



Pall Corporation

Electrostatic Discharge in Lubrication and Hydraulic Systems



When two dissimilar materials are placed in contact and then separated in a sliding motion, it results in electron transfer between the two materials. This is referred to as triboelectric charging. Frictional contact between fluid and filter media in a lubrication or hydraulic system results in triboelectric charge generation that, if not dissipated, accumulates and discharges to a lower potential surface. It's like a lightning bolt in a filter housing.

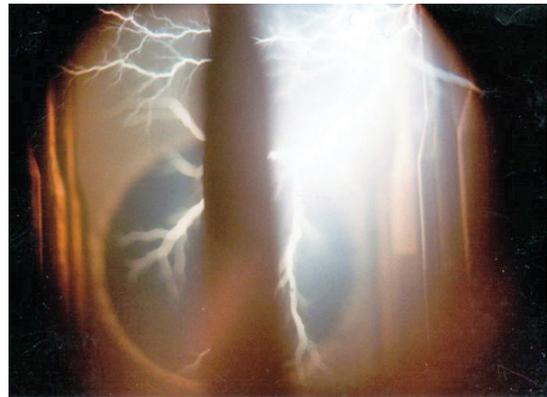
With technology and fluid formulations changing, more challenging operating conditions for fluid systems are created, and triboelectric charging becomes more prevalent. Higher machine speeds, higher operating pressures, more demanding duty cycles, and highly refined, lower conductivity fluids each contribute to triboelectric charge buildup. Nonpolar materials yield higher charging, as do higher fluid velocity, higher fluid viscosity, lower fluid conductivity, lower moisture content, and more contact areas. Filters with large surface areas combined with full flow features of filter elements in particular yield higher charging.

As a result, principal applications where triboelectric charging have been observed include:

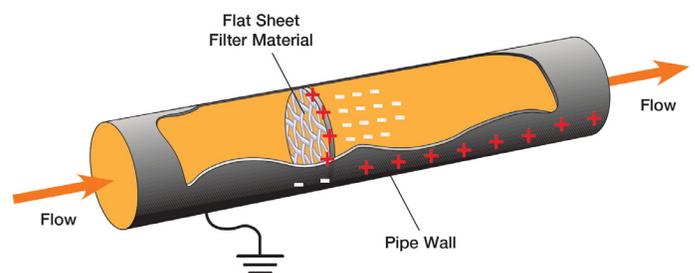
- Power generation turbine lubrication systems
- Primary metals hydraulic systems
- Paper machine lubrication systems
- Plastic injection molding machines
- Hydraulic test stands
- Jet fuel systems and other fuel oils
- Insulating oils

Synthetic fluids passing through synthetic filter media are more likely to generate electrostatic charges, than traditional fluids through traditional media. The charge can build to the point where it causes high voltage sparks to jump to the closest metallic point, often blasting holes through filter media and damaging components. And damaged filters cannot do their jobs.

If you stand beside a filter where arcing is occurring, you will hear a harsh knocking, crackling or pinging sound from within. This is the electric charge letting go against the side walls of the filter assembly. Internally, this can involve the filter, housing, reservoir and/or heat exchanger; externally, this can involve the surface/pipe-to-ground or surface-to-surface. You may notice burn marks on the filtration medium and/or downstream



Electrical discharge occurring inside oil tank



support mesh, burn marks on the spiral wrap and/or end caps, and/or blackened media.

Standard glass-fiber media installed in the lube system can potentially experience severe electrostatic-induced damage in a short time. Heat exchangers, flowmeters, valves, filter housing, and filter elements can all experience damage. Also, fluids can break down, resulting in thermal degradation/varnish formation, premature additive depletion, and reduced fluid service life. Electrical arcing can also pose a safety hazard, causing fires or even explosions.

For many years, most people ignored this phenomenon. But as problems have worsened, people are paying more attention to triboelectric charging. Modern turbine lube oils are highly refined API group II oils, meaning they are less polar and have low conductivity (5-40 pS/m range). Modern turbine lube systems are also smaller with lower fluid volume—resulting in high fluid turnover, more stress on oil, and less time for charge dissipation. They have higher filter flow rates, resulting in higher flow density creating higher charge generation. At the same time, there is ever-finer filtration with synthetic, borosilicate fiber filter media, resulting in higher surface area and, again, higher charge generation. For all of these reasons, there is a much greater risk of electrostatic discharge occurring in these systems.



Pall customers have been enjoying the protection provided by anti-static filters for well over a decade. Pall Athalon® Filters have anti-static protection incorporated into their media that not only ensures against electrostatic discharge, but also has higher dirt capacity, lower pressure drop, longer service life, and larger surface area for fluid contact. Stainless steel fibers in the media gives it a light gray appearance instead of white, but that gray appearance gives you the assurance that any charge buildup will be dissipated, meaning you can confidently pass fluids through smaller filters and at higher flows.

Pall recognized that electrostatic buildup would be a problem as filter and fluid technology improved. To address this phenomenon, Pall began investigating various filter media material and configurations with various fluids in the laboratory. This resulted in the development of a composite glass-fiber, resin-bonded media that has been thoroughly tested and validated in laboratory and field in various applications. As a result, Pall anti-static filters have now been in service across a wide range of applications for well over a decade.

Using grounded filter housings and pipes is a preventative safety measure that can reduce external discharging, but it cannot stop fluid charge generation or internal damage to the filter or other system components caused by arcing. The fact that all manufacturers' standard glass media generate electrostatic charging, but Pall anti-static filters substantially reduce fluid discharging and eliminate noise, discharge, and the resulting filter and fluid damage. Athalon filters allow finer filtration with the existing housing and flow, make smaller housings and higher flow possible for new designs, and ensure the elimination of fluid damage by controlling varnish formation.

To learn more about how Athalon filters from Pall can reduce electrostatic buildup and protect your equipment, visit Pall.com today!

Fluid degradation is also a serious problem. Electrostatic discharges result in changes in the chemical composition of the fluids. Nonpolar molecules can be changed to polar molecules, which can act as precursors to varnishes. Varnishes are insoluble film deposits that form on surfaces inside fluid systems, including on pipes, tanks, bearings, heat-exchangers, and servo-valves. These deposits can cause operation problems, clogging valves and coating bearings to make them less effective.

While others are only just now starting to understand that electrostatic buildup and discharge is a problem, Pall has been designing filters capable of preventing the affects of this problem since 2004. Pall filters are made with minute metallic content designed into the media that dissipates any charge.