

NFPA No.

495

**MANUFACTURE, TRANSPORTATION,  
STORAGE, AND USE OF  
EXPLOSIVES &  
BLASTING  
AGENTS  
1970**



\$1.25

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**NATIONAL FIRE PROTECTION ASSOCIATION  
International**

60 Batterymarch Street, Boston, Mass. 02110

4M-6-70-FP-SC

Printed in U.S.A.

## **Official NFPA Definitions**

Adopted Jan. 23, 1964; Revised Dec. 9, 1969. Where variances to these definitions are found, efforts to eliminate such conflicts are in process.

**SHALL** is intended to indicate requirements.

**SHOULD** is intended to indicate recommendations or that which is advised but not required.

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\*Among the laboratories nationally recognized by the authorities having jurisdiction in the United States and Canada are the Underwriters' Laboratories, Inc., the Factory Mutual Research Corp., the American Gas Association Laboratories, the Underwriters' Laboratories of Canada, the Canadian Standards Association Testing Laboratories, and the Canadian Gas Association Approvals Division.

**LISTED:** Equipment or materials included in a list published by a nationally recognized testing laboratory that maintains periodic inspection of production of listed equipment or materials, and whose listing states either that the equipment or material meets nationally recognized standards or has been tested and found suitable for use in a specified manner.

**LABELED:** Equipment or materials to which has been attached a label, symbol or other identifying mark of a nationally recognized testing laboratory that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling is indicated compliance with nationally recognized standards or tests to determine suitable usage in a specified manner.

**AUTHORITY HAVING JURISDICTION:** The organization, office or individual responsible for "approving" equipment, an installation, or a procedure.

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This material has been developed in the interest of safety to life and property under the published procedures of the National Fire Protection Association. These procedures are designed to assure the appointment of technically competent Committees having balanced representation from those vitally interested and active in the areas with which the Committees are concerned. These procedures provide that all Committee recommendations shall be published prior to action on them by the Association itself and that following this publication these recommendations shall be presented for adoption to the Annual Meeting of the Association where anyone in attendance, member or not, may present his views. 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 non-compliance with the provisions given herein, for any restrictions imposed on materials or processes, or for the completeness of the text.

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**Code for the Manufacture, Transportation,  
Storage, and Use of  
Explosives and Blasting Agents**

**NFPA No. 495 — 1970**

**1970 Edition of No. 495**

The 1970 edition incorporates amendments detailed below that were proposed by the Sectional Committee on Explosives. It supersedes the 1969 edition.

**Origin and Development of No. 495**

This Code, prepared by the NFPA Committee on Chemicals and Explosives, was first adopted on July 13, 1959 by the NFPA Board of Directors on authorization of the Annual Meeting of that year. Following reorganization of the committee in 1960, the Sectional Committee on Explosives was assigned responsibility for the development and maintenance of NFPA recommendations on the manufacture, transportation, storage, and use of explosives and blasting agents. The Sectional Committee reports to the Association through the Correlating Committee of the Committee on Chemicals and Explosives. Amendments to No. 495 were adopted in 1962, 1965, 1967, 1968 (editorial change), 1969 and 1970.

**Amendments Adopted in 1970**

Principal changes: Definition of "semiconductive hose" added to Article 12; Sections 359, 721i, 726i, 842a, and 842c added; Section 422 amended to agree with present Department of Transportation vehicle marking requirements; Section 423 amended to require a minimum of two 10-BC extinguishers on vehicles; Section 724e amended to include requirement that metal powders be kept dry; Sections 733b-e amended to increase restrictions on movement of bulk delivery trucks; Section 831 amended to cover mixing facilities not in buildings; Section 831a amended to describe how to determine separation distances between mixing facilities and inhabited buildings, etc.; Sections 832, 833, 834 renumbered 833, 834, 835 so that new Section 832 on mixing buildings could be added; Section 842c renumbered 842g and amended.

Additional changes were adopted for the following Sections: 553, 724b, 726d, 726e, 726f, 726g, 726h, 733f, 747, 769, 842d, 842e, and Article 73.

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SCOPE: This committee serves as a policy-making and correlating group to administer and process reports of the various sectional committees dealing with chemicals and explosives.

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† Non-voting member.

**Code for the Manufacture, Transportation, Storage,  
and Use of  
Explosives and Blasting Agents**

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## FOREWORD

This Code is intended to provide regulations for reasonable safety in the manufacture, storage, transportation, and use of explosives and blasting agents of the type where common usage is incidental to mining, quarrying, road building, harbor improvement, and similar operations, including their usage on farms. Special provisions are included to cover small arms ammunition, smokeless propellants and primers, and industrial propellant- and explosive-actuated devices. It is also intended to cover the storage and use of explosives and blasting agents in industrial laboratories and laboratories of technical institutions, colleges and universities. The Code may be used as a guide for the preparation of legal regulations. An Appendix contains Suggested Provisions for Municipal Regulations.

Recommended safe practices on a nation-wide scope have many advantages, particularly as to uniform interpretation and proper application at state and city levels. This Code and the Suggested Provisions for Municipal Legal Regulations, contained in Appendix B, are recommended for promoting safety in intrastate and intracity transportation and handling of explosives. Facilities for the handling of explosives incidental to shipment by water should conform with the regulations of the United States Coast Guard. (See Public Law 562 in Appendix A.)

Explosives are acceptable articles of commerce when properly stabilized, packaged, and marked in accordance with the regulations of the U. S. Department of Transportation and when handled with specified care. Appendix A contains a partial list of explosives which are forbidden and unacceptable for transportation by common carriers.

Explosives present a definite hazard when improperly handled or when involved in a fire, collisions, and similar emergencies, especially to personnel of the fire and police departments who may be called upon for assistance, thus making the application of good practices all the more important.

Reasonable and intelligent application of proper enforcement of recognized safe practices can best be effected when the authorities having jurisdiction have readily available authoritative data covering the commodities to be safeguarded. Following is a list of sources of published information and advisory services.

American Association of Port  
Authorities  
601 Southern Building  
Washington, D. C. 20005

American Insurance Association  
(NBFU)  
85 John Street  
New York, N. Y. 10038

Bureau of Explosives  
2 Penn Plaza  
7th Avenue and West 33rd Street  
New York, N. Y. 10001

Bureau of Mines  
U. S. Department of the Interior  
Washington, D. C. 20242

Institute of Makers of Explosives  
420 Lexington Avenue  
New York, N. Y. 10017

Manufacturing Chemists' Asso-  
ciation, Inc.  
1825 Connecticut Ave., N.W.  
Washington, D. C. 20009

Munitions Carriers Conference,  
Inc.  
1424 Sixteenth Street, N.W.  
Washington, D. C. 20036

National Cargo Bureau, Inc.  
99 John Street  
New York, N. Y. 10038

National Fire Protection  
Association  
60 Batterymarch Street  
Boston, Mass. 02110

National Rifle Association of  
America  
1600 Rhode Island Avenue, N.W.  
Washington, D. C. 20036

Sporting Arms & Ammunition  
Manufacturers' Institute  
420 Lexington Avenue  
New York, N. Y. 10017

United States Coast Guard  
Washington, D. C. 20226

U. S. Department of  
Transportation  
Washington, D. C. 20423

U. S. Government Printing  
Office  
Washington, D. C. 20402

## CHAPTER 1. SCOPE AND DEFINITIONS

### 11. SCOPE

111. This Code shall apply to the manufacture, keeping, having, storage, sale, transportation, and use of explosives, blasting agents, and pyrotechnics.

112. It shall not apply to the transportation of explosives or blasting agents when under the jurisdiction of and in compliance with the regulations of the U. S. Department of Transportation (DOT), the regulations of the United States Coast Guard, and the regulations of the Civil Aeronautical Board and the Board of Transport Commissioners for Canada. It shall, however, apply to state and municipal supervision as to compliance with federal regulations within the jurisdiction of a state or a municipality.

113. It shall not apply to the shipment, transportation and handling of military explosives by the Armed Forces of the United States, State Militia and the Armed Forces of Canada.

114. It shall not apply to the transportation and use of explosives or blasting agents in the normal and emergency operations of federal agencies such as the Bureau of Mines, the Federal Bureau of Investigation, the Secret Service and equivalent Canadian governmental agencies, nor to state or municipal fire and police departments, providing they are acting in their official capacity and in the proper performance of their duties.

115. It shall not apply to the sale and use (public display) of pyrotechnics commonly known as fireworks.\*

### 12. DEFINITIONS

121. In this Code the following words are used as defined below:

**APPROVED.** The term "approved" shall mean approved by the authority having jurisdiction.

**BLASTING AGENT.** Shall mean any material or mixture, consisting of a fuel and oxidizer, intended for blasting, not otherwise classified as an explosive and in which none of the ingredients are classified as an explosive, provided that the fin-

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\* See Appendix A43.



ished product, as mixed and packaged for use or shipment, cannot be detonated by means of a No. 8 test blasting cap when unconfined.

NOTE 1: A No. 8 test blasting cap is one containing 2 grams of a mixture of 80% mercury fulminate and 20% potassium chlorate, or a cap of equivalent strength.

NOTE 2: Nitro-Carbo-Nitrate. This term applies to any blasting agent which has been classified as nitro-carbo-nitrate under the U. S. Department of Transportation Regulations, and which is packaged and shipped in compliance with the regulations of the U. S. Department of Transportation.

EXPLOSIVE-ACTUATED POWER DEVICES. Shall mean any tool or special mechanized device which is actuated by explosives, but not to include propellant-actuated power devices. Examples of explosive-actuated power devices are jet tappers and jet perforators.

EXPLOSIVES. The term "explosive" or "explosives" shall mean any chemical compound, mixture or device, the primary or common purpose of which is to function by explosion, i.e., with substantially instantaneous release of gas and heat, unless such compound, mixture, or device is otherwise specifically classified by the U. S. Department of Transportation. The term "explosives" shall include all material which is classified as Class A, Class B and Class C explosives by the U. S. Department of Transportation, and includes, but is not limited to, dynamite, black powder, pellet powders, initiating explosives, blasting caps, electric blasting caps, safety fuse, fuse lighters, fuse igniters, squibs, cordeau detonant fuse, instantaneous fuse, igniter cord, igniters, small arms ammunition, small arms ammunition primers, smokeless propellant, cartridges for propellant-actuated power devices and cartridges for industrial guns, and some special fireworks. (Commercial explosives are those explosives which are intended to be used in commercial or industrial operations.)

NOTE 1: Classification of explosives is described by the U. S. Department of Transportation as follows:

*Class A Explosives.* Possessing, detonating or otherwise maximum hazard; such as dynamite, nitroglycerin, picric acid, lead azide, fulminate of mercury, black powder, blasting caps, and detonating primers.

*Class B Explosives.* Possessing flammable hazard, such as propellant explosives (including some smokeless propellants), photographic flash powders, and some special fireworks.

*Class C Explosives.* Includes certain types of manufactured articles which contain Class A or Class B explosives, or both, as components but in restricted quantities.

*Forbidden or Not Acceptable Explosives.* Shall mean explosives which are forbidden or not acceptable for transportation by common carriers by rail freight, rail express, highway, or water in accordance with the regulations of the U. S. Department of Transportation.

NOTE 2: Certain chemicals and certain fuel materials may have explosive characteristics which are not specifically classified by the U. S. Department of Transportation and are not readily classified for coverage in this Code. Authoritative information should be obtained for such unclassified materials and action commensurate with their hazards, location, isolation and safeguards, should be taken.

**HIGHWAY.** Shall mean any public street, public alley or public road.

**INHABITED BUILDINGS.** Shall mean a building or structure regularly used in whole or part as a place of human habitation. The term "inhabited building" shall also mean any church, school, store, railway passenger station, airport terminal for passengers, and any other building or structure where people are accustomed to congregate or assemble, but excluding any building or structure occupied in connection with the manufacture, transportation, storage and use of explosives.

**MAGAZINE.** Shall mean any building or structure, other than an explosives manufacturing building, approved for the storage of explosives.

**MOTOR VEHICLE.** Shall mean any self-propelled vehicle, truck, tractor, semi-trailer, or truck-full trailers used for the transportation of freight over public highways.

**PERSON.** Shall mean any individual, firm, co-partnership, corporation, company, association, joint stock association, and including any trustee, receiver, assignee or personal representative thereof.

**PROPELLANT-ACTUATED POWER DEVICES.** Shall mean any tool or special mechanized device or gas generator system which is actuated by a smokeless propellant or which releases and directs work through a smokeless propellant charge.

**PUBLIC CONVEYANCE.** Shall mean any railroad car, street car, ferry, cab, bus, airplane or other vehicle which is carrying passengers for hire.

**PYROTECHNICS.** Shall mean and include any combustible or explosive compositions or manufactured articles designed and prepared for the purpose of producing audible or visible effects which are commonly referred to as fireworks.

**RAILWAY.** Shall mean any steam, electric, diesel electric or other railroad or railway which carries passengers for hire on the particular line or branch in the vicinity where explosives are stored or where explosives manufacturing buildings are situated.

**SEMICONDUCTIVE HOSE.** A hose with an electrical resistance high enough to limit flow of stray electric currents to safe levels yet not so high as to prevent drainage of static electric charges to ground; hose of not more than 2 megohms resistance over its entire length and of not less than 5,000 ohms per foot meets the requirement.

**SINGULAR AND PLURAL.** Words used in the singular number shall include the plural and in the plural the singular.

**SMALL ARMS AMMUNITION.** Shall mean any shotgun, rifle, pistol or revolver cartridge, and cartridges for propellant-actuated power devices and industrial guns. Military-type ammunition containing explosive bursting charges, incendiary, tracer, spotting or pyrotechnic projectiles is excluded from this definition.

**SMALL ARMS AMMUNITION PRIMERS.** Small percussion-sensitive explosive charges, encased in a cup, used to ignite propellant powder.

**SMOKELESS PROPELLANTS.** Solid propellants, commonly called smokeless powders in the trade, used in small arms ammunition, cannon, rockets, propellant-actuated power devices, etc.

**SPECIAL INDUSTRIAL EXPLOSIVES DEVICES.** Shall mean explosive-actuated power devices and propellant-actuated power devices.

**SPECIAL INDUSTRIAL EXPLOSIVES MATERIALS.** Shall mean shaped materials and sheet forms and various other extrusions, pellets and packages of high explosives, which include dynamite, TNT,\* PETN,\* RDX,\* and other similar compounds used for

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\* Trinitrotoluene, pentaerythritoltetranitrate, cyclotrimethylenetrinitramine

high-energy-rate forming, expanding and shaping in metal fabrication, and for dismemberment and quick reduction of scrap metal.

**WATER GELS, OR SLURRY EXPLOSIVES.** These comprise a wide variety of materials used for blasting. They all contain substantial proportions of water and high proportions of ammonium nitrate, some of which is in solution in the water. Two broad classes of water gels are (a) those which are sensitized by a material classed as an explosive, such as TNT or smokeless powder, and (b) those which contain no ingredient classified as an explosive; these are sensitized with metals such as aluminum or with other fuels. Water gels may be premixed at an explosives plant or mixed at the site immediately before delivery into the bore hole.

## CHAPTER 2. GENERAL REQUIREMENTS

### 21. EXPLOSIVES MANUFACTURING

211. The manufacture of any explosive, including small arms ammunition, pyrotechnics, and blasting agent as herein defined, shall be prohibited within (name of city, county, state, or other area) unless such manufacture is authorized by the authority having jurisdiction and is conducted in accordance with recognized safe practices satisfactory to the authority having jurisdiction. This shall not apply to hand loading of small arms ammunition prepared for personal use and not for resale.

212. The manufacture of explosives or blasting agents within (name of city, county, state, or other area) shall be prohibited when such manufacture presents an undue hazard to life and property as determined by the authority having jurisdiction.

### 22. MISCELLANEOUS PROVISIONS

221. No person shall store, handle, or transport explosives or blasting agents when such storage, handling and transportation of explosives or blasting agents constitutes an undue hazard to life and property.

222. No person shall possess, keep, store, sell, or offer for sale, give away, use, transport, or dispose of in any manner any explosive or blasting agent except upon the approval of the authority having jurisdiction, provided however that this limitation shall not apply to small arms ammunition and components, cartridges for propellant-actuated power devices, and cartridges for industrial guns intended for personal use and not for resale.

223. No person shall sell or give away any explosive or blasting agent to any unauthorized person.

224. No person shall sell, display or expose for sale any explosive or blasting agent on any highway, street, sidewalk, public way, or public place.

225. Nothing in this Code shall be construed to prohibit the use of explosives in the form prescribed by the official United States Pharmacopeia.

226. Government and industrial laboratories, laboratories of technical institutes, colleges, universities and similar institutions may be permitted to keep, store and use explosives or blasting

agents when confined to the purpose of scientific or technical instruction or research, provided the storage and use of explosives or blasting agents is under experienced and competent supervision and not more than 15 pounds of explosives (exclusive of small arms ammunition, small arms ammunition primers and smokeless propellant) or blasting agents are kept on hand at any time in such laboratories. When additional quantities of explosives or blasting agents are required, application shall be made for a special ruling by the authority having jurisdiction.

227. The authority having jurisdiction may restrict the quantity of explosives or blasting agents that may be handled at any location within (name of city, county, state, or other area).

## CHAPTER 3. STORAGE OF EXPLOSIVES

### 31. GENERAL PROVISIONS

311. All Class A, Class B, Class C explosives, and special industrial explosives, and any newly developed and unclassified explosives, shall be kept in magazines which meet the requirements of this chapter. This shall not be construed as applying to the following:

1. Stocks of small arms ammunition, propellant-actuated power cartridges, small arms ammunition primers in quantities of less than 750,000, and smokeless propellant in quantities of less than 750 pounds (see Chapter 9).
2. Explosive-actuated power devices when in quantities of less than 50 pounds net weight of explosive.
3. Fuse lighters and fuse igniters.
4. Safety fuse (safety fuse does not include cordeau detonant fuse).

312. Blasting caps, electric blasting caps, detonating primers and primed cartridges shall not be stored in the same magazine with other explosives.

313. Ground around magazines shall slope away for drainage. The land surrounding magazines shall be kept clear of brush, dried grass, leaves, and other materials for a distance of at least 25 feet.

314. Magazines as required by this chapter shall be of two classes, namely, Class I magazines, and Class II magazines.

315. Class I magazines shall be required where the quantity of explosives stored is more than 50 pounds. Class II magazines may be used where the quantity of explosives stored is 50 pounds or less, except that the authority having jurisdiction may authorize the use of Class II magazines for the temporary storage at blasting sites of larger quantities of explosives.

316. Class I magazines shall be located away from inhabited buildings, passenger railways and public highways and from other magazines in conformity with the American Table of Distances for Storage of Explosives.\*

317. Except as provided in paragraph 318, Class II magazines shall be located in conformity with the American Table of Distances for Storage of Explosives, but may, subject to the approval of the authority having jurisdiction, be permitted in warehouses and in wholesale and retail establishments when located on a floor which has an entrance at outside grade level and the magazine is located not more than 10 feet from such an en-

\* See Appendix A11.

trance. Two Class II magazines may be located in the same building when one is used only for blasting caps in quantities not in excess of 5,000 caps and a distance of 10 feet is maintained between magazines. The location of Class II magazines within a building shall not be changed without the approval of the authority having jurisdiction.

318. When used for temporary storage at a site for blasting operations, Class II magazines shall be located away from neighboring inhabited buildings, railways, highways, and other magazines. A distance of at least one hundred and fifty (150) feet shall be maintained between Class II magazines and the work in progress when the quantity of explosives kept therein is in excess of 25 pounds, and at least 50 feet when the quantity of explosives is 25 pounds, or less. The authority having jurisdiction may require a greater separation between Class II magazines and the work in progress where conditions warrant.

### 32. CONSTRUCTION OF MAGAZINES — GENERAL

321. Magazines shall be constructed in conformity with the provisions of this chapter, or may be of substantially equivalent construction satisfactory to the authority having jurisdiction.

322. Magazines for the storage of explosives, other than black powder, Class B and Class C explosives shall be bullet-resistant, weather-resistant, fire-resistant, and ventilated sufficiently to protect the explosive in the specific locality. Magazines used only for storage of black powder, Class B and Class C explosives shall be weather-resistant, fire-resistant, and have ventilation. Magazines for storage of blasting and electric blasting caps shall be weather-resistant, fire-resistant, and ventilated.

323. Property upon which Class I magazines are located and property where Class II magazines are located outside of buildings shall be posted with signs reading "Explosives — Keep Off." Such signs shall be located so as to minimize the possibility of a bullet traveling in the direction of the magazine if anyone shoots at the sign.

324. Magazines requiring heat shall be heated by either hot water radiant heating within the magazine building; or air directed into the magazine building over either hot water or low pressure steam (15 psig) coils located outside the magazine building.

325. The magazine heating systems shall meet the following requirements:

a. The radiant heating coils within the building shall be installed in such a manner that the explosives or explosives con-



tainers cannot contact the coils and air is free to circulate between the coils and the explosives or explosives containers.

b. The heating ducts shall be installed in such a manner that the hot air discharge from the duct is not directed against the explosives or explosives containers.

c. The heating device used in connection with a magazine shall have controls which prevent the ambient building temperature from exceeding 130° F.

d. The electric fan or pump used in the heating system for a magazine shall be mounted outside and separate from the wall of the magazine and shall be grounded.

e. The electric fan motor and the controls for electrical heating device used in heating water or steam shall have overloads and disconnects, which comply with the local electrical codes and the National Electrical Code.\* All electrical switch gear shall be located a minimum distance of 25 feet from the magazine.

f. The heating source for water or steam shall be separated from the magazine by a distance of not less than 25 feet when electrical and 50 feet when fuel-fired. The area between the heating unit and the magazine shall be cleared of all combustible materials.

g. The storage of explosives and explosives containers in the magazine shall allow uniform air circulation so product temperature uniformity can be maintained.

326. When lights are necessary inside the magazine, electric safety flashlights or electric safety lanterns shall be used.

a. The authority having jurisdiction may authorize interior lighting of special design for magazines under continual surveillance, if adequate safety is assured.

### 33. CONSTRUCTION OF CLASS I MAGAZINES

331. Class I magazines shall be of masonry construction or of wood or of metal construction, or a combination of these types. Thickness of masonry units shall not be less than eight inches. Hollow masonry units used in construction required to be bullet-resistant shall have all hollow spaces filled with weak cement or well tamped sand. Wood constructed walls, required to be bullet-resistant, shall have at least a six-inch space between interior and exterior sheathing and the space between sheathing shall be filled with well tamped sand. Metal wall construction, when required to be bullet-resistant, shall be lined with brick at least

\* See Appendix A44.

four inches in thickness or shall have at least a 6-inch sand fill between interior and exterior walls.

332. Floors and roofs of masonry magazines may be of wood construction. Wood floors shall be tongue and grooved lumber having a nominal thickness of one inch.

333. Roofs required to be bullet-resistant shall be protected by a sand tray located at line of eaves and covering the entire area except that necessary for ventilation. Sand in the sand tray shall be maintained at a depth of not less than 4 inches.

334. All wood at the exterior of magazines, including eaves, shall be protected by being covered with black or galvanized steel or aluminum metal of thickness of not less than No. 26 gage. All nails exposed to the interior of magazines shall be well countersunk.

335. Foundations for magazines shall be of substantial construction and arranged to provide good cross ventilation.

336. Magazines shall be ventilated sufficiently to prevent dampness and heating of stored explosives. Ventilating openings shall be screened to prevent the entrance of sparks.

337. Openings to magazines shall be restricted to that necessary for the placement and removal of stocks of explosives. Doors for openings in magazines for Class A Explosives shall be bullet-resistant. Doors for magazines not required to be bullet-resistant shall be designed to prevent unauthorized entrance to the magazine. The authority having jurisdiction may accept doors for openings in magazines when in substantial conformity with the requirements if such construction is considered as sufficiently bullet-resistant.

338. Magazines shall be provided with substantial means for locking; locks shall be provided and magazine doors shall be kept locked, except during the time of placement and removal of stocks of explosives.

339. Provisions shall be made to prevent the piling of stocks of explosives directly against masonry walls, brick lined or sand filled metal walls and single thickness metal walls; such protection, however, shall not interfere with proper ventilation at interior of side and end walls.

#### 34. CONSTRUCTION OF CLASS II MAGAZINES

341. Class II magazines shall be of wood or metal construction, or a combination thereof.

342. Wood magazines of this class shall have sides, bottom and cover constructed of two-inch hardwood boards well braced at corners and protected by being entirely covered with sheet metal of not less than No. 20 gage. All nails exposed to interior of the magazine shall be well countersunk. All metal magazines of this class shall have sides, bottom and cover constructed of sheet metal, and shall be lined with  $\frac{3}{8}$ -inch plywood or the equivalent. Edges of metal covers shall overlap sides at least one inch.

343. Covers for both wood and metal constructed magazines of this class shall be provided with substantial strap hinges and shall be provided with substantial means for locking. Covers shall be kept locked except during the placement or removal of explosives.

344. Magazines of this class shall be painted red and shall bear lettering in white, on all sides and top, at least three inches high, "Explosives — Keep Fire Away." Class II magazines when located in warehouses, and in wholesale and retail establishments shall be provided with substantial wheels or casters to facilitate easy removal in the case of fire. Where necessary due to climatic conditions, Class II magazines shall be ventilated.

### 35. STORAGE WITHIN MAGAZINES

351. Packages of explosives shall be laid flat with top side up. Black powder when stored in magazines with other explosives shall be stored separately. Black powder stored in kegs shall be stored on ends, bungs down, or on side, seams down. Corresponding grades and brands shall be stored together in such a manner that brands and grade marks show. All stocks shall be stored so as to be easily counted and checked. Packages of explosives shall be piled in a stable manner. When any kind of explosive is removed from a magazine for use, the oldest explosive of that particular kind shall always be taken first.

352. Packages of explosives shall not be unpacked or repacked in a magazine nor within 50 feet of a magazine or in close proximity to other explosives. Tools used for opening packages of explosives shall be constructed of non-sparking materials, except that metal slitters may be used for opening fiberboard boxes. A wood wedge and a fiber, rubber or wood mallet shall be used for opening or closing wood packages of explosives. Opened packages of explosives shall be securely closed before being returned to a magazine.

353. Magazines shall not be used for the storage of any metal tools nor any commodity except explosives, but this restriction shall not apply to the storage of blasting agents and blasting supplies.

354. Magazine floors shall be regularly swept, kept clean, dry, free of grit, paper, empty used packages and rubbish. Brooms and other cleaning utensils shall not have any spark-producing metal parts. Sweepings from floors of magazines shall be properly disposed of. Magazine floors stained with nitroglycerin shall be cleaned according to instructions by the manufacturer.

355. When any explosive has deteriorated to an extent that it is in an unstable or dangerous condition, or if nitroglycerin leaks from any explosive, then the person in possession of such explosive shall immediately report the fact to the authority having jurisdiction and upon his authorization shall proceed to destroy such explosive in accordance with the instructions of the manufacturer. Only experienced persons shall do the work of destroying explosives.

356. When magazines need inside repairs, all explosives shall be removed therefrom and the floors cleaned. In making outside repairs, if there is a possibility of causing sparks or fire the explosives shall be removed from the magazine. Explosives removed from a magazine under repair shall either be placed in another magazine or placed a safe distance from the magazine where they shall be properly guarded and protected until repairs have been completed, when they shall be returned to the magazine.

357. Smoking, matches, open flames, spark-producing devices and firearms (except firearms carried by guards when authorized by the authority having jurisdiction) shall not be permitted inside of or within 50 feet of magazines. The land surrounding a magazine shall be kept clear of all combustible materials for a distance of at least 25 feet. Combustible materials shall not be stored within 50 feet of magazines.

358. Magazines shall be in the charge of a competent person at all times who shall be at least 21 years of age, and who shall be held responsible for the enforcement of all safety precautions.

359. Explosives recovered from blasting misfires shall be placed in a separate magazine until competent personnel has determined from the manufacturer the method of disposal. Caps recovered from blasting misfires shall not be reused. Such explosives and caps shall then be disposed of in the manner recommended.

## CHAPTER 4. TRANSPORTATION OF EXPLOSIVES

### 41. GENERAL PROVISIONS

411. In addition to all other applicable requirements set forth in this Code, the transportation of explosives over all highways shall be in accordance with U. S. Department of Transportation regulations. U. S. Department of Transportation regulations and changes lawfully on file and approved by the U. S. Department of Transportation are hereby adopted as a part of this Code.

412. Explosives shall not be transported through any prohibited vehicular tunnel, or subway, or over any prohibited bridge, roadway, or elevated highway.

413. No person shall smoke, carry matches or any other flame-producing device, or carry any firearms or loaded cartridges while in or near a motor vehicle transporting explosives; or drive, load or unload such vehicle in a careless or reckless manner.

414. Explosives shall not be carried or transported in or upon a public conveyance or vehicle carrying passengers for hire.

415. Explosives may be loaded into and transported in the following:

1. Truck
2. Truck with semitrailer
3. Truck with full trailer
4. Truck tractor with semitrailer
5. Truck tractor with semitrailer and full trailer

416. Explosives shall not be transferred from one vehicle to another within the (name of city, county, state, or other area) without informing the fire and police departments thereof. In the event of breakdown or collision the local fire and police departments shall be promptly notified to help safeguard such emergencies. Explosives shall be transferred from the disabled vehicle to another only when proper and qualified supervision is provided.

417. Blasting caps, or electric blasting caps, shall not be transported over the highways on the same vehicles with other explosives, except by permit from the authority having jurisdiction.

418. This chapter does not apply to the transportation of small arms ammunition and components (see Chapter 9).

**42. TRANSPORTATION VEHICLES**

421. Vehicles used for transporting explosives shall be strong enough to carry the load without difficulty and be in good mechanical condition. If vehicles do not have a closed body, the body shall be covered with a flameproof and moistureproof tarpaulin or other effective protection against moisture and sparks. All vehicles used for the transportation of explosives shall have tight floors and any exposed spark-producing metal on the inside of the body shall be covered with wood or other non-sparking materials to prevent contact with packages of explosives. Packages of explosives shall not be loaded above the sides of an open-body vehicle.

422. Every vehicle used for transporting explosives and certain oxidizing materials shall be marked as follows:

a. Exterior markings or placards required on applicable vehicles shall be as follows for the various classes of commodities:

Commodity	Type of Marking or Placard
Explosives, Class A, any quantity or a combination of Class A and Class B explosives.	EXPLOSIVES A (Red letters on white background)
Explosives, Class B, any quantity.	EXPLOSIVES B (Red letters on white background)
Oxidizing material (blasting agents, ammonium nitrate, etc.), 1,000 pounds or more gross weight.	OXIDIZERS (Yellow letters on black background)

b. Each marking or placard shall consist of letters not less than four inches high, in the color specified, using approximately a  $\frac{5}{8}$ -inch stroke. The placard must be larger than the lettering required thereon by at least one inch at the top and bottom sides. Such marking or placard described in paragraph a shall be contained in an area on the vehicle which has no other marking, lettering, or graphic display, for at least three inches in each direction.

c. Such markings or placards shall be displayed at the front, rear, and on each side of the motor vehicle or trailer, or other cargo carrying body while it contains explosives or other dangerous articles of such type and in such quantity as specified in paragraph a. The front marking or placard may be displayed on the front of either the truck, truck body, truck tractor or the trailer.

d. Any motor vehicle, trailer or other cargo-carrying body containing more than one kind of explosive as well as an oxidizing material requiring a placard under the provisions of paragraph a, the aggregate gross weight of which totals 1,000 pounds or more, shall be marked or placarded "Dangerous" as well as "Explosive A" or "Explosive B" as appropriate. If explosives Class A and explosives Class B are loaded on the same vehicle, the "Explosives B" marking need not be displayed.

e. In any combination of two or more vehicles containing explosives or other dangerous articles each vehicle shall be marked or placarded as to its contents and in accordance with paragraphs a and c of this section.

423. Each motor vehicle used for transporting explosives shall be equipped with a minimum of two extinguishers, each having a rating of at least 10-BC.

a. Only extinguishers listed or approved by Underwriters' Laboratories, Inc., Factory Mutual Laboratories, the Underwriters' Laboratories of Canada or by some other nationally recognized fire equipment testing laboratory, shall be deemed suitable for use on explosives-carrying vehicles.

b. Extinguishers shall be filled and ready for immediate use and located near the driver's seat. Extinguishers shall be examined periodically by a competent person.

424. A motor vehicle used for transporting explosives shall be given the following inspection to determine that it is in proper condition for safe transportation of explosives:

1. Fire extinguishers shall be filled and in working order.
2. All electrical wiring shall be completely protected and securely fastened to prevent short-circuiting.
3. Chassis, motor, pan and underside of body shall be reasonably clean and free of excess oil and grease.
4. Fuel tank and feed line shall be secure and have no leaks.
5. Brakes, lights, horn, windshield wipers, and steering apparatus shall function properly.
6. Tires shall be checked for proper inflation and defects.
7. The vehicle shall be in proper condition in every other respect and acceptable for handling explosives.

### 43. OPERATION OF TRANSPORTATION VEHICLES

431. Vehicles transporting explosives shall only be driven by and be in the charge of a driver who is physically fit, careful, capable, reliable, able to read and write the English language, and not addicted to the use, or under the influence of intoxicants, narcotics, or other dangerous drugs, and not less than 21 years of age. He shall be familiar with the traffic regulations, state laws, and the provisions of this Code.

432. Except under emergency conditions, no vehicle transporting explosives shall be parked before reaching its destination, even though attended, on any public street adjacent to or in proximity to any bridge, tunnel, dwelling, building, or place where people work, congregate, or assemble.

433. Every motor vehicle transporting any quantity of Class A or Class B explosives shall, at all times, be attended by a driver or other attendant of the motor carrier. This attendant shall have been made aware of the class of the explosive material in the vehicle and of its inherent dangers, and shall have been instructed in the measures and procedures to be followed in order to protect the public from those dangers. He shall have been made familiar with the vehicle he is assigned to attend, and shall be trained, supplied with the necessary means, and authorized to move the vehicle when required.

a. For the purpose of this section, a motor vehicle shall be deemed "attended" only when the driver or other attendant is physically on or in the vehicle, or has the vehicle within his field of vision and can reach it quickly and without any kind of interference; "attended" also means that the driver or attendant is awake, alert and not engaged in other duties or activities which may divert his attention from the vehicle, except for necessary communication with public officers, or representatives of the carrier, shipper or consignee, or except for necessary absence from the vehicle to obtain food or to provide for his physical comfort.

b. However, an explosive-laden vehicle may be left unattended if parked within a securely fenced or walled area with all gates or entrances locked where parking of such vehicle is otherwise permissible, or at a magazine site established solely for the purpose of storing explosives.

434. No spark-producing metal, spark-producing metal tools, oils, matches, firearms, electric storage batteries, flammable sub-



stances, acids, oxidizing materials, or corrosive compounds shall be carried in the body of any motor truck and/or vehicle transporting explosives, unless the loading of such dangerous articles and the explosives comply with U. S. Department of Transportation regulations.

435. Vehicles transporting explosives shall avoid congested areas and heavy traffic. Where routes through congested areas have been designated by local authorities such routes shall be followed.

436. Delivery shall only be made to authorized persons and into authorized magazines or approved temporary storage or handling areas.

## **CHAPTER 5. USE OF EXPLOSIVES AND BLASTING AGENTS**

### **51. GENERAL PROVISIONS**

511. The handling of explosives may be performed by the person holding a permit to use explosives or by other employees under his direct supervision provided that such employees are at least 21 years of age.

512. While explosives are being handled or used, smoking shall not be permitted and no one near the explosives shall possess matches, open light or other fire or flame. No person shall handle explosives while under the influence of intoxicating liquors, narcotics, or other dangerous drugs.

513. Original containers or Class II magazines shall be used for taking detonators and other explosives from storage magazines to the blasting area.

514. When blasting is done in congested areas or in close proximity to a structure, railway, or highway or any other installation that may be damaged, the blast shall be covered before firing with a mat constructed so that it is capable of preventing fragments from being thrown.

515. Persons authorized to prepare explosive charges or conduct blasting operations shall use every reasonable precaution, including but not limited to warning signals, flags, barricades, or woven wire mats to insure the safety of the general public and workmen.

516. Blasting operations, except by special permission of the authority having jurisdiction, shall be conducted during daylight hours.

517. Whenever blasting is being conducted in the vicinity of gas, electric, water, fire alarm, telephone, telegraph and steam utilities, the blaster shall notify the appropriate representatives of such utilities at least 24 hours in advance of blasting, specifying the location and intended time of such blasting. Verbal notice shall be confirmed with written notice. In an emergency this time limit may be waived by the local authority issuing the original permit.

518. Due precautions shall be taken to prevent accidental discharge of electric blasting caps from current induced by radar, radio transmitters, lightning, adjacent power lines, dust storms,

or other sources of extraneous electricity. These precautions shall include:

1. The suspension of all blasting operations and removal of persons from the blasting area during the approach and progress of an electric storm.
2. The posting of signs warning against the use of mobile radio transmitters on all roads within 350 feet of the blasting operations.
3. Compliance with the latest recommendations of the Institute of Makers of Explosives with regard to blasting in the vicinity of radio transmitters or power lines.

## 52. STORAGE AT USE SITES

521. Empty boxes and paper and fiber packing materials which have previously contained high explosives shall not be used again for any purpose, but shall be destroyed by burning at an approved isolated location out of doors, and no person shall be nearer than 100 feet after the burning has started.

522. Containers of explosives shall not be opened in any magazine or within 50 feet of any magazine. In opening kegs or wooden cases, no sparking metal tools shall be used; wooden wedges and either wood, fiber or rubber mallets shall be used. Non-sparking metallic slitters may be used for opening fiber-board cases.

523. Explosives or blasting equipment that are obviously deteriorated or damaged shall not be used.

524. No explosives shall be abandoned.

## 53. LOADING OF EXPLOSIVES IN BLAST HOLES

531. All drill holes shall be sufficiently large to admit freely the insertion of the cartridges of explosives.

532. Tamping shall be done only with wood rods without exposed metal parts, but non-sparking metal connectors may be used for jointed poles. Plastic tamping poles may be used, provided they have been approved by the authority having jurisdiction. Violent tamping shall be avoided. Primed cartridges shall not be tamped.

533. When loading blasting agents pneumatically over electric blasting caps, semiconductive delivery hose shall be used and the equipment shall be bonded and grounded (*see Section 734*).

534. No holes shall be loaded except those to be fired in the next round of blasting. After loading, all remaining explosives

shall be immediately returned to an authorized magazine. (See Section 355 for requirements pertaining to deteriorating explosives.)

535. Drilling shall not be started until all remaining butts of old holes are examined with a wooden stick for unexploded charges, and if any are found, they shall be refired before work proceeds.

536. No person shall be allowed to deepen drill holes which have contained explosives.

537. After loading for a blast is completed, all excess blasting caps or electric blasting caps and other explosives shall immediately be returned to their separate storage magazines.

#### 54. INITIATION OF EXPLOSIVE CHARGES

541. Only electric blasting caps shall be used for blasting operations in congested districts, or on highways, or adjacent to highways open to traffic, except where sources of extraneous electricity make such use dangerous.

542. When fuse is used, the blasting cap shall be securely attached to the safety fuse with a standard ring type cap crimper. All primers shall be assembled at least fifty feet from any magazine.

543. Primers shall be made up only as required for each round of blasting.

544. No blasting cap shall be inserted in the explosives without first making a hole in the cartridge for the cap with a wooden punch of proper size or standard cap crimper.

545. Explosives shall not be extracted from a hole that has once been charged or has misfired unless it is impossible to detonate the unexploded charge by insertion of a fresh additional primer.

546. If there are any misfires while using cap and fuse, all persons shall remain away from the charge for at least one hour. If electric blasting caps are used and a misfire occurs, this waiting period may be reduced to thirty minutes. Misfires shall be handled under the direction of the person in charge of the blasting and all wires shall be carefully traced and search made for unexploded charges.

547. Blasters, when testing circuits to charged holes, shall use only blasting galvanometers designed for this purpose.

548. Only the man making leading wire connections in electrical firing shall fire the shot. All connections should be made from bore hole back to the source of firing current, and the leading wires shall remain shorted and not be connected to the blasting machine or other source of current until the charge is to be fired.

#### 55. WARNING REQUIRED

551. Before a blast is fired, a loud warning signal shall be given by the person in charge, who has made certain that all surplus explosives are in a safe place, all persons and vehicles are at a safe distance or under sufficient cover, and that an adequate warning has been given.

## CHAPTER 6. EXPLOSIVES AT PIERS, RAILWAY STATIONS AND CARS OR VESSELS NOT OTHERWISE SPECIFIED IN THIS CODE

### 61. GENERAL PROVISIONS

611. Except in an emergency and with permission of the local authority having jurisdiction, no person shall have or keep explosives in a railway car unless said car and contents and methods of loading are in accordance with the U. S. Department of Transportation Regulations for the Transportation of Explosives.

612. No person shall deliver any explosive to any carrier unless such explosive conforms in all respects, including marking and packing, to the U. S. Department of Transportation Regulations for the Transportation of Explosives.

613. Every railway car containing explosives which has reached its destination, or is stopped in transit so as no longer to be in interstate commerce, shall have attached to both sides and ends of the car, cards with the words "Explosives — Handle Carefully — Keep Fire Away" in red letters at least one and one-half inches high on a white background.

614. Any explosives at a railway facility, truck terminal, pier, wharf, harbor facility, or airport terminal, within the jurisdiction, whether for delivery to a consignee, or forwarded to some other destination, shall be kept in a safe place, isolated as far as practicable and in such manner that they can be easily and quickly removed.

615. Explosives shall not be delivered to or received from any railway station, truck terminal, pier, wharf, harbor facility, or airport terminal within the jurisdiction between the hours of sunset and sunrise, except by special permit from the authority having jurisdiction.

### 62. NOTIFICATIONS

621. When explosives are brought into the locality under the jurisdiction of this Code, by any means of transportation, for delivery to an intermediate receiver, consignee's agent or consignee, or to be forwarded to some other destination, the carrier performing the shipment shall immediately notify the consignee, fire chief, port authorities, and such other authorities as may be designated, of the arrival of the explosives, and if said con-

signee does not receive and remove the said explosives from the possession of the carrier within 48 hours (Sundays and holidays excluded), after such notification, then the railway, trucking firm, vessel agent, or airline shall remove the said explosives from the jurisdiction or to a properly permitted magazine or make a report to the authority having jurisdiction, who shall see that the said explosives are moved to a place of safety.

622. Any person having been notified, as consignee, of a shipment of explosives being in the hands of any carrier, and within the jurisdiction, shall remove the said explosives within 48 hours, Sundays and holidays excluded, after receiving such notification to some place meeting the requirements of this Code.

### 63. DESIGNATION OF FACILITIES

631. The local authority having jurisdiction has the authority to and may designate the location for, and limit the quantity of, explosives which may be loaded, unloaded, reloaded, or temporarily retained at any facility within the jurisdiction.

## CHAPTER 7. BLASTING AGENTS

### 71. GENERAL

711. Unless otherwise set forth in this Chapter, blasting agents, excluding water gels, shall be transported, stored, and used in the same manner as explosives. Water gels are covered in Chapter 8.

### 72. FIXED LOCATION MIXING

721. Buildings or other facilities used for mixing blasting agents shall be located, with respect to inhabited buildings, passenger railroads and public highways, in accordance with the American Table of Distances.\*

a. In determining the distances separating highways, railroads and inhabited buildings from potential explosions (as prescribed in the American Table of Distances), the sum of all masses which may propagate (i.e., lie at distances less than prescribed in Appendix A12) from *either* individual *or* combined donor masses are included. However, when the ammonium nitrate must be included, only 50 percent of its weight shall be used because of its reduced blast effects.

722. Buildings used for the mixing of blasting agents shall conform to the requirements of this section, unless otherwise specifically approved by the authority having jurisdiction.

a. Buildings shall be of noncombustible construction or sheet metal on wood studs.

b. Floors in a mixing plant shall be of concrete or of other nonabsorbent materials.

c. All fuel oil storage facilities shall be separated from the mixing plant and located in such a manner that in case of tank rupture, the oil will drain away from the mixing plant building.

d. The building shall be well ventilated.

e. Heating units which do not depend on combustion processes, when properly designed and located, may be used in the building. All direct sources of heat shall be provided exclusively from units located outside the mixing building.

f. All internal-combustion engines used for electric power generation shall be located outside the mixing plant building, or shall be properly ventilated and isolated by a firewall. The ex-

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\* See Appendix A11.



haust systems on all such engines shall be located so any spark emission cannot be a hazard to any materials in or adjacent to the plant.

723. Equipment used for mixing blasting agents shall conform to the requirements of this section.

a. The design of the mixer shall minimize the possibility of frictional heating, compaction, and especially confinement. All bearings and drive assemblies shall be mounted outside the mixer and protected against the accumulation of dust. All surfaces shall be accessible for cleaning.

b. Mixing and packaging equipment shall be constructed of materials compatible with the fuel-ammonium nitrate composition.

c. Suitable means shall be provided to prevent the flow of fuel oil to the mixer in case of fire. In gravity flow systems an automatic spring-loaded shutoff valve with fusible link shall be installed.

724. The provisions of this Section shall be considered when determining blasting agent compositions.

a. The sensitivity of the blasting agent shall be determined by means of a No. 8 test blasting cap at regular intervals and after every change in formulation, or as may be requested by the authority having jurisdiction.

b. Oxidizers of small particle size, such as crushed ammonium nitrate prills or fines, may be more sensitive than coarser products and shall, therefore, be handled with greater care.

c. No hydrocarbon liquid fuel with flash point lower than that of No. 2 diesel fuel oil (125° F. minimum or legal) shall be used.

d. Crude oil and crankcase oil shall not be used because they may contain light ends that offer increased vapor-explosion hazards or gritty particles that tend to sensitize the resulting blasting agent.

e. Metal powders such as aluminium shall be kept dry and shall be stored in containers or bins which are moisture-resistant or weather-tight. Solid fuels shall be used in such manner as to minimize dust explosion hazards.

f. Peroxides and chlorates shall not be used.

g. The requirements of Paragraphs c, d and f do not apply to compositions made under the supervision of qualified personnel capable of determining the over-all hazards of the resulting product in its manufacture, storage, transportation and use.

725. All electrical switches, controls, motors, and lights located in the mixing room shall conform to the requirements in the National Electrical Code\* for Class II, Division 2 locations; otherwise they shall be located outside the mixing room. The frame of the mixer and all other equipment that may be used shall be electrically bonded and be provided with a continuous path to the ground.

726. Safety precautions at mixing plants shall include the requirements of this Section.

a. Floors shall be constructed so as to eliminate floor drains and piping into which molten materials could flow and be confined in case of fire.

b. The floors and equipment of the mixing and packaging room shall be cleaned regularly and thoroughly to prevent accumulation of oxidizers or fuels and other sensitizers.

c. The entire mixing and packaging plant shall be cleaned regularly and thoroughly to prevent excessive accumulation of dust.

d. Smoking, matches, open flames, spark-producing devices and firearms (except firearms carried by guards when authorized by the authority having jurisdiction) shall not be permitted inside of or within 50 feet of any building or facility used for the mixing of blasting agents.

e. The land surrounding the mixing plant shall be kept clear of brush, dried grass, leaves and other materials for a distance of at least 25 feet.

f. Empty ammonium nitrate bags shall be disposed of daily in a safe manner.

g. No welding shall be permitted or open flames used in or around the mixing or storage area of the plant unless the equipment or area has been completely washed down and all oxidizer material removed.

h. Before welding or repairs to hollow shafts, all oxidizer material shall be removed from the outside and inside of the shaft and the shaft vented with a minimum 1/2-inch diameter opening.

i. Explosives shall not be permitted inside of or within 50 feet of any building or facility used for the mixing of blasting agents.

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\* See Appendix A44.

### 73. BULK DELIVERY AND MIXING VEHICLES

731. The provisions of Article 73 shall apply to off-highway private operations as well as to all public highway movements.

732. A bulk vehicle body for delivering and mixing blasting agents shall conform to the construction requirements of this section.

a. The body shall be constructed of noncombustible materials.

b. Vehicles used to transport bulk premixed blasting agents on public highways shall have closed bodies.

c. All moving parts of the mixing system shall be designed as to prevent a heat buildup. Shafts or axles which contact the product shall have outboard bearings with one-inch minimum clearance between the bearings and the outside of the product container. Particular attention shall be given to the clearances on all moving parts.

d. A bulk delivery vehicle shall be strong enough to carry the load without difficulty and be in good mechanical condition.

733. Operation of bulk delivery vehicles shall conform to the requirements of this Section.

a. The hauling of ammonium nitrate prills or blasting agent over public highways is subject to existing local, state and federal regulations. These include the placarding requirements as specified by DOT regulations.

b. The operator shall be trained in the safe operation of the vehicle together with its mixing, conveying, and related equipment. He shall be familiar with the commodities being delivered and the general procedure for handling emergency situations.

c. The hauling of either blasting caps or other explosives, but not both, shall be permitted on bulk trucks provided that a special wood or nonferrous-lined container is installed for the explosives. Such blasting caps or other explosives shall be in DOT-specified shipping containers.

d. No person shall smoke, carry matches or any flame-producing device, or carry any firearms while in or about bulk vehicles effecting the mixing transfer or down-the-hole loading of blasting agents at or near the blasting site.

e. Caution shall be exercised in the movement of the vehicle in the blasting area to avoid driving the vehicle over or dragging

hoses over firing lines, cap wires, or explosive materials. The driver in moving the vehicle shall obtain the assistance of a second person to guide his movements.

- f. No in-transit mixing of materials shall be performed.

734. Pneumatic loading from bulk delivery vehicles into blast holes primed with electric blasting caps or other static-sensitive systems shall conform to the requirements of this section.

- a. A positive grounding device shall be used to prevent the accumulation of static electricity.

- b. A discharge hose shall be used that has a resistance range that will prevent conducting stray currents, but that is conductive enough to bleed off static buildup.

- c. A qualified person shall evaluate all systems to determine if they will adequately dissipate static under potential field conditions.

735. Repairs to bulk delivery vehicles shall conform to the requirements of this section.

- a. No welding or open flames shall be used on or around any part of the delivery equipment unless it has been completely washed down and all oxidizer material removed.

- b. Before welding or making repairs to hollow shafts, the shaft shall be thoroughly cleaned inside and out and vented with a minimum 1/2-inch diameter opening.

#### 74. BULK STORAGE BINS

741. The bin, including supports, shall be constructed of compatible materials\*, waterproof, and adequately supported and braced to withstand the combination of all loads including impact forces arising from product movement within the bin and accidental vehicle contact with the support legs.

742. The bin discharge gate shall be designed to provide a closure tight enough to prevent leakage of the stored product. Provision shall also be made so that the gate can be locked.

743. Bin loading manways or access hatches shall be hinged or otherwise attached to the bin and be designed to permit locking.

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\* See Section 422 of the Code for the Storage of Ammonium Nitrate (See Appendix A47) for guidance on choosing compatible materials.

744. Any electrically driven conveyors for loading or unloading bins shall conform to the requirements of the National Electrical Code\*. They shall be designed to minimize damage from corrosion.

745. Bins containing blasting agent shall be located, with respect to inhabited buildings, passenger railroads and public highways, in accordance with the American Table of Distances†, and separation from other blasting agent storage and explosives storage shall be in conformity with the Table of Recommended Separation Distances of Ammonium Nitrate and Blasting Agents from Explosives or Blasting Agents.\*\*

746. Bins containing ammonium nitrate shall be separated from blasting agent storage and explosives storage in conformity with the Table of Recommended Separation Distances of Ammonium Nitrate and Blasting Agents from Explosives or Blasting Agents.\*\*

747. Good housekeeping practices shall be maintained around any bin containing ammonium nitrate or blasting agent. This includes keeping weeds and other combustible materials cleared within 25 feet of such bin. Accumulation of spilled product on the ground shall be prevented.

## 75. STORAGE OF BLASTING AGENTS AND SUPPLIES

751. Blasting agents and oxidizers used for mixing of blasting agents shall be stored in the manner set forth in this Section.

a. Blasting agents or ammonium nitrate, when stored in conjunction with explosives, shall be stored in the manner set forth in Chapter 3 for explosives. The mass of blasting agents and one-half the mass of ammonium nitrate shall be included when computing the total quantity of explosives for determining distance requirements.

b. Blasting agents, when stored entirely separate from explosives, may be stored in the manner set forth in Chapter 3 or in one-story warehouses (without basements) which shall be:

1. Noncombustible or fire-resistive;
2. Constructed so as to eliminate open floor drains and piping into which molten materials could flow and be confined in case of fire;

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\* See Appendix A44.

\*\* See Appendix A12.

† See Appendix A11.

3. Weather resistant;
4. Well ventilated; and
5. Equipped with a strong door kept securely locked except when open for business.

c. Semi-trailer or full-trailer vans used for highway or on-site transportation of the blasting agents are satisfactory for temporarily storing these materials, provided they are located in accordance with the American Table of Distances\*\* with respect to inhabited buildings, passenger railways, and public highways and according to the Table of Recommended Separation Distances of Ammonium Nitrate and Blasting Agents from Explosives or Blasting Agents\* with respect to one another. Trailers shall be provided with substantial means for locking, and the trailer doors shall be kept locked, except during the time of placement and removal of stocks of blasting agents.

752. Warehouses used for the storage of blasting agents separate from explosives shall be located as set forth in this Section.

a. Warehouses used for the storage of blasting agents shall be located in accordance with the provisions of the American Table of Distances\*\* with respect to inhabited buildings, passenger railways and public highways, and according to the Table of Recommended Separation Distances of Ammonium Nitrate and Blasting Agents from Explosives or Blasting Agents\* with respect to one another.

b. If both blasting agents and ammonium nitrate are handled or stored within the distance limitations prescribed through Section 721, one-half the mass of the ammonium nitrate shall be added to the mass of the blasting agent when computing the total quantity of explosives for determining the proper distance for compliance with the American Table of Distances.\*\*

753. Smoking, matches, open flames, spark producing devices and firearms shall be prohibited inside of or within 50 feet of any warehouse used for the storage of blasting agents. Combustible materials shall not be stored within 50 feet of warehouses used for the storage of blasting agents.

754. The interior of warehouses used for the storage of blasting agents shall be kept clean and free from debris and empty containers. Spilled materials shall be cleaned up promptly and safely removed. Combustible materials, flammable liquids, cor-

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\* See Appendix A12.

\*\* See Appendix A11.

rosive acids, chlorates or nitrites shall not be stored in any warehouse used for blasting agents unless separated therefrom by a fire resistive separation of not less than one hour resistance. The provisions of this Section shall not prohibit the storage of blasting agents together with non-explosive blasting supplies.

755. Piles of ammonium nitrate and warehouses containing ammonium nitrate shall be adequately separated from readily combustible fuels.

756. Caked oxidizers, either in bags or in bulk, shall not be loosened by blasting.

757. Every warehouse used for the storage of blasting agents shall be under the supervision of a competent person who shall be not less than 21 years of age.

758. The local authority having jurisdiction has the authority to and may designate the location for, and limit the quantity of blasting agents which may be loaded, unloaded, reloaded, or temporarily retained at any facility within the jurisdiction.

#### 76. TRANSPORTATION OF PACKAGED BLASTING AGENTS

761. When blasting agents are transported in the same vehicle with explosives, all of the requirements of Chapter 4 shall be complied with.

762. Vehicles transporting blasting agents shall only be driven by and be in charge of a driver at least twenty-one (21) years of age who is capable, careful, reliable and in possession of a valid motor vehicle operator's license. Such a person shall also be familiar with the State vehicle and traffic laws.

763. No matches, firearms, acids or other corrosive liquids shall be carried in the bed or body of any vehicle containing blasting agents.

764. No person shall be permitted to ride upon, drive, load or unload a vehicle containing blasting agents while smoking or under the influence of intoxicants, narcotics, or other dangerous drugs.

765. It is prohibited for any person to transport or carry any blasting agents upon any public vehicle carrying passengers for hire.

766. Vehicles transporting blasting agents shall be in safe operating condition at all times.

767. When offering blasting agents for transportation on public highways the packaging, marking and labeling of containers of blasting agents shall comply with the requirements of DOT.\*

768. Vehicles used for transporting blasting agents on public highways shall be placarded in accordance with DOT regulations.\*

#### 77. USE OF BLASTING AGENTS

771. Persons using blasting agents shall comply with all of the applicable provisions of Chapter 5 of this Code.

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\* See Appendix A32.



## CHAPTER 8. WATER GEL (Slurry) EXPLOSIVES and BLASTING AGENTS

### 81. GENERAL PROVISIONS

811. Unless otherwise set forth in this Chapter, water gels shall be transported, stored and used in the same manner as explosives or blasting agents in accordance with the classification of the product.

### 82. TYPES AND CLASSIFICATIONS

821. Water gels containing a substance in itself classified as an explosive shall be classified as an explosive and manufactured, transported, stored and used as specified for "explosives" in this Code, except as noted in Section 824.

822. Water gels containing no substance in itself classified as an explosive and which are cap-sensitive as defined in Section 121 under Blasting Agent shall be classified as an explosive and manufactured, transported, stored and used as specified for "explosives" in this Code.

823. Water gels containing no substance in itself classified as an explosive and which are not cap-sensitive as defined in Section 121 under Blasting Agent shall be classified as blasting agents and manufactured, transported, stored and used as specified for "blasting agents" in this Code.

824. When tests on specific formulations of water gels result in Department of Transportation classification as a Class B explosive, bullet-resistant magazines are not required (see Section 322).

### 83. FIXED LOCATION MIXING

831. Buildings or other facilities used for mixing water gels shall be located with respect to inhabited buildings, passenger railroads and public highways, in accordance with the American Table of Distances.\*

a. In determining the distances separating highways, railroads, and inhabited buildings from potential explosions (as prescribed in the American Table of Distances), the sum of all masses that may propagate (i.e., lie at distances less than prescribed in Appendix A12) from *either* individual *or* combined donor masses are

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\* See Appendix A11.

included. However, when the ammonium nitrate must be included, only 50 percent of its weight shall be used because of its reduced blast effects.

832. Buildings used for the mixing of water gels shall conform to the requirements of this Section, unless otherwise specifically approved by the authority having jurisdiction.

a. Buildings shall be of noncombustible construction or sheet metal on wood studs.

b. Floors in a mixing plant shall be of concrete or of other nonabsorbent materials.

c. Where fuel oil is used all fuel oil storage facilities shall be separated from the mixing plant and located in such a manner that in case of tank rupture, the oil will drain away from the mixing plant building.

d. The building shall be well ventilated.

e. Heating units that do not depend on combustion processes, when properly designed and located, may be used in the building. All direct sources of heat shall be provided exclusively from units located outside of the mixing building.

f. All internal-combustion engines used for electric power generation shall be located outside the mixing plant building, or shall be properly ventilated and isolated by a fire wall. The exhaust systems on all such engines shall be located so any spark emission cannot be a hazard to any materials in or adjacent to the plant.

833. Ingredients of water gels shall conform to the requirements of this Section.

a. Ingredients in themselves classified as Class A or Class B explosives shall be stored in conformity with Chapter 3, Storage of Explosives.

b. Nitrate-water solutions may be stored in tank cars, tank trucks, or fixed tanks without quantity or distance limitations. Spills or leaks which may contaminate combustible materials shall be cleaned up immediately.

c. Metal powders such as aluminum shall be kept dry and shall be stored in containers or bins which are moisture-resistant or weather-tight. Solid fuels shall be used in such manner as to minimize dust explosion hazards.

d. Ingredients shall not be stored with incompatible materials.

e. Peroxides and chlorates shall not be used.

834. Mixing equipment shall comply with the requirements of this Section.

a. The design of the processing equipment, including mixing and conveying equipment, shall be compatible with the relative sensitivity of the materials being handled. Equipment shall be designed to minimize the possibility of frictional heating, compaction, overloading, and confinement.

b. Both equipment and handling procedures shall be designed to prevent the introduction of foreign objects or materials.

c. Mixers, pumps, valves and related equipment shall be designed to permit regular and periodic flushing, cleaning, dismantling and inspection.

d. All electrical equipment including wiring, switches, controls, motors and lights, shall conform to the requirements of the National Electrical Code, NFPA No. 70.\*

e. All electric motors and generators shall be provided with suitable overload protection devices. Electrical generators, motors, proportioning devices, and all other electrical enclosures shall be electrically bonded. The grounding conductor to all such electrical equipment shall be effectively bonded to the service-entrance ground connection and to all equipment ground connections in a manner so as to provide a continuous path to ground.

835. Mixing facilities shall comply with the fire prevention requirements of this Section.

a. The mixing, loading and ingredient transfer areas where residues or spilled materials may accumulate shall be cleaned periodically. A cleaning and collection system for dangerous residues shall be provided.

b. A daily visual inspection shall be made of the mixing, conveying and electrical equipment to establish that such equipment is in good operating condition. A program of systematic maintenance shall be conducted on regular schedule.

c. Heaters which are not dependent on the combustion process within the heating unit may be used within the confines of processing buildings or compartments, if provided with temperature and safety controls and located away from combustible materials and the finished product.

#### 84. BULK DELIVERY AND MIXING VEHICLES

841. The design of vehicles shall comply with the requirements of this Section.

a. Vehicles used over public highways for the bulk transportation of water gels or of ingredients classified as dangerous commodities, shall meet the requirements of the Department of

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\* See Appendix A44.

Transportation and shall meet the requirements of Chapter 4 and of Article 76 (Chapter 7) of this Code.

b. When electric power is supplied by a self-contained motor generator located on the vehicle the generator shall be at a point separate from where the water gel is discharged.

c. The design of processing equipment and general requirements shall conform to Section 833 and Section 834.

d. A positive action parking brake which will set the wheel brakes on at least one axle shall be provided on vehicles when equipped with air brakes and shall be used during bulk delivery operations. Wheel chocks shall supplement parking brakes whenever conditions may require.

842. Operation of bulk delivery and mixing vehicles shall comply with the requirements of this section.

a. The hauling of water gel explosives or blasting agent over public highways is subject to existing local, state and federal regulations. These include the placarding requirements as specified by DOT regulations.

b. The operator shall be trained in the safe operation of the vehicle together with its mixing, conveying, and related equipment. He shall be familiar with the commodities being delivered and the general procedure for handling emergency situations.

c. The hauling of either blasting caps or other explosives, but not both, shall be permitted on bulk trucks provided that a special wood or nonferrous-lined container is installed for the explosives. Such blasting caps or other explosives shall be in DOT-specified shipping containers.

d. No person shall smoke, carry matches or any flame-producing device, or carry any firearms while in or about bulk vehicles effecting the mixing, transfer or down-the-hole loading of water gels at or near the blasting site.

e. Caution shall be exercised in the movement of the vehicle in the blasting area to avoid driving the vehicle over or dragging hoses over firing lines, cap wires, or explosive materials. The driver in moving the vehicle shall obtain the assistance of a second person to guide his movements.

f. No in-transit mixing of materials shall be performed.

g. The location chosen for water gel or ingredient transfer from a support vehicle into the borehole loading vehicle shall be away from the blast hole site when the boreholes are loaded or in the process of being loaded.

## **CHAPTER 9. SMALL ARMS AMMUNITION, SMALL ARMS PRIMERS, AND SMOKELESS PROPELLANTS**

### **91. GENERAL PROVISIONS**

911. In addition to all other applicable requirements in this Code, the intrastate transportation of small arms ammunition, small arms ammunition primers and smokeless propellants shall be in accordance with current U. S. Department of Transportation regulations.

912. The provisions of this chapter do not apply to in-process storage and intra-plant transportation during manufacture of small arms ammunition, small arms primers, and smokeless propellants.

### **92. SMALL ARMS AMMUNITION**

921. No restrictions are imposed on truck or rail transportation of small arms ammunition other than those which are imposed by the U. S. Department of Transportation or by the presence of other hazardous material.

922. No quantity limitations shall be imposed on storage of small arms ammunition in warehouses, retail stores and other general occupancies, except those imposed by limitations of storage facilities and consistency with public safety.

923. Small arms ammunition shall be separated from flammable liquids, flammable solids (as classified by the U. S. Department of Transportation), and oxidizing materials by a fire-resistive wall of one-hour rating or by a distance of 25 feet.

924. Small arms ammunition shall not be stored together with Class A or Class B explosives (as defined by U. S. Department of Transportation regulations) unless the storage facility is adequate for this latter storage.

### **93. SMOKELESS PROPELLANTS**

931. Quantities of smokeless propellants in shipping containers approved by the U. S. Department of Transportation not in excess of 25 pounds may be transported in a passenger vehicle.

932. Quantities in excess of 25 pounds but not exceeding 50 pounds in a passenger vehicle shall be transported in a portable magazine having wooden walls of at least 1 inch nominal thickness.

933. Transportation of quantities in excess of 50 pounds is prohibited in passenger vehicles.

934. Transportation of quantities in excess of 50 pounds in other than passenger vehicles shall be in accordance with U. S. Department of Transportation regulations, except that warning placards shall be prominently displayed when more than 250 pounds are being transported.

935. All smokeless propellants shall be stored in DOT-approved shipping containers.

936. Smokeless propellants intended for personal use in quantities not to exceed 20 pounds may be stored in original containers in residences; quantities over 20 pounds but not to exceed 50 pounds may be stored in residences in a wooden box or cabinet having walls of at least 1 inch nominal thickness.

937. Not more than 20 pounds of smokeless propellants, in containers of 1-pound maximum capacity, shall be displayed in commercial establishments. Commercial stocks of smokeless propellants over 20 pounds and not more than 100 pounds shall be stored in approved portable wooden boxes having walls of at least 1 inch nominal thickness.

938. Commercial stocks in quantities not to exceed 750 pounds shall be stored in nonportable storage cabinets having wooden walls of at least 1 inch nominal thickness. Not more than 400 pounds shall be permitted in any one cabinet.

939. Quantities in excess of 750 pounds shall be stored in magazines constructed and located as specified in Chapter 3.

#### 94. SMALL ARMS AMMUNITION PRIMERS

941. Small arms ammunition primers shall not be transported or stored except in the original shipping container approved by the U. S. Department of Transportation.

942. Truck or rail transportation of small arms ammunition primers shall be in accordance with U. S. Department of Transportation regulations.

943. Not more than 25,000 small arms ammunition primers shall be transported in a passenger vehicle.

944. Not more than 10,000 small arms ammunition primers may be stored in residences.

945. Not more than 10,000 small arms ammunition primers may be displayed in commercial establishments.

946. Small arms ammunition primers shall be separated from flammable liquids, flammable solids (as classified by the U. S. Department of Transportation), and oxidizing materials by a fire-resistive wall of one-hour rating or by a distance of 25 feet.

947. Not more than 750,000 small arms ammunition primers shall be stored in any one building, except as provided in Section 948; not more than 100,000 shall be stored in any one pile, and piles shall be at least 15 feet apart.

948. Quantities of small arms ammunition primers in excess of 750,000 shall be stored in magazines in accordance with Chapter 3.

# **APPENDIX A. QUANTITY-DISTANCE TABLES, FORBIDDEN EXPLOSIVES, FEDERAL REGULATIONS, REFERENCES**

## **A1. QUANTITY DISTANCE TABLES**

### **A11. American Table of Distances for Storage of Explosives.\***

Explosives		Distances in Feet When Storage is Barricaded			
POUNDS OVER	POUNDS NOT OVER	IN- HABITED BUILD- INGS	PAS- SENGER RAIL- WAYS	PUBLIC HIGH- WAYS	SEPA- RATION OF MAGA- ZINES
2	5	70	30	30	6
5	10	90	35	35	8
10	20	110	45	45	10
20	30	125	50	50	11
30	40	140	55	55	12
40	50	150	60	60	14
50	75	170	70	70	15
75	100	190	75	75	16
100	125	200	80	80	18
125	150	215	85	85	19
150	200	235	95	95	21
200	250	255	105	105	23
250	300	270	110	110	24
300	400	295	120	120	27
400	500	320	130	130	29
500	600	340	135	135	31
600	700	355	145	145	32
700	800	375	150	150	33
800	900	390	155	155	35
900	1,000	400	160	160	36
1,000	1,200	425	170	165	39
1,200	1,400	450	180	170	41
1,400	1,600	470	190	175	43
1,600	1,800	490	195	180	44
1,800	2,000	505	205	185	45
2,000	2,500	545	220	190	49
2,500	3,000	580	235	195	52
3,000	4,000	635	255	210	58
4,000	5,000	685	275	225	61
5,000	6,000	730	295	235	65
6,000	7,000	770	310	245	68
7,000	8,000	800	320	250	72
8,000	9,000	835	335	255	75
9,000	10,000	865	345	260	78

*(Continued on Next Page)*

\* As revised and approved by the Institute of Makers of Explosives, September 30, 1955.