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NFPA 1125 Manufacture of Model Rocket Motors 1988 Edition

National Fire Protection Association Batterymarch Park, Quincy, MA 02269

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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 accepts 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.

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NATIONAL FIRE PROTECTION ASSOCIATION

NFPA 1125

Code for the Manufacture of

Model Rocket Motors

1988 Edition

This edition of NFPA 1125, *Code for the Manufacture of Model Rocket Motors*, was prepared by the Technical Committee on Pyrotechnics and acted on by the National Fire Protection Association, Inc. at its Annual Meeting held May 16-18, 1988, in Los Angeles, California. It was issued by the Standards Council on June 8, 1988 with and effective date of June 28, 1988, and supersedes all previous editions.

The 1988 edition of this document has been approved by the American National Standards Institute.

Origin and Development of NFPA 1125

With the increased interest in rocketry, especially model rocketry, the Technical Committee on Pyrotechnics believed that public safety would best be served by the development of a code relating to the manufacture of model 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 motors. The development of a specific code for the manufacture of model rocket motors would not only tend to assure the production of model rocket motors capable of meeting the standards set forth in NFPA 1122, *Code for Unmanned Rockets*, but would also serve as a guideline to those companies who wish to get into the model rocket field by providing them with information on the requirements believed by the Committee to be necessary to promote safety in the manufacture of model rocket motors.

Technical Committee on Pyrotechnics

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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.

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NFPA 1125

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Model Rocket Motors

1988 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 5 and Appendix C.

Chapter 1 General

1-1 Scope.

1-1.1 This code shall apply to the manufacture of model rocket motors designed, sold, and used for the purpose of propelling recoverable aero models. (*See NFPA 1122, Code for Unmanned Rockets.*)

1-1.2 This code shall not apply to the sale and use of model rocket motors. (*See NFPA 1122, Code for Unmanned Rockets.*)

1-1.3 This code shall not apply to the manufacture, transportation, and storage of fireworks. (*See NFPA 1124, Code for the Manufacture, Transportation, and Storage of Fireworks.*)

1-1.4 This code shall not apply to the manufacture, transportation, and storage of rocket motors by federal and state military agencies.

1-2 Purpose.

1-2.1 The purpose of this code is to provide reasonable safety in the manufacture of model rocket motors.

1-2.2 The purpose of this code is also to supplement existing federal, state, or local regulations.

1-3 Equivalency. This code is not intended to prevent the use of systems, methods, or devices that provide equivalent protection to the provisions of this code, provided equivalency can be demonstrated.

1-4 Definitions. For the purpose of this code, the following terms shall have the meanings given below.

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 or 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 which is in a position to determine compliance with appropriate standards for the current production of listed items.

Authority Having Jurisdiction. The "authority having jurisdiction" is 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, 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 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."

Barricade. A natural or artificial barrier that will effectively screen a magazine, building, railway, or highway from the effects of an explosion in a magazine or building containing explosives. To be effective, a barricade must be of such height that a straight line from the top of any sidewall of a magazine or building containing explosives to the eave line of any magazine or building, or to a point 12 ft (3.7 m) above the center of a railway or highway, will pass through the barricade.

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

Natural Barricade. Natural features of the ground, such as hills or timber of sufficient density that the surrounding exposures which require protection cannot be seen from the magazine or building containing explosives when the trees are bare of leaves.

Bullet-Sensitive Explosive Material. Explosive material that can be detonated by 150-grain M2 ball ammunition having a nominal muzzle velocity of 2700 ft/s (824 m/s) when fired from a 0.30 caliber rifle at a distance of 100 ft (30.5 m), measured perpendicularly. The test material is at a temperature of 70 ° F to 75° F (21° C to 24° C) and is placed against a ¼-in. (6.4-mm) steel plate.

Composite Propellant Model Rocket Motor. Any device as defined under "Model Rocket Motor" below, but which utilizes a propellant charge consisting primarily of an inorganic oxidizer dispersed in a carbonaceous polymeric binder.

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

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

Explosive.* Any chemical compound, mixture, or device, the primary or common purpose of which is to function by explosion. The term includes, but is not limited to, dynamite, black powder, pellet powder, initiating explosives, detonators, safety fuses, squibs, detonating cord, igniter cord, and igniters. The term "explosives" includes any materials determined to be within the scope of Title 18, *United States Code,* Chapter 40, Importation, Manufacture, Distribution and Storage of Explosive Materials, and also includes any material classified as a Class A or Class B explosive by the Hazardous Materials Regulations of the U.S. Department of Transportation.

Facility. All land and buildings (including the model rocket motor plant) comprising a model rocketry manufacturing operation.

Flash Powder. Explosive composition intended for use in firecrackers and salutes. Flash powder produces an audible report and a flash of light when ignited. Typical flash powder composition contains potassium chlorate or potassium perchlorate, sulfur or antimony sulfide, and powdered aluminum.

Highway. Any public street or road.

Igniter. A device containing a small quantity of igniting compound in contact with a bridge wire or resistance wire.

Inhabited Building. A building outside the facility occupied in whole or in part as a habitation for human beings, or any church, schoolhouse, railroad station, store, or other structure where people are accustomed to assemble.

Labeled. Equipment or materials to which has been attached a label, symbol or other identifying mark of an organization 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.

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.

Magazine. Any building or structure used exclusively for the storage of explosive materials and that meets the requirements of Chapter 4.

Manufacture. The preparation of propellant, delay, and ejection mixes and the loading and assembly of model rocket motors and igniters.

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

Model Rocket Motor. A solid propellant or pressurized liquid rocket motor that conforms to the standards for rocket motors as set forth in NFPA 1122, *Code for Unmanned Rockets.*

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

Motor Vehicle. Any self-propelled vehicle, truck, tractor, semitrailer, or truck-trailer combination used for the transportation of freight over public highways.

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

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

Pressing System. A building or group of buildings comprising one model rocket motor manufacturing unit. Considered as one process building for application of Table of Distances.

Process Building. Any mixing building; any building in which propellant, delay composition, or ejection composition is pressed or otherwise prepared for finish and assembly. If while in process, a propellant or delay composition is stored in a process building, the building is still considered a process building.

Propellant Composition. A chemical mixture which, upon burning and without explosion, produces thrust to propel a recoverable aero model.

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

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 model rocket motor plant or storage facility.

Screen Barricade. Any barrier that will contain the embers and debris from a fire or deflagration in a process building, thus preventing propagation of fire to other buildings or areas. Such barriers may be constructed of metal roofing, ¼- to ½-in. mesh screen, or equivalent material. The barrier extends from floor level to a height such that a straight line from the top of any side wall of the donor building to the eave line of any exposed building intercepts the screen at a point not less than 5 ft (1.5 m) from the top of the screen. The top 5 ft (1.5 m) of the screen

are inclined toward the donor building at an angle of 30° to 45°.

Shall. Indicates a mandatory requirement.

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

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

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

Chapter 2 Manufacturing Operations for Black Powder-Based Model Rocket Motors

2-1 Basic Requirements.

2-1.1 The manufacture of any model rocket motor, as defined in Section 1-4, shall be prohibited unless it is authorized by federal license, where required, and is conducted in accordance with this code.

2-2 Permit Requirements.

2-2.1 Any person engaged in the business of importing, manufacturing, or dealing in model rocket motors shall possess a valid federal license or permit, where required by Title XI, *Regulation of Explosives,* of the Crime Control Act of 1970 (Title 18, *United States Code,* Chapter 40) and shall comply with all applicable state and local laws and regulations.

2-2.1.1 Copies of all required licenses and permits shall be posted at each model rocket motor plant.

2-2.1.2 License and permit holders shall take every reasonable precaution to protect licenses and permits from loss, theft, defacement, destruction, or unauthorized duplication. Any such occurrence shall be immediately reported to the issuing authority.

2-2.1.3 Licenses or permits shall not be reassigned or transferred.

2-2.2 The issuing authority shall be notified immediately of any change of business address.

2-3 Record Keeping and Reporting.

2-3.1 License or permit holders shall maintain records of all transactions or operations involving explosive materials. Such records shall be kept for five years and shall be made available upon request to the authorities having jurisdiction.

2-3.1.1 An accumulation of invoices, sales slips, delivery tickets or receipts, bills of lading, or similar papers representing individual transactions will satisfy the requirements for record keeping, provided such documents include the signature of the receiver of the explosive materials.

2-3.2 The loss, theft, or unlawful removal of explosive materials shall be reported immediately to the appropriate officer of the Bureau of Alcohol, Tobacco, and Firearms, U.S. Department of the Treasury, and to local law enforcement authorities.

2-4 Applicability.

All model rocket motor plants that manufacture black powder-based motors shall meet the requirements of this chapter.

2-5 Site Security.

2-5.1 The plant shall be completely surrounded by a substantial fence having a minimum height of 6 ft (1.8 m).

2-5.2 All openings in the fence shall have suitable gates that shall be kept closed and securely locked at all times when the plant is not in operation.

2-5.3 Conspicuous signs indicating "WARNING — NO SMOKING — NO TRESPASSING" shall be posted along the fence.

2-5.4 Only authorized employees or representatives of federal, state, or local agencies having jurisdiction over the plant shall be allowed in the plant without special permission of the person in charge.

2-6 Separation Distances.

2-6.1 Process buildings shall be separated from other inhabited buildings, public highways, and passenger railways according to the distance specified in Table 2-6.1.

Table 2-6.1 Minimum Separation Distances of Process Buildings from Inhabited Buildings, Passenger Railways, and Public Highways

Net Weight of Rocket Motor Composition[2]	Distance from Passenger Railways and Public Highways[3, 4]	Distance from Inhabited Buildings[3, 4]
Pounds	Feet	Feet
100	200	200
200	200	200
400	200	200
600	200	208
800	200	252
1,000	200	292

For SI Units: 1 pound = .454 kg
1 foot = .305 m

NOTE 1: This Table does not apply to separation distances for manufacturing buildings or magazines containing Class A or B explosives.

NOTE 2: Net weight of all propellant, delay, and ejection composition only.

NOTE 3: See Chapter 1 for definitions of "passenger railways," "public highways," and "inhabited buildings."

NOTE 4: All distances in this table are to be applied with or without barricades or screen-type barricades.

2-6.2 Process buildings shall be separated from nonprocess buildings by the distances specified in Table 2-6.2. Magazines shall be separated from both process and nonprocess buildings by the distances specified in Table 2-6.2.

Table 2-6.2 Minimum Separation Distances at Rocket Motor Manufacturing Plants

Net Weight of Class A or B Explosives	Distance of Magazine from Process Buildings and Nonprocess Buildings[2, 3]	Distance Between Process Buildings and Nonprocess Buildings[2, 3]
Pounds	Feet	Feet
100	30	30
200	35	35
400	44	44
600	51	51
800	56	56
1,000	60	60
2,000	76	76
3,000	87	87

For SI Units: 1 pound = .454 kg
1 foot = .305 m

NOTE 1: For the purposes of applying the separation distances in Table 2-6.2, process buildings include mixing buildings or any buildings in which propellant, pyrotechnic, or explosive compositions are pressed or otherwise prepared for finishing and assembling. Nonprocess buildings are office buildings, warehouses, and other facility buildings where no propellant, delay, or explosive compositions are processed.

NOTE 2: Distances apply with or without barricades or screen-type barricades.

NOTE 3: Distances include those between magazines, between a magazine and a process building, and between a magazine and a nonprocess building.

2-6.3 Magazines containing either black powder or Class B explosives shall be separated from each other and from inhabited buildings, public highways, and passenger railways according to the distances specified by the Bureau of Alcohol, Tobacco, and Firearms or Table 2-6.3. (*See page 8.*)

2-7 Process Building Construction.

2-7.1* The interior surfaces of walls and ceilings shall be smooth. Interior finish shall be of noncombustible or limited combustible materials. (*See NFPA 220, Standard on Types of Building Construction.*)

Exception: Materials used for deflagration vent closures need not meet this requirement.

2-7.2 Horizontal ledges and surfaces upon which dust may settle and accumulate shall be minimized.

2-7.3* Floors and work surfaces shall not have cracks or crevices in which explosive or pyrotechnic composition may lodge. Floors and work surfaces in mixing and pressing buildings shall be electrically conductive.

2-8 Means of Egress.

2-8.1 Means of egress in process buildings shall comply with the applicable requirements of NFPA *101®*, *Life Safety Code®*, and the following requirements:

(a) In every undivided floor area of more than 100 sq ft (9 sq m), there shall be at least two remotely located exits.

Exception: Rooms not containing exposed explosive or pyrotechnic composition need have only one exit, provided that exit is located away from or suitably shielded from rooms that do contain such composition.

(b) Exits shall be so located that every point within the room or undivided floor area is within 25 ft (7.6 m) of an exit. The routes to the exits shall not be obstructed.

(c) Exit doors shall open outward and shall be capable of being pressure actuated from the inside.

2-9 Heat, Light, and Electrical Equipment.

2-9.1 Stoves, exposed flames, and portable electric heaters shall be prohibited in any manufacturing room where propellant composition, delay composition, ejection composition, components for the preceding, or flammable liquids are or may be present.

2-9.2 Heating shall be provided by steam, hot water, or indirect hot air radiators, or any other means acceptable to the authority having jurisdiction.

2-9.2.1 Unit heaters located in rooms that contain or may contain exposed explosive or pyrotechnic composition shall be equipped with motors and electrical devices suitable for use in Class II, Group E, Division 1 locations. (*See Article 502 of NFPA 70, National Electrical Code®.*)

Exception: Buildings or rooms that are used only for static motor tests.

2-9.3 All wiring in process buildings shall be in rigid metal conduit or shall be Type MI cable. Wiring, switches, and electrical fixtures shall be suitable for Class II, Group E, Division 1 locations. (*See Article 502 of NFPA 70, National Electrical Code.*)

2-9.3.1 Temporary or loose electrical wiring shall not be used.

2-9.3.2 When lighting is necessary within a magazine, electric safety flashlights or electric safety lanterns shall be used.

Exception: Approved portable lighting equipment may be used during repair operations, provided the area has been cleared of all explosive or pyrotechnic composition and all dust or residue has been removed by washing.

2-9.3.3 All presses and other mechanical devices shall be electrically bonded and grounded.

2-9.4 All artificial lighting shall be electrically powered.

2-10 Maximum Number of Occupants and Maximum Quantity Limitations.

2-10.1* The number of occupants in each process

Table 2-6.3 Minimum Separation Distances for Magazines Storing Black Powder or Class B Propellant from Inhabited Buildings, Public Highways, and Other Magazines Storing Black Powder or Class C Propellant

This table is completely reproduced from the *American Table of Distances for Storage of Explosives* as revised and approved by the Institute of Makers of Explosives in May, 1983.

QUANTITY OF EXPLOSIVES		DISTANCES IN FEET							
		Inhabited Buildings		Public Highways Class A to D		Passenger Railways — Public Highways with Traffic Volume of more than 3,000 Vehicles/Day		Separation of Magazines	
Pounds Over	Pounds Not Over	Barricaded	Unbarricaded	Barricaded	Unbarricaded	Barricaded	Unbarricaded	Barricaded	Unbarricaded
2	5	70	140	30	60	51	102	6	12
5	10	90	180	35	70	64	128	8	16
10	20	110	220	45	90	81	162	10	20
20	30	125	250	50	100	93	186	11	22
30	40	140	280	55	110	103	206	12	24
40	50	150	300	60	120	110	220	14	28
50	75	170	340	70	140	127	254	15	30
75	100	190	380	75	150	139	278	16	32
100	125	200	400	80	160	150	300	18	36
125	150	215	430	85	170	159	318	19	38
150	200	235	470	95	190	175	350	21	42
200	250	255	510	105	210	189	378	23	46
250	300	270	540	110	220	201	402	24	48
300	400	295	590	120	240	221	442	27	54
400	500	320	640	130	260	238	476	29	58
500	600	340	680	135	270	253	506	31	62
600	700	355	710	145	290	266	532	32	64
700	800	375	750	150	300	278	556	33	66
800	900	390	780	155	310	289	578	35	70
900	1,000	400	800	160	320	300	600	36	72
1,000	1,200	425	850	165	330	318	636	39	78
1,200	1,400	450	900	170	340	336	672	41	82
1,400	1,600	470	940	175	350	351	702	43	86
1,600	1,800	490	980	180	360	366	732	44	88
1,800	2,000	505	1,010	185	370	378	756	45	90
2,000	2,500	545	1,090	190	380	408	816	49	98
2,500	3,000	580	1,160	195	390	432	864	52	104
3,000	4,000	635	1,270	210	420	474	948	58	116
4,000	5,000	685	1,370	225	450	513	1,026	61	122
5,000	6,000	730	1,460	235	470	546	1,092	65	130
6,000	7,000	770	1,540	245	490	573	1,146	68	136
7,000	8,000	800	1,600	250	500	600	1,200	72	144
8,000	9,000	835	1,670	255	510	624	1,248	75	150
9,000	10,000	865	1,730	260	520	645	1,290	78	156
10,000	12,000	875	1,750	270	540	687	1,374	82	164
12,000	14,000	885	1,770	275	550	723	1,446	87	174
14,000	16,000	900	1,800	280	560	756	1,512	90	180
16,000	18,000	940	1,880	285	570	786	1,572	94	188
18,000	20,000	975	1,950	290	580	813	1,626	98	196
20,000	25,000	1,055	2,000	315	630	876	1,752	105	210
25,000	30,000	1,130	2,000	340	680	933	1,866	112	224
30,000	35,000	1,205	2,000	360	720	981	1,962	119	238
35,000	40,000	1,275	2,000	380	760	1,026	2,000	124	248
40,000	45,000	1,340	2,000	400	800	1,068	2,000	129	258
45,000	50,000	1,400	2,000	420	840	1,104	2,000	135	270
50,000	55,000	1,460	2,000	440	880	1,140	2,000	140	280
55,000	60,000	1,515	2,000	455	910	1,173	2,000	145	290
60,000	65,000	1,565	2,000	470	940	1,206	2,000	150	300
65,000	70,000	1,610	2,000	485	970	1,236	2,000	155	310
70,000	75,000	1,655	2,000	500	1,000	1,263	2,000	160	320
75,000	80,000	1,695	2,000	510	1,020	1,293	2,000	165	330
80,000	85,000	1,730	2,000	520	1,040	1,317	2,000	170	340
85,000	90,000	1,760	2,000	530	1,060	1,344	2,000	175	350
90,000	95,000	1,790	2,000	540	1,080	1,368	2,000	180	360
95,000	100,000	1,815	2,000	545	1,090	1,392	2,000	185	370
100,000	110,000	1,835	2,000	550	1,100	1,437	2,000	195	390
110,000	120,000	1,855	2,000	555	1,110	1,479	2,000	205	410
120,000	130,000	1,875	2,000	560	1,120	1,521	2,000	215	430
130,000	140,000	1,890	2,000	565	1,130	1,557	2,000	225	450
140,000	150,000	1,900	2,000	570	1,140	1,593	2,000	235	470
150,000	160,000	1,935	2,000	580	1,160	1,629	2,000	245	490
160,000	170,000	1,965	2,000	590	1,180	1,662	2,000	255	510
170,000	180,000	1,990	2,000	600	1,200	1,695	2,000	265	530
180,000	190,000	2,010	2,010	605	1,210	1,725	2,000	275	550
190,000	200,000	2,030	2,030	610	1,220	1,755	2,000	285	570
200,000	210,000	2,055	2,055	620	1,240	1,782	2,000	295	590
210,000	230,000	2,100	2,100	635	1,270	1,836	2,000	315	630
230,000	250,000	2,155	2,155	650	1,300	1,890	2,000	335	670
250,000	275,000	2,215	2,215	670	1,340	1,950	2,000	360	720
275,000	300,000	2,275	2,275	690	1,380	2,000	2,000	385	770

For SI Units: 1 lb = 0.454 kg; 1 ft = 0.305 m

NOTE 1: "Explosive materials" means explosives, blasting agents, and detonators.

NOTE 2: "Explosives" means any chemical compound, mixture, or device, the primary or common purpose of which is to function by explosion. A list of explosives determined to be within the coverage of 18 *U.S.C.* Chapter 40, "Importation, Manufacture, Distribution and Storage of Explosive Materials" is issued at least annually by the Director of the Bureau of Alcohol, Tobacco, and Firearms of the Department of Treasury.

NOTE 3: "Blasting agents" means any material or mixture, consisting of fuel and oxidizer, intended for blasting, not otherwise defined as an explosive, provided that the finished product, as mixed for use or shipment, cannot be detonated by means of a No. 8 test blasting cap when unconfined.

NOTE 4: "Detonator" means any device containing a detonating charge that is used for initiating detonation in an explosive; the term includes, but is not limited to, electric blasting caps of instantaneous and delay types, blasting caps for use with safety fuses and detonating-cord delay connectors.

NOTE 5: "Magazine" means any building or structure, other than an explosives manufacturing building, used for the permanent storage of explosive materials.

NOTE 6: "Natural Barricade" means natural features of the ground, such as hills, or timber of sufficient density that the surrounding exposures which require protection cannot be seen from the magazine when the trees are bare of leaves.

NOTE 7: "Artificial Barricade" means an artificial mound or revetted wall of earth of a minimum thickness of 3 ft (0.9 m).

NOTE 8: "Barricaded" means that a building containing explosives is effectually screened from a magazine, building, railway, or highway, either by a natural barricade, or by an artificial barricade of such height that a straight line from the top of any sidewall of the building containing explosives to the eave line of any magazine, or building, or to a point 12 ft (3.7 m) above the center of a railway or highway, will pass through such intervening natural or artificial barricade.

NOTE 9: "Inhabited Building" means a building regularly occupied in whole or in part as a habitation for human beings, or any church, schoolhouse, railroad station, store, or other structure where people are accustomed to assemble, except any building or structure occupied in connection with the manufacture, transportation, storage, or use of explosives.

NOTE 10: "Railway" means any steam, electric, or other railroad or railway which carries passengers for hire.

NOTE 11: "Highway" means any street or public road. "Public Highways Class A to D" are highways with average traffic volume of 3,000 or less vehicles per day as specified in *American Civil Engineering Practice* (Abbott, Vol. 1, Table 46, Sec. 3-7.4, 1956 Edition, John Wiley and Sons).

NOTE 12: When two or more storage magazines are located on the same property, each magazine must comply with the minimum distances specified from inhabited buildings, railways, and highways, and, in addition, they should be separated from each other by not less than the distances shown for "Separation of Magazines," except that the quantity of explosives contained in cap magazines shall govern in regard to the spacing of said cap magazines from magazines containing other explosives. If any two or more magazines are separated from each other by less than the specified "Separation of Magazines" distances, then such two or more magazines, as a group, must be considered as one magazine, and the total quantity of explosives stored in such group must be treated as if stored in a single magazine located on the site of any magazine of the group, and must comply with the minimum of distances specified from other magazines, inhabited buildings, railways, and highways.

NOTE 13: Storage in excess of 300,000 lb (136 200 kg) of explosives in one magazine is generally not required for commercial enterprises.

NOTE 14: This Table applies only to the manufacture and permanent storage of commercial explosives. It is not applicable to transportation of explosives or any handling or temporary storage necessary or incident thereto. It is not intended to apply to bombs, projectiles, or other heavily encased explosives.

NOTE 15: All types of blasting caps in strengths through No. 8 cap should be rated at 1½ lb (0.7 kg) of explosives per 1,000 caps. For strengths higher than No. 8 cap, consult the manufacturer.

NOTE 16: For quantity and distance purposes, detonating cord of 50 to 60 grains per ft (10.7 to 12.8 g per m) should be calculated as equivalent to 9 lb of high explosives per 1,000 ft (13.4 kg per 1000 m). Heavier or lighter core loads should be rated proportionately.

building and in each magazine shall not exceed the number necessary for proper conduct of production operations.

2-10.1.1 The maximum number of occupants permitted in each process building and in each magazine shall be posted in a conspicuous location in each process building or magazine.

2-10.2 No more than 500 lb (226.5 kg) of explosive, pyrotechnic, or propellant composition shall be permitted at any one time in any mixing building.

2-10.3 No more than 75 lb (34 kg) of explosive or pyrotechnic composition shall be permitted at any one time in a pressing system, with no more than 5 lb (2.27 kg) of explosive material in the pressing room itself.

2-11 Fire and Explosion Prevention.

2-11.1 All buildings shall be kept clean, orderly, and free of accumulations of dust or rubbish.

2-11.2 Spills of explosive, pyrotechnic, or propellant composition shall be immediately cleaned up and removed from the building. The spilled material shall be destroyed by immersion in water (if applicable) or by burning in a manner acceptable to the authority having jurisdiction.

2-11.3 Rags, combustible scrap, and paper shall be kept separate from waste explosive, pyrotechnic, or propellant composition. Both shall be kept in containers until removed from the building. Disposal containers shall be removed from buildings on a regular basis and removed from the plant at regular intervals. Waste explosive or pyrotechnic composition shall be destroyed as described in 2-11.2.

2-11.4* Smoking materials shall not be carried into or in the vicinity of process buildings. Personnel shall deposit all smoking materials at a suitable location in a nonprocess building immediately upon entering the plant.

2-11.5 Smoking shall be permitted only in office buildings or in buildings used exclusively as lunchrooms or rest rooms and in which the presence of explosive, pyrotechnic, or propellant composition is prohibited.

2-11.6 Authorized smoking locations shall be so marked, shall contain suitable receptacles for disposal of smoking materials, and shall be provided with at least one approved portable fire extinguisher suitable for use on Class A fires.

2-11.7 Personnel whose clothing may be contaminated with explosive or pyrotechnic composition to a degree that may endanger personnel safety shall not be allowed in smoking locations.

2-12 Personnel Safety.

2-12.1 No employee or other person shall be permitted to enter the plant while in possession of or under the influence of alcohol, drugs, or narcotics.

2-12.2 Personnel working at mixing, pressing, and loading operations shall be provided with and shall wear cotton or flame-retardant clothing. Other protective clothing, eye protection, and respiratory protection shall be worn as needed. Short-sleeved shirts and short pants shall not be permitted.

2-12.3 Washing, shower, and changing facilities shall be provided.

2-12.4 Work clothing shall be washed frequently to prevent accumulation of explosive, pyrotechnic, or propellant composition.

2-12.5 Each plant shall have an employee designated as safety officer, who shall be responsible for general safety, fire prevention and protection, and employee safety training. This person shall normally be the area supervisor.

2-12.5.1 The safety officer shall give formal instruction regarding proper methods and procedures, safety requirements, and procedures for handling explosive and pyrotechnic compositions and devices to all employees upon commencing employment and at least annually thereafter.

2-12.6 In areas where sparks may ignite materials, only nonsparking hand tools shall be used.

Exception: Normal maintenance in rooms containing less than 1 lb (.45 kg) of dry explosive or pyrotechnic composition need not use nonsparking hand tools.

2-12.7* Oxidizers shall not be stored in the same building with combustible powdered materials such as charcoal, gums, metals, or sulfur.

2-13 Fire Protection and Emergency Procedures.

2-13.1 Portable fire extinguishers shall be provided in all buildings according to the requirements of NFPA 10, *Standard for Portable Fire Extinguishers.*

Exception: Extinguishers shall not be located in buildings in which more than 5 lb (2.27 kg) of explosive or pyrotechnic composition is exposed.

2-13.2 Each plant shall have formal emergency procedures. Such procedures shall include employee instruction and training and shall be applicable to all anticipated emergencies.

2-13.3 Emergency procedures shall include instruction in the use of portable fire extinguishers and on which fires they may be safely used.

2-13.3.1 Employees shall be instructed to abandon fire fighting efforts if the fire involves or may spread to explosive or pyrotechnic composition or devices. In such cases, employees shall be instructed to evacuate the building immediately and to alert other plant personnel.

2-14 Testing of Model Rocket Motors. Testing of motors and motor components shall be performed only in an area set aside specifically for that purpose. The test site shall be located at a safe distance from all plant buildings or structures.

Chapter 3 Manufacturing Operations for Composite Propellant Model Rocket Motors

3-1 Basic Requirements.

3-1.1 The requirements of this chapter shall apply to the manufacture of composite propellant model rocket motors as defined in Section 1-4 and also meeting the following criteria:

3-1.1.1 Both raw materials and the finished propellant are classified by the U.S. Department of Transportation as nondetonable (Class B Explosive or lesser classification).

3-1.1.2 The propellant ingredients are mixed either by hand or in a mixer that does not use moving parts to effect mixing.

3-1.1.3 The propellant batch being mixed at any one time does not exceed a weight of 30 lb (13.64 kg).

3-1.1.4 The propellant formulation does not include solid ferrocene.

3-1.2 Composite propellant manufacturing processes that do not meet these criteria shall adhere to the requirements of Chapter 2, where applicable.

3-1.3 The manufacture of any composite propellant model rocket motor, as defined in Section 1-4, shall be prohibited unless it is authorized by federal license, where required, and is conducted in accordance with this code.

3-2 Permit Requirements.

3-2.1 Any person engaged in the manufacture of composite propellant model rocket motors shall comply with all applicable federal, state, and local laws and regulations.

3-2.1.1 Copies of all required licenses and permits shall be posted at each model rocket motor plant.

3-2.1.2 License and permit holders shall take every reasonable precaution to protect licenses and permits from loss, theft, defacement, destruction, or unauthorized duplication. Any such occurrence shall be immediately reported to the issuing authority.

3-2.1.3 Licenses or permits shall not be reassigned or transferred.

3-2.2 The issuing authority shall be notified immediately of any change of business address.

3-3 Site Security.

3-3.1 All doors to the plant shall be kept closed and securely locked at all times when the plant is not in operation.

3-3.2 Only authorized employees or representatives of federal, state, or local agencies having jurisdiction over the plant shall be allowed in the plant without special permission of the person in charge.

3-4 Storage of Materials.

3-4.1 Storage of oxidizers is limited to 10 lb (4.53 kg), or 50 lb (22.65 kg) when stored in a Type-2 indoor magazine.

3-4.2 Unfinished propellant mix in excess of 60 lb (27.18 kg) shall be stored in magazines meeting the requirements of Chapter 4.

3-4.3 Storage of binder and metal fuel ingredients shall be separate from storage of oxidizer.

3-5 Process Building Construction.

3-5.1 Interior wall and ceiling surfaces shall be smooth.

3-5.2 Horizontal ledges and surfaces upon which dust may settle and accumulate shall be minimized.

3-5.3 Floor surfaces in mixing and casting areas shall be smooth and nonsparking.

3-5.4 Propellant mixing by mechanical means shall be conducted either outdoors or in a separate building or in a room separated from other areas of the building by walls having a two-hour fire resistance rating.

3-5.4.1 Power to the mixer shall be controlled from outside the mix room or building.

3-5.4.2 A remotely activated water deluge system shall be provided to the mix room or building. The deluge system shall be acceptable to the authority having jurisdiction.

3-6 Means of Egress.

3-6.1 Means of egress in process buildings shall meet the following requirements:

3-6.1.1 From every point in every undivided floor area of more than 150 sq ft (13.5 sq m) there shall be at least two remotely located exits.

Exception: Toilet rooms need have only one exit, provided the exit is located away from or suitably shielded from process areas.

3-6.1.2 Exits shall be so located that every point within the room or undivided floor area is within 25 ft (7.62 m) of an exit. The routes to the exits shall not be obstructed.

3-6.1.3 Exit doors shall open outward and shall be capable of being pressure actuated from the inside.

3-7 Heat, Light, and Electrical Equipment.

3-7.1 Stoves, exposed flames, and portable electric heaters shall be prohibited in any manufacturing room where propellant composition, delay composition, ejection composition, components for the preceding, or flammable liquids are or may be present.

3-7.2 Heating shall be provided by steam, hot water, or indirect hot air radiators, or any other means acceptable to the authority having jurisdiction.

3-7.2.1 Unit heaters located in rooms that contain or may contain propellant composition shall be equipped with motors and electrical devices suitable for use in Class II, Group E, Division 1 locations. (*See Article 502 of NFPA 70, National Electrical Code.*)

Exception: Buildings or rooms that are used only for static motor tests.

3-7.3 All wiring in mixing and casting areas shall be in rigid metal conduit or shall be Type MI cable. Wiring, switches, and electrical fixtures shall be suitable for Class II, Group E, Division 1 locations. (*See Article 502 of NFPA 70, National Electrical Code.*)

3-7.3.1 Temporary or loose electrical wiring shall not be used.

3-7.3.2 When lighting is necessary within the magazine, electric safety flashlights or electric safety lanterns shall be used.

Exception: Approved portable lighting equipment may be used during repair operations, provided the area has been cleared of all propellant materials and all dust or residue has been removed by washing.

3-7.3.3 All presses and other mechanical devices shall be electrically bonded and grounded.

3-7.4 All artificial lighting shall be electrically powered.

3-8 Maximum Number of Occupants and Maximum Quantity Limitations.

3-8.1 The number of occupants in each process building and in each magazine shall not exceed the number necessary for proper conduct of production operations.

3-8.1.1 The maximum number of occupants permitted in each process building and in each magazine shall be

posted in a conspicuous location in each process building or magazine.

3-8.2 No more than 60 lb (27.18 kg) of propellant composition shall be permitted at any one time in any mixing room or building.

3-8.3 No more than 60 lb (27.18 kg) of uncased propellant composition shall be permitted at any one time in a finishing or assembly room or building.

3-9 Fire and Explosion Prevention.

3-9.1 All buildings shall be kept clean, orderly, and free of accumulations of dust or rubbish.

3-9.1.1 Spills of propellant composition shall be immediately cleaned up. The spilled material shall be destroyed by burning in a manner acceptable to the authority having jurisdiction.

3-9.1.2 Rags, combustible scrap, and paper shall be kept separate from waste propellant composition. Both shall be kept in containers until removed from the building. All such disposal containers shall be removed from buildings on a regular basis and removed from the plant at regular intervals. Waste propellant composition shall be destroyed as described in 3-9.1.1.

3-9.2 Smoking materials shall not be carried into or in the vicinity of process rooms or buildings. Personnel shall deposit all smoking materials at a suitable location in a nonprocess room or building immediately upon entering the plant.

3-9.2.1 Smoking shall be permitted only in office buildings or in buildings used exclusively as lunchrooms or rest rooms and in which the presence of unfinished propellant composition is prohibited.

3-9.2.2 Authorized smoking locations shall be so marked, shall contain suitable receptacles for disposal of smoking materials, and shall be provided with at least one approved portable fire extinguisher suitable for use on Class A fires.

3-9.2.3 Personnel whose clothing may be contaminated with propellant composition to a degree that may endanger personnel safety, shall not be allowed in smoking locations.

3-9.3 No employee or other person shall be permitted to enter the plant while in possession of or under the influence of alcohol, drugs, or narcotics.

3-9.4 Personnel working at mixing and casting operations shall be provided with and shall wear cotton or flame-retardant clothing. Other protective clothing, eye protection, and respiratory protection shall be worn as needed. Short sleeved shirts and short pants shall not be permitted.

3-9.4.1 Washing, shower, and changing facilities shall be provided.

3-9.4.2 Work clothing shall be washed frequently to prevent accumulation of oxidizer or propellant composition.

3-9.5 Each plant shall have an employee designated as safety officer, who shall be responsible for general safety, fire prevention and protection, and employee safety training. This person shall normally be the area supervisor.

3-9.5.1 The safety officer shall give formal instruction regarding proper methods and procedures, safety requirements, and procedures for handling propellant composition, ingredients, and devices to all employees upon commencing employment and at least annually thereafter.

3-9.6 In areas where sparks may ignite materials, only nonsparking hand tools shall be used.

Exception: Normal maintenance in rooms containing less than 1 lb (0.45 kg) of dry explosive or pyrotechnic composition need not use nonsparking hand tools.

3-10 Fire Protection and Emergency Procedures.

3-10.1 Portable fire extinguishers shall be provided in all rooms or buildings, but shall only be used for Class A or Class B fires.

Exception: Extinguishers shall not be located in rooms in which more than 5 lb (2.27 kg) of propellant composition is exposed.

3-10.2 Each plant shall have formal emergency procedures. Such procedures shall include employee instruction and training and shall be applicable to all anticipated emergencies.

3-10.3 Emergency procedures shall include instruction in the use of portable fire extinguishers and on which fires they may be safely used.

3-10.3.1 Employees shall be instructed to abandon fire fighting efforts if the fire involves or may spread to propellant compositions or devices. In such cases, employees shall be instructed to evacuate the building immediately and to alert other plant personnel.

3-11 Testing of Model Rocket Motors.

3-11.1 Testing of motors and motor components shall be performed only in an area set aside specifically for that purpose. The test site shall be located at a safe distance from all plant buildings or structures.

Chapter 4 Storage of Class B Explosives and Black Powder

4-1 Basic Requirements.

4-1.1 Class B propellants and black powder shall be stored in magazines meeting the requirements of this chapter. They shall be so stored at all times unless in the process of manufacture, packaging, or transport.

4-1.1.1 Materials that are bullet-sensitive shall be stored only in a Type 1, 2, or 3 magazine.

4-1.1.2 Black powder and materials that are not bullet-sensitive shall be stored only in a Type 1, 2, 3, or 4 magazine.

4-1.2 Magazines containing black powder or Class B explosives shall be separated from inhabited buildings, passenger railways, public highways, and other magazines by the distances specified by the Bureau of Alcohol, Tobacco, and Firearms.

4-2 Magazine Construction — General.

4-2.1 Magazines shall be constructed to comply with this chapter or in a manner substantially equivalent to the requirements of this chapter.

4-2.2 The ground around magazines shall be graded so that water drains away from the magazine.

4-2.3 Magazines requiring heat shall be heated by either hot water radiant heating within the magazine building or by indirect warm air heating.

4-2.3.1 Indirect warm air shall be heated by either hot water or low-pressure (15 psig or less) steam coils located outside the magazine building.

4-2.3.2 Magazine heating systems shall meet the following requirements:

(a) Radiant heating coils within the building shall be installed so that explosive materials or their containers cannot contact the coils and so that air is free to circulate between the coils and the explosives. The surface temperature of the coils shall not exceed 165° F (76° C).

(b) Heating ducts shall be installed so that the hot air discharge from the ducts is not directed against explosive materials or their containers.

(c) The heating system shall be controlled so that the ambient temperature of the magazine does not exceed 130° F (54° C).

(d) Any electric fan or pump used in the heating system shall be located outside the magazine, separate from the magazine walls, and shall be grounded.

(e) Any electric motor or any controls for electric heating devices used to heat water or produce steam shall have overload devices and disconnects that comply with NFPA 70, *National Electrical Code*. All electrical switchgear shall be located at least 25 ft (7.6 m) from the magazine.

(f) Any fuel-fired heating source for the hot water or steam shall be separated from the magazine by a distance of not less than 25 ft (7.6 m). The area between the heating unit and the magazine shall be cleared of all combustible materials.

(g) Explosive materials stored in magazines shall be arranged so that uniform circulation of air is assured.

4-2.4 When lighting is necessary within the magazine, electric safety flashlights or electric safety lanterns shall be used.

Exception: As provided for in 4-2.4.1.

4-2.4.1 Electric lighting may be used within the magazine only if the installation meets the following requirements:

(a) Junction boxes containing fuses or circuit breakers and electrical disconnects shall be located at least 25 ft (7.6 m) from the magazine.

(b) Disconnects, fuses, and circuit breakers shall be protected by a voltage surge arrestor capable of handling 2500 amperes for 0.1 seconds.

(c) All wiring from switches, both inside and outside the magazine, shall be installed in rigid conduit. Wiring leading into the magazine shall be installed underground.

(d) Conduit and light fixtures inside the magazine shall be protected from physical damage by suitable guards or by location.

(e) Light fixtures shall be suitably enclosed to prevent sparks or hot metal from falling on the floor or onto material stored in the magazine.

(f) Junction boxes located within the magazine shall have no openings and shall be equipped with close-fitting covers.

(g) Magazines containing materials that may release flammable vapors shall have wiring and fixtures that meet the requirements of Article 501 of NFPA 70, *National Electrical Code*.

(h) Lights inside magazines shall not be left on when the magazine is unattended.

4-2.5 There shall be no exposed ferrous metal on the interior of the magazine where it may contact material stored within.

4-2.6 When ventilation is required in the magazine, sufficient ventilation shall be provided to protect the stored materials for the specific area in which the plant is located.

4-2.6.1 Stored materials shall be placed so they do not interfere with ventilation and to prevent contact with masonry walls, any steel, or any other ferrous metal by means of a nonsparking lattice or equivalent lining.

4-3 Magazine Construction — Requirements for Specific Types.

4-3.1 Type 1 Magazine. A Type 1 magazine shall be a permanent structure, such as a building or igloo, that is bullet resistant, fire resistant, theft resistant, weather resistant, and ventilated.

(a) Walls and doors shall be bullet resistant and may be constructed according to any of the specifications listed in Appendix B.

(b) The roof may be constructed of any type of structurally sound materials that are or have been made fire resistant on the exterior.

(c)* Where the natural terrain around a Type 1 magazine makes it possible for a bullet to be shot through the roof and ceiling at such an angle that the bullet can strike the explosive materials within, then either the roof or the ceiling shall be of bullet resistant construction.

(d) The foundation may be of masonry, wood, or metal, and shall be completely enclosed except for openings to provide cross ventilation. A wood foundation enclosure shall be covered on the exterior with not less than 26 gauge metal.

(e) The floor shall be constructed of wood or other suitable material. Floors constructed of materials that may cause sparks shall be covered with a nonsparking surface, or the packages of explosive material shall be packed on pallets of nonsparking material.

(f) Type 1 magazines shall be ventilated to prevent dampness or heating of explosives. Ventilation openings shall be screened to prevent entrance of sparks. Ventilators in side walls shall be offset or shielded. Magazines having foundation and roof ventilators, with the air circulating between side walls and floor and between side walls and ceiling, shall have a wood lattice lining or equivalent means to prevent packages from being stacked against side walls and blocking air circulation.

(g) Each door of the magazine shall be equipped with one of the following locking systems:

1. Two mortise locks;
2. Two padlocks in separate hasps and staples;
3. A mortise lock and a padlock;
4. A mortise lock that requires two keys to open;
5. A three-point lock or an equivalent lock that secures the door to the frame at more than one point.

Padlocks shall be steel, shall have at least five tumblers, and shall have at least a 7/16 in. (11 mm) case-hardened shackle. All padlocks shall be protected by steel hoods installed to discourage insertion of bolt cutters. Doors secured by a substantial internal bolt do not require additional locking devices. Hinges and hasps shall be securely fastened to the magazine and all locking hardware shall be secured rigidly and directly to the door frame.

4-3.2 Type 2 Magazine. A Type 2 magazine shall be a portable or mobile structure, such as a box, skid-magazine, trailer, or semitrailer, that is fire resistant, theft resistant, weather resistant, and ventilated. If used for outdoor storage, Type 2 magazines shall be bullet resistant.

4-3.2.1 Type 2 Outdoor Magazine.

(a) Walls and roof or ceiling shall be constructed according to the provisions of 4-3.1(a), (b), and (c).

(b) Doors shall be of metal, constructed according to the provisions of 4-3.1(a), or shall have a metal exterior with an inner door meeting the provisions of 4-3.1(a).

(c) Floors constructed of ferrous metal shall be covered with a nonsparking surface.

(d) A top-opening magazine shall have a lid that overlaps the sides by at least 1 in. (25.4 mm) when in the closed position.

(e) The magazine shall be supported so that its floor does not directly contact the ground.

(f) Magazines less than 1 cu yd (0.77 cu m) in size shall be securely fastened to a fixed object to prevent theft of the entire magazine.

(g) Hinges, hasps, locks, and locking hardware shall comply with 4-3.1(g).

Exception: Padlocks on vehicular magazines need not be protected by steel hoods.

(h) Whenever a vehicular magazine is left unattended, its wheels shall be removed or its kingpins shall be locked or it shall otherwise be effectively immobilized.

4-3.2.2 Type 2 Indoor Magazines.

(a) The magazine shall have substantial wheels or casters to facilitate removal from the building in case of emergency.

(b) The cover of the magazine shall have substantial strap hinges and a means for locking. The magazine shall be kept locked, except during placement or removal of explosive materials, with a five-tumbler padlock or its equivalent.

(c) The magazine shall be painted red and the top shall bear the words "Explosives — Keep Fire Away" in white letters at least 3 in. (76 mm) high.

(d) Magazines constructed of wood shall have sides, bottoms, and covers or doors of 2-in. (51-mm) hardwood, well braced at corners. The magazines shall be covered with sheet metal of not less than 26 gauge. Nails exposed to the interior of the magazines shall be countersunk.

(e) Magazines constructed of metal shall be of 12 gauge sheet metal and shall be lined with a nonsparking material. Edges of metal covers shall overlap the sides by at least 1 in. (25.4 mm).

4-3.3 Type 3 Magazine. A Type 3 magazine shall be a portable structure that is fire resistant, theft resistant, and weather resistant.

(a) The magazine shall be equipped with a five-tumbler padlock.

(b) Magazines constructed of wood shall have sides, bottoms, and covers or doors of 4-in. (102-mm) hardwood, well braced at corners. They shall be covered with sheet metal of not less than 26 gauge. Nails exposed to the interior of the magazine shall be countersunk.

(c) Magazines constructed of metal shall meet the requirements 4-3.2.2(e).

4-3.4 Type 4 Magazine. A Type 4 magazine shall be a permanent, portable, or mobile structure such as a building, igloo, box, semitrailer, or other mobile container that is fire resistant, theft resistant, and weather resistant.

4-3.4.1 Type 4 Outdoor Magazine.

(a) The magazine shall be constructed of masonry, wood covered with sheet metal, fabricated metal, or a combination of these materials. Doors shall be metal or wood covered with metal.

(b) Permanent magazines shall comply with 4-3.1(d), (f), and (g).

(c) Vehicular magazines shall comply with 4-3.2.1(g) and shall be immobilized when unattended, as described in 4-3.2.1(h).

4-3.4.2 Type 4 Indoor Magazine. A Type 4 indoor magazine shall comply with all provisions of 4-3.2.2.

4-4 Storage Within Magazines.

4-4.1 Magazines shall be under the responsibility of a competent person at all times. This person shall be at least 21 years of age and shall be responsible for the enforcement of all safety precautions.

4-4.2 All magazines containing explosives shall be opened and inspected at intervals not exceeding three days to determine whether there has been unauthorized or attempted entry or whether there has been unauthorized removal of the magazines or their contents.

4-4.3 Magazine doors shall be kept locked except during placement or removal of explosive materials or during inspection.

4-4.4 Safety rules covering the operations of magazines shall be posted on the interior side of the magazine door.

4-4.5 When explosive materials are removed from the magazine for use, the oldest stock shall be used first.

4-4.6 Corresponding grades and brands of explosive materials shall be stored together so that brand and grade markings are readily visible. All stock shall be stored so as to be easily counted and checked.

4-4.7 Containers of explosive materials shall be piled in a stable manner, laid flat and with top side up.

4-4.8 Open containers of explosive materials shall be securely closed before being returned to a magazine. No container without a closed lid may be stored in a magazine.

4-4.9 Containers of explosive materials shall not be opened, unpacked, or repacked inside or within 50 ft (15.25 m) of a magazine or in close proximity to other explosives.

Exception: Fiberboard containers may be opened inside or within 50 ft (15.25 m) of a magazine. They shall not, however, be unpacked.

4-4.10 Tools used for opening containers of explosive materials shall be nonsparking.

Exception: Metal slitters may be used for opening fiberboard containers.

4-4.11 Magazines shall be used exclusively for the storage of explosive and pyrotechnic materials. Metal tools other than nonferrous conveyors shall not be stored in magazines. Ferrous metal conveyor stands protected by a coat of paint may be stored within magazines.

4-4.12 Magazine floors shall be regularly swept, and kept clean, dry, free of grit, paper, empty packing materials, and rubbish. Brooms and other cleaning utensils shall not have spark-producing metal parts. Sweeping from magazine floors shall be disposed of according to manufacturer's instructions.

4-4.13 When any explosive or pyrotechnic material has deteriorated to the extent that it has become unstable or dangerous, the person responsible shall immediately contact the manufacturer for assistance.

4-4.14 Before making repairs to the interior of a magazine, all explosive or pyrotechnic material shall be removed and the interior shall be cleaned.

4-4.15 Before making repairs to the exterior of a magazine where there is a possibility of causing sparks or fire, all explosive and pyrotechnic material shall be removed from the magazine.

4-4.16 Explosive or pyrotechnic material removed from a magazine undergoing repair shall either be placed in another magazine or be placed a safe distance from the magazine, where they shall be properly guarded and protected. Upon completion of the repairs, the materials shall be promptly returned to the magazine.

4-5 Miscellaneous Safety Precautions.

4-5.1 Smoking, matches, open flames, spark-producing devices, and firearms shall not be permitted inside of or within 50 ft (15.25 m) of a magazine.

Exception: Firearms carried by authorized guards.

4-5.2 The area around a magazine shall be kept clear of brush, dried vegetation, leaves, and similar combustibles for a distance of at least 25 ft (7.6 m).

4-5.3 Combustible materials shall not be stored within 50 ft (15.25 m) of a magazine.

4-5.4 Property on which Type 1 magazines and outdoor magazines of Types 2 and 4 are located shall be posted with signs reading "Explosives—Keep Off." Such signs shall be located to minimize the possibility that a bullet shot at the sign will hit the magazine.

Chapter 5 Referenced Publications

5-1 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.

5-1.1 NFPA Publications. National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

NFPA 10-1988, *Standard for Portable Fire Extinguishers*
NFPA 70-1987, *National Electrical Code*
NFPA *101*-1988, *Life Safety Code*
NFPA 220-1985, *Standard on Types of Building Construction*
NFPA 1122-1987, *Code for Unmanned Rockets*
NFPA 1124-1988, *Code for the Manufacture, Transportation, and Storage of Fireworks*

5-1.2 Other Publications.

American Civil Engineering Practice (Abbott, Vol. 1, Table 46, Sec. 3-7.4, 1956 edition, John Wiley and Sons).

American Table of Distances for Storage of Explosives, May, 1983; Institute of Makers of Explosives, 1575 Eye St., NW, Washington, DC 20005.

5-1.3 U.S. Government Publications. Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

Title 18, *United States Code,* Chapter 40, Importation, Manufacture, Distribution, and Storage of Explosive Materials, 1970.

Title XI, *Regulation of Explosives,* of the Crime Control Act of 1970 (Title 18, *United States Code,* Chapter 40).

Appendix A

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

A-1-4 Explosive. A list of explosives determined to be within the scope of Title 18, *United States Code*, Chapter 40, is published at least annually by the Bureau of Alcohol, Tobacco, and Firearms, U.S. Department of the Treasury.

Classification of explosives described in the Hazardous Materials Regulations of the U.S. Department of Transportation is as follows:

Class A Explosives:	Possessing detonating or otherwise maximum hazard, such as dynamite, desensitizing nitroglycerine, lead azide, fulminate of mercury, black powder, blasting caps, and detonating primers.
Class B Explosives:	Possessing flammability hazards, such as propellants, including some smokeless propellants, photographic flash powders.
Blasting Agents:	Possessing minimum accidental explosion hazard.
Class C Explosives:	Includes certain manufactured articles that contain Class A or Class B explosives, or both, as components, but in restricted quantities.
Forbidden Explosives:	Explosives that are forbidden from or not acceptable for transportation by common carriers.

Certain chemicals and fuel materials may have explosive characteristics, but are not within the scope of Title 18, *USC*, Chapter 40, and are not specifically classified as explosives by the U.S. Department of Transportation. Authoritative information should be obtained for such materials, and action commensurate with their hazards, location, isolation, and safeguards should be taken.

A-2-7.1 In general, the wall having the largest area should be chosen to provide explosion relief. The entire area of the wall should be utilized. The term "weak-wall" is used to describe the relative strength of the explosion-relieving wall as compared to the rest of the building.

A-2-7.3 For information on the use of conductive surfaces to minimize the hazard of static electricity, see NFPA 99, *Standard for Health Care Facilities.*

A-2-10.1 This requirement is for purposes of minimizing personnel exposure and is distinct from any requirement on maximum building occupancy that may exist in local ordinances.

A-2-11.4 Smoking materials include matches, lighters, cigarettes, cigars, and pipes.

A-2-12.7 Oxidizers include nitrates, chlorates, and perchlorates.

A-4-3.1(c) A bullet resistant roof may be constructed according to any of the specifications listed in Appendix B. A bullet resistant ceiling may be constructed at the eave line, covering the entire area of the magazine, except for the necessary ventilation space. Examples of bullet resistant ceiling construction include:

1. Any construction meeting the specifications listed in Appendix B.

2. A sand tray having a sand depth of at least 4 in. (102 mm).

Appendix B Magazine Construction

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

Magazines constructed according to the following minimum specifications are approved as bullet resistant (as defined in Chapter 1 of this code). All steel and wood dimensions are actual thickness; concrete block and brick dimensions are nominal.

B-1 Steel Exterior.

B-1.1 Five-eighths-in. steel with an interior lining of nonsparking material.

B-1.2 One-half-in. steel with an interior lining of plywood at least ⅜ in. thick.

B-1.3 Three-eighths-in. steel lined with one of the following:

(a) 2 in. of hardwood;

(b) 3 in. of softwood;

(c) 2¼ in. of plywood.

B-1.4 One-fourth-in. steel lined with one of the following:

(a) 3 in. of hardwood;

(b) 5 in. of softwood;

(c) 5¼ in. of plywood;

(d) 1¼ in. of plywood with an intermediate layer of 2 in. of hardwood.

B-1.5 Three-sixteenths-in. steel lined with one of the following:

(a) 4 in. of hardwood;

(b) 7 in. of softwood;

(c) 6¾ in. of plywood;

(d) ¾ in. of plywood with an intermediate layer of 3 in. of hardwood.

B-1.6 One-eighth-in. steel lined with one of the following:

(a) 5 in. of hardwood;

(b) 9 in. of softwood;

(c) ¾ in. of plywood with an intermediate layer of 4 in. of hardwood;

(d) Two layers of ¾-in. plywood with an intermediate layer of 3⅝ in. of well-tamped dry sand or sand/cement mixture.

For SI units: 1 in. = 25.4 mm

B-2 Fire-resistant Exterior. Exterior of any type of fire-resistant material that is structurally sound with:

B-2.1 An interior lining of ½-in. plywood placed securely against an intermediate 4-in. thick layer of solid concrete block, solid brick, or solid concrete.

B-2.2 An interior lining of ¾-in. plywood, a first intermediate layer of ¾-in. plywood, a second intermediate layer of 3⅝ in. of well-tamped dry sand or sand/cement mixture, a third intermediate layer of ¾-in. plywood, and a fourth intermediate layer of 2-in. hardwood or 14 gauge steel.

B-2.3 An intermediate 6-in. space filled with well-tamped dry sand or sand/cement mixture.

B-3 Masonry Exterior.

B-3.1 Standard 8-in. concrete block with voids filled with well-tamped dry sand or sand/cement mixture.

B-3.2 Standard 8-in. solid brick.

B-3.3 8-in. solid concrete.

B-3.4 Two layers of 4-in. concrete block.

For SI Units 1 in. = 25.4 mm

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 NFPA Publications. National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

NFPA 13-1987, *Standard for the Installation of Sprinkler Systems*

NFPA 43A-1980, *Code for the Storage of Liquid and Solid Oxidizing Materials*

NFPA 99-1987, *Standard for Health Care Facilities*

C-1.2 Other Publications.

C-1.2.1 U.S. Government Publications. Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

Title 18, *United States Code,* Chapter 40, Importation, Manufacture, Distribution, and Storage of Explosive Materials, 1970.

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SUBMITTING PROPOSALS ON NFPA TECHNICAL COMMITTEE DOCUMENTS

Contact NFPA Standards Administration for final date for receipt of proposals on a specific document.

INSTRUCTIONS

Please use the forms which follow for submitting proposed amendments. Use a separate form for each proposal.

1. For each document on which you are proposing amendment indicate:
   (a) The number and title of the document
   (b) The specific section or paragraph.

2. Check the box indicating whether or not this proposal recommends new text, revised text, or to delete text.

3. In the space identified as "Proposal" include the wording you propose as new or revised text, or indicate if you wish to delete text.

4. In the space titled "Statement of Problem and Substantiation for Proposal" state the problem which will be resolved by your recommendation and give the specific reason for your proposal including copies of tests, research papers, fire experience, etc. If a statement is more than 200 words in length, the technical committee is authorized to abstract it for the Technical Committee Report.

5. Check the box indicating whether or not this proposal is original material, and if it is not, indicate source.

6. 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.

NOTE: The NFPA Regulations Governing Committee Projects in Paragraph 10-10 state: Each proposal shall be submitted to the Council Secretary and shall include:

(a) identification of the submitter and his affiliation (Committee, organization, company) where appropriate, and

(b) identification of the document, paragraph of the document to which the proposal is directed, and

(c) a statement of the problem and substantiation for the proposal, and

(d) proposed text of proposal, including the wording to be added, revised (and how revised), or deleted.