Onsite gas mixing

Finding the right fit in instrumentation

Offering increased flexibility and lower costs, onsite gas mixing is common practice in a number of applications. Here, Thermco's Dennis Richardson explores the benefits of onsite gas mixing – and selecting the right instrumentation for a successful project.

Mixing gases onsite has become a standard practice for most industrial gas companies. Onsite mixing provides many benefits, from reduced costs to reduced cylinder handling.

Some examples of these advantages are:

- Lower costs due to utilization of bulk gas supplies
- Ability to easily change the gas mixture proportion, allowing the user to experiment and optimize the process
- Reduced cylinder handling which translates into a safer workplace
- In some cases higher mixing precision than industrial grade gas mixtures in cylinders
- Elimination of the problem of stratification in cylinders caused by incomplete mixing during the cylinder filling process

How do onsite gas mixers work?

Onsite mixing is usually accomplished with the surge tank type gas mixer. These gas mixers utilize a surge tank to allow the gas mixer to have infinite flow rate turndown.

This type of gas mixer operates by holding the pressure in a surge tank between a lower level and an upper level. Once the mixed gas demand reduces the surge tank pressure to the lower level, a pressure switch/solenoid valve combination causes the mixed gas to flow into the surge tank until it reaches the upper level when the flow is turned off. If demand increases the cycle rate increases, but the action of the regulators and flow restriction components remains essentially the same. The mixture created is often then monitored with a built-in gas analyzer.

Onsite gas mixing can be used anywhere that there is a medium to high demand for gas mixtures. Common applications include:

- Welding shield gases
- Modified food packaging atmospheres
- Furnace atmospheres
- Leak detection systems
- Laser gases
- Lamp filling
- Airbag canisters
- Chemical blanketing

How to choose the right gas mixer

The first step in the process of choosing the gas mixer is to accurately define the specifications.

It will be necessary for the gas mixer manufacturer to have this information to quote the gas mixer. These specifications are:

- Gases to be mixed and if the mixture requires adjustability, the range of mixing (i.e. 0-30 percent CO_2 in Ar)
- Minimum and maximum mixed gas flow rate
- Available supply gas pressure
- Required mixed gas pressure
- Indoor or outdoor installation

Some applications are specific to a specialized process and will require more information. Examples of this type of application are leak detection systems, airbag canister filling and tank blanketing. For these cases it is important to discuss the gas mixture accuracy required, the ambient temperature at the gas mixer and the temperature of the supply gases.

In situations where an out-of-specification mixture or lack of mixture could cause an unsafe condition, the needed safety shut-offs should be discussed. In the case of furnace atmospheres, industry standards are available that define the minimum needed safety controls in a gas mixer. In the US the standard is NFPA 86.

One of the most often confused specifications is the gas mixture accuracy. A general term such as '±5 percent accuracy' is not adequate. If the gas mixer is designed to mix at a particular mixture, the mixture should be defined on an absolute basis. For example, if the requested mixture is 10.0 percent He, 90.0 percent N_2 then the accuracy should be defined as '±0.5 percent He absolute', which will equal an accuracy envelope of 9.5 to 10.5 percent He balance N_2.

If the gas mixer is designed to produce a range of mixtures, the accuracy may be defined as '±5 percent of the full range on an absolute basis'; for a range of 0-20 percent He in N_2 this would equal ±1.0 percent He. The accuracy envelope at 10.0 percent He would be 9.0 percent to 11.0 percent He balance N_2.

Accuracy statements should always define the temperature conditions. Every gas mixer will be effected by ambient and gas supply temperatures. An example of the temperature statement would be *'stated accuracy assumes that the supply gases are equal in temperature and the ambient and supply gases are in the range of 50°F to 90°F/10° to 32°C'.*

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Is a gas analyzer necessary?

Continuous gas analysis of the gas mixture is a common feature of gas mixers. Gas analyzers are expensive so the decision to include a gas analyzer will have a major impact on the cost.

Some mixtures are much more expensive to measure than other mixtures. Binary mixtures such as CO_2/Ar and He/N_2 can be measured with a thermal conductivity type gas analyzer, which has moderate cost and low maintenance requirements. Three gas mixtures such as CO_2/O_2/Ar are much more difficult and costly to measure, since they require two gas analyzers, one specific for CO_2 and another specific for O_2.

Some applications will require a gas analyzer due to safety concerns with out-of-specification gas mixtures. Examples of these applications are furnace atmospheres and chemical blanketing. Some applications, such as welding shield gas for a small number of welders, may not justify the cost of a gas analyzer.

The popularity of onsite gas mixing will continue to grow as users choose the cost and technical advantages of onsite gas mixing. The key to a successful project is to clearly define the gas mixing specifications and to communicate this information between the end-user, gas supplier and gas mixer manufacturer. SGR

Get in touch

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