



COMPRESSED GAS ASSOCIATION, INC.

POSITION STATEMENT

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APPLYING CODES AND STANDARDS FOR HYDROGEN STORAGE, USE AND DISPENSING SYSTEMS

This position statement provides details on the applicability of national codes and standards developed by a consensus process for compressed hydrogen gas and cryogenic liquid hydrogen storage systems. It recommends the use of consensus codes and standards for hydrogen storage instead of locally developed codes.

This position statement covers hydrogen supply, storage, use and dispensing systems, as a compressed gas, cryogenic fluid, or some combination of gas and cryogenics. Standardization provides safe, efficient, consistent installations and operations across the country. It also permits Compressed Gas Association (CGA) members and the general public to focus efforts on continuing and improved safety by working with only one set of standards for compressed gases and cryogenic fluids, in this case NFPA 55, *Compressed Gases and Cryogenic Fluids Code* [1]. The extract and harmonization processes ensure that the fundamental elements of fire protection are included in the fire codes, specifically the *International Fire Code*® (IFC) and NFPA 1, *Fire Code* [2, 3].

Bulk hydrogen storage systems, whether in liquid or gas form, are installed per CGA H-5, *Installation Standards for Bulk Hydrogen Supply Systems* [4]. CGA H-5 supplements the requirements of the National Fire Protection Association (NFPA) and International Code Council (ICC).

Background

CGA uses NFPA codes and standards, specifically NFPA 1, for siting requirements of customer supply systems for cryogenic fluid and compressed gas [3]. NFPA 1 addresses compressed gas and cryogenic fluids in chapter 63, "Compressed Gases and Cryogenic Fluids." The IFC is a parallel fire code that may be used by some jurisdictions [2]. The IFC addresses compressed gases in chapter 30, "Compressed Gases," and cryogenic liquids in chapter 32, "Cryogenic Fluids." Although the codes have some differences, both refer to NFPA 55 for specific hydrogen storage system requirements and NFPA 52, *Vehicular Fuel Systems Code*, for hydrogen dispensing requirements [1, 5]. The requirements for gas and liquid hydrogen supply systems are consistent, whether a municipality has adopted NFPA 1 or IFC [2, 3].

Question

Is updating consensus standards a better path towards safe, efficient codes than local code development? Is the code development process better served by working through the established NFPA and ICC update processes?

Answer

Development of specialized local fire codes for industrial gases in general or for specific gases, such as hydrogen, tends to dilute the work on consensus standards, create confusion, and in some cases, create hazardous situations.

In many cases, the local codes are not harmonized with the consensus standards and add requirements that are unnecessary. This means that the local authority having jurisdiction may enforce standards that are in conflict with consensus codes.

The update process allows for significant input in and comments on the proposed changes that can lead to developing the optimum changes to the entire family of fire and building codes.

The update process ensures that codes are updated automatically and in a fashion that allows new technology to be incorporated in a reasonable timeframe. Using the model fire codes avoids references to outdated codes.

The code update process allows resources from subject matter experts to perform and or utilize testing and research required.

There is a much larger pool of experts for input in the consensus codes.

Industry standards and best practices based on operational experiences are incorporated into the consensus codes.

Methods for referencing or extracting from a standard

There are two methods that the model codes can use for referencing a standard or extracting from a standard:

- NFPA uses a process where requirements for industrial gases contained in NFPA 55 are extracted to other NFPA publications such as NFPA 1 [1, 3]. The extraction process is similar to a “copy and paste” procedure where the material is copied from NFPA 55 and placed into other codes without change; and
- Local government agencies have adopted model codes from either ICC or NFPA with modifications that the agency deems necessary. However, for industrial gases, local agencies typically do not make changes to the requirements for compressed gases and cryogenic fluids.

There are key safety and operational aspects of bulk hydrogen storage systems that are written into CGA H-5, NFPA 1, IFC, and other standards to ensure safe, efficient, and consistent systems [4, 3, 2].

Local code language that deviates from consensus codes and standards

Below is a summary of some local code language that deviates from consensus codes and standards:

- Local code—Requires emergency shutdown systems on all hydrogen systems greater than 400 scf (a large hydrogen cylinder holds 300 scf, so any system greater than 2 cylinders requires an emergency shutdown).

Consensus codes and standards—Liquid hydrogen storage tanks above 2000 gal capacity have remotely-operated emergency isolation valves. See CGA H-3, *Cryogenic Hydrogen Storage* and Appendix B; NFPA 55, Section 11.2.4.2.2 [6, 1]. Gas supply systems have much smaller quantities of hydrogen compared to liquid storage systems, meaning that potential releases are significantly less. NFPA 55 does not require remotely-operated emergency isolation valves for gaseous systems [1].

- Local code—Requires reporting all normal and abnormal venting of hydrogen.

Consensus codes and standards—All venting of hydrogen is designed to be through a vent stack to a safe location. See CGA H-5, Section 8.9; CGA G-5.5, *Hydrogen Vent Systems*; NFPA 55, Sections 10.2.1 and 11.2.2.2 [4, 7, 1]. Hydrogen gas is vented normally during delivery, maintenance, and operation. Reporting all these instances is not feasible.

- Local code—Disallows the use of flexible hoses.

Consensus codes and standards—Piping and flexible hoses are allowed to be used in gas and liquid service. See CGA H-5, Section 8.8; CGA G-5.4, *Standard for Hydrogen Piping Systems at Consumer Locations*; CGA G-5.8, *High Pressure Hydrogen Piping Systems at Consumer Locations*; NFPA 55, Section 11.2.3.3 [4, 8, 9, 1].

- Local code—Disallows the use of threaded, welded, flanged, and other connections indoors.

Consensus codes and standards—Existing codes allow the use of threaded, welded, flanged, and other connections, see CGA H-5, Section 8.8; CGA G-5.4; CGA G-5.8; NFPA 55, Section 11.2.3.3 [4, 8, 9, 1]. Pressure gauges, transmitters, and other devices are made with a variety of fittings. Manufacturers of equipment or assemblies follow the consensus standards and manufacturers guidelines for use in hydrogen service.

- Local code—Requires isolation valves on vaporizers.

Consensus codes and standards—No consensus codes require valves. This is an operational issue not a safety issue. While valves may be useful for isolation of vaporizers, it is not typical that one vaporizer needs replacement while the others are in operation. The addition of these valves also leads to needing