure or gravity type and cartridges for petroleum products, blowers for liquid agitation and mixers.



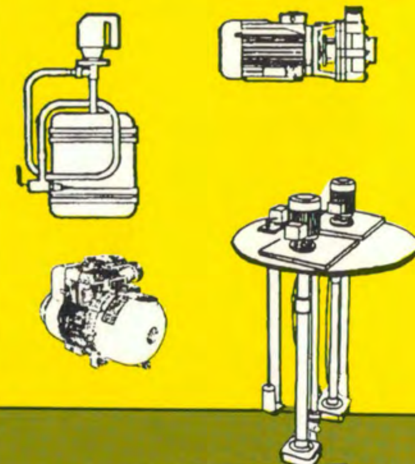
& WASTE TREATMENT

Covers instrumentation to control, record or monitor pH or conductivity for the purpose of adjusting or neutralizing; also includes flow control instruments, mixers, pump stations and filter presses for solids compaction and drying and final effluent trap filtration.



PUMPS

Vertical or Horizontal - centrifugal, piston, peristaltic, diaphragm - for transfer, metering, spraying, filtering or drum dispensing.

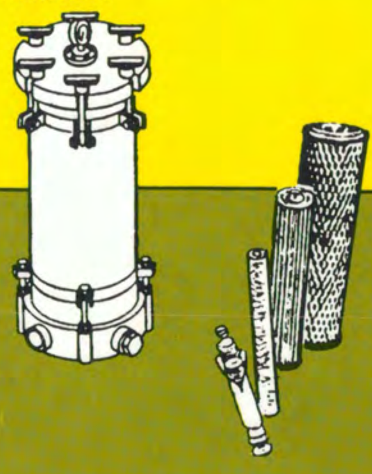


FILTRATION SYSTEMS

For alkaline or acid solutions used for chemical, electroplating, pharmaceutical, food products, etc.

FILTRATION CHAMBERS & MEDIA

Chambers of steel, stainless steel, rubber lined or molded and fabricated of various engineering plastics . . . . . for straining with bags, carbon for purification, or other media, including string wound depth, pleated paper or membrane for nominal to sub-micron absolute particle retention.



SERFILCO®, LTD.

1234 Depot Street
Glenview, IL 60025 U.S.A.
312/998-9300
800-323-5431
FAX NO.: 312-998-8929 Telex: 289557 SERFC UR

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