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Standards Relevant to the Installation of Hydrogen Fuel Cell Systems:

ReliOn, Inc. is a leading manufacturer of Proton Exchange Membrane (PEM) fuel cell systems and is committed to providing its customers with the safest, most cost effective, versatile back-up power solutions available. ReliOn products are based on several safety standards. The referenced standards are listed below:

Referenced Codes and Standards:

- *NFPA 55 – Standard for the Storage, Use, and Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationary Container, Cylinders, and Tanks, 2005.
- *NFPA 853 – Standard for Installation of Stationary Fuel Cell Power Plants, 2003
- *NFPA 70 – National Electric Code
- *NFPA 496 – Standard for Purged & Pressurized Enclosures for Electrical Equipment, 1998
- *NFPA 497 – Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas, 1997.
- CGA E-11 – Standard for Stationary Compressed Gas Cylinder Discharging Manifolds for Working Pressures up to 3000 PSI.
- CGA – G-5.4 – Standard for Hydrogen Piping Systems at Consumer Locations
- ASME/ANSI B31.3 – Process Piping Code
- ANSI/CSA FC1 – Standard for Stationary Fuel Cell Power Systems
- Applicable sections of NEBS GR 487, 1063 & 1089

**Note: The NFPA standards are developed by committee and are designed as guidelines, and the NFPA does not approve, inspect, or certify any installations, procedures, equipment, or materials. In determining the acceptability of installations, procedures, equipment, or materials, the authority having jurisdiction (AHJ) may base acceptance on compliance with NFPA or other standards, or the said authority may use their own judgment or refer to the listings or labeling practices of an organization that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items. The NFPA claims that it will yield to due diligence engineering analysis, or an equipment manufacturer's recommendations and successful experience with the testing and installation of their own product.*

While all of the standards listed above are valid for the design and manufacture of ReliOn products, the three standards that are most relevant to the installation of hydrogen fuel cell systems such as the I-1000™ Fuel Cell System and the Outdoor Enclosure are NFPA 55, NFPA 853, and NFPA 70. NFPA 70 is Article 500/501 of the National Electric Code. Copies of these standards are available directly from NFPA by calling 1-800-344-3555. These standards will aid in the selection of a site location which should be acceptable to the authority having jurisdiction (AHJ). Where public safety is primary, the AHJ may be a federal, state, local, or other regional department or individual such as a fire chief, fire marshal, or permitting agency. Our experience has shown that this authority is generally a county or city fire chief/marshal, or local construction permitting agency. Though most utilities are exempt from NEC codes related to equipment owned and operated by the utility per NEC Article 90.2, Section B, Paragraphs 4&5, it is good practice to contact the AHJ prior to the placement of a hydrogen fuel cell system to ensure that they do not require any special conditions for the site.

ReliOn offers setback distance and clearance information on the second page of this document. These recommendations are based on reasonable interpretations of NFPA and International Fire Code Council (IFCC) standards, an understanding of the properties of hydrogen, correspondence with various state and local AHJs, and engineering studies on failure mode analysis and probability. These recommendations are offered by ReliOn for the convenience of the customer; however, ultimately it is up to the customer and/or the AHJ to choose what works best for the application.

Hydrogen Storage:

The industrial-grade hydrogen fuel is contained within steel cylinder tanks that are stored in metal fuel wing (cabinet). The standard ReliOn outdoor enclosure fuel wing holds 6 cylinders for a combined total of 1560 ft³ of hydrogen gas. The equivalent liquid volume of all 6 cylinders combined is about 77 gallons. The hydrogen cylinders connect to a common manifold where they feed through a ¼”to 3/8” O.D. stainless steel line to the fuel cells. The hydrogen fuel is controlled by a normally-closed fuel shut off safety solenoid that is only activated when the fuel cells are operating and generating power. Multiple hydrogen sensors within the fuel cell enclosure monitor the ambient air and will shut down the system if hydrogen is detected at a level approaching 1/5th the lower flammability limit of hydrogen (7500ppm).

Setback Distances:

The recommended setback distances shown below extend from the hydrogen storage wing to the type of exposure.

<u>Type of Exposure</u>	<u>Distance (ft.)</u>
Property lines (property that can be built upon)	5’
Overhead high-voltage power lines (distance from a vertical plane extending down to the ground)	5’
Electrical equipment (non-normally arcing/sparking and nonincendive (<800°F)) <i>{Examples: utility AC meterbase, brushless motors, field wiring & connections, transfer switches sealed breakers, general purpose equipment or equipment in general purpose enclosures, etc}</i>	5’
Wall openings of normally occupied buildings (opening doors or windows, not directly above)	10’
Liquid fuel tank (above or below ground (<1000 gal.))	10’
HVAC intakes of normally occupied buildings	15’
Wall openings of normally occupied buildings (opening doors or windows, directly above)	15’
Public sidewalks and parked vehicles	15’
Electrical equipment (normally arcing/sparking, or incendive (>800°F)) <i>{Examples: generators, alternators, open blade disconnect switches, igniters, etc.}</i>	15’
Open flames and welding	25’
Liquid fuel tank (above or below ground (>1000 gal.))	25’

The setback distances for building HVAC equipment are generally regarded to be applicable for buildings that are normally occupied. Equipment cabinets, huts, vaults (CUE/CEV), and other non-normally occupied control buildings/structures are not specifically called out in the standards and are considered to be exempt. If the building/structure does not have an occupancy permit, then it is not normally occupied.

Proven Safety Record of ReliOn’s Hydrogen Fuel Cell Systems:

ReliOn holds safety in the highest regard. There are over 850 ReliOn commercial fuel cell systems deployed in the field and our customers have encountered **zero** safety issues. This spectacular track record is accomplished in part by ReliOn’s use of robust piping and containment systems made of the highest-quality materials rated specifically for hydrogen. These system designs comply with the requirements of such industry-leading organizations as the American Society of Mechanical Engineers (ASME), Compressed Gas Association (CGA), American National Standards Institute (ANSI, FC1), Canadian Standards Association (CSA), European Community Trade Group (CE), Underwriter Laboratories (UL), and the Network Equipment Building Standards (NEBS) telecommunications evaluation group. Many of these organizations have directly tested, evaluated, and approved or certified the ReliOn fuel cell and hydrogen storage systems as safe commercial products. By design, these systems are safer than a common household propane grill.

ReliOn’s Applications Engineers are available for consultation to discuss such topics as proposed installation sites, codes and standards, and general hydrogen safety. ReliOn’s Applications Engineers teach hydrogen safety as part of our Training Services and Commissioning Assistance Services. Hydrogen safety video tapes and DVDs are available from an independent third party by calling Hydrogen 2000, Inc at 303-530-0336. In issuing and making this document available, ReliOn is not undertaking to render professional or other services for or on behalf of any person or entity. ReliOn makes no guarantee or warranty as to the accuracy or completeness of any information within.