NFPA®

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Vehicular Natural Gas Fuel Systems Code

2019

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ISBN: 978-145592145-4 (PDF)
ISBN: 978-145592215-4 (eBook)

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NFPA® 52

Vehicular Natural Gas Fuel Systems Code

2019 Edition

This edition of NFPA 52, *Vehicular Natural Gas Fuel Systems Code*, was prepared by the Technical Committee on Vehicular Alternative Fuel Systems. It was issued by the Standards Council on November 5, 2018, with an effective date of November 25, 2018, and supersedes all previous editions.

This document has been amended by one or more Tentative Interim Amendments (TIAs) and/or Errata. See "Codes & Standards" at www.nfpa.org for more information.

This edition of NFPA 52 was approved as an American National Standard on November 25, 2018.

Origin and Development of NFPA 52

While compressed natural gas (CNG) vehicles have been used extensively in other countries since the late 1940s, it was not until the late 1970s that their use in the United States became extensive enough to warrant preparation of a national standard.

Between 1980 and 1982, a committee of the American Gas Association (AGA) developed a draft of a fire safety standard for vehicular fuel systems. This was based on existing worldwide standards and current U.S. practice.

In late 1981, the AGA petitioned the NFPA to establish a technical committee project on the subject. The normal NFPA solicitation of comments revealed sufficient response from various interested parties, and the Committee on Compressed Natural Gas Vehicular Fuel Systems was established by the Standards Council in July 1982.

The first edition of NFPA 52, *Standard for Compressed Natural Gas (CNG) Vehicular Fuel Systems*, was issued in 1984, and it was revised in 1988, 1992, 1995, and 1998.

The 2002 edition of NFPA 52 contained minor revisions, most of these in the chapter on engine fuel systems. There also were some changes made to comply with the NFPA *Manual of Style* for technical committee documents. The most significant of these were reordering of chapters and numbering of definitions.

The 2006 edition of NFPA 52 was a complete revision. NFPA 57, *LNG Vehicular Fuel Systems Code*, was incorporated into NFPA 52. Additionally, the scope of the committee was expanded to include hydrogen, and new chapters were added that addressed general gaseous hydrogen requirements and equipment qualifications; service and maintenance of gaseous hydrogen engine fuel systems; gaseous hydrogen compression, gas processing, storage, and dispensing systems; and liquefied hydrogen fueling facilities.

The 2010 edition of NFPA 52 revised the committee scope so that it better coordinated with the responsibilities of NFPA 55, *Compressed Gases and Cryogenic Fluids Code*, with regard to hydrogen storage systems. A large number of changes were also made to the chapters concerning hydrogen to update to current material in NFPA documents, the *Manual of Style for NFPA Technical Committee Documents*, and acceptable performance criteria.

Paragraphs extracted from NFPA 55 were shown with the extract reference in brackets [ ] at the end of the paragraph. In some cases, modifications were made to the extracted text to use terminology appropriate for this standard, such as the term *cryogenic fluid* instead of *compressed gas*. In those instances, brackets encased the modified terms.

The 2013 edition removed the requirements for hydrogen systems, the responsibility for which were transferred to NFPA 2, *Hydrogen Technologies Code*. A chapter on general fueling requirements was added, and changes were made to the onboard gas detection requirements for LNG-fueled vehicles. The installation requirements for ASME Tanks for LNG were updated to coordinate with NFPA 59A, *Standard for the Production, Storage, and Handling of Liquefied Natural Gas (LNG)*.

The 2016 edition was completely reorganized for easier access to requirements. The title of the document was changed from *Vehicular Gaseous Fuel Systems Code* to *Vehicular Natural Gas Fuel Systems Code* to coordinate with the removal of hydrogen systems from the scope of the document in 2013. New and revised definitions harmonized the code with the new CSA Group NGV 5.1 standard, *Residential Fueling Appliances*. Most notably, a new definition for *residential fueling appliances* was added and the definition for *vehicle fueling appliances* was revised.

For the 2019 edition, text reorganization and additions have been made to address vehicle fueling applications (VFAs). A new chapter was added for nonresidential CNG fueling applications. Several terms have been added and updated to align with current definitions and VFA updates to the document. Examples are changing the term *Qualified Engineer* to *Qualified Person* and adding the definition of the term *Contiguous Building Volume* to Chapter 3. Sections of the residential CNG Fueling chapter were removed because they were part of the certification of appliances covered in CSA Group NGV 5.1, *Residential Fueling Appliances*.

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This list represents the membership at the time the Committee was balloted on the final text of this edition. Since that time, changes in the membership may have occurred. A key to classifications is found at the back of the document.

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 fire and explosion hazards associated with compressed natural gas (CNG), liquefied natural gas (LNG) engine fuel systems, on vehicles of all types and for refueling stations and associated storage.

The Committee shall coordinate its documents with the Committee on the National Fuel Gas Code with respect to natural gas piping within the scope of that Committee; with the Committees on Industrial Trucks, Fire Safety for Recreational Vehicles, and Marine Fire Protection with respect to engine fuel systems and refueling stations within their scopes; and the Liquefied Natural Gas Committee with respect to storage of LNG within its scope.

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2019 Edition

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. As an aid to the user, the complete title and edition of the source documents for extracts in mandatory sections of the document are given in Chapter 2 and those for extracts in informational sections are given in Annex D. 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 publications can be found in Chapter 2 and Annex D.

Chapter 1 Administration

1.1* Scope.

1.1.1 This code shall apply to the design, installation, operation, and maintenance of compressed natural gas (CNG) and liquefied natural gas (LNG) engine fuel systems on vehicles of all types and for fueling vehicle (dispensing) systems and facilities, and associated storage, including the following:

(1) Original equipment manufacturers (OEMs)
(2) Final-stage vehicle integrator/manufacturer (FSVIM)
(3) Vehicle fueling (dispensing) systems

1.1.2 This code shall apply to the design, installation, operation, and maintenance of LNG engine fuel systems on vehicles of all types, to their associated fueling (dispensing) facilities, and to LNG-to-CNG facilities with LNG storage in ASME containers of 100,000 gal (379 m^3) or less.

1.1.3 This code shall not apply to those aspects of vehicles and fuel supply containers that are covered by federal motor vehicle safety standards (FMVSSs).

1.1.4 This code shall include marine, highway, rail, off-road, and industrial vehicles.

1.1.5 Where conflicts occur between provisions of this code and referenced codes and standards, the provisions of this code shall apply.

1.1.6 Where, in any specific case, different sections of this code specify different materials, methods, or other requirements, the most restrictive shall govern.

1.1.7 Where there is a conflict between a general requirement and a specific requirement, the specific requirement shall be applicable.

1.1.8 Manufacturer specifications shall equal or surpass the applicable requirements of this code.

1.2 Purpose. The purpose of this code shall be to provide fundamental safeguards against fire and explosion hazards associated with compressed natural gas (CNG) and liquefied natural gas (LNG) engine fuel systems on vehicles of all types and for refueling stations and associated storage.

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

1.3.1 Unless otherwise specified, the provisions of this code are not intended to require upgrading 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.

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

1.3.3 The retroactive requirements of this code shall be permitted to be modified if their application clearly would be impractical in the judgment of the authority having jurisdiction, and only where a reasonable degree of safety is provided and is clearly evident.

1.4 Alternate Provisions. Site conditions, advancements in technology, and improvements in system design and equipment shall be permitted to allow for equipment fabrication methods, component design requirements, and installation and operating practices that differ from those specified in this code.

1.4.1 Such deviations or improvements shall be permitted to provide equivalent safety and compatible operation that meet the intent of this code.

1.4.2 Such deviations shall be permitted where the authority having jurisdiction has seen evidence that a special investigation of all factors has been made and, based on sound experience and engineering judgment, has concluded that the proposed deviations meet the intent of this code.

1.5 Training. Persons engaged in the handling and storage of LNG, CNG, and LCNG shall be trained in the hazards and properties of these materials.

1.6 Units.

1.6.1 Metric units in this code are based on IEEE/ASTM SI 10, *American National Standard for Metric Practice.*

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

1.7 Enforcement. This code shall be administered and enforced by the authority having jurisdiction designated by the governing authority. *(See Annex B for sample wording for enabling legislation.)*

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.

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,* 2019 edition.

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

NFPA 16, *Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems,* 2019 edition.

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

NFPA 20, *Standard for the Installation of Stationary Pumps for Fire Protection,* 2019 edition.

NFPA 22, *Standard for Water Tanks for Private Fire Protection,* 2018 edition.

NFPA 24, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances,* 2019 edition.

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

NFPA 37, *Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines,* 2018 edition.

NFPA 51B, *Standard for Fire Prevention During Welding, Cutting, and Other Hot Work,* 2019 edition.

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

NFPA 56, *Standard for Fire and Explosion Prevention During Cleaning and Purging of Flammable Gas Piping Systems,* 2017 edition.

NFPA 59A, *Standard for the Production, Storage, and Handling of Liquefied Natural Gas (LNG),* 2016 edition.

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

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

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

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

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

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

NFPA 1221, *Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems,* 2019 edition.

NFPA 5000®, Building Construction and Safety Code®, 2018 edition.

2.3 Other Publications.

2.3.1 API Publications. American Petroleum Institute, 1220 L Street, NW, Washington, DC 20005-4070.

API 620, *Design and Construction of Large, Welded, Low-Pressure Storage Tanks,* 2013.

2.3.2 ASCE Publications. American Society of Civil Engineers, 1801 Alexander Bell Drive, Reston, VA 20191-4400.

ASCE 7, *Minimum Design Loads for Buildings and Other Structures,* 2016.

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

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

ASME *Boiler and Pressure Vessel Code,* 2017.

2.3.4 ASTM Publications. ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM A47/A47M, *Standard Specification for Ferritic Malleable Iron Castings,* 2014.

ASTM A395/A395M, *Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures,* 2014.

ASTM A536, *Standard Specification for Ductile Iron Castings,* 2014.

ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials,* 2016.

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

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.

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

CGA 341, *Standard for Insulated Cargo Tank Specification for Nonflammable Cryogenic Liquids,* 2017.

CGA C-6.4, *Methods for External Visual Inspection of Natural Gas Vehicle (NGV) and Hydrogen Vehicle (HGV) Fuel Containers and Their Installations,* 2012.