Emerson™ Lifecycle Services
Reducing or Replacing Carrier Gas Usage in 700XA Gas Chromatographs

WHAT IF...

...You could reduce operational costs associated with high Helium prices.

...You could ensure detector response to measurement components for accurate gas analysis.

... You could minimize downtime and assure regulatory compliance with reliable support services from Emerson.

CHALLENGE

The majority of online gas chromatographs with Thermal Conductivity Detectors (TCD) use Helium as a carrier gas. Recently, many suppliers of chromatograph grade helium have been experiencing supply shortages, in turn leading to increasing prices. Many users are looking for alternatives to decrease or eliminate the usage of helium.

OUR SOLUTION

There are two steps to reducing helium usage in installed Rosemount 700XA gas chromatographs:

1. Convert the actuation gas to nitrogen or air
2. Convert the actuation gas to nitrogen or air and the carrier gas to hydrogen

HOW IT WORKS

Converting the actuation gas. The analysis valves in the chromatograph oven typically use the carrier gas to actuate the pneumatic analytical valves. These valves switch the flow path to direct the analyzed sample and the carrier gas through columns and across the detector depending on the application. Converting the actuation gas to nitrogen or air will reduce the use of helium to less than 20 cc/min for a four-minute C6+ application. The alternative actuation gas should be at 115 PSI (800 kPa), be dry and free of particulates greater than two microns.

For more information visit:
Emerson.com/RosemountGasAnalysis
or contact your local Emerson sales representative

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Converting to hydrogen carrier gas. To convert to hydrogen as a carrier gas, the analytical flow path will also need to be altered. Most helium carrier applications have the high-pressure helium supply pass over the reference detector (Figure 3). If high pressure hydrogen is passed over the detector, the thermistors will degrade rapidly.

To avoid the rapid degradation of the detector, the hydrogen carrier is routed to the reference detector through a restrictor and the hydrogen supply to the analytical flow path is routed around the detector. The restrictor is matched to the restriction of flow of the analytical flow path to ensure the flow across the reference side of the detector is similar to the measure side of the detector.

Additionally, the existing detectors should be replaced with thermistors designed for hydrogen use. For gas chromatographs installed inside an analyzer house, the hydrocarbon Lower Explosion Limit (LEL) room monitors may need to be replaced with monitors that detect hydrogen and hydrocarbons.

REAL PROBLEMS. REAL SOLUTIONS.

Helium is used with TCD applications because it has a very high thermal conductivity compared to many of the components being detected (Figure 1) and therefore provides a large detector response to the measured components. Other inert gases (such as Argon) are not generally suitable as they have a thermal conductivity close to the measured components and will not provide the required amount of resolution for most applications.

Hydrogen can be used as an alternative carrier gas to helium as it has a similar thermal conductivity and therefore will provide a similar detector response. However, hydrogen is a flammable gas and therefore raises hazardous area approval issues.

The carrier gas is also commonly used as the actuation gas for the pneumatic analytical valves in the 700XA as many installation locations lack a reliable source of high pressure air. This provides the largest potential for reducing helium usage by converting this actuation gas supply to nitrogen or instrument air.

Figure 1 – Existing Flow Path with Helium as the Actuation Gas.

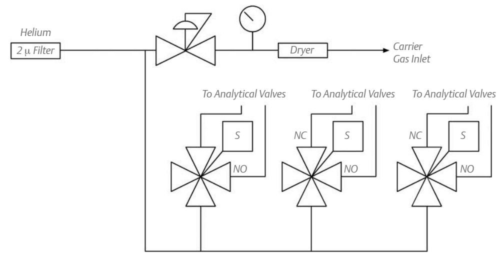


Figure 1 shows the flow path with helium as the carrier gas and the actuation gas.

Figure 2 – Flow Path with Nitrogen or Air Actuation Gas and the Pneumatic Shut-off Valve Installed.

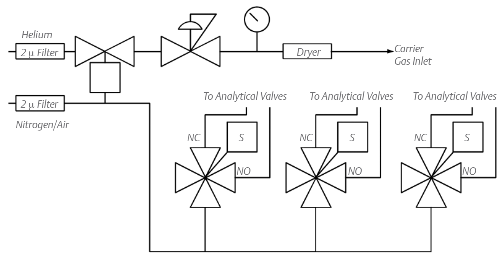
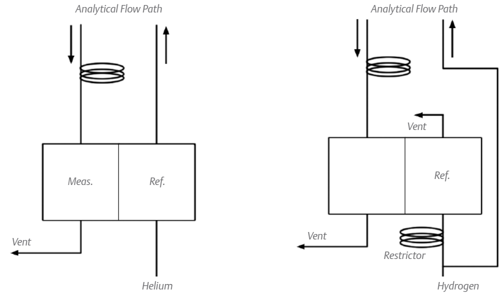


Figure 2 shows the flow path with the alternative actuation gas kit installed. The pneumatic shut-off valve will shut-off the flow of carrier gas in the event of the loss of actuation gas pressure. Without this shutoff, if the actuation gas pressure falls none of the pistons in the analyzer valves will seal. This will create multiple paths for the helium to escape to vent and dramatically increase the use of helium use, possibly emptying the helium supply.

Figure 3 – Typical Detector Flow Path (left) and the Hydrogen Carrier Flow Path (right) Across the Detector.



SPECIFICATION AND ORDERING

RETROFIT KITS:

The actuation gas conversion kit: P/N 2-3-710-261

- Pneumatic shut-off valve
- Bracket for installing the shut-off valve
- Two-micron inline filter
- Pre-bent stainless tube
- Various Swagelok® fittings

Components that are not included in the conversion kit but may be required include:

- Actuation gas bottle regulator(s)
- Stainless tubing for connection to the gas supply

700XA single regulator and detector retrofit kit: P/N 2-3-710-259

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