

Design Considerations in Gas Detector Sampling

Introduction

Gas detectors sample gas using one of three techniques:

- Diffusion of gas to the front face of the sensor
- Manual drawing of the sample using an aspirator bulb
- Automatic drawing of the sample using a pump

This Application Note offers design tips relating to manual and pumped aspiration. Aspirator bulbs and pumps produce either positive or negative pressure transients during sampling, depending on whether they are upstream or downstream of the sensor tray. A design goal is to minimise these pressure and flow transients at the top face of the toxic and oxygen gas sensors.

Design Components

The gas sampling system can be considered as a combination of three components:

- Inlet and outlet tubes which often include restrictors.
- Flow hood which connects the inlet and outlet pipes and creates the gas space above the sensor.
- Sensor tray to constrain the sensor (without undue mechanical force).

Design Consideration

When designing the sampling system, the following design tips should be borne in mind:

1. The source of the pressure change should not be directly above the sensor; that is, the input and output of the pump or the aspirator bulb should not be in close proximity to the sensor top.
2. Gas flow should be parallel to the sensor face and not perpendicular. Always flow the gas across the sensor and not at the sensor. Avoid straight-line (laminar) flow; design a bend or change of angle between inlet and outlet of the sensor hood.
3. The amount of "dead volume" between the sensor and the point of generated pressure should be maximised, which will involve a compromise, since the overall detector dimensions and fast response time requirements demand minimum dead volume.
4. The use of baffles and other pressure/ flow modulators on the inlet and outlet tubes should be considered
5. Remember that all sampling systems will produce positive and negative transient pressure/flow effects, but sensor outputs will return to the original output as the sensors return to equilibrium.
6. Include a particulate inlet filter if sampling in dirty environments.
7. Ensure that the sensor hood inlet/ outlet orifice sizes are such that the diameter closest to the pump/ aspirator is the smallest.
8. When manually aspirating, consider the aspirator location. Placing the bulb downstream of the hood, you need to restrict the reflation rate of the bulb (usually by a restrictor). If the bulb is upstream, then reflation does not need controlling, but flow rate will depend on the user: not advised.

Schematics below show good and bad designs.

