How to Know if a Gas Generator is the Right Choice for Your Lab

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Supplying the Required Gases for your Laboratory

About the Authors

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Many analytical instruments require highly purified gases for operation. For example, Hydrogen is required for gas chromatographs with flame ionization detection, dry air is required with Fourier Transform Infrared Spectrometers, and Nitrogen is required with gas chromatographs, GC-MS and LC-MS systems. In addition, dry air, which contains exceedingly low levels of Carbon Dioxide, Carbon Monoxide and Water is required for Total Organic Carbon systems. Highly purified gases are also employed in a broad range of other activities in the laboratory; as an example, highly purified nitrogen is used to provide an oxygen free environment in dry boxes and to perform a variety of organic and inorganic syntheses.

The method that you choose to provide the necessary gas must be capable of providing the appropriate gas in a manner that meets the requirements of the instrument (or synthetic reaction) and must provide the required purity as well as the necessary flow rate and pressure. In addition, there are several other important issues that you should consider when you are selecting the optimum method to provide the gas including laboratory safety, reliability, potential expansion of the laboratory needs, cost and convenience. In this paper, we will describe the various criteria that you should use in selecting how you can most effectively provide the necessary gas for your laboratory.

Selecting the method of providing the necessary gas

Gases for instrumentation can be provided in two distinctly different ways:

Purchasing Bottled Gas from an External Supplier:

When bottled gas is employed, the user obtains a pressurized bottle containing the desired gas and installs it into the analytical system. In many facilities, moving and installing the bottle safely requires specially trained personnel since the contents may be at a pressure of 1000 psi or greate. There are several steps involved in this approach; the bottles must first be ordered, received and stored in a safe location until needed. The bottles must then be transported from the storage area to the laboratory and installed into the analytical system. It should be noted that installing a new bottle requires a break in the overall system and could introduce impurities. The empty bottle must then be returned to be refilled (transporting the bottles is costly and contributes to global warming). Calculation of the overall cost of using bottled gas should include the cost of the manpower required for each of these steps as well as the demurrage charges for the bottle. Additional concerns with the use of bottled gas are that replacement of the bottle may occur at an inconvenient time in the day to day operation of the laboratory and the situation that laboratory must depend on an external supplier and their availability of replacement bottles. In the midst of a crisis (e. g. COVID-19), it is possible that the supplier may not be able to provide the gas, or the personnel required to move the bottle might not be available.

Using an in-house gas generator:

An in-house gas generator is directly connected to the analytical instrument system(s) that requires the gas. The generator provides the desired pressure and flow rate on a 24/7 basis and requires a minimum amount of maintenance. As an example, the Parker Hannifin Dry Gas Generator provides highly 99.999% nitrogen from laboratory air at a maximum flow rate of 10 L/min at a maximum pressure of 60 psig. There are a number of important benefits to the use of an in-house generator including safety, reliability, cost and convenience Since the generator is directly connected to the instrument there is no danger that impurities can enter the system as it is not necessary to break the connection between the gas supply and the system. The various benefits of using an in-house generator to supply the gas have led analysts to select this approach and have found that the overall cost of the system pays for itself in a year or less.

Selecting the most appropriate gas generator for your laboratory

The selection of the appropriate in-house gas generator for your laboratory depends on a number of criteria:

Q Does the generator provide the necessary flow rate and pressure to meet today and tomorrow's needs?

A While it may seem obvious that an in-house gas generator must meet the flow rate and pressure requirements of your instrument, many users find that users that it is important to ensure that the generator can meet the needs of future laboratory requirements (i. e. do you expect to add additional gas chromatographs in the near future).

Q Has the instrument manufacturer qualified or validated the gas generator for your instrument?

A In many cases, an instrument manufacturer will indicate that certain gas generators have been found to be well suited to be interfaced to their instrument. If the instrument manufacturer has not qualified a specific gas generator, interfacing if to the instrument may be difficult and diagnosing overall system problems may be difficult. In this regard, if there are difficulties in interfacing the systems, the instrument manufacturer's service representative may blame the gas generator while the gas generator's service representative may blame the instrument. In extreme cases, the use of a non-qualified gas generator may void the warranty of the instrument.

Q Does the system meet the environmental health, manufacturing accreditation and safety requirements of your organization and all applicable government regulations?

A You should verify that the gas generator meets all applicable regulations including electromagnetic emissions, occupational health requirements, etc. The gas generator must be manufactured to meet all governmental requirements and quality requirements that your laboratory is subject to (e.g. GMP regulations, CE approval).

Q Is the generator designed to operate safely?

A In the event of a problem, the generator should be able to shut down and send a signal to the operator of the system. The generator must include the ability to detect a leak or an over pressure condition. As an example, if Hydrogen gas were to leak into the laboratory, an explosive condition might occur. In the same vein, an over pressure condition could damage components of your instrument.

Q Is the generator easy to use and maintain?

A A gas generator may require adjustment of various settings to meet the needs of different applications. It is important to make sure that any changes are easy to perform and are readily verified. In addition, it should be easy to perform routine maintenance operations such as changing of the filter. It is worthwhile to see the system before you purchase it; this may be difficult if the generator is made in a foreign country. Be sure to ask other users about their experiences and whether they are satisfied with the level of support from the supplier (ask the supplier for referrals).

Does the Supplier provide support for the long-term use of the generators?

Q Are service parts and maintenance readily available?

A Some gas generators are manufactured by overseas companies and it may be difficult or time consuming to get the support that you need. The actual cost of downtime to your facility if you lose a day of production maybe be significant.

Q What does the warranty provide for?

A Ideally, the warranty should include parts and labor and should be long enough to ensure that the generator is operating within specifications.

Q Has the manufacturer manufactured gas generators for an extended period?

A An established manufacturer has experience in the requisite technology and has continuously improved the system. If you purchase a gas generator from a company that has started to manufacture the generator relatively recently, it is quite possible that they are still eliminating problems and the system performance is not optimized.

Q Is the manufacturer well established and financially stable?

A The purchase of a gas generator should be considered as an investment that will be used for many years. It is important that you verify that the manufacturer is financially stable so that your long-term needs will be fulfilled. It is possible that a financially unstable manufacturer may discontinue the product line or go out of business. making it more difficult to get the necessary support.

How to optimize your instrument gas requirements

Use a gas generator:

– rather than bottled gas
– that is qualified by your instrument manufacturer
– that meets all safety, and regulatory requirements
– that is manufactured by an established company
– from a manufacturer that will provide support over the lifetime of your system

What is the overall cost of operation of supplying the desired gas to your system?

Q Should you use bottled gas or a gas generator?

A While the initial cost of the generator may be an important factor in your decision, is critical that you determine the long-term cost to your facility. Obtaining the gas from bottles requires a significant number of steps, each of which requires costly labor input, which adds cost (e. g. cutting an order for bottles, transporting the bottles, installing the bottle).

Q What would the unavailability of gas bottles or replacement parts do to your productivity?

A If replacement bottles or the necessary, spare parts to maintain your gas generator were not readily available. the cost due to lost productivity could be significant.

Q Is an extended service contract available and does it fit your budget?

A Long term support for the gas generator must be available at a reasonable cost and the service should be provided on a timely basis. It is recommended that you contract for periodic service visits to minimize the possibility of down time.

Conclusion

Selecting the method of supplying the necessary gas for your laboratory should include a number of considerations including safety, convenience and overall cost of operation. It is important to consider the overall cost of delivering the gas, both in terms of dollars and user interaction time. An increasing large number of analysts prefer a gas generator that has been qualified by the instrument manufacture and is supplied by an established manufacturer who has significant experience in the field and the ability to support the product over the long term. These users have found that a gas generator can provide reliable, safe, low cost, maintenance free supply of highly purified gas with a minimum of operator interaction.

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