

Delphi Application Note: Hydrogen and Composite PPM

Delphi Sensor Types



Delphi sensors measure key gas concentrations, typically in insulating oil. The sensors are available in two types: Hydrogen only and composite sensors. Each sensor type gives a reading for key gases in parts per million, PPM. Each sensor is

calibrated in the laboratory before being installed in an instrument for field use.

Hydrogen Sensor PPM Values

The Delphi Hydrogen sensor measures PPM as an absolute value for Hydrogen alone. It is highly selective and has negligible response to other gases.

Composite PPM Values

The Delphi composite sensor responds to 4 separate key gases, but at different proportions for each gas, and sums the measurements to give a single PPM value:

Key Gas	Symbol	Sensitivity
Acetylene	C ₂ H ₂	~15%
Ethylene	C ₂ H ₄	~5%
Carbon Monoxide	CO	~15%
Hydrogen	H ₂	100%

Table 1 Composite Delphi Typical Sensitivity

The level of response to each of these gases is measured in the laboratory when the sensor is calibrated.

Composite PPM Example

In this example, an oil sample has laboratory DGA values as shown in Table 2, and has the sensitivities given in Table 1. The percentage values for sensitivities act as multipliers for the actual PPM values. In this case the final Composite Value shown by the Delphi is 284 ppm. If any of the four key gases were to change, the resulting composite PPM value would change.

Key Gas	Lab PPM	Multiplier	Value
C ₂ H ₂	6	0.15	1
C ₂ H ₄	40	0.05	2
CO	540	0.15	81
H ₂	200	1.00	200
Composite Value			284

Table 2 Composite Delphi Typical Sensitivity

One-way calculation

A change in the final PPM value cannot be attributed to a particular key gas, and it is not possible to 'work back' from the composite value to the individual gas levels. In the example above, 284 ppm, could also be derived from 284 ppm of hydrogen and zero from the other gases.

Application

Delphi sensors act as detectors of change between regular laboratory samples. Changes in Delphi ppm levels are possible indicators of a developing problem and need to be investigated.

Expertise

More than any other company in the world, Doble experts have been dealing with issues in transformers and insulating fluids for over 80 years. We know the applications, we have done the research, and continue to publish numerous articles on the subject. Doble is always willing to help our customers with the equipment that we provide and interpretation of data from the Delphi sensors.

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