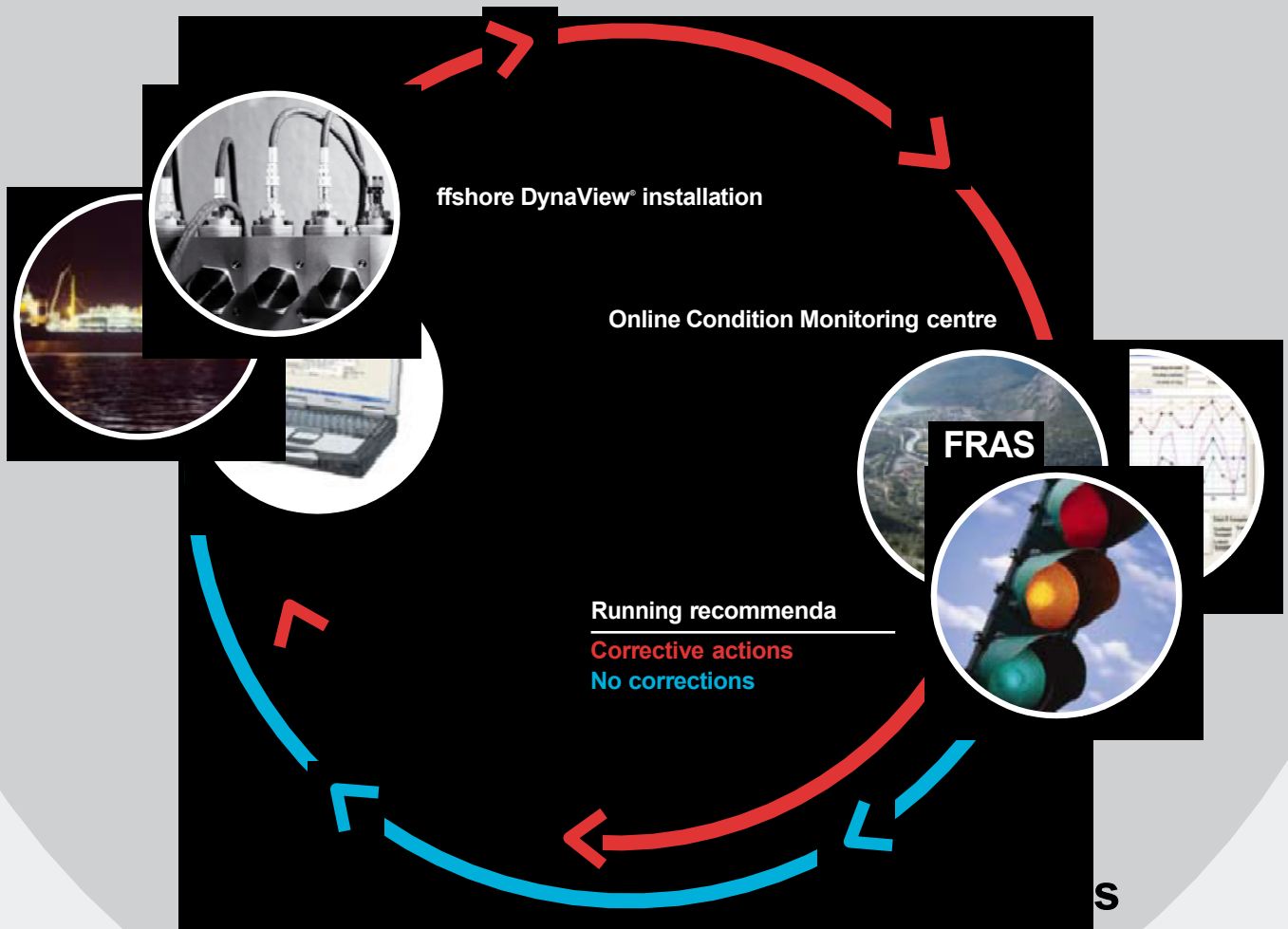


Advantages and overview of on-line condition monitoring

DynaView® online condition monitoring

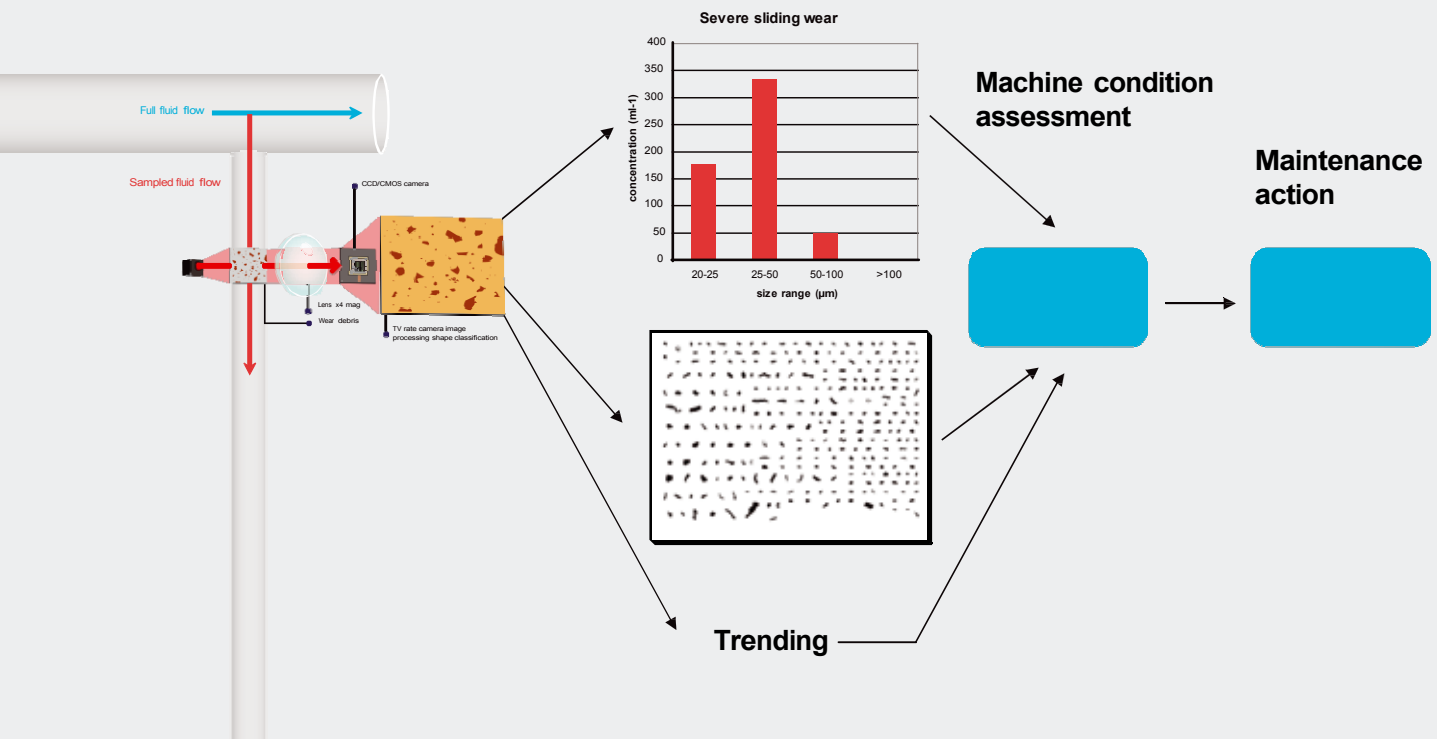
- 1 Real time online wear debris analysis
- 1 Identify type, severity and rate of wear debris progression
- 1 Predict mechanical faults
- 1 Accurate and reliable information
- 1 Provides immediate results and actionable information
- 1 Eliminates routine sampling
- 1 Reduced cost, manning and logistics
- 1 Reduced unplanned maintenance actions
- 1 Increased system and personal safety
- 1 Adaptable to DynaSamp® applications
- 1 Operation parameter monitoring

DynaView® is an online condition monitoring system for lubrication and hydraulic installations. The system can help the manufacturer and operator to achieve the planned availability levels and minimize the outage risk. All major items of wear and process information can be recorded in a database and will be automatically evaluated, aggregated and visualized to ensure efficient service planning. The system is remotely controlled and performed by skilled personnel from our condition monitoring centre, which ensure correct evaluation and interpretation of the results. In order to achieve service planning, the historical presentation of the wear level (trending) can be determined continuously to estimate residual service life for the machine.



Sample analysis

Wear mode classification

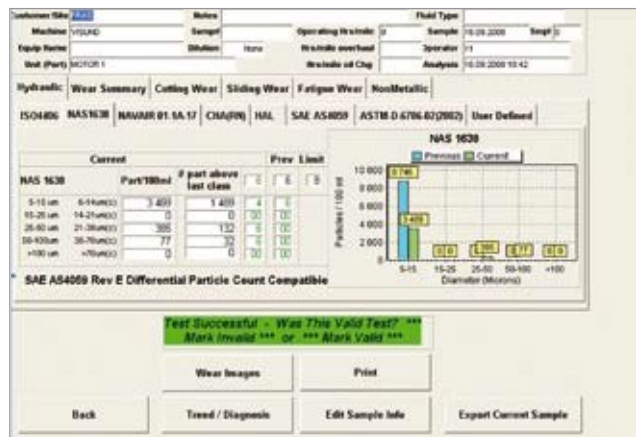
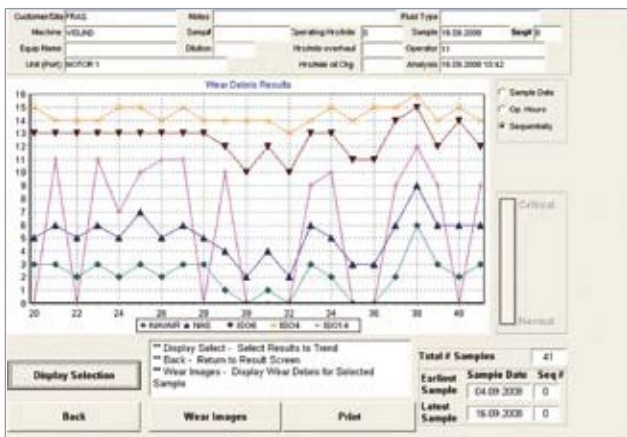




The DynaView® system

DynaView® is an integral condition monitoring system, which includes remote access and integrating drive components (actuators) auxiliary units (ventilator, hydraulic units), an on-line wear debris analysis and a continuous stress measurement. DynaView® is an online condition monitoring for hydraulic and lubricating fluid systems. An optical sensor is used for detecting and classifying suspended particles in the fluid. The fluid is drawn through a patented viewing cell that is back-illuminated with pulsed laser diode to freeze the particle motion. The coherent light is transmitted through the fluid and imaged onto a digital CCD camera. Each resulting image is analyzed for particles, with several thousand images ultimately used to determine the characteristics of the

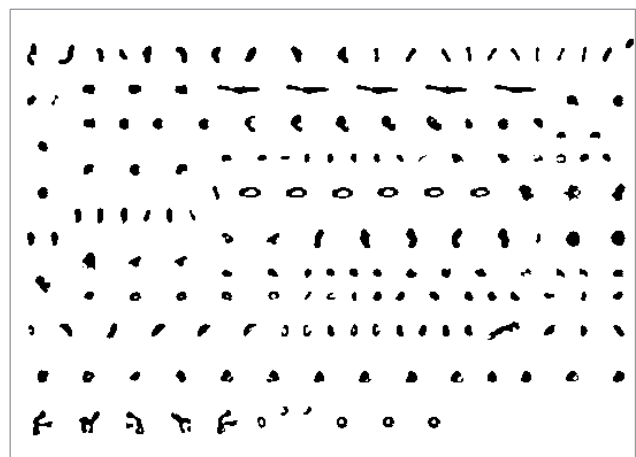
suspended particles and to obtain good counting statistics. Concentrations are measured for particle sizes between 4 µm to over 100 µm. It reports particle size in terms of maximum chord and also calculates equivalent circular diameter for capability with ISO cleanliness codes. Shape characteristics are calculated for particles greater than 20 µm, and the particle is classified into either a wear category or contaminant category. Classification is done with an artificial neural network that was developed specifically for this system. Shape features were chosen to give optimal distinction between the assigned classes of fatigue, cutting, severe sliding, nonmetallic, fibers, water bubbles, and air bubbles. An extensive library of particles, which were identified by experience experts, was used to train the artificial neural network.



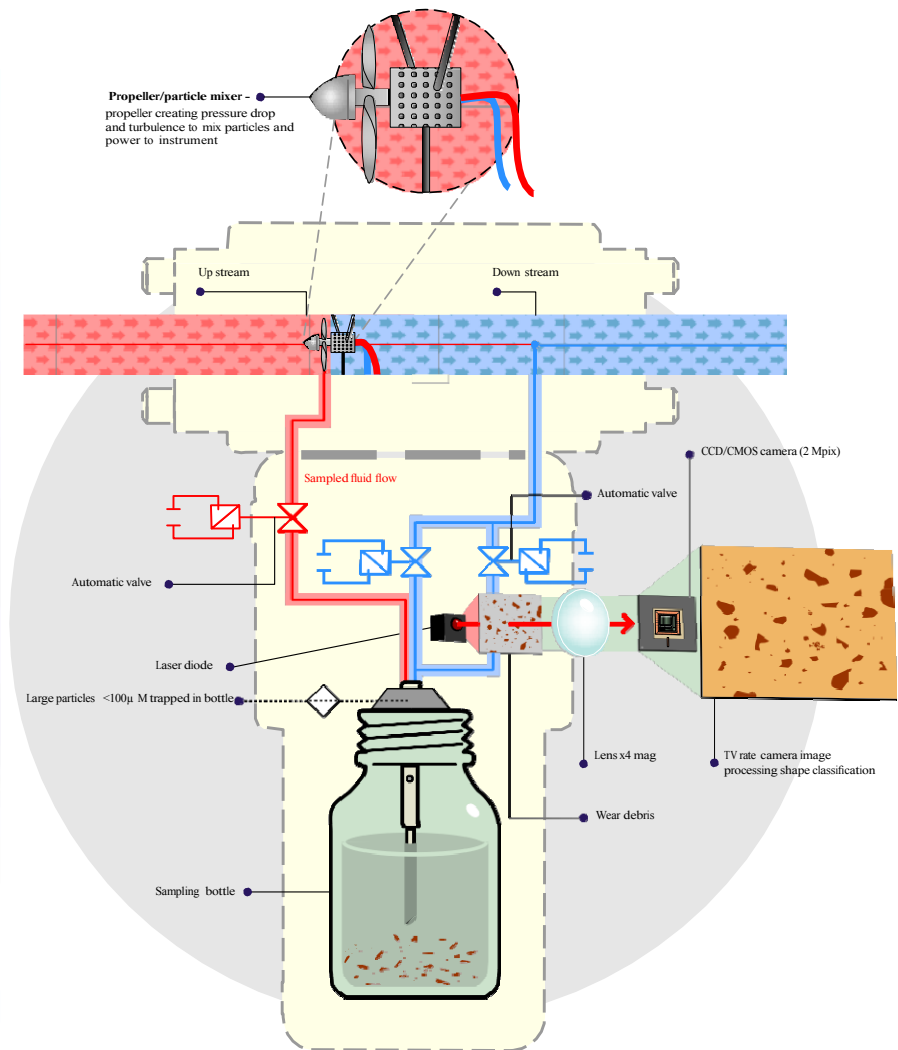
ABOVE LEFT: Trending the quantity of wear particles in a sample over a period of time for a specific machine is a recommended method for identifying an underlying abnormal wear mode. The trending screen permits the user to trend any of the specific abnormal wear particle types such as severe, fatigue, cutting and nonmetallic. In order to achieve a safe operating level, the recorded critical parameters may trigger a warning signal when the critical level is reached

ABOVE RIGHT: The main results screen provides several formats in which to view the information collected by DynaView®. The cleanliness code is automatically calculated and the results can be presented according to selectable standards (ISO4406, NAS1638, NAVAIR, CHAR, HAL, SAE AS4059, ASTM D6786 and user defined).

RIGHT: The wear particle image map shows silhouettes for each particle detected in the sample that are greater than 20µm in size. The particles can be selectively viewed individually with dimensions and morphological information.



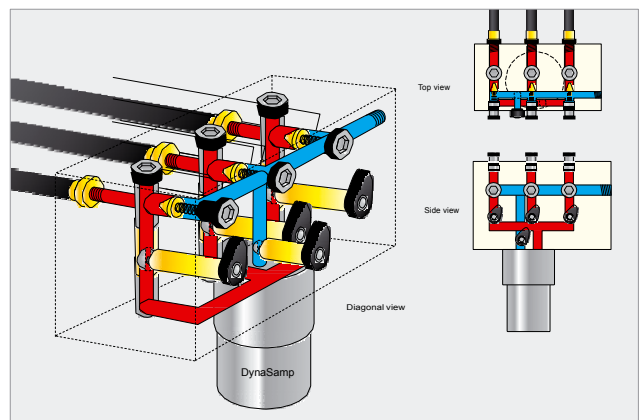
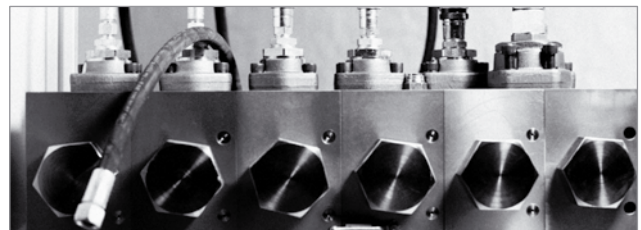
LEFT: Optical sensors are used for detecting and classifying suspended particles in fluid flow systems. The instrument provides objective evidence of machinery faults through the size distribution and morphological analysis of wear debris and contaminants in oil samples.



ABOVE LEFT: The sampler device provides accurate and repeatable fluid sampling during working process without any significant system interference. It provides continuous, autonomous and representative sampling as well as it eliminates the manual drawing of the sample.

ABOVE RIGHT: A cut through illustration of the DynaView® unit showing the built-in electronic components. Automatic valves can be remotely operated by the machinery, or can be set to operate at certain intervals. When opened they will divert the oil stream towards the patented viewing cell. A laser diode back-illuminates the oil stream and projects a shadow image through a magnifying lens (4x) that is registered onto an image CCD camera chip. This information is then transmitted directly to the on-shore monitoring centre for online analysis and trending. An in-stream propeller, powered by the flow, works as a built-in power source for the electronic components in the DynaView® unit.

RIGHT: Integration of DynaSamp® with an in-house designed Multiblock provides the possibility to connecting different units to one DynaView® system. The Multiblock is based on sandwich module sections, which can be assembled together in order to connect multiple units to one DynaView® system.



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