

LifeGuard Supplies Hydrogen Filling Hoses to Air Liquide US

A Case Study in Improving Safety

By Melanie Gogan



LifeGuard Technologies, specializing in its patented and patent-pending safety hose technology, with North American headquarters in Newtown Square, Pennsylvania, recently completed a project for Air Liquide U.S. Industrial LP (Air Liquide US), or the replacement of all of their hydrogen filling hoses. The project included over 550, one-half inch x 14 feet convoluted high pressure metallic LifeGuard safety hoses.

Air Liquide's Requirements

Based in Houston, Texas, Air Liquide US specializes in the delivery of innovative gas solutions and technologies to a wide range of industries. In the fall of 2014, Air Liquide US made a request to replace all of their hydrogen filling hoses with LifeGuard Safety hoses with its internal shut-down system.

Hazards associated with handling gaseous hydrogen are fire, explosion, and pressure. Although hydrogen tends to dissipate quickly, its minimum ignition energy is extremely low, allowing relatively easy ignition of hydrogen mixtures in the flammable range. Hydrogen is easily ignited by open flames, electrical sparks and static electricity. It may also detonate and ignite when rapidly vented into the air. Burning with an almost invisible flame, severe burns can easily result from unknowingly walking into a hydrogen fire. A hose failure can literally be catastrophic.

Chad Laflin, P.E. Air Liquide US Industrial, Manager, Engineering Technologies, who was directly involved in the design and implementation of this project, comments, "Not only does this project display Air Liquide's commitment to safety — but it also represents a standard for safe hose design for the industry. Air Liquide strives to promote a high level of safety for our employees and customers as well as the entire industry."

Convoluted Stainless Steel Hose vs Other Tube Materials

Appropriate hose specifications for hydrogen gaseous service has been an area of debate for a considerable amount of time. There are two fundamental schools ETFE [a polymer whose source-based name is poly (ethene-co-tetrafluoroethene) and trade name is TEFZEL™] tube versus metallic tube.

The Case for ETFE

One of the most common causes of metal hose failure is "high velocity" gas flow. Because of the ribs on the corrugated type hose, high velocity flow (above recommended levels) can damage or crack a metal type hose. To avoid hose damage, it is important to know the velocity of gas flowing through the hose LifeGuard Technologies provides charts that will help determine velocity flow levels. Since hydrogen gas flow velocity is very high, it is argued that a smooth bore PTFE (polytetrafluoroethylene) or ETFE type hose is considered by some to be most appropriate. Metal inner core hoses have a velocity limitation of 100 feet per second (FPS) for a straight run, 50 FPS for a 90 degree bend, and 25 FPS for a 180 degree bend according to metal hose manufacturer's rules of thumb. Smooth bore hose are designed to handle higher velocity gas flow requirements.

The Case for Metallic Hose

Metal inner core hoses will not effuse or diffuse gas, that is, they have zero permeation. This is why they are preferred for high purity and hazardous specialty gases, as well as hydrogen and helium when in a constant pressurized application. Pressurized gas will permeate or effuse through the wall of the PTFE hose at rates consistent with the gas molecule size and weight, and with atmospheric gases this effusion is hardly

noticeable and minimal. For hydrogen and helium, the ETFE or hose has typically one-third the effusion rate of a PTFE hose, so ETFE (or "post sintered") is the recommended inner core material for hydrogen and helium cylinder filling applications.

The Choice

In the end, the decision of which hose to use can be based upon either of these two independent and valid schools of thought. Air Liquide opted to use metallic hoses for the above mentioned reasons.

A long-standing global supplier of hoses to Air Liquide since 1992, LifeGuard provided 550+, one-half inch x 14 feet convoluted metallic hoses. Built to stand up to hazardous gases, like hydrogen, LifeGuard's metallic safety hoses utilize a patented and patent-pending design that eliminates the potential for disaster through the use of an internal cable or engineered compression spring connected to specially designed — normally unsealed valves — located on each end of the cable or spring. In the event of hose separation, stretching to the point of an unsafe condition or coupling-to-hose separation, the valves are released, instantly "seat-stopping" the flow in both directions. Including delivery and installation, the project was successfully completed in the span of six months.

Andy Abrams, Executive Vice President for LifeGuard Technologies, commented on the project saying, "We have collaborated with Air Liquide on a global basis for more than 20 years because they have taken a highly progressive approach to safety. This project is consistent with their safety stewardship position in our industry." ■

Melanie Gogan is Editor of *Hose & Coupling World*.