

NFPA[®]

1125

**Code for the Manufacture of
Model Rocket and High-Power
Rocket Motors**

2017



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NFPA®1125

Code for the

Manufacture of Model Rocket and High-Power Rocket Motors

2017 Edition

This edition of NFPA 1125, *Code for the Manufacture of Model Rocket and High-Power Rocket Motors*, was prepared by the Technical Committee on Pyrotechnics. It was issued by the Standards Council on May 13, 2016, with an effective date of June 2, 2016, and supersedes all previous editions.

This edition of NFPA 1125 was approved as an American National Standard on June 2, 2016.

Origin and Development of NFPA 1125

With the increased interest in high power rocketry, the Technical Committee on Pyrotechnics believed that public safety would be best served by the development of a code relating to the manufacture of model and high power rocket motors rather than relying on the provisions of NFPA 1124, *Code for the Manufacture, Transportation, and Storage of Fireworks*. NFPA 1124 pertains to the manufacture of fireworks, much of which is not applicable to the manufacture of model rocket and high power rocket motors.

In 1988, the Technical Committee developed the first edition of NFPA 1125 for model rocket motors only. However, by 1995, the use of high power rocket motors became important as a distinction from the model rocketry sector of the public. The scope of NFPA 1125 was expanded to address both model and high power rocket motor manufacture. NFPA 1125 included requirements developed by the Committee to promote safety in the manufacture of model rocket motors and also the manufacture of high power rocket motors.

For the 2001 edition, the Technical Committee incorporated changes updating regulatory provisions, which made the code compatible with industry practices and consistent with NFPA 1122, *Code for Model Rocketry*, and NFPA 1127, *Code for High Power Rocketry*. The revision also included changes to conform with the NFPA *Manual of Style* for technical committee documents.

The 2007 revision of the code included updates to definitions for coordination with the rocketry documents and to be consistent with the *NFPA Glossary of Terms*.

The Technical Committee modified the definition of and design requirements for hybrid propellant high power rocket motors to allow the use of liquid fuels. The Committee also added a requirement for labeling the casing of reloadable rocket motors with the maximum number of times the casing can be reused.

The 2012 edition of the code contained updates of extracted definitions and updates to U.S. Bureau of Alcohol, Tobacco, and Firearms (BATF) regulatory citations applicable to various provisions within the code. The Technical Committee amended the definitions for *high power rocket motor* and *model rocket motor* in order to differentiate the two motors and to clarify what properties must be satisfied to achieve certification as a model rocket motor. Based upon experience from certification testing of motors and metallurgical studies, the Committee permitted higher casing temperatures under limited applications.

The Technical Committee also clarified the classification for “G” power class motors, which were either high power rocket certified or model rocket certified, depending upon conditions not apparent to store owners or consumers. The Committee also added requirements for certification testing of a user-selectable delay motor system for model and high power rocket motors.

The 2017 edition removes the requirement for sprinklers in mixing rooms. The Committee has added a requirement for instructions provided to the consumer to be part of the overall set of material reviewed by the testing organization. Additional changes clarify code requirements.

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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. 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 manufacture of model and high-power rocket motors designed, sold, and used for the purpose of propelling recoverable aero models.

1.1.2 This code shall apply to the design, construction, and reliability of model and high-power rocket motors and model rocket and high-power motor-reloading kits and their components, and to the limitation of propellant mass and power.

1.1.3 This code shall not apply to the sale and use of the following:

- (1) Model rocket motors (covered by NFPA 1122)
- (2) High-power rocket motors (covered by NFPA 1127)

1.1.4* This code shall not apply to the manufacture, transportation, and storage of fireworks.

1.1.5 This code shall not apply to the manufacture, transportation, and storage of rocket motors by the United States military or other agencies or political subdivisions of the United States.

1.1.6 This code shall not apply to the assembly of reloadable model or high-power rocket motors by the user.

1.1.7 This code shall not apply to the fabrication of model rocket motors or high-power rocket motors by individuals for their personal use.

1.2 Purpose.

1.2.1 The purpose of this code shall be to provide reasonable safety in the manufacture of model rocket and high-power rocket motors.

1.2.2 The purpose of this code shall be to ensure the availability of commercial model and high-power rocket motors and components that meet the standards as stated herein.

1.2.3 The purpose of this code shall also be to supplement existing federal, state, or local regulations.

1.3 Equivalency. 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.

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

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

1.4 Enforcement. This code shall be administered and enforced by the authority having jurisdiction designated by the governing authority. (See Annex C 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*, 2017 edition.

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

NFPA 101®, *Life Safety Code*®, 2015 edition.

NFPA 400, *Hazardous Materials Code*, 2016 edition.

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

NFPA 1122, *Code for Model Rocketry*, 2013 edition.

NFPA 1127, *Code for High Power Rocketry*, 2013 edition.

2.3 Other Publications.

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

Title 16, Code of Federal Regulations, Part 1500, Federal Hazardous Substances Act.

Title 16, Code of Federal Regulations, Parts 1500.85(8) and (9), Consumer Product Safety Commission (CPSC) Regulations.

Title 18, United States Code, Chapter 40, "Importation, Manufacture, Distribution, and Storage of Explosive Materials," 1970, revised 1990, 2002.

Title 27, Code of Federal Regulations, Part 555, Bureau of Alcohol, "Commerce in Explosives," Tobacco, Firearms, and Explosives, U.S. Department of Justice.

Title 29, Code of Federal Regulations, Part 1910.119.

Title 40, Code of Federal Regulations, U.S. EPA, Superfund Appropriation and Reauthorization Act (SARA), Title III.

Title 49, Code of Federal Regulations, Parts 100 to end (Hazardous Materials Regulations, U.S. Dept. of Transportation).

DOT SP-7887, Special Permit Authorization to Title 49, Code of Federal Regulations, Parts 171–180.

2.3.2 Other Publications.

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

2.4 References for Extracts in Mandatory Sections.

NFPA 495, *Explosive Materials Code*, 2013 edition.

NFPA 1122, *Code for Model Rocketry*, 2013 edition.

NFPA 1124, *Code for the Manufacture, Transportation, and Storage of Fireworks and Pyrotechnic Articles*, 2017 edition.

NFPA 1127, *Code for High Power Rocketry*, 2013 edition.

Chapter 3 Definitions

3.1 General. The definitions contained in this chapter shall apply to the terms used in this code. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. *Merriam-Webster's Collegiate Dictionary*, 11th edition, shall be the source for the ordinarily accepted meaning.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

3.2.2* Authority Having Jurisdiction (AHJ). An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

3.2.3* Code. A standard that is an extensive compilation of provisions covering broad subject matter or that is suitable for adoption into law independently of other codes and standards.

3.2.4 Labeled. Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

3.2.5* Listed. Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.

3.2.6 Shall. Indicates a mandatory requirement.

3.2.7 Should. Indicates a recommendation or that which is advised but not required.

3.3 General Definitions.

3.3.1 Aero Model. An unmanned flying device including the category of model or high-power rocket as defined in this section.

3.3.2* Barricade. A natural or artificial barrier that effectively screens a magazine, building, railway, or highway from the effects of an explosion in a magazine or building containing explosives.

3.3.2.1 Artificial Barricade. An artificial mound or revetted wall of earth of a minimum thickness of 0.9 m (3 ft).

3.3.2.2 Natural Barricade. A natural outdoor feature(s), such as hills or trees, with a density sufficient to prevent surrounding exposures that require protection from being seen from a magazine or building containing explosives when the trees are bare of leaves. [1124, 2017]

3.3.2.3* Screen Barricade. Any barrier that contains the embers and debris from a fire or deflagration in a process building, thus preventing propagation of fire to other buildings or areas.

3.3.3 Building.

3.3.3.1* Inhabited Building. A building regularly occupied in whole or part as a habitation for human beings, or any church, schoolhouse, railroad station, store, or other structure where people are accustomed to assemble, but not including any building or structure occupied in connection with the manufacture, transportation, storage, or use of explosive materials. [495, 2013]

3.3.3.2 Mixing Building. Any building used primarily for mixing and blending of propellant, delay, or ejection compositions.

3.3.3.3 Nonprocess Building. Any office building, warehouse, or other building located in a rocket motor plant where no explosives are processed or stored.

3.3.3.4 Process Building. Any building in which propellant, delay composition, or ejection composition is mixed, pressed, or modified in any manner, or in which any modification is made to the model or high-power rocket motor prior to its completed form, excluding interim storage,

labeling, or packaging of the completed motor in consumer packaging or in a container acceptable to the Department of Transportation.

3.3.3.5 Storage Building. Any building or structure in the rocket motor plant in which model rocket motors or high-power rocket motors in any state of processing or finished model rocket motors or high-power rocket motors are stored, but in which no processing or manufacturing is actually performed.

3.3.4 Certified. Approved or endorsed authoritatively.

3.3.5* Certified Motor. A commercially made rocket motor that has been tested by a recognized testing organization that is acceptable to the authority having jurisdiction and found to meet the requirements set forth in this code.

3.3.6* Certified User. An individual, a distributor, or a seller who has been tested or otherwise examined by a recognized organization that is acceptable to the authority having jurisdiction and found to be qualified to purchase, possess, or use high-power rocket motors.

3.3.7 Commercial Manufacturer. Any individual, firm, partnership, joint venture, corporation, or other business entity engaged in research, development, production, preparation, testing, maintenance, or supply of rockets, rocket motors, rocket propellant chemicals, rocket propellant, delay or ejection modules, or rocket components or parts. [1122, 2013]

3.3.8 Composition.

3.3.8.1 Delay Composition. A chemical mixture that, upon burning and without explosion, is used to provide a delay between the thrust and ejection phases.

3.3.8.2 Ejection Composition. A chemical mixture that, upon burning, produces a burst of gas for deploying recovery devices.

3.3.8.3 Propellant Composition. A chemical mixture that, upon burning, produces thrust to propel a recoverable aero model.

3.3.9* Explosive. Any chemical compound, mixture, or device, the primary or common purpose of which is to function by explosion. [495, 2013]

3.3.9.1 Low Explosive. Explosive materials that can be caused to deflagrate when confined.

3.3.10 Facility. All land and buildings, including the rocket motor plant, constituting a model or high-power rocket motor manufacturing operation.

3.3.11 Flight Cylinder. A high-pressure container used in a hybrid rocket motor system to contain pressurized liquid or gas. [1127, 2013]

3.3.11.1 Sealed Flight Cylinder. A flight cylinder used in a hybrid rocket motor system into which a pressurized liquid or gas can be loaded prior to launch and stored for an indefinite period.

3.3.11.2 Vented Flight Cylinder. A flight cylinder used in a hybrid rocket motor system that continuously vents a pressurized liquid or gas to the atmosphere during the motor fill and ignition procedures.

3.3.12 Highway. Any public street, public alley, or public road including a privately financed, constructed, or maintained road that is regularly and openly traveled by the general public.

3.3.13 Magazine. A building or structure, other than an explosives manufacturing building, approved for the storage of explosive materials. [1124, 2017]

3.3.14* Manufacture. The preparation of propellant, delay, and ejection compositions and the loading and assembly of model or high-power rocket motors and igniters and any other alteration of their pyrotechnic components.

3.3.15 Model Rocket Engine. See 3.3.24, Rocket Motor.

3.3.16 Module. A pyrotechnic component of a hybrid or reloadable rocket motor in which its chemical composition is preloaded into a finished assembly that does not necessitate mixing of ingredients by the user.

3.3.17 Motor-Reloading Kit. A package designed and produced by a commercial manufacturer that contains all the components and parts necessary to reload and reuse a reloadable model or high-power rocket motor casing.

3.3.18 Person. Any individual, firm, copartnership, corporation, company, association, or joint-stock association, including any trustee, receiver, assignee, or personal representative thereof.

3.3.19 Production Lot. A uniquely identifiable group of solid-propellant model or high-power rocket motors, motor-reloading kits, or pyrotechnic module(s) possessing the same characteristics resulting from production under common manufacturing conditions using the same batch of materials.

3.3.20 Propellant. The material(s) utilized in a model or high-power rocket motor that produces thrust by the discharge of a working fluid generated by combustion, decomposition, change of state, or other operation of such material contained, carried, or stored within the model or high-power rocket motor.

3.3.21 Public Conveyance. Any railroad car, street car, ferry, cab, bus, airplane, or other vehicle that carries passengers for hire.

3.3.22 Railway. Any steam, electric, diesel-electric, or other railroad or railway that carries passengers for hire on the particular line or branch in the vicinity of a rocket motor plant or storage facility.

3.3.23 Rocket Engine. See 3.3.24, Rocket Motor.

3.3.24* Rocket Motor. A device containing propellant that provides the force or thrust to cause a rocket to move. [1122, 2013]

3.3.24.1 Composite Propellant Rocket Motor. Any device as defined under rocket motor that utilizes a propellant charge consisting primarily of an inorganic oxidizer dispersed in a carbonaceous polymeric binder.

3.3.24.2 High-Power Rocket Motor. A rocket motor that has no more than 40,960 N-sec (9209 lb-sec) of total impulse, and that does not otherwise meet all the requirements for a model rocket motor set forth in this code.

3.3.24.3 Hybrid Rocket Motor. A rocket motor in which one or more of the fuels exist in a physical state (solid, liquid, or gaseous) different than the oxidizer and that derives its force or thrust from the combination thereof.

3.3.24.4 Model Rocket Motor. A solid-propellant rocket motor that has a total impulse of no greater than 160 N-sec (36 lb-sec), an average thrust of no greater than 80 N (18 lbf), and that otherwise meets the other requirements set forth in this code.

3.3.24.5 Reloadable Motor System. A combination of a reloadable rocket motor casing and a motor-reloading kit that are designed to be used together as a system.

3.3.24.6 Reloadable Rocket Motor. A rocket motor that has been designed and manufactured so that the user can load, reload, and reuse the pressure-containing body or casing using the parts and components of a motor-reloading kit.

3.3.24.7 Solid-Propellant Rocket Motor. A rocket motor that contains a fuel and an oxidizer in solid form and whose force or thrust is produced by the combustion of the fuel and oxidizer. [1122, 2013]

3.3.25 Rocket Motor Plant. All land and buildings thereon used for the manufacture or processing of propellants and model rocket or high-power motors, including storage buildings with or in connection with plant operation.

3.3.26 Rocket Propellant. See 3.3.20, Propellant.

3.3.27 Warehouse. Any building or structure used exclusively for the storage of materials that are not used to manufacture model rocket motors or high-power rocket motors.

Chapter 4 Manufacturing Operations for Rocket Motors

4.1 Basic Requirements.

4.1.1 This chapter shall only apply to the manufacture of any solid-propellant rocket motor or motor-reloading kit.

4.1.2 The manufacture of any rocket motor shall be prohibited in any residence or dwelling, or in any inhabited building in an area zoned as residential by the local building authority and building codes in effect.

4.1.3 The manufacturer of any rocket motor shall be in compliance with 29 CFR 1910.119.

4.2 Permit Requirements.

4.2.1 Any person engaged in the manufacture of rocket motors, motor-reloading kits, or pyrotechnic modules shall possess a federal license or permit, as required by 18 USC Chapter 40 Title XI, Regulation of Explosives, of the Crime Control Act of 1970 and shall comply with all applicable state and local laws and regulations.

4.2.1.1 Copies of all required licenses and permits shall be posted at each rocket motor plant.

4.2.1.2 License and permit holders shall take reasonable precaution to protect licenses and permits from loss, theft, defacement, destruction, or unauthorized duplication. Any such occurrence shall be reported immediately to the issuing authority.

4.2.1.3 Licenses or permits shall not be reassigned or transferred.

4.2.2 The issuing authority shall be notified when required of any change of business name, controlling ownership, or address.

4.3 Recordkeeping and Reporting.

4.3.1 Records shall be maintained in accordance with 27 CFR 555.

4.3.2 The loss, theft, or unlawful removal of explosive materials shall be reported immediately to the appropriate officer of the Bureau of Alcohol, Tobacco, Firearms, and Explosives, U.S. Department of the Treasury, and to local law enforcement authorities.

4.4 Applicability. All rocket motor plants that manufacture black powder-based motors shall meet the requirements of Chapter 4.

4.5 Site Security.

4.5.1* The rocket motor plant shall be completely surrounded by a fence or equivalent barrier capable of deterring entry by unauthorized persons.

4.5.2 All openings in the fence shall have gates that shall be kept closed and securely locked at all times when the plant is not in operation.

4.5.3 Conspicuous signs that read WARNING — NO SMOKING — NO TRESPASSING or other signage as required by the authority having jurisdiction shall be posted at the entrance(s) and along the fence or barrier.

4.5.4 Only authorized employees or representatives of federal, state, or local agencies having jurisdiction over the plant shall be permitted inside the plant without special permission of the person in charge.

4.6 Separation Distances.

4.6.1 Process buildings shall be separated from other inhabited buildings, passenger railways, and public highways in accordance with the distances specified in Table 4.6.1.

4.6.2 Process buildings shall be separated from nonprocess buildings by the distances specified in Table 4.6.2.

4.6.3 Magazines shall be separated from both process and nonprocess buildings by the distances specified in Table 4.6.2.

4.7 Process Building Construction.

4.7.1* The interior surfaces of walls and ceilings shall be smooth.

4.7.1.1 Interior finish shall be of noncombustible or limited-combustible materials.

4.7.1.2 Materials used for deflagration vent closures shall not be required to be of noncombustible or limited-combustible materials.

4.7.2 Horizontal ledges and surfaces on which dust can settle and accumulate shall be minimized.

4.7.3 Floors and work surfaces shall not have cracks or crevices in which propellant, delay, or ejection composition can lodge.