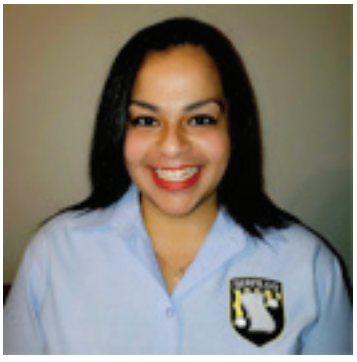


Article written by Melissa Mitchell, SERFILCO

Melissa Mitchell is the Business Development Manager for Latin America and a technical applications specialist at SERFILCO. SERFILCO is a global manufacturer of chemical resistant filtrations systems, pumps and agitation equipment, headquartered in Northbrook, IL, Melissa has been at SERFILCO for over five years and has had the honor to work with global electroplaters and anodizers in North and South America; providing outstanding customer service and technical advice. She has organized and attended several tradeshows and technical courses in many locations and is totally committed to helping customers achieve their business, environmental and developmental goals.

Pumped Eductor Agitation

With an increased need to improve process efficiency while reducing costs and improving working environment, pumped agitation with eductors has quickly become the preferred technology in the surface finishing industry. Every week process tanks operating with air and mechanical systems are being replaced with this type of agitation on a wide variety of applications throughout the world. When properly designed, pumped agitation will optimize your process by reducing heating costs, reducing surface emissions, reducing consumption of brighteners, leaving a homogenous solution.

Common methods of agitation have been via air or mechanical methods. Air agitation consists of a compressor or blower generating air which is dispersed through piping arranged at the bottom of tanks. Mechanical agitation, or cathode rod movement, consists of lateral movements of a cathode bar throughout the length of a tank. And lastly, pumped agitation with eductor nozzles, which is the focus of this paper.

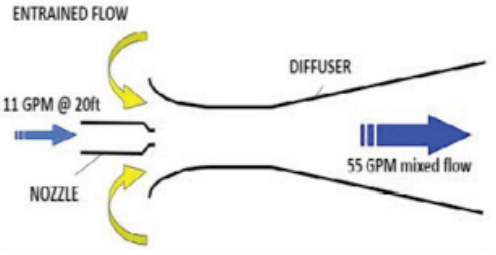
Air Agitation

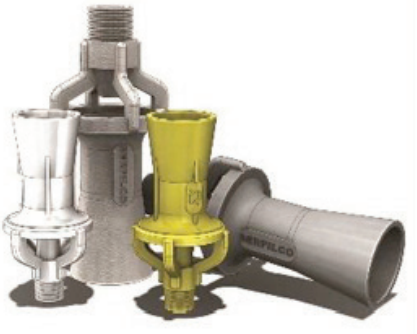
Air agitation has been in use for many years, this method has more disadvantages than advantages. For starters, the explosion of air bubbles on the surface of process tanks produces foam and chemical fumes which creates a potentially dangerous working environment as well as an increase in rejects. As these air bubbles rise to the top of the process tank, latent heat is lost to the atmosphere, increasing the energy input required to sustain operating temperature.

The holes in the air sparger are small making them prone to blockage, commonly producing a turbulent surface in only parts of the process tank; a clear indication that the agitation isn't uniform throughout.

Air oxidation accelerates the breakdown of brighteners causing the consumption to increase drastically. Finally, compressors are inefficient and expensive to run while air blowers are noisy and difficult to control.

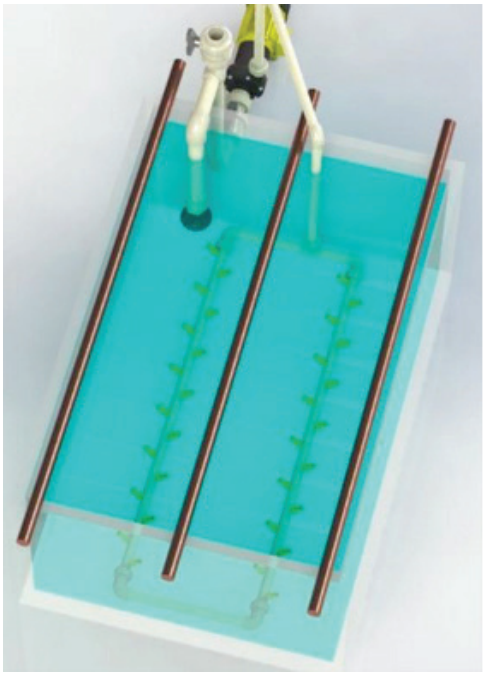
Cathode Rod Agitation
Cathode rod movement is limited to a slow backward and forward movement through the length of the process tank, making the distance the bar moves becomes lost cathode space. The rod cannot have too much movement because then you cause a wave within the tank which will then have your solution splashing out of the tank.





Eductor Agitation
Eductor nozzles use the Venturi principal in that it amplifies and directs solution from the pump to the required area in the process tank. For each gallon of pressured liquid that enters the nozzle, five gallons recirculate at the output of the nozzle. The nozzle is converting a high pressure, high velocity, low volume flow into a low pressure, low velocity, high volume flow, creating a closed loop agitation; all while using a small pump and strategically positioned nozzles.

Pumped eductor agitation has several advantages that include: lower heating costs, reduced emissions, even temperature, reduced brightener consumption and chemical evaporation, elimination of distorted air spargers, better filtration and better plating on complex parts that may have bends or folds. The manifolds we design can also help to eliminate the buildup you tend to see around your heating elements or your anode bags.



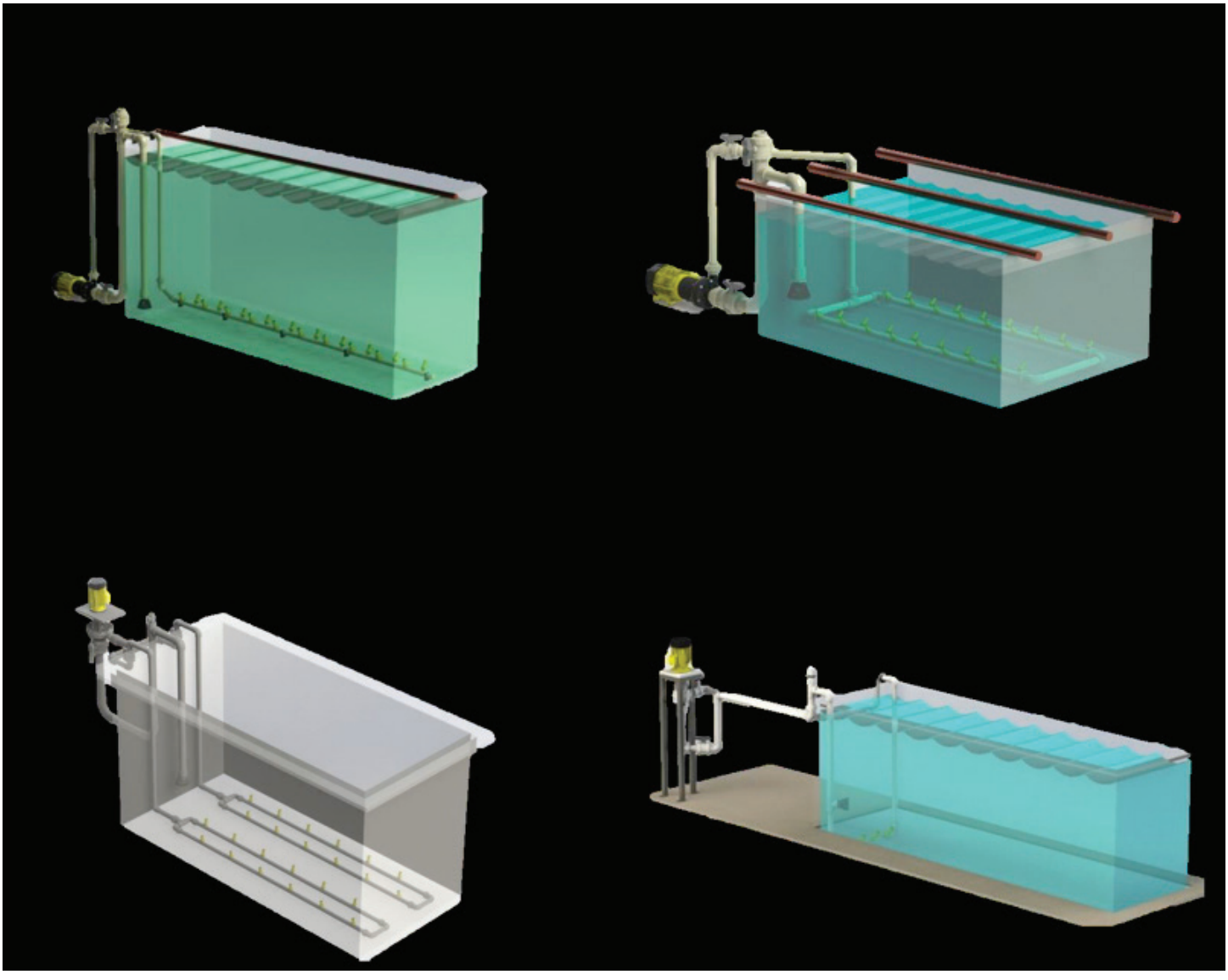
Designing a Pumped Eductor Agitation System
Taking the time to truly understand your needs in order to design an agitation system unique to your process tank is essential. This way, you are able to maximize the effectiveness of the system to provide a homogenous tank. The majority of process tanks use vigorous turbulence to ensure constant movement within and throughout the tank. Electroless nickel, electroless copper and alkaline zinc should avoid direct impingement on the parts where general agitation is effective. Solutions such as phosphating and cleaners benefits from agitation focused on the tank floor to prevent any sludge from settling and keeping those solids in suspension for removal by a separate filtration system. Filtering these types of solutions alone with no agitation would not produce the

desired cleansing of the process tank. Taking into account the tank configuration, including the dimensions, anode/cathode placement, heater locations and rack placement; along with the type of process is the most effective way to calculate the size, number and position of the eductor nozzles. This then determines the size pump required to achieve the calculated flow required to successfully agitate the process tank. It is always recommended that a flow valve be installed between the pump and the eductor manifold so that the agitation can be controlled easily. In order to avoid excessive pressure drop, it is important to ensure pipework is at least the same size as the pump discharge.

Filtration and Agitation

It is recommended that a separate pump from that of a filtration system be used. When sizing a pump for a calculated number of eductor nozzles, do not consider the tank turnovers for filtration. Instead, consider the appropriate pump for the calculated number of eductors and separately calculate tank turnovers, depending on the process tank, to recommend a separate filtration system complete with its own housing, pump and media. When you have cartridge media retaining contaminant, there will be a drop in flow. When this occurs, the effectiveness of both the filtration and the agitation are severely compromised.

Typical Manifold Designs



Processes Benefiting from Eductor Pumped Agitation

Listed below are processes where eductor pumped agitation has been successfully introduced, exhibiting performance improvements when compared to other methods by reducing heating costs, saving brighteners, reducing rejects; especially with complex parts, reducing hydrogen pitting and most importantly providing a homogeneous solution:

Nickel & Chrome	Cleaning & Rinses	Tin
Acid Copper	Anodizing	Cyanide Copper
Electroless Nickel & Copper	Alkaline & Acid Zinc	Electroforming
Phosphating	Cadmium	Gold, Rhodium & Silver

Conclusion

A relatively small capital investment is required to install an eductor pumped agitation system and a payback can be seen in a very short period of time. With today's industry being so competitive and the demand for cost reductions, this type of technology will improve your process tanks and quickly show that a reduction in operating costs while helping you keep your staff safe, follow environmental legislation and prevent pollution prevention. When designed correctly, an agitation system is indisputably the best way to maintain your process tanks. The number of eductor pumped agitation systems throughout the world increases every week and is a sure way to optimize your process.