Smokeless Powder

Properties & Storage

This publication has been prepared by the Sporting Arms and Ammunition Manufacturers' Institute to provide anyone concerned with the handling or storing smokeless powder certain basic and important facts about the subject. These statements and recommendations do not supersede local, state or federal regulations, or constitute legal advice. Local authorities should be consulted regarding any regulation on the storage, transportation, display, sale, and handling of smokeless powder within each individual community. Information is updated periodically, however SAAMI provides no warranty or guarantee as to the accuracy, adequacy or completeness of the information.

Ammunition handloading has become increasingly popular in recent years. This publication summarizes information that is generally known by an experienced handloader and provides general information to persons interested in handloading. It discusses the properties of smokeless powder and offers recommendations for its storage. A second publication entitled "*Sporting Ammunition Primers: Properties, Handling & Storage"* supplements this document on smokeless powder and may be found at www.saami.org.

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 firearm.

Smokeless powders are most commonly made in three physical forms[1]:

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

[1] Other forms, such as cut sheet propellant, are generally not available in the US, but may be encountered in ammunition loaded outside the US. While the physical form is different, the chemistry, nature, and hazards are the same.

Single-base smokeless powders derive their main source of energy from nitrocellulose, also known as "Guncotton."

The energy sources for double-base smokeless powder are 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 appliance or device, such as a hot plate or incandescent bulb, or a fire directed against or near a closed container even if the powder itself is not exposed to the flame.

Smokeless powder can also be ignited by impact, friction, and static discharge, among other sources.

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 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 unconfined as it does when in a firearm.

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 firearm, 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 can eventually 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 ("DOT") sets requirements for shipping containers for propellants and requires tests of filled 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 the SAAMI video "*Smokeless Powder and the Fire Service*," which can be found at www.saami.org.

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 similar to vinegar and may produce reddish-brown fumes. (The acidic smell should not be confused with common solvent odors such as alcohol, ether and acetone.) Properly dispose of deteriorating smokeless powders immediately.

Check to make certain that smokeless powder is not exposed to elevated temperatures 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 flames, 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 vent 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. Constructed to allow for the venting of combustion gases which would result if the smokeless propellant being stored within were ignited.

If smokeless powder is ignited in a tightly enclosed storage space, the walls of the enclosure could expand or move outwards to release the gas pressure.

Under such conditions, the sudden release of gas pressure could create a shock wave similar or identical to the effects of 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 this document).

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, light bulbs, 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.

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. Properly dispose of deteriorated powders immediately.

Obey all regulations regarding quantity and methods of storage. 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.

For further recommendations on storage and handling of smokeless powder, see NFPA 495 - Explosive Materials Code: https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=495

This code identifies reasonable levels of safety for the manufacture, transportation, storage, sale, and use of explosive materials. It does not apply to transportation of such material used for military purposes or when under jurisdiction of the federal government**.**

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11/8/2022