NFPA®

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Hydrogen Technologies Code

2020

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NFPA® 2

Hydrogen Technologies Code

2020 Edition

This edition of NFPA 2, *Hydrogen Technologies Code,* was prepared by the Technical Committee on Hydrogen Technology. It was issued by the Standards Council on June 10, 2019, with an effective date of June 30, 2019, and supersedes all previous editions.

This edition of NFPA 2 was approved as an American National Standard on June 30, 2019.

Origin and Development of NFPA 2

With the increased interest in hydrogen being used as a fuel source, the National Fire Protection Association was petitioned to develop an all-encompassing document that establishes the necessary requirements for hydrogen technologies. In 2006, the Technical Committee on Hydrogen Technology was formed and tasked to develop a document that addresses all aspects of hydrogen storage, use, and handling; that draws from existing NFPA codes and standards; and that identifies and fills technical gaps for a complete functional set of requirements for code users and enforcers. This document is also structured so that it works seamlessly with building and fire codes.

This code is largely extracted from other NFPA codes and standards (e.g., NFPA 52, NFPA 55, and NFPA 853) and is organized in a fashion that is specific for hydrogen. Paragraphs that have been extracted from other documents are shown with the extract reference brackets at the end of the paragraph. In some cases, modifications have been made to the extracted text to use terminology appropriate for this code, such as the terms GH_2 instead of *compressed gas* and LH_2 instead of *cryogenic fluid*. In those instances, brackets encase the modifying words. Similarly, where language was deleted to adhere to requirements based exclusively on hydrogen and no other changes were made to the paragraph, brackets that encompass a hyphen [-] are inserted into the paragraph to denote a change to the original material while retaining the extract to the source document. In short, added or modified text is shown with brackets around the differing language and pure deletions of text are shown with [-].

The 2016 edition of NFPA 2 was more closely aligned with the requirements in NFPA 55 for gaseous and liquefied hydrogen systems. Both documents were in the same revision cycle, which allowed the technical committees to work more closely together on revisions to the joint content. The requirements for hydrogen generation systems in NFPA 2 (Chapter 13) were no longer extracted from NFPA 55, and the requirements for hydrogen fueling systems (Chapters 10 and 11) were no longer extracted from NFPA 52. The Technical Committee on Hydrogen Technology had primary responsibility for those requirements.

The 2016 edition had the following changes:

(1) Significant revisions to Chapter 10, Gaseous Vehicle Fueling Facilities, that reflected significant efforts by the technical committee in improving this chapter
(2) Clarification and organization of the requirements for gaseous hydrogen systems into three tiers based on the quantity of hydrogen stored: less than or equal to the maximum allowable quantity (MAQ), greater than the MAQ but less than the bulk quantity, and bulk systems
(3) Changes to the requirements in Chapter 7 for emergency isolation consistent with the changes made to NFPA 55
(4) New requirements for hydrogen equipment enclosures to address the growing use of these systems in a variety of field applications
(5) New chapters for parking garages and repair garages for hydrogen fuel cell vehicles

For the 2020 edition of NFPA 2, several updates have been made to both Chapter 10, GH_2 Vehicle Fueling Facilities, and Chapter 18, Repair Garage. Changes made to Chapter 10 focus on addressing fueling protocols, authorized fueling, signage, and vehicle to station communication protocols. With the inclusion of these updates, Chapter 10 has been restructured to maintain clarity for the user. With this new edition of NFPA 2, Chapter 18 has been limited to only apply to LH_2 applications. The changes made to Chapter 18 enhance the ease of repair garages to accept hydrogen as an alternative motor fuel while properly addressing the additional hazards the repair and servicing of these vehicles can present without reducing the level of protection currently required.

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NOTE: Membership on a committee shall not in and of itself constitute an endorsement of the Association or any document developed by the committee on which the member serves.

Committee Scope: This committee shall have primary responsibility for documents on the storage, transfer, production, and use of hydrogen. The use of hydrogen would include stationary, portable, and vehicular applications.

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Hydrogen Technologies Code

2020 Edition

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NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates that explanatory material on the paragraph can be found in Annex A.

A reference in brackets [ ] following a section or paragraph indicates material that has been extracted from another NFPA document. Extracted text may be edited for consistency and style and may include the revision of internal paragraph references and other references as appropriate. Requests for interpretations or revisions of extracted text shall be sent to the technical committee responsible for the source document.

Information on referenced and extracted publications can be found in Chapter 2 and Annex N.

Chapter 1 Administration

1.1 Scope. (Reserved)

1.2 Purpose. The purpose of this code shall be to provide fundamental safeguards for the generation, installation, storage, piping, use, and handling of hydrogen in compressed gas (GH_2) form or cryogenic liquid (LH_2) form.

1.3* Application.

1.3.1 This code shall apply to the production, storage, transfer, and use of hydrogen in all occupancies and on all premises.

1.3.2 The use of hydrogen shall include stationary, portable, and vehicular infrastructure applications.

Δ **1.3.3** The fundamental requirements of Chapters 1 and 4 through 8 shall apply in addition to the use-specific requirements provided in Chapters 9 through 18, as applicable.

1.3.4 Exemptions. This code shall not apply to the following:

(1) Onboard vehicle or mobile equipment components or systems, including the onboard GH_2 or LH_2 fuel supply

(2) Mixtures of GH_2 and other gases with a hydrogen concentration of less than 95 percent by volume when in accordance with NFPA 55

(3) The storage, handling, use, or processing of metal hydride materials outside of metal hydride storage systems defined in Chapter 3

1.4 Retroactivity. The provisions of this code reflect a consensus of the criteria necessary to provide an acceptable degree of protection from the hazards addressed in this code at the time the code was issued.

1.4.1 Unless otherwise specified, the provisions of this code shall not apply to facilities, equipment, structures, or installations that existed or were approved for construction or installation prior to the effective date of the code. Where specified, the provisions of this code shall be retroactive.

1.4.2 In those cases where the authority having jurisdiction (AHJ) determines that the existing situation presents an unacceptable degree of risk, the AHJ shall be permitted to apply retroactively any portions of this code deemed appropriate.

Δ **1.4.3** The retroactive requirements of this code shall be permitted to be modified if their application would be impractical in the judgment of the AHJ, and only where it is evident that a reasonable degree of safety is provided.

1.5 Equivalency.

1.5.1 Nothing in this code is intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety over those prescribed by this code.

1.5.2 Technical documentation shall be submitted to the AHJ to demonstrate equivalency.

1.5.3 The system, method, or device shall be approved for the intended purpose by the AHJ.

1.6 Units and Formulas.

1.6.1 The units of measure in this code are presented first in U.S. customary units (inch-pound units). International System (SI) of Units follow the inch-pound units in parentheses.

1.6.2 Either system of units shall be acceptable for satisfying the requirements in the code.

1.6.3 Users of this code shall apply one system of units consistently and shall not alternate between units.

1.6.4 The values presented for measurements in this code are expressed with a degree of precision appropriate for practical application and enforcement. It is not intended that the application or enforcement of these values be more precise than the precision expressed.

1.6.5 Where extracted text contains values expressed in only one system of units, the values in the extracted text have been retained without conversion to preserve the values established by the responsible technical committee in the source document.

1.6.6 If a value for measurement given in this standard is followed by an equivalent value in other units, the first stated shall be regarded as the requirement. The given equivalent value shall be considered to be approximate.

1.6.7 All pressures in this document are gauge pressures, unless otherwise indicated.

1.7 Enforcement.

1.7.1* This code shall be administered and enforced by the AHJ designated by the governing authority under the administrative provisions of the adopted building or fire prevention code. (*See Annex C for sample wording for enabling legislation.*)

1.7.2 The administrative provisions of Annex B shall be allowed to be used where specifically adopted.

Chapter 2 Referenced Publications

2.1 General. The documents or portions thereof listed in this chapter are referenced within this code and shall be considered part of the requirements of this document.

Δ **2.2 NFPA Publications.** National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 10, *Standard for Portable Fire Extinguishers,* 2018 edition.

NFPA 11, *Standard for Low-, Medium-, and High-Expansion Foam,* 2016 edition.

NFPA 12, *Standard on Carbon Dioxide Extinguishing Systems,* 2018 edition.

NFPA 12A, *Standard on Halon 1301 Fire Extinguishing Systems,* 2018 edition.

NFPA 13, *Standard for the Installation of Sprinkler Systems,* 2019 edition.

NFPA 14, *Standard for the Installation of Standpipe and Hose Systems,* 2016 edition.

NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection,* 2017 edition.

NFPA 17, *Standard for Dry Chemical Extinguishing Systems,* 2017 edition.

NFPA 17A, *Standard for Wet Chemical Extinguishing Systems,* 2017 edition.

NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems,* 2017 edition.

NFPA 30, *Flammable and Combustible Liquids Code,* 2018 edition.

NFPA 30A, *Code for Motor Fuel Dispensing Facilities and Repair Garages,* 2018 edition.

NFPA 31, *Standard for the Installation of Oil-Burning Equipment,* 2016 edition.

NFPA 45, *Standard on Fire Protection for Laboratories Using Chemicals,* 2018 edition.

NFPA 54, *National Fuel Gas Code,* 2018 edition.

NFPA 55, *Compressed Gases and Cryogenic Fluids Code,* 2020 edition.

NFPA 58, *Liquefied Petroleum Gas Code,* 2017 edition.

NFPA 68, *Standard on Explosion Protection by Deflagration Venting,* 2018 edition.

NFPA 69, *Standard on Explosion Prevention Systems,* 2019 edition.

NFPA 70®, National Electrical Code®, 2017 edition.

NFPA 72®, National Fire Alarm and Signaling Code, 2019 edition.

NFPA 79, *Electrical Standard for Industrial Machinery,* 2018 edition.

NFPA 80, *Standard for Fire Doors and Other Opening Protectives,* 2019 edition.

NFPA 86, *Standard for Ovens and Furnaces,* 2019 edition.

NFPA 88A, *Standard for Parking Structures,* 2019 edition.

NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems,* 2018 edition.

NFPA 91, *Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Particulate Solids,* 2015 edition.

NFPA *101®, Life Safety Code®,* 2018 edition.

NFPA 110, *Standard for Emergency and Standby Power Systems,* 2019 edition.

NFPA 111, *Standard on Stored Electrical Energy Emergency and Standby Power Systems,* 2019 edition.

NFPA 259, *Standard Test Method for Potential Heat of Building Materials,* 2018 edition.

NFPA 400, *Hazardous Materials Code,* 2019 edition.

NFPA 496, *Standard for Purged and Pressurized Enclosures for Electrical Equipment,* 2017 edition.

NFPA 505, *Fire Safety Standard for Powered Industrial Trucks Including Type Designations, Areas of Use, Conversions, Maintenance, and Operations,* 2018 edition.

NFPA 704, *Standard System for the Identification of the Hazards of Materials for Emergency Response,* 2017 edition.

NFPA 750, *Standard on Water Mist Fire Protection Systems,* 2019 edition.

NFPA 853, *Standard for the Installation of Stationary Fuel Cell Power Systems,* 2015 edition.

NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems,* 2018 edition.

2.3 Other Publications.

N **2.3.1 AIHA Publications.** American Industrial Hygiene Association, 3141 Fairview Park Dr., Suite 777, Falls Church, VA 22042.

ANSI/AIHA Z9.5, *Laboratory Ventilation*, 2012.

Δ **2.3.2 ANSI Publications.** American National Standards Institute, Inc., 25 West 43rd Street, 4th Floor, New York, NY 10036.

ANSI/IEEE C2, *National Electrical Safety Code*, 2017.

ANSI Z535.1, *Safety Colors*, 2017.

ANSI Z535.2, *Environmental and Facility Safety Signs*, 2017.

ANSI Z535.3, *Criteria for Safety Symbols*, 2017.

ANSI Z535.4, *Product Safety Signs and Labels*, 2017.

2.3.3 ASME Publications. American Society of Mechanical Engineers, Two Park Avenue, New York, NY 10016-5990.

ASME A13.1, *Scheme for the Identification of Piping Systems*, 2015.

ASME B31, *Code for Pressure Piping*, 2016.

ASME B31.3, *Process Piping*, 2016.

ASME B31.12, *Hydrogen Piping and Pipelines*, 2014.

ASME *Boiler and Pressure Vessel Code*, Section VIII, 2017.

ASME *International, Boiler and Pressure Vessel Code,* "Rules for the Construction of Unfired Pressure Vessels," Section VIII, 2017.

2.3.4 ASTM Publications. American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, 2018.

ASTM E136, *Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C*, 2016a.

ASTM E1529, *Determining Effects of Large Hydrocarbon Pool Fire on Structural Members and Assemblies*, 2016e1.

ASTM E1591, *Standard Guide for Data for Fire Models*, 2013.

ASTM E2652, *Standard Test Method for Behavior of Materials in a Tube Furnace with a Cone-shaped Airflow Stabilizer, at 750°C*, 2016.

ASTM E2965, *Standard Test Method for Determination of Low Levels of Heat Release Rate for Materials and Products Using an Oxygen Consumption Calorimeter*, 2017.

Δ **2.3.5 CGA Publications.** Compressed Gas Association, 14501 George Carter Way, Suite 103, Chantilly, VA 20151-2923.

CGA C-7, *Guide to Classification and Labeling of Compressed Gas*, 2014.

CGA G-5.5, *Hydrogen Vent Systems*, 2014.

CGA P-1, *Safe Handling of Compressed Gases in Containers*, 2015.

CGA S-1.1, *Pressure Relief Device Standards — Part 1 — Cylinders for Compressed Gases*, 2011.

CGA S-1.2, *Pressure Relief Device Standards — Part 2 — Cargo and Portable Tanks for Compressed Gases*, 2009.

CGA S-1.3, *Pressure Relief Device Standards — Part 3 — Stationary Storage Containers for Compressed Gases*, 2008.

N **2.3.6 CSA Group Publications.** CSA Group, 8501 East Pleasant Valley Road, Cleveland, OH 44131.

CSA B51, *Boiler, Pressure Vessel, and Pressure Piping Code*, 2014.

ANSI/CSA FC 1, *Fuel Cell Technologies — Part 3-100: Stationary fuel cell power systems — Safety*, 2014.

ANSI/CSA America FC 3, *Portable Fuel Cell Power Systems*, 2004.

ANSI/CSA HGV 4.3, *Test Methods for Hydrogen Fueling Parameter Evaluation*, 2016.

2.3.7* CTC Publications. Canadian Transport Commission, Queen's Printer, Ottawa, Ontario, Canada. (Available from the Canadian Communications Group Publication Centre, Ordering Department, Ottawa, Canada K1A 0S9.)

Transportation of Dangerous Goods Regulations.

Δ **2.3.8 ICC Publications.** International Code Council, 500 New Jersey Avenue, NW, 6th Floor, Washington, DC 20001.

International Fire Code (IFC), 2018.

International Fuel Gas Code (IFGC), 2018.

N **2.3.9 IEC Publications.** International Electrotechnical Commission, 3, rue de Varembé, P.O. Box 131, CH-1211 Geneva 20, Switzerland.

IEC 62282-5-100, *Portable Fuel Cell Power Systems, Safety*, 2018.

2.3.10 SAE Publications. Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096, www.SAE.org.

SAE J2579, *Standard for Fuel Systems in Fuel Cell and Other Hydrogen Vehicles*, 2018.

SAE J2600, *Compressed Hydrogen Surface Refueling Connection Devices*, 2015.

2.3.11 UL Publications. Underwriters Laboratories, Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

UL 263, *Fire Tests of Building Construction and Materials*, 2018.

ANSI/UL 723, *Tests for Surface Burning Characteristics of Building Materials*, 2018.

2.3.12 U.S. Government Publications. U. S. Government Printing Office, Washington, DC 20402.

Title 29, Code of Federal Regulations, Part 1910.1000.

Title 49, Code of Federal Regulations, Part 100–199.

2.3.13 Other Publications.

Merriam-Webster's Collegiate Dictionary, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2003.

UN Global Technical Regulation No. 13, *Global technical regulation on hydrogen and fuel cell vehicles*, 2013.

Δ **2.4 References for Extracts in Mandatory Sections.**

NFPA 1, *Fire Code*, 2018 edition.
NFPA 13, *Standard for the Installation of Sprinkler Systems*, 2019 edition.
NFPA 13D, *Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes*, 2019 edition.
NFPA 30, *Flammable and Combustible Liquids Code*, 2018 edition.
NFPA 30A, *Code for Motor Fuel Dispensing Facilities and Repair Garages*, 2018 edition.
NFPA 45, *Standard on Fire Protection for Laboratories Using Chemicals*, 2019 edition.
NFPA 52, *Vehicular Natural Gas Fuel Systems Code*, 2019 edition.
NFPA 54, *National Fuel Gas Code*, 2018 edition.
NFPA 55, *Compressed Gases and Cryogenic Fluids Code*, 2020 edition.
NFPA 56, *Standard for Fire and Explosion Prevention During Cleaning and Purging of Flammable Gas Piping Systems*, 2017 edition.
NFPA 58, *Liquefied Petroleum Gas Code*, 2017 edition.
NFPA 70®, National Electrical Code®, 2017 edition.
NFPA 80, *Standard for Fire Doors and Other Opening Protectives*, 2019 edition.
NFPA 86, *Standard for Ovens and Furnaces*, 2019 edition.
NFPA 88A, *Standard for Parking Structures*, 2019 edition.
NFPA 91, *Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Particulate Solids*, 2015 edition.
NFPA *101®, Life Safety Code®*, 2018 edition.
NFPA 318, *Standard for the Protection of Semiconductor Fabrication Facilities*, 2018 edition.
NFPA 400, *Hazardous Materials Code*, 2019 edition.