EURO Heat&Power
KRAFT-WÄRME-KOPPLUNG ■ NAH-/FERNWÄRME ■ CONTRACTING

Offprint from EURO Heat&Power
November 2004 edition

CO regulation for industrial furnaces acknowledged

By-products of combustion as indicators of the quality of the combustion process

The Walldorf company LAMTEC has been acknowledged for its „CO regulation for industrial furnaces“ as part of the 2004 German gas industry prize for innovation. The prize for innovation was awarded by the Asue 'Arbeitsgemeinschaft für sparsamen und umweltfreundlichen Energieverbrauch e.V.' for outstanding efforts to save energy and increase energy efficiency.

The monitoring and regulation of combustion processes is based mainly on measuring the 0_2 content in the flue gas with a λ probe. A solution developed by LAMTEC Mess- und Regelungstechnik für Feuerungen GmbH of Walldorf goes one step further: a zircon dioxide probe has been used to produce a combustion regulation system which uses the by-products of combustion as indicators of the quality of the combustion process for gas-fired furnaces. The O_2 content of the flue gas is still measured but is only used for monitoring and display purposes.

Reference installation at the Bayrische Julius-Maximilians-Universität in Würzburg: 14 MW double-fired tube hot-water boiler fitted with two Ray burners and CO regulation

Source: LAMTEC Mess- und Regelungstechnik für Feuerungen GmbH

Regulation concept

Measurement of the 0_2 content of the flue gas alone cannot provide an indication of complete combustion. Knowledge regarding the amounts of the non-burned H_2 and CO constituents contained in the flue gas is also required. For if incomplete combustion occurs, H_2 and CO emissions always occur together in the flue gas. This fact has been taken into consideration in the solution developed by LAMTEC. Advantages associated with this solution include improved control, a clearly shorter response time, compensation for infiltrated air, better reliability, robustness, freedom from maintenance and additional energy savings. With this solution, there is also no calibration or adjustment of the burner in a furnace because the system determines the optimum working point for combustion itself.

Awards ceremony: Dipl.-Ing. Harald Weber, managing director of LAMTEC (2nd from right) receives a certification of commendation from Prof. Dr. Wolfgang Richter (left), TU Dresden and spokesman of the jury, Dr. Michael Rogowski (2nd from left), President of the BDI and Dipl.-Ing. Reinhard Schüler (right), President of the ASUE

Source: Asue

Combination probe

The system is based on the combination probe KS1D which resembles a potentiometric O_2 probe in terms of design. However with this probe, the catalytic activity of the CO/H_2 selective electrode has been specifically reduced in order to prevent the reaction between oxidizable gas constituents such as CO or H_2 assisted by catalysts directly on the surface of the electrode as much as possible. As a result, the sensor provides a mixing potential which consists of one part which depends on the O_2 reaction and one part which depends on the reaction with oxidisable gas. This mixing potential is already clearly higher with low concentrations of xidisable gases than the signal from a pure O_2 probe. In addition, its special feature is that selective measurement of O_2 and oxidisable (non-burned) flue gases can be carried out simultaneously using one sensor. An additional indicator for non-burned flue gas constituents is the dynamic response of the sensor signal. As the proportion of non-burned constituents increases, so does the dynamic response of the signal.

Automatic calibration

The optimum working point for the burner system is determined by means of these two criteria – signal strength and dynamic response. The fuel/air ratio is also changed dynamically without affecting the output regulator in order to achieve a low λ value until the combination probe indicates the start of incomplete combustion through the signal increase and dynamic response. From this point, the λ value of the fuel-air mixture will be increased again and the working point determined using this method will be subjected to a plausibility check before it is 'accepted' by the system. This procedure is repeated at cyclic intervals in order to ensure an optimum combustion process even if conditions should change.

Operating experience

The CO regulation system was released for sale after extensive tests had been carried out at 2 industrial furnaces and design testing was completed at the start of 2004. Since then more than 2000 systems have been put into operation. In both cases, the O_2 content in the flue gas has been clearly reduced compared with the O_2 regulation system varisously installed – values of < 1% by volume of O_2 were possible in the medium or high firing rate range, for example. This has resulted in an improved level of combustion efficiency (up to 0.5%) compared to the O_2 based control method a minimisation of pollutants and lower flue gas losses.

www.lamtec.de

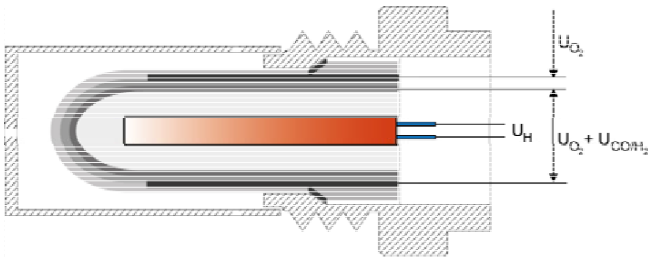
Maximum Energy Savings

Anerkennung in der Kategorie Innovationspreis 2004 für Planung, Forschung und Entwicklung der deutschen Gaswirtschaft

LAMTEC CO regulation

A new development in industrial combustion technology

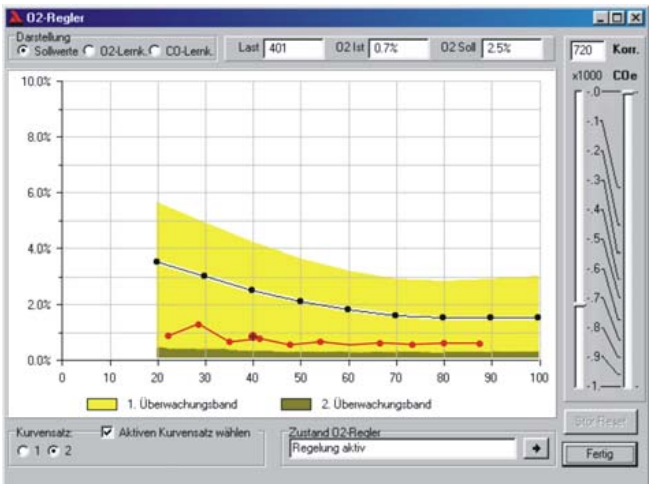
It is essential to monitor and control combustion processes in order to save energy and prevent damage to the environment and property as well as personal injury. Measurement of the oxygen content in off-gases alone cannot provide an indication of complete combustion. Therefore it is especially important to record and reduce the amounts of non-burned constituents contained in off-gas. These non-burned constituents include carbon monoxide (CO) and hydrogen (H_2). If incomplete combustion occurs, hydrogen and carbon monoxide emissions always occur together in the off-gas. With the combination probe KS1D, it is now possible for the first time to detect in situ oxygen (O_2) and oxidising (non-burned) constituents in off-gases from gaseous fuels quickly and with freedom from maintenance and then to regulate combustion.



Schematic structure of combination probe KS1D

The combination probe KS1D is similar to a potentiometric oxygen probe in terms of design. Unlike an oxygen probe with an operating electrode which has a high level of catalytic activity, with the combination probe KS1D the catalytic activity of the CO/H_2 selective electrode has been specifically reduced. This prevents the reaction between oxidisable gas constituents such as eg CO or H_2 assisted by catalysts on the surface of the electrode.

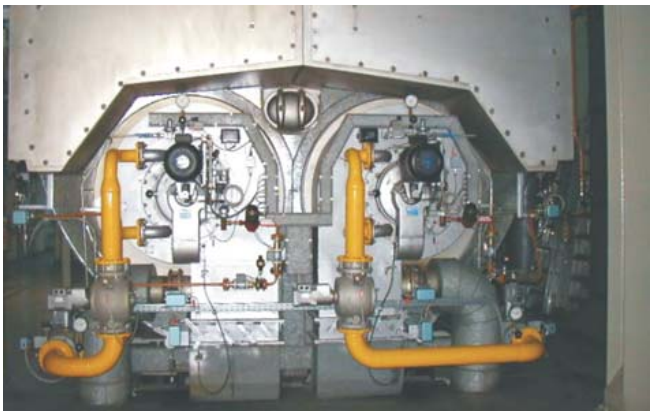
Advantages of CO regulation compared with O_2 regulation:



Plant characteristique

- Energy savings are significant higher compared with O_2 regulation on account of permanent self optimisation at each firing rate point
- Better control on account of clearly shorter response time
- Not dependent on infiltrated air and fail-safe
- High level of operational reliability

Already There are more than 2000 reference facilities in operation world wide. The O_2 value can be reduced to 1 % by volume during normal operation Is no longer a rarity.



LAMTEC

LAMTEC Meß- und Regeltechnik
für Feuerungen GmbH & Co. KG
Wiesenstraße 6
D-69190 Walldorf
Telefon +49 (0) 6227 / 6052-0
Telefax +49 (0) 6227 / 6052-57
E-Mail: info@lamtec.de
www.lamtec.de

LAMTEC Leipzig GmbH & Co. KG
Portitzer Straße 69
D-04425 Taucha
Telefon +49 (0) 34298 / 4875-0
Telefax +49 (0) 34298 / 4875-99

Druckschrift-Nr. DLT7011-12-aDE-005
Printed in Germany