Application Note

INGOLD
Leading Process Analytics

In-line Monitoring of Gaseous Oxygen Reduces Emission of VOC

Volatile organic compounds (VOCs) require emission controls because of their noxious characteristics. When VOCs are disposed of by combustion, monitoring and control of gaseous oxygen it allows the confirmation of both the delivery of gases to be processed and the supply of the correct amount of oxygen for good combustion.

A French pharmaceutical company reduced atmospheric emissions

A French pharmaceutical company has made a major upgrade investment in a plant for manufacturing pharmaceutical active principles. This upgrade includes facilities to reduce atmospheric emissions, including emissions of VOCs, and the ability to save energy by recovering the heat of combustion.

Volatile organic compounds (VOCs)

VOCs are a large class of organic compounds characterized by normally being in the gaseous state or evaporating readily at standard temperature and pressure (20 °C, 105 Pa). As to toxicity, common VOCs can give rise to various symptoms and effects ranging from mild irritation to severe respiratory distress and some are suspected carcinogens. VOC emissions are governed by EU Directive 99/13, originally issued March 13, 1999, which sets forth limits on point source (stack) and diffuse emissions with special provisions for certain more toxic solvents requiring reduction or substitution.

METTLER TOLEDO

Treatment of VOCs

For onsite treatment of VOCs, at the above mentioned pharmaceutical plant, gases generated by manufacturing processes are collected at each production unit and are sent under pressure to an incinerator. To facilitate complete disposal, the resulting combustion gases are employed to generate steam used on-site.

The content of oxygen in the combustion gases is monitored and controlled at the important points in the process; namely the collection reservoirs ahead of the burner, and the burner itself. This benefits operation as well as safety. It is desirable to keep the content of gaseous oxygen low in the collection system to eliminate explosion risk. At the level of the burner the correct ratio of gaseous oxygen will optimize combustion and thereby ensure thorough conversion of the VOCs.
Because of the importance of the oxygen monitoring the sensor employed needs to be highly responsive, and at the same time durable and reliable. This means in particular that it must be resistant to any of the media to which it might be exposed.

The solution offered by METTLER TOLEDO

The solution for measurement of gaseous oxygen proposed by METTLER TOLEDO is comprised of the following components:

- an M700 (X) transmitter with an O_2 4700 (X) module;
- an InPro 6800 G sensor, type Ka (Kalrez O-ring); and
- an InFit 761 stationary housing.

Before this monitoring system was installed permanently, a test setup was installed for checking proper function under the conditions of the particular plant.

Characteristics and advantages of the InPro 6800 G gas sensor

- Rapid response time, as a result of utilization of the "Clark principle" in the probe design;
- Minimal maintenance;
- Calibration using air;
- Certified safe for use in explosive atmospheres (ATEX II/2G Ex ia T6/T5/T4)
- Other certification: FM IS, Class I, Div. 1, Group A, B, C D.

Characteristics and advantages of the M700 (X) (with O_2 4700 (X)) transmitter

Simultaneous monitoring of oxygen and temperature;

- Certified safe for use in explosive atmospheres (ATEX II 2 (1) G Ex ib [ia] IIC T4
- Other certification: FM IS, Class I, Div. 1, Group A, B, C D.

Results of the testing

The operation of the InPro 6800 G gas sensor was evaluated over a period of two months, to validate the measuring circuit proposed by METTLER TOLEDO. The sensor demonstrated its capability for reliable real-time on-time monitoring of the gaseous oxygen content, its minimal maintenance costs due to rapid replaceability of the membrane, and its ease of calibration, which can be accomplished directly in atmospheric air. The METTLER TOLEDO system, with its simultaneous monitoring of the temperature, and ATEX certification of each of the components in the measuring circuit, would thus seem to be an ideal system for monitoring and control of gaseous oxygen.

Also noteworthy is the fact that the sensor demonstrated excellent robustness; particularly the durability of its Kalrez O-ring under difficult measurement conditions which included the presence of numerous alkenes and solvent vapors.

Transmitters M700, M400


InPro 6800 G


InFit 761

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Installation on-site

The InPro 6800 G sensor was installed directly in the conduit, using an InFit 761 stationary housing. Due to the InPro 6800 G working principle there is no need for a gas sampling system even in very humid gases.

To provide for optimal monitoring of the gaseous oxygen content over the entire installation, a validated measuring circuit was installed at each critical point, particularly the junction points of the conduits from each of the individual production units. Additional measuring circuits are planned for installation in the coming months – particularly at the outlet of the burner unit and at the exit points of the gases from each of the production units. The total number of measuring circuits in the completed installation will be 20.

Conclusions

The oxygen monitoring system employing the METTLER TOLEDO InPro 6800 G sensor enabled the pharmaceutical company to fully meet its objective of substantial reduction of VOC emissions in accordance with the EU Directive and the company's own program for health, safety, and environmental protection. The heat recovery system provides economical steam for use on-site, as well as providing an additional level of emission control.After the installation of the complete system, and the control of each of the oxygen measuring circuits installed, the client will perform validation of the overall installation with a view to employing comparable systems at its other plants.

For more information:
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