

# New Quality Criteria for DGA

According to IEC 60657, quality control of laboratory analyses is performed at regular intervals using gas-in-oil standards. A CIGRE comparison of laboratories revealed that the accepted analytical methods show deviations of up to 44 per cent for the individual gases. In practice, there is the additional influence of the sampling, which the standard refers to as being of fundamental importance. This alone is ample reason why laboratory analyses are inferior to online techniques.

It is necessary to introduce new quality criteria for the accuracy of gas-in-oil analyses. A suitable parameter for this is the solution pressure, which can only be measured online.

In laboratory practice, it is already usual to calculate the solution pressure on the basis of complete analyses according to Henry and Dalton's Law. It is then used to evaluate gas saturation.

The measurable solution pressure is represented in Fig. 1 by the "riser tube experiment".

The solution pressure can be measured and evaluated and it is hence legitimate to introduce it as the basic parameter of the gas household.

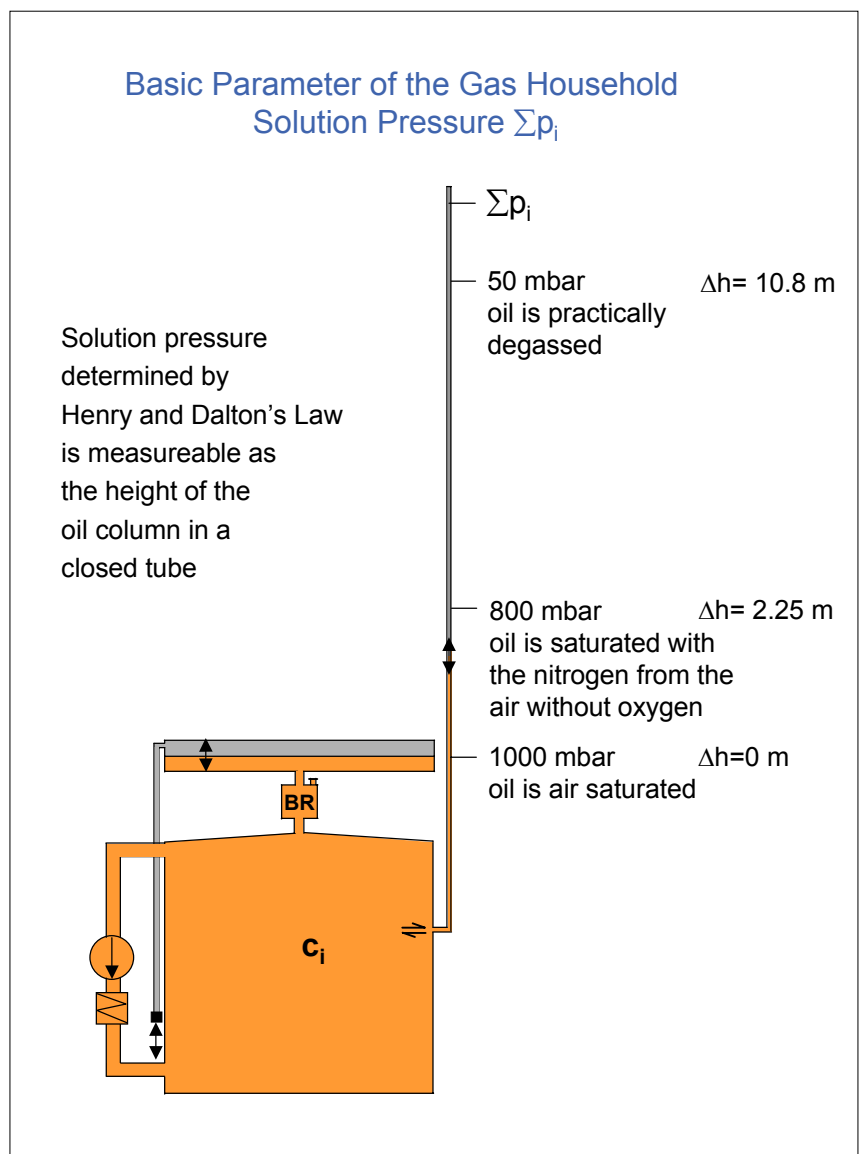


Fig. 1  
„Riser Tube Experiment“

In practice, the solution pressure can be measured directly, continuously and accurately using the new technique of online equilibrium gas (Transformer Gas Monitor – TGM – of GATRON GmbH).

The comparison of the measured solution pressure in Fig. 2A with the calculated solution pressure can be applied as a quality criterion. In addition, calibrated gas analyses in the equilibrium gas (online or manual) and the relevant solubility coefficients allow the actual individual gas concentrations (Fig. 2B) to be determined. This proves the correctness of a gas-in-oil analysis for a particular oil filling of the transformer. This also allows comparisons including sampling with original oil samples to be performed.

The experience gained in using the online equilibrium gas technique shows that in air-breathing transformers the partial pressure of nitrogen in the equilibrium is equal to the partial pressure of nitrogen in the atmospheric air. Therefore, a concentration of 66,000 ppm  $\pm$  5 % can be defined for nitrogen as a natural internal standard (NIS) for the usual temperature and air pressure ranges. The NIS criterion can be applied to all analytical methods as a quality criterion. Equilibrium techniques also allow the actual gas concentrations in the oil to be determined, if necessary even combined with the determination of the relevant solubility coefficients (Extraction Gas Sampler – EGS – of GATRON GmbH).

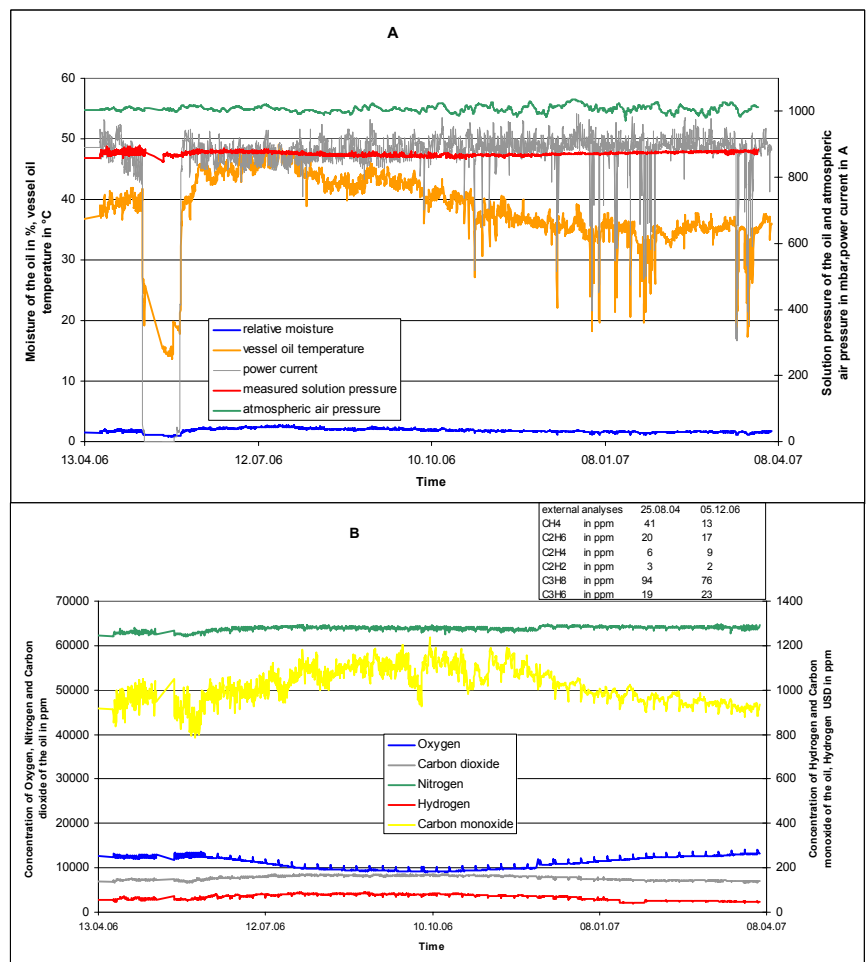


Fig. 2  
Service diagrams  
for monitoring of the  
gas household