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NFPA 1122 Code for Model Rocketry 1994 Edition

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For information on the procedures for requesting Technical Committees to issue Formal Interpretations, proposing Tentative Interim Amendments, proposing amendments for Committee consideration, and appeals on matters relating to the content of the document, write to the Secretary, Standards Council, National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

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Policy Adopted by NFPA Board of Directors on December 3, 1982

The Board of Directors reaffirms that the National Fire Protection Association recognizes that the toxicity of the products of combustion is an important factor in the loss of life from fire. NFPA has dealt with that subject in its technical committee documents for many years.

There is a concern that the growing use of synthetic materials may produce more or additional toxic products of combustion in a fire environment. The Board has, therefore, asked all NFPA technical committees to review the documents for which they are responsible to be sure that the documents respond to this current concern. To assist the committees in meeting this request, the Board has appointed an advisory committee to provide specific guidance to the technical committees on questions relating to assessing the hazards of the products of combustion.

Statement on NFPA Procedures

This material has been developed under the published procedures of the National Fire Protection Association, which are designed to assure the appointment of technically competent Committees having balanced representation. While these procedures assure the highest degree of care, neither the National Fire Protection Association, its members, nor those participating in its activities accept any liability resulting from compliance or noncompliance with the provisions given herein, for any restrictions imposed on materials or processes, or for the completeness of the text.

NFPA has no power or authority to police or enforce compliance with the contents of this document, and any certification of products stating compliance with requirements of this document is made at the peril of the certifier.

NFPA 1122

Code for Model Rocketry

1994 Edition

This edition of NFPA 1122, *Code for Model Rocketry*, was prepared by the Technical Committee on Pyrotechnics and acted on by the National Fire Protection Association, Inc. at its Fall Meeting held November 15-18, 1993, in Phoenix, AZ. It was issued by the Standards Council on January 14, 1994, with an effective date of February 11, 1994, and supersedes all previous editions.

The 1994 edition of this document has been approved by the American National Standards Institute.

Changes other than editorial are indicated by a vertical rule in the margin of the pages on which they appear. These lines are included as an aid to the user in identifying changes from the previous edition.

Origin and Development of NFPA 1122

NFPA 1122 was created originally as a tentative code by the Technical Committee on Pyrotechnics as NFPA 41L, *Code for Model Rocketry*. It was adopted tentatively in 1967 and adopted officially by the Association in May 1968. In November 1976, a major revision of NFPA 41L, including its redesignation as NFPA 1122L, *Code for Unmanned Rockets*, was adopted. The 1976 edition was revised by the Technical Committee on Pyrotechnics in 1980 to eliminate the "L" designation and to delete the requirements for cold propellant model rocket motors, which no longer are allowed because of their use of chlorofluorocarbons (Freon 12™). Other technical changes were made at that time. Those revisions were adopted at the 1981 NFPA Fall Meeting, and the new document became the 1982 edition. Amendments to the 1982 edition were processed at the 1986 NFPA Fall Meeting, resulting in the 1987 edition. Because of the rapid progress in consumer rocket technology and the emergence of the commercial space transportation industry, the 1987 edition has been amended, and its title has been changed back to NFPA 1122, *Code for Model Rocketry* for this 1994 edition.

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This list represents the membership at the time the Committee was balloted on the text of this edition. Since that time, changes in the membership may have occurred.

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 protection against the fire and life hazards associated with the manufacture, transportation, and storage of fireworks, fireworks used in outdoor displays; pyrotechnics used before a proximate audience; and the construction, launching, and other operations that involve unmanned rockets, including the manufacture of model rocket motors. This Committee shall not have responsibility for documents on the use of fireworks by the general public, including sale, storage, or display of same.

Contents

Foreword

This code in intended to prohibit the making and launching of dangerous homemade "rocket bombs" and to eliminate the tragic injuries and deaths that have occurred due to experiments with explosive "rocket fuels," homemade rocket motors, and unsafe launching mechanisms.

This code contains instructional guidelines and specific standards for the design, construction, limitation of charge and power, and reliability of all rocket motors manufactured for sale to the general public; for the design and construction of rockets propelled by these motors; and for the performance of tests, launchings, and other operations involving such rockets in order to minimize hazards.

The NFPA Technical Committee on Pyrotechnics believes that this code contains appropriate measures to safeguard this popular and growing activity. Safe model rocket activities should not be confused with the hazardous, uncontrolled operations of so-called basement bombers and amateur rocketeers who attempt to make their own propellants, rocket motors, and large, metallic rocket vehicles. Model rocket activities should be allowed within the specifications of this code to guide our science-minded youth and citizens safely.

NFPA 1122

Code for

Model Rocketry

1994 Edition

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

Information on referenced publications can be found in Chapter 6 and Appendix C.

Chapter 1 General Requirements

1-1 Scope.

1-1.1 This code shall apply to the design, construction, limitation of propellant mass and power, and reliability of model rocket motors, and model rocket motor reloading kits and their components, produced commercially for sale to or use by the public for purposes of education, recreation, and sporting competition.

1-1.2 This code also shall apply to the design and construction of model rockets propelled by model rocket motors specified in 1-1.1.

1-1.3 This code also shall apply to the conduct of launch operations of model rockets specified in 1-1.2.

1-1.4 This code shall not apply to the design, construction, production, manufacture, fabrication, maintenance, launching, flight, test, operation, or use of or any other activity in connection with a rocket or rocket motor when carried out or engaged in by:

(a) The government of the United States of America;

(b) Any state or local government;

(c) Any individual, firm, partnership, joint venture, corporation, or other business entity engaged as a licensed business in the research, development, production, testing, maintenance, or supply of rockets, rocket motors, rocket propellant chemicals, or rocket components or parts; or

(d) Any college or university.

1-1.5 This code shall not apply to the design, construction, fabrication, maintenance, production, manufacture, launching, flight, test, operation, or use of rocket-propelled model aircraft that sustain their mass against the force of gravity by aerodynamic lifting surfaces that support the aircraft during the entire duration of its flight in the air. However, this code shall apply to the model rocket motors and their components that provide the propulsion for such model aircraft.

1-1.6 This code shall not apply to model or toy rockets propelled by pressurized liquid rocket motors containing less than 250 ml (8.45 fl oz) of water.

1-1.7 This code shall not apply to fireworks rockets or pyrotechnic rockets as defined in NFPA 1123, *Code for the Outdoor Display of Fireworks*, NFPA 1124, *Code for the Manufacture, Transportation, and Storage of Fireworks*, and NFPA 1126, *Standard for the Use of Pyrotechnics before a Proximate Audience*, such as skyrockets, rockets with sticks, or other types of rockets not covered by this code.

1-2 Purpose.

1-2.1 The purpose of this code shall be to ensure the wide and easy availability of commercial model rocket motors and components that meet standards of safety and reliability, thereby ensuring that the creative and experimental urges of the public regarding model rocket devices have reasonably safe outlets.

1-2.2 The purpose of this code also shall be to discourage the making and launching of homemade rockets and other rocket-like vehicles propelled or intended to be propelled by homemade rocket propulsion devices.

1-2.3 The purpose of this code also shall be to discourage experiments with explosive or highly energetic rocket propellants, construction of homemade rocket propulsion motors, and attempted launchings or operations of these homemade rocket devices, thereby minimizing tragic deaths and injuries.

1-3 Definitions. For the purposes of this code, the following terms shall be defined as specified in this section.

Aero Model. A miniature, unmanned flying device that includes the category of model rocket, as defined in this section.

Approved. Acceptable to the authority having jurisdiction.

NOTE: The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials; nor does it approve or evaluate testing laboratories. In determining the acceptability of installations, procedures, equipment, or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization concerned with product evaluations that is in a position to determine compliance with appropriate standards for the current production of listed items.

Authority Having Jurisdiction. The organization, office, or individual responsible for approving equipment, an installation, or a procedure.

NOTE: The phrase "authority having jurisdiction" is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

Cold Propellant Model Rocket Motor. A model rocket motor that produces force or thrust by a change of state of its propellant, i.e., not by a process involving combustion.

Commercial Manufacturer. Any individual, firm, partnership, joint venture, corporation, or other business

entity engaged as a licensed business in research, development, production, preparation, testing, maintenance, or supply of model rockets, model rocket motors, model rocket propellant chemicals, model rocket propellant, delay or ejection modules, or model rocket components or parts.

Hybrid Model Rocket Motor. A model rocket motor in which the fuel exists in a different physical state (solid, liquid, or gaseous) than the oxidizer and that derives its force or thrust from the combination thereof.

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.

Liquid Propellant Model Rocket Motor. A model rocket motor that contains a fuel and an oxidizer in liquid form or in a combined monopropellant liquid form as a single chemical and that derives its force or thrust from the combustion thereof.

Listed. Equipment or materials included in a list published by an organization acceptable to the authority having jurisdiction and concerned with product evaluation that maintains periodic inspection of production of listed equipment or materials and whose listing states either that the equipment or material meets appropriate standards or has been tested and found suitable for use in a specified manner.

NOTE: The means for identifying listed equipment may vary for each organization concerned with product evaluation, some of which do not recognize equipment as listed unless it is also labeled. The authority having jurisdiction should utilize the system employed by the listing organization to identify a listed product.

Model Rocket. A model rocket is a rocket that is propelled by a model rocket motor. It has structural parts made of paper, wood, or breakable plastic; it has a means for its return to the ground so it can be flown again; and its primary use is for purposes of education, recreation, and sporting competition. A model rocket motor as defined shall be permitted to be made of metal.

Model Rocket Engine. (*See definition of Model Rocket Motor.*)

Model Rocket Motor. A solid propellant or pressurized liquid rocket motor that conforms to the standards for model rocket motors as set forth in this code. Where the term model rocket motor is used in this code, it includes both assembled reloadable model rocket motors and manufactured expendable model rocket motors.

Model Rocket Vehicle. (*See definition of Model Rocket.*)

Module. A pyrotechnic component of a reloadable model rocket motor in which its chemical composition is cast into a finished assembly to avoid the measuring or mixing of ingredients or the handling of raw pyrotechnic materials by the user.

Motor Reloading Kit. A package designed and produced by a commercial manufacturer that contains all the components and parts necessary to reload and re-use a nonexpendable model rocket motor casing specifically designed and manufactured for use with such components and parts. These components and parts normally include a propellant module(s), a new model rocket motor nozzle, new insulation components, prepackaged delay and ejection modules, an electrical igniter, and the parts necessary to seal the casing during operation.

Pressurized Liquid Model Rocket Motor. A model rocket motor that derives its force or thrust from a liquid expelled from the model rocket motor by pressurized gas and that involves no combustion or change of state.

Production Lot. A quantity of solid propellant model rocket motors, motor casings, or motor reloading kits produced during a single work shift on the same manufacturing device, using the same batch of pyrotechnic material.

Propellant. The material(s) utilized in a model 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 rocket motor.

Reloadable Rocket Motor. A model rocket motor that has been designed and manufactured so that the user can load, reload, and re-use the pressure-containing body or casing using the parts and components of a motor reloading kit specifically designed, manufactured, and intended for use with that model rocket motor casing by the manufacturer.

Rocket. A device that ascends into the air without the use of aerodynamic lifting forces acting against gravity and that is propelled by a rocket motor.

Rocket Engine. (*See definition of Rocket Motor.*)

Rocket Motor. A device, or combination of devices, that provides the necessary force or thrust to cause a rocket to move. The force or thrust shall be created by the discharge of gas generated by combustion, decomposition, change of state, or other operation of materials contained, carried, or stored solely within the rocket motor or rocket and not dependent upon the outside environment for reaction mass.

Rocket Vehicle. (*See definition of Rocket.*)

Shall. Indicates a mandatory requirement.

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

Skyrocket or Rockets with Sticks. Fireworks rockets not intended for re-use that meet the definition of "skyrocket" or "missile-type rocket" in the Hazardous Materials Regulations of the U.S. Department of Transportation. Fireworks rockets approved for transportation by DOT normally are classed as Fireworks UN 0335, Explosive 1.3G (formerly Class B Explosive, Special Fireworks) or Fireworks UN 0336, Explosive 1.4G (formerly Class C Explosive, Common Fireworks), depending on the quantity of pyrotechnic composition contained in the rocket. Skyrockets use a wooden stick for flight guidance and stability, while missile-type rockets use fins.

NOTE: See *Code of Federal Regulations*, Title 49, Part 173.

Solid Propellant Model Rocket Motor. A model rocket motor containing a fuel and an oxidizer in solid form and deriving its force or thrust from the combustion thereof.

Steam Model Rocket Motor. A model rocket motor that produces its force or thrust by means of steam carried or stored within the model rocket motor or model rocket vehicle or produced in the model rocket motor or model rocket vehicle by the heating of water therein.

Structural Parts. The load-bearing parts of a model rocket; specifically, the nose cone, body tube, and fins.

Thrust Augmenter. A device that increases the force or motive power of a model rocket motor by imparting a portion of the momentum of the model rocket motor's exhaust jet to the surrounding environmental medium and that is considered to be part of a model rocket motor when and where used.

Chapter 2 Requirements for Model Rocket Construction and Operation

2-1* Model Rocket Operations. A model rocket shall comply at all times with the requirements of construction and operation as set forth in, *United States Code*, Title 49, Section 1348, "Airspace Control and Facilities," 72 Statute 749, Section 307, Federal Aviation Act of 1958, covering *Federal Aviation Administration Regulations*, from *Code of Federal Regulations*, Title 14, Chapter 1, Subchapter F, Part 101, Paragraph 101.1 (a)(3)(ii)(a) through (d) or later revisions or amendments thereto.

2-2 Model Rocket Materials. A model rocket's structural parts, including the body, nose cone, and fins, shall be made of paper, wood, or plastic and shall contain no substantial metal parts. A model rocket motor shall be assembled with all pyrotechnic ingredients preloaded into a cylindrical paper or similarly constructed nonmetallic tube that will not fragment into sharp, hard pieces.

Exception: A model rocket motor casing shall be permitted to be metallic and reloadable as specified in this code and if specifically allowed by federal agencies.

2-3* Model Rocket Recovery. A model rocket shall have a means for returning it to the ground so it can be flown again (e.g., a parachute). All recovery wadding used in a model rocket shall be flame resistant.

2-4 Model Rocket Maximum Weights. A model rocket shall weigh no more than 453 gm (16 oz) at lift-off, and its motor(s) shall produce an installed total impulse of no more than 320 newton-seconds (71.9 pound-seconds).

Exception: A model rocket weighing in excess of 453 gm (16 oz) but no more than 1500 gm (53 oz) shall be permitted if the Federal Aviation Administration notice and waiver requirements are met.

NOTE: See *Federal Aviation Administration Regulations*, from *Code of Federal Regulations*, Title 14, Chapter 1, Subchapter F, Part 101.

2-5 Model Rocket Weights. A model rocket shall weigh no more than the motor manufacturer's recommended maximum lift-off weight for the motors used or shall use motors recommended by the kit manufacturer.

2-6 Model Rocket Payloads A model rocket shall not carry a payload that is intended to be flammable, explosive, or harmful to persons or property. A model rocket shall not be launched on a flight path aimed at a target.

2-7 Model Rocket Launch Site. A model rocket shall be launched outdoors in a cleared area, free of tall trees, power lines, buildings, and dry brush and grass.

2-8 Model Rocket Launch Site Size. The launch site shall be at least as large as specified in Table 2-8.

Table 2-8 Launch Site Dimensions

Installed Total Impulse (N-sec)	Equivalent Motor Type	Minimum Site (ft)	Dimensions (m)
0 – 1.25	¼ A and ½ A	50	15.2
1.26 – 2.50	A	100	30.5
2.51 – 5.00	B	200	61.0
5.01 – 10.00	C	400	122.0
10.01 – 20.00	D	500	152.4
20.01 – 40.00	E	1000	304.8
40.01 – 80.00	F	1000	304.8
80.01 – 160.00[1,2]	2F (or 1G)	1000	304.8
160.01 – 320.00[2]	4F (or 2G)	1500	457.2

[1]See Exception No. 1
[2]See Exception No. 2
NOTE: For a circular area, the minimum launch site dimension is the diameter in feet, for a rectangular area, it is the shortest side in feet.

Exception No. 1: A model rocket with an installed total propellant weight exceeding 113.4 gm (4 oz) shall comply with the additional operating requirements as set forth in the Federal Aviation Administration Regulations, from Code of Federal Regulations, Title 14, Chapter 1, Subchapter F, Part 101.

Exception No. 2: "G" motors with an installed total impulse of more than 80 newton-seconds to 160 newton-seconds shall be permitted to be used if specifically allowed by federal agencies.

2-9 Model Rocket Launchers. A model rocket shall be launched from a stable launch device that provides rigid guidance until it has reached a speed adequate to ensure a safe flight path.

2-10 Model Rocket Launcher Eye Safety. To prevent accidental eye injury, the launcher shall be placed so the end of the rod is above eye level, or the end shall be capped when approaching it. The launch rod shall be capped or disassembled when not in use and shall not be stored in an upright position.

2-11 Model Rocket Launch Safety. The launcher shall have a blast deflector device to prevent the motor exhaust from hitting the ground directly. The area around a launch device shall be cleared of brown grass, dry weeds, or other easy-to-burn materials.

2-12 Model Rocket Ignition System. The system used to launch a model rocket shall be remotely controlled and electrically operated. It shall have a launching switch that will return to "off" when released. The system shall be equipped with a removable safety interlock in series with the launch switch.

2-13 Spectator Distances. All persons shall remain at least 15 ft (4.6 m) from the model rocket when igniting model rocket motors with an installed total impulse of

30 newton-seconds or less, and at least 30 ft (9.1 m) from the model rocket when igniting model rocket motors with an installed total impulse of more than 30 newton-seconds.

2-14 Spectator Notification. All people in the launch area shall be made aware of the pending model rocket launch. An audible 5-second countdown shall take place.

2-15 Model Rocket Misfires. If a model rocket misfires, no person shall approach the launcher until one minute has elapsed and the safety interlock has been removed or the battery has been disconnected from the ignition system.

2-16 Model Rocket Launch Weather. A model rocket shall not be launched in a wind of more than 20 mph (32 km/hr) or into a cloud or near an aircraft in flight.

2-17 Model Rocket Launch Angle. The launch device shall be pointed within 30 degrees of vertical.

2-18 Model Rocket Retrieval Safety. A model rocket shall not be retrieved if it becomes entangled in a power line or other dangerous place.

Chapter 3 Requirements for Model Rocket Motors and Components

3-1 Solid Propellant Model Rocket Motors and Components.

3-1.1* A solid propellant model rocket motor, motor reloading kit, or component shall be a device produced by a commercial manufacturer.

3-1.1.1 Expendable Model Rocket Motor.

3-1.1.1.1 An expendable (nonreloadable) model rocket motor shall have all of the propellant preloaded into the motor casing in such a manner that the propellant cannot be removed without destroying the motor.

3-1.1.1.2 Delay trains and ejection charges shall be permitted to be included as an integral part of the motor or shall be permitted to be preloaded and packaged separately if:

(a) The auxiliary package is a single preassembled unit containing all of the remaining combustible material; and

(b) The auxiliary package is designed so that an individual shall have no difficulty handling and using it safely.

3-1.1.2 Reloadable Model Rocket Motor.

3-1.1.2.1 Propellant modules packaged in motor reloading kits for reloadable model rocket motors having a total impulse equal to or greater than 30 newton-seconds shall be shipped and stored in an insulating sleeve having a low thermal conductivity and of equal or greater length than the propellant module and having a thickness of not less than 0.030 in. (0.08 cm).

3-1.1.2.2 Propellant modules packaged in motor reloading kits for reloadable model rocket motors having a total impulse of less than 30 newton-seconds shall be limited to a maximum of three modules per package.

3-1.1.2.3 Ejection charges shall be packaged in such a manner that any flame from ignition of a charge will have a low probability of cross-propagation to other ejection charges.

3-1.2 A solid propellant model rocket motor casing shall be made so that the temperature of the external surface of the model rocket motor casing cannot exceed 392°F (200°C) during or after operation.

3-1.3 A solid propellant model rocket motor casing shall be designed so that, if it ruptures, it will not project any casing fragments beyond a radial distance of 10 ft (3 m) for motors of less than 30 newton-seconds total impulse, or 20 ft (6 m) for motors equal to or greater than 30 newton-seconds. Metal casings, if used, shall be designed and constructed so that their primary failure mode shall be along the longitudinal axis of the motor.

3-1.4 A solid propellant model rocket motor or motor reloading kit shall be designed and constructed to be incapable of spontaneous ignition in air, in water, or as a result of physical shocks, jarring, impacts, or motion under conditions that would reasonably be expected to occur during shipment, storage, and use, or when subjected to a temperature of 176°F (80°C) or less.

3-1.5* A solid propellant model rocket motor shall contain no more than 62.5 gm (2.2 oz) of propellant materials and shall produce a total impulse not in excess of 80 newton-seconds as set forth in *Code of Federal Regulations*, Title 16, Part 1500.85(a)(8)(ii). A model rocket motor shall produce an average thrust of 80 newtons or less when tested by an organization acceptable to the authority having jurisdiction.

Exception: A total impulse not in excess of 160 newton-seconds shall be permitted if specifically allowed by federal agencies.

3-1.6 A manufacturer of solid propellant model rocket motors or motor reloading kits shall subject a random sample of 1 percent of each motor or motor reloading kit production lot to a static test that shall measure and record the assembled model rocket motor's total impulse, delay time, and action of ejection charge for each item, as included.

Production lots shall be corrected, destroyed, or retested by the manufacturer under any of the following conditions:

(a) The total impulse of any test item varies more than 20 percent from the established mean total impulse value of the model rocket motor or reloading kit type;

(b) The time delay of any test item varies more than 20 percent from the established mean time delay value of the model rocket motor or motor reloading kit type; but in no case shall this variation exceed 3 seconds;

(c) The ejection charge, if any, of any test item does not function properly;

(d) Any test item malfunctions in any other manner that affects the safety of its shipment, storage, handling, or use. Static tests shall be conducted with the test items at ambient temperature.

For a retest, a manufacturer shall test a minimum additional 2 percent of the production lot in question. If any additional test item displays any of the conditions of

3-1.6(a) through (d), the entire production lot shall be corrected or destroyed by the manufacturer.

3-1.7 The performance of a solid propellant model rocket motor or motor reloading kit that deviates from the sample test criteria and limits detailed in 3-1.6 within 5 years from the date of manufacture shall be withdrawn from commercial sale and redesigned to provide reliable operation when ignited within a period of 5 years from the date of manufacture.

3-1.8 A solid propellant model rocket motor or motor reloading kit shall be shipped and stored with no ignition element installed that can be activated by an open flame at a temperature of less than 302°F (150°C), or by incident radio frequency radiation normally encountered in shipping, storage, handling, or use.

3-1.9 No manufacturer, distributor, or other person shall sell, offer to sell, expose for sale, or otherwise make available to the public any type of model rocket motor ignition device that is intended to be initiated by a hand-held flame.

3-1.10 A solid propellant model rocket motor, motor reloading kit, or component shall be shipped and sold with complete instructions for its storage, handling, and use. These instructions shall contain a warning to read and follow all instructions carefully and to use the model rocket motor only in accordance with the instructions. In addition, the instructions shall contain the following information:

(a) Instructions that specify how to ignite the model rocket motor safely by electrical means;

(b) Performance data on the model rocket motor or motor reloading kit type that include propellant weight, total impulse, average thrust, time delay, and representative thrust—time curve;

(c) Any special first aid data or action to be taken in the event of burns or oral ingestion of the propellant;

(d) Proper and safe disposal of the model rocket motor, or pyrotechnic components of a motor reloading kit, if it has become too old, has been subjected to conditions that might impair its performance, or, in the opinion of the user, possibly has become unsafe;

(e) Any special action that shall be taken to fight any fire in which stored model rocket motors, or motor reloading kits, might be involved.

3-1.11 A model rocket motor or module shall have imprinted on its external surface, casing, or label a recognized code indicating the nominal performance parameters — e.g., "C6-5" (for a model rocket motor having a total impulse of 5.01 to 10.0 newton-seconds, an average thrust of 6 newtons, and a time delay of 5 seconds) or "5-second time delay module" (for a time delay module having a time delay of 5 seconds) — and the date of manufacture or equivalent coding.

3-2 Pressurized Liquid Model Rocket Motors.

3-2.1 A pressurized liquid model rocket motor shall be sold as a completely prefabricated, assembled device ready for the user to fill, pressurize, and use.

3-2.2 A pressurized liquid model rocket motor shall use water in the liquid state or other nontoxic liquid as a propellant or reaction mass.

3-2.3 A pressurized liquid model rocket motor shall be designed for an internal working pressure not greater than 7 atmospheres gauge (103 psig or 710 kPa) and shall be equipped with a nonadjustable, nonremovable safety valve or pressure release means that will operate when the internal pressure exceeds 10 atmospheres gauge (147 psig or 1014 kPa). The pressurized liquid model rocket motor casing shall be designed and constructed to possess a minimum burst pressure of 20 atmospheres gauge (294 psig or 2027 kPa).

3-2.4 A pressurized liquid model rocket motor shall be shipped and stored with no propellant material inside it and vented to atmospheric pressure.

3-2.5 The pressure used by a pressurized liquid model rocket motor shall be either generated or produced by a pressure source such as a pump outside the model rocket motor or generated by the noncombustible chemical reaction of chemicals within the model rocket motor or model rocket vehicle.

3-2.6 Materials used in the construction or fabrication of a pressurized liquid model rocket motor shall be nonmetallic.

Chapter 4 Testing and Certification

4-1* Certification of Model Rocket Motors, Motor Reloading Kits, and Components. Model rocket motor, motor reloading kit, and component(s) types offered for sale, exposed for sale, sold, used, or made available to the public shall be examined and tested by the authority having jurisdiction to determine whether they comply with the standards and requirements detailed in Chapter 3. The authority having jurisdiction shall certify as acceptable for sale and use those products that do comply. At the discretion of the authority having jurisdiction, such examination, testing, and certification shall be permitted to be carried out by an approved testing laboratory or an organization acceptable to the authority having jurisdiction.

4-2 Listing of Certified Model Rocket Motors and Motor Reloading Kits. The authority having jurisdiction shall maintain a current and complete list of all those model rocket motor and motor reloading kit types that are certified as complying with the standards and requirements detailed in Chapter 3 and shall make copies of this list available to citizens and public safety officials who request it.

Chapter 5 Prohibited Activities and Permit Requirements

5-1 Prohibited Activities. The following activities shall be prohibited by this code:

(a) The use of model rocket motors, motor reloading kits, or components for the primary purpose of producing a spectacular display of color, light, sound, or any combination thereof;

Exception: This shall not be construed as prohibiting the public demonstration of model rockets as defined herein and as certified according to these requirements.

(b) The use of a model rocket or model rocket motor, motor reloading kit, or component as a weapon against a target;

(c) The use of a model rocket motor, motor reloading kit, or component contrary to the instructions for its use and contrary to the provisions of *Federal Aviation Administration Regulations*, from *Code of Federal Regulations*, Title 14, Chapter 1, Subchapter F, Part 101, Paragraph 101.1(a)(3)(ii);

(d) Tampering with any model rocket motor or motor reloading kit or component in any manner or to any degree that is contrary to the purpose for which the model rocket motor, motor reloading kit, or component is designed and intended to be used;

(e) The sale or transfer to the general public, not otherwise exempted in 1-1.4, of any model rocket motor, motor reloading kit, or component that has not been certified in accordance with Chapter 4;

(f) The operation, discharge, or activation of a model rocket motor contrary to the provisions of *Federal Aviation Administration Regulations*;

(g) The manufacture, production, fabrication, making, operation, maintenance, launch, flight, test, activation, discharge, or other experimentation with model rockets, model rocket motors, motor reloading kits, or components that have not been certified in accordance with the provisions of Chapter 4 including, but not limited to, cold propellant model rocket motors, hybrid model rocket motors, liquid propellant model rocket motors, steam model rocket motors, and model rocket propellant chemicals for solid, liquid, and hybrid model rocket motors, including monopropellants;

(h) The sale, offer for sale, exposure for sale, making, or use of fuse, wick, or other ignition devices intended to be activated by a hand-held flame for the purpose of starting or igniting a model rocket motor;

(i) Affixing to a model rocket motor, motor reloading kit, or component a statement of compliance with the regulations or statement of certification required by Chapter 4, or exhibiting statements in writing in advertising or on packaging that certification in accordance with Chapter 4 has been obtained, when such certification has not been obtained, has been withdrawn, or has been denied;

(j) Reloading any expendable solid propellant model rocket motor with any material after that motor has been operated;

(k) Reloading, refilling, or pressurizing any model rocket motor with any material or by any means not specifically provided or recommended by the manufacturer.

5-2 User Permits. A permit shall be required for the storage by a user of more than 220 lb (100 kg) of solid propellant model rocket motors, motor reloading kits, or components. No other permit shall be required of a user (e.g., possession, use, purchase, transportation, or sale of model rocket motors, motor reloading kits, or components).

Chapter 6 Referenced Publications

6-1 The following documents or portions thereof are referenced within this code and shall be considered part of the requirements of this document. The edition indicated for each reference is the current edition as of the date of the NFPA issuance of this document.

6-1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 1123, *Code for the Outdoor Display of Fireworks*, 1990 edition.

NFPA 1124, *Code for the Manufacture, Transportation, and Storage of Fireworks*, 1988 edition.

NFPA 1126, *Standard for the Use of Pyrotechnics before a Proximate Audience*, 1992 edition.

6-1.2 Other Publications.

6-1.2.1 NAR Publication. National Association of Rocketry, P.O. Box 177, Altoona, WI 54720.

Model Rocket Safety Code of the National Association of Rocketry — Hobby Industry Association of America, 1991.

6-1.2.2 U.S. Government Publications. Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

Code of Federal Regulations, Title 16, Part 1500.85(a)(8)(ii).

Code of Federal Regulations, Title 27, Part 55.

Code of Federal Regulations, Title 49, Parts 100-end.

Federal Aviation Administration Regulations, from *Code of Federal Regulations*, Title 14, Chapter 1, Subchapter F, Part 101, Paragraph 101.1(a)(3)(ii)(a) through (d) or revisions or amendments thereto.

United States Code, Title 49, Section 1348, "Airspace Control and Facilities," 72 Statute 749, Section 307.

Appendix A Explanatory Material

This Appendix is not a part of the requirements of this NFPA document, but is included for informational purposes only.

A-2-1 Excerpt from *United States Code*, Title 49, Section 1348, "Airspace Control and Facilities," 72 Statute 749, Section 307, Federal Aviation Act of 1958, covering *Federal Aviation Administration Regulations*, Part 101, Subpart A, Paragraph 101.1(a)(3)(ii):

The Part prescribes rules governing the operation in the United States of the following: . . .

(3) Any unmanned rocket except . . .

(ii) Model rockets

(a) Using not more than four ounces of propellant;

(b) Using a slow-burning propellant;

(c) Made of paper, wood, or breakable plastic, containing no substantial metal parts, and weighing not more than 16 ounces, including the propellant; and

(d) Operated in a manner that does not create a hazard to persons, property, or other aircraft.

A-2-3 Launch Times. Models should be launched only during hours of daylight.

A-3-1.1 See *Code of Federal Regulations*, Title 16, Part 1500.83(a)(36), for additional labeling requirements for model rocket motors.

A-3-1.5 A recognized testing organization includes, but is not limited to, the National Association of Rocketry or its successor organization.

A-4-1 Model rocket motors other than preloaded, expendable types should be sold only to persons age 16 or older. A nationally recognized testing organization includes, but is not limited to, the National Association of Rocketry or its successor organization.

Appendix B

This Appendix is not a part of the requirements of this NFPA document, but is included for informational purposes only.

NOTE: Appendix B is an extract from the *Model Rocket Safety Code of the National Association of Rocketry.*

B-1 Model Rocket Safety Code of the National Association of Rocketry.

1. *Materials.* My model rocket will be made of lightweight materials such as paper, wood, rubber, and plastic suitable for the power used and the performance of my model rocket. I will not use any metal for the nose cone, body, or fins of a model rocket.

2. *Motors.* I will use only commercially-made NAR certified model rocket motors in the manner recommended by the manufacturer. I will not alter the model rocket motor (engine), its parts, or its ingredients in any way.

3. *Recovery.* I will always use a recovery system in my model rocket that will return it safely to the ground so it may be flown again. I will use only flame resistant recovery wadding if wadding is required by the design of my model rocket.

4. *Weight and Power Limits.* My model rocket will weigh no more than 1,500 grams (53 ounces) at liftoff and its rocket motor(s) will produce no more than 320 Newton-seconds (4.45 Newtons equals 1.0 pound) of total impulse. My model rocket will weigh no more than the motor manufacturer's recommended maximum liftoff weight for the motors used, or I will use motors recommended by the manufacturer for my model rocket.

5. *Stability.* I will check the stability of my model rocket before its first flight, except when launching a model rocket of already proven stability.

6. *Payloads.* Except insects, my model rocket will never carry live animals or a payload that is intended to be flammable, explosive, or harmful.

7. *Launch Site.* I will launch my model rocket outdoors in a cleared area, free of tall trees, power lines, buildings, and dry brush and grass. My launch site will be at least as large as that recommended in the Launch Site Dimensions table.

8. *Launcher.* I will launch my model rocket from a stable launch device that provides rigid guidance until the model rocket has reached a speed adequate to ensure a safe flight path. To prevent accidental eye injury, I will always place the launcher so the end of the rod is above eye level or I will cap the end of the rod when approaching it. I will cap or disassemble my launch rod when not in use and I will never store it in an upright position. My launcher will have a jet deflector device to prevent the motor exhaust from hitting the ground directly. I will always clear the area around my launch device of brown grass, dry weeds, or other easy-to-burn materials.

LAUNCH SITE DIMENSIONS

Installed Total Impulse (newton-seconds)	Equivalent Motor Type	Minimum Site Dimensions (feet)
0 — 1.25	¼ A & ½ A	50
1.26 — 2.50	A	100
2.51 — 5.00	B	200
5.01 — 10.00	C	400
10.01 — 20.00	D	500
20.01 — 40.00	E	1000
40.01 — 80.00	F	1000
80.01 — 160.00	G	1000
160.01 — 321.00	2Gs	1500

9. *Ignition Systems.* The system I use to launch my model rocket will be remotely controlled and electrically operated. It will contain a launching switch that will return to "off" when released. The system will contain a removable safety interlock in series with the launch switch. All persons will remain at least 15 feet from the model rocket when I am igniting model rocket motors totalling 30 Newton-seconds or less of total impulse and at least 30 feet from the model rocket when I am igniting model rocket motors totalling more than 30 Newton-seconds of total impulse. I will use only electrical igniters recommended by the motor manufacturer that will ignite model rocket motor(s) within one second of actuation of the launching switch.

10. *Launch Safety.* I will ensure that people in the launch area are aware of the pending model rocket launch and can see the model rocket's liftoff before I begin my audible five-second countdown. I will not launch a model rocket so its flight path will carry it against a target. If my model rocket suffers a misfire, I will not allow anyone to approach it or the launcher until I have made certain that the safety interlock has been removed or that the battery has been disconnected from the ignition system. I will wait one minute after a misfire before allowing anyone to approach the launcher.

11. *Flying Conditions.* I will launch my model rocket only when the wind is no more than 20 miles per hour. I will not launch my model rocket so it flies into clouds, near aircraft in flight, or in a manner that is hazardous to people or property.

12. *Pre-launch Test.* When conducting research activities with unproven model rocket designs or methods I will, when possible, determine the reliability of my model rocket by pre-launch tests. I will conduct the launching of an unproven design in complete isolation from persons not participating in the actual launching.

13. *Launch Angle.* My launch device will be pointed within 30 degrees of vertical. I will never use model rocket motors to propel any device horizontally.

14. *Recovery Hazards.* If a model rocket becomes entangled in a power line or other dangerous place, I will not attempt to retrieve it.

Appendix C Referenced Publications

C-1 The following documents or portions thereof are referenced within this code for informational purposes only and thus are not considered part of the requirements of this document. The edition indicated for each reference is the current edition as of the date of the NFPA issuance of this document.

C-1.1 NAR Publication. National Association of Rocketry, P.O. Box 177, Altoona, WI 54720.

Model Rocket Safety Code of the National Association of Rocketry — Hobby Industry Association of America, 1991.

C-1.2 U.S. Government Publications. Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

Code of Federal Regulations, Title 16, Part 1500.83(a)(36).

Code of Federal Regulations, Title 49, Part 173.

Federal Aviation Administration Regulations, from *Code of Federal Regulations*, Title 14, Chapter 1, Subchapter F, Part 101, Paragraph 101.1(a)(3)(ii).

United States Code, Title 49, Section 1348, "Airspace Control and Facilities," 72 Statute 749, Section 307.

Index

The NFPA Codes and Standards Development Process

Since 1896, one of the primary purposes of the NFPA has been to develop and update the standards covering all areas of fire safety.

Calls for Proposals
The code adoption process takes place twice each year and begins with a call for proposals from the public to amend existing codes and standards or to develop the content of new fire safety documents.

Report on Proposals
Upon receipt of public proposals, the technical committee members meet to review, consider, and act on the proposals. The public proposals – together with the committee action on each proposal and committee-generated proposals – are published in the NFPA's Report on Proposals (ROP). The ROP is then subject to public review and comment.

Report on Comments
These public comments are considered and acted upon by the appropriate technical committees. All public comments – together with the committee action on each comment – are published as the Committee's supplementary report in the NFPA's Report on Comments (ROC).

The committee's report and supplementary report are then presented for adoption and open debate at either of NFPA's semi-annual meetings held throughout the United States and Canada.

Association Action
The Association meeting may, subject to review and issuance by the NFPA Standards Council, (a) adopt a report as published, (b) adopt a report as amended, contingent upon subsequent approval by the committee, (c) return a report to committee for further study, and (d) return a portion of a report to committee.

Standards Council Action
The Standards Council will make a judgement on whether or not to issue an NFPA document based upon the entire record before the Council, including the vote taken at the Association meeting on the technical committee's report.

Voting Procedures
Voting at an NFPA Annual or Fall Meeting is restricted to members of record for 180 days prior to the opening of the first general session of the meeting, except that individuals who join the Association at an Annual or Fall Meeting are entitled to vote at the next Fall or Annual Meeting.

"Members" are defined by Article 3.2 of the Bylaws as individuals, firms, corporations, trade or professional associations, institutes, fire departments, fire brigades, and other public or private agencies desiring to advance the purposes of the Association. Each member shall have one vote in the affairs of the Association. Under Article 4.5 of the Bylaws, the vote of such a member shall be cast by that member individually or by an employee designated in writing by the member of record who has registered for the meeting. Such a designated person shall not be eligible to represent more than one voting privilege on each issue, nor cast more than one vote on each issue.

Any member who wishes to designate an employee to cast that member's vote at an Association meeting in place of that member must provide that employee with written authorization to represent the member at the meeting. The authorization must be on company letterhead signed by the member of record, with the membership number indicated, and the authorization must be recorded with the President of NFPA or his designee before the start of the opening general session of the Meeting. That employee, irrespective of his or her own personal membership status, shall be privileged to cast only one vote on each issue before the Association.

Sequence of Events Leading to Publication of an NFPA Committee Document

Call for proposals to amend existing document or for recommendations on new document.

▼

Committee meets to act on proposals, to develop its own proposals, and to prepare its report.

▼

Committee votes on proposals by letter ballot. If two-thirds approve, report goes forward. Lacking two-thirds approval, report returns to committee.

▼

Report is published for public review and comment. (Report on Proposals - ROP)

▼

Committee meets to act on each public comment received.

▼

Committee votes on comments by letter ballot. If two-thirds approve, supplementary report goes forward. Lacking two-thirds approval, supplementary report returns to committee.

▼

Supplementary report is published for public review. (Report on Comments - ROC).

▼

NFPA membership meets (Annual or Fall Meeting) and acts on committee report (ROP and ROC).

▼

Committee votes on any amendments to report approved at NFPA Annual or Fall Meeting.

▼

Complaints to Standards Council on Association action must be filed within 20 days of the NFPA Annual or Fall Meeting.

▼

Standards Council decides, based on all evidence, whether or not to issue standard or to take other action, including hearing any complaints.

▼

Appeals to Board of Directors on Standards Council action must be filed within 20 days of Council action.

FORM FOR PROPOSALS ON NFPA TECHNICAL COMMITTEE DOCUMENTS

Mail to: Secretary, Standards Council
National Fire Protection Association, 1 Batterymarch Park, Quincy, Massachusetts 02269-9101
Fax No. 617-770-3500

Note: All proposals must be received by 5:00 p.m. EST/EDST on the published proposal-closing date.

If you need further information on the standards-making process, please contact the Standards Administration Department at 617-984-7249.

Date 9/18/93 **Name** John B. Smith **Tel. No.** 617-555-1212

Company _____

Street Address 9 Seattle St., Seattle, WA 02255

Please Indicate Organization Represented (if any) Fire Marshals Assn. of North America

1. a) NFPA Document Title National Fire Alarm Code **NFPA No. & Year** NFPA 72, 1993 ed.

b) Section/Paragraph 1-5.8.1 (Exception No.1)

FOR OFFICE USE ONLY
Log # _____
Date Rec'd _____

2. Proposal recommends: (Check one)
- ❑ **new text**
- ❑ **revised text**
- ☒ **deleted text**

3. Proposal (include proposed new or revised wording, or identification of wording to be deleted):

Delete exception.

4. Statement of Problem and Substantiation for Proposal: (Note: State the problem that will be resolved by your recommendation; give the specific reason for your proposal including copies of tests, research papers, fire experience, etc. If more than 200 words, it may be abstracted for publication.)

A properly installed and maintained system should be free of ground faults. The occurrence of one or more ground faults should be required to cause a "trouble" signal because it indicates a condition that could contribute to future malfunction of the system. Ground fault protection has been widely available on these systems for years and its cost is negligible. Requiring it on all systems will promote better installations, maintenance and reliability.

5. ☒ This Proposal is original material. (Note: Original material is considered to be the submitter's own idea based on or as a result of his/her own experience, thought, or research and, to the best of his/her knowledge. is not copied from another source.)

❑ **This Proposal is not original material; its source (if known) is as follows:** _____

Note 1: Type or print legibly in black ink.
Note 2: If supplementary material (photographs. diagrams, reports, etc.) is included, you may be required to submit sufficient copies for all members and alternates of the technical committee.

I hereby grant NFPA the non-exclusive, royalty-free rights, including non-exclusive, royalty-free rights in copyright, in this proposal and I understand that I acquire no rights in any publication of NFPA in which this proposal in this or another similar analogous form is used.

John B. Smith
Signature (Required)

PLEASE USE SEPARATE FORM FOR EACH PROPOSAL

FORM FOR PROPOSALS ON NFPA TECHNICAL COMMITTEE DOCUMENTS

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Date _____ **Name** _____ **Tel. No.** _____

Company _____

Street Address _____

Please Indicate Organization Represented (if any) _____

1. a) NFPA Document Title _____ **NFPA No. & Year** _____

b) Section/Paragraph _____

2. Proposal Recommends: (Check one)
- ❑ **new text**
- ❑ **revised text**
- ❑ **deleted text**

FOR OFFICE USE ONLY

Log # _____

Date Rec'd _____

3. Proposal (include proposed new or revised wording, or identification of wording to be deleted):

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_____
Signature (Required)

PLEASE USE SEPARATE FORM FOR EACH PROPOSAL

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