

NFPA[®]

85

**Boiler and
Combustion Systems
Hazards Code**

2019



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NFPA® 85

Boiler and Combustion Systems Hazards Code

2019 Edition

This edition of NFPA 85, *Boiler and Combustion Systems Hazards Code*, was prepared by the Technical Committees on Fluidized Bed Boilers, Fundamentals of Combustion Systems Hazards, Heat Recovery Steam Generators, Multiple Burner Boilers, Pulverized Fuel Systems, Single Burner Boilers, and Stoker Operations and released by the Correlating Committee on Boiler Combustion System Hazards. 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 85 was approved as an American National Standard on November 25, 2018.

Origin and Development of NFPA 85

NFPA 85 has a long history of documents that were combined to form the present-day NFPA 85. (See *Annex J*, which is a flowchart depicting the complex development of NFPA 85.) The first of these documents, in 1924, was NBFU 60, “Regulations of the National Board of Fire Underwriters for the Installation of Pulverized Fuel Systems as Recommended by the National Fire Protection Association,” which changed from an NBFU/NFPA document to an NFPA code in 1946.

The 2001 edition of NFPA 85 was a compilation of the following six standards:

NFPA 8501, *Standard for Single Burner Boiler Operation*

NFPA 8502, *Standard for the Prevention of Furnace Explosions/Implosions in Multiple Burner Boilers*

NFPA 8503, *Standard for Pulverized Fuel Systems*

NFPA 8504, *Standard on Atmospheric Fluidized-Bed Boiler Operation*

NFPA 8505, *Standard for Stoker Operation*

NFPA 8506, *Standard on Heat Recovery Steam Generator Systems*

In the 2001 edition, significant new material was added for multiple burner boilers, including requirements for reburn systems. For heat recovery steam generators, the minimum purge flow requirements prior to starting the combustion turbine were reduced.

The 2004 edition was reorganized to provide administrative requirements in Chapters 1, 2, and 3 and common requirements in Chapter 4, Fundamentals of Boiler Combustion Systems.

Subsequent chapters covered the specific requirements for each of the boiler and combustion systems covered by the document. The 2004 edition also provided new requirements that addressed selective catalytic reduction (SCR) systems for multiple burner boilers.

In the 2007 edition, Annex M was added to assist users to better understand the complex development of what is now known as NFPA 85. Chapter 4 in the 2007 edition also included new requirements for flue gas path auxiliary systems and flame proving, along with supporting annex material.

The 2007 edition recognized the use of valve-proving systems for single burner boilers in Chapter 5. Furnace structural design requirements for multiple burner boilers were added to Chapter 6 and account for the impact of booster fans. Implosion protection was clarified as not being required on units that have no fan in the flue gas stream downstream of the boiler. In conjunction with those changes, a definition of booster fan was added to Chapter 3. New requirements for flue gas path auxiliary systems were added to Chapters 6 and 7 for multiple burner boilers and fluidized-bed

boilers, respectively. New requirements were added for lance and burner safety shutoff valves on fluidized-bed boilers.

The scope of Chapter 8 was expanded in the 2007 edition from heat recovery steam generators to include other combustion turbine exhaust systems that present similar fire and explosion hazards, including those with no heat recovery. The definition of combustion turbine exhaust systems was added to Chapter 3, and other changes were made throughout the code as required for consistency. Additional combustion turbine interlocks were added to ensure fuel gas in-leakage does not occur during the combustion turbine purge and that excessive fuel is not introduced during combustion turbine light-off.

The 2011 edition incorporated a renumbering and reorganization of Chapter 4 to make it easier to use and cite. In addition, Chapter 4 expanded requirements and annex guidance for burner management systems to describe the types of signals and transmitters used to initiate safety alarms and interlocks and how those signals should be monitored for reliability. Chapter 4 was updated with modified requirements for continuous trend display for single burner boilers to require only those parameters critical to operation.

A definition of *combustion turbine purge credit* was added to Chapter 3, and requirements for the credit to Chapter 8, in the 2011 edition. The combustion turbine purge credit enables designers and operators to establish and maintain a “purged” condition for HRSGs for an extended period of time between restarts.

Guidance was also added to Annex A of the 2011 edition regarding flue gas analyzers in Chapters 5, 6, and 7 concerning the potential for certain types to provide a source of ignition during start-up. In Chapter 6, which addresses multiple burner boilers, the “all fan trip” purge requirements were revised for clarity and to improve the safety of that procedure.

The 2015 edition incorporated new requirements in Chapter 4 for safely purging fuel gas piping systems, both into and out of service. The coverage in NFPA 85 began at the newly defined *equipment isolation valve*. All gas- and liquid fuel-fired boilers are required to be installed with an identifiable equipment isolation valve that demarcates equipment within the scope of NFPA 85 from piping and equipment within the scope of other codes and standards, such as NFPA 54, *National Fuel Gas Code*, or ASME B31.1, *Power Piping*. The new purge requirements contain provisions addressing piping and equipment, both upstream and downstream of the equipment isolation valve.

Several provisions were moved from Chapter 6, Multiple Burner Boilers, to Chapter 4, Fundamentals, so that they apply to all equipment under the scope of NFPA 85. These include requirements for conducting a process hazard analysis for unattended operation, removing interlocks from service during start-up or operation, and preventing the flow of flue gases from a common stack into an idle boiler or HRSG. A provision was added to Chapter 5 to exempt some single burner boilers from the process hazard analysis.

The 2015 edition recognized the use of safety-rated programmable logic controllers for use with single burner boilers where they are certified as at least SIL 3 capable according to IEC 61508, *Functional Safety of Electrical/Electronic Programmable Electronic Safety-Related Systems*.

Chapter 9, Pulverized Fuel Systems, was completely rewritten in the 2015 edition to separate requirements for direct-fired and indirect-fired systems to assist users in identifying and applying requirements for specific equipment. The requirements for indirect-fired systems were greatly expanded and clarified so that the chapter is easier to apply to the unique hazards related to those types of systems. In addition, the “strength of equipment” requirements were modified to recognize that the 344 kPa (50 psi) pressure threshold is really a maximum allowable working pressure (MAWP) and that this MAWP is associated with pulverized fuel having P_{max} of 10 bar-g (145 psig) or less, as identified in NFPA 69, *Standard on Explosion Prevention Systems*. Chapter 9 was updated to reflect the new terminology and methodology.

Finally, the annex material was reorganized so that all supplemental information on stokers is in Annex F and all supplemental information on fluidized bed boilers is in Annex D.

The 2019 edition incorporates new and revised definitions for interlock, trip, and permissive, and correlated terms related to these (such as safety interlock, interlock system, safety or interlock device, master fuel trip, and emergency shutdown) throughout the document for consistency. New language has been added to require specification of autoignition temperature for fuels over the range of expected operating conditions. Revisions have been made to more accurately describe the allowed uses of Class 2 and Class 3 igniters. Requirements for overpressure protection, which had been repeated in multiple equipment-specific chapters, has been moved forward into the Fundamentals chapter, with additional detail added to clarify the application of overpressure protection and methods to achieve it. The Single Burner Boiler requirements has been reformatted to eliminate repetition and combine similar procedures used for both water-tube and fire-tube boilers. Annex material has been added to provide guidance on the frequency of testing for Multiple Burner Boiler interlocks, and operational leak test frequencies has been clarified and revised to specify that the test does not need to be repeated if completed within 8 hours. Language has been added to clarify that a combustion turbine purge is not required on subsequent starts if purge credit is maintained. The annex on Supervised Manual Systems has been removed and replaced with information on Concentrated Flame Igniters.

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Committee Scope: This Committee shall have primary responsibility for documents on the reduction of combustion system hazards in single-burner boilers, multiple-burner boilers, and stoker-fired boilers with a heat input rate of 12,500,000 Btu/hr and above. This includes all fuels. This Committee also is responsible for documents on the reduction of hazards in pulverized fuel systems, fluidized-bed boilers, and heat recovery steam generators and other combustion turbine exhaust systems at any heat input rate.

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