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BASIC CONSIDERATIONS WHEN SELECTING PUMPS & FILTERS

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Platers and metal finishers have unique requirements, as compared to the average user of pumps and filtration equipment. The solutions they use are toxic, precious, expensive, and corrosive, or all of the above. So, a certain amount of thought goes into the specification of each component used in the plating and metal finishing industries.

There are many personalities involved in the selection of pumps and filters, and each person has individual concerns and requirements leading to the purchase. However, since each individual may have a different opinion about the application, let alone the equipment to be selected, it is important to consider all of the concerns.

THE FACILITIES MANAGER'S CONCERNS:

His questions usually are:

- What are the utility requirements, i.e. amp draw of the motors, voltage requirements, power consumption?
- Shop air requirement at SCFM or PSI
- Dimensions of the equipment, LxWxH or footprint

THE MAINTENANCE MANAGER'S CONCERNS:

The Maintenance Manager must select a suitable location to install the pumps and equipment so that sufficient room is available to work on the components, when repair becomes necessary.

His questions in general usually are:

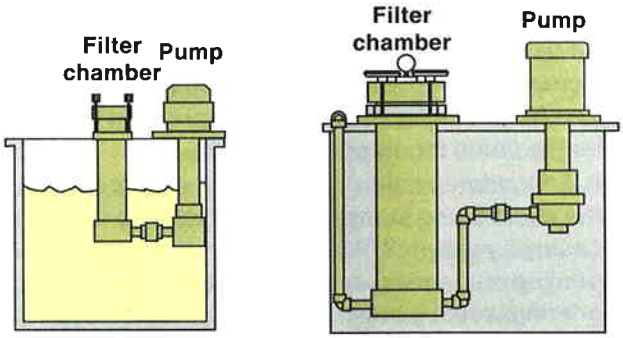
- What is required for a proper installation?
- In addition to the item purchased, what components, such as pipe, fittings, valves, electrical components, starter, switches etc. are needed to install the equipment?

His questions relating to pumps are:

- What type of pump is best for the particular application?
- Will the pumps be mounted in-tank or outside the tank?

  If in-tank vertical pumps,
  - How will the chemicals and fumes affect the motors?
  - Will the coating on the motors withstand the harsh environment without peeling, or will the paint fall off the motors into the solution and contaminate it?
  - Will the motor bearings hold up? Are the bearings sealed or unsealed, and what service is required for them?
  - What is the service factor of the motors?
  - Are they insulated for chemical duty?
  - Will the pumps introduce air into the solution?
- Are drip shields for the motors available?
- Are all wet end components compatible with each constituent of the chemical being pumped?
- Can the pump run dry without damage?
- In electroless plating where the metal has a tendency to plate out and deposit on plastic, can the wet end components of the pump withstand the effects of the stripping solution without damage?
- What temperature range will the pump withstand without damage?
- What are the PSI to temperature ratios the pump will operate under?
- Will the pump run against a "dead head" or closed discharge without damage? If so, how long? Will the internal components warp under heat?

TYPICAL VERTICAL PUMP INSTALLATIONS



For vertical pumps *(mounted outside the tank)*

- Will the liquid being pumped be kept in the pump column, or will it pump up the column when under a closed discharge?
- Does the pump have a vapor seal at the mounting plate to protect the motor bearing from corrosive fumes?

- Does the pump come with a compatible motor starter, and if not, what is required?
- What spare parts should be kept in inventory for emergencies?
- Are there any parts susceptible to wear, and what preventative maintenance is required to keep the pump running at optimum performance?

- When repairs are necessary, can the pump be removed and repaired in the shop, or does it need to be shipped back to the factory for repair?
- Are there any factory authorized dealers in the area knowledgeable enough to service the pump, if needed?
- What are the return authorization procedures when needing to return the pump to the factory for repair?
- What is the length of warranty of the pump and components, and what is or isn't covered?
- Are there any special tools required for disassembly and repair of the pump?
- Are a parts list and owner's manual with operating instructions provided with the pump?

If out-of-tank horizontal pumps,

In addition to most of the above vertical pump concerns, there are further concerns relating to out-of-tank pumps:

The horizontal pump might be a Magnetic Driven Seal-less Centrifugal pump, a Direct Drive Single or Double Seal Centrifugal pump, a Self-Priming Centrifugal pump, an Air-Diaphragm pump, or any number of positive displacement or other types of pumps.

Of course, each of these pumps present different concerns for the Maintenance Manager in addition to the concerns presented by the in-tank pumps. The list sometimes seems "endless", but each concern is legitimate, and must be answered in order to arrive at a successful installation:

- What are the NPSH (Net Positive Suction Head) factors of the pump and particular application involved? The NPSH factor needs to be addressed for every single pump mounted out-of-tank.
- Is a "flooded suction" to the pump available? If so, is the liquid being pumped or introduced to the suction casing by gravity? With flooded suction available, priming is unnecessary. If not available, either manual priming would be necessary, or a priming chamber would need to be considered.
- Can the pump handle abrasives or be run dry? If so, for how long?

The MAGNETIC DRIVEN SEAL-LESS pump might be considered if the solution were a precious metal solution, or had a fairly low specific gravity of 1.4 or lower or the impeller was trimmed to handle the specific gravity. Magnetic driven pumps totally isolate the process solution. Since they do not have mechanical seals, packing rings or shaft lip seals, they are referred to as seal-less or leak proof. This added measure of safety could reduce environmental concerns and help the user stay within EPA regulations. However, magnetic driven pumps should never be used with electroless plating solutions or cleaners containing ferrous metal fines because the particles will adhere to the magnet and act like a grinding wheel to eventually destroy the pump.

The MECHANICAL SEALED pump with a single mechanical seal might be considered if the solution pumped is not extremely toxic or contaminated with abrasives, and where slight leakage due to wear or failure of the seal would not present a problem. If temperatures above 140°F. are anticipated, or where abrasives in the solution might cause problems, the double water flushed seal should be considered in order to cool and flush the abrasives off the face of the process seal to prevent premature failure of the seal.

PUMPS WITH PRIMING CHAMBERS are effective when piping from the process tank is plumbed over the side of the tank, and gravity does not introduce liquid to the suction of the pump. If the pump were to be mounted higher than the liquid level in the tank, caution would need to be exercised and the "NPSH" would need to be calculated and applied. Pumps with priming chambers require priming only at initial start-up.

AIR DIAPHRAGM pumps are usually the choice for waste treatment to pump heavy or abrasive sludges such as from a sludge thickener through a filter press. These pumps may be used whenever NPSH calculations reveal a shortcoming for centrifugal pumps. With air, the Maintenance Manager's additional concerns might be:

- Is sufficient shop air available to operate the pumps, or is the additional purchase of an air compressor required?
- Would the pumps need oil lubrication for the ball check valves? If so, are the oil lubrication components standard with the pump, or do they need to be pur chased separately?
- What noise levels are expected by the pulsation of the pump, and is a muffler included with the pump?
- Are pulsation dampeners required on either the pump inlet or discharge plumbing in order to reduce vibration to prevent cracking or loosening hard plumbing? If so, are they included with the pump purchase, or do they need to be purchased separately?

POSITIVE DISPLACEMENT pumps, such as peristaltic, gear or metering pumps, involve most of the prior mentioned considerations and the addition of by-pass pressure relief valves may be required on the discharge of the pumps.

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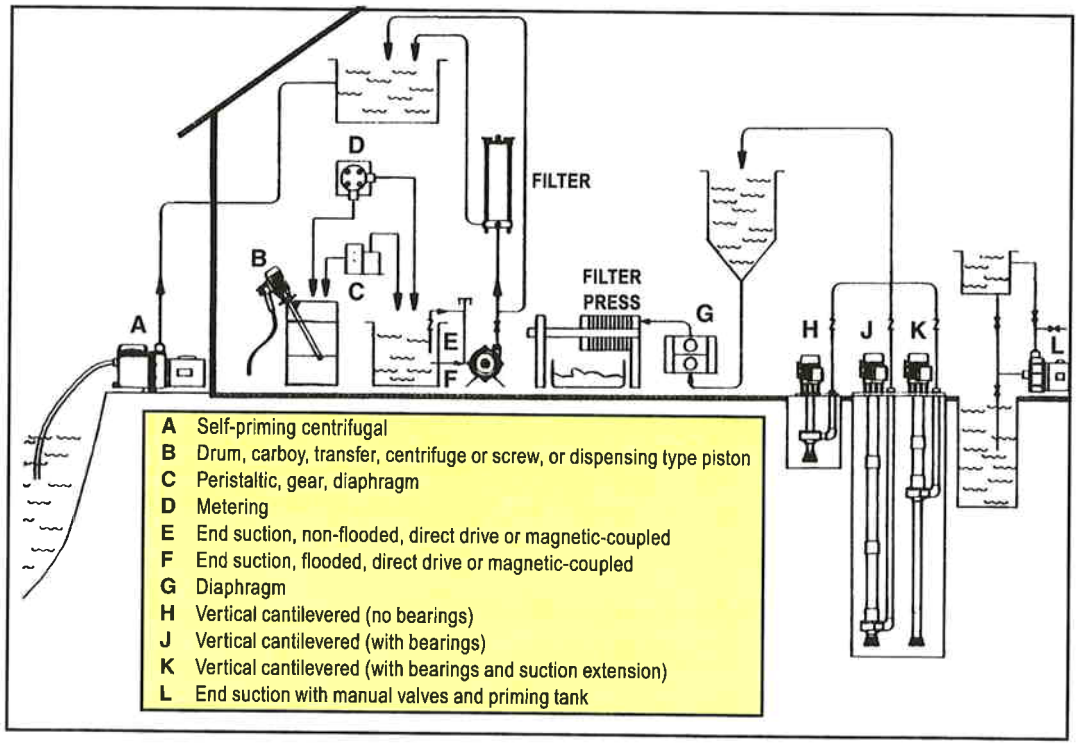
TYPICAL PUMP APPLICATIONS

Many different types of pumps with a wide range of flow rates and discharge pressures are available to meet the requirements of various applications. In order to achieve the desired flow and pressure, all considerations should be made to determine the minimum required TDH of the pump, which includes the vertical suction lift and the friction loss incurred between the pump suction and discharge destination. These losses should include losses incurred from length of pipe line, fittings, valves and any other possible impediment in the line, plus the desired discharge pressure.

Inlet and outlet port sizes of the pump selected do not necessarily indicate the actual size of either the suction or discharge piping.

The use of properly selected values to maintain pump prime and control flow and pressure is critical to any pumping system. In order to prevent backsiphoning, loss of solution or loss of prime, check valves should be utilized and consideration must be given to ensure that the pump will be capable of developing adequate pressure to open the check valve at time of start-up. A globe valve, ball valve or plug valve should be installed on the discharge line directly after the pump discharge nozzle. (Gate valves are not recommended to throttle or regulate flow.)

When specific gravities higher than 1.0 are encountered, oversized motors are required.



Reference E in the above illustration indicates that the horizontal pump would have to be manually primed at least the first time used, and a foot valve (check valve) should be used on the suction side of the pump to maintain prime when the pump is not operating.

The illustration also indicates the employment of three different length vertical pumps, the shortest of which will generally be considered to be the most dependable. The slightly longer pump with a suction extension could continue to lift the liquid, provided the level is slightly above the suction strainer (flooded suction). If the pump was shut off and the liquid level falls below the pump and suction strainer, it would lose its suction or prime and the pump would then require priming or a flooded suction. Therefore, use of the very longest pump may be required under certain conditions, particularly when it would be necessary to pump at any given time from any level within the reservoir.

If the installation requires constant pumping or pumping upon demand, it is recommended that standby pumps are included in the installation. If the desired flow rate reaches its peak only occasionally, then it might be possible to use a smaller pump with the second being energized only when required. In such an instance, a third pump might be suggested to make absolutely certain that two of the three pumps are available at any one time.

PUMP APPLICATION FORM

To help select the proper pump, gather as many application details as possible.

CAPACITY AND SPEED

Capacity required _____ U.S. gallons per minute.

Operating speed _____ revolutions per minute.

Is service continuous or intermittent? _____

If intermittent, please explain _____

_____

Is there a filter system? _____ Average flow required _____ U.S. GPM _____

LIQUID PUMPED

Type and concentration _____ pH _____ Pumping temperature _____

Viscosity at 70°F _____ at 100°F _____ at 210°F _____

Specific gravity _____ or weight per U.S. gallon _____

Are solids or abrasives present? If so, please explain _____

_____

DISCHARGE PRESSURE (if any)

Pounds per square inch _____ or _____ foot head

Constant or varying? _____ if varying, explain _____

_____

Vertical distance from center line of pump to highest discharge outlet _____

Pipe size _____ I.D. Total length of discharge line _____

Number of elbows _____ 90°; _____ 45°; Other units _____

Is there a heat exchanger? _____ Pressure drop _____ PSI _____

Type of filter system _____ Average pressure drop _____ PSI.

SUCTION LINE

Vertical distance from center line of pump to surface of liquid supply _____ Pipe size _____ I.D

Total suction line length _____ No. of elbows _____ 90°; _____ 45°; _____ other

Is there a strainer? _____ Type _____ size _____

NPSH available _____ feet.

POWER UNIT

To be furnished by our company _____; furnished by our supplier _____

_____

Specify prime mover (electric motor, gas engine, etc.) _____

_____ Horsepower developed _____ and other characteristics _____

Electric motor: Make _____, HP _____, RPM _____

Phase _____, Hertz _____, Volts _____, Motor enclosure _____

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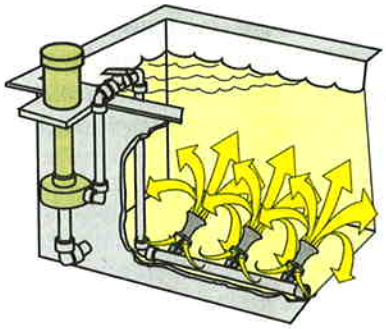
THE PROCESS ENGINEER or CHEMIST'S CONCERNS:

- Will the chemistry or operation characteristics of the process be changed by the operation of the pump, filtration, or agitation system? If so, in what ways? Will the removal of particles from the solution by a filter result in a deposit that is smoother and without roughness?
- Will any of the pumps introduce air into the solutions which may adhere to the flat surfaces of parts being plated? For example, parts such as printed circuit boards may experience "mouse bites" as a result of tiny air bubbles sticking to the surface. (This is a common concern in the printed circuit board industry. The problem is being resolved by using in-tank pump agitation as a replacement for low pressure air blowers.)



Typical solution flow patterns using eductor agitation.

- Will increased flow of the solution give better throwing power in the low current density areas of the parts being plated?
- Can plating time be reduced and higher production achieved without burning the high current density areas as a result of increased agitation of the pumped solution?
- Will stratification or "dead spots" in any area of the process tank be reduced, and particles swept off the tank bottom by the agitation? Will particles be kept off the "shelves" of parts being plated due to the increased agitation and filtration of the solution?
- Will more or fewer brighteners or chemical additions be required by the increased agitation?
- If anode bags are used to cover the metal anodes, or curtains or drapes are installed in front of the anodes, will there be any detrimental effect on the finish due to particles being forced by the pump agitation through the bags or curtains and into the solution? Or will the filtration rate be sufficient to remove them before they cause roughness on the plated parts? (A turnover rate of 10 to 20 times per hour may be required to achieve the speed of particle removal necessary to prevent this condition from occuring.)

In a nutshell, the Process Engineer or Chemist desires IMPROVEMENT in his process by the addition of pump or filtration equipment. Otherwise, he doesn't want, or need it!

THE PLATING TECHNICIAN or PLATER'S CONCERNS:

- The main concern is: Are the pumps, filters, plumbing, valves, agitation eductors, or any of the other components such as hoses, etc. in his way? The rack, hook, fixture, or barrel load of parts to be plated must be able to be loaded and unloaded without any obstruction.
- The anodes must not be shaded with added equipment in front of them that will decrease the exchange of positive/negative ions interacting in the bath.
- If internal or external auxiliary anodes are needed on occasion, there must be room for immediate insertion and removal, as required, without being obstructed by the pump or filter components.
- Would the pump suction or discharge interfere with the parts being plated in any way by the turbulence of either the suction or discharge of the pump? Could the parts be sucked off the rack or blown off?

The Plater's concerns are that none of the pump or filtration components should add increased labor to his plating process. Assuming production is his responsibility, he does not want to lose tank space to bulky or misplaced components added to the tank and placed in his way!

THE SHOP OWNER, CEO or G.M'S CONCERNS:

His greatest concern is "The bottom line!" He requires the greatest return on investment. His concerns might be:

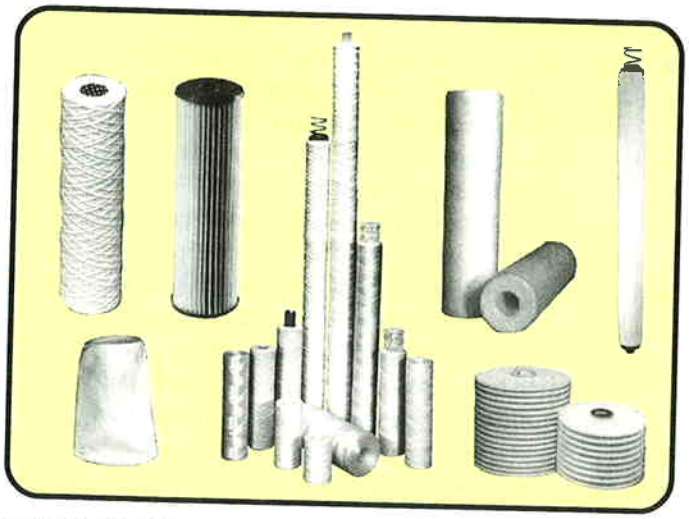
- Can we get along without it? If not, how did we get along without it up to now?
- What are our justifications in adding or replacing the equipment?
- How much is the installation of the additional or replacement equipment going to cost?
- If we need it, how long is the pay back on the equipment and "SHOW ME THE $ MONEY $".

Please keep in mind that some of the previously cited decision makers with their various concerns may also have a staff that can influence their decisions! Every member of the staff can also have unending questions about the application. Therefore, whether the selection of the product commences with the shop maintenance worker or the CEO, one way or the other, the majority of these concerns must be addressed. To satisfy the needs of the various personnel before the selection is finished, is to avoid problems later.

FILTRATION MEDIA

After all of the pumps have been specified and turnover agreed upon, then the type of filtration media should be considered, if filtration is a requirement. There are a number of effective filtration media available, which will remove particulate from 100 microns down to sub-micron levels, if needed. The degree of automation required for the use of the equipment should be considered as well.

The choice of media is left to the user. However, based on successful installations and past experience, the supplier will usually offer alternate methodologies such as depth wound filter cartridges, flat paper or cellulose discs, horizontal or vertical plates, bags, cleanable sleeves, disposable fabric, or backwashable permanent media. Each media has its pros and cons.



THE STRING WOUND DEPTH CARTRIDGE is the choice of filtration media for the average plater because of its simplicity of use, high solids holding capacity and wide range of porosities available to remove progressively smaller particles. A 10" x 2½" diameter cartridge is equal to 3½ sq.ft. of surface media.

For instance, when filtering iron from nickel, acid zinc or cadmium solutions, a single 10" long x 2½" diameter filter of 15 micron retention will easily hold 8 ounces of iron before loading. Sized at (1) one cartridge per 50 gallons of plating solution with a suitable pump to achieve an initial turnover rate of the solution of twice per hour, 8 to 12 weeks between cartridge changes is not uncommon. For just a small extra capital investment at purchase, the filter chamber size could be doubled, and two 10" filters per 50 gallons of solution could provide 16 to 24 weeks between filter changes.

If iron is the main particulate material being filtered, the cartridges might either be backwashed or soaked in a dilute acid solution to redissolve the iron. Also, an alkaline cleaner solution could be used to remove some oil and soil build up in the filters, and they could then be carefully rinsed, and neutralized for several reuses prior to landfill disposal. If a spare change of filters is kept in stock, one set can be on line, while the other set is being soaked for reuse. Typically 2-4 cartridges of 50-100 micron retention per 100 gallons work best on cleaners.

One of the most common objections to the use of string wound depth filters is that they are too bulky for landfill, as compared to discs or bags. However, whenever any bulky material is sent to landfill for disposal, it is usually processed through a shredder or compactor first, so depth filters are no more of a problem to dispose of than any of the other media. In the future, incineration may be considered for disposal because polypropylene supports combustion and used cartridges can be utilized to reduce the cost of fuel.

Industry should have a use for string wound filter cartridges for many years into the future because of their overall effectiveness, economy and simplicity of use.

Filter cartridges are also available in other configurations such as pleated material, melt bonded polypropylene free of organic sizing agents, and a number of others including membranes for electronic grade use. These membranes will filter down to 0.1 micron nominal or absolute, if needed.

Carbon impregnated fibers as well as granulated carbon filter cartridges are also available in the same 10" x 2½" diameter configuration, and may be mixed selectively with the other filter cartridges in the filter chamber to achieve carbon adsorption of unwanted organics while filtering particles. Where heavy dirt loads are encountered, it is recommended that the solution be filtered first and then carbon treated in a separate chamber downstream on a by-pass.

DISC FILTER SETS, composed of paper, polypropylene, or cellulose fiber are another type of filter media used in industry. The discs may be used alone with paper, or precoated with filter aid to achieve a faster and finer micron retention of the particulate filtered. The downside to discs is their low solids holding capacity. They need to be cleaned or serviced often, compared to depth wound string filters. In heavy particulate applications such as acid zinc or cadmium plating with high iron content, daily cleaning is common, especially on barrel lines.

Wheel platers are the connoisseurs of disc filtration systems. They like them because of their rapid filtration of fine particulate. They buff and polish between steps in many shops so introduction of buffing compound into the plating bath is common. However, since most buffing compound contains animal fat and grease, carbon needs to be used on the precoat of the discs to remove this organic contamination. When using powdered carbon on the discs, the brighteners in the acid copper and bright nickel baths need to be replenished continuously. If bulk granulated carbon is used on a by-pass in a separate chamber downstream from the filter discs, the depletion of the brightener is much less rapid.

BAG FILTERS are used in electroless nickel and copper plating applications because autocatalytic baths have a tendency to plate-out on any surfaces they contact. Bags are the easiest filters to use in these applications since they are a surface type media. When they are plated with metal, the operator can visually see the plate-out and service the bags. When discs or depth filters are used in an enclosed chamber, the operator can not see the problem occurring and plate-out of the entire bath could occur if the problem is not detected and corrected immediately.

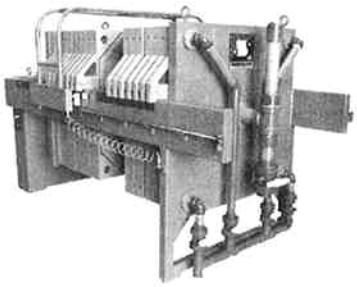
Also, bags are a favorite where high loading of coarse solids occurs, such as in acid dip tanks and running water rinses. If the solution is not slimy and does not coat the bag surface, then the bag will load like a vacuum cleaner bag. However, aklaline cleaner baths are usually slimy so the particles they contain blind off the bag surface quickly, requiring frequent service. On cleaner or acid dip tanks, where oil contamination is a problem, an additional coalescing filter cartridge installed downstream of the bag filter may remove the oil. Auto-gravity filters are also ideal for this application.

COALESCING CARTRIDGES will separate any dissimilar liquids with a difference in specific gravity of 0.09 or greater. The pre-filter removes the unwanted particulate so the coalescing filter will last indefinitely as long as no particulate is introduced to it. The oil coalesces from tiny droplets into large ones that float to the top of the water in the chamber. This oil can be manually bled off or automatically bled with the proper valving. An oil recycler then can recycle the concentrated oil.

PERMANENT MEDIA FILTRATION SYSTEMS are a choice of platers where unattended operation is desirable, and where disposable filter media, or the labor to change it, is an objection. When used in a suitable system, the plating solution is kept clean, and the filter media is restored to a clean state each time the system automatically backwashes itself. The upside of this type of system is that it operates in the top 20% of the filtration flow range at all times as compared to non-backwashed media where flow diminishes as the media loads and requires service. The backwashable sand filtration system is also an excellent choice to polish clarified wastewater from the wastewater treatment system. A key advantage of the backwashable pressure filtration system is that it cleans itself automatically.

DISPOSABLE FABRIC FILTRATION SYSTEMS are often referred to as AUTOMATIC INDEXING GRAVITY FILTERS. They employ an array of tanks, conveyors, pulleys, motors, pumps and float level controls to index disposable filter media over a stationary conveyor. These units are the choice of industrial plants using water based oil coolants for grinding, cutting, and stamping, as well as for screw machines and other types of machines such as CNC lathes, etc. This type of system has also been effectively used to remove particulate from phosphating solutions, carbonized deposits from quench oil to ease the plater's cleaning problems, copper fines from printed circuit board deburring operations, and anywhere high solids content is a problem and needs to be removed. The micron retention of the available fabric ranges from 1 to 125 micron.

RECESSED PLATE FILTER PRESSES are used in about every precipitation wastewater treatment plant to dewater the underflow of clarifiers. A typical tube type, or slant plate clarifier with an inverted pyramid bottom or cone, achieves approximately 0.5% solids on the bottom. If a flat bottom is used, and a sludge rake or scraper sweeps the bottom of the clarifier, 3% solids may be achieved, if proper flocculation and settling occurs. However, this slurry still needs to be thickened to 8 or 9% solids through a sludge thickener before pumping through a filter press, otherwise a much larger press would be needed, and would be cost prohibited.



Where extremely high solids in liquid, usually 5 to 10%, need to be dewatered, an air-diaphragm pump operated from 60 to 90 PSI usually is the choice to transfer the thickened slurry through the filter press. The polypropylene filter plates have recessed cavities of ½" to ¾" each with a 20 micron polypropylene filter cloth. As the plates are sandwiched together under pressure, every pair of plates provides a 1" to 1.5" cavity to retain the solids as the slurry is pumped though the plates. This type of filtration system is capable of achieving 30 to 35% solids with standard filter cloths. Using membrane type filter cloths with high PSI pumps, solids of up to 60% have been achieved. However, the cost of this type of system is much greater than the standard filter press.

Capacities of ½ to 50 or more cubic feet are readily available and applications may be sized accordingly. The general rule of thumb in sizing a filter press for the average plating or printed circuit shop is 2 cubic foot capacity minimum for every 25 gpm flow through the clarifier. This sizing arrangement will usually provide a full 8-hour shift before dumping is necessary. The time required to dump and clean a filter press is minimal, usually 15 to 20 minutes by one worker.

CARBON PURIFICATION is the choice of platers to adsorb organic contamination from plating solutions, rinses, etches and cleaners.

If total purification is required in a batch treatment, the solution is transferred to a treatment tank, and temperature raised above 140°F. Hydrogen peroxide is sometimes added to the solution as stipulated by the chemical manufacturer, and 3-12½ lbs. of powdered carbon per hundred gallons of solution is added, stirred in, and al-

lowed to sit 4 to 8 hours. The carbon will settle to the bottom, along with the adsorbed contaminants, and the clean liquid then may be decanted or pumped back to the process tank through suitable filtration media. The carbon sludge is then batch treated and disposed of with the rest of the hazardous waste.

The frequency of the batch carbon treatment procedure may be greatly reduced by circulating the plating solutions continuously through a chamber containing granulated carbon. In this way, a constant balance of brighteners to achieve uniform ductility will be achieved.

An effective way to accomplish purification is to install a separate canister containing granular carbon on a by-pass with a valve controlling the flow. After the solution has passed through the filter chamber to remove particulate, a portion (about 5-20%) may be directed through the granulated carbon on a continuous basis to remove the unwanted organics and then through a coalescer to remove oil. Granular carbon will remove organic breakdown products of the brighteners as well as oil, grease, etc. without stripping the brightener system as occurs when batch treating with powdered carbon.

The canisters holding the carbon either have fine mesh screens or fine retention depth filters of 1 to 3 microns to trap any carbon attempting to exit the vessel. This type of granulated carbon canister is also widely used as a portable system on a cart with its own pump, hoses, valves, etc. to recirculate solutions needing carbon treatment as a maintenance precaution.

ALL THINGS CONSIDERED, CAVEAT EMPTOR

An experienced sales application consultant will attempt to gather the pertinent data for the application to satisfy all of the concerns of the team involved in the purchase. His ultimate goal is to have a successful installation.

- MSDS (Material Safety Data Sheets) which supply the chemical composition of the material, must be obtained wherever possible. These documents contain valuable information such as flash points, toxicity, etc. as well as the constituents.
- It is absolutely essential that chemical compatibility, pH, pressure, temperature limitation, and flow performance curves be researched for the pumps, filters and components for the application.
- What type and amount of solids are to be removed and how fast?
- Are abrasives present? Are oil or dissimilar liquids which need to be separated present?

All of this data must be used to select the material and components for the application.

Manufacturers with proven track records, employing a staff of trained, qualified application consultants are available to assist you and make recommendations for your particular application. Their archives of application data gained in the past by trial and error are useful in bringing success in subsequent installations. After many successful installations, the compatibility of solutions and materials of construction of the components is known. For example, experience has shown that for alkaline solutions, stainless steel may be used, as well as steel, but plastics such as PVC, CPVC, PVDF, polypropylene, Noryl, Ryton, polysulfone, or Teflon may be successfully utilized on pumps, filters and components. On acidic solutions, the prior mentioned materials could also be used, depending on compatibility. However, chemical compatibility charts from several manufacturers should be cross-referenced and checked against each constituent in the chemical process.

In the end, the rule of Caveat Emptor, i.e. Let the Buyer Beware, usually applies. If you let the application consultant make the recommendation, and purchase the product recommended, a reputable manufacturer will stand behind and back up the product sold for the application. So choose reputable vendors with proven products and a proven track record that has stood the test of time. Real products applied to real applications over and over again offer the customer the greatest assurance and the most peace of mind that the proper product for the application has been quoted.