

Does Gassing always mean a faulty equipment? SC D1/PS1

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?

Ivanka Atanasova-Hoehlein, Germany



Dissolved gas analysis

- Dissolved Gas Analysis is based on thermodynamic principles and on the energy injected (W. D. Halstead, 1973). This is valid independent of the type of insulating liquid, although values may vary. **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.**

Selection of hydrocarbon gas analyses quoted by Davies¹²

Fault	Fault Temp. K	Concentration of Hydrocarbon Gas ppm					Source Ref.
		H ₂	CH ₄	C ₂ H ₆	C ₂ H ₄	C ₂ H ₂	
Arcing	—	11	6	4	12	23	12
Arcing	—	29	3	4	13	122	12*
Arcing	—	103	35	11	69	676	12
Hot spot	593	44	55	39	8	0	12*
Hot spot	628	43	92	81	8	1	12*
Overheat	—	70	45	45	100	0	12

Fault gases do not always mean a fault equipment

- It is, however, necessary to distinguish between gassing and faulty equipment.

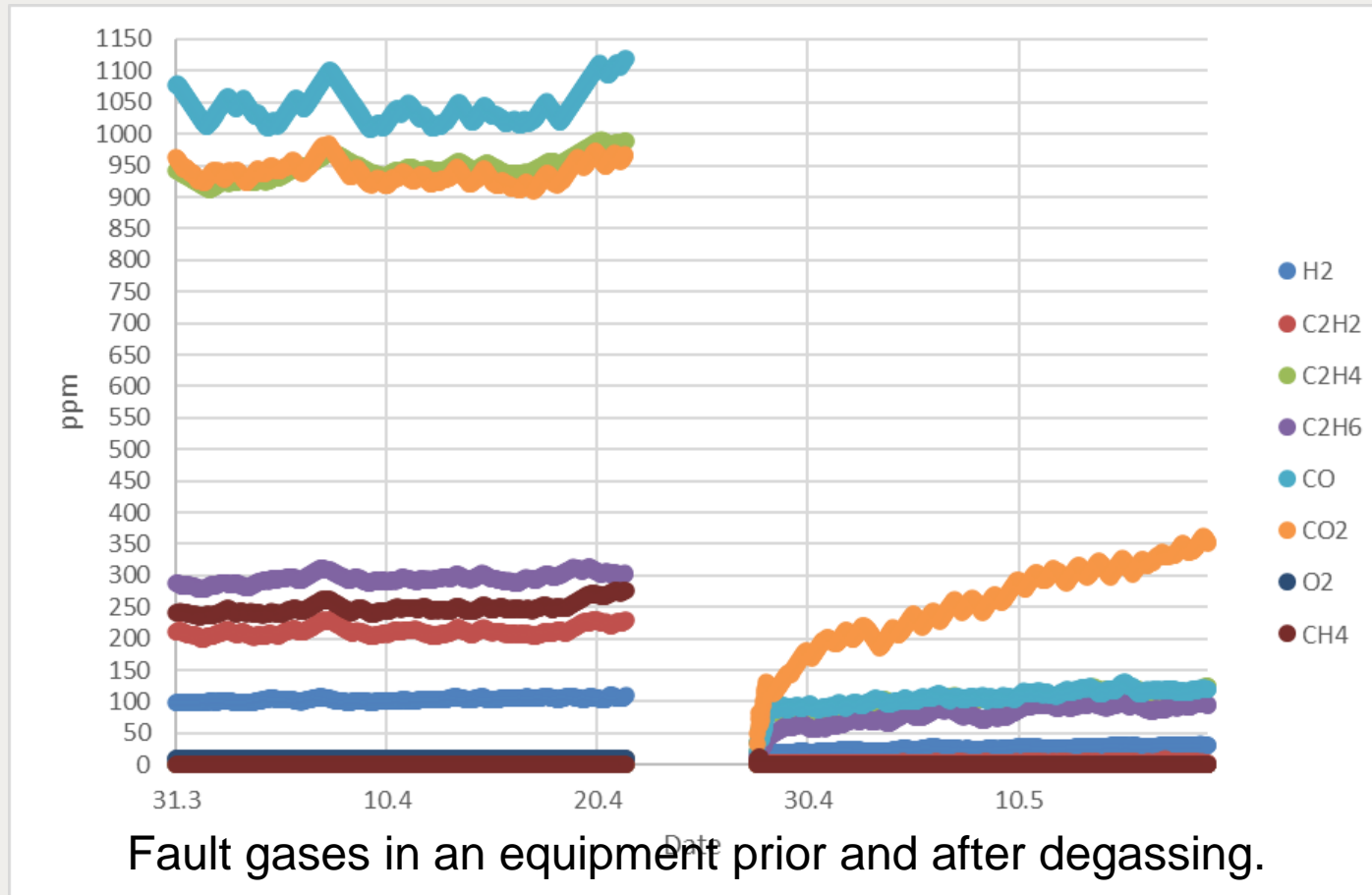
It requires engineering expertise regarding the type and design of the equipment, as well as the grid in which it is operated. In some cases also construction materials may create artifacts which can be evaluated as faults from some evaluation schemes.

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

Fault gases do not always mean a fault equipment



- Rate of increase (e.g. IEEE C57.104:2019) may have a much higher influence than absolute values themselves.
- 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.

Fault gases do not always mean a fault equipment

- 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.