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GROUP REF. : SC D1
PREF. SUBJECT : 1
QUESTION N° : 1.11

ANSWER TO QUESTION 1.11 : Does input data for interpretation have the required accuracy? Are schemes and software programs for DGA evaluation meaningful enough for universal fault evaluation? What information is necessary to make an evaluation representative?

DOES GASSING ALWAYS MEAN A FAULTY EQUIPMENT?

Dissolved gas analysis (DGA) is an indispensable tool for the evaluation of liquid filled electrical equipment, independent whether this is mineral oil, ester or silicone filled equipment. There are certain common criteria based on thermodynamic principles which allow the recognition of problems – e.g. thermal or electrical. It shall be, however, distinguished between a problem and a defective equipment and this shall be done not only on the basis of DGA but requires further investigations, e.g. laboratory test (e.g. stray gassing), electrical tests, maintenance procedures (e.g. degassing) (Fig. 1).
It requires engineering expertise regarding the type and design of the equipment, as well as the grid in which it is operated. In some cases also construction materials may create artifacts which can be evaluated as faults from some evaluation schemes (Table 1). Some liquids may show "stray gassing" which does not always have the same manifestation (IEC 60296:2020).
Additional to common used tools for evaluation of DGA like absolute values and ratios also:

- Rate of increase (e.g. IEEE C57.104:2019) may have a much higher influence than absolute values themselves.
- Concerning the above argument it may be of great value to introduce online monitoring as a part of DGA evaluation procedure where possible. .Especially the combination with additional parameters, e.g. oil temperature can explain some DGA trends.

With other words:
DGA evaluation schemes may be useful, but do not represent the whole picture.
Engineers are well advised to consider additional factors and compare equipment, design and operation conditions. DGA interpretation shall be adapted to specific applications, such as windfarm, network, GSU, distribution and not only on the basis of absolute values. Transient effects may take place especially during commissioning, leading to high gases, but not necessarily to a fault in the equipment.

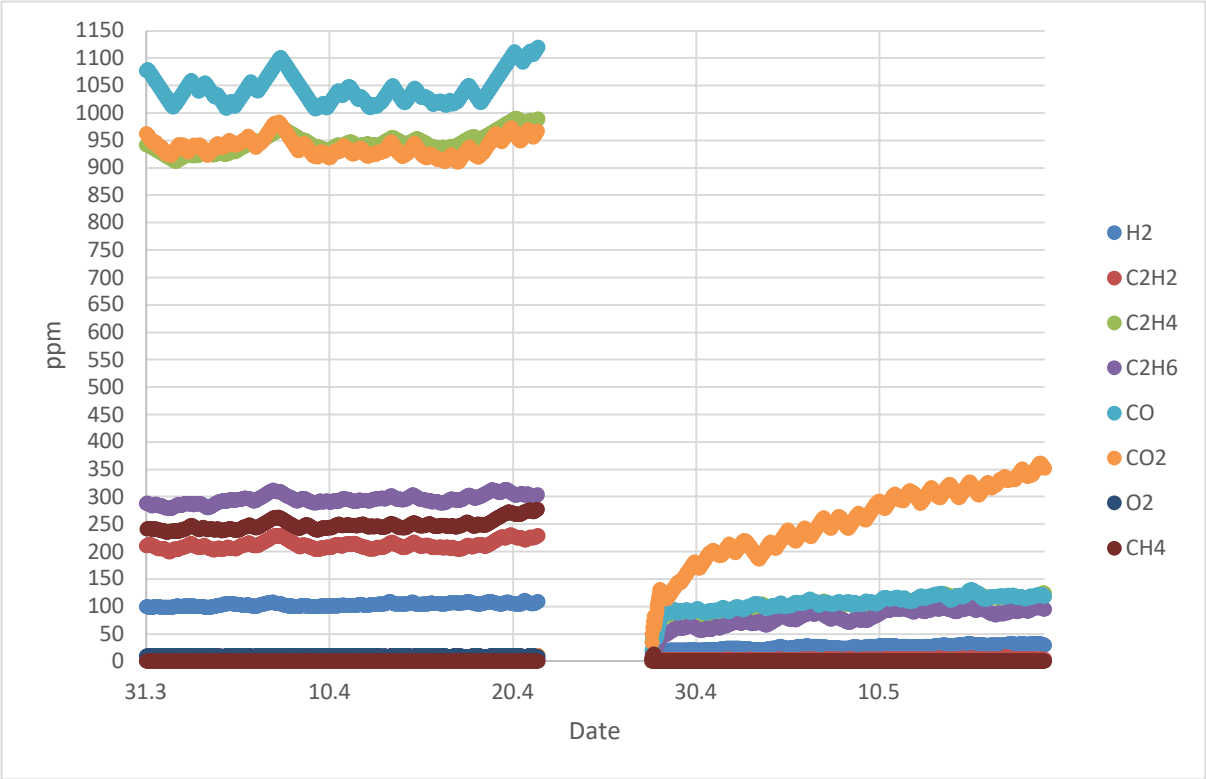

Figure1: Fault gases in an equipment prior and after degassing.

Table 1. Gas in oil analysis of an insulating liquid with high methane values, derived from an XLPE material

Fault Gas		Ppm (v/v*)
H2	Hydrogen	< 1
CH4	Methane	1501
C2H6	Ethane	34
C2H4	Ethene	< 1
C2H2	Acetylene	< 1
C3H8	Propane	14
C3H6	Propene	< 1
CO	Carbon monoxide	6
CO2	Carbon dioxide	811
O2	Oxygen	4088
N2	Nitrogen	27150

*volume/volume