

## **Comparison of TCG Measurements Made With the Arbiter Systems, Inc. Model 921A Combustible Gas Meter, the McGraw-Edison TCG Meter, and Oil Sampled GC Measurements**

### **Model 921A Compared to McGraw-Edison**

Measurements made with the Model 921A Combustible Gas Meter may be expected to be somewhat different than those made with the older McGraw-Edison type meter. There are two reasons for this: first, the Model 921A is calibrated to read correctly for methane (other gases give higher or lower readings, depending on the characteristics of each gas; see table in manual), whereas the calibration basis of the McGraw-Edison unit is not specified, and is probably different; and second, the sensor in the Model 921A, while similar in operating principal to the MSA sensors used in the McGraw-Edison instrument, is not identical and would therefore be expected to have relative sensitivities to the different combustible gases which are not identical to those of the MSA sensors.

In general, readings made with the two TCG meters will increase more or less in proportion as the concentration increases. This is most true as the concentration of a single combustible gas increases. In general, though, transformer gases will contain several different components. Due to the different relative sensitivities of the two instruments, one may show a larger increase than the other if several gases are increasing at the same time. In all cases, however, both instruments will register an increase as the combustible gas concentrations increase.

Although we specify the 'accuracy' of the Model 921A at +10%, this is more meaningful if viewed as calibration stability and repeatability of measurements than as an absolute accuracy specification, given the wide variety of gas compositions to be measured. In other words, if the instrument is operating properly, measurements taken on methane in nitrogen should be within 10% of the actual concentration. This is important for proper operation under actual conditions, because this check is a valid indicator of proper instrument operation.

### **TCG Measurements and Oil Sampling (GC) Tests**

Because of the wide variations in gas composition, and the fact that TCG measurement by its definition is not able to differentiate between different chemical species, TCG measurements should in most cases be viewed as relative rather than absolute indications. When making service decisions for transformers, it is the trend of a

series of measurements (e.g. a sharp increase in TCG after a period of several months of stable results), rather than the absolute TCG value, that is typically used as a decision criterion.

The value of a TCG measurement as an indicator of transformer health is that TCG measurements can be performed quickly and with minimal expense. Results are immediate, allowing near real-time monitoring of problem transformers when the circumstances require it. TCG measurements should be viewed as complement, and not a substitute, for oil sampling and gas chromatograph (GC) analysis. Chromatography is by far the most powerful technique for detailed analysis of combustible gas composition, since the GC's column is designed to separate the various components of the generated gases, thereby allowing measurement of each component individually, even those components which are not combustible. Most transformer manufacturers and users recommend periodic GC measurements of oil samples, typically every 12 to 18 months.

However, GC analysis is expensive and time-consuming. A year is a long time for a fault to go undetected in a transformer. With a TCG meter, you can test your transformers on a more timely basis, once per month for example, and increase the probability of detecting a problem early before the transformer has failed. Transformer failures in the field can be very expensive, and the cost of performing frequent TCG measurements has been found to be cost-effective in the long run, further enhancing system reliability.

### **Summary**

The new Arbiter Systems, Inc. Model 921A Combustible Gas Meter is a valuable addition to the field of transformer maintenance. Fully-automatic measurement operation and fast, in-the-field results will enhance your system reliability and reduce maintenance costs. However, because of differences in design, the Model 921A will give results that are similar to but not necessarily directly interchangeable with those made with the older McGraw-Edison instrument. Furthermore, TCG measurements in general should be viewed as a complement to, and not a replacement for, oil testing for dissolved gases by gas chromatography.