

**NFPA<sup>®</sup>**

**87**

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Standard for  
Fluid Heaters

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**2021**



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## NFPA® 87

Standard for

## Fluid Heaters

2021 Edition

This edition of NFPA 87, *Standard for Fluid Heaters*, was prepared by the Technical Committee on Fluid Heaters. It was issued by the Standards Council on October 5, 2020, with an effective date of October 25, 2020, and supersedes all previous editions.

This edition of NFPA 87 was approved as an American National Standard on October 25, 2020.

### Origin and Development of NFPA 87

In 2006, the Standards Council authorized the Technical Committee on Ovens and Furnaces to begin work on a new recommended practice on process heaters. The task force formed by the committee to develop the recommended practice comprised members of the Technical Committee on Ovens and Furnaces (NFPA 86, *Standard for Ovens and Furnaces*) and fire safety professionals from the community of fluid heater users and manufacturers.

The need for NFPA to develop a document on fluid heaters became apparent when NFPA received requests over a number of years for interpretation as to whether fluid heaters were covered by any existing NFPA codes and standards. The Technical Committee on Boiler and Combustion Systems specifically excluded process heaters used in chemical and petroleum manufacture from coverage by NFPA 85, *Boiler and Combustion Systems Hazards Code*. NFPA 86 did not exclude process heaters, but the Technical Committee on Ovens and Furnaces recommended the development of a new document that recognized that process heaters were fundamentally different from ovens and furnaces. The first (2011) edition of NFPA 87 was published in 2010.

The 2011 edition of NFPA 87 incorporated safety recommendations consistent with requirements in NFPA 86 and NFPA 85, especially those related to hazards associated with the combustion of gaseous and liquid fuels. Additional recommendations were added to NFPA 87 that addressed unique hazards associated with the heating of combustible fluids (e.g., pressure containment, flow and temperature monitoring, and mitigation of accidental fluid releases).

The 2015 edition of NFPA 87 included the addition of definitions for *burner management system (BMS)* and *emergency shutoff valve (ESOV)* and other updates to definitions for consistency with NFPA 86. Changes to Chapter 6 for consistency with NFPA 86 included ESOV recommendations, emergency isolation valves, and overpressure protection. The technical committee added procedures for placing equipment into service based on purging practices in NFPA 54 and NFPA 56. The committee added a recommendation against manifolding vent lines from different pressure levels based on NFPA 85. As a result of introducing definitions for BMS and combustion safeguard, the technical committee modified recommendations for logic systems for both BMS logic and PLC systems. The technical committee completely revised recommendations for Class F heaters in Chapter 9 and added new content for Chapters 10 and 11 on Class G and Class H heaters, respectively.

For the 2018 edition, NFPA 87 transitioned from a recommended practice to a standard. The committee added nine new definitions to Chapter 3 that were extracted from NFPA 86, including *self-piloted burner*, *line pressure regulator*, *monitoring pressure regulator*, *series pressure regulator*, *service pressure regulator*, *flame rod*, *flame detector*, *supervised flame*, and *flame failure response time (FFRT)*. A definition for authorized personnel from NFPA 1901 was modified, and qualified personnel from NFPA 70 was modified.

In addition, Class F, Class G, and Class H heaters were combined into one chapter due to the similarity of the requirements for all three classes of heaters. Fluid mixture changes were revised to be in accordance with heater manufacturers' recommendations, in accordance with fluid manufacturers' recommendations, or with a third-party approved by the AHJ. Fluid type changes

were also revised to be in accordance with heater manufacturers' recommendations or a third-party approved by the AHJ. Provisions in 8.2.9 required the use of two manual hardwired emergency switches — one located remotely and one located locally in reference to the fluid heater. Requirements in 8.5.2.5 addressed the issue of false flame signal for flame sensing technologies. The PLC software section was altered to refer to the PLC logic programming instead of the general term *software*.

Finally, interlock requirements that had been in Chapter 9 were moved to Chapter 8 with other system interlock requirements. Chapter 9 allowed secondary catch/storage tanks, and safety PLC requirements were aligned with NFPA 86. A requirement for blanket gas low-pressure proving devices was also added.

For the 2021 edition of NFPA 87, a new Chapter 10, Solid Fuel–Fired Heating Systems, provides requirements and guidance for manufacturers and users of solid-fuel–fired fluid heaters. With this chapter, new definitions have been added to Chapter 3 for terms such as *primary air*, *solid fuel backup burner*, *mechanical feeder*, and *flame arrestor*. For thermal fluid applications, annex language has been added that discourages the use of ball valves due to the risk of thermal expansion of trapped fluid. For Chapter 8, supplemental annex material adds context to the existing purge volume requirement and cautions when this requirement may not be conservative. Also, a new annex figure for Chapter 9 has been added that provides information on typical expansion tank instruments and appurtenances.

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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:** The committee shall have primary responsibility for documents covering fluid heaters where the release of energy inside the heater indirectly heats a process fluid that is flowing under pressure. The committee shall not have responsibility for boilers (which are covered by NFPA 85); ovens and furnaces (which are covered by NFPA 86); fired heaters in petroleum refineries and petrochemical facilities (which are covered by API Standards and Recommended Practices); units that heat air for occupiable space or comfort; and LP-gas vaporizers designed and installed in accordance with NFPA 58 and NFPA 59.

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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 D.

## Chapter 1 Administration

### 1.1\* Scope.

**1.1.1** This standard covers fluid heaters and related equipment.

**1.1.2** Within the scope of this standard, a fluid heater is considered to be any thermal fluid heater or process fluid heater with the following features:

- (1) Fluid is flowing under pressure.
- (2) Fluid is indirectly heated.
- (3) Release of energy from combustion of a liquid, solid, or gaseous fuel or an electrical source occurs within the unit.

**Δ 1.1.3** This standard does not apply to the following:

- (1) Boilers (which are covered by NFPA 85 or ANSI/ASME CSD-1, *Controls and Safety Devices for Automatically Fired Boilers*)
- (2) Class A, B, C, or D ovens and furnaces (which are covered by NFPA 86)

- (3) Fired heaters in petroleum refineries and petrochemical facilities that are designed and installed in accordance with API STD 560, *Fired Heaters for General Refinery Service*; API RP 556, *Instrumentation, Control, and Protective Systems for Gas Fired Heaters*; and API RP 2001, *Fire Protection in Refineries*
- (4) Fired heaters commonly called reformer furnaces or cracking furnaces in the petrochemical and chemical industries
- (5) Units that heat air for occupiable space or comfort
- (6) LP-Gas vaporizers designed and installed in accordance with NFPA 58
- (7)\* Coal-fired systems
- (8) Listed equipment with a heating system(s) that supplies a total input not exceeding 150,000 Btu/hr (44 kW)
- (9) Quiescent bath fire-tube heaters

**1.2 Purpose.** This standard provides requirements for fluid heaters to minimize the fire and explosion hazards that can endanger the fluid heater, the building, or personnel.

**1.3\* Application.** This standard applies to new installations and to alterations or extensions of existing equipment.

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

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

**1.4.2** 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 standard deemed appropriate.

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

**1.5\* Equivalency.** Nothing in this standard 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 recommended by this standard.

**1.5.1** Technical documentation shall be submitted to the authority having jurisdiction to demonstrate equivalency.

**1.5.2** The system, method, or device shall be approved for the intended purpose by the authority having jurisdiction.

### 1.6 Units and Formulas.

**1.6.1 SI Units.** Metric units of measurement in this standard are in accordance with the modernized metric system known as the International System of Units (SI).

**1.6.2 Primary and Equivalent Values.** If a value for a measurement as given in this standard is followed by an equivalent value in other units, the first stated value is the requirement. A given equivalent value might be approximate.

**1.6.3 Conversion Procedure.** SI units have been converted by multiplying the quantity by the conversion factor and then rounding the result to the appropriate number of significant digits.

## Chapter 2 Referenced Publications

**2.1 General.** The documents or portions thereof listed in this chapter are referenced within this standard 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*, 2021 edition.

NFPA 12, *Standard on Carbon Dioxide Extinguishing Systems*, 2021 edition.

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

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

NFPA 17, *Standard for Dry Chemical Extinguishing Systems*, 2021 edition.

NFPA 17A, *Standard for Wet Chemical Extinguishing Systems*, 2021 edition.

NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, 2020 edition.

NFPA 30, *Flammable and Combustible Liquids Code*, 2021 edition.

NFPA 31, *Standard for the Installation of Oil-Burning Equipment*, 2020 edition.

NFPA 54, *National Fuel Gas Code*, 2021 edition.

NFPA 58, *Liquefied Petroleum Gas Code*, 2020 edition.

NFPA 70®, *National Electrical Code®*, 2020 edition.

NFPA 79, *Electrical Standard for Industrial Machinery*, 2021 edition.

NFPA 85, *Boiler and Combustion Systems Hazards Code*, 2019 edition.

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

NFPA 91, *Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Particulate Solids*, 2020 edition.

NFPA 654, *Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids*, 2020 edition.

NFPA 664, *Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities*, 2020 edition.

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

### 2.3 Other Publications.

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

API STD 560, *Fired Heaters for General Refinery Service*, 2016.

API RP 556, *Instrumentation, Control, and Protective Systems for Gas Fired Heaters*, 2011.

API RP 2001, *Fire Protection in Refineries*, 2012.

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

ANSI/ASME B1.20.1, *Pipe Threads, General Purpose, Inch*, 2013.

ANSI/ASME B16.1, *Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250*, 2015.

ANSI/ASME B16.5, *Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard*, 2017.

ANSI/ASME B16.20, *Metallic Gaskets for Pipe Flanges*, 2017.

ANSI/ASME B16.21, *Nonmetallic Flat Gaskets for Pipe Flanges*, 2016.

ANSI/ASME B16.24, *Cast Copper Alloy Pipe Flanges, Flanged Fittings, and Valves: Classes 150, 300, 600, 900, 1500, and 2500*, 2016.

ANSI/ASME B16.42, *Ductile Iron Pipe Flanges and Flanged Fittings: Classes 150 and 300*, 2016.

ANSI/ASME B16.47, *Large Diameter Steel Flanges: NPS 26 through NPS 60 Metric/Inch Standard*, 2017.

ANSI/ASME B31.1, *Power Piping*, 2018.

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

ANSI/ASME B36.10M, *Welded and Seamless Wrought Steel Pipe*, 2018.

ANSI/ASME CSD-1, *Controls and Safety Devices for Automatically Fired Boilers*, 2018.

*Boiler and Pressure Vessel Code*, 2019.

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

ASTM A53/A53M, *Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless*, 2018.

ASTM A106/A106M, *Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service*, 2019.

ASTM A254/A254M, *Standard Specification for Copper-Brazed Steel Tubing*, 2012, reapproved 2019.

ASTM A268/A268M, *Standard Specification for Seamless and Welded Ferritic and Martensitic Stainless Steel Tubing for General Service*, 2020.

ASTM A269/A269M, *Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service*, 2015a, reapproved 2019.

ASTM A312/A312M, *Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes*, 2019.

ASTM B88, *Standard Specification for Seamless Copper Water Tube*, 2020.

ASTM B280, *Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service*, 2020.

ASTM D396, *Standard Specification for Fuel Oils*, 2019a.

**N 2.3.4 CSA Group Publications.** CSA Group, 178 Rexdale Boulevard, Toronto, ON M9W 1R3, Canada, www.csagroup.org.

ANSI LC 1/CSA 6.26, *Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing*, 2018.