

NFPA®

495

Explosive Materials Code

2023



NFPA® 495

Explosive Materials Code

2023 Edition



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NFPA® 495

Explosive Materials Code

2023 Edition

This edition of NFPA 495, *Explosive Materials Code*, was prepared by the Technical Committee on Explosives. It was issued by the Standards Council on November 29, 2022, with an effective date of December 19, 2022, and supersedes all previous editions.

This edition of NFPA 495 was approved as an American National Standard on December 19, 2022.

Origin and Development of NFPA 495

This code was originally issued in 1912 under the title *Suggested State Law to Regulate the Manufacture, Storage, Sale, and Use of Explosives*. The second edition was issued in 1941 by the Committee on Laws and Ordinances and retitled *Suggested Explosives Ordinance for Cities*. Later, the document was designated as NFPA 495L.

After being assigned to the Committee on Chemicals and Explosives, a new edition was issued in 1959. This was retitled as the *Code for the Manufacture, Transportation, Storage, and Use of Explosives and Blasting Agents* and redesignated as NFPA 495.

Following the reorganization of the committee in 1960, the responsibility for amendments to NFPA 495 was assigned to the Sectional Committee on Explosives. This committee reported to the Correlating Committee of the Committee on Chemicals and Explosives. Revised editions were issued in 1962, 1965, 1967, 1968, 1969, and 1970. A new edition was issued in 1972, with the document title revised to *Code for the Manufacture, Transportation, Storage, and Use of Explosive Materials*. A subsequent edition followed in 1973.

Following the issuance of the 1973 edition, the Sectional Committee on Explosives was redesignated as a Technical Committee. In 1976, the committee began a detailed review intended to amend requirements to eliminate conflicts with the regulations promulgated by the various federal agencies concerned with explosive materials (e.g., U.S. Bureau of Alcohol, Tobacco, and Firearms; U.S. Mine Safety and Health Administration; and U.S. Department of Transportation [DOT]). This effort resulted in the 1982 edition, which was followed by a new edition in 1985. In 1990, the document was again revised and the title changed to *Explosive Materials Code*. The 1992 edition incorporated various technical and editorial amendments.

The 1996 edition incorporated changes in the classification of explosives to conform with DOT's "Hazardous Materials Regulations," which in turn was based on United Nations Recommendations on the Transport of Dangerous Goods. The 1996 edition also included technical and editorial amendments.

The 2001 edition of NFPA 495 included technical and editorial amendments highlighted by an increase in the amount of smokeless propellants permitted to be stored on the shelves of retail establishments. The change was needed due to the reclassification of certain explosive materials by DOT.

In the 2006 edition, a new chapter on Manufacturing and Testing was added. The code added updated tables based on the most current IME industry practices. The committee also prepared technical and editorial amendments to comply with the *Manual of Style for NFPA Technical Committee Documents*.

The 2010 edition updated definitions reflecting changes in federal regulatory provisions. A security plan was required as part of the permitting process for explosive materials, and new requirements for site control were included. The 2010 code allowed quantitative risk assessment (QRA) to be used where the quantity–distance (Q–D) requirements cannot be met. With the introduction of QRA, the siting requirements recognized the QRA method in addition to the traditional American Table of Distances. The committee also modified quantity limits for display or storage of certain small arms primers.

The 2013 edition contained updates to the ground vibration limitations in Chapter 11, Ground Vibration, Air Overpressure, Flyrock, and Gases to reflect the advancement and availability of blasting seismograph equipment. The code presented two options for limiting ground vibrations: monitoring with a blasting seismograph or using the scaled distance equations. The committee also made several editorial and reference updates to the code.

The 2018 edition contained updates to Chapter 5 requirements on the Electrical Wiring and Equipment section, providing better guidance on where to design and install watertight and dusttight equipment when in proximity of explosive materials. Chapter 10, Use of Explosive Materials for Blasting, added responsibilities for the blaster-in-charge to prevent potential conflict with project manager responsibilities. Additionally, Chapter 10 adopted requirements for recording blast records to better align with federal and state regulations. The committee also made several editorial and reference updates to the code.

The 2023 edition adds provisions for equivalent cabinet or box construction when storing smokeless propellants, as there are other materials that cabinets or boxes can be constructed of that can meet or exceed the protection that a 1-inch nominal thickness of wood can provide in regard to fire and mechanical protection and the ability to fragment in the event of an explosion.

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Committee Scope: This Committee shall have primary responsibility for documents on the manufacture, transportation, storage and use of explosives and related materials. This Committee does not have responsibility for documents on consumer and display fireworks, model and high power rockets and motors, and pyrotechnic special effects.

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Explosive Materials Code

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

A reference in brackets [] following a section or paragraph indicates material that has been extracted from another NFPA document. Extracted text may be edited for consistency and style and may include the revision of internal paragraph references and other references as appropriate. Requests for interpretations or revisions of extracted text shall be sent to the technical committee responsible for the source document.

Information on referenced and extracted publications can be found in Chapter 2 and Annex F.

Chapter 1 Administration

1.1 Scope. This code shall apply to the manufacture, transportation, storage, sale, and use of explosive materials.

1.2 Purpose. This code is intended to provide reasonable safety in the manufacture, storage, transportation, and use of explosive materials.

1.3 Application.

1.3.1 This code shall not apply to the transportation of explosive materials where under the jurisdiction of the U.S. Department of Transportation (DOT). It shall apply, however, to state and municipal supervision of compliance with U.S. DOT 49 CFR 100–199.

1.3.2 This code shall not apply to the transportation and use of military explosives by federal or state military agencies, nor shall it apply to the transportation and use of explosive materials by federal, state, or municipal agencies while engaged in normal or emergency performance of duties.

1.3.3 This code shall not apply to the manufacture of explosive materials under the jurisdiction of the U.S. Department of Defense (DOD). This code also shall not apply to the distribu-

tion or storage of explosive materials by military agencies of the United States, nor shall it apply to arsenals, navy yards, depots, or other establishments owned or operated by, or on behalf of, the United States.

1.3.4 This code shall not apply to pyrotechnics such as flares, fuses, and railway torpedoes. It also shall not apply to fireworks and pyrotechnic special effects as defined in NFPA 1123, NFPA 1124, and NFPA 1126.

1.3.5 This code shall not apply to model and high power rocketry as defined in NFPA 1122, NFPA 1125, and NFPA 1127.

1.3.6 This code shall not apply to the use of explosive materials in medicines and medicinal agents in the forms prescribed by the United States Pharmacopeia or the National Formulary.

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

1.4.1 Unless otherwise specified, the provisions in this code shall not apply to facilities, equipment, structures, or installations that existed or were approved for construction or installation prior to the effective date of the code. Where specified the provisions in this code shall be retroactive.

1.4.2 In those cases where the authority having jurisdiction determines that the existing situation presents an unacceptable degree of risk, the authority having jurisdiction shall be permitted to apply retroactively any portions of this code deemed appropriate.

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

1.5 Equivalency. Nothing in this code is intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety over those prescribed by this code.

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

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

1.6 Enforcement. This code shall be administered and enforced by the authority having jurisdiction designated by the governing authority. (See Annex B for sample wording for enabling legislation.)

Chapter 2 Referenced Publications

2.1 General. The documents or portions thereof listed in this chapter are referenced within this code and shall be considered part of the requirements of this document.

2.2 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 1, *Fire Code*, 2021 edition.

NFPA 13, *Standard for the Installation of Sprinkler Systems*, 2022 edition.

NFPA 70®, *National Electrical Code*®, 2023 edition.

NFPA 498, *Standard for Safe Havens and Interchange Lots for Vehicles Transporting Explosives*, 2023 edition.

NFPA 1122, *Code for Model Rocketry*, 2018 edition.

NFPA 1123, *Code for Fireworks Display*, 2022 edition.

NFPA 1124, *Code for the Manufacture, Transportation, and Storage of Fireworks and Pyrotechnic Articles*, 2022 edition.

NFPA 1125, *Code for the Manufacture of Model Rocket and High-Power Rocket Motors*, 2022 edition.

NFPA 1126, *Standard for the Use of Pyrotechnics Before a Proximate Audience*, 2021 edition.

NFPA 1127, *Code for High Power Rocketry*, 2018 edition.

NFPA 5000®, *Building Construction and Safety Code*®, 2021 edition.

2.3 Other Publications.

2.3.1 IAPMO Publications. International Association of Plumbing and Mechanical Officials, 5001 E. Philadelphia Street, Ontario, CA 91761.

Uniform Mechanical Code, 2021.

2.3.2 IME Publications. The Institute of Makers of Explosives, 1212 New York Avenue, NW, Suite 650, Washington, DC 20005.

IME SLP 2, “American Table of Distances (ATD),” June 1991 (incorporates changes through October 2017).

2.3.3 ISEE Publications. International Society of Explosives Engineers, www.isee.org, 26500 Renaissance Parkway, Cleveland, OH 44128.

“Field Practice Guidelines for Blasting Seismographs,” 2020.

“Performance Specifications for Blasting Seismographs,” 2017.

2.3.4 UN Publications. 1 United Nations Plaza, New York, NY 10017.

Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria, 7th revised edition, 2019.

2.3.5 U.S. Government Publications. U.S. Government Publishing Office, 732 North Capitol Street, NW, Washington, DC 20401-0001.

ATF Publication 5400.7, *Federal Explosives Law and Regulations*, 2012.

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

Title 18, United States Code, Chapter 44, “Firearms.”

Title 27, Code of Federal Regulations, Part 555, “Commerce in Explosives.”

Title 49, Code of Federal Regulations, Parts 100–199, “Pipeline and Hazardous Materials Safety Administration, Department of Transportation.”

Title 49, Code of Federal Regulations, Part 397, “Transportation of Hazardous Materials; Driving and Parking Rules.”

2.3.6 Other Publications.

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

2.4 References for Extracts in Mandatory Sections.

NFPA 221, *Standard for High Challenge Fire Walls, Fire Walls, and Fire Barrier Walls*, 2021 edition.

NFPA 1124, *Code for the Manufacture, Transportation, and Storage of Fireworks and Pyrotechnic Articles*, 2022 edition.

NFPA 5000®, *Building Construction and Safety Code*®, 2021 edition.

Chapter 3 Definitions

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

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

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

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

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

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

3.2.6 Shall. Indicates a mandatory requirement.

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

3.3 General Definitions.

3.3.1 Acceptor. A charge of explosives or blasting agent receiving an impulse from an exploding donor charge.

3.3.2 Ammonium Nitrate. A chemical compound represented by the formula NH_4NO_3 .

3.3.3 ANFO (Ammonium Nitrate Fuel Oil Mixture). A blasting agent (Explosive 1.5D) that contains no essential ingredients other than prilled ammonium nitrate and fuel oil.

3.3.4 Blast Area. The area in which concussion (shock wave), flying material, or gases from an explosion can cause injury to persons.

3.3.5* Blast Site. The area where explosive material is handled during loading of the borehole, including 15.2 m (50 ft) in all directions from the perimeter formed by loaded holes.

3.3.6 Blaster. A person qualified to assist in the loading and firing of a blast.

3.3.7 Blaster-in-Charge. A person qualified to be in charge of and responsible for the loading and firing of a blast.

3.3.8* Blasting Agent. A material or mixture intended for blasting that meets the requirements of the DOT "Hazardous Materials Regulations," as set forth in 49 CFR 173.56, 49 CFR 173.57, and 49 CFR 173.58, Explosive 1.5D.

3.3.9* Borehole. A hole drilled in the material to be blasted for the purpose of containing an explosive charge; also called *blast hole* or *drill hole*.

3.3.10 Building.

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

3.3.10.2* Operating Building. A building utilized in conjunction with the manufacture, transportation, or use of explosive materials.

3.3.11 Bulk Mix. A mass of explosive material prepared for use in bulk form without packaging.

3.3.12 Bulk Mix Delivery Equipment. Equipment (usually a motor vehicle with or without a mechanical delivery device) that transports explosive materials in bulk form for mixing or loading directly into boreholes, or both.

3.3.13* Bullet-Resistant Construction. Refers to magazine walls or doors, constructed to resist penetration of a bullet of 150-grain M2 ball ammunition having a nominal muzzle velocity of 824 mps (2700 fps) when fired from a 0.30-caliber rifle from a distance of 30.5 m (100 ft) perpendicular to the wall or door.

3.3.14 Day Box. A Type 3 magazine.

3.3.15 Detonating Cord. A flexible cord containing a center core of high explosive used to detonate other explosives.

3.3.16* Detonator. Any device containing an initiating or primary explosive that is used for initiating detonation.

3.3.16.1 Electronic Detonator. A detonator that utilizes stored electrical energy as a means of powering an electronic timing delay element/module and that provides initiation energy for firing the base charge.

3.3.16.2 No. 8 Test Detonator. A detonator with 0.40 to 0.45 g PETN (pentaerythritol tetranitrate) base charge pressed to a specific gravity of 1.4 g/cc and primed with standard weights of primer, depending on manufacturer.

3.3.17 Device.

3.3.17.1* Explosive-Actuated Device. Any tool or special mechanized device that is actuated by explosive materials.

3.3.17.2* Propellant-Actuated Device. Any tool or special mechanized device or gas generator system that is actuated by a propellant or that releases or directs work through a propellant charge.

3.3.17.3 Special Industrial Explosives Device. Explosive-actuated devices and propellant-actuated devices.

3.3.18 Distance.

3.3.18.1 Inter magazine Distance (IMD). The minimum separation distance between magazines.

3.3.18.2 Intraline Distance (ILD) or Intraplant Distance (IPD). The distance to be maintained between any two operating buildings on an explosives manufacturing site, at least one of which contains or is designed to contain explosives; the distance between a magazine and an operating building.

3.3.18.3 Minimum Separation Distance (D_0). The minimum separation distance between adjacent buildings occupied in conjunction with the manufacture, transportation, storage, or use of explosive materials where one of the buildings contains explosive materials and the other building does not.

3.3.18.4* Quantity-Distance (Q-D). The quantity of explosive material and the separation distance relationships providing protection.

3.3.19 Donor. An exploding charge producing an impulse that impinges upon an explosive acceptor charge.

3.3.20* Explosive. Any chemical compound, mixture, or device, the primary or common purpose of which is to function by explosion.

3.3.20.1 Binary Explosive. A blasting explosive formed by mixing or combining two precursor chemicals, for example ammonium nitrate and nitromethane.

3.3.20.2 Emulsion Explosive. An explosive material containing substantial amounts of oxidizer dissolved in water droplets surrounded by an immiscible fuel or droplets of an immiscible fuel surrounded by water containing substantial amounts of oxidizer.

3.3.20.3 Primary Explosive. A sensitive explosive such as lead azide, which detonates by simple ignition from such means as spark, flame, impact, friction, or other primary heat sources of appropriate magnitude.

3.3.20.4 Two-Component Explosive. See 3.3.20.1, Binary Explosive.

3.3.21 Fire Barrier Wall. A wall, other than a fire wall, having a fire resistance rating. [221, 2021]

3.3.22* Fire Extinguisher Rating. This rating is identified on an extinguisher by a number (e.g., 5, 20, 70), indicating relative effectiveness, followed by a letter (e.g., A, B, C, or D) indicating the class or classes of fires for which the extinguisher has been found to be effective.

3.3.23* Flash Point. The minimum temperature at which a liquid or a solid emits vapor sufficient to form an ignitable mixture with air near the surface of the liquid or the solid.

3.3.24 Fuel. Any substance that reacts with the oxygen in the air or with the oxygen yielded by an oxidizer to produce combustion.

3.3.25 Hardwood. Any close-grained wood such as oak, maple, ash, or hickory that is free from loose knots, wind shakes, or similar defects.

3.3.26* Hazards Analysis (HA). The process of identifying situations or conditions that have the potential to cause injury to people, damage to property, or damage to the environment.

3.3.27 Magazine. A building or structure, other than an explosives manufacturing building, approved for the storage of explosive materials. [1124, 2022]

3.3.28 Manufacturing. Mixing, blending, extruding, assembling articles outside the blast site, disassembling, chemical synthesis, and other functions involved in making a product or device that is intended to explode.

3.3.29 Mass Detonate (Mass Explode). Simultaneous detonation or explosion of the total amount or a substantial amount of a quantity of explosive material caused by the explosion of a unit or part of the explosive material.

3.3.30 Material.

3.3.30.1 Explosive Material. Any explosive, blasting agent, emulsion explosive, water gel, or detonator.

3.3.30.1.1* Bullet-Sensitive Explosive Material. Explosive material that can be detonated by 150-grain M2 ball ammunition having a nominal muzzle velocity of 824 mps (2700 fps) when fired from a 0.30-caliber rifle at a distance of 30.5 m (100 ft), measured perpendicularly.

3.3.30.1.2* Cap-Sensitive Explosive Material. Any explosive material that can be detonated by means of a No. 8 blasting cap or its equivalent.

3.3.30.1.3 High Explosive Material. Explosive materials that are characterized by a very high rate of reaction, high pressure development, and the presence of a detonation wave.

3.3.30.1.4 Low Explosive Material. Explosive material that is characterized by deflagration or a low rate of reaction and the development of low pressure.

3.3.30.1.5* Special Industrial Explosive Material. Shaped materials, sheet forms, and various other extrusions, pellets, and packages of high explosives used for high-energy-rate forming, expanding, and shaping in metal fabrication and for dismemberment and reduction of scrap metal.

3.3.30.2 Hazardous Material. A chemical or substance that is a physical hazard or health hazard as defined and classified in NFPA 1 whether the material is in usable or waste condition.

3.3.30.2.1 Health Hazard Material. A chemical or substance classified as a toxic, highly toxic, or corrosive material in accordance with the definitions set forth in NFPA 1.

3.3.30.2.2* Incompatible Material(s). Materials that, when in contact with each other and outside of the condition of intended use, have the potential to react in a manner that

generates heat, fumes, gases, or by-products that are hazardous to life and property.

3.3.30.2.3 Physical Hazard Material. A chemical or substance classified as a combustible liquid, combustible fiber, explosive, flammable cryogen, flammable gas, flammable liquid, flammable solid, organic peroxide, oxidizer, oxidizing cryogen, pyrophoric, unstable (reactive), or water reactive material, in accordance with the definitions set forth in this code or in NFPA 1.

3.3.30.3* Oxidizing Material. Any solid or liquid that readily yields oxygen or other oxidizing gas or that readily reacts to oxidize combustible material.

3.3.31 Misfire. A charge of explosive material that fails to detonate completely after initiation.

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

3.3.33 Net Explosive Weight (NEW). The aggregate amount of explosive materials, expressed in pounds, contained in a manufactured article or within buildings, magazines, structures, or portions thereof.

3.3.34 Nonsparking Metal. A metal that resists producing a spark when impacted with tools, rock, or hard surfaces.

3.3.35 Operating Line. A group of buildings, facilities, or workstations so arranged as to permit performance of the steps in the manufacture of an explosive or in the loading, assembly, modification, and maintenance of ammunition or devices containing explosive materials.

3.3.36 Person. Any individual, firm, partnership, corporation, company, association, or joint-stock association, including any trustee, receiver, assignee, or personal representative thereof. [5000, 2021]

3.3.37 Plywood. Exterior grade plywood.

3.3.38 Precursor Chemicals. Two or more unmixed, commercially manufactured prepackaged chemical ingredients (including oxidizers, flammable liquids or solids, or similar ingredients) that are *not* classified as explosives but that, where mixed or combined, form a blasting explosive.

3.3.39 Primer. A unit, package, or cartridge of explosive material used to initiate other explosives or blasting agents and that contains (1) a detonator or (2) a detonating cord to which is attached a detonator designed to initiate the cord.

3.3.39.1 Small Arms Ammunition Primers. Small percussion-sensitive explosive charges encased in a cap and used to ignite propellant powder.

3.3.40* Propellant. An explosive that normally functions by deflagration and is used for propulsion purposes.

3.3.40.1 Composite Propellant. A mixture consisting of an elastomeric-type fuel and an oxidizer used in gas generators and rocket motors.

3.3.40.2 Smokeless Propellants. Solid propellants, commonly referred to as smokeless powders, used in small arms ammunition, cannons, rockets, or propellant-actuated devices.

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

3.3.42* Public Highway. Any road, street, or way, whether on public or private property, open to public travel.

3.3.43 Railway. Any steam, electric, diesel electric, or other railroad or railway that carries passengers for hire on a particular line or branch in the vicinity of an explosives storage or manufacturing facility.

3.3.44 Resistant.

3.3.44.1* Fire Resistant. Construction designed to provide reasonable protection against fire.

3.3.44.2 Theft Resistant. Construction designed to deter illegal entry into facilities for the storage of explosive material.

3.3.44.3 Weather Resistant. Construction designed to offer protection against weather.

3.3.45* Semiconductive Hose. Any hose with an electrical resistance sufficient to limit the flow of stray electric currents to safe levels, yet not high enough to prevent the relaxation of static electric charges to ground.

3.3.46 Sensitivity. A characteristic of an explosive material, classifying its ability to detonate upon receiving an external impulse such as impact shock, flame, or other influence that can cause explosive decomposition.

3.3.47* Shock Tube. A small diameter plastic tube used for initiating detonators.

3.3.48 Slurry. An explosive material containing substantial portions of a liquid, oxidizers and fuel, plus a thickener.

3.3.49* Small Arms Ammunition. Any shotgun, rifle, or pistol cartridge and any cartridge for propellant-actuated devices.

3.3.50 Softwood. Any coarse-grained wood such as fir, hemlock, spruce, or pine that is free from loose knots, wind shakes, or similar defects.

3.3.51* Steel. General purpose, hot- or cold-rolled, low carbon steel.

3.3.52* Water Gel. An explosive material that contains substantial portions of water, oxidizers, and fuel, plus a cross-linking agent.

Chapter 4 Security and Safety of Explosive Materials

4.1 Basic Requirements. This chapter shall not apply to hand-loading of small arms ammunition prepared for personal use and not for resale. (*See Chapter 14.*)

4.1.1 Response to Fires.

4.1.1.1* No attempt shall be made to fight a fire that cannot be contained or controlled before it reaches explosive materials other than Division 1.4S.

4.1.1.2 In such cases, all personnel shall be evacuated immediately to a safe location.

4.1.1.3 In all such cases, the area shall be guarded from entry by spectators or intruders.

4.1.2 Fire Department Notification.

4.1.2.1 The local fire department and other local emergency response agencies shall be notified of the location of all magazines and of any changes in location.

4.1.2.2 Such notification shall be made verbally before the end of the day on which storage of the explosive materials commenced and in writing within 48 hours from the time such storage commenced.

4.1.3 The manufacture of any explosive material, as defined by this code, shall be prohibited unless such manufacture is authorized by federal license and is conducted in accordance with recognized safe practices.

4.1.4 The manufacture of explosive materials shall be prohibited where such manufacture presents an undue hazard to life or property.

4.1.4.1 Prior to manufacturing or testing of explosives, ammunition, or blasting agents, the authority having jurisdiction shall be furnished with the following information:

- (1) The exact location of the place of manufacture or testing
- (2) The type and net explosive weight (NEW) of explosives ammunition, blasting agents to be manufactured or tested, and the in-process classification of the materials to be used
- (3) A plot plan of the operating premises with the operating buildings indicated in which greater than 0.45 kg (1 lb) of explosives is to be manufactured, used, tested, or stored
- (4) The plot plan dimensioned so as to accurately portray the size of each operating building and its location relative to barricades, storage magazines, property lines, inhabited buildings, and public transportation routes
- (5)* Information from hazard assessments as required by process safety management (PSM)

4.1.5 All explosive materials and any newly developed and unclassified explosive materials shall meet the license and permit requirements of this chapter.

4.1.5.1 The requirement in 4.1.5 shall not apply to stocks of small arms ammunition and components thereof, to the extent that they are covered by the provisions of 18 USC 44.

4.1.6 A person intending to engage in business as an importer, manufacturer, dealer, or user of explosive materials shall obtain a federal license in accordance with 18 USC 40.

4.1.7 The requirements contained in this chapter are intended to supplement existing federal laws and regulations; therefore, any person who possesses a license or permit under 18 USC 40, which properly covers the activities of such person, shall not be required to obtain a permit under this chapter.

4.1.8 Warning Signs.

4.1.8.1 All normal access roads to explosive storage magazines shall be posted with the following warning sign:

DANGER.

NEVER FIGHT EXPLOSIVE FIRES.

**EXPLOSIVES ARE STORED
ON THIS SITE.**

CALL _____.

4.1.8.2 The sign shall be weather resistant with a reflective surface and lettering at least 50 mm (2 in.) high.

4.1.9 Transportation Placards.

4.1.9.1 Placards required by the U.S. Department of Transportation regulations in 49 CFR 172, Subpart F, for the transportation of blasting agents (Division 1.5 materials) shall be displayed on all Type 5 magazines that contain blasting agents (Division 1.5 materials).

4.1.9.2 Emptied Type 5 magazines (including over-the-road trailers) that have previously contained packaged blasting agents (Division 1.5 materials) shall not be required to display placards.

4.2 Permit Requirements.

4.2.1 No person shall be in possession of explosive materials, or conduct an operation or activity requiring the use of explosive materials, or perform or supervise the loading and firing of explosive materials without first obtaining the correct permit.

4.2.2 Explosive materials shall not be sold, given, delivered, or transferred to any person not possessing a valid permit.

4.2.3 Responsibility.

4.2.3.1 Every person conducting an operation or activity that uses explosive materials shall obtain a permit to use explosive materials.

4.2.3.2 Such persons shall be responsible for the results and consequences of any loading or firing of explosive materials.

4.2.3.3 Such person shall also ensure that loading and firing are performed or supervised by a person possessing a permit to blast.

4.2.3.4 Laboratories engaged in testing explosive materials, other than where conducting test blast explosions, shall require only a permit to use.

4.2.4 Where required by the authority having jurisdiction, the permit applicant shall provide evidence of a public liability insurance policy.

4.2.5* Applicants for licenses and permits shall have a security plan.

4.3 Permit Classes.

4.3.1 Permit to Use. Before a person conducts an operation or activity that uses explosive materials, that person shall obtain a license or permit from the Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF) as required, which provides authorization to purchase, possess, store, and use such materials.

4.3.2 Permit to Blast. Before a blaster-in-charge supervises the loading and firing of explosive materials, that individual shall obtain the appropriate permit to blast, as specified in Table 4.3.2.

4.4 Requirements for Blaster's Permit.

4.4.1 The applicant for an initial permit to supervise and perform the loading and firing of explosive materials, as specified in 4.3.2, shall demonstrate training and experience in the use of explosive materials in the class authorized by the specific permit for which application is made.

Table 4.3.2 Classifications for Permit to Blast

Class	Category	Blasting Permitted
A	Unlimited	All types of blasting
B	General aboveground	All phases of blasting operations in quarries, open pit mines, and aboveground construction
C	General underground	All phases of blasting operations in underground mines, shafts, tunnels, and drifts
D	Demolition	All phases of blasting in demolition projects
E	Seismic	All phases of blasting in seismic prospecting
F	Agriculture	All phases of blasting in agriculture, but limited to not more than 22.7 kg (50 lb) per blast
G	Special	Special blasting as described on the permit

4.4.2 Qualifying Examination.

4.4.2.1 Each applicant shall pass a qualifying examination.

4.4.2.2 The examination shall be administered in written or oral format, or by such other means as necessary to determine that the applicant is competent to conduct blasting operations and to perform the duties of a blaster.

4.4.3 The applicant shall be approved by the ATF as an explosives possessor or responsible person.

4.4.4 Any holder of a permit to blast who is convicted of a violation of any explosives law or regulation shall be required to pass a qualifying examination as a condition of retention of the permit.

4.4.5 Any person whose permit to blast has been revoked shall be required to pass a qualifying examination as a condition of reinstatement of the permit.

4.4.6 Any person whose permit to blast has lapsed for a period of 1 year or longer shall be required to pass a qualifying examination as a condition of renewal of the permit.

4.5 Posting of Permits.

4.5.1 Permit to Use. A copy of the permit shall be posted at each place of operation.

4.5.2 Permit to Blast. A copy of the permit shall be carried by the permit holder during blasting operations.

4.5.3 Permit Loss or Damage.

4.5.3.1 Permit holders shall take every reasonable precaution to protect their permits from loss, theft, defacement, destruction, or unauthorized duplication.

4.5.3.2 Any such occurrence shall be reported immediately to the issuing authority.

4.6 Permit Restrictions.

4.6.1 No permit shall be permitted to be assigned or transferred.

4.6.2 No permit shall be issued to a person under 21 years old.

4.6.3 Permits shall be dated and numbered.

4.6.4 Permits shall be valid for no longer than 3 years from the date of issue.

4.7 Denial or Revocation of Permits.

4.7.1 A permit for the possession and use of explosive materials shall be denied or revoked for any of the following reasons:

- (1) Noncompliance with any order of the issuing authority within the time specified by such order
- (2) Proof that the permit applicant or holder is under indictment for, or has been convicted of, a crime punishable by imprisonment for a term exceeding 1 year
- (3) The applicant or holder is a fugitive from justice
- (4) The applicant or holder is an unlawful user of, or is addicted to, narcotics or dangerous drugs
- (5) The applicant has been adjudicated as mentally defective
- (6) Proof that the permit applicant or holder advocates, or knowingly belongs to, any organization or group that advocates violent overthrow of, or violent action against, any federal, state, or local government
- (7) Proof that the permit applicant or holder suffers from a mental or physical defect that would interfere with the safe handling of explosives
- (8) Violation by the permit applicant or holder of any provision of any explosives law or regulation, or proof that false information was provided or a misrepresentation was made to obtain the permit by the applicant or holder

4.7.2 Notification of Permit Denial or Revocation.

4.7.2.1 In any case in which the issuing authority denies or revokes a permit, the issuing authority shall notify the permit applicant or holder promptly.

4.7.2.2 Such notification as described in 4.7.2.1 shall specify the basis for denial or revocation of the permit.

4.7.2.3 Such notification shall also state that, upon written request by the applicant or holder, a hearing before the issuing authority is to be held within 10 days after the date of the request.

4.7.3 In cases where a hearing is held, the issuing authority shall state its findings and conclusions in writing.

4.7.4 The issuing authority shall transmit a copy of the findings and conclusions to the applicant or former permit holder promptly.

4.7.5 Upon notice of the revocation of any permit, the former permit holder immediately shall surrender the revoked permit and all copies thereof to the issuing authority.

4.8 Record Keeping and Reporting.

4.8.1 Records.

4.8.1.1 A holder of a permit to use shall keep a record of all transactions or operations involving explosive materials.

4.8.1.2 Such record shall be retained for 5 years.

4.8.1.3 Permits shall be made available to the issuing authority upon request.

4.8.2 An accumulation of invoices, sales slips, delivery tickets or receipts, or similar records representing individual transactions shall be considered to satisfy the requirements for record keeping, provided they include the signature of the receiver of the explosive materials.

4.8.3 Daily Records.

4.8.3.1 A holder of a permit to blast shall keep a daily record of all explosive materials received and fired or otherwise disposed of by the permit holder.

4.8.3.2 Such records shall be retained for 5 years.

4.8.3.3 Records shall be made available to the issuing authority upon request.

4.8.4 A holder of a permit shall notify the issuing authority promptly of any change in address.

4.8.5* The loss, theft, or unlawful removal of explosive materials shall be reported within 24 hours to the Bureau of Alcohol, Tobacco, Firearms and Explosives, to the permit-issuing authority, and to the local law enforcement agency.

4.8.6 Accidents involving explosive material that cause a lost-time injury or property damage shall be reported immediately to the authority having jurisdiction.

4.9 Applications.

4.9.1 An application for a permit or for renewal of a permit shall be made to the issuing authority on forms provided by the authority.

4.9.2 Such applications shall contain such information as is required.

4.10 Renewals.

4.10.1 Where an application for renewal is filed with the issuing authority before expiration of the current permit, the renewal shall become effective upon expiration of the current permit.

4.10.2 No renewal permit shall be issued more than 30 days prior to the expiration date of the current permit.

4.10.3 An application for renewal filed after the expiration date of the current permit shall be considered an application for a new permit.

Chapter 5 Manufacturing and Testing

5.1 Scope. Manufacture and testing of explosives shall be in accordance with the requirements of this chapter.

5.1.1 Blasting agents shall not be subject to the requirements of this chapter (*see Chapter 6*).

5.1.2 Water gels, slurries, and emulsion explosives shall not be subject to the requirements of this chapter (*see Chapter 7*).

5.1.3 This chapter shall not apply to handloading of small arms ammunition prepared for personal use and not for resale (*see Chapter 14*).

5.2 General Requirements.

5.2.1 Emergency Procedures. Emergency procedures shall be developed for each manufacturing facility.

5.2.2 Posting of Pertinent Information. Standard operating procedures governing the manufacturing process shall be located in a location and form accessible to workers.

5.2.3 Training. Persons handling explosive materials or working in operating buildings shall be trained in the following areas:

- (1) The physical and health hazards of the explosive materials to be manufactured
- (2) The operational activities involved in processing the materials to include instructions in emergencies that are anticipated in the manufacturing process
- (3) The operating rules applicable to the materials in the manufacturing process
- (4) Plans for emergency procedures in the event of a fire or explosion

5.2.3.1 Personnel shall be made aware of emergency warning signals and actions to take in the event the warning signal is activated.

5.2.3.2 Contract personnel working in explosive manufacturing areas shall be instructed in site-specific operating procedures, emergency procedures, and hot work operations, prior to engaging in any activity, whether maintenance-related or not.

5.2.3.3 Visitors entering operational areas shall receive orientation training and be accompanied by a trained escort.

5.2.4* Containers. Bulk explosive materials shall be stored in approved containers when not in use.

5.2.5* Waste. When waste receptacles are provided for the collection of waste and debris, such receptacles shall be approved and equipped with covers.

5.2.5.1 Emptying Waste Containers. Waste receptacles shall be emptied and cleaned in accordance with operating procedures.

5.2.5.2 Collection of Spilled Material.

5.2.5.2.1 Explosive materials that are spilled or dropped outside of designated containment or confinement zones shall be collected promptly for disposal.

5.2.5.2.2 The area in which the materials were spilled shall be cleaned.

5.2.5.3 Contaminated Materials. Cleaning materials or materials that have been contaminated with explosives shall be removed daily and disposed of in an approved manner.

5.2.5.3.1 Shipping Containers. Shipping containers used for explosive materials shall be allowed to be retained for reuse as required.

5.2.6 Maintenance. Nonroutine maintenance and repair work shall not be performed in an explosive manufacturing area until cleanup and decontamination have been performed as required by operating procedures.

5.2.6.1 Repair Work. Maintenance and repair that is not addressed by the operating procedures shall be reviewed and approved by supervisory personnel prior to conducting the work.

5.2.7 Ignition Source Control.

5.2.7.1 Smoking. Smoking shall be prohibited on the plant site, except where permit notices are posted.

5.2.7.2 Flame-Producing Devices. Matches, torches, or other flame-producing devices shall be prohibited from explosives manufacturing areas without a written permit signed by an authorized supervisor.

5.2.7.3* Portable Electrical and Electronic Equipment. Portable electrical and electronic equipment shall be permitted only when designated by the manufacturing process and incorporated into the operating instructions described in 5.2.2.

5.2.7.4 A hazards analysis that evaluates and documents the essential safety design of the process shall be performed for processes involving the manufacturing, movement, storage, testing, or development of energetic materials.

5.2.8 Clothing.

5.2.8.1 Type of Clothing. Clothing to be worn by persons involved in the manufacturing process shall be of a type approved by management.

5.2.8.2 Accessories. Watches, jewelry, finger rings, earrings, and items intended for use as accessories shall not be worn in areas where explosive materials are manufactured.

5.2.8.3 Contaminated Clothing. Persons wearing clothing that has been contaminated with explosive materials shall not be permitted to enter areas where smoking is permitted or where operations involving the use of open flame or open ignition sources are present.

5.2.9 Clearance from Combustibles. The area within 7.6 m (25 feet) of operating buildings shall be kept clear of combustible materials.

5.2.10 Limited Access by Authorized Personnel. Manufacturing areas shall be secured against unauthorized entry.

5.2.11 Separation of Incompatible Materials. Incompatible materials that are in storage and storage of materials that are incompatible with materials in use shall be separated by one of the following methods:

- (1) Segregating incompatible materials in storage from those materials in use by a distance of not less than 6.1 m (20 ft)
- (2) Isolating incompatible materials in storage by a noncombustible partition extending not less than 457 mm (18 in.) above and to the sides of the stored material
- (3) Storing liquid and solid materials in hazardous materials storage cabinets that comply with NFPA 1

5.2.12 Housekeeping.

5.2.12.1 Floors. Floors of manufacturing areas shall be swept or otherwise maintained to prevent the accumulation of explosive materials.

5.2.12.2 Tools and Equipment. Tools and equipment shall be kept in designated areas when not in use during manufacturing operations.

5.2.13 Hot Work. Hot work operations shall be conducted in accordance with the requirements of NFPA 1.

5.2.13.1 Management. Management shall be responsible for the supervision of hot work activity.

5.2.13.2 Permits. Permits to conduct hot work operations shall be required.

5.3 Classification and Characterization of Energetic Materials Used in Process Operations.

5.3.1* In-Process Hazard Classification. Explosive materials being processed shall be classified with an in-process hazard classification based on the hazards of the material in its configuration and the quantity employed.

5.3.1.1 High Explosion Hazard. The classification of materials that has not been established by testing, or where the quantity or configuration of materials used exhibits a high explosion hazard shall be classified as a high explosion hazard.

5.3.1.1.1 Materials of known character or composition in the configuration and quantity specific to the process where the in-process hazard classification is approved by the AHJ shall be allowed to be classified as other than a high explosion hazard.

5.3.1.1.2 Physical Hazards Established by Testing. When testing is performed, the test methods shall be those established by the DOD, the ATF, the United Nations (UN) *Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria*, the DOT, or other approved criteria.

5.3.1.1.3 Technical Assistance. The AHJ shall be permitted to require a review by an independent third party with expertise in the matter to be reviewed at the submitter's expense.

5.3.1.2 Health Hazard Classification. The health hazards of materials used in the manufacturing process shall be determined in accordance with the requirements of NFPA 1.

5.3.1.2.1 In addition to physical hazards that are present, materials classified as toxic, highly toxic, or corrosive shall be classified as health hazards.

5.3.1.3 Multiple Hazards. Materials that have multiple hazards shall conform to this code's requirements for each applicable hazard category specified.

5.3.2* Quantity of Explosives. The quantity–distance (Q–D) tables in 5.3.3 shall apply to operating buildings.

5.3.2.1 If the Q–D tables cannot be met, the use of a quantitative risk assessment shall be permitted to determine minimum distances from potential explosion sites.

5.3.2.2 The net explosive weight shall be determined in accordance with the following:

- (1) Mass explosion hazards — Division 1.1 or 1.2 explosives
 - (a) The total net explosive weight is used.
 - (b) See Table 5.3.3(a) for operating buildings, and Table 9.4.1(a) through Table 9.4.1(d) for all other cases.
 - (c) When the TNT equivalence of the explosive material has been determined, the equivalence is allowed to be used to establish the net explosive weight.
- (2) Non–mass explosion hazards (excluding Division 1.4)
 - (a) Division 1.3 propellants
 - i. The total weight of the propellants alone is the net explosive weight.
 - ii. The net weight of the propellants is used. [See Table 5.3.3(b).]

(b) Combinations of bulk metal powder and pyrotechnic compositions

- i. The sum of the net weights of metal powders and pyrotechnic compositions in the containers is used.

(3) Combinations of mass explosion and non–mass explosion hazard explosives (excluding Division 1.4)

(a)* When Division 1.1 and 1.2 explosives are located in the same site, determine the distances for the total quantity first as 1.1 and then as 1.2.

- i. The required distance is the greater of the two.
- ii. When the Division 1.1 requirements are controlling and the TNT equivalence of the 1.2 is known, the TNT equivalent weight of the 1.2 items is added to the total explosive weight of Division 1.1 items to determine the net explosive weight of explosives for Division 1.1 distance determination. See Table 5.3.3(a) or Table 5.3.3(b) as applicable.

(b)* When Division 1.1 and 1.3 explosives are located in the same site, determine the distances for the total quantity first as 1.1 and then as 1.3.

- i. The required distance is the greater of the two.
- ii. When the Division 1.1 requirements are controlling and the TNT equivalence of the 1.3 items is known, the TNT equivalent weight of the 1.3 items is added to the total explosive weight of Division 1.1 items to determine the net explosive weight of explosives for Division 1.1 distance determination. See Table 5.3.3(a) or Table 5.3.3(b) as applicable.

(c)* When Division 1.1, 1.2, and 1.3 explosives are located in the same site, determine the distances for the total quantity first as 1.1, next as 1.2, and finally as 1.3.

- i. The required distance is the greatest of the three.
- ii. As permitted by 5.3.2.2(3)(a) and 5.3.2.2(3)(b) above, TNT equivalent weights for 1.2 and 1.3 items are allowed to be used to determine the net weight of explosives for Division 1.1 distance determination.
- iii. Table 5.3.3(a) or Table 5.3.3(b) shall be used when TNT equivalency is used to establish the net explosive weight.

(4) Combinations of non–mass-exploding ammunition and explosives of different divisions are treated as follows:

- (a) Determine the required separation for each division.
- (b) Use the greatest separation of those determined.

5.3.3* Separation of Operating Buildings. Operating buildings, including those where explosives are assembled, manufactured, prepared, or loaded, utilizing Division 1.1, 1.2, 1.3, or 1.4 explosives, shall be separated from all other operating buildings, magazines, inhabited buildings, public highways, and passenger railways at a distance not less than those shown in Table 9.4.1(a) through Table 9.4.1(d) and Table 5.3.3(a) through Table 5.3.3(c) as applicable.

Table 5.3.3(a) Minimum Intraline (Intraplant) Separation Distances (ILD or IPD) Between Barricaded Operating Buildings Containing Explosives — Division 1.1 or 1.2 — Mass Explosion Hazard

Net Explosive Weight (lb)		Intraline Distance (ILD) or Intraplant Distance (IPD) (ft)
Pounds Over	Pounds Not Over	
2	5	16
5	10	20
10	20	25
20	30	28
30	40	31
40	50	34
50	75	38
75	100	42
100	125	45
125	150	48
150	200	53
200	250	57
250	300	60
300	400	66
400	500	71
500	600	76
600	700	80
700	800	84
800	900	87
900	1,000	90
1,000	1,200	96
1,200	1,400	101
1,400	1,600	106
1,600	1,800	110
1,800	2,000	113
2,000	2,500	122
2,500	3,000	130
3,000	4,000	143
4,000	5,000	154
5,000	6,000	164
6,000	7,000	172
7,000	8,000	180
8,000	9,000	190
9,000	10,000	200
10,000	12,000	210
12,000	14,000	220
14,000	16,000	230
16,000	18,000	238
18,000	20,000	245
20,000	25,000	265
25,000	30,000	280
30,000	35,000	295
35,000	40,000	310
40,000	45,000	320
45,000	50,000	330
50,000	55,000	340
55,000	60,000	350
60,000	65,000	360
65,000	70,000	370

(continues)

Table 5.3.3(a) Continued

Net Explosive Weight (lb)		Intraline Distance (ILD) or Intraplant Distance (IPD) (ft)
Pounds Over	Pounds Not Over	
70,000	75,000	380
75,000	80,000	390
80,000	85,000	395
85,000	90,000	400
90,000	95,000	410
95,000	100,000	420
100,000	110,000	430
110,000	120,000	445
120,000	130,000	455
130,000	140,000	465
140,000	150,000	475
150,000	160,000	485
160,000	170,000	495
170,000	180,000	505
180,000	190,000	515
190,000	200,000	525
200,000	210,000	535
210,000	230,000	555
230,000	250,000	575
250,000	275,000	600
275,000	300,000	635

For SI units, 1 lb = 0.454 kg; 1 ft = 0.30 m.

Notes:

(1) Where a building or magazine containing explosives is not barricaded, the intraline distances shown in this table shall be doubled.

(2) Linear interpolation between tabular values shall not be allowed.

Nonlinear interpolation of the values shall be allowed subject to an approved technical opinion and report prepared in accordance with the requirements of NFPA 1.

(3) Minimum separation distance (D_0) shall be a minimum of 60 ft. Where a building or magazine containing explosives is barricaded, the D_0 shall be 30 ft.

5.3.3.1 Distances to assumed property lines drawn for the purposes of determination of exterior wall and opening protection under the requirements of the *NFPA 5000* shall not be used to establish the minimum distance for separation between buildings on an operating line.

5.3.3.2 The minimum separation distance (D_0) required by Note (3) to Table 5.3.3(a) shall be allowed to be reduced to less than 18.3 m (60 ft) when the fire resistance of exterior walls and protection of wall openings is in accordance with *NFPA 5000*.

5.3.4 Determination of Net Explosive Weight for Operating Buildings. In addition to the requirements of 5.3.2 to determine the net explosive weight for materials stored or used in operating buildings, quantities of explosive materials stored in magazines located at distances less than ILDs from the operating building shall be added to the contents of the operating building to determine the net explosive weight for the operating building.

Table 5.3.3(b) Table of Distances (Q–D) for Buildings Containing Explosives — Division 1.3 Mass Fire Hazard

Quantity of Division 1.3 Explosives (Net Explosive Weight) (lb)		Distances (ft)			
Pounds Over	Pounds Not Over	Inhabited Buildings Distance (IBD)	Distance to Public Traffic Route (PTR)	Intermagazine Distance (IMD)	Intraline Distance (ILD) or Intraplant Distance (IPD)
0	1,000	75	75	50	50
1,000	5,000	115	115	75	75
5,000	10,000	150	150	100	100
10,000	20,000	190	190	125	125
20,000	30,000	215	215	145	145
30,000	40,000	235	235	155	155
40,000	50,000	250	250	165	165
50,000	60,000	260	260	175	175
60,000	70,000	270	270	185	185
70,000	80,000	280	280	190	190
80,000	90,000	295	295	195	195
90,000	100,000	300	300	200	200
100,000	200,000	375	375	250	250
200,000	300,000	450	450	300	300

For SI units, 1 lb = 0.454 kg; 1 ft = 0.30 m.

Notes:

- (1) Black powder, when stored in magazines, is defined as low explosive by the ATF.
- (2) For quantities less than 1,000 lb, the required distances are those specified for 1,000 lb. The user of lesser distances shall be permitted when supported by test data and/or analysis.
- (3) Linear interpolation of explosive quantities between table entries is permitted. For quantities over 300,000 lb, the formula $D = 8W^{1/3}$ shall be used for IBD and PTR minimum distances and the formula $D = 5W^{1/3}$ shall be used for IMD and IPD minimum distances, where D = distance and W = weight in pounds. $W^{1/3}$ means the explosives' weight to the one third power.
- (4) Minimum separation distances (D_0) shall be a minimum of 50 ft.

Table 5.3.3(c) Table of Distances (Q–D) for Buildings Containing Explosives — Division 1.4

Quantity of Division 1.4 Explosives (Net Explosive Weight) (lb)		Distances (ft)			
Pounds Over	Pounds Not Over	Inhabited Buildings Distance (IBD)	Distance to Public Traffic Route (PTR)	Intermagazine Distance (IMD)	Intraline Distance (ILD) or Intraplant Distance (IPD)
50	Not limited	100	100	50	50

For SI units, 1 lb = 0.454 kg; 1 ft = 0.30 m.

Notes:

- (1) A separation distance of 100 ft is required for buildings of other than Type I and Type II construction as defined in *NFPA 5000*.
- (2) For earth-covered magazines, no specified separation is required.
- (3) Restricted to articles, including articles packaged for shipment, that are not regulated as an explosive by ATF regulations, or to unpackaged articles used in process operations that do not propagate a detonation or deflagration between articles.
- (4) Linear interpolation between tabular values is not applicable.
- (5) Minimum separation distances (D_0) shall be a minimum of 50 ft.