

# THE ELEMENTAL

Placing Safety at the Center of Hydrogen



## Liquid Hydrogen System Considerations

Because cryogenic liquid hydrogen (LH<sub>2</sub>) must be kept at extremely low temperatures (below -253°C or -423°F) it presents several unique challenges.

One major challenge presented by liquid hydrogen is solidification, which includes freezing as well as deposition (the changing of a gas directly to a solid). At these temperatures, water moisture from the air will freeze. This can lead to frozen valves as well as vent line blockage, which can cause vent flow issues and pose a threat to equipment from overpressure. Along with frozen water, cryogenic temperatures can also lead to deposition as all gases except helium become solid at these temperatures. This limits options for line purging.

Another unique challenge presented by liquid hydrogens cryogenic temperatures is condensation. Specifically, condensed air, which can form on uninsulated LH<sub>2</sub> equipment and present a hazardous situation as oxygen enrichment creates explosive conditions near the liquid hydrogen system.

In addition, liquid hydrogen systems present a unique concern when it comes to venting because (even when stored properly) liquid hydrogen warms and vaporizes. This continuous evaporation necessitates the use or venting of the generated gas and can lead to potential pressure failure if not properly managed. Additionally, the cold gaseous hydrogen produced during evaporation does not rise and dissipate as quickly as ambient hydrogen. Therefore, any LH<sub>2</sub> storage container must include a pressure relief system connected to a vent stack, designed to vent gaseous hydrogen at a height and location that minimizes risk to personnel and equipment. This is an important design best practice because periodic venting of excess pressure from LH<sub>2</sub> boil-off is a normal part of LH<sub>2</sub> system operation.

For more in depth information don't miss our [eLearning Course](#) or our [Webinar](#) on the topic. For further reading see the [H2Tools](#) site.



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