

Process chromatography

Total sulfur, an innovative measurement



PGC5007B Class Oven for total sulfur measurement in refineries and petrochemical plants

Introduction

Gas chromatographs are the most commonly used analyzers in refineries and in the petrochemical field. In addition to high performance in terms of accuracy and sensitivity, they must also be easy to use and reliable.

In response to these needs, ABB has developed the PGC5000 series of process gas chromatographs that are easy to use and high-performing. These are innovative analyzers, in terms of design and the advanced man-machine and machine- controls interface that ABB proposes for the chemical and petrochemical industry, for applications on gas and fluids in refineries, for all types of measurements in the petrochemical sector, and for measuring natural gas, biogas, syngas etc.

The instrument is composed of two essential and physically distinct units; the electronic control unit and the analytical unit enclosed inside the oven. The innovative PGC5000A 'master controller' control unit has a graphical man-machine interface with a multifunction keyboard, a built-in touch-sensitive mouse and a touch screen.

ABB has recently developed a new model of gas chromatograph, the PGC5007B Class Oven, specifically designed for measuring total sulfur. The tool is able to measure samples in liquid or gaseous form and is suitable for applications in refineries and petrochemical plants.

Measurement made easy

An 'intelligent' oven

The PGC5000 Smart Oven™ has been optimized for the advanced electronic control of parameters such as pressure and temperature in order to carry out the analytical methods required for an analysis of the programmed streams in a simple and direct manner. The use of multiple Smart Ovens enables the most complex applications to be broken down into individual analytical sequences with a twofold result; on one hand, greater ease of use of the analyzer and less maintenance, and on the other hand, greater reliability of analysis.

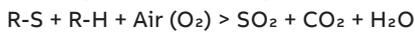
The instruments in this series provide many advantages. They are ideal for measuring hydrocarbon gases in confined spaces (the analytical configuration of the GC is pre-configured and does not allow corrective operations in the field) and commissioning requires simple and reduced operations thanks to the modularity of the hardware.

For analysis of total sulfur

ABB has also recently developed a new model of gas chromatograph, the PGC5007B Class Oven, specifically designed for measuring total sulfur. In fact, this is the only process analyzer for measuring total sulfur according to its own online ASTM method D7041-04 (2010).

The instrument is able to measure samples in liquid or gaseous form and to detect components at ppb level, and can be applied to the analysis of various hydrocarbon mixtures, from natural gas to measurements in flares, crude oil and fuels derived from petroleum and other origins, to diesel, bio and otherwise.

Before measurement, the sulfur is completely oxidized according to the following reaction:



A fixed volume of sample from the process stream is injected through the sampling valve. Air transports the sample to the furnace inside the isothermal oven, where the sample is completely oxidized by the pyrolytic oven to CO₂, H₂O and SO₂. The presence of a reducing gas inside the valve prevents the oxidation of liquid samples inside the valve itself. These components are then separated by using packed columns and pass through the detector (FPD), where the traces of SO₂ are measured at high sensitivity.

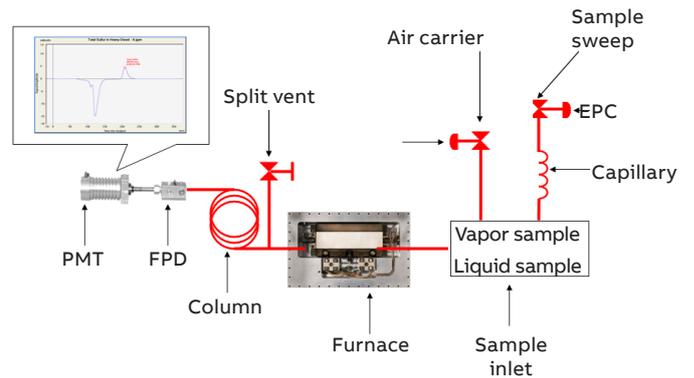


Figure 2 Operating diagram of the analysis system (sample injection, oxidation, separation, measurement)

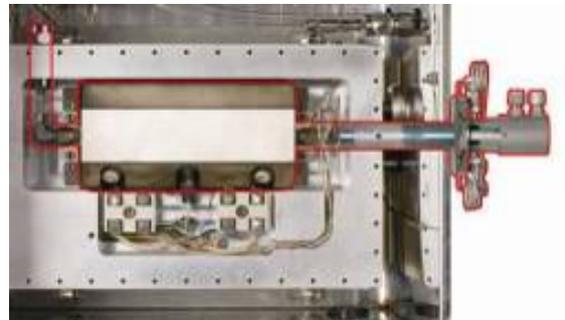


Figure 3 The sample valve for gas samples is inserted directly into the body of the furnace



Figure 1 PGC5000A Master Controller, PGC5000B and PGC5000C Smart Ovens

A critical factor

Massimo Baldizzone, Product Manager at ABB, Measurement Products tells us: “Precision in measuring total sulfur in the production of fuels and hydrocarbon mixtures is a critical factor on which the efficiency of a refinery or petrochemical plant is based. In fact, the efficient operation of the entire plant is closely linked to the accuracy of this measurement.

The advantage of having its own online ASTM method D7041-04 (2010) makes this analyzer truly innovative in this type of measurement, which takes place in a direct and repeatable manner. Furthermore, the design of the furnace has been optimized in order to have stable oxidation conditions at a controlled temperature. The sample valve is inserted directly into the body of the furnace, so as to avoid areas at lower temperatures that may alter the oxidation process”.

High sensitivity

In addition, the flame photometric detector (FPD), specific to sulfur compounds, has within it a standard addition of sulfur (Sulfur Addition Module) of 100 ppb of sulfur, enabling it to operate in a region with improved sensitivity and linearity for the measurement of sulfur in ppm and ppb. The response of the detector is proportional to the square of the concentration of sulfur, and the presence of the addition of 100 ppb increases its sensitivity by 200 times.

Baldizzone concludes by saying:

“In fact, process gas chromatography is the only system that enables direct measurement of sulfur compounds without having to use optical filters to eliminate interference due to CO₂. Examples of successful installations in plants around the world are increasingly numerous and, with major investment, they enable the plant to operate efficiently and safely”.

For further information, you can contact Massimo Baldizzone by e-mail at massimo.baldizzone@it.abb.com

PGC5000 7B: technical specifications

Perfectly assembled LSV and vaporizer

The design of the liquid sample valve integrates with the oxidation oven without the use of capillaries or tubing for transfer of the vaporized sample from the LSV to the furnace.

Direct injection of liquid samples

Vaporization of even heavy samples is complete thanks to the LSV's adjustable electronic temperature control and the use of chemically inert special metallurgical materials and those with increased thermal conduction. This leads to an improvement in the detection limits of compounds present in traces, in sub-ppm concentrations.

Smart Oven

For complete conversion, the oven temperature is 900 °C, (1652 °F) lower than that of other instruments on the market, which provides greater maintenance intervals and better reliability of the measurement.

Flame photometric detector (FPD) with photomultiplier tube (PMT)

- Compact design for use in the Smart Oven
- Higher sensitivity for the measurement of sulfur in ppm and ppb
- The electrically cooled tube has a longer useful life

“In fact, process gas chromatography is the only system that enables direct measurement of sulfur compounds without having to use optical filters to eliminate interference due to CO. Examples of successful installations in plants around the world are increasingly numerous and, with major investment, they enable the plant to operate efficiently and safely”

—

ABB S.p.A.

Process Automation

Measurement & Analytics

Via Luciano Lama, 33

20099 Sesto San Giovanni (MI)

Italy

Email: strumentazione.processo@it.abb.com

abb.com/measurement



—

We reserve the right to make technical changes or modify the contents of this document without prior notice. With regard to purchase orders, the agreed particulars shall prevail. ABB does not accept any responsibility whatsoever for potential errors or possible lack of information in this document.

We reserve all rights in this document and in the subject matter and illustrations contained therein. Any reproduction, disclosure to third parties or utilization of its contents – in whole or in parts – is forbidden without prior written consent of ABB.

©ABB 2018
All rights reserved.