Agilent Technologies

Agilent Technologies Inc.
2850 Centerville Rd
Wilmington, DE 19808-1610

302-636-3726 telephone
302-633-8913 fax
Andrew_deionno@agilent.com

Andrew Delonno
Product Safety Engineer
Chemical Analysis Group

January 25, 2008

Subject: Use of Hydrogen in the 6890 and 7890 Gas Chromatographs

Dear Customer:

I am pleased to respond to your request for information concerning the use of hydrogen as a carrier gas in the 6890 and 7890 Gas Chromatographs produced by Agilent Technologies.

These instruments were designed to use hydrogen as a carrier gas. The Hydrogen Carrier Gas Safety Guide and the operation manuals for the instruments contain safety instructions, but it is recommended that anyone working with flammable or explosive gases take a lab safety course covering proper gas handling and use.

Some laboratory precautions that are recommended for controlling hydrogen build up include directing vent lines into a fume hood and leak-testing the gas connections, lines, and valves before operating the instrument. Because hydrogen leaks frequently originate in tubing and connections external to the gas chromatograph (e.g., at the tank), hydrogen leak-testing throughout the lab should be performed at least weekly and whenever a tank is changed.

These Agilent gas chromatographs are not designed for use in hazardous atmospheres, but they have built-in safety features to reduce the risk of and the potential for injury from oven explosions when used in a standard laboratory environment. Enclosed is a set of frequently asked questions which should answer your questions about the use of hydrogen in the oven.

Lastly, it should be noted that we have not received any reports of injuries due to the use of hydrogen in these instruments.

Agilent's Chemical Analysis Solutions Unit appreciates your interest in ensuring safe use of your instruments. Should you require any additional information on this subject, please do not hesitate to contact us.

Sincerely,

Andrew DeIonno
Product Safety Engineer

Hydrogen Safety Frequently Asked Questions (FAQ)

Question: Does my GC have safety features built in to limit the possibility of an oven explosion when Hydrogen is used as a carrier gas?

Answer: Yes, the GC has several design features built in to limit the potential of a hydrogen explosion. These features show up in the Firmware set point monitoring/control, the mechanical operation of the EPC, the oven design, and the oven heater control.

Firmware Hydrogen Safety Design

Question: What Firmware features does the GC have to control hydrogen delivery in the GC system?

Answer: The firmware monitors the ability of the Hydrogen channel to reach a user defined set point and controls the EPC operation in reaching that set point.

Question: How could the GC detect that there is a hydrogen leak?

Answer: When a channel is set for hydrogen use and a user has initiated the channel to a specific set point, the GC will monitor the ability of the hydrogen channel to reach the user set point.

Question: What happens if the GC hydrogen channel does not reach a set point?

Answer: If the GC firmware determines that a set point is not attained within a specific period of time then the GC will alert the user via an audible alarm. The alarm will intermittently sound for a short period of time. If the set point is still not reached, then the GC shuts down the EPC module, shuts off the zone heaters and shuts off the oven heater.

Question: If I have a hydrogen shutdown, may I reset the GC remotely via control software like Chemstation?

Answer: No, the hydrogen shutdown may only be cleared by a human action at the GC keyboard as described in the Users Manuals.

EPC and Column Hydrogen Safety Features

Question: What safety features exist in the EPC?

Answer: The EPC flow valve is in the closed position when the valve is off and the lab supplied pressure works to press the valve diaphragm closed. However, if the valve still remains open due to a valve seating fault, there is a flow limiting mechanical device known as a frit. The frit is permanently built into the EPC and will limit hydrogen flow into the system. In a two fault condition, such as a missing column and a valve seating fault,

the frit will mechanically limit the hydrogen flow to a level that has been experimentally shown to pose no increased risk due to the hydrogen leakage.

Question: If a column breaks when using hydrogen carrier gas, how does the safety feature work?

Answer: The capillary columns provide additional restrictions to the hydrogen flow. This, in addition to the EPC firmware control, oven start up control and the mechanical frit greatly limits the amount of hydrogen that can leak into the oven cavity.

Oven, Oven Heater, and Oven Control Hydrogen Safety Features

Question: Does the oven itself have any hydrogen safety related features?

Answer: Yes.

First, when the oven start command is applied, the GC will run through a specific start up sequence to purge oven gases out of the oven cavity. During start up, the oven flaps will open with the oven fan on. This will pressurize the oven slightly and flush any hydrogen out of the oven cavity. After this oven purging, the flaps are closed and the oven heater will have electricity applied.

Second, the oven heater hardware control has a controlling triac and a double pole controlling relay to prevent the oven heater from faulting into an “on” position when the control or user has turned the oven heater off.

Third, the oven is not a sealed shut with respect to hydrogen and does not contain areas where air will not circulate (dead volumes). This allows for very light small molecular gases, such as Hydrogen, to easily diffuse out of the oven cavity even when the oven itself is turned off. To aid in this diffusion, the rear oven flaps are automatically opened half way when the oven is placed into an off state at the GC keyboard or through Chemstation.

Fourth, if there is an explosion in the oven for any reason, the oven door is designed to buckle under the explosion pressure and assist in safely releasing the oven pressure from the oven cavity.