



Long Term Results Using ISOPur Balanced Charge Agglomeration™ Technology

For the past 4 years, people have written into the various oil and reliability forums, and published magazine articles, questioning the capability of ISOPur Balanced Charged Agglomeration BCA™ technology. Competitors muddied the already murky oils with all kinds of claims in order to gain some market share in the varnish mitigation industry. These forums and articles told us about auto-degradation of oil and BCA™ agglomerated particles pushing through filters and clogging hydraulics. The latest invention is soluble vs. insoluble varnish, and how BCA™ will not work without additional technology. I think our latest results in oil testing on seven 7FA gas turbines will help clear the waters.

A Southeastern USA power plant had over three years of operational time on their seven new GE 7FA turbines. The oil being used in their lubrication and hydraulic system was suffering from early stage varnish buildup. The turbines were tripping offline due to servo valves sticking. The common oil sump was also loaded with sludge. They had two choices; either flush and refill the lubrication system with new oil or try something new. They chose to install seven ISOPur MR Systems that use BCA™ technology.

Within a few weeks, the benefits of installing the new systems were beginning to show. All 7 GE 7FA turbines experienced a rapid drop in VPI, Varnish Potential Index, and servo valve trips stopped. At the first inspection of the oil sump, the plant maintenance staff was surprised to find that varnish and sludge deposits were disappearing and the tank did not need cleaning.

Now, nearly eight years since the plant went into operation, the original oil installed at commissioning has over 35,000 operating hours and is still in use. The varnish potential numbers on the latest sample, in July 2009, indicate the oil is as clean as, or cleaner than new oil. New oil VPI, on a scale of 0 to 100, has a rating of 1 to 3. The average of the seven samples from their turbine lube oil is 10 with two samples at 3 on the VPI scale.





Gravimetric Patch samples are another great tool for determining oil health without resorting to the more complex and in some cases controversial tests. A sample of oil is drawn down through a filter with a suction pump. The filter is then weighed on a sensitive scale. No chemistry is involved, and nearly anyone can learn how to conduct this test. In the case of the referenced GE 7FA's, the latest samples' patch weights average 50 milligrams per liter (mg/l). Compare this to 75 mg/l for new oil and as much as several hundred for oil in lubrication systems using only conventional 10 micron filtration.

It is the high concentrations of submicron debris in the oil, not soluble varnish, which keeps the varnish on the walls of the oil systems. The ISOPur system removes submicron debris from oil by charging it positive and negative in two separate flow paths, then mixing the charged particles in the oil together to make small particles stick together or agglomerate. The larger particles are collected in good quality filters. BCA™ Technology will, in theory, remove all debris from the oil down to sizes not easily measured, 0.01 micron and less. The resulting oil is extremely clean and works as a very strong solvent. It is this ultraclean oil that removes varnish from the system, not the purification system.

Any varnish mitigation system that does not remove submicron debris can give the appearance of solving varnish problems. They give this appearance of working because they alter the reading obtained by VPI testing as a result of altering oil chemistry to attempt to remove polar molecules. Since they have only been available for 2 to 3 years, the industry has seen no evidence to date that shows conclusively that use of these systems results in long term varnish cleanup, or reduction of additives and remaining useful life of the oil.

BCA™ systems operate at high voltage levels that are below what is necessary to cause oil ionization or chemical decomposition. Since oil is an insulating liquid, there is no electrolysis and breakdown of the oil. BCA™ does not change oil chemistry; it only removes submicron particles to clean the oil to a high level of purity. Clean oil diffuses varnish and sludge back into itself due to its increased solubility. The BCA™ system then removes the varnish as a submicron particle along with all contaminants in the oil that can take an electrostatic charge.

Several years ago there was an article in the one of the turbine machinery magazines, that claimed BCA and electrostatic purifiers would not work to provide a "Magic Bullet" for varnish removal. The article claimed Ion Exchange technology was required for a real cleanup. The reasons cited included the auto-degradation of oil and the inability of BCA to remove soluble varnish. We feel the results of testing of the oil on these seven turbines prove their article was mistaken in its appraisal of BCA™ technology.



The new oils about to enter the lubrication oil market reduce the varnish plating on system internals by increasing the oils ability to hold varnish in solution. Older base stock one oils possessed this ability, so varnish was not as severe a problem with older oils. Presently, it appears that BCA technology will not harm the new oils, and may actually enhance the oils' ability to hold varnish in solution. This is contrary to other technologies that affect oil chemistry that actually may reduce the new oils ability to hold varnish in solution.

The first BCA system was placed on a GE steam plant 15 years ago. That machine is still operating today. The oil in that plant has never been changed, and it also is cleaner than new oil.