

# Hydrogen Safety for the Agilent Intuvo 9000 GC System

The Agilent Intuvo 9000 GC System was designed to use hydrogen as a carrier gas. The operation manual for the instrument contains 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 Agilent recommends for controlling hydrogen build-up in the laboratory include directing vent lines into a fume hood, and leak-testing the gas connections, tubing, and valves frequently. This should be performed 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.

The Intuvo 9000 gas chromatograph is not designed for use in hazardous atmospheres, but it has built-in safety features to reduce the risk of and the potential for injury from explosion when used in a standard laboratory environment. Below is a set of frequently asked questions, which should answer your questions about the use of hydrogen in the GC.

Note that Agilent has not received any reports of injuries due to the use of hydrogen in this instrument.

## Hydrogen safety frequently asked questions (FAQ)

**Question:** Does my GC have safety features built in to limit the possibility of an 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 lack of a containment area for hydrogen, and the extensive cooling airflow through the instrument.

## 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 inlet to control both the hydrogen flow and the column pressure to user-defined setpoints. It controls the EPC operation in reaching these setpoints.

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

**Answer:** The GC can detect a leak in the system by monitoring the ability of the inlet hydrogen flow and column pressure to reach user-defined setpoints. For example, a leak at the column connection can result in the inability of the column pressure setpoint to be achieved.

**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 and the zone heaters.

**Question:** If I have a hydrogen shutdown, may I reset the GC remotely via control software such as Agilent Chemstation?

**Answer:** No, the hydrogen shutdown may only be cleared by a human action at the GC, as described in the User Manual.

## 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. If the valve 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 of explosion 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. In addition to the EPC firmware control, the mechanical frit greatly limits the amount of hydrogen that can leak into the column oven.

## Intuvo 9000 mechanical safety features

**Question:** Can the GC accumulate H<sub>2</sub> in the column oven?

**Answer:** No, the column oven is not sealed and if a column leaks hydrogen, then it will quickly diffuse out of the column oven area before a hazardous situation could arise.

**Question:** Can the GC accumulate H<sub>2</sub> in the GC chassis?

**Answer:** No, for thermal management reasons, the Intuvo 9000 has a very high airflow rate throughout the interior of the GC. Also, the Intuvo design has several large openings to allow warm air to easily vent out of the system. This thermal management design also helps with hydrogen safety. Because of the large airflow through the Intuvo, the areas for the accumulation of hydrogen is very limited. If the airflow is off, then the large number of vent openings in the Intuvo enclosure will work to greatly reduce the hydrogen within the GC.

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