

# Emission Monitoring with Set CEM CERT

## A Modularised and EN 15267-3 Approved CEMS Solution Concept

Protection of the environment and human health is a major concern for the European Union. Beside the establishment of different directives (WID, LCPD, IPPC) for the industry, performance criteria and test procedures for automated measuring systems (AMS) have been put in place under EN15267-3. The Siemens Set CEM CERT system has been certified by TUEV Sued in Germany for fulfilling these requirements. Set CEM CERT is used for continuous monitoring of  $\text{NO}_x$ ,  $\text{SO}_2$ , CO and  $\text{O}_2$  in stack gases emitted by power plants, boilers, gas turbines, furnaces, incineration plants, chemical plants, etc. The certificate is the basis for acceptance in all EU member states, and due to the modular concept of Set CEM CERT the system can be applied to various emission monitoring tasks.

“Another important benefit of Set CEM CERT is the high variety of different measuring ranges, which have been tested and approved.”

by Rudi Spinner  
Siemens AG  
Industry Sector

Industry Automation Division  
Sensors and Communication  
I IA SC PA PRM 4, Siemensallee 84  
76187 Karlsruhe, Germany  
Tel: +49 721 595-5359  
Fax: +49 721 595-2525  
Mobile: +49 172 5708683  
Email: rudi.spinner@siemens.com

Bob Lane  
Business Manager - Process Analytics  
NWE RC-GB I IA&DT IA SC PA  
Siemens Industry GB&I  
Bridgwater Road, Worcester, WR4 9ZQ, UK  
Tel: +44 (0)7788 498078  
Email: bob.lane@siemens.com

### Measurement Techniques

The stringent requirements of the European Commission require a very high performance for CEMS (continuous emission monitoring systems). The emission limit values (ELV's) are becoming lower and hence the performance of the measurement equipment is becoming more important. CEMS can mainly be divided into two categories: extractive or in-situ. Set CEM CERT (Figure 1) is based on so called "cold-extractive" technology. A heated sample probe with a filter element continuously extracts a sample, after which the heated sample line transfers the sample to a compressor gas cooler, where the moisture content is taken out. The dried gas can then be measured by dedicated analysers. One of the benefits of this cold-extractive technology is that no moisture measurement is required, since the measurement is already based on dry base, as required by the according directives. The components  $\text{NO}$ ,  $\text{SO}_2$  and CO are determined by a non dispersive infrared (NDIR) analyser (ULTRAMAT 23). For lower emission limit values, gas turbine emission monitoring applications, for example, a non dispersive ultraviolet (NDUV) analyser (SIPROCESS UV600) can be chosen as an alternative. Due to the fact that the emitted gases need to be referenced to a certain oxygen level, an oxygen measurement is required as well, which is offered with either a paramagnetic or electrochemical cell placed in the ULTRAMAT 23.

As mentioned in the preface, there were many test procedures that had to be conducted to the Set CEM CERT during the certification process, in the laboratory as well in the field under real process conditions. Test procedures included checking of parameters such as calibration function, response time, linearity, maintenance interval, zero and span drift, availability, reproducibility, NO converter efficiency, sample flow rate, influence of vibration and, probably most importantly, the influence of specified disturbing and interfering components. Out of the results from lab and field tests the total uncertainty is calculated and listed in the EN 15267-3 certificate.

Before and during the purchase process of Set CEM CERT the operator is required to establish and implement data and information required by EN 14181 in order to assure the quality of the CEMS. The quality assurance process is classified into three different quality assurance levels (QAL's): QAL 1, QAL 2 and QAL 3. In addition to the QAL-3 step there is an Annual Surveillance Test (AST) to be conducted. AST can be considered as a minor scale of the QAL 2 tests.

### Unique System Features

During the field tests of Set CEM CERT according to EN 15267 the influence of each component had to be examined as a whole.

For example, it has to be taken into account that  $\text{SO}_2$  (sulphur dioxide), which is formed when sulphur within the fuel reacts with oxygen, is very water soluble. Due to the cooling of the wet gas in the cooler down to +5°C dew point, the moisture content in the stack gas forms condensate, which then can be removed by peristaltic pumps. If this precaution is not taken, a significant loss of  $\text{SO}_2$  due to the water solubility in the condensate takes place at low concentration levels. Set CEM CERT offers a solution to prevent this loss of  $\text{SO}_2$ . An acidification module establishes a sufficient acidic environment inside the cooler's heat exchangers in order to replace the water condensate with weak acid. Due to the acidic environment, the solubility of acidic and water soluble gases is minimised to a negligible extent. A very suitable acid for this purpose is diluted ortho-phosphoric acid ( $\text{H}_3\text{PO}_4$ ), which is injected in front of the primary cooler by a peristaltic pump. All the diluted ortho-phosphoric acid solution mixed with condensate is consecutively removed as acid condensate from the bottom part of the cooler by another peristaltic pump. The acidification module (Figure 2) is recommended when measuring  $\text{SO}_2$  or  $\text{NO}_2$  concentrations, which has a similar behavior to  $\text{SO}_2$ , in ranges less than 0-150  $\text{mg}/\text{m}^3$ . Therefore, Set CEM CERT can be used as an EN 15267 approved system for emission monitoring in cases where low  $\text{SO}_2$  concentrations have to be measured, such as gas turbine applications.

Another important benefit of Set CEM CERT is the high variety of different measuring ranges, which have been tested and approved. In case of  $\text{SO}_2$  the largest range which can be applied is 0-7000  $\text{mg}/\text{m}^3$ . Furthermore, the modular package allows the certified use of system components from two different leading European manufacturers, thus keeping the number of spare parts in stock to a reasonable amount. Up to two different analysers with different measuring ranges can be configured in the Set CEM CERT, and versions for both indoor and outdoor installation are available. When using electric heaters or cabinet air conditioners the ambient temperature application range can be extended according to the local requirements.



Figure 1: Set CEM CERT panel layout

## Main applications

Set CEM CERT can be used in a variety of applications such as:

- Power plants fueled with solid, gaseous or liquid fuels
- Cement plants and lime kilns
- Plants for steel and aluminum production
- Glass melting furnaces

The modular measuring equipment is composed of the sampling probe, the heated sample gas line, a two-stage sample gas cooler, a gas pump and the multi-component analysers, ULTRAMAT 23 and SIPROCESS UV600. The gas path splits in parallel after the sample gas cooler. This supplies each analyser separately with sample gas. One advantage for maintenance is that each analyser can be individually serviced without affecting the other. The sample gas coolers have a moisture alarm in case of malfunction. For additional security, each analyser is also protected by a condensation barrier, which stops the gas flow if a malfunction occurs. This guarantees optimum protection for the heart of the Set CEM CERT - the gas analysers. Semi-automatic calibration with zero and span gases is provided by a 3/2-way solenoid valve installed between the first and second cooling stages. This solenoid valve can also be used for AUTOCAL calibration purposes of the ULTRAMAT 23 (fully automatic timing).

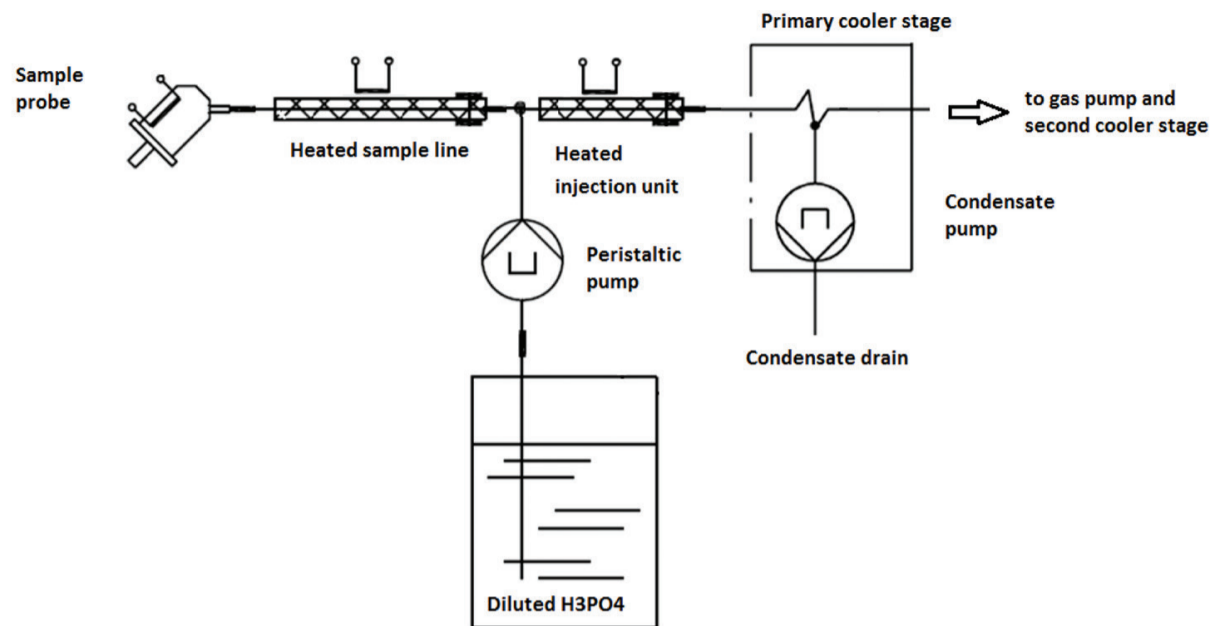


Figure 2: SETCEM CERT sample conditioning path

Read, Print, Share or Comment on this Article at: [Envirotech-Online.com/Articles](http://Envirotech-Online.com/Articles)

