

## Application

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.



Transit Case for the A-RFS System

## Automated Rotrode Filter Spectroscopy Sample Preparation System (A-RFS)

*"Rotrode Filter Spectroscopy (RFS) is an analytical technique that enables Atomic Emission Spectroscopy Rotating Disc Electrode (AES/RDE) Spectrometers 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."*

The Automated Rotrode Filter Analysis System is a completely 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 readily available and affordable solvents. The entire system is on casters and can be easily transported.

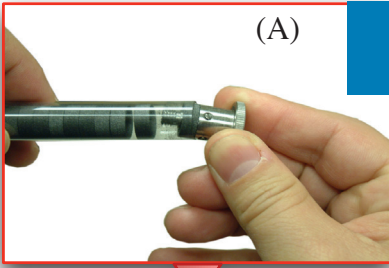
RFS analysis may be easily added as a complimentary technique to standard RDE/AES analysis. It provides additional information on the condition of the machine being monitored by concentrating the metallic and non-metallic debris and expanding the particle size detection capability beyond the RDE/AES technique. It can also be very effective as a screening tool to identify the need to perform additional testing using more time consuming analytical techniques such as ferrography.



## Features of the A-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 the RFS discs, rod electrodes and readily available solvent.*
- *Samples can be prepared and stored until ready for analysis.*

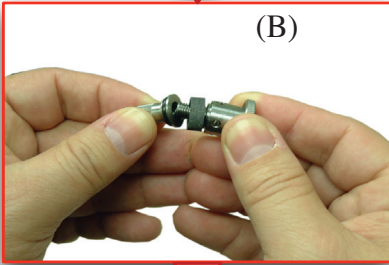
(A)



## RFS Theory of Operation

The RFS method makes use of the fact that spectroscopic grade carbon is porous and may be used as a filter. The A-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 carbon filter so that only particles remain on the outer circumference of the filter.

(B)



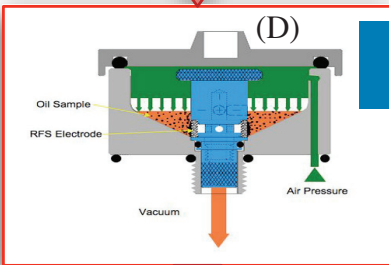
Specially designed carbon filters (A) are mounted on an electrode clamp assembly for installation in one of five preparation stations. The electrode clamp assembly is made of two separate pieces (B) so that a new filter can be mounted on it directly from its container, thus limiting the possibility of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

(C)



The electrode clamp assembly with a fresh carbon filter is installed in one of the RFS sample funnels (C). 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 carbon filter and the filtration process concentrates large wear particles on the surface of the filter (D). A sensor determines when most of the sample has been filtered and automatically starts the electrode cleaning and drying process.

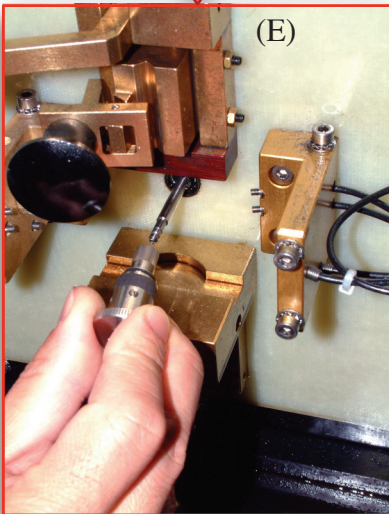
(D)



## A-RFS Summary

Automated rotrode filter spectroscopy (A-RFS) is a sample preparation device designed for the AES that concentrates large and small wear metal debris in a graphite filter electrode. When the graphite filter electrode is analyzed using AES, sensitivity is increased by a factor of 80-100 and particle size detection is improved by a factor of 10. When the sample is prepared by the A-RFS device the particle size detection capability of AES is extended from 8-10 micrometers to greater than 70 micrometers.

(E)



*A-RFS System in Operation with a Spectroil M/N Oil Analysis Spectrometer*

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