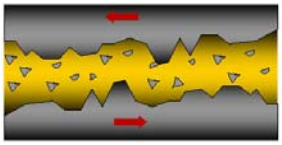
Introduction

The PPM (parts per million wt/wt) result of several metal elements (e.g. iron, copper ,tin ,aluminum ,ect) in used oil sample is usually analyzed by an Atomic Emission Spectrometer (AES) or Spectrometric Oil Analysis technique .
PPM (parts per million) unit is the concentration of wear metal elements .
Unfortunately , Spectrometric Oil Analysis technique is unable to detect all wear metal element debris -particle size .
Each Atomic Emission Spectrometer have its limited range detection –sensitivity .(see picture 1) .
Spectrometric Oil Analysis technique have been known to have decreasing sensitivity as particle size increased.

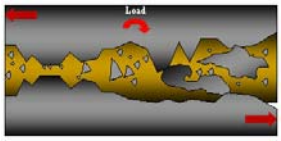
During machinery in operations , wear metal debris particles are generated by rubbing motion of mechanical component parts , are either normal wear or abnormal wear .

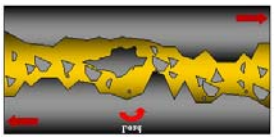
Normal wear particles will tend to have particle size in fine wear particles or small wear particles or less than 5 micron in size .



Normal Wear

Abnormal wear mechanism (high load ; high speed) , often tend to proceed gradually with many fine wear particles together with coarse or large wear particles (larger than 5 micron).





Abnormal Wear

Particle Size Limitation of Spectrometric Analysis

Traditional Spectrometric Analysis that are widely used for measuring concentration (in PPM units) of wear metal elements ,additives and contaminants in used oil analysis are “RDE-AES Spectrometer” or “ICP AES Spectrometer” .
Those spectrometer methods (RDE spectrometric and ICP Spectrometric) are blinded or unable to detect large wear debris particles indicating abnormal wear .

Most widely understanding and accepting , that
ICP – AES Spectrometers **can not** detect wear metal particles more than 3 micron in size .
RDE – AES Spectrometer **can not** detect wear metal particles large than 8 microns in size.

“***Spectrometric oil analysis measures only very small particles and dissolved metal elements in oil ”***

“ Spectrometric oil analysis , as they are routinely applied today , are blind to large debris wear particles”

Abbreviation :
RDE – Atomic Emission Spectrometer : Rotating Disk Electrode - Atomic Emission Spectrometer
ICP – Atomic Emission Spectrometer : Inductively Coupled Plasma - Atomic Emission Spectrometer

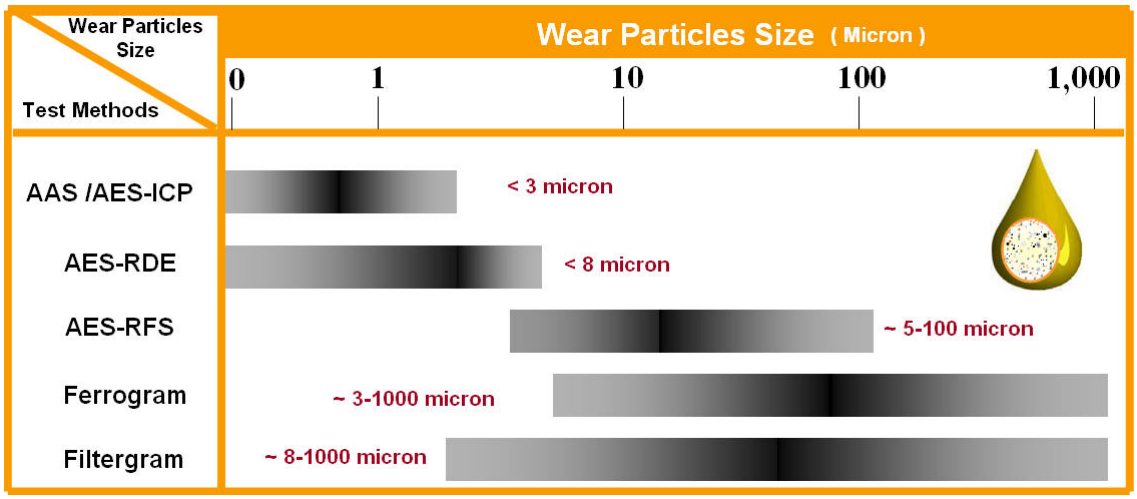
Method of detecting large wear particles.

Focuslab have been introducing RFS Spectrometric Analysis (RFS Coarse Wear Spectrometric Analysis) combined with RDE Spectrometric Analysis (RDE Fine Wear Spectrometric Analysis) , the combined 2 test method is called " Double WearCheck ™ "

Double WearCheck™ √√ is a special Spectrometric Analysis that combining
RDE Spectrometric Analysis together with
RFS Spectrometric Analysis
in order to detecting metal element concentration (in ppm unit) of both
fine wear debris particles -metal elements and
coarse wear particles - metal elements .

RFS Spectrometer technology was developed specifically to detect large particles of wear metals and contaminants particles in used oil.

Wear Metal Detection Limit due to particle size



Focuslab has been integrating the RFS method with RDE spectrometer (for fine wear metals ,additives and contaminants) to provide an excellent Spectrometric Analysis .

Double WearCheck™ √√ are named for this dual spectrometric analysis (RDE + RFS).

Double WearCheck™ √√ will give more advanced warning than traditional or conventional spectrometric analysis in used oil analysis –conditioning monitoring .

If **Double WearCheck™ √√** detects any abnormal or severe wear **,** then we can perform further analytical testing such as **Ferrographic Analysis** to find out Root Cause.

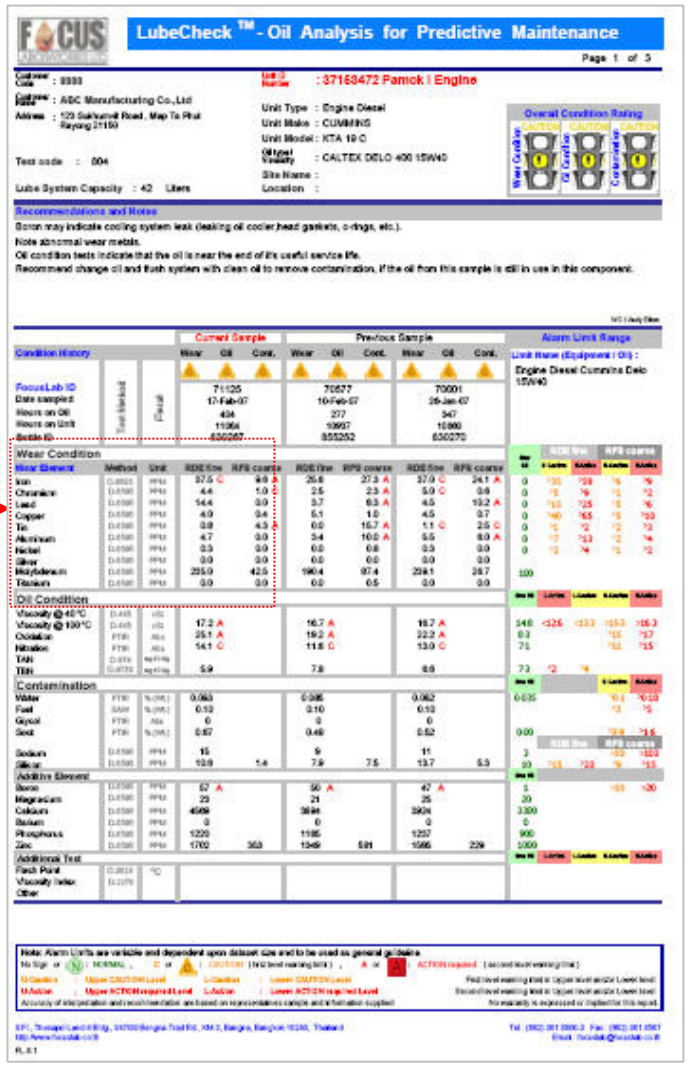
Abbreviation :
RFS Spectrometer : Rotrode Filter Spectroscopy - Atomic Emission Spectrometer

RFS Spectrometric (Course Wear Particles)

RDE Spectrometric (Fine Wear Particles)

Wear Condition

Wear Element	Method	Unit	RDE fine	RFS coarse
Iron	D-6595	PPM	37.5 C	9.6 A
Chromium	D-6595	PPM	4.4	1.0 C
Lead	D-6595	PPM	14.4	0.0
Copper	D-6595	PPM	4.0	0.4
Tin	D-6595	PPM	0.8	4.3 A
Aluminum	D-6595	PPM	4.7	0.0
Nickel	D-6595	PPM	0.3	0.0
Silver	D-6595	PPM	0.0	0.0
Molybdenum	D-6595	PPM	235.0	42.5
Titanium	D-6595	PPM	0.0	0.0



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RDE – Atomic Emission Spectrometer : Rotating Disk Electrode - Atomic Emission Spectrometer
ICP – Atomic Emission Spectrometer : Inductively Coupled Plasma - Atomic Emission Spectrometer
RFS Spectrometer : Rotrode Filter Spectroscopy - Atomic Emission Spectrometer
PPM : part per million