

**S A A M I**<sup>®</sup>

SPORTING ARMS AND AMMUNITION MANUFACTURERS' INSTITUTE, INC.

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# **SMOKELESS POWDER**

Properties & Storage

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Ammunition handloading has become increasingly popular in recent years. This leaflet discusses properties of smokeless powder and offers recommendations for its storage.

This leaflet is intended to increase the knowledge of all concerned individuals and groups regarding smokeless powder. The statements and recommendations made are not intended to supersede local, state or Federal regulations. Proper authorities should be consulted on regulations for storage and use of smokeless powder in each specific community. A second leaflet entitled "SPORTING AMMUNITION PRIMERS: PROPERTIES, HANDLING & STORAGE FOR HANDLOADING" supplements this leaflet on smokeless powder.

## PROPERTIES OF SMOKELESS POWDER

Smokeless powders, or propellants, are essentially mixtures of chemicals designed to burn under controlled conditions at the proper rate to propel a projectile from a gun.

Smokeless powders are made in three forms:

1. Thin, circular flakes or wafers
2. Small cylinders, both perforated and unperforated
3. Small spheres or flattened spheres

Single-base smokeless powders derive their main source of energy from nitrocellulose.

The energy released from double-base smokeless powder is derived from both nitrocellulose and nitroglycerin.

All smokeless powders are extremely flammable; by design, they are intended to burn rapidly and vigorously when ignited.

Oxygen from the air is not necessary for the combustion of smokeless powders since they contain sufficient built-in oxygen to burn completely, even in an enclosed space such as the chamber of a firearm.

Ignition occurs when the powder granules are heated above their ignition temperature. This can occur by exposing the powder to:

1. A flame such as a match or a primer flash.
2. An electrical spark or the sparks from welding, grinding, etc.
3. Heat from an electric hot plate or a fire directed against or near a closed container even if the powder itself is not exposed to the flame.

When smokeless powder burns, a great deal of gas at high temperature is formed. If the powder is confined, this gas will create pressure in the surrounding structure. The rate of gas generation is such, however, that the pressure can be kept at a low level if sufficient space is available or if the gas can escape.

In this respect smokeless powder differs from blasting agents or high explosives such as dynamite or blasting gelatin, although powder may contain chemical ingredients common to both of these products.

Smokeless powder does not detonate like high explosives as it has a controlled rate of burn and differs considerably in its burning characteristics from common "black powder." Black powder burns at essentially the same rate out in the open (unconfined) as when in a gun.

When ignited in an unconfined state, smokeless powder burns inefficiently with an orange-colored flame. It may produce a considerable amount of light brown, noxious smelling smoke. It leaves a residue

of ash and partially burned powder. The flame is hot enough to cause severe burns.

When it burns under pressure, as in a cartridge fired in a gun, smokeless powder produces very little smoke, a small glow and leaves very little or no residue. The burning rate of smokeless powder increases with increased pressure.

If burning smokeless powder is confined, gas pressure will rise and eventually can cause the container to burst. Under such circumstances, the bursting of a strong container creates effects similar to an explosion.

For this reason, the U.S. Department of Transportation (formerly Interstate Commerce Commission) sets requirements for shipping containers for propellants and requires tests of loaded containers under actual fire conditions before approving them for use.

When smokeless powder in DOT-approved containers is ignited during such tests, the container seams split open or lids pop off to release gasses and powder from confinement at low pressure. Additional details are available in a SAAMI video "Smokeless Powder and the Fire Service."

## HOW TO CHECK SMOKELESS POWDER FOR DETERIORATION

Although modern smokeless powders contain stabilizers and are basically free from deterioration under proper storage conditions, safe practices require a recognition of the signs of deterioration and its possible effects.

Deteriorating smokeless powders produce an acidic odor and may produce a reddish brown fume. (Don't confuse this with common solvent odors such as alcohol, ether and acetone.) Dispose of deteriorating smokeless powders immediately.

Check to make certain that smokeless powder is not exposed to extreme heat as this may cause deterioration. Such exposure produces an acidity which accelerates further reaction and has been known, because of heat generated by the reaction, to cause spontaneous combustion.

Never salvage powder from old cartridges and do not attempt to blend salvaged powder with new powder or attempt to blend two types of powder to make a "custom" blend. Don't accumulate old powder stocks.

## CONSIDERATIONS FOR STORAGE OF SMOKELESS POWDER

Smokeless powder is intended to function by burning, so it must be protected against accidental exposure to flame, sparks or high temperatures.

For these reasons, storage enclosures should be made of insulating materials to protect the powder from external heat sources.

Once smokeless powder begins to burn, it will continue to burn (and generate gas pressure) until it is consumed.

DOT-approved containers are constructed to open up at low internal

pressures to avoid the effects normally produced by the rupture or bursting of strong containers.

Storage enclosures for smokeless powder should be constructed in a similar manner:

1. Of fire-resistant and heat-insulating materials to protect contents from external heat.
2. Sufficiently loose to vent the gaseous products of combustion satisfactorily which would result if the quantity of smokeless powder within the enclosure accidentally ignited.

If a small, tightly enclosed storage enclosure is loaded to capacity with containers of smokeless powder, the walls of the enclosure will expand or move outwards to release the gas pressure — if the smokeless powder in storage is accidentally ignited.

Under such conditions, the effects of the release of gas pressure are similar or identical to the effects produced by an explosion. Therefore, storage of smokeless powder should be in strict compliance with all applicable regulations and recommendations of the National Fire Protection Association (reprinted at end of leaflet).

## **RECOMMENDATIONS FOR STORAGE OF SMOKELESS POWDER**

Store in a cool, dry place. Be sure the storage area selected is free from any possible sources of excess heat and is isolated from open flame, furnaces, hot water heaters, etc. Do not store smokeless powder where it will be exposed to the sun's rays. Avoid storage in areas where mechanical or electrical equipment is in operation. Restrict from the storage areas heat or sparks which may result from improper, defective or overloaded electrical circuits.

Do not store smokeless powder in the same area with solvents, flammable gasses or highly combustible materials. Store only in Department of Transportation approved containers.

Do not transfer the smokeless powder from an approved container into one which is not approved.

Do not smoke in areas where smokeless powder is stored or used. Place appropriate "no smoking" signs in these areas.

Do not subject the storage cabinets to close confinement.

Storage cabinets should be constructed of insulating materials and with a weak wall, seams or joints to provide an easy means of self-venting.

Do not keep old or salvaged powders. Check old powders for deterioration regularly. Destroy deteriorated powders immediately.

Obey all regulations regarding quantity and methods of storing. Do not store all your smokeless powders in one place. If you can, maintain separate storage locations. Many small containers are safer than one large container.

Keep your storage and use area clean. Clean up spilled smokeless powder promptly. Make sure the surrounding area is free of trash or other readily combustible materials.

## **Know the Following Recommendations on Storage and Handling**

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**NFPA 495**

**Explosive Materials Code  
1996 Edition**

This edition of NFPA 495, Explosive Materials Code, was prepared by the Technical Committee on Explosives and acted on by the National Fire Protection Association, Inc. at its Annual Meeting held May 20-23, 1996, in Boston, MA. It was issued by the Standards Council on July 18, 1996, with an effective date of August 9, 1996, and supersedes all previous editions.

The 1996 edition of this document has been approved by the American National Standards Institute.

### **Origin and Development of NFPA 495**

This code was originally issued in 1912 as the 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 Ordinance and retitled Suggested Explosives Ordinance for Cities. Later, the document number NFPA 495L was designated.

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 redesigned as NFPA 495.

Following 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 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 so that there were no conflicts with the regulations promulgated by the various federal agencies concerned with explosive materials (Bureau of Alcohol, Tobacco and Firearms, U.S. Mine Safety and Health Administration, US Department of Transportation, etc.) This effort resulted in the 1982 edition, which was subsequently followed by a new edition in 1985. In 1990, the document was again revised and included the title being changed to the Explosive Materials Code. The latest edition, issued in 1996, incorporates change in the classification of explosives to conform with recent U.S. Department of Transportation "Hazardous Materials Regulations" which in turn are based on United Nations Recommendations on the Transport of Dangerous Goods. The 1996 edition also includes technical and editorial amendments.

## Chapter 11

### Small Arms Ammunition and Primers, Smokeless Propellants, and Black Powder Propellants

#### 11-1 Basic Requirements.

**11-1.1** In addition to all other applicable requirements of this code, intrastate transportation of small arms ammunition, small arms primers, smokeless propellants, and black powder shall comply with US Department of Transportation Hazardous Materials Regulations, 49 CFR, Parts 100-199.

**11-1.2** This chapter applies to the channels of distribution of and to the users of small arms ammunition, small arms primers, smokeless propellants, and black powder.

**11-1.3** This chapter does not apply to in-process storage and intra-plant transportation during manufacture.

**11-1.4** This chapter applies to the transportation and storage of small arms ammunition and components.

**11-1.5** This chapter does not apply to safety procedures in the use of small arms ammunition and components.

#### 11-3 Smokeless Propellants

**11-3.1** Quantities of smokeless propellants not exceeding 25 lb. (11.3 kg) in shipping containers approved by the U.S. Department of Transportation, may be transported in a private vehicle.

**11-3.2** Quantities of smokeless propellants exceeding 25 lb. (11.3 kg) but not exceeding 50 lb. (22.7 kg), transported in a private vehicle, shall be transported in a portable magazine having wood walls of at least 1 in. (25.4 mm) nominal thickness.

**11-3.3** Transportation of more than 50 lb. (22.7 kg) of smokeless propellants in a private vehicle is prohibited.

**11-3.4** Commercial shipments of smokeless propellants in quantities not exceeding 100 lb. (45.4 kg) may be reclassified for transportation purposes as flammable solids (Division 4.1) when packaged in accordance with the U.S. Department of Transportation Hazardous Materials Regulation (49 CFR, Part 173.171), and shall be transported accordingly.

**11-3.5** Commercial shipments of smokeless propellants exceeding 100 lb. (45.4 kg); or not packaged in accordance with the regulations cited in 11-3.4 shall be transported in accordance with the U.S. Department of Transportation regulations for Division 1.3C propellant explosives.

**11-3.6** Smokeless propellants shall be stored in shipping containers approved by US Department of Transportation.

**11-3.7** Smokeless propellants intended for personal use in quantities not exceeding 20 lb. (9.1 kg) shall be permitted to be stored in original containers in residences. Quantities exceeding 20 lb. (9.1 kg), but not exceeding 50 lb. (22.7 kg), shall be permitted to be stored in residences where kept in a wooden box or cabinet having walls of at least 1 in. (25.4 mm) nominal thickness.

**11-3.8** Not more than 20 lb. (9.1 kg) of smokeless propellants, in containers of a 1 lb. (0.45 kg) maximum capacity shall be displayed in commercial establishments.

**11-3.9** Commercial stocks of smokeless propellants shall be stored as follows:

(a) Quantities exceeding 20 lb. (9.1 kg) but not exceeding 100 lb. (45.4 kg) shall be stored in portable wooden boxes having walls of at least 1 in. (25.4 mm) thickness.

(b) Quantities exceeding 100 lb. (45.4 kg) but not exceeding 800

lb. (363 kg) shall be stored in non-portable storage cabinets having walls of at least 1 in. (25.4 mm) thickness. Not more than 400 lb. (181 kg) shall be permitted to be stored in any one cabinet and cabinets shall be separated by a distance of at least 25 ft (7.63 m) or by a fire partition having a fire resistance of at least 1 hour.

(c) Quantities exceeding 800 lb. (363 kg) but not exceeding 5,000 lb. (2,268 kg) shall be permitted to be stored in a building, provided the following requirements are met:

**1.** The warehouse or storage room shall not be accessible to unauthorized personnel.

**2.** Smokeless propellants shall be stored in non-portable storage cabinets having wood walls of at least 1 in. (25.4 mm) thickness and having shelves with no more than 3 ft (0.92 m) of separation between shelves.

**3.** No more than 400 lb. (181 kg) shall be stored in any one cabinet.

**4.** Cabinets shall be located against the walls of the storage room or warehouse with at least 40 ft. (12.2 m) between cabinets.

**5.** The separation between cabinets shall be permitted to be reduced to 20 ft. (6.1 m) where barricades twice the height of the cabinets are attached to the wall, mid-way between each cabinet. The barricades shall extend at least 10 ft. (3 m) outward, shall be firmly attached to the wall, and shall be constructed of 1/4 in (6.4 mm) boiler plate, 2 in (51 mm) thick wood, brick, or concrete block.

**6.** Smokeless propellant shall be separated from materials classified by the US Department of Transportation as flammable liquids, flammable solids, and oxidizing materials by a distance of 25 ft (7.63 m) or by a fire partition having a fire resistance of at least 1 hour.

**7.** The building shall be protected by an automatic sprinkler system installed in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*.

(d) Smokeless propellants not stored in accordance with 11-3.9 (a), (b), and (c) shall be stored in a Type 4 magazine constructed and located in accordance with Chapter 6.

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