



## ASL Technologies, LLC

### Electrostatic Filtration Systems

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Hydraulic fluid is the lifeblood of your system; this paper will introduce you to ASL's patented line of Electrostatic Fluid Purification Systems, and what they can do for you.

ASL Technologies, LLC, manufactures a line of Patented Electrostatic oil filtration systems, which have been proven to deliver and maintain ISO cleanliness codes much cleaner than possible with mechanical filtration, without requiring expensive "absolute" cartridge changes. On typical hydraulic systems, the ASL Electrostatic System can deliver and maintain ISO 10/7 or better, depending on ingress levels. Rubbermaid, Rexam, Amcor, and hundreds of others already own many of our Electrostatic Systems, and are quite pleased with the results.

Our systems use the forces of electrostatics and electromagnetics to remove all contaminants from fluids, down to submicronic tars and varnishes. ASL products use patented technology to remove contamination from non-conductive and semi-conductive fluids. Typical applications include hydraulic, transformer, lubricating, compressor, transmission, and turbine oils. This product has also been used to filter cleaning solvents. ASL holds three patents on the process. U.S. Patent Nos. 5,149,422; 5,242,587; and 5,891,315. A fourth patent for Phosphate ester fluids is pending.

There are basically five (5) major factors contributing to the contamination of fluids: **air, heat, water, particulate and oxidation by-products**. Contamination of fluids is a great concern because their condition is directly related to the condition of the overall system in which they function. Controlling these five factors is foundational to maintaining a trouble-free oil system.

As with most equipment, preventative measures do much to extend the life of the fluid and the host system. One must minimize the external ingress of air and particulate in the fluid. Breather bags and air intake filters have been used effectively for this purpose. Maintaining the fluid temperatures within the specified limits can be achieved through proper care and maintenance of the cooling system. Equipping the filtering system with continuous water removal capability prevents build up due to condensation and keeps the fluid dry.

Finally, the fluid must be kept as clean as possible, not only by removing particulate such as dirt, fibers and wear materials, but also the submicronic contaminants such as silts, tars, and varnishes. Tars and varnishes, the byproducts of oxidation, typically occur and are encouraged because of the presence of air, heat and water. Oxidation is usually observed in lubricants and hydraulic oils and results in the formation and deposition of tars and varnishes on the components of the host system. Removing these contaminants continuously from the system will prevent the majority of problems that plague mechanics and cause expensive downtime. Keeping the fluid as clean as possible is what ASL's products will accomplish for you.



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How clean is clean enough? What if we told you that several of our customers have reduced the amount of oil related maintenance problems by 70%? While doing so, they have also decreased the amount of power required to operate their equipment! This is in addition to the other, more obvious benefits of extremely clean oil. The fact is that oil cannot be too clean, but it surely can be too dirty. Only in the past few years have removal of particles smaller than 5 microns (half the size of a red blood cell) been considered as part of an oil cleanliness program. The really small contaminants, which are measured in angstroms (one one-hundred millionth of a centimeter) are the trouble makers, causing stiction problems, and are the source of tars and varnishes in an oil system. How about the larger sized particles? Well, contaminants in the 1 micron size and larger range do rapid damage in areas of close tolerance like gear pumps, hydraulic cylinders, servos, bearings and spool valves. When these large particles enter moving components, they break off machined surfaces and cause more particles. There are several university studies, which document the damage caused by these particulates and the life extension achieved by having extremely clean oil. The long-term benefits of continuous filtration with Electrostatics, as the contaminants are purged from the system, will become evident through reduced downtime and maintenance expenditures, extended machine life and vastly improved (3 to 5 times) fluid life. Coupled with a water absorber pre-filter, (standard equipment with ASL Systems) this product will protect the lifeblood of the oil system from three of the five major factors that contribute to fluid degradation.

### **Pro Active Maintenance:**

Without a doubt, the biggest benefit of extremely clean oil is equipment life extension. The University of Oklahoma conducted extensive research over a period of years and thousands of hydraulic equipment tests. Their work defined a very predictable relationship between component life and contamination level. Their research summarizes that a system with a contaminant level of 1000 particles greater than 10 microns per ml, will have an average life of 1,000 hours. Filtering that same oil to a cleanliness of 100 particles per ml, yields an average life of 50,000 hours! Restated, one unit of improved cleanliness, can often produce 50 units of machine life extension, which is the ultimate goal of Proactive Maintenance. Let's look at dirt and contamination another way for a moment. Let's say your oil has an ISO code of 21/18. That means the pump is passing 136 - 50 pound bags of dirt through its teeth per year. Lowering the oil to an ISO of 14/11, means that the pump will only pass one 50 pound bag per year, giving it a life extension of 8.8!

The most irrefutable study comes from the British Hydromechanic Research Association. They conducted a three year investigation on 117 hydraulic systems in eight different machine categories. The study concluded that they were able to confirm the relationship between fluid cleanliness and machine life, in the field, as previously established in the laboratory.



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#### The Electrostatic Cell:

Filtration of submicronic particles is done with an Electrostatic cell that utilizes both electrostatic and electromagnetic forces to entrap particulate of all sizes and types. As the fluid medium passes through the cell, any non-chemically bonded contaminants will remain in the cell, held there by these forces. Additives are not removed because the chemical bonds involved keep the additives in solution.

The nature of the forces retaining contaminants within the cell requires slower flow rates and pressures than observed with typical mechanical filters. Higher flow velocities or pressures will overcome the electrostatic and magnetic forces entrapping the particulate. Imagine a particle being held in a force field while the oil flows around it. If the oil flow around the particle is not controlled, the force field inside the cell would be unable to “hold” the contaminant. ASL’s electrostatic systems are designed and constructed with an integrated pump and motor to re-circulate the oil on a continuous basis within the reservoir at low flow rates. Typically 30 – 80 gallons per hour, depending on reservoir size, rate of contamination ingress, etc. Pressure within the systems is held at 40 psi. This type of filtration is often referred to as “kidney loop,” “slip stream,” or “off-line” filtration. The ASL filtration system’s pump slowly draws fluid from the bottom of the reservoir, sends it through a 5 micron water absorber pre-filter, and on through the Electrostatic Cell, returning the cleaned fluid to the top of the reservoir.

ASL’s Patented Electrostatic cell is the heart of the system. The design allows the cell to clean fluids without regard to particle size. Any particle, any size, can be captured by the Electrostatic Cell. Fluid to be cleaned first enters the bottom of the cell, where a series of perforated metal plates are arranged within a plastic housing. Separating the plates are polyolefin foam discs, which become a home for the particles. When a particle comes in contact with a charged plate, (plates are charged at 15,000 VDC) it is electrically influenced, causing it to be attracted to oppositely charged particles. The particles are then “strawed” into the foam, and are held there, as if by an electromagnet. While electrostatics have been in use for years in air cleaning systems, only one U.S. owned company (ASL) holds patents on the fluid process. The ASL Cell was designed with a unique back flush ability. When the High Voltage charge is removed from the cell, contamination is released, allowing it to be blown out with shop air. After about a year (at typical ingress levels) the cell can be re-manufactured and returned to service. ASL re-manufactures thousands of cells a year. Another advantage to the ASL cell is the ability to electrically influence all particles, even nonferrous, to make them act ferrous.

A trip through the Electrostatic cell involves multiple reversals in polarity, with permanent magnets located in the foam pads between the positive to negative plates (with respect to fluid flow). A corona forms around the positive plates, and has a force field acting in a counter-clockwise direction. The magnets have a toroidal flux field, which interacts with the corona. The toroidal flux field aids the corona at some places, and opposes it in other places, causing a turbulence of the particles suspended in the fluid. If not confined within the micro pores (straws) of the foam, the particles remain in constant motion, trapped in the resultant force field established by the interaction of the flux and corona. The different effects at



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different locations in the force fields tend to create greater random agitation. However, since the particles are confined within the straws, the agitation causes them to become embedded within the foam. Once the particle entrapment builds sufficiently, (the system informs you) the cell can be back flushed with shop air, removing most of the particles embedded in the foam. After enough time, back flushing is no longer effective, and the cell must be returned for re-manufacture. Based on continuous round the clock use, the cost of annual cell re-manufacture and replacement of the water absorber element, amounts to <4 cents per operating hour.

**System Sizing:**

Our systems are available in a variety of flow rates, sized to your reservoir capacity. The system needs to cycle all of the fluid in the reservoir approximately once every 24-30 hours. Hence a 40 GPH ASL system will handle a reservoir of around 1200 gallons or less. ASL systems are available in 30, 40, 80, and 200 GPH sizes, covering reservoirs from 7000 gallons on down. Note that these examples are for one electrostatic system dedicated to one reservoir.

**Return On Investment:**

Figure the payback any way you want; equipment life extension, better, more consistent operation, less scrap and waste, reduced maintenance costs, lowered operating energy, or 3 – 5 times (or more) oil life, the savings add up pretty quick, and you're doing the environment a favor too.

Thanks for the opportunity to tell you about our products! Please feel free to call upon me at any time to ask any questions you may have. Not ones to rest on our success, we are constantly refining and improving our systems, as well as searching for ways to improve manufacturing efficiencies, and lower the cost of our systems. Our goal is customer satisfaction!

Best regards,

Sarah M. Soliday  
ASL Technologies, LLC