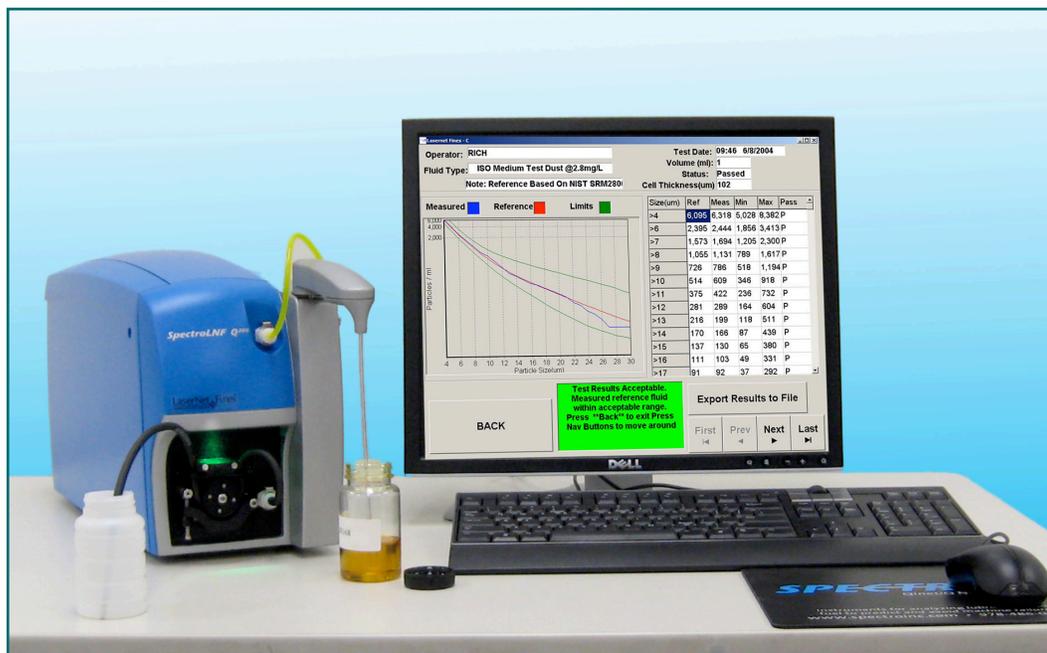


SpectroLNF Q²⁰⁰

Features

- ▶ Provides ISO Code 4406 (1999) for particles >4, >6 and >14 µm.
- ▶ Algorithms to perform shape analysis, wear particle identification and machine condition assessment.
- ▶ Viscosity analysis 10 cst - 325 cst at 25 degrees C in 6 min. or less.
- ▶ Large particles are classed by a neural network as "cutting, fatigue, severe sliding, nonmetallic, free water droplets or fibers".
- ▶ Provides image maps of all particles greater than 20 µm.
- ▶ Can handle particle concentrations over 5,000,000 particles/ml.
- ▶ Automatic adjustment for fluid darkness. Sees through black diesel lubricating oils.
- ▶ Measures soot content in used diesel engine lubricants.
- ▶ Can handle fluid viscosities up to 150 ISO grade without dilution.
- ▶ Includes built-in data-base for machine condition trending.
- ▶ Data outputs include particle type identification, image maps, size trends and NAS, NAVAIR and ISO cleanliness codes.
- ▶ Magnification is set at factory. Recalibration is never required.



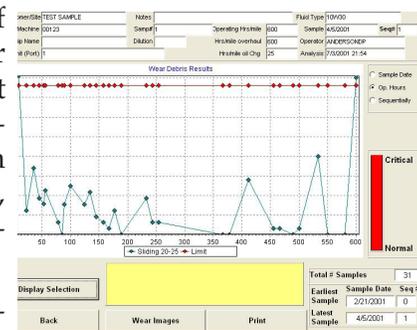
NEW - Faster camera and viscosity analysis.

"The SpectroLNF Q²⁰⁰ uses laser imaging techniques and advanced image processing software to identify the type, rate of production, and severity of mechanical faults by measuring the size distribution, rate of progression, and shape features of wear debris in lubricating fluids."

Application

The SpectroLNF Q²⁰⁰ is the next generation of particle shape classifiers and particle counters after the innovative and highly successful LaserNet Fines-C (LNF-C). The new SpectroLNF Q²⁰⁰ features numerous enhancements including a much faster CCD camera, an ergonomic sipper design, improved maintainability and the ability to measure viscosity.

Machine condition monitoring based on oil analysis has become an accepted practice in any well run maintenance management program. With knowledge of the wear metals and contaminants present in a lubricating system, it may be determined if that equipment is operating properly or if preventive maintenance is required. SpectroLNF Q²⁰⁰ combines the standard oil analysis techniques of particle counting, shape classification, and viscosity into a single analytical instrument. Lockheed Martin Tactical Defense Systems developed SpectroLNF Q²⁰⁰ in cooperation with the Naval Research Laboratory for the Office of Naval Research on its Accelerated Capabilities Initiative for Condition-Based Maintenance.



Automatic Alarms using Dynamic Equilibrium

Operation



The SpectroLNF Q²⁰⁰ is an automated microscope that captures the silhouette image of particles in oil flowing through a 100 μm thick flow cell. Using magnifying optics and a powerful pulsed laser, an image of the sample is captured by a video camera and stored in computer memory. The objects are then analyzed for maximum size and several shape characteristics which are used to classify particles into mechanical wear classes. Each laser pulse provides a single image frame to be analyzed, and the results of thousands of frames are combined for the analysis of each sample.

Particle Shape Classifier

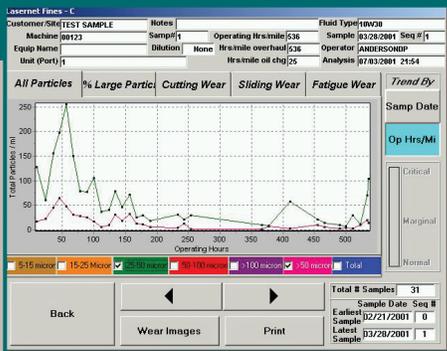
Particle shape classification is performed with an artificial neural network that was developed specifically for the SpectroLNF Q²⁰⁰ system. Shape features were chosen to give optimal distinction between the assigned classes of cutting, fatigue, severe sliding, nonmetallic, free water droplets and fibers. The neural network was trained on an extensive library of particles that were classified by human experts using ferrography and microscopy.

Particle Counter

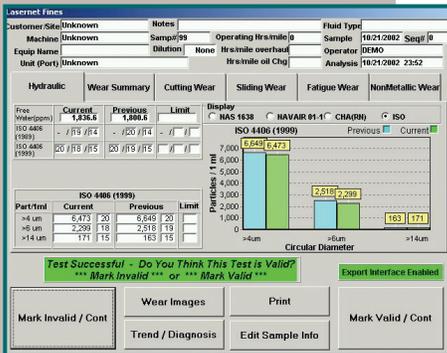
The SpectroLNF Q²⁰⁰ stores thousands of images to obtain good counting statistics. Although the actual shape of each particle is captured, the equivalent circular diameter of each particle, from 4 to $>100 \mu\text{m}$, is calculated to provide NAS, NAVAIR, and ISO cleanliness codes. The SpectroLNF Q²⁰⁰ accurately measures much higher particle concentrations than conventional particle counters because it views many particles simultaneously within an area of $1600 \times 1200 \mu\text{m}$ rather than measuring the light blockage caused by one particle at a time. It is not necessary to recalibrate the SpectroLNF Q²⁰⁰ because, like a microscope, once the magnification is set at the factory, it remains fixed. NIST Standard Reference Material 2806 (Medium Test Dust in Hydraulic Fluid) is measured as a final QC procedure at the factory and may be used thereafter as a check fluid. Air bubbles ($> 20 \mu\text{m}$) are recognized and eliminated from the count and water droplets ($> 20 \mu\text{m}$) are recognized and quantified. The laser is powerful enough to process sooted (black) oils.

Viscosity

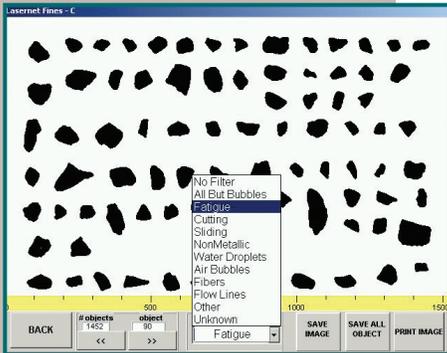
When selected, the SpectroLNF Q²⁰⁰ provides viscosity of the sample at the same time as it performs particle count and particle shape classification. Dynamic Viscosity measurements are reported in Centipoise (cP) at ambient temperatures. Typical processing time is 2-6 minutes per sample for a viscosity range of 10 to 325 cst at 25°C. The viscosity capability also does not require calibration, but the SpectroLNF Q²⁰⁰ performance can be periodically verified with the SRM 2806 Particle count check fluid standard supplied with the instrument.



Particle Trending



Particle Counting



Particle Shape Classifying

AUTOMATIC SAMPLE PROCESSOR (ASP)

An optional ASP is available that automatically runs 24 samples. Before processing each sample, a special stirrer re-suspends particles without introducing air bubbles. The stirrer and sipper are rinsed after each sample to prevent cross-contamination. The ASP can be added later without the need for any retrofitting.



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