AIR-X ON-LINE LUBRICANT AERATION MEASUREMENT

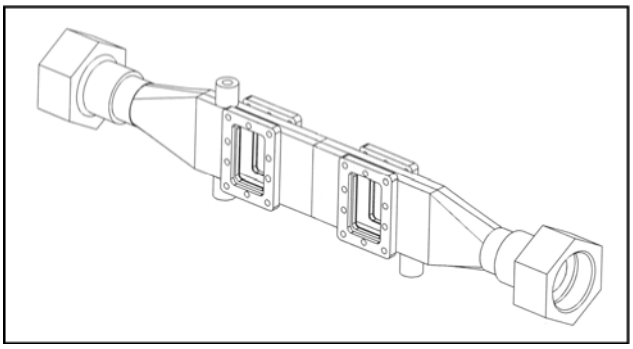
How Does It Work?

Air-X is a new instrument designed for on-line monitoring of oil aeration in a running mechanical system (engine, gear box, etc.). The operating principle is based on an accurate density measurement using X-ray transmission. An oil sample coming from the mechanical system is circulated continuously into a compact measuring chamber where the density measurement is performed.

The specific chamber design of Air-X allows the instrument to perform on-line measurements using a very low activity X-ray source. The chamber is self-shielded so that no radiation at all comes out from the unit whatever the operating conditions.

The total volume of oil sampled in "Air-X" is less than 0.5 liter for a minimal impact on the operating mechanical system.

The chamber includes probes that are used for automatic temperature and pressure compensation. Therefore, the air content can be computed and displayed at standard conditions (i.e. T = 20°C and P = 1 bar).



The core of Air-X is a compact measuring chamber with 2 windows: one is used for the X-ray transmission measurement, the other for the visualisation of the oil flow via a video system.

Where To Install?

Air-X is able to sample and evaluate oil from atmospheric or pressurized lines in an operating hydraulic system. For fired engines, the oil is typically sampled from the sump at a location which is close to the input of the oil pump. The sampling unit of Air-X includes an internal oil pump with accurate and variable flow control. All operating parameters are selected from the user's interface.

For applications on fired engines oil can also be sampled directly from the gallery. The sampling unit includes a precision valve that limits the pressure drop in the gallery to an acceptable value.

Air-X is a methodology developed and patented by DSI sprl, of Tournai, Belgium.

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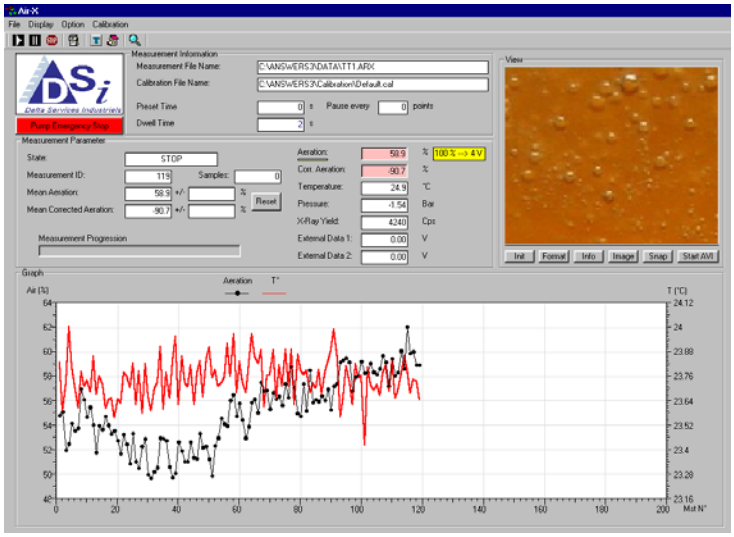
SOFTWARE

A software package is supplied with Air-X that offers the following functions :

- Setting-up of equipment
- Calibration
- On-line measurement
- On-line visualization of the oil flow in the measuring chamber (compressed video signal)



Calibration:

As the operating principle of Air-X is based on a density measurement, it is necessary to deduce the relationship that describes density variations according to temperature. This is easily done using a calibration routine included in the software package. Such calibration must be done once for each type of oil to be used during the tests.

Then, before starting a new measurement, a single calibration point is done by launching the acquisition while the air content is 0% (engine stopped).

On-line measurement:

The oil is sampled continuously in the measuring chamber but the dwell time for data acquisition can be selected between 1s up to several mins. Short dwell times allow visualizing aeration during transient operating phases of the engine, while longer dwell times provides a high accuracy on the absolute air content.

All measurement data (oil temperature, oil pressure and aeration level) are recorded and can be visualized on a graphic during operation of Air-X. A dedicated routine is also provided, which allows convertion of the results to a text format.

Air-Mix: Controlled Aeration Generator for I.C. Engines and Gear Boxes

The generator delivers a very homogeneous mixture of oil and air, not simply a mixture of oil and bubbles. It is operated and controlled through the Air-X measuring system to deliver a pre-defined and regulated aeration level to the mechanical system under test (engine, gear box or any component test rig).

Basically, aerated oil is supplied at atmospheric pressure, in such a way that the dissolved air fraction is limited to a few percent. There is also a possibility to increase pressure in the output line in order to increase the ratio (dissolved/undissolved air) up to 100%. Maximum output pressure of the generator is 10 bars. Oil temperature is regulated in a range between 0°C and 150°C.

To cover a wide range of applications, the aeration measurement can be performed either directly in the output line of the generator, or at a selected point in the mechanical system under test. Whatever the sampling point, the generator will increase automatically the aeration level in the supply line until a pre-defined value is reached at the sampling point.