

Analysis of Large Wear & Contaminant Particles in Lubricants

Automated Rotrode Filter Spectroscopy (RFS) System

Rotrode Filter Spectroscopy (RFS) is an analytical technique that enables rotating disc electrode (RDE) spectroscopy to detect and analyze large wear and contaminant particles in fluids. RFS supplements standard spectroscopy by providing additional information that can be used to determine the mechanical condition of machinery.

Background:

Routine spectrometric analysis of used oil samples becomes less responsive to particles as they increase in size. Atomic absorption (AA) and inductively coupled plasma (ICP) spectrometers suffer the most from the problem. Rotating disc electrode (RDE) spectrometers are responsive to somewhat larger particles, but even their detection capabilities decrease rapidly as particles approach 8 to 10 micrometers in size. With the addition of RFS analysis, the RDE technique can analyze particles greater than 10 micrometers in used oil samples. By trending the change in the ratio between standard RDE spectroscopy and RFS results, the two methods can be used to improve the detection and analysis of progressive wear.

RFS System:

The Rotrode Filter Spectroscopy System is a complete automated analytical accessory to the Spectroil M/C or M/N Oil Analysis Spectrometers. It consists of one stand-alone cabinet and includes a five-station disc electrode preparation fixture, vacuum/pressure pump, a reservoir for cleaning solvent, a sump for waste oil, and electrode clamp assemblies. It requires only external electrical power for operation and uses only environmentally friendly solvents. The entire system is on casters and can be easily transported.

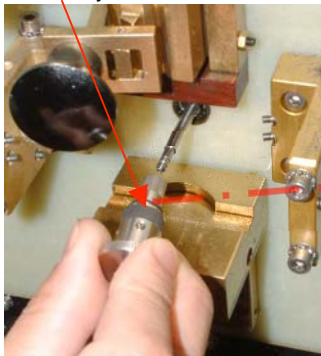
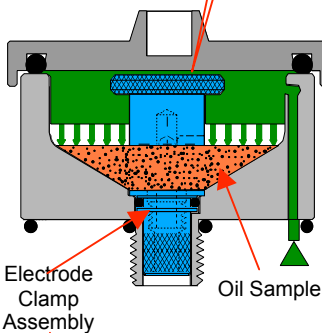
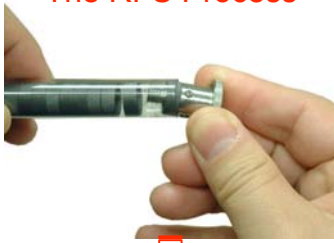


Features of the RFS System:

- Complements normal spectrometric analysis with analytical results for large particles.
- Separates and concentrates particles on a disc electrode for analysis.
- Automatic and simultaneous preparation of up to five samples at one time.
- Economical and simple to use.
- Only consumables are RFS discs, rod electrodes and environmentally friendly solvent.
- Samples can be prepared and stored until ready for analysis

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The RFS Process



RFS Theory of Operation:

The RFS method makes use of the fact that carbon disc electrodes used in rotating disc electrode (RDE) spectrometers are porous and may be used as a filter. The RFS system has a five-station fixture of funnels. Within each funnel, a vacuum/pressure pump pulls and pushes the used oil sample through the disc electrode so that only particles remain on the outer circumference of the disc.

Specially designed disc electrodes are mounted on an electrode clamp assembly for installation in one of five preparation stations. The electrode clamp assembly is made of two separate pieces so that a new electrode can be mounted on it directly from its container, thus limiting the possibility of contamination through handling. The clamps are numbered so they can be linked to their matching oil sample.

The electrode clamp assembly with a fresh carbon disc is installed in one of the RFS sample funnels. An oil sample is poured into the funnel and the funnel is clamped shut. With the start of the automated process, a vacuum/pressure pump pulls and pushes the sample through the disc electrode and the filtration process concentrates large wear particles on the surface of the electrode. A sensor determines when most of the sample has been filtered through the electrode and automatically starts the electrode cleaning and drying process.

The RFS preparation process is complete when all the oil has passed through the disc electrode, residual oil has been washed away, and the electrode is dried. The operator then removes the electrode clamp assembly and uses it as a tool to install the electrode in the Spectroil spectrometer for analysis.

Summary:

RFS is an important enhancement to standard RDE analysis. It provides new information on the condition of the machine being monitored by expanding the particle detection capability of the RDE technique. It is sometimes also used to screen samples for more time consuming analyses such as ferrography.

