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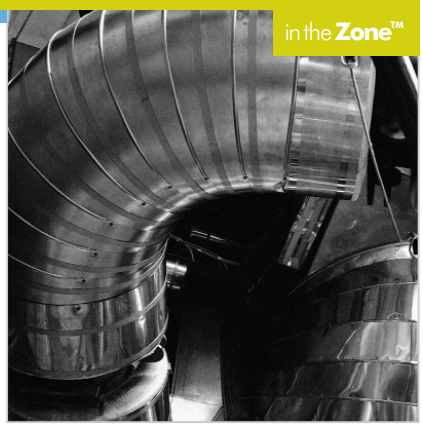
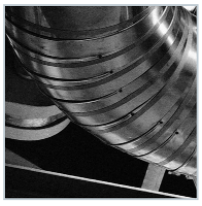
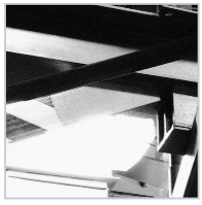
APPLICATION NOTE October 2002

Monitoring for gas in air ducts







There are a number of applications in industry, where a knowledge of the concentration of one or more gases in an air duct is important. Some familiar examples are carbon monoxide in the exhaust duct from a car park and flammable gas in an air intake to a ventilation system for a building in a petrochemical plant.

It is often possible to monitor the gas concentration in a duct by fitting a sensor or sensors inside it. This may not be appropriate if the temperature of the air/gas mixture is outside the operating or certified range of the sensor. A significant level of particulate matter mixed with the air flow, or excessive fluctuations in the pressure, may also preclude fitting sensors in the duct. In such cases it is necessary to extract a sample from the duct and pretreat it before it passes into the sensor. This note is limited only to in situ monitoring.

Methods of Detection

For flammable gases. The catalytic oxidation principle, which depends on the controlled burning of the flammable components in the air mixture, is very widely used. Recently, more sensitive sensing elements of this type have been developed, permitting lower alarm levels to be set and extending the range of vapors which can be detected.

Infrared absorption is another principle of hydrocarbon gas detection which responds more quickly and can be more sensitive than catalytic oxidation. When a beam of infrared radiation passes from a source to a detector some of the energy will be lost if the beam meets any absorbing medium. The size of this loss is a measure of the amount of vapor along the path of the beam. If the path length is short enough to be accommodated within the sensor housing it is known as a point detector and can be installed in a similar way to catalytic oxidation detectors. If not, then open path gas detectors may be used.

For toxic gases and oxygen. The most widely used method in current use for detecting oxygen and toxic gases is the electrochemical cell. Several cells are available, each being made specific by its chemistry to a particular gas. The most common of these are oxygen, carbon monoxide, chlorine, nitrogen dioxide, sulphur dioxide and hydrogen sulfide. Air surrounding the cell is allowed to diffuse into it. If the appropriate gas is present, an electrochemical reaction will take place and generate an electric current, the size of which is a function of the concentration of that gas.

Monitoring for gas in air ducts

Mounting the sensor(s)

When a sensor is mounted inside a duct it is important to ensure that it does not impede the flow of air/gas mixture through the duct. This leads to the conclusion that in small ducts only the sensor should protrude into the duct, and not its terminal housing.

One way of mounting the sensor inside the duct is illustrated below.

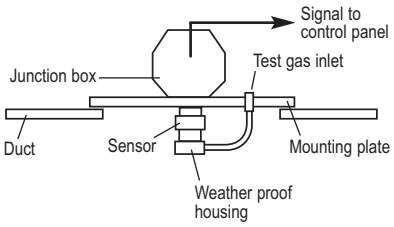


Diagram of duct mounted assembly for catalytic bead or electrochemical gas detector.

The duct mounting assembly is fitted to a prepared cutout in the duct so that the sensor is located in the air flow. It should be protected against excessive draught, which could cool the element of a catalytic detector or possibly cause a pressure drop by venturi effect inside the cell. Either of these could lead to inaccurate readings. Provision is also made to apply test gas for calibration purposes to the sensor without the need to remove the plate and sensor from the duct.

For some installations it is necessary to fit more than one sensor and separate kits for 2 or 3 sensors are available. This would cover the need to measure more than one gas in the duct or allow a voting system on a single gas to be applied.

In all these kits the terminal housing is mounted outside the duct and is supported by a bracket secured to the plate.

When the duct is larger, it is possible to mount both the sensor and its terminal housing inside the duct without disturbing the flow pattern excessively.
If the gas being monitored is flammable the sensor and terminal housing together must be designed and certified as safe to operate in a potentially hazardous atmosphere. Typical of such installations is the hood of the inlet duct to the combustion chamber of a gas turbine.

System Outputs

The sensors are usually connected to control equipment which will give an indication that preset alarm levels have been reached.
Alarm outputs are provided in the form of volt free relay contacts. These may be used to directly operate audible/visual alarms, or switch in fans and dampers on the ventilation system.

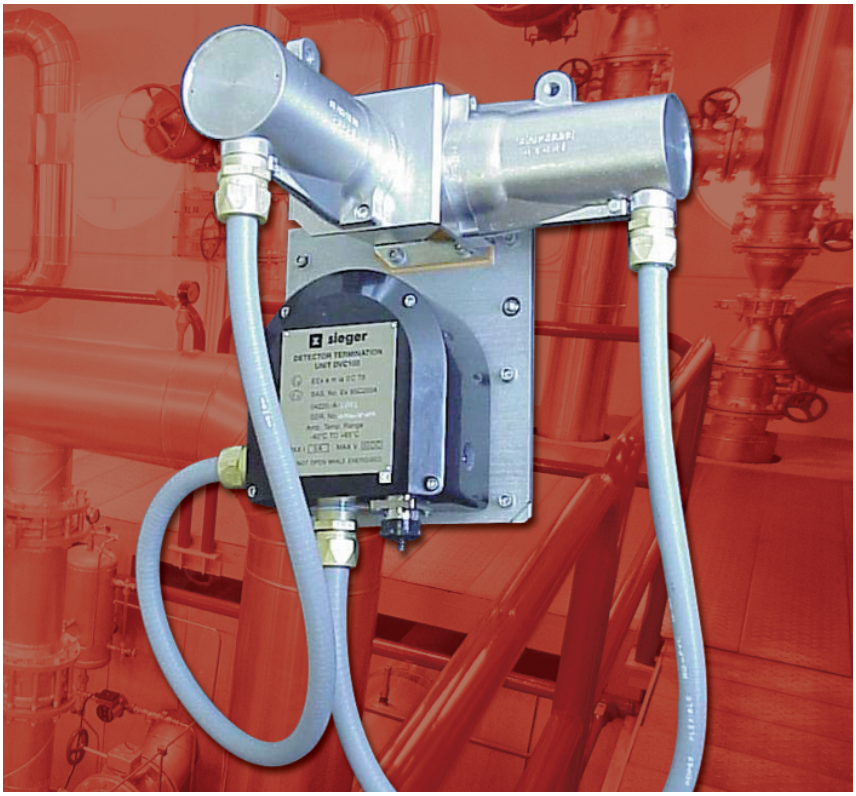
Analogue signals can be connected to a remote recorder or may be fed into a host computer which can initiate any or all of these actions.

Solutions

Among the products designed and manufactured by Zellweger Analytics for this application are:

Controllers

Single and multi channel controllers for use in both hazardous and safe areas. These include Bias 1 – single channel, Bias 4 – four channel, System 57 – 19" rack mounted – unlimited channels.



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Sensors

Flammable and toxic gas sensors for use in hazardous and safe areas.
Solutions include
Sensepoint & Signalpoint catalytic bead and electro chemical gas detectors.
Optima Plus – point infrared flammable gas detector.
Searchpoint Excel – open path (duct mounted) infrared flammable gas detector.
Apex & Opus – flammable & toxic gas detector with built in user interface for local, non-intrusive are main operation.

Literature is available giving full details of all these products and will be supplied on request.

References

Several hundred duct mounting kits have been supplied for many diverse applications. These range from duct monitoring of heating, ventilation and air conditioning (HVAC) systems on commercial and small industrial premises to large petrochemical or offshore applications.
A few are listed below:

Statoil	(Norway)
Elf	(Norway)
PPCON	(Norway)
Unilever	(South Africa)
Engen	(South Africa)
Waterford Glass	(Ireland)
Chubb Monitoring Station	(Ireland)
Saudi Aramco	(United Arab Emirates)
Avery	(Belgium)

- Zellweger Analytics is accustomed to working with a wide variety of international customers and organisations. By keeping in close contact with the market place, Zellweger Analytics has developed an enviable reputation for providing products to solve diverse gas detection problems.

- To meet specific requirements, the design of nonstandard items or assemblies to supplement the standard range of products are supported by a dedicated Special Projects Group (SPG).

- Qualified and highly trained Field Service Engineers are available to maintain, calibrate and service installations throughout the world. Zellweger Analytics provides service and training on site; alternatively instrumentation can be routinely collected for service or repair in our service centers. Customised service contracts are available.

- These activities are supported by a large team of scientists and development engineers dedicated to the improvement of gas detection techniques through the use of the very best in applied technology.

- Zellweger has a full range of agencies and distributors providing worldwide support.

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