A SAFE PRACTICES MANUAL FOR THE MANUFACTURING, TRANSPORTATION, STORAGE AND USE OF PYROTECHNICS

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Since regulating authority is fragmented, this document presents compilation of existing regulations, consensus standards, and professional recommendations for the protection of persons involved in the manufacture, transport, storage, use, and field mixing of pyrotechnics.

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ABSTRACT

Although the Consumer Product Safety Commission reports that "injuries due to fireworks have dropped dramatically in recent years," to reduce injuries even further, it is important to provide safety information for those who manufacture, transport, or use pyrotechnics.

Regulating authority is fragmented, so presented in this document are a compilation of existing promulgated regulations, consensus standards, and professional recommendations for the protection of persons involved in the manufacture, transport, storage, use, and field mixing of pyrotechnics.

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INTRODUCTION

Whether admired for the bright patterns they produce or for the noise they make, most fireworks achieve their effect by a combination of explosion and combustion. As a result, the laws and regulations of the federal and state governments treat fireworks as a category of explosives and distinguish between two classes of fireworks, based on how dangerous they are and who uses them. "Special" fireworks include both the relatively small, but dangerous devices and those larger devices which are used for public displays. These fireworks require the same precautions for their manufacture, storage, transportation, or sale as other, equally dangerous explosives.

So-called "common" fireworks, on the other hand, are fireworks suitable for use by the public, that is, by household consumers. The common fireworks are generally small devices which, when used properly, do not expose the consumer to substantial danger. Roman candles, sky rockets, fountains, firecrackers, and sparklers, if they contain less than specified amounts of explosives, fall into this class.

The safe use of common fireworks requires respect for the fact that fireworks can cause injury through misuse, malfunction, or both. A CPSC draft document on Firework Related Injuries, 1976 (Paula A. Present, Statistician, Division of Hazard Evaluation, CPSC) estimated that in our bicentennial year, 1976, 9,012 injuries related to fireworks were treated in hospital emergency rooms. This report indicated that burns accounted for 54% of the injuries; an eye was involved in 22% of the injuries; and 23% involved injuries to other parts of the head. It was estimated that about 4 out of 10 of the injuries reported appeared to result from product malfunction alone or in conjuction with product misuse.

Although the Consumer Product Safety Commission reports that "injuries due to fireworks have dropped dramatically in recent years" and the National Safety Council* reports a decline in deaths due to fireworks injuries from 10 in 1972 to 0 in 1975, it is still important to maintain a safety vigilance. After all, more fireworks are ignited for the Fourth of July than for any other national celebration in the world.

Regulating authority is fragmented so we have presented here a compilation of existing promulgated regulations, consensus standards and professional recommendations for the protection of persons involved in the manufacture, transport, storage, use, and field mixing of pyrotechnics.

*National Safety Council. 1977. Accident Facts. NSC Chicago, Ill., p-12.

HANDLING RAW MATERIALS

A significant potential hazard in the fireworks industry is presented by raw materials. The vast majority of chemicals encountered are used on an "as is" basis, and the pyrotechnic composition is a mixture of raw chemicals. Many of these chemicals are highly flammable and will, in fact, explode under certain conditions. In addition, since these chemicals are often encountered in bulk operations there is a significant potential for toxic hazards. Appendix A is a compilation of chemicals frequently used by the pyrotechnics industry. Short discussions of the combustion hazards (i.e., flammability, explosibility), toxic hazards (especially symptoms of poisoning), precautions to be taken in the handling and storage of the material, hygienic precautions to be taken when handling the material (including immediate first aid procedures in case of contact), fire precautions (fire prevention and firefighting techniques), and proper procedures for cleaning up spills or leaks are included under the specific raw material.

While the best safety procedure is accident prevention, it is imperative to have well designed first aid and firefighting programs. The first few minutes after an accident occurs are the most important in terms of lives saved and reduced material loss.

MANUFACTURE

The manufacture of fireworks is subject to federal license and permit requirements and federal agency safety regulations. It is important to understand that the more specific and more safety-oriented regulations apply to common fireworks, those generally available for public use. Special effects fireworks and special fireworks, which contain substantial amounts of pyrotechnic composition and are legally available only to licensed operators, are subject to the federal regulations that apply to the manufacture of explosive materials. In addition, many states and local jurisdictions have enacted laws and ordinances related to the manufacture of fireworks. Knowledge and understanding of both the federal and state regulations and the recommended or required safety practices are essential to the safe manufacture of fireworks.

FEDERAL LICENSE AND PERMIT REQUIREMENTS

Federal regulation of the manufacture of fireworks is a complex subject, but is generally based on the premise that fireworks are explosives and therefore regulations pertaining to the manufacture of explosives also apply to the manufacture of fireworks, with certain exceptions. These exceptions include activities such as the transportation of explosives for delivery to federal, state or local governments; the manufacture of explosives regulated by the U.S. military department; and the importation and distribution of common fireworks in a finished state. Although federal regulations do not specify safety practices to be adhered to in the manufacture of explosives, general surveillance over the manufacturing process is maintained by the federal agencies that issue licenses and permits.

Regulations, promulgated by the Bureau of Alcohol, Tobacco and Firearms, Department of the Treasury, to implement Title XI, Regulation of Explosives, of the Organized Crime Control Act of 1970, give the licensing and permit requirements for manufacturing explosives (27 CFR 181.41).

License

- A license is necessary for:
  - A manufacturer of explosive materials (see 1978 List of Explosive Material - Appendix B) used in manufacturing special fireworks (Class B) or common fireworks (Class C)

- An importer of or dealer in special fireworks

- A manufacturer of black powder

o License entitles (subject to provisions of the law) the licensee to:

- Transport, ship, and receive explosive materials in interstate or foreign commerce

- Engage in business specified by license at location described on the license and, for manufacturer, on site within the same internal revenue region, for period stated on license

(A limited license entitles the licensee to manufacture explosives for his own use, but not offer the explosives for sale.)

o Procedure for obtaining license:

- File Form 4705 in duplicate with the Regional Administrator (Bureau of Alcohol, Tobacco and Firearms) for the district in which business will be conducted (the United States is divided into 7 ATF Regional Offices; these are identified in Appendix C)

- Application must be accompanied by fee of $50 for manufacturer's license (fee for manufacturer-limited license is $5)

- File Form 4706 (Part III) for renewal of license

o Regional Regulatory Administrator will approve application for license (within 45 days) if application is properly executed and:

- Applicant is at least 21 years old

- Applicant (in the case of corporation, partnership or association, any person who directs the management) is not prohibited by Chapter 40 Title 18 U.S.C from receiving explosive materials because

  -- Applicant is under indictment or has been convicted of crime punishable by imprisonment of more than one year

  -- Applicant is fugitive from justice

  -- Applicant unlawfully uses or is addicted to marihuana, any depressant or stimulant drug, or narcotic drug

  -- Applicant has been judged by a court to be a mental defective or has been committed to a mental institution

  -- Applicant has not willfully violated the Organized Crime Control Act of 1970 (18 U.S.C Chapter 40)

- Applicant has not withheld information or made false or deceitful statements in connection with his application

- Applicant has in a state business premises from which to conduct operations for which he is seeking a license

- Applicant has storage facilities for the relevant class of explosives unless he can establish that his business will not require the storage of explosive materials

- Applicant has certified in writing that he is familiar with and understands all published state laws and local ordinances relating to explosives

- Applicant has submitted certificate required by Section 21 of the Federal Water Pollution Control Act, as amended (33 U.S.C.1171 (b)).

-Permit

o A permit is necessary for:

- Each person who intends to acquire explosive material from a licensee in a state other than the one where he lives for use in manufacturing special or common fireworks

- Each person who intends to acquire explosive material from a foreign country

- Each person who intends to transport explosive material in interstate commerce for his own use and not for resale. (If explosive materials are acquired intrastate, a permit would not be required; however, ATF Form 4710, Explosives Transaction Record, is required to be kept on file by the seller.)

o Permit entitles (subject to provisions of the law) the permittee to :

- Acquire, transport, ship, and receive explosive materials in interstate and foreign commerce.

o Procedure for obtaining permit:

- File Form 4707 in duplicate with the Regional Regulatory Administrator for the district in which applicant resides or where his principal place of business is located

- Application accompanied by $20 fee ($2 for user-limited permit)

- File Form 4708 for renewal of permit.

- Approval of application for permit:

  - Same conditions as those listed for approval of license.

These licenses and permits are only valid in respect to the nature of the business and the class of explosives specified on the license or permit. Any changes in the nature of the business require notification of the Regional Regulatory Administrator, Bureau of Alcohol, Tobacco, and Firearms. In the case of denial of an application, appeal procedures are outlined. It should also be noted that any person who holds such a federal license or permit is subject to the provisions of applicable state or local laws governing the area in which the business is conducted.

Federal regulations require that these federally issued licenses and permits (or copies thereof) be posted and available for inspection where explosive materials are manufactured (also where stored, imported or distributed). When a licensed manufacturer sells or otherwise distributes explosive material, he shall verify that the persons (firm) receiving the explosive material have a valid license or permit, as required by law. A licensed manufacturer may not distribute explosive materials in any way to:

- Any person less than 21 years old
- In any state where purchase, possession or use of explosive material would violate law
- Any person who may transport explosive material into a state where purchase, possession, use, or transport into that state is illegal
- Any person whom the manufacturer has reason to believe will use the explosive material for an unlawful purpose
- Any person who is under indictment or has been convicted of a crime punishable by imprisonment of more than one year
- Any person who is a fugitive from justice
- Any person who is an unlawful user of marihuana, depressant, stimulant, or narcotic drugs
- Any person who has been legally declared mentally defective or committed to a mental institution.

In addition, every holder of federally-issued licenses and permits must maintain records pertaining to amount, use, and distribution of the explosive materials. These records must be in permanent form and must be kept

for a period of not less than five years. Officers of the Bureau of Alcohol, Tobacco and Firearms must be permitted to enter the premises of a licensed manufacturer to examine such records.

Licensed manufacturers are specifically required to keep records of:

- All explosive materials on hand. True and accurate inventory shall be taken at the time business is commenced, moved, discontinued or at the written request of the Regional Regulatory Administrator, Bureau of Alcohol, Tobacco and Firearms.
- Marks of identification (if any), the quantity and class of explosive materials, as prescribed in the Explosives List (Appendix B), that he manufactures or otherwise acquires, the date of such manufacture or acquisition
- Explosive materials distributed to another licensee
- Quantity and class, amount used daily, and date of use of explosive materials manufactured for own use
- Separate records of sales or distributions of explosive materials to persons not holding licenses or permits. Such transactions must be recorded on Form 4710.

It is legal for persons not holding licenses or permits to acquire explosive materials under certain circumstances:

- The explosive materials are acquired from a licensed manufacturer, importer, or dealer who conducts business in the same state where the nonlicensee resides
- The explosive materials are acquired from a licensed manufacturer, importer, or dealer who conducts business in a state contiguous to the one where the nonlicensee resides, if that state has enacted legislation that specifically authorizes the acquisition of explosive materials from a neighboring state.

However, the distribution of explosive materials is still limited by the conditions noted above which forbid such distribution in any way.

All licensed manufacturers, in addition to the required safety labeling information that is discussed in a later section, must legibly identify all

explosive materials manufactured by them for sale or distribution. The manufacturer and location, date and shift of manufacture must be identified. This information must be placed on each immediate container and on the outside container used for packaging.

Several states maintain surveillance over the safety practices of fireworks manufacturers by requiring manufacturers to pay an annual fee and obtain a license from the state fire marshal. The granting of the license is contingent upon satisfactory inspection of the fireworks plant and the existence and maintenance of safety practices to minimize any potential hazards. The National Fire Protection Association (NFPA) Code for the Manufacture, Transportation, and Storage of Fireworks recommends specific practices that are implicitly or explicitly specified by those states that regulate fireworks manufacture.

PHYSICAL SPECIFICATIONS FOR PYROTECHNICS MANUFACTURING PLANT

The key safety factors to be considered in the physical layout characteristics of a fireworks or pyrotechnics manufacturing plant are:

- o Maintenance of security
- o Distances to other structures and facilities
- o Construction of buildings.

Maintenance of Security

Security within the manufacturing operation is best maintained by surrounding the entire plant (including any storage buildings) with a substantial fence at least 6 feet high. All gates are to be locked at all times except the main gate which may be open during regular working hours if it is observed at all times by a responsible person. No persons are admitted through the gates who are not employees of the plant or authorized representatives of a relevant governmental jurisdiction or persons with special permission from the plant office. The state of Maryland requires that all visitors to a fireworks plant sign in at the main office, stating the nature of their visit. Records of visits must then be kept for at least two years and are subject to inspection by the state fire marshal.

The posting of signs is an additional important element of security. Signs are to be posted on the fence at intervals of no less than 500 feet. Lettering on the signs should be large and clear and should state:

WARNING - NO SMOKING - NO TRESPASSING

The state of California requires that each building on the premises of a manufacturing plant be posted with signs of red letters (not less than 3 inches high and 1/2 inch wide) on a white background, stating;

NO SMOKING BY ORDER OF THE STATE FIRE MARSHAL

Distances to Other Structures and Facilities

The hazardous nature and potential of the raw materials and the finished products of the pyrotechnics manufacturing process require that the buildings where pyrotechnic compositions are stored or manufactured should be separated from other buildings and facilities by specified minimum distances. The following tables give minimum separation distances as recommended by the National Fire Protection Association.

Table 1*

Minimum Separation Distances of Fireworks Processing Buildings, Fireworks Magazines, and Fireworks Storage Buildings from Inhabited Buildings, Passenger Railways, and Public Highways[1]

Net Weight of Fireworks[2]	Distance From Passenger Railways and Public Highways[3,4,5]		Distance from Inhabited Buildings[3,4,5]	
	Class C Fireworks	Class B Fireworks[5]	Class C Fireworks	Class B Fireworks[5]
Pounds	Feet	Feet	Feet	Feet
100	25	200	50	200
200	30	200	60	200
400	35	200	70	200
600	40	200	80	208
800	45	200	90	252
1,000	50	200	100	292
2,000	58	230	115	459
3,000	62	296	124	592
4,000	65	352	130	704
5,000	68	400	135	800
6,000	70	441	139	882
8,000	73	509	140	1,018
10,000	75	565	150	1,129
15,000	80	668	159	1,335
20,000	83	745	165	1,490
30,000	87	863	174	1,725
40,000	90	953	180	1,906
50,000	93	1,030	185	2,060
60,000	95	1,095	189	2,190
80,000	98	1,205	195	2,410
100,000	100	1,300	200	2,600
150,000	105	1,488	209	2,975
200,000	108	1,638	215	3,275
250,000	110	1,765	220	3,530

*From National Fire Protection Association, 1974, Manufacture, Transportation, and Storage of Fireworks, NFPA No. 44A, pp. 35-36.

[1] This Table does not apply to separation distances at fireworks manufacturing buildings, and magazines for storage of Class B fireworks and storage buildings for Class C fireworks. Those separation distances are given in Table 2.

[2] Net weight is the weight of all pyrotechnic and explosive composition and fuse only.

[3] See Glossary for definitions.

[4] Class B fireworks processing buildings and Class B fireworks magazines, including buildings located on the property of a fireworks plant shall be separated from passenger railways, public highways, and inhabited buildings by a minimum distance of 200 feet except that the separation from hospitals, schools and bulk storages of flammable liquids or flammable gases shall be by a minimum distance of 500 feet.

[5] The separation distances shall apply to all Class B fireworks except salutes.

[6] All distances in Table 1 are to be applied with or without barricades or screen-type barricades.

Table 2

Minimum Separation Distances at Fireworks Manufacturing Plants*

Net Weight Fireworks[1]	Distance of Magazines and Storage Buildings from Process Buildings and Nonprocess Buildings[2,5]		Distance Between Process Buildings and Between Process and Nonprocess Buildings[2]	
	Class C Fireworks[3]	Class B Fireworks[4]	Class C Fireworks[3]	Class B Fireworks[4]
Pounds	Feet	Feet	Feet	Feet
100	30	30	37	57
200	30	35	37	69
400	30	44	37	85
600	30	51	37	97
800	30	56	37	105
1,000	30	60	37	112
2,000	30	76	37	172
3,000	35	87	48	222
4,000	38	95	60	264
5,000	42	103	67	300
6,000	45	109	72	331
8,000	50	120	78	382
10,000	54	129	82	423

[1] Net weight is the weight of all pyrotechnic and explosive compositions and fuse only.

[2] See Glossary for definitions.

[3] Distances apply with or without barricades or screen-type barricades.

[4] Distances apply only with barricades or screen-type barricades.

[5] Distances include those between magazines, between storage buildings, between magazines and storage buildings, between magazines or storage buildings from process buildings and nonprocess buildings.

*From National Fire Protection Association, 1974, Manufacture, Transportation, and Storage of Fireworks, NFPA No. 44A, p. 37.

Some state legislation also incorporates minimum separation distances, although not as specifically as the NFPA. These distances are difficult to compare because the states do not consider the quantity of fireworks or differentiate between Class B and Class C fireworks as does the NFPA. A comparison is given in Table 3.

Table 3

State Specified Minimum Separation Distances in Feet from Fireworks Manufacturing Plant

	To Nearest Inhabited Building	To Highway or Railroad	To Bldg Where Fireworks or Explosives Stored	To Other Factory Building
Ohio	1,000	300	100	50
Illinois	500	200	100	50
New Jersey	200	200	50	25

Implicit in the delineation of these separation distances is the precaution that fireworks shall not be manufactured and stored in the same building.

Construction of Buildings

All buildings at a fireworks manufacturing plant are to be constructed to minimize the danger and potential danger posed by the possibility of fire and explosion. The NFPA specifies that buildings be no more than one story high and have no basement. For process buildings, where any activity involving explosive or pyrotechnic materials takes place, including preparation for shipping, breakaway construction should be used. This means that one wall is intentionally weak so that explosive effects can be directed and minimized. The weak wall should be away from other process or storage buildings. The building material for the exterior of process buildings shall be no more combustible than painted wood. The interiors of all buildings shall be noncombustible, and to minimize the accumulation of dust, ceilings, floors, and walls should be smooth with no cracks and crevices and as few horizontal ledges as possible. All places where walls are joined and where plumbing and wiring require openings should be sealed so that no dust enters. Properly grounded, conductive flooring is required in all buildings where mixing and pressing operations take place.

Exits from process buildings are to be located in accordance with the following specifications:

- o No point in any room more than 25 feet from nearest exit
- o Floor area more than 100 square feet, undivided:
  - Minimum of 2 exits accessible from different directions
- o Floor area divided into rooms, for each room of more than 100 square feet:
  - At least 2 exits
- o Path to exits must be unobstructed
- o Restrooms:
  - Need only one exit
  - Access away from or shielded from fireworks processing area
- o Exit doors must open outward
- o It must be possible to pressure actuate exit doors (panic hardware) from the inside.

Other requirements for exit from process buildings are found in Guide to OSHA Fire Protection Regulations, Code for Life Safety From Fire in Buildings and Structures, NFPA No. 101 (See Appendix D).

Requirements for electrical wiring, lighting fixtures, and switches in process buildings are found in Article 502 of the National Electrical Code, NFPA No. 70 (See Appendix E). Wiring shall be Type MI cable or in rigid metal conduits. Artificial lighting must be electric, but no temporary or loose wiring is permitted. Portable lighting equipment may only be used for repairs after the area has been cleared of all pyrotechnic materials and all dust has been removed by washing.

Except in areas where all pyrotechnic composition and flammable liquids are banned, no stoves, exposed flames or electric heaters may be used. The heating system must be approved by local authorities. All mechanical equipment in the process buildings must be properly bonded and grounded.

Where electricity enters the plant, there must be a master switch that is capable of cutting off all electricity to the plant. However, there should be a separate switch to maintain current for emergency equipment such as fire pumps and emergency lighting.

The NFPA states that regulation of building occupancy must be based on minimizing personnel exposure to the dangers posed by pyrotechnics and therefore the general requirements of local building codes are not likely to be stringent enough for application to fireworks manufacturing plants.

The NFPA stipulates:

- The number of persons in a process building should not be greater than the minimum number required to properly carry out operations
- The maximum number of persons permitted should be conspicuously posted in each building
- Not more than 500 pounds of pyrotechnic and explosive composition present at one time in mixing building or where prepared for finishing,
- Not more than 500 pounds of pyrotechnic or explosive composition should be present at one time in building where finishing operations take place.

These safety requirements related to the physical characteristics of a fireworks manufacturing plant are enforced by federal license and permit requirements and state licensing and inspection practices, in states where these are legislated.

For example, to obtain a permit to manufacture fireworks in Massachusetts, the application must include, among several other documents, a drawn-to-scale plan of the entire plant showing distances between buildings, exits, and boundaries. In addition, the plant must be open to inspection by the Department of Public Safety and the chief of the local fire department. In New Jersey, the Commissioner of Labor orders an inspection of fireworks plants to determine conformance with law before a certificate of registration is issued. In Ohio, inspections to determine conformance with the state code are conducted by the Department of Industrial Relations. In Maryland, the State Fire Marshal is responsible for plant inspections, but other jurisdictions also have the right to determine compliance with other applicable statutes and report to the State Fire Marshal. Accidents, the discovery of fire or explosion hazards, or any other non-compliance with the relevant laws are causes for revocation of licenses or permits to manufacture pyrotechnics.

PERSONNEL SAFETY

The key factors to be considered in protecting the health and safety of persons working in a pyrotechnics manufacturing plant are:

- o Instruction of personnel in safe practices
- o Prevention of fire and explosion.

Instruction of Personnel in Safe Practices

It is the responsibility of the employer (the manufacturer) to inform his employees for their protection. Therefore, every plant engaged in the manufacture of pyrotechnics should have a designated safety officer responsible for alerting employees to the hazards involved in their work and instructing employees on appropriate safe practices. Employees should receive instruction from the safety officer at the time they are hired and at least annually thereafter. The State of Maryland requires that employees sign statements certifying that they have received such instruction.

The following precautions must be taken by employees of a pyrotechnics manufacturing plant:

1. No smoking or carrying of lighted cigarettes, cigars, or pipes. This prohibition extends to all areas except places such as lunchrooms or restrooms where fireworks or explosive composition are banned.

2. No matches, lighters or other flame producing devices may be brought into a process building. The management should provide appropriate receptacles at the entrance to the plant where such articles may be deposited.

3. No liquor and narcotics on the premises. No person may enter the plant with liquor or narcotics in his possession; no person under the influence of liquor or narcotics may enter the plant; no person may partake of liquor or narcotics while on the premises of the plant.

4. Protective clothing and eye protection may be necessary in process buildings. Employees should be provided with non-static producing work uniforms, particularly employees involved in mixing and pressing operations. Cotton socks and conductive shoes must be worn for all Class B fireworks operations, and mixing, pressing, loading, and matching procedures involved with the manufacture of Class C fireworks.

5. Facilities for changing clothing, washing and showering shall be provided to employees. Work uniforms must not be worn outside the plant. Persons whose uniforms are contaminated with pyrotechnic materials to the extent that personnel safety is endangered shall not be permitted in smoking areas. Uniforms should be frequently laundered to prevent accumulation of pyrotechnic dust.

6. Respirators may be necessary in mixing areas (need determined by specific situation).

7. Nonferrous safety tools shall be used where there is the possibility of ignition from sparks. All tools shall be properly maintained.

8. Employees shall be trained in emergency procedures:

   - An emergency warning signal shall be devised and made known to employees.

   - Employees shall be trained in the operation of portable fire extinguishers, and they shall know what kinds of fires the specific extinguishers should be used on.

   - Employees will be advised that they should immediately evacuate the building to a designated safe area if the fire is involving or threatening to involve pyrotechnic materials.

   - Procedures will be established for alerting other employees of the danger.

Prevention of Fire and Explosion

Obviously, many of the safety precautions that are required to be made known to and practiced by employees are directed towards the prevention of fire and explosion in pyrotechnics manufacturing plants. Additional operating safety practices are required to be instituted as company policy to assure continued safe production. The nature of both the raw materials and the finished products requires great attention to the prevention of fire and explosion. Potassium chlorate mixes,for example, are particularly sensitive to ignition by fire, spark, or friction, and extreme caution should be used with these compositions (See Appendix A).

Some states that regulate the manufacture of pyrotechnics specify in the relevant statutes that the extent of fire protection required must be correlated to the extent of the hazard. In New Jersey, this determination is made by the Commissioner of Labor, who directs the installation of fire protection measures. In Maryland, the State Fire Prevention Commission issues regulations to protect the safety of employees, the public, and public property. In Ohio, the Department of Industrial Relations specifies the degree of hazard and the corresponding necessary fire protection.

The NFPA code (NFPA No. 44A-1974) enumerates certain essential measures for prevention of fire and explosion:

1. No dust must be allowed to accumulate in the plant.

2. Spills of pyrotechnic and explosive materials must be cleaned up immediately.

3. Waste must be removed daily from buildings.

4. Waste should be destroyed by submersion or burning or as prescribed by local authorities.

5. Rags and scraps must be stored in approved, labeled containers.

6. Rags, combustible, pyrotechnic or explosive scrap and paper must be kept separate from each other.

7. Oxidizers (nitrates, chlorates, perchlorates) must NEVER be stored in the same building with combustible powders (charcoal, gums, metals, sulfur, antimony sulfide).

8. Fireworks may be tested only in specially designated areas, at a safe distance from plant buildings or other structures.

9. Fire extinguishers must be present in all buildings except where pyrotechnic mixtures are exposed.

10. Fire extinguishers should only be used on fires of ordinary combustible materials and only if it appears to be possible to fight the fire without exposing pyrotechnic substances.

11. Finished fireworks must not be kept in buildings where manufacturing operations occur.

In addition, all manufacturers of pyrotechnics are subject to the rules and regulations promulgated by OSHA. Some states require proof of financial ability to meet judgments in the event of an accident. Ohio requires that the owner or operator of a plant file an indemnity bond of between $10,000 and $50,000 to provide for payment for injury to persons or property resulting from explosion at the plant. This requirement is eliminated if the manufacturer can show proof of financial ability to meet judgments to the satisfaction of the state Department of Industrial Hygiene. Massachusetts requires that any accident connected with manufacturing that causes damage to life or property must be immediately reported to the State Fire Marshal, and subsequently confirmed in writing. Where licenses to manufacture are required, the existence of a fire or explosion hazard constitutes a cause for license revocation.

SPECIFICATIONS FOR FIREWORKS

On June 8, 1976, the Consumer Product Safety Commission published in the Federal Register its Final Order for Fireworks Devices. The order, constituting regulations pursuant to the Federal Hazardous Substances Act, became effective on December 6, 1976. In response to injuries caused by fireworks, the order deals with Class C fireworks, intended for consumer use, but has no effect on existing state bans on fireworks or generally on fireworks used for public display (Class B fireworks). The order regulates common fireworks by specifying:

- What fireworks devices may not be sold to consumers
- The prohibited chemicals which cannot be used in regulated fireworks devices
- The physical specifications for the regulated fireworks devices
- Labeling of fireworks.

Permissible and Banned Fireworks

The regulations promulgated by the Consumer Product Safety Commission pursuant to the Hazardous Substances Act ban the following articles as hazardous substances "because they possess such a degree or nature of hazard that adequate cautionary labeling cannot be written and the public health and safety can be served only by keeping such articles out of interstate commerce" (Section 1500.17).

- Fireworks devices designed to produce an audible effect if the effect is produced by more than 2 grains of pyrotechnic composition (including but not limited to cherry bombs, M-80 salutes, silver salutes, and other large firecrackers, aerial bombs, and other fireworks designed to produce audible effects, including kits and components to produce fireworks)
- Firecrackers designed to produce audible effects,if the effect is produced by more than 50 milligrams (.772 grains) of pyrotechnic composition
- Aerial bombs, and devices that can be confused with food, i.e., "dragon eggs", "cracker balls" ("ball-type caps")
- Kits and components intended to produce such fireworks
- All fireworks devices, besides firecrackers, that do not comply with the requirements of Part 1507 of the Act.

Exceptions to these prohibitions are fireworks devices that are distributed to agricultural workers as part of a wildlife management program administered by the Department of the Interior or equivalent state and local agencies. To obtain fireworks under these conditions, a written request must be filed that describes the problem that necessitates use of the device. The quantity of fireworks used must be no greater than what is necessary to alleviate the problem. In addition, such use of fireworks requires that no other means is available or adequate to control the problem.

Other jurisdictions also prohibit the manufacture of specific fireworks devices as shown in the following table:

Table 4

Specific State Prohibitions Against Manufacture of Pyrotechnic Devices

	Prohibited Devices
District of Columbia	- Sparklers more than 20'' long - Devices that emit flames or sparks more than 12 feet - Any imitation or actual firecracker or cherry bomb - Any firework or fuse without protective cap or seal approved by Fire Chief - Any cylindrical tube firework with clay choke or other device that restricts or delays escape of gases - Any firework found dangerous by Fire Chief.
New Jersey	- Only manufacture devices that can be approved for interstate commerce
Ohio	- Only manufacture devices that can be approved for interstate commerce (Class C)
Maryland	- Class B fireworks - "Flash and sound products"
Mississippi	- Class B fireworks - Devices with explosive composition of 2 grains or more
Louisiana	- Devices containing white or yellow phosphorous
Colorado	- Manufacture of pyrotechnic devices prohibited where Division of Labor determines there is undue hazard to life and property
Arkansas	- Only Class C permitted
Puerto Rico	- All pyrotechnic devices
South Dakota	- Firecrackers longer than 3 inches, made wholly or in part from dynamite, nitroglycerine, giant powder
Virginia	- All pyrotechnic devices
North Carolina	- All pyrotechnic devices

Chemical Composition of Regulated Substances

Part 1507 of the Hazardous Substances Act lists requirements for fireworks devices (other than firecrackers) that are not otherwise banned by law. With the exceptions noted, such fireworks devices may not contain:

- o Arsenic sulfide, arsenates, or arsenites
- o Boron
- o Chlorates
  - Permitted in colored smoke mixtures that contain equal or greater parts of sodium bicarbonate
  - Permitted in caps and party poppers
  - Permitted in small devices (i.e., ground spinners) with total powder content less than 4 grams, of which no more than 15% (or 600 milligrams) is potassium, sodium, or barium chlorate
- o Gallates or gallic acid
- o Magnesium
  - Magnesium/aluminum alloys (magnalium) are permitted
- o Mercury salts
- o Red or white phosphorus
  - Red phosphorus permitted in caps and party poppers
- o Picrates or picric acid
- o Thiocyanates
- o Titanium
  - Particle size greater than 100-mesh permitted
- o Zirconium

In addition to the prohibition against including the above-listed chemicals in fireworks devices, a manufacturer of fireworks should also know that the possession, acquisition through interstate commerce, or manufacture of certain explosive materials requires the obtaining of a federal license. Such materials are identified in the annual publication of the List of Explosive Materials by the Secretary of the Treasury, as required by 18 U.S.C. Chapter 40 (See current list, Appendix B).

Several jurisdictions require that manufacturers submit samples of fireworks devices to a regulatory agency for chemical analysis. This must be done prior to sale and as a prerequisite to labeling. In other instances, the manufacturers are responsible for performing the chemical analysis and must then submit reports of the analysis to the appropriate agency. These analyses enable the monitoring of the chemical composition of pyrotechnic devices and serve as the basis for the classification of fireworks that is required for labeling and shipping through interstate commerce. Any changes in composition of new products require retesting.

Physical Specifications of Fireworks Devices

Part 1507 of the Federal Hazardous Substances Act incorporates the final order of the Consumer Product Safety Commission for common fireworks devices. The following specifications apply to the manufacture of permitted pyrotechnic devices. The asterisk notes the specific safety precaution.

- o Fuses (where required)
  - Treated or coated to prevent side ignition (Exemption: ground spinners or similar devices that require restricted orifice for proper thrust, and contain less than 6 grams of pyrotechnic composition.)
  - Must burn at least 3 seconds but not more than 6 seconds before ignition
  - Securely attached; must support either the weight of the device + 8 ounces of dead weight or double the weight of the device without separating from the device
  - * Prevent side ignition and resulting shorter burning time.
- o Bases (for devices that operate in upright position)
  - Minimum horizontal dimension or diameter of base equal to at least 1/3 the height of device
  - * Prevent tipping of device so that sparks or other effects are not aimed at spectators.
- o Pyrotechnic leakage; burnout and blowout
  - Pyrotechnic chamber sealed
  - Walls of pyrotechnic chamber constructed to withstand internal pressure from burning composition
  - * Prevent pyrotechnic material from coming out of sides or bottom of devices and injuring operator or spectators.

- o Handles for devices to be held in hand and spikes
  - Label must indicate device to be held in hand
  - Handle at least 4 inches long and firmly attached to device
  - If handle is integral part of device, must extend at least 4 inches below pyrotechnic chamber
  - Spikes at least 2 inches from base of device
  - Spikes must have blunt tip no less than 1/8 inch diameter or 1/8 inch square
  - * Prevent burning of person holding a handle-type device and prevent spike from tipping over.
- o Wheel Devices
  - Drivers must be securely attached
  - If intended to operate in fixed location, axle must remain securely attached to device during normal operation
  - * Prevent drivers from coming loose during transportation, handling, and normal operation.
- o Toy smoke devices and flitter devices
  - Constructed to prevent bursting and external flame during normal operation
  - Must be of color and configuration to avoid confusion with M-80 salutes, silver salutes, or cherry bombs
  - No plastic in exterior if pyrotechnic composition comes in contact with plastic
  - * Prevent injury from external flame; avoid confusion with dangerous banned Class B explosive devices.
- o Rockets with sticks
  - Incorporate straight, rigid stick firmly attached to driver
  - * Prevent injury from unstable or unpredictable flight.
- o Party poppers
  - Contain no more than .025 grains of pyrotechnic composition

- Cloth or soft paper inserts must not ignite during normal operation.

* Prevent burns

The California State Fire Marshal has enumerated even more detailed and stringent specifications for all handle goods, stick, dowel, spike and California candle fireworks with a stick dowel or inside diameter greater than 1/8 inch, party poppers, and other devices as noted. These specifications can be found in Appendix F.

Special Fireworks

The State of California gives specifications for the manufacture of mortars, the devices used to fire special fireworks. Fragmenting types of metal such as cast iron are prohibited from being used in the manufacture of mortars. Mortars must be made of Shelby seamless steel tubing or equivalent with a smooth bore, and must have a steel bottom plate equal in thickness to the tube and welded continuously around its perimeter. If they meet specified conditions, wooden base plugs may be substituted for steel bottom plates.

If the mortars are to be used only for firing of single break shells and finale batteries (hedgehogs), they may be constructed of spiral or convolute wound chipboard or kraft paper tubes. Wall thicknesses for various sized tubes are specified: minimum 1/4 inch for 2 inch shells; minimum 3/8 inch for 3 inch shells; minimum 1/2 inch for 4,5, and 6 inch shells. All tubes must have base plugs in good condition that are securely glued and nailed to tube. The minimum inside length of mortars must not be less than five times their inside diameter where inside diameter is less than 7 inches, and not less than four times their inside diameter where diameter is greater than 7 inches. Mortars that are defective in any way (split or bulged tube, base, seam, or with loose rivets, bolts or wooden base plug) may not be used for firing.

The NFPA in its proposed Standard for Public Display of Fireworks (NFPA 1123-1978) specifies wall thicknesses of paper mortars, which must be constructed of convolute wound paper. However, spiral wound paper may be used only for 3-inch (76 mm) diameter mortars. The recommended wall thicknesses are shown in Table 5.

Table 5

NFPA Recommended Wall Thicknesses of Paper Mortars

Mortar Type	Mortar Diameter in.	(mm)	Wall Thickness in.	(mm)
Convolute	2	(51)	1/4	(6.4)
Convolute or spiral	3	(76)	3/8	(9.5)
Convolute	4	(102)	1/2	(12.7)
Convolute	5	(127)	3/4	(19.0)
Convolute	6	(152)	3/4	(19.0)

In conjunction with these specifications for the manufacture of mortars, the NFPA also indicates specifications for shells.

- o Shells must be classified and described only in terms of the inside diameters of mortars in which they are intended to be used.
- o For 2-inch (51 mm) and 3-inch (76 mm) shells, the difference between the inside diameter of the mortar and the outside diameter of the shell must be no less than 1/8 inch and no more than 1/4 inch.
  - For 3-inch or larger shells, this difference must be between 1/8 inch and 1/2 inch.
- o The length of the internal delay fuse and amount of lift charge must be calculated so that the shells will function properly in their mortars.
- o At least 6 inches (152 mm) of quick match fuse must protrude from the mortar after insertion of the shell.
- o A black match fuse must be at least 3 inches (76 mm) long.
- o The fuse must not be folded back or doubled back under the safety cap.
- o A safety cap of a different color than the fuse, must be installed over the exposed end of the fuse.
- o There must be at least 4 seconds between the time the tip of the black match is lit and ignition of the lift charge.
- o Shells must be labeled to indicate the type and size and the manufacturer or distributor.

- Label should also include a warning: WARNING: DANGEROUS EXPLOSIVE If found, do not handle--contact local fire or police department.

Labeling of Common Fireworks Devices

Manufacturers of common fireworks are also subject to federal requirements for labeling of fireworks. Each device must have a label that includes the name of the manufacturer, cautionary information, instructions for use, and the words "DOT Class C Common Fireworks." The specific label wordings are found in Section 1500.14-Products Requiring Special Labeling... of the Federal Hazardous Substances Act. These regulations state:

"Because of the special hazards presented by fireworks devices if not used in a certain manner, the following listed fireworks devices shall be labeled as indicated":

Chapter II - Consumer Product Safety Commission 1500.14

(i) Fountains

WARNING (or CAUTION)

FLAMMABLE (or EMITS SHOWERS OF SPARKS, if more descriptive)
Use only under (close) adult supervision. (Use of the word close is optional.)
For outdoor use only.
Place on level surface.
Light fuse and get away.

(ii) California candles

WARNING (or CAUTION)

EMITS SHOWERS OF SPARKS
Use only under (close) adult supervision. (Use of the word close is optional.)
For outdoor use only.
Hold in hand at bottom of tube.
Point away from body so that neither end points toward body.

(iii) Spike and handle cylindrical fountains

(A) Spike fountains

WARNING (or CAUTION)

EMITS SHOWERS OF SPARKS

Use only under (close) adult supervision. (Use of the word close is optional.)
For outdoor use only.
Stick firmly in ground in an upright position.
Do not hold in hand.
Light fuse and get away.

(B) Handle fountains

WARNING (or CAUTION)

EMITS SHOWERS OF SPARKS
Use only under (close) adult supervision. (Use of the word close is optional.)
For outdoor use only.
Hold in hand - point away from body.
Light fuse.

(iv) Roman Candles

WARNING (or CAUTION)

SHOOTS FLAMING BALLS
Use only under (close) adult supervision. (Use of the word close is optional.)
For outdoor use only.
Stick butt end in ground.
Do not hold in hand.
Light fuse and get away.

(v) Rockets with sticks

WARNING (or CAUTION) FLAMMABLE

Use only under (close) adult supervision. (Use of the word close is optional.)
For outdoor use only.
Place in wooden trough or iron pipe at 75° angle, pointing away from people or flammable material.
Do not hold in hand.
Light fuse and get away.

(vi) Wheels

WARNING (or CAUTION) FLAMMABLE
(or EMITS SHOWERS OF SPARKS, if more descriptive)

Use only under (close) adult supervision. (Use of the word close is optional.)
For outdoor use only.

Attach securely by means of a nail through the hole (or place on hard flat surface for ground spinners).
Light fuse and get away.

(vii) Illuminating torches

WARNING (or CAUTION) FLAMMABLE
(EMITS SHOWERS OF SPARKS, if more descriptive)

Use only under (close) adult supervision. (Use of the word close is optional.)
For outdoor use only.
Hold in hand - point away from body, clothing, or other flammable material (or place upright on level ground. Do not hold in hand, if more descriptive).
Light fuse (or light fuse and get away, if more desriptive).

(viii) Sparklers

On the front and back panels:

WARNING (or CAUTION)

FLAMMABLE

On the side, front, back, top, or bottom panel:

CAUTION

Use only under (close) adult supervision. (Use of the word close is optional.)
For outdoor use only.
Do not touch glowing wire (or do not touch hot plastic, wood, etc., if more descriptive).
Hold in hand with arm extended away from body.
Keep burning end or sparks away from wearing apparel or other flammable material.

(ix) Mines and shells

WARNING (or CAUTION)

EMITS SHOWERS OF SPARKS
(SHOOTS FLAMING BALLS, if more descriptive)

Use only under (close) adult supervision. (Use of the word close is optional.)
For outdoor use only.
Place on hard smooth surface (or place upright on level ground, if more descriptive).

Do not hold in hand.
Light fuse and get away.

(x) Whistles without report

WARNING (or CAUTION) FLAMMABLE
(SHOOTS WHISTLE IN AIR if applicable)

Use only under (close) adult supervision. (Use of the word close is optional.)
For outdoor use only.
Do not hold in hand.
Light fuse and get away.

(xi) Toy smoke devices and flitter devices

WARNING (or CAUTION)
FLAMMABLE (or EMITS SHOWERS OF SPARKS, if more descriptive)

Use only under (close) adult supervision. (Use of the word close is optional.)
For outdoor use only.
Do not hold in hand.
Light fuse and get away.

(xii) Helicopter-type rockets

WARNING (or CAUTION)
FLAMMABLE (EMITS SHOWERS OF SPARKS, if more descriptive)

Use only under (close) adult supervision. (Use of the word close is optional.)
For outdoor use only.
Place on hard, open surface.
Light fuse and get away.

(xiii) Party poppers

WARNING (or CAUTION) FLAMMABLE

Use only under (close) adult supervision. (Use of the word close is optional.)
Do not point either end toward face or other person.
Hold in hand, jerk string.

(xiv) Missile-type rockets

WARNING (or CAUTION)
FLAMMABLE (or EMITS SHOWERS OF SPARKS, if more descriptive)

Use only under (close) adult supervision. (Use of the word close is optional.)

For outdoor use only.
Place on hard, open surface.
Light fuse and get away.

Any fireworks device for which a specific label is not prescribed must, nonetheless, have a warning label indicating the necessary safety precautions and where and how the item is to be used, in addition to the name of the manufacturer.

The statement of the principal hazard(s), the signal word, and instructions to read cautionary labeling must appear distinctly and separately on the main label panel. Color, typography, borders, etc. shall be used to call attention to these words. The signal word and statement of hazard should be in capital letters, the signal word should be in not less than 18-point type, and the statement of hazard should be in no less than 12-point type. If the label is too small to accommodate these sizes of type, the size can be proportionately reduced, but it may never be smaller than 6-point type.

The specified label requirements (other than those named above that are required to be on the main panel) may appear on the main panel or they may appear together elsewhere in a distinctive place. Color, typography, and layout should be used to achieve adequate contrast; the type should be no smaller than 10-point, unless the label is too small, but in no case shall type be smaller than 6-point. The name and place of business of the manufacturer, packer, distributor, or seller may appear separately on the label.

Any fireworks that will be involved in interstate or foreign commerce must bear the required Department of Transportation (49 CFR 172.101) label on the outside shipping package:

Common fireworks: Explosive C
Special fireworks: Explosive B

The states of California and Washington specify the similar labeling requirements but also require: the seal of registration of the State Fire Marshal, the license or registration number of the registrant, and the classification of the fireworks device. The manufacturer, who must be licensed, is responsible for applying the seal of registration and classification to all classified pyrotechnic devices. To obtain classification, a licensed manufacturer must submit pyrotechnic devices to the State Fire Marshal. Fireworks that are not classified or do not have a label of classification cannot be used, stored, or sold for use in the state of California. The manufacturer must submit to the State Fire Marshal no fewer than 10 live samples for a "safe and sane" clasification and no fewer than 3 for "agricultural wildlife", "dangerous", and "emergency signaling devices" classifications. To obtain a "safe and sane" classification, the manufacturer must submit the notarized results of chemical analysis to the

Fire Marshal. Any change in the composition of an already classified device requires that the Fire Marshal be notified and the device be submitted for retest. (Special effects items designed and manufactured for a single time usage are exempt from these classification and labeling requirements.)

Other states that require the manufacturer to submit fireworks devices to a state agency for inspection and state requirements for labeling are shown in Table 6. The requirement to submit fireworks devices to a state agency for inspection provides a means of determining compliance with federal and state safety regulations.

Table 6

State Requirements For Inspection and Labeling

State	Inspection Requirements	Labeling (Classification) Requirements
District of Columbia	o Submit to Fire Chief 3 samples of each firework + complete specifications & chemical analyses	o Name of manufacturer, number and type of firework and directions for use (on all retail).
Idaho		o All packages stamped or labeled: Dangerous Safe and Sane Agricultural or Wildlife
Illinois		o Shipping package labeled, letters at least 7/16" high: FIREWORKS-HANDLE CAREFULLY-KEEP FIRE AWAY o Name of manufacturer
Indiana	o Before shipping into state for sale, manufacturer must submit samples of sparklers and toy snakes to Fire Marshal for testing	
Mississippi		o DOT label on package
Nebraska	o Before sale, permissible fireworks must be submitted to Fire Marshal to determine compliance with safety requirements	
New Jersey		o Letters 7/16" high, minimum: FIREWORKS-HANDLE CAREFULLY-KEEP FIRE AWAY o Name of manufacturer

Table 6 (Continued)

State Requirements For Inspection and Labeling

State	Inspection Requirements	Labeling (Classification) Requirements
Oklahoma		o DOT designation Class C fireworks, identified on label
Ohio		o Letters minimum 7/16 inch high FIREWORKS-HANDLE CAREFULLY- KEEP AWAY FROM FIRE o Name of manufacturer
South Dakota	o Before sale, submit to Fire Marshal to determine compliance with specifications and general safety requirements	
Washington	o Submit 3 live samples to Fire Marshal with notarized chemical analysis	o Classfied by Fire Marshal, labeled prior to sale: Dangerous Safe and Sane Agricultural and Wildlife o Firing instructions o Not classified or labeled by Fire Marshal are considered dangerous.

TRANSPORTATION

Insofar as fireworks are carried interstate, their transportation is regulated by the Department of Transportation. The states are empowered to regulate the transportation of fireworks within their boundaries. The essential safety factor involved in the transportation of fireworks is the minimalization of the danger to persons (and property), who because of the movement of the fireworks are inadvertently exposed to the potential hazard. Therefore, regulations involve the identification of the hazard through packaging, marking, labeling, and placarding requirements and the institution of safety practices specific to the mode of transportation -- by motor vehicles on public highways, by rail, by aircraft, and by ship.

The Department of Transportation requires that each person who offers a hazardous material for transportation shall describe the material by its proper shipping name and hazard class (e.g., fireworks, common-Class C explosive; fireworks, special-Class B explosive) on shipping papers (49 CFR 172.200). The shipping paper must include the notation "Placarded", followed by the name of the placard required. The shipping paper must contain the following certification made by the person offering a hazardous material for transportation:

> This is to certify that the above-named materials are properly classified, described, packaged, marked and labeled, and are in the proper condition for transportation according to the applicable regulations of the Department of Transportation.

FEDERAL LICENSE AND PERMIT REGULATIONS

The regulations found in Part 181 of Title 27 of the Code of Federal Regulations, which implement Title XI, Regulation of Explosives (18 U.S.C. Chapter 40), of the Organized Crime Control Act of 1970, contain the requirements relative to interstate and foreign commerce in explosives. Explosives include fireworks except those Class C common fireworks which may legally be used by consumers. Every person who intends to engage in business as an importer, a person engaged in the business of bringing explosive materials into the United States for purposes of sale or distribution, must obtain a federal license (fee $50) from the Service Center Director of the Internal Revenue District where his business is located. Such a license will entitle the lincensee to engage in business as specified on the license and to transport, ship, and receive explosive materials in interstate or foreign commerce.

A person who intends to acquire explosive materials, as defined by the List of Explosives (Appendix B) from a licensee in another state or from a foreign country, or who intends to transport explosive materials in interstate or foreign commerce must obtain a federal user permit (fee $20). This permit is not necessary where a state has enacted legislation that specifically allows the acquisition of explosive materials from a contiguous state. The permit entitles the holder to acquire, transport, ship, and receive in interstate or foreign commerce explosive materials of the class authorized by the permit.

The same conditions that apply to the granting of licenses and permits necessary for manufacturing, storing, and dealing in explosive materials also apply to licenses and permits required for importation and transportation of explosive materials. The restrictions on distributions of explosive materials also apply. When explosive materials are brought into this country, they cannot be released from customs custody until the person claiming them provides proof that he is a licensed importer or holds a permit that entitles him to acquire the materials.

The federal regulations also require that licensees and permittees maintain records of their transactions in permanent form for at least five years. Each licensed importer of explosive materials is required to take "true and accurate inventories" of explosive materials on hand when he commences business and thereafter as required by the Assistant Regional Commissioner of the Bureau of Alcohol, Tobacco, and Firearms. When the licensed importer receives through importation or otherwise acquires explosive materials, he must record information about the explosives received by no later than the close of the next business day. The information recorded must include the quantity and class of explosive materials, as prescribed in the Explosives List; the manufacturer; manufacturer's identification marks, if any; country of manufacture; and the date of importation or acquisition.

The licensed importer is also required to keep records of distribution of explosive materials to other licensees or permittees. These records must include quantity and class of explosives; manufacturer and identification marks, if any; country of manufacture; license or permit number of person receiving the explosives; and the transaction date. This information must be recorded by no later than close of the next business day after the transaction. Separate records must be kept of distributions to persons not holding licenses or permits (see MANUFACTURE — FEDERAL LICENSE AND PERMIT REQUIREMENTS). A licensed importer can apply for permission to use alternate means of recordkeeping, but these may not be employed until approval is received from the Assistant Regional Commissioner.

The exportation of explosive materials must be conducted in accord with the applicable provisions of Section 414 of the Mutual Security Act of 1954 (22 U.S.C. 1934). In addition, the license holders (importers, manufacturers,

and dealers) who export explosive materials must keep records that show the manufacture or acquisition of explosive materials, the quantity and class of explosives, the name and address of the former consignee of the explosive materials, and the date of exportation.

GENERAL REQUIREMENTS

Regulations issued by the Department of Transportation (49 CFR 171.2) state that "no person may offer or accept a hazardous material for transportation in commerce within the United States unless that material is properly classed, described, packaged, marked, labeled, and in the condition for shipment as required by (the) subchapter." As described below, the transportation of fireworks is regulated on the basis of their definition as Class B or Class C explosives.

The Department of Transportation regulates the transportation of explosive materials via highway, railroad, air, and water. These regulations are found in Title 49 - Transportation - of the Code of Federal Regulations. The following fireworks devices are forbidden from being offered for transportation (49 CFR 173.51):

- Firecrackers, flash crackers, salutes, or similar commercial devices which produce or are intended to produce an audible effect, the explosive content of which exceeds 12 grains each in weight; and pest control bombs, the explosve content of which exceeds 18 grains each in weight; and any such devices, without respect to explosive content, which on functioning are liable to project or disperse metal, glass or brittle plastic fragments

- Fireworks that combine an explosive and a detonator or blasting cap

- Fireworks containing an ammonium salt and a chlorate

- Fireworks containing yellow or white phosphorus

- Fireworks or fireworks compositions that ignite spontaneously or undergo marked decomposition when subjected for 48 consecutive hours to a temperature of 75°C (167°F)

- Fireworks, properly condemned by the Bureau of Explosives, except properly repacked samples for laboratory examinations

- Toy torpedoes, the maximum outside dimension of which exceeds 7/8 inch, or toy torpedoes containing a mixture of potassium chlorate, black antimony and sulfur with an average weight of explosive composition in each torpedo exceeding four grains

- Toy torpedoes containing a cap composed of a mixture of red phosphorus and potassium chlorate exceeding an average of one-half (0.5) grain per cap

- Fireworks containing copper sulfate and a chlorate.

In addition, new fireworks devices are forbidden for transport except as provided in 49 CFR 173.86.

The transportation of permissible fireworks is regulated on the basis of the class of explosive to which the device belongs. Fireworks must be in a finished state, as supplied for retail trade, so that no loose pyrotechnic composition will be present in packages being transported. As defined by the Department of Transportation, Class B explosives include special fireworks, flash powders, and some pyrotechnic signal devices (49 CFR 173.88). Specific devices named include: toy torpedoes, railway torpedoes, some firecrackers and salutes, exhibition display pieces, aeroplane flares, illuminating projectiles, incendiary projectiles, incendiary bombs or grenades, and smoke projectiles or smoke bombs fuzed or unfuzed and containing expelling charges but without bursting charges, flash powders in inner units not exceeding 2 ounces each, flash sheets in interior packages, flash powder or spreader cartridges containing not over 72 grains of flash powder each, and flash cartridges consisting of a paper cartridge shell, small-arms primer, and flash composition, not exceeding 180 grains all assembled in one piece.

Common fireworks are included in the category of Class C explosives (49 CFR 173.100). The common fireworks that are considered by the Department of Transportation as Class C explosives are limited as to the types, sizes, and amounts of pyrotechnic composition they may contain. No component of any device that is intended to produce audible effects may contain more than 2 grains* of pyrotechnic composition, and devices may not disperse any metal, glass, or brittle plastic fragments upon functioning. Any new device that is not specifically listed in 49 CFR 173.100(r) must be approved by the Bureau of Explosives before it can be offered for transportation as common fireworks. The enumerated common fireworks are:

- Roman candles - no more than 10 balls spaced uniformly in tube, total pyrotechnic composition no more than 20 grams each in weight; inside tube diameter no greater than 3/8 inch.

- Sky rockets, with sticks - total pyrotechnic composition no more than 20 grams each in weight; inside tube diameter no greater than 1/2 inch; sticks securely fastened to tubes.

- Helicopter type rockets - total pyrotechnic composition no more than 20 grams each in weight; inside tube diameter no greater than 1/2 inch.

* 1 grain = 0.0648 grams

- Cylindrical fountains - total pyrotechnic composition no more than 75 grams each in weight; inside tube diameter no greater than 3/4 inch.

- Cone fountains - total pyrotechnic composition no more than 50 grams each in weight.

- Wheels - total pyrotechnic composition no more than 60 grams for each driver unit or 240 grams for each wheel; inside tube diameter of driver units no greater than 1/2 inch.

- Illuminating torches and colored fire in any form - total pyrotechnic composition no more than 100 grams each in weight.

- Dipped sticks - pyrotechnic composition of which contains any chlorate or perchlorate shall not exceed 5 grams.

- Mines and shells of which mortar is an integral part - total pyrotechnic composition no more than 40 grams each in weight.

- Firecrackers and salutes with casings - external dimensions no greater than 1 1/2 inches long or 1/4 inch in diameter; total pyrotechnic composition no more than 2 grains each in weight.

- Novelties - consisting of two or more of devices enumerated above when approved by the Bureau of Explosives.

Whenever the transportation of fireworks results in a hazardous incident, this fact must be reported by telephone to the Department of Transportation (202/426-1830) "at the earliest practicable moment" (49 CFR 171.15). An incident must be reported if during the course of transportation and as a direct result of the hazardous materials a person is killed or receives injuries requiring hospitalization, or estimated property or carrier damage exceeds $50,000, or in the judgment of a carrier there is continuing danger to life at the scene of the incident. The information must also be reported in writing within 15 days on DOT Form F5800.1. The reported information must include:

- Name and phone number of person reporting incident

- Name & address of carrier

- Date, time, and location of incident

- Extent of injuries, if any

- Classification, name, and quantity of hazardous materials involved

- Type of incident, nature of hazardous material involvement, whether there is continuing danger.

To learn the requirements for packaging and transporting fireworks via highway, railroad, air, or water, one must know to which class of explosives the fireworks belong and then consult the relevant regulations for that class. In some instances the federal regulations do identify practices related specifically to the transportation of fireworks, and these are summarized in the following pages, along with state regulations and NFPA recommendations.

PACKAGING

The regulations for packaging fireworks for transportation are aimed at minimizing potential hazards from explosion by restricting the types and quantities of fireworks that can be packaged in specified containers. Part 178 of 49 CFR contains the detailed specifications for shipping containers that are referenced in 49 CFR 173.91 pertaining to special fireworks and in 49 CFR 173.108 pertaining to common fireworks. It is the responsibility of the person who offers the fireworks for transportation to ensure that these specifications are met.

Special Fireworks

Special fireworks must be securely packed in the following types of containers that meet the referenced specifications in 49 CFR 178:

- Wooden boxes - gross weight no more than 500 pounds
- Fiberboard boxes - gross weight no more than 65 pounds.

The regulations for high explosives must be adhered to for shipping fireworks that can be exploded all at once by dropping the shipping container from a height of six feet or by the impact of a rifle bullet. Certain devices (illuminating projectiles, incendiary projectiles and smoke projectiles exceeding 90 pounds each in weight or at least 4 1/2 inches in diameter; and illuminating, incendiary, and smoke projectiles less than 4 1/2 inches may be shipped by, for, or to any branch of the U.S. military without being boxed if they are securely blocked and braced in accordance with the methods required by the relevant military department. Such projectiles, when less than 4 1/2 inches in diameter, must also be palletized. (A pallet is a portable platform designed for handling by a forklift truck or crane and used for storage or movement of materials and packages.)

Flash or spreader cartridges that contain no more than 72 grains of flash powder each must be packed in wooden or fiberboard boxes that meet the enumerated specifications. Inside containers must be cartons or tin cans that hold no more than 6 cartridges; there must be no more than 150 cartons or cans to an outer box. Flash cartridges, made up of a paper cartridge shell, small arms primer, and flash composition, not more than 180 grains each, must be packed in wooden or fiberboard boxes in which there are no more than 12 inside cartons, containing no more than 12 cartridges each. When flash cartridges or flash sheets weighing no more than 5 pounds are packed in small interior wooden boxes, these may be packed with non-explosive, nonflammable, or noncorrosive articles.

Flash sheets must be packed in wooden or fiberboard boxes in which the inner containers are packages or envelopes. There must be no more than 12 inner packages or envelopes, and each one must contain no more than 6 flash sheets. A wooden box must weigh no more than 150 pounds (gross) and a fiberboard box no more than 65 pounds.

Aside from the specific weight restrictions identified in the preceding paragraphs, no outside container of special fireworks may ever weigh more than 500 pounds. Each outside container must be plainly marked in letters at least 7/16 inch high, "SPECIAL FIREWORKS - HANDLE CAREFULLY - KEEP FIRE AWAY."

Common Fireworks

Common fireworks, as Class C explosives, must be securely packed in the following types of containers that meet the referenced specifications in 49 CFR 178:

- Wooden boxes - gross weight no more than 100 pounds
- Fiberboard boxes - gross weight no more than 65 pounds.

In addition, Chinese firecrackers may be transported in the package in which they were imported, if these are wooden or fiberboard boxes that meet the referenced specifications and are in good condition, completely covered with strong matting and weigh no more than 100 pounds. Fireworks, like sparklers that have a match tip or similar ignition site or surface, must be packed so that each ignition point or surface is entirely covered to prevent accidental contact or friction.

Except as otherwise specified, an outside package containing common fireworks may never weigh more than 100 pounds (gross). Each outside package must be plainly marked in letters no smaller than 7/16 inch, "Common Fireworks - Handle Carefully - Keep Fire Away."

All specification containers for the shipping of hazardous materials must meet the following general criteria (49 CFR 173.24):

- Marked in unobstructed area with letters and numerals identifying the container specification (e.g., DOT-15A)
- The name, address, and symbol of person who so marks container
- Markings must be stamped, embossed, burned or otherwise put on container to provide accessibility, permanence, and contrast so that marks can be readily seen and understood
- Letters and numerals must be at least 1/2 inch high
- Steel used must be low-carbon, commercial quality
- Lumber must be well seasoned, commercially dry and free from any defects that would lessen its strength.
- Appropriate materials and techniques must be used in welding and brazing
- Packaging materials and contents must present no possibility of significant chemical or galvanic reactions among any of the materials in the package
- Closures of packages must be adequate to prevent leakage of contents under normal conditions of transportation
- No nails, staples, etc., must protrude into the interior of the packaging
- The packaging must be thick and strong enough so that friction caused in transportation cannot produce enough heat to affect the chemical stability of the contents.

Some states have incorporated similar requirements for packaging of fireworks into their relevant regulations. States that have license and permit requirements for using fireworks frequently forbid the transportation of fireworks except for permitted uses. State regulations are in addition to

and never replace federal regulations. In some instances, state regulations simply require that intrastate transportation of fireworks should be in accord with Department of Transportation (DOT) regulations and only fireworks with the DOT or Interstate Commerce Commission (ICC) label may be transported.

MARKINGS, LABELS, AND PLACARDS

In addition to the information that is required to be put on packages containing fireworks, the classification of fireworks as Class B and Class C explosives necessitates the placement of warning labels on outside containers and placards on vehicles transporting fireworks. The packages must be durably and clearly marked with:

- The proper shipping name:

  Fireworks, Common
  or
  Fireworks, Special

- Name and address of consignee or consignor (except (1) if transportation is by highway and there will be no transfer to another carrier; or (2) package is part of a load destined for one consignee.

- The required label (49 CFR 172.407):

  Explosive C for common fireworks

  Explosive B for special fireworks

The explosives labels must be orange with black printing, durable and weather resistant, in the diamond-shape with each side at least 4 inches (101 mm) long.

In addition, each motor vehicle, railcar, and freight container that carries a hazardous material may be required to be placarded on each end and each side with specified placards (does not apply to transportation by air or water) (49 CFR 172.500). If the motor vehicle, railcar, or freight container holds special fireworks, classified as Class B explosives, the placard must read:

EXPLOSIVES B

When more than 1000 pounds of common fireworks, classified as Class C explosives, are being transported by motor vehicle and when any quantity of Class C explosives are being transported by railcar or freight container, the placard must read:

FLAMMABLE

The placards must be securely attached to be plainly visible from the direction they face.

The EXPLOSIVES B placard must be orange with a 1/2-inch (12.7 mm) white outer border, and black printing and symbol (49 CFR 172.524).

The FLAMMABLE placard must be red with white symbol and letters and 1/2-inch (12.7 mm) border (49 CFR 172.542).

The detailed specifications for paint and printing ink colors, the placard dimensions, and placard holders are contained in Appendices A, B, and C of 49 CFR 172.500.

Some (Texas, Massachusetts, New Jersey, Ohio) states require additional placarding of vehicles carrying fireworks. These placarding requirements are:

- FIREWORKS - NO SMOKING - letters at least 4 inches high (Texas)
- FIREWORKS - red letters on white background, minimum 6 inches high (Massachusetts)
- FIREWORKS - DANGER - KEEP FIRE AWAY - letters at least 3 inches high (New Jersey, Ohio)

TRANSPORTATION BY PUBLIC HIGHWAY (49 CFR 177)

Hazardous materials may be accepted for transportation by private, common, and contract carriers in interstate or foreign commerce if the materials are in good condition and properly classed, labeled, packed, stored, marked, described, and certified. All vehicles carrying hazardous materials must be marked and placarded as described above.

With a few exceptions (transport of small-arms ammunition, emergency shipments of drugs, chemicals and hospital supplies, and accompanying munitions of war of the U.S. military and where no other practicable means of transportation are available), no explosives or other hazardous materials may be transported on passenger-carrying vehicles. No explosive, except small-arms ammunition, may be transported in the passenger-carrying space of a motor vehicle transporting passengers for hire. The Department of Transportation regulations allow the transportation of limited quantities of explosives on vehicles carrying passengers for hire where no other practicable means of transportation are available:

- o No more than 100 pounds gross weight of any or all kinds of explosives that are permitted to be transported by rail express or rail baggage services
  - But samples of explosives for laboratory examination must weigh no more than one-half pound each and not exceed 20 samples at one time in one vehicle.

All motor vehicles used to transport explosives must have either a closed body, or the body must be covered with a tarpaulin. Explosives other than black powder may be transported on flat-bed vehicles if the explosives are packed in fire and water resistant containers or covered with a fire and water resistant tarpaulin. Motor vehicles transporting Class B explosives must have tight floors, and the interior sections that are in contact with the explosives must be lined with either non-metallic material or non-ferrous metals. The interior of the vehicle cargo space must be in good condition to minimize the possibility that the packages will be damaged by exposed nuts, bolts, broken floor boards or side panels, or other projections.

The NFPA (No. 44A) recommends that vehicles transporting fireworks be inspected to verify that the following components are in good working order and free from defects:

- o Fire extinguishers (at least two with a combined rating of 2A:10-B:C)
- o Electrical wiring - completely protected and secured to prevent short circuiting
- o Chassis, motor pan, and underside of body - reasonably clean and free of excess oil and grease
- o Fuel tank and feed lines - secure, no leaks
- o Brakes, lights, horn, windshield wipers, steering apparatus - function properly
- o Tires - properly, inflated, no defects.

The NFPA also enumerates qualifications for drivers of motor vehicles transporting explosives. The driver must be properly licensed, "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 that impair the faculties and not less than twenty-one years of age." In addition, when Class B fireworks are being transported, the driver or other qualified representative of the carrier must attend the vehicle at all times, except for necessary communication, and to obtain food or provide for physical comfort. A vehicle carrying Class B explosives may be left unattended in a parking area that meets the requirements stated in NFPA No. 498, Standard for Explosive Motor Vehicle Terminals. Except in an emergency or in order for the driver to obtain food or provide for his physical comfort, no vehicle transporting Class B fireworks may be parked, even if attended, on any public street adjacent to or near any bridge, tunnel, or building where people are present. DOT driver qualifications are found in 49 CFR, Part 391.

The attendant must know about the nature of the cargo and its inherent dangers, and must receive instruction on how to protect the public from danger. The attendant must be familiar with all traffic regulations and applicable State and Federal regulations concerning the transportation of fireworks. Local jurisdictions are empowered to prohibit the transportation of fireworks over specified roadways, bridges, and through tunnels. In addition, authorities may designate routes through congested areas, and these should be followed. Drivers of vehicles carrying fireworks should, in any case, avoid congested areas and heavy traffic.

Specific safety practices are required by DOT regulations during the loading and unloading of explosives. The engine of the motor vehicle must not be running while explosives are being loaded or unloaded. The hand brake must be set. No metal tools such as bale hooks may be used for any handling of explosives, nor any tools likely to damage the closure of the packages. No package or container of explosives, except barrels or kegs, may be rolled. Explosives must never be dropped or thrown. Care must be taken so that the explosives will not catch fire from sparks or hot gases coming from the tailpipe.

Extreme care must be taken to keep fire away from cargoes of explosives at all times. Smoking and the carrying of any open flame must be forbidden on or about any motor vehicle while explosives or flammable materials are being loaded or unloaded. Reasonable care should be taken to prevent an undue rise in the temperature of containers of explosives during transit.

Containers of explosives should be braced in the vehicle to prevent their movement while the vehicle is in motion. There must be no tampering with or discharge of the contents of any container between the point of origin and the destination. The transfer of explosives enroute is forbidden except

in emergencies. In such cases, all practicable means, including the use of red electric lanterns, reflectors, or red flags, should be taken to protect and warn other users of the highway of the hazard. Containers of explosives should be segregated or secured to be separated from other cargo, such as metal articles.

Similar provisions apply to the transport of Class C explosives, which include Class C fireworks: materials must be contained within the body of the motor vehicle or covered with a tarpaulin; special care must be taken to keep the materials from becoming wet; where there is danger from heating or spontaneous combustion, articles must be loaded to ensure sufficient ventilation to protect against the hazard. The segregation and separation requirements for special and common fireworks are listed below. Neither special nor common fireworks may be loaded or stored with these hazardous substances:

(1) Low explosives or black powder

(2) High explosives or propellant explosives, Class A

(3) Initiating or priming explosives, wet

(4) Blasting caps or electric blasting caps when quantity exceeds 1,000 caps; detonating primers

(5) Ammunition for cannon, small arms, rockets with various types of projectiles; boosters; bursters; and supplementary charges without detonators (Class B explosives must not be loaded or stored with chemical ammunition containing incendiary charges or white phosphorus either with or without bursting charges)

(6) Explosive projectiles; bombs; torpedoes; mines; rifle or hand grenades (explosive); jet thrust units (jato), Class A; igniters, jet thrust, Class A; rocket motors, Class A; igniters, rocket motor, Class A

(7) Detonating fuzes, Class A, with or without radioactive components

(8) Poisonous gases or liquids in cylinders, projectiles or bombs, poison gas label.

The transport of all hazardous substances should proceed with as little delay as possible. Delivery must be made only to an authorized person or for explosives shipments immediately placed in a magazine which is then locked. In the event of an accident, every effort must be made to keep people away from the scene, to prevent smoking near the scene, and if there is danger of explosion, to warn inhabitants in the vicinity and other highway users of the hazard.

All broken and unbroken containers of explosives should be removed from the scene of the accident as expeditiously as possible to prevent fire and explosion. Any explosive material spilled within the motor vehicle must be thoroughly swept up and removed. A damaged package may be repaired when this is not obviously dangerous; a package damaged beyond repair should be wrapped by stout paper and twine, placed in a strong box, and surrounded by dry, fine sawdust, or dry and clean cotton waste, or elastic wads made from dry newspapers. The box should then be securely attached. Such a damaged package of explosives must not be transported beyond the minimum distance necessary to reach a place where it can be disposed of safely.

In the case of an accident involving a vehicle carrying Class C explosives (e.g., Class C fireworks), every practicable and available means of warning approaching persons of the hazard must be taken. Care should be taken to limit the spread of any fire; if the removal of broken packages would minimize the hazard this should be accomplished.

TRANSPORTATION BY RAIL (49 CFR 174)

Railroad cars carrying fireworks must be placarded as described above. A placarded railcar may not be transported in a passenger train. Special fireworks, classified as Class B explosives, must be transported in closed cars or container cars that are in good condition and do not permit the entry of sparks. Cars with wood floors must have spark shields. The cars must not be equipped with any type of lighted heater or open-flame device or with any type of apparatus that utilizes an internal combustion engine. Packages must be blocked and braced to prevent movement; consult Bureau of Explosives Pamphlet No. 6 for methods of blocking and bracing (49 CFR 174.112). The transportation of special fireworks in passenger carrying railcars is forbidden.

Common fireworks, classified as Class C explosives, may be transported in any closed car or container car that is in good condition. As required for Class B explosives, the packages of Class C explosives must be blocked and braced to prevent the packages from changing position, falling onto the floor, or sliding into each other during transportation (49 CFR 174.115). No more than 50 pounds (maximum net quantity in one package) of common fireworks may be transported in passenger-carrying railcars.

Other safety regulations for the transport of hazardous materials in railcars specify segregation and separation requirements. Neither special nor common fireworks may be loaded or stored with the hazardous substances listed in the previous section. Additional requirements for separating and handling placarded railcars are contained in 49 CFR 174.

TRANSPORTATION BY CIVIL AIRCRAFT (49 CFR 175)

The acceptance of fireworks for transportation by aircraft requires that the amount of common fireworks be no more than 50 pounds (maximum net quantity in one package) for passenger carrying aircraft and no more than 200 pounds for cargo-only aircraft. The transportation of special fireworks on passenger-carrying aircraft is forbidden; up to 200 pounds may be transported on cargo-only aircraft (49 CFR 172.101). In addition, the fireworks must be described and certified on a shipping paper: labeled and marked, and placarded as required; and special fireworks labeled with CARGO AIRCRAFT ONLY label.

No hazardous material may be carried onto an aircraft unless the operator of the aircraft has inspected the package or outside container and determined that there are "no holes, leakage, or other indication that its integrity has been compromised". The pilot-in-command must be given the information in the shipping papers and told where the hazardous materials are located on the aircraft.

The operator must report any incident involving hazardous materials to the nearest Federal Aviation Administration (FAA) facility as soon as possible after the incident. An incident must be reported if through the presence of hazardous material a person is killed or receives injuries requiring hospitalization, estimated carrier or property damage or both exceeds $50,000, or the operator believes that a continuing danger to life exists at the site of the incident. In addition, such an incident must be reported in writing to the Department of Transportation on DOT Form F 5800.1 within 15 days of the date of discovery.

TRANSPORTATION BY SHIP (49 CFR 176)

The following explosives or explosive compositions are prohibited from being transported, carried, conveyed, stored, stowed, or used on board domestic or foreign vessels within the navigable waters of the United States:

- Any fulminate or other detonating compound in bulk in dry condition
- Any explosive composition that can ignite spontaneously or markedly decompose when subjected for 48 consecutive hours to a temperature of 167°F (75°C)
- Any composition containing an ammonium salt and a chlorate or other similar explosive.

The transportation of military explosives by ship is governed by the Coast Guard regulations as found in 46 CFR. An enforcement officer of the Coast Guard may at any time board any vessel for the purpose of enforcing the regulations relative to the transportation of hazardous materials. A customs collector may detain any vessel in violation of the regulations (under the authority of 46 U.S.C. 170(13). The National Cargo Bureau, Inc., is authorized to assist the Coast Guard in enforcing the regulations pertaining to inspection of vessels and stowage of hazardous materials. The National Cargo Bureau, Inc., can issue a certificate of loading that will be accepted by the Coast Guard as evidence that the cargo is stowed in conformity with 46 U.S.C. 170.

Certain requirements must be met to transport hazardous materials by ship:

- The material must be properly described on shipping papers with the appropriate certification, as described above
- The master of the vessel must prepare and retain for one year a dangerous cargo manifest, list, or stowage plan that includes:
  - Name and official number (or international radio call sign) of vessel
  - Nationality of vessel
  - Shipping name of each hazardous material on board
  - Number, description, and gross weight of package
  - Classification of hazardous material
  - Stowage location
  - For vessels used to store explosives, name and address of owner, location of mooring, name of person in charge, name and address of owner of the cargo, a complete record of all receipts and disbursements of hazardous materials
- The master of a manned vessel must be certain that each hold or compartment containing hazardous materials is inspected after stowage is complete and at least every 24 hours thereafter (not necessary where there are smoke or fire detection systems)
- The cargo of unmanned vessels must be inspected after stowage is complete
- Cargo must be inspected immediately before entering any U.S. port.

The handling and stowage of hazardous materials must be carried out under the supervision of a qualified person. Any person believed by the master of the vessel to be under the influence of liquor or drugs will not be permitted on board the vessel during the loading, unloading, or transport of explosives. Smoking is prohibited on or near any vessel loading or unloading explosives at a waterfront facility or explosives anchorage; NO SMOKING signs must be conspicuously posted. No leaking or damaged packages may be accepted for shipment. The hold or storage compartment for the hazardous materials must be swept clean of debris.

Common fireworks may be stowed either on deck or under deck away from heat (under deck is preferred where available) on both cargo and passenger vessels. Special fireworks may only be stowed under deck. Toy torpedoes may not be packed with other special fireworks. On passenger vessels, both common and special fireworks must be in metal lockers that meet the following specifications;

- Cubic capacity no greater than 150 cubic feet
- If more than 5 feet high, must be dividing shelf at half the height to carry the imposed load without deflection
- Constructed of steel of thickness no less than 16 gauge
- Interior must be completely smooth, with top and bottom closures unless built-in to the structure of the vessel (may not be built-in if over deck or under deck is wood)
- Closures must be hinged door or removable plate type if locker is flame tight when closed
- Where portable plate closures used, there must be accessible side openings for insertion of fire hose nozzle for flooding (opening at least 3 inches in diameter, 12 inches below the top of the locker, fitted with a metal flap to remain flame tight)
- Locker must be readily accessible from a companion way or cargo hatch; in wood vessels, locker must be easily observable by watchman; locker must be secured to prevent shifting.

Fireworks, like all explosives, must be handled carefully. Packages must not be thrown, dropped, rolled, dragged or slid over each other or the deck; each package must be secured and dunnaged to prevent movement in any direction. A fire hose long enough to cover the operation should be laid out and ready for use during loading. For additional details concerning the stowage, separation and segregation requirements and transport of explosives by ship, 49 CFR 176 should be consulted.

When an accident occurs aboard a vessel carrying hazardous materials, it is the responsibility of the master of the vessel to take action to safeguard the vessel, its passengers, crew, and cargoes. Hazardous materials may be jettisoned only if such action is necessary to prevent or substantially minimize a threat to human life. In the event of a fire or other hazardous situation, the master must notify the Captain of the nearest port as soon as possible. Where hazardous materials are involved in the incident, hazardous Materials Incident Reports may be required (see GENERAL REQUIREMENTS).

STORAGE

Class B fireworks require different storage facilities from Class C fireworks because of their different properties. All fireworks tend to be less sensitive to shock and impact than other explosives; however, fireworks tend to be more sensitive to sparks and flame than most explosives. Class B fireworks are intended to produce visible or audible effects by combustion, deflagration, or detonation. Class C fireworks produce their visible effects by combustion. Therefore, Class B fireworks must be stored in explosives magazines of Type 1, 2, 3, or 4 because of their explosive properties while Class C storage facilities are specially designed to reduce the confinement of the fireworks during a fire in order to prevent the material from becoming explosive. Thus, concrete or earthen barricades which effectively prevent shock initiated explosions of even unconfined Class A explosive materials can be a danger by increasing the amount and distance of fragment throw when the barricades confine fireworks.

The federal government and most states have detailed regulations pertaining to the storage of fireworks. These regulations must be consulted and followed at all times. Retail fireworks licensees should note that most states require that unsold fireworks be returned to the wholesaler or placed in approved, permanent storage except during a restricted period around the Fourth of July and New Year's.

Fireworks should always be segregated from other explosive materials and from other combustible materials such as paints, oils, or varnishes, unless kept in their original unbroken containers. Resin, turpentine, gasoline, or other flammable substances may not be kept with fireworks. Any room or building where fireworks are kept should be posted "FIREWORKS - NO SMOKING" in 4 inch high letters. In retail establishments fireworks must be kept out of reach of the general public, and fireworks should never be stored where sunlight can hit them, such as in window displays.

PERMITS AND RECORDS

The Bureau of Alcohol, Tobacco, and Firearms, as well as many states, requires a permit to store special fireworks. This permit can be issued only to persons 21 years of age or older, and it must be available for inspection at all storage facilities. The permit is non-transferable and must be renewed yearly. The permit may be revoked or denied for a number

of reasons, including non-compliance with regulations. A permit holder intending to change the location of a permanent magazine, add onto or change existing facilities, or upgrade the class of explosives stored in a magazine must apply for an amended permit.

A daily record of transactions at each magazine must be kept. It should include the total quantity of special fireworks received, the total quantity removed, and the total remaining on hand at the close of business for each class of explosives. If loss or theft of any material is determined, it must be reported to the Bureau of Alcohol, Tobacco, and Firearms and local authorities within 24 hours. Failure to do so is subject to the maximum penalty of $1,000 fine and/or 1 year imprisonment.

SEPARATION

All fireworks must be separated from inhabited buildings, passenger railways, public highways, and other magazines according to Tables 1 and 2 and Appendix G. Table 1 should be consulted for the separation of Class B or C fireworks from inhabited buildings, passenger railways, and public highways. Table 2 describes distances needed for Class B fireworks from other magazines and fireworks plants, and for Class C fireworks from magazines, processing plants, and other Class C fireworks storage facilities. In addition, no storage facility should be located under a high voltage (750 V or more) power line, nor may it be located near a fire hazard or in such a manner that fire fighting would be obstructed.

STORAGE FACILITIES - CLASS B FIREWORKS

There are four types of magazines designed for the storage of various amounts of Class B fireworks. A Type 1 magazine is a permanent structure that is bullet resistant, fire resistant, theft resistant, weather resistant, and ventilated. A Type 2 magazine is a portable or mobile structure (such as a box, skid-magazine, trailer, or semi-trailer) that is fire resistant, theft resistant, weather resistant, and ventilated. Type 2 magazines used outdoors are also bullet resistant. A Type 3 magazine is a portable magazine intended for the temporary attended storage of explosive materials. When unattended it is stored in another appropriate magazine. A Type 3 magazine is bullet resistant, fire resistant, theft resistant, and weather resistant. A Type 4 magazine is a permanent, portable, or mobile structure (e.g., building, igloo, box, semi-trailer) that is fire resistant, theft resistant, and weather resistant. The following table indicates which Class B fireworks are stored in these magazines:

Table 7

Classes of Magazines for Type B Fireworks Storage

Explosive Material	Magazine Type			
	1	2	3	4
Class B Fireworks (bullet sensitive)	x	x	x	
Class B Fireworks (not bullet sensitive)	x	x	x	x

There are many sources of information on the construction of storage magazines. Any construction must comply with federal (see Appendix G) and state requirements. The following specifications for the four types of storage magazines follow the recommendations of the National Fire Protection Association (NFPA).

General

The following general construction information applies to all types of magazines unless noted otherwise in the discussion of the specific magazine types that follows.

Grading - The ground should always be graded so that water will drain away from the magazine.

Heat - Heating systems should not be installed unless necessary and must be approved first. Heating can be by either hot water radiant heating inside or forced hot air warmed when blown over hot water, or low pressure (not more than 15 psig) steam coils, or electrically heated coils, located outside the magazine. There must be controls to keep the ambient temperature below 54.4°C (130°F). When using radiant heat the air must be free to circulate between explosives and coils. Storage of the explosives should be in a manner to allow uniform air circulation to maintain uniform temperatures. Ducts for forced air heat should not be allowed to blow hot air directly on the explosives. Fireworks containers must not come into contact with heating coils. Electric fans or pumps must be mounted outside, separate from the wall of the magazine, and they must be grounded. The electric fan motor and controls for electric heat must have overload protection and disconnects as specified in NFPA 70-1975, National Electrical Code (Appendix E). All electrical switching gear and an electrical heating source for water or steam must be at least 25 feet from the magazine, and a

fuel fired heating source must be at least 50 feet away. No portable magazine should be allowed within 20 feet of a heat source. The area betweeen the heating source and the magazine must be kept clear of combustible materials.

Lights - The only recommended lights are electric safety flashlights or electric safety lanterns. However, if other kinds of electric lights are authorized, adequate safety must be maintained.

Sprinklers - Because of the sensitivity of fireworks to spark or flame, storage buildings should be equipped with sprinklers. In some cases, however, depending on size and location of building, it may be better to allow a storage building to burn with controlled supervision.

Type 1 Magazine

Foundation - The foundation must be of masonry, wood, or metal. The only permissible openings are those for cross-ventilation.

Walls - The walls must be bullet resistant as well as fire and weather resistant. There are several types of construction that will fill this requirement.

- o The walls can be of 8-inch hollow masonry block filled with tamped dry sand or tamped cement and sand mixture.
- o They can be 8 inches of brick or solid cement.
- o They can be wood covered with 26 gauge metal and with a three-quarter inch sheathing of wood or plywood. There must be at least 6 inches between interior and exterior sheathings filled with tamped sand or tamped cement and sand mixture of at least a 1:8 ratio, respectively.
- o They can be 14 gauge metal lined with 4 inches of brick, solid cement block, or hardwood; or filled with 6 inches of sand.

There must be no ferrous metal exposed on the interior because of the danger of sparks.

Roof - The construction of the roof can be of 14 gauge metal, or three-quarter inch wood sheathed with 26 gauge metal or some other non-combustible material. Any wood exposed to the exterior must be covered with at least 26 gauge metal.

Floors - Hardwood or other suitable flooring is recommended. Any material that could cause sparks must be covered with non-sparking material. Alternatively, wooden pallets can be built over unsuitable flooring and the explosives stacked on these. Those magazines that have ventilated foundations must leave two inches of air space between the edge of the floor and the walls for air circulation.

Ceiling - If it is possible to shoot a bullet through the roof at such an angle that it could hit the explosive stores, then the roof or ceiling has to be made bullet resistant. For example, a sand tray 4 inches deep or 4 inches of hardwood should cover the whole ceiling, except for ventilation spaces.

Ventilation - To prevent dampness and overheating, adequate ventilation should be built into the magazine. To prevent sparks entering the magazine all vents should be screened with one-quarter inch or smaller wire mesh. Vents in the ceiling should be of water proof sheet metal. Vents in the walls should be offset or shielded. Magazines with vents that are designed to allow air circulation between floors and walls or ceilings and walls should have a wooden lattice "lining" installed to prevent explosive materials from being stacked against the wall where they would restrict air flow.

Doors - Two examples of bullet resistant doors are:

- three-eighths inch steel plate lined with 4 layers of three-quarter inch, tongue-and-groove hardwood, and
- 14 gauge (or thicker) metal plate lined with 4 inches of hardwood.

Locks - It is important to protect fireworks from theft by having adequate locks. The NFPA recommends the following locking systems for each door of a Type 1 magazine:

- 2 mortise locks, or
- 2 padlocks fastened in separate hasps and staples, or
- a mortise lock with 2 keys, or
- a 3-point or equivalent lock.

Doors locked by internal bolts do not need the additional locks above. The locks should secure the door to the frame at more than one place. The steel padlocks, with a minimum of 5 tumblers and at least 7/16 inch diameter case-hardened shackle, must have steel hoods to prevent the shackle being cut with bolt cutters. Hinges and hasps must be fastened to the magazine itself, and all locking hardware must be secured directly to the door frame.

Finally, when testing a Type 1 or any other magazine for bullet resistance, use test panels or be sure the magazine itself is empty.

Type 2 Magazine

Indoor - The magazine must have wheels or castors so that it can be quickly removed in emergencies. The sides, bottom and cover can be made of 2 inches of hardwood braced at the corners and covered with 20 gauge or thicker sheet metal. Interior nails must be countersunk. Alternatively, the magazine can be made of 12 gauge metal lined with non-sparking material. The edges of metal covers must overlap the sides by at least 1 inch. The cover must be attached with substantial strap hinges and be locked with a 5 tumbler steel padlock or the equivalent. The box must be painted red and say "EXPLOSIVES - KEEP FIRE AWAY" on the top in 3 inch high, white letters.

Outdoor - A Type 2 magazine to be used outdoors must be bullet resistant. It can be constructed of metal lined with at least 4 inches of hardwood or equivalent bullet resistant material. The floor must be of wood or other non-sparking material. Therefore, ferrous metal floors must be covered with other, nonsparking material. As in indoor boxes, the lid must overlap the sides by at least 1 inch when closed. The floor cannot be in direct contact with the ground. Small magazines will be securely fastened to a fixed object to prevent theft. Hinges, hasps, and locks must conform to Type 1 magazine specifications.

Vehicular - The sides and roof of a mobile Type 2 magazine must be of at least 20 gauge metal. The walls must be lined with:

- 4 inches of brick, solid cement block, or hardwood, or
- 6 inches of sand or other bullet resistant material.

The roof or ceiling must also be bullet resistant as in a Type 1 magazine. Exposed interior walls may be lined with wood. The floors are to conform to Type 1 construction. The doors can be either:

- metal lined with 4 inches of hardwood, or
- a metal exterior door and a 4 inch hardwood interior door.

There must be 2 padlocks on each entrance to the magazine:

- 2 padlocks on the exterior, on separate hasps and staples, or
- 1 padlock each on an exterior and an interior door.

The padlocks must be steel, with 5 tumblers, and at least a 7/16 inch diameter case-hardened shackle. They need not be protected by a steel hood. As in a Type 1 magazine, hinges and hasps are attached directly to the magazine, and all locks are mounted directly to the door frame. When unattended, the wheels must be removed or locked with a kingpin, or the trailer must be otherwise immobilized.

Type 3 Magazine

A Type 3 magazine shall be made of:

- o 4 inches of hardwood braced at the corners and covered with at least 20 gauge metal, or
- o 12 gauge metal lined with a nonsparking material. The edges must overlap the sides by at least 1 inch.

Nails exposed to the interior of wooden magazines must be countersunk. Type 3 magazines must have at least a five-tumbler padlock.

Type 4 Magazine

Outdoor - An outdoor Type 4 magazine will have the same foundations as a Type 1 magazine. The walls and roof must be constructed of:

- o masonry, or
- o wood covered with metal, or
- o fabricated metal, or
- o any combination of a, b, or c.

The doors should be metal or wood covered with metal. The floors, ventilation, locks, hinges and hasps shall also conform to Type 1 specifications.

Vehicular - Type 4 magazines should meet Type 2 specifications for locks, hinges, hasps, and locking hardware. The vehicle must be immobilized when unattended.

Magazine Operations

The magazine must be in the charge of a competent person 21 years or older, who is responsible for the enforcement of safety procedures. The safety rules should be posted on the interior of the magazine door. The magazine

must be locked at all times except during the placement and removal of fireworks and during inspections. Inspections should take place at least every 3 days to check for unauthorized entry or illegal removal of the contents.

No smoking, matches, open flames, spark-producing devices or gun (except a gun worn by a guard) is permitted within 50 feet of any Class B fireworks storage facility. The area around a magazine must be kept clear of brush, dry grass, and other combustibles for 25 feet, and of rubbish for 50 feet. No other combustible materials may be stored within 50 feet of a magazine. The property around a magazine must be posted with warning signs that say "EXPLOSIVES - KEEP OFF." The signs should be situated in such a way as to minimize the possibility that a bullet which is shot at a sign might hit the magazine.

Good housekeeping procedures must be followed at all times. Corresponding grades and brands of fireworks should be stored together so that their marks show. This makes it easier to count and check supplies. Different kinds of explosive materials should be segregated from one another. The Class B fireworks containers should be laid flat with the top sides up. They should be piled in a stable manner. Powder kegs should be stored on their ends with the bungs down or on their sides with the seams down.

Wooden or damaged containers should not be unpacked or repacked inside a magazine, or within 50 feet of a magazine or other explosives. Only fiberboard containers may be opened inside a magazine. Tools to open Class B fireworks containers should be of nonsparking material. A wooden wedge and a fiber, rubber, or wooden mallet are used for opening and closing wooden cases. Metal slitters may be used to open fiberboard. Open containers must be securely closed before being returned to the magazine. No container without a lid may be stored. Metal tools other than non-ferrous conveyors cannot be stored with Class B fireworks. Ferrous metal conveyor stands may be stored in a magazine when the stands are protected with a coat of paint.

The floors should be swept regularly and kept clean and dry. Brooms and other cleaning utensils must not have any metal, spark-producing parts. The sweepings should be disposed of according to the manufacturers instructions. If interior repairs to the magazine are necessary, all fireworks must be removed and the floors thoroughly cleaned. The contents must also be removed during exterior repairs if there is a danger of producing sparks. The materials should be placed in another magazine, or a safe distance away where they will be protected and under guard. They should be returned promptly to the magazine as soon as repairs are completed.

STORAGE FACILITIES - CLASS C FIREWORKS

Class C fireworks are exempted from federal storage regulation. Therefore, the following safety information is taken from the National Fire Protection Association. These storage recommendations refer to the Class C fireworks listed in TRANSPORTATION - GENERAL REQUIREMENTS.

A Class C fireworks storage facility may be permanent, portable, or mobile (i.e., building, igloo, box, trailer, semitrailer). It must be fire resistant on the exterior, weather resistant, theft resistant, and ventilated. If venting is not supplied, the facility must be constructed with a "weak wall" that will give way under the pressure generated by burning fireworks. The wall must be directed toward a "safe" area. Class C fireworks in any phase of processing may be stored only in such a facility.

All entrances and windows must have locks. Doors must open outwards and all exits must be clearly marked. Aisles and exits must not become blocked.

Wiring must conform to the National Electrical Code Section 502-4(b). Only dust-ignition proof type fixtures can be used, and all light fixtures must have guards. No wall receptacles may be used. There must be a master switch located outside any storage facility that has electricity.

Because of the high sensitivity of fireworks to spark or flame, sprinklers should be provided in storage buildings. If a warehouse is small, no sprinklers should be necessary.

Facility Operations

The storage facility must be in the charge of a competent person 21 years or older, who is responsible for the enforcement of safety procedures. Safety rules must be posted. The facility must be locked except during operations.

No smoking, matches, open flames, spark-producing devices, or firearms (except a gun worn by a guard) is permitted within 25 feet of a Class C fireworks storage facility. The surrounding area must be kept clear of brush, dried grass, leaves, and other combustibles for at least 25 feet, unless equivalent protection is provided. The storage building must be posted with signs that say "FIREWORKS - NO SMOKING" in letters at least 4 inches high.

Good housekeeping procedures must be followed at all times. Class C fireworks should be stored unopened in their original cases or cartons because of the insulation properties of the packaging. However, Class C fireworks returned by retailers may be temporarily placed in bins until they can be repackaged. Containers must be piled in a stable manner. Tools used to open containers must be of nonsparking material, except metal slitters can be used to open fiberboard packaging.

The floors should be swept regularly and kept clean and dry. Brooms and other cleaning utensils must not have any metal, spark-producing parts. Sweepings, including empty, used packaging must be properly disposed of. If interior repairs to the storage area are necessary, all fireworks must be removed and the interior thoroughly cleaned. The contents must also be removed during exterior repairs if there is a danger of producing sparks. The fireworks should be placed in another storage facility or else a safe distance away where they will be protected and guarded. They should be returned promptly as soon as repairs are completed.

PUBLIC DISPLAYS

The following recommendations on storing fireworks at public displays are taken from the California fireworks laws, Title 19, Subchapter 6, Article 15.

At public displays all fireworks must be stored in a manner secure from fire, accidental discharge, and theft. Generally, such storage must be approved by the fire authority. Before firing begins, the entire complement of shells must be at the site. Storage should be at least 25 feet away and upwind from the nearest mortar. The shells must be kept in a "ready box" constructed of at least:

- o 1/2 inch wood, or
- o 3/8 inch plywood, chipboard, prestwood, or equivalent.

Preferably, the "ready box" should be compartmented to avoid the mixing of shell sizes, or a "ready box" can be provided for each shell size at large displays.

The boxes should be set with their bottoms facing the mortars so that the tops open away from the mortars. The front of the box (now facing the ground) should be raised at least 30 degrees from horizontal. However, the boxes may set on their bottoms and open towards the mortars provided the lids have stops so that they may be opened no more than 60 degrees. Latches, hooks, or other devices to hold open the "ready boxes" must not be used. A flameproof, water repellent canvas must protect the "ready boxes" at all times except during the removal and return of shells.

SPECIAL EFFECTS

California has legislated the use of special effects pyrotechnics in the entertainment business. The safety recommendations found here are taken from Title 19, Subchapter 6, Article 14. The storage facilities supplied are to be used only for special effects materials, and the area must not be used for the assembly or manufacture of special effects or any other fireworks. The storage facility must be either a Class I or a Class II magazine. A Class I magazine is bullet resistant and conforms to a Type I magazine or a Type 2 outdoor or vehicular magazine. A Class II magazine conforms to a Type 2 indoor, Type 3, or Type 4 magazine.

Additionally, storage may be in a special effects building or room as described by Title 19:

- o The building shall be sprinklered as required in Article 38, Subchapter 1, Title 19.
- o It shall be deemed that the storage of Special Effects Materials creates an atmosphere of flammable dust.
- o Two or more permanent openings having an area of not less than 100 square inches shall be located in the exterior wall to provide natural ventilation. These openings shall be protected by screens or louvers covered with ¼ inch wire mesh screen.
- o Walls, floor, ceiling, shelves and benches shall have a smooth non-metallic surface which can be easily cleaned with a minimum of brushing or scrubbing.

- Each entrance door shall be posted on the outside with signs stating, "Authorized Personnel Only" and "No Smoking."

- Assembling and manufacturing are prohibited in Special Effects Storage rooms or buildings.

- The room shall be located above grade in a one-story building or on the top floor of a multi-storied building or may be a separate building.

- The room or building shall have a minimum floor area of 80 square feet with no dimension less than 8 feet.

- Electric wiring, lighting and heating shall be of a type approved for use in hazardous locations.

Table 8 specifies the storage of special effects materials in Class I or II magazines, or special effects rooms. The permanent storage of any quantity of special effects materials over 10 pounds must comply with these recommendations. Quantities of 10 pounds or less may be stored in containers and locations approved by the local fire authority. Outside storage is only allowed upon written permission of the local fire authority. Temporary storage for the duration of a single production must be limited to the amount of special effects materials needed for that production and specified in the permit obtained from the local fire authority. A Class II magazine may be used to carry working quantities of materials to and from sets and locations. The same good housekeeping practices described under STORAGE FACILITIES - CLASS B FIREWORKS should apply.

Table 8

Storage of Special Effects Materials

Item	DOT Classification	Quantity Permitted In: Class I Magazine	Class II Magazine	Special Effects Room	Special Instructions
Bulk Smoke Comp. Black, White, Gray in 1 lb. containers	Class C Explosives	Note 2	100 lbs	Note 3	Maximum of 50 each 1 lb. cartons in a closed DOT required box
Bulk Smoke Comp. All Colors (Dye Base)	Class C Explosives	Note 4	Capacity of box	Note 3	Keep in individual cartons in a closed DOT required box

Table 8 (continued)

Storage of Special Effects Materials

Item	DOT Classification	Quantity Permitted In: Class I Magazine	Class II Magazine	Special Effects Room	Special Instructions
Two-component White Smoke Component #1	Not subject to classification	No Limit	Capacity of box	Note 3	Packaged in 1 lb. cartons
Component #2	Special Fireworks Class B Explosives	Note 2	100 lbs.	Note 3	Maximum of 50 each 1 lb. cartons in a closed DOT required box.
Smoke Pots, Black, White, Gray & Colors	Class C Explosives	Note 4	Capacity of box	Note 3	Maximum of 1 gross in a closed DOT required box
Smoke Pellets (Pyrotechnic)	Common Fireworks Class C Explosives	Note 4	Capacity of box	Note 3	Maximum of 10 lbs. per carton
Smoke Pellets (Non-Pyrotechnic)	Not Restricted				
Smoke Cloth	Special Fireworks Class B Explosives	Note 2	Capacity of box	50 lbs.	1 square yard wrapped in paper and packaged
Flash Powders in 2 oz. containers	Special Fireworks Class B Explosives	Note 2	10 lbs.	Note 1	Maximum of 80 each 2 oz. container in a closed DOT required box
Common Photo Flash --Two part for shipping: Comp. A Comp. B	Flammable Solid Oxidizing Material				Store as Flammable Solid Store as Oxidizing Material

Table 8 (continued)

Storage of Special Effects Materials

Item	DOT Classification	Quantity Permitted In: Class I Magazine	Class II Magazine	Special Effects Room	Special Instructions
Flash Sheet Lightning Flash	Special Fireworks Class B explosive	Note 2	Capacity of box	10 sheets in closed box	Sheets, flat or rolled, wrapped paper or cardboard, in a required DOT box. Not to be stored beyond current production
Flash Reports	Special Fireworks Class B Explosives	Note 2	Capacity of box	200 pieces in closed box	50 pieces in DOT required box
Simulated Phosphorus in 2 oz. containers	Special Fireworks Class B Explosive	Note 2	Capacity of box	10 lbs. in a closed box	Keep in 2 oz. containers in a closed DOT required box
Imitation Phosphorus	Flammable Solid		50 lbs.	Note 3	50 each 5 lb. containers in a DOT required box
Photo Flares	Hand Signal Device Class C Explosive	Note 4	Capacity of box	200 Flares	12 flares per closed DOT required box
Underwater Flares	Class C Explosive	Note 4	Capacity of box	200 Flares	12 flares per DOT required box
Common Fireworks (Firecrackers, Roman Candles, Sparklers, Fountains, etc.)	Common Fireworks Class C Explosive	Note 4	Capacity of box	Note 3	Packaged in DOT required containers. Not to be stockpiled beyond current production

Table 8 (continued)

Storage of Special Effects Materials

Item	DOT Classification	Quantity Permitted In Class I Magazine	Quantity Permitted In Class II Magazine	Quantity Permitted In Special Effects Room	Special Instructions
Colored Fire Red, Green, Yellow, etc.	Common Fireworks Class C Explosive	Note 4	100 lbs.	Note 3	50 each 1 lb. cartons per DOT required box
Fire Lighters	Class C Explosive	Note 4	Capacity of box	Note 3	50 per carton packed into DOT required box when more than 1000
Electric Squibs	Class C Explosive	Note 4	Capacity of box	Note 3	50 per carton, packed into DOT required box when more than 1000
Bullet Effects/ Hits Soft Dots (1000 or more)	Electric Blasting Caps Class A Explosive	Cannot be stored in a magazine with other explosives	Capacity of box. (With no other explosives)	Not Permitted	Maximum of 100 each, separately wrapped and shunted, per approved carton
Bullet Effects/ Hits Soft Dots (less than 1000)	Electric Blasting Caps Class C Explosive	Cannot be stored with other explosives	Capacity of box. (With no other explosives)	3000 pieces (1000 per Class II magazine)	Maximum of 100 each, separately wrapped and shunted, per approved carton
Instantaneous Fuse (Black Match, Quick Match, Raw Match, Arcing Match, etc.)	Class C Explosive	Note 4	Capacity of box	Note 3	250 ft. per carton (mailing tube)

Table 8 (continued)

Storage of Special Effects Materials

Item	DOT Classification	Quantity Permitted In			Special Instructions
		Class I Magazine	Class II Magazine	Special Effects Room	
Safety Fuse (Red or Green Fuse, Dynamite Fuse)	Class C Explosive	Note 4	Capacity of box	Note 3	Keep in approved cartons
Primacord	Cordeau Detonant Fuse Class C Explosive	Note 2	Capacity of box	1000 ft.	1000 ft. spools in DOT required boxes Cannot be stored with detonators or high explosives
Black Powder Bombs 16 oz.	Special Fireworks Class B Explosives	Note 2	90 pieces	Note 1	Maximum of 45 pieces per closed DOT required box, separated by suitable packing
12 oz.	Special Fireworks Class B Explosives	Note 2	90 pieces	Note 1	"
8 oz.	Special Fireworks Class B Explosives	Note 2	90 pieces	Note 1	"
6 oz.	Special Fireworks Class B Explosives	Note 2	150 pieces	Note 1	Maximum of 75 pieces, as above
4 oz.	Special Fireworks Class B Explosives	Note 2	200 pieces	Note 1	Maximum of 100 pieces, as above
3 oz.	Special Fireworks Class B Explosives	Note 2	200 pieces	Note 1	"

Table 8 (continued)

Storage of Special Effects Materials

Item	DOT Classification	Quantity Permitted In Class I Magazine	Class II Magazine	Special Effects Room	Special Instructions
2 oz.	Special Fireworks Class B Explosives	Note 2	200 pieces	Note 1	Maximum of 100 pieces, as above
1 oz.	Special Fireworks Class B Explosives	Note 2	200 pieces	Note 1	"
Black Powder	Class A Explosive	Note 2	10 lbs. Not over 1 lb. per container	Note 1	Maximum of 25 lbs. per container in Class I Magazine
Trail Powder	Class A Explosive	Note 2	10 lbs. Maximum 1 lb. per container	Note 1	
Smokeless Powder	Propellant Explosives, Class B	Note 2			

SPECIAL NOTES:

1. Flash powder, black powder, and black powder bombs and detonating fuse are not to be stockpiled in a Special Effects Materials Storage Room. Only that quantity needed in connection with a current production is permitted. Individual bombs shall be kept within containers as listed under Special Instructions. Bombs larger in size than 4 ounces may only be stored in a maximum net weight of 10 pounds except by written permit from the local fire authority.

2. In a Magazine of the First Class, storage shall be prescribed by the Quantity-Distance Table.

3. The maximum amount of materials allowed in a Special Effects Materials Storage Room shall be 760 pounds in the aggregate.

4. Class C explosives are to be stored in manner prescribed by local fire authority.

USE

According to the Consumer Product Safety Commission, injuries from fireworks can be characterized as arising from misuse or malfunction of the devices, or both. It is thus essential to know the proper use of fireworks devices and the safe practices that can mitigate the effects of device malfunction. To discuss safe practices in the use of fireworks, one must first of all know which fireworks can be legally sold and used by consumers and which fireworks are available only through specially enacted legislative exemptions.

In an attempt to reduce the number of injuries from fireworks, the federal government incorporated into the Child Protection Act of 1966 a ban on Class B consumer fireworks. These Class B fireworks, which include the large exploding fireworks such as M-80s, cherry bombs, and all other devices containing more than 2 grains (130 mg) of explosive composition, are thus not available for consumer use. However, virtually every state has enacted legislation to permit the use of such devices for public display when the display is conducted by a competent operator, a permit is obtained from the proper governmental body, and a bond is posted and/or proof of ability to assume financial responsibility for injury to persons and property is submitted. This and some less important uses that constitute exceptions to the general ban on dangerous fireworks will be discussed in this section.

At the federal level, the Consumer Product Safety Commision is the agency which is primarily concerned with safety in the handling of Class C fireworks. In addition, most states have requirements and restrictions related to the sale (ordinarily a prerequisite to use) and the use of Class C fireworks. And often local jurisdictions are empowered to regulate the sale and use of fireworks as well.

The person desiring to use fireworks should first be certain that it is legally permissible for him to use the device in the place where he intends to use it: the device must have a label that includes the name of the manufacturer, cautionary information, instructions for use, and the words "Class C Fireworks". In addition, the user must ascertain whether the use of such a device is prohibited by any state or local law or regulation. Once the person has determined that he/she can legally use a fireworks device, he/she should follow the safe practices for use of common fireworks outlined under USE OF CLASS C COMMON FIREWORKS.

The use of Class B fireworks by consumers is extremely hazardous and is, therefore, prohibited; however, there are certain exceptions to this prohibition that constitute non-consumer uses of fireworks. Such exceptions are regulated first of all by federal license and permit requirements and then by the individual state's definition and regulation of the excepted uses as described under USE OF CLASS B SPECIAL FIREWORKS.

USE OF CLASS C COMMON FIREWORKS

The following discussion of safe practices involved with the use of common or Class C fireworks is predicated upon the assumption that such use is legal. Although federal law does not prohibit the use of such fireworks, many states and local jurisdictions do prohibit or restrict their use to varying degrees. In some states, only those fireworks that bear the Department of Transportation Class C label may be sold. Some states use the distinction between safe and sane and dangerous fireworks and stipulate that only those classified by the State Fire Marshal as safe and sane are permissible. Other states enumerate devices or specify what amount and what kinds of pyrotechnic composition may be present in permissible fireworks devices. Still other states prohibit the sale and use of all devices except those specified, which often include devices that use or contain toy caps having a pyrotechnic composition of no more than 25/100 of a grain and are constructed so that the hand cannot be in contact with the cap when it explodes. Sparklers are also frequently excepted.

Only two states (Hawaii and Nevada) have no state laws pertaining to fireworks. The information in Table 9 summarizes state regulation of Class C fireworks. However, it is the responsibility of the user to ascertain both state and local requirements for the use of fireworks.

The final order for fireworks and firecrackers issued by the Consumer Product Safety Commission on June 8, 1976, lowered the permissible amount of pyrotechnic composition in firecrackers from 130 mg to 50 mg and established performance standards and labeling requirements for Class C fireworks intended for consumer use. A discussion of the performance standards and a description of the required labels are found under TRANSPORTATION in this manual. It is essential that the user read and abide by the instructions for use that are required by federal regulation to be on the label of every fireworks device.

In light of the potential for injury, the user should follow certain practices to mitigate the effects of possible malfunction of the fireworks device:

Table 9

State Class C Fireworks Regulations

State	Allow All	Allow Those Approved	Allow Those Specified by Law	Allow Only Sparklers	Allow Only Snakes	No State Laws	Ban All
Alabama				X			
Alaska	X						
Arizona							X
Arkansas	X						
California		X					
Colorado				X			
Connecticut							X
Delaware							X
District of Columbia			X				
Florida				X			
Georgia							X
Hawaii						X	
Idaho			X				
Illinois							X
Indiana				X	X		
Iowa				X	X		
Kansas		X					
Kentucky				X	X		
Louisiana	X						
Maine				X			
Maryland				X			
Massachusetts							X
Michigan				X	X		
Minnesota							X
Mississippi	X						
Missouri	X						

Table 9 (continued)

State Class C Fireworks Regulations

State	Allow All	Allow Those Approved	Allow Those Specified by Law	Allow Only Sparklers	Allow Only Snakes	No State Laws	Ban All
Montana			X				
Nebraska		X					
Nevada						X	
New Hampshire							X
New Jersey							X
New Mexico		X					
New York							X
North Carolina							X
North Dakota			X				
Ohio							X
Oklahoma			X				
Oregon				X	X		
Pennsylvania				X			
Rhode Island							X
South Carolina			X				
South Dakota	X						
Tennessee	X						
Texas			X				
Utah				X			
Vermont							X
Virginia			X				
Washington		X					
West Virginia							X
Wisconsin				X			
Wyoming			X				

- o Look for a manufacturer's label - fireworks without this label are made illegally and may not incorporate safeguards required for legal manufacture.

- o Do not use any fireworks device that looks as though it may have been wet - moisture affects the chemical composition and may cause the paper casing and the fuse to deteriorate.

- o Do not use any fireworks device that is leaking powder, appears to be old, or shows any signs of mishandling.

- o Do not use any fireworks device that has a loose fuse - the device may not ignite properly.

All legal fireworks must meet performance specifications and carry a label that includes the name of the manufacturer, instructions for use, and the words "Class C Fireworks". Fireworks without this label should never be used.

Since misuse of fireworks is the most common cause of injury, particularly for children under 15, the CPSC recommends certain practices to avoid such misuse:

- o Do not allow small children to use any fireworks, including sparklers, which burn at very high temperatures. Children cannot understand the danger involved or proper emergency procedures.

- o An adult should be present when fireworks are used.

- o Read the cautionary information and read and follow the instructions for proper use on the fireworks label.

- o Handle the fireworks carefully at all times.

- o Fireworks should be used outside in a clear area, away from buildings, people, and flammable material.

- o Do not put fireworks into any glass or metal container before lighting them.

- o Never take fireworks devices apart or attempt to make your own fireworks.

- o Keep a bucket of water handy.

- o Do not handle or attempt to relight a firework that has failed to function.

- o Dispose of fireworks that have malfunctioned by soaking them in water.

- o Only light one fireworks device at a time and move back quickly after lighting.
- o Be sure all persons are a safe distance away before lighting fireworks.
- o Never carry fireworks in your pockets or anywhere within your clothes.
- o Store fireworks in a cool dry place.

In addition general safety precautions, some of which are incorporated into state regulations, apply to the safe use of fireworks:

- o Never use fireworks near gasoline or other flammable liquids.
- o Never smoke while using fireworks.
- o Never use fireworks near where anyone is smoking or in the presence of open flames.
- o Never throw fireworks at any person.
- o Never light or discharge fireworks near any person.
- o Never throw fireworks into or from a moving vehicle.
- o Never handle or use fireworks while under the influence of drugs or alcohol.

State laws that regulate the sale of fireworks devices also affect the use of fireworks. Most states that allow the use of fireworks require that both wholesalers and retailers obtain a license to sell fireworks. The issuance of a license requires that the sale of fireworks presents no condition that increases the risk of fire and explosion. Retail sale in most states is restricted to the time around the Fourth of July (from mid or late June until July 5) and in some cases also around New Year's (mid to late December until January 1 or 2). State laws also specify that it is illegal to sell fireworks to children who are under a certain age (i.e., age 10 in Texas, age 12 in Illinois, age 21 in Montana), and to intoxicated or irresponsible persons.

Some states prohibit the sale of fireworks from vehicles and roadside stands. Frequently state regulations specify that fireworks being sold may not be directly accessible to the public unless an attendant is present at all times. Fireworks should not be displayed in store windows where the sun can shine on them, nor should they be sold where there are paints, oils, and varnishes, unless these remain in their original containers.

Likewise fireworks should not be sold where there are resins, turpentine, gasoline and other flammable substances that may generate flammable vapors. Many states specify that fireworks cannot be stored, sold or discharged within a specific number of feet (California - 100 feet; District of Columbia - 50 feet) from gasoline pumps. Wherever fireworks are sold, signs must clearly indicate their presence: FIREWORKS - NO SMOKING.

Local jurisdictions as well as the states may regulate the sale of fireworks, so any person desiring to sell or buy fireworks should carefully investigate what the regulations are in the place where business will be conducted. Generally, such regulations are intended to minimize the danger from fire and explosion that is potentially present where there are fireworks and to restrict the use of the fireworks to responsible, adult consumers.

USE OF CLASS B SPECIAL FIREWORKS

The use of Class B fireworks by consumers is prohibited; Class B fireworks may be used only as defined by legislatively enacted exceptions. Most such uses require a federal license or permit. The exceptions to the prohibition of the use of Class B fireworks include:

- Fireworks for public display (the most important use)
- Fireworks used for signal purposes or illumination by railroads or other transportation agencies
- Blank cartridges used for shows or for signal or ceremonial purposes in sports events
- Fireworks used by the military
- Fireworks used in agriculture to protect crops and prevent the occupancy of unwanted animals (most states prescribe conditions for this use).

The section titled Public Display describes in detail the safe practices to be followed when using Class B fireworks for public display. These and the general safety practices for using fireworks also apply to the other excepted uses.

Federal User Licenses and Permits

Title XI of the Organized Crime Control Act of 1970 (18 U.S.C. Chapter 40) establishes requirements for the use of explosive materials, including

black powder and other pyrotechnic compositions commonly used in fireworks. These requirements are implemented by the regulations in Part 181 of Title 27, Code of Federal Regulations. Although "the importation and distribution of fireworks in a finished state commonly sold at retail for personal use in compliance with State laws or local ordinances" are specifically exempted from regulation (Section 181.14(h)), these requirements do apply to "special fireworks", which are classified as Class B explosives by the Department of Transportation. Here again, the essential point to remember is that some fireworks are explosives and the regulations which apply to explosives also apply to these fireworks.

A dealer, "any person engaged in the business of distributing explosive materials at wholesale or retail", must apply for a federal dealer license. A dealer license will entitle the person to transport, ship, and receive explosive materials (Class B fireworks) in interstate and foreign commerce and to engage in the business of distributing such materials at wholesale or retail. An application for a dealer license must be filed with the Service Center Director for the internal revenue district in which the business is located and must be accompanied by a $20 fee.

Users of special fireworks or of explosive materials needed in manufacturing fireworks must apply for a user permit when interstate commerce is involved. The user permit can be obtained through application to the Service Center Director of the internal revenue district where the applicant resides or maintains his principal place of business; the user permit fee is $20. This permit authorizes the person to acquire explosive materials for his own use from a licensee in another state or foreign country and to transport the explosives in interstate or foreign commerce.

A user-limited permit, obtained similarly through application and payment of a $2.00 fee, is valid only for a single purchase transaction. This type of permit would be needed by civic organizations who put on Fourth of July fireworks displays. However, frequently groups contract for special fireworks from out-of-state dealers who provide a total service that includes the transportation of the fireworks and the service of a pyrotechnics operator. In such a case, those sponsoring the display would not require a federal user-limited permit because they are not actually acquiring the fireworks, or receiving or transporting them through interstate commerce. Agencies of the United States Government or of any U.S. state or political subdivision are exempt from the permit requirements and, therefore, need not obtain a permit to purchase Class B fireworks for a display.

Within 45 days from the time the application is submitted, the Assistant Regional Commissioner must either approve or refuse the application for a license or a permit. If the application is properly filled out and the Commissioner finds through further investigation or otherwise that the applicant is entitled to the license or permit, the license or permit will be issued if:

- The applicant is 21 years old
- Distribution of explosive materials to the applicant is not forbidden under the Organized Crime Control Act, and applicant has not willfully violated the Act
- The applicant has not knowingly made false or deceitful statements on his application
- The applicant has in a State business premises from which to conduct the business stipulated on his license or permit
- The applicant has storage facilities that meet the federal requirements for storage of particular types of explosives unless he can establish that storage will not be a necessary part of this operation
- The applicant has certified that he understands all relevant State laws and local ordinances
- The applicant has submitted the certificate required by Section 21 of the Federal Water Pollution Control Act

The dealer license and user permit are valid for one year; the user-limited permit is valid only for a single purchase transaction. Licenses and permits are not transferable, and change in the nature of the business may require a new or a different category of license. It is important to remember that the granting of a federal license or permit does not in any way affect the responsiblity of the licensee or permittee to abide by state and local laws. The federal regulations state: "A license or permit issued under this part confers no right or privilege to conduct business or operations, including storage, contrary to State or other law ... similarly, compliance with the provisions of any State or other law affords no immunity under Federal law or regulations".

Holders of Federal licenses and permits must fulfill certain requirements in the conduct of their business:

- The licenses or permits issued or copies thereof must be kept posted and available for inspection where explosive materials are distributed.
- A licensed dealer who sells or otherwise distributes explosive materials must verify the identity and status as a license or permit holder of the person receiving the explosives. In the case of a business receiving explosive materials, the identity of the authorized agent must be verified.
- A licensed dealer or permittee who acquires explosive materials from another licensee or permittee must submit a certified current statement of the intended use of the explosive materials.

- A user-limited permit, valid for a single transaction only, must be presented to the licensed manufacturer, dealer, or importer who will write "transaction completed" across the permit, the date, sign his name, write his license number, and return the permit to its holder.

As described under MANUFACTURING, in some limited circumstances explosive materials can be acquired without a federal license or permit. Basically, such transactions are possible if the explosive materials do not go through interstate commerce. A licensed dealer is prohibited from distributing explosive materials to certain persons under certain circumstances:

- The person does not hold a license or permit and does not reside in the same state or a contiguous state that has enacted legislation to permit such transactions
- The person is under 21 years old
- The person resides in a state or intends to transport explosives to a State where the purchase, possession or use of such explosive materials by such person violates State law or local ordinance
- The explosives may be used for an unlawful purpose
- The person is under indictment for a crime punishable by more than one year in prison
- The person is an unlawful user of marihuana, stimulant, depressant or narcotic drugs
- The person has been found by a court to be mentally defective or has been committed to a mental institution.

Federal license and permit holders are required to keep and maintain records of their transactions in permanent form for a minimum of five years. These records must be open to inspection by internal revenue officers. Licensed dealers must keep specific records as stipulated by the federal regulations:

- True and accurate inventory of explosive materials on hand; such inventory must be taken when business is commenced, moved or discontinued, and at other times as required by the Assistant Regional IR Commissioner
- Each purchase or other acquisition of explosive materials must be recorded no later than the close of the next business day; the record of each transaction must include:
  - the date of receipt

- the name, address, and license or permit number of person from whom materials were received
- the name of the manufacturer and importer, if any
- the manufacturer's marks of identification, if any
- the quantity and class of explosive materials as prescribed in the Explosives List (Appendix B)

o Each sale or other distribution of explosive material must be recorded in permanent form and must include:

- quantity and class of explosives as prescribed in the Explosives List
- the name of the manufacturer and importer, if any
- the manufacturer's marks of identification, if any
- the license or permit number of person receiving explosive materials
- the date of transaction.

o Separate records must be kept of sales or other distributions made to persons not holding a license or permit (recorded on Form 4710).

The Code of Federal Regulations also includes penalties for failure to abide by the regulations. A person who engages in business of dealing in explosives without a license will be fined up to $10,000, imprisoned for up to 10 years, or both. The same penalty can be incurred for withholding information or making false statements in order to obtain a license or permit for explosive materials and for knowingly making false entries into records required to be kept. Improper storage of explosive materials carries a fine of up to $1000, one year of imprisonment or both. Failure to report theft or loss of explosive materials within 24 hours of discovery also carries a fine of $1000, one year in prison, or both. Any explosive materials that are involved, used, or intended to be used in violation of the Organized Crime Control Act or any criminal law of the United States are subject to seizure and forfeiture.

Public Display

The major exception to the prohibition on the use of Class B or special fireworks is the use of these large devices to produce visible or audible effects by combustion or explosion as a show for spectators. Every state has legislatively enacted this exception to the ban on use of Class B

fireworks, but such displays are subject to State and local regulation. The National Fire Protection Association will present a Standard for Public display of Fireworks (NFPA 1123-1978) for final approval at its November 1978 meeting. The requirements involved with the public display of fireworks can be discussed in terms of pre-display activities, the display itself, and post-display activities.

Pre-Display

Every state that provides for the public display of fireworks has stipulated as a minimum three basic requirements:

(1) Those putting on the display must obtain at least approval and more often a permit from the proper authority (State Fire Marshal, local governing body, police and/or fire chiefs).

(2) The display must be in the charge of a competent operator - a person who is experienced in discharging fireworks and whose competence has been approved by proper authorities.

(3) Those putting on the display must show proof (bond or insurance policy) of financial ability to meet claims arising from injury to persons or property as a result of the display.

It is the responsibility of the person or group putting on or sponsoring the fireworks display to find out what the specific requirements are in the jurisdiction where the display is to be held. It is very important to learn the specific requirements of the jurisdiction because these requirements vary not only from state to state but also within the same state. The local police and fire departments would be good starting places for determining the specific applicable regulations.

In general, a person who wants to put on a public display of fireworks can expect that he will be required to file an application for permits (State and Federal) a specified number of days before the display. The application will minimally require the identification of the person or organization sponsoring the display, the identification of the persons who will be in charge of firing the display (the operator), the date, time, and exact location of the display, evidence of financial responsibility, the number and kind (including manufacturer) of fireworks to be displayed, and the manner and place of storage of fireworks prior to the display. In addition, the application may require a detailed description of the pyrotechnics operator: age, years of experience, physical characteristics, evidence of competency, license number, where required. The applicant may also be asked to provide a diagram of the display site that shows the exact place where the fireworks will be discharged, the location of all buildings, highways, other lines of communication, telephone wires and overhead obstructions, and the lines behind which the spectators will be restrained.

In many states, the chief of the fire department is responsible for making an investigation to determine whether the display can safely be conducted in compliance with regulations at the proposed site. Then he confers with the police chief to ascertain whether issuance of the permit would be consistent with public safety. If both the fire and police chiefs approve the application, it is then sent to the State Fire Marshal. If the Fire Marshal is satisfied with the application and the evidence of financial responsibility, a nontransferable permit will be issued for the display.

Conduct of Display

The overriding safety consideration in conducting a fireworks display is the protection of persons and property from injury by the fireworks. Therefore, the display must be conducted so that the discharge, failure to fire, faulty firing, or fallout from firing will not injure persons or property. Several states have incorporated into their regulations or statutes minimum distances between point of fireworks discharge and various buildings and spectators. These distances are shown in Table 10.

The table also includes the maximum wind velocities that may be present during a fireworks display. Many states stipulate that such displays may not be conducted during a windstorm. The reason is obvious: the wind makes it more difficult to control the discharge and flight of the fireworks devices and ensure safety. The NFPA recommendations, based on size of mortars, are shown in Table 11.

It is important not only that minimum distances be maintained between the spectators and the site of discharge, but also the spectators must be restrained behind lines or barriers as designated by the authorities. In no instance may any spectators go inside the barricaded area. This barricaded area, where the firing will occur, is accessible only to authorized persons and those actually in charge of the display.

As noted above, the competency of the operator is a condition to obtaining a permit for public display. In some cases competency means simply that the person is a minimum age (18 or 21), has had some experience in firing fireworks, and is approved by the police and fire chief for the display. A few states, notably California, have an elaborate system to examine the competency of operators and certify them. The NFPA recommends that the operator be at least 21 years old, able-bodied, and certified for the task by the State Fire Marshal. During the display, the operator must have his certificate of competency in his possession. The certificate can be revoked if the individual's behavior endangers public safety.

Table 10

Minimum Safe Distances (in feet) and Maximum Wind Velocities for Fireworks Displays

	To Buildings & Roads	To Schools, Churches, Hospitals, Institutions	To Telephone Poles and Overhead Obstructions	To Spectators	Wind Velocity mph
Alabama	200	500	50	200	20
Arkansas		600			
Illinois		600			
Kansas		1000			
Louisiana		1000			
Maine	900		150	150	30
Massachusetts	200		50	150	
Mississippi		600			
New York	200		50	150	30
Oklahoma		500			
Oregon	200		50	200	20
Rhode Island	200	500	50	200	20
Tennessee		600			
Texas		600		100	
NFPA	200	500	25	200	20

Table 11

Mortar Separation Distances

Mortar Sizes	Spectator Viewing Areas Parking Areas 1 & 2-family Dwellings[1]	Health Care & Penal Facilities[1]	Storage of Hazardous Materials[2]	Clear Landing Area
2 in (51 mm)	50 ft (15.2 m)	500 ft (152.4 m)	500 ft (152.4 m)	150 ft (45.7 m)
3 in (76 mm)	75 ft (22.9 m)	500 ft (152.4 m)	500 ft (152.2 m)	150 ft (45.7 m)
4 in (102 mm)	75 ft (22.9 m)	500 ft (152.4 m)	500 ft (152.4 m)	150 ft (45.7 m)
5 in (127 mm)	100 ft (30.5 m)	500 ft (152.4 m)	500 ft (152.4 m)	150 ft (45.7 m)
6 in (152 mm) & larger	150 ft (45.7 m)	500 ft (152.4 m)	500 ft (152.4 m)	150 ft (45.7 m)

Note 1: As defined in Life Safety Code, NFPA 101.
Note 2: See the following for aid in determining whether materials are to be considered hazardous:
Fire Hazard Properties of Flammable Liquids, Gases and Volatile Solids, NFPA 325M and Hazardous Chemicals Data, NFPA 49.

The NFPA recommends that at least two pyrotechnic operators should be on duty during a display, and one must hold a certificate of competency. The persons assisting the certified operator must be at least 21 years old, able-bodied, and capable of reading, writing, speaking, and understanding English. A person must never be involved in a fireworks display while under the influence of alcohol, narcotics or any drug which affects judgment, movement, or stability.

To obtain a pyrotechnic operator license in California, a person must take a written exam of at least three parts:

- laws relating to fireworks
- regulations relating to fireworks
- practices and procedures related to license scope.

The applicant must score at least 70% on each section. If the applicant fails the exam, it can be taken again within 15 days. In addition, the applicant must give five references who are pyrotechnic operators but not related to him. Applicants are subject to investigation by the State Fire Marshal.

California has seven categories of pyrotechnic operators, each involving different requirements and responsibilities.

(1) Pyrotechnic operator-unrestricted: authorized to perform all fireworks activity connected with public display.

Requirements:

- 2 years experience as pyrotechnic operator-basic commercial
- 2 years experience as pyrotechnic operator-rockets, first class
- 2 years experience as pyrotechnic operator-special effects, first class.

A minimum of 6 years total experience is required.

(2) Pyrotechnic operator-basic commercial: authorized to perform all activities connected with commercial fireworks displays.

Requirements:

- 2 years experience as unlicensed assistant to pyrotechnic operator
- or 1 year experience if successfully complete a training course approved by the State Fire Marshal
- participation in no less than 8 public displays.

(3) Pyrotechnic operator-special effects, first class: responsible for use, preparation for transportation, and preparation of all special effects to produce visible or audible effects for movie, television, theatrical or opera production.

Requirements:

- 2 years experience as pyrotechnics operator-special effects, second class
- or 1 year experience if complete approved course.

(4) Pyrotechnic operator-special effects, second class: authorized to use special effects, blank cartridges, colored fire, flash paper and composition and smoke composition, and other fireworks permitted by fire authority having jurisdiction in connection with television or movies.

Requirements:

- 2 years experience as pyrotechnic operator-special effects, third class
- or 1 year experience if complete approved course.

(5) Pyrotechnic operator-special effects, third class: authorized to load blank cartridges and shells and use special effects when under the direct control of pyrotechnic operator-special effects, first or second class.

No requirements.

(6) Pyrotechnic operator-theatrical: authorized to use special effects, blank cartridges, colored fire, flash paper and composition and smoke composition in stage or theatrical productions only.

Requirements:

- 2 years as a trainee under direct supervision of pyrotechnic operator-theatrical
- or 1 year if complete approved training course.

(7) Pyrotechnic operator-performer; restricted to persons who perform before an audience and use special effects devices, blank cartridges, colored fire, flash paper and composition and smoke composition.

No requirements.

Again, the requirements for pyrotechnic operators are specific to the jurisdiction where the display is to be held and should be investigated when ascertaining other requirements for public fireworks displays. However, an analysis of NFPA recommendations and state requirements revealed that the operator, as the person in charge of the actual firing, generally has certain responsibilities:

- Once the fireworks have been delivered to the display site, the operator must make certain that the devices are not left unattended and do not become wet.

- The operator should inspect all fireworks upon delivery. If any show signs of damage or wetness, these should be set aside and not fired. After the display, these should be returned to the supplier or destroyed according to supplier's instructions.

- All fireworks devices must be stored at the display site so as to be secure from fire, accidental discharge and theft, and as approved by the local jurisdiction.

- Shells, rockets, and missiles must be set for firing so that they will not cross over or burst above spectators.

- All fireworks are set at locations as designated by the authority having jurisdiction.

- Flight of shells, rockets and missiles should be as vertical as possible, unless firing is near a body of water, and it is intended that fireworks burst over the water.

- The operator is responsible for the conduct of all persons connected with the display.

- The operator must cooperate with fire prevention authorities to assure maximum safety for spectators and participants.

California, alone among the states, gives very detailed descriptions of practices and procedures for public fireworks displays. These regulations are reprinted in part in Appendix H.

The NFPA in its proposed Standard for Public Display of Fireworks (NFPA-1123) recommends specific practices aimed at maximizing safety at public displays of fireworks. Upon delivery, shells should be separated according to diameter and stored in tightly covered containers of metal, wood, or plastic or in fiber drums or corrugated cardboard cartons that meet the specifications for transportation set by the U.S. Department of Transportation. A flame-retardant tarpaulin may be used to provide additional protection, shells should be stored at least 25 feet (7.6 m) from the discharge site, and during the display should be located to be upwind

from the discharge site. If the wind direction should shift during the display, the shells should be moved accordingly. There must be no smoking or open flames where shells are present, and conspicuous signs should so indicate.

Mortars, the tubes from which shells are fired, should never be used if they are defective in any way. Paper mortars may only be used for single- and double-break shells; metal mortars are acceptable for all shells. It is essential that the mortars be positioned so that shells will burst over a clear area. The mortars should be grouped according to diameter to minimize the possibility that shells will be put into the wrong mortars. Mortars are set in position either by burying them in the ground to a depth of 2/3 to 3/4 of their length or by fastening them securely in mortar boxes (troughs) or drums. If the ground is soft, precautions must be taken to assure that the mortars will not sink: heavy timber or slabs of rock should be placed under the mortars. Precautions are also necessary to protect the mortars from moisture in the ground and from the weather: before putting the mortar in the ground, put in a weather resistant bag under the bottom of the mortar; place weather resistant bags over the open ends of the mortar. Measures (sand bags, dirt boxes, etc.) should be taken to protect the operator from ground bursts, but such protection is not necessary on the down-range side of the discharge site. Mortars should be separated from each other by a distance at least as great as double their diameters.

Operators are also responsible for monitoring the weather to be certain that unsafe conditions will not exist during the display. If the operator or the fire authority having jurisdiction determine that hazardous conditions exist due to high winds or unusual wetness, the display should be postponed. NFPA contends that a display need not be postponed because of light snow or mist as long as the fireworks are protected from the weather.

Preparatory to firing, the shells should be carried to their mortars by their bodies, never by their fuses. The operator must check to be certain that no water or debris has accumulated in the mortars. It is extremely important that the operator checks that the shells fit into the mortars properly--shells must never be forced into mortars. If the shells do not fit properly, they should not be fired because if the fit is too loose, the shell may not go high enough into the intended firing range or may not lift at all. Likewise, if the fit is too tight, the shell may stay in the mortar.

To load the shells into the mortars, the operator should hold the shell by the thickest section of the fuse and carefully lower it into the mortar, being careful to never position any part of his body over the throat of the mortar. In other words, the operator should crouch down along side of the mortar. At no time during the entire process should the operator ever position his body over the mortar. The operator should then check that the

shell is properly seated in the mortar. Only flashlights and electric lighting as needed for artificial illumination should be used by the operator and his assistants.

Immediately before firing, the operator who will ignite the fuse should remove the safety cap that protects the fuse. The tip of the fuse is then lit with a fusee, torch, portfire or similar device. It is also possible to use electrical ignition of the fuses. As soon as the fuse is lit, the operator must leave the mortar area, but should position himself so that he can carefully observe the flight and bursting of the shell and the falling of any debris. Since the flight trajectory is calculated on the basis of safety considerations for persons and property, the operator must verify that the shell has indeed followed its intended flight and any debris has fallen into the intended landing area. The operator will make adjustments as needed during the display. After each firing, the operator should check all mortars for debris and clean them as necessary.

Paper mortars should be allowed to cool for 30 seconds between firing and reloading the mortars.

If a shell fails to ignite in the mortar, the operator should not approach it for at least five minutes; then it should be flooded with water. After the display, such mortars should be emptied into a bucket of water. The operator is responsible for contacting the supplier to ascertain the proper procedure for disposing of the unfired shell.

Likewise, an operator must never attempt to repair or take apart a shell. A wet shell, lance, or pot must never be dried for reuse. In these cases as well, the operator should contact the supplier for disposal instructions.

When ground display pieces (e.g., fountains, roman candles, wheels, "set pieces") are included in the fireworks display, these should be put outside of the firing range of the aerial display. Mortars should not fire towards any ground pieces. Ground display pieces must be at least 75 feet (22.9 m) from spectators and parking areas. The operator should follow the supplier's specific instructions for use of ground pieces. The poles for ground pieces should be securely placed and braced so that they will not fall when the pieces fire. If the area where the ground pieces are set is dry, it should be thoroughly wet down, and the operator should be certain that no dry grass or combustible materials are beneath the ground pieces.

In addition to the NFPA, several states also stipulate that the sponsor of the display is responsible for arranging and coordinating adequate fire protection during the display. The fire authority having jurisdiction will determine the necessary level of protection, and it is up to the sponsor to

see that the specified protection is forthcoming. In some instances, this means detailing the services of one or more members of the local fire department. The sponsor is then responsible for compensating the firemen. Fire protection may also include the presence of fire extinguishers at the site of discharge and standby fire apparatus down range.

The NFPA recommends the appointment of monitors to enforce crowd control procedures. The fire authority will determine the necessary number of monitors and where they should be placed. Monitors will prevent spectators and all unauthorized persons from entering the discharge area. It is recommended that the display be immediately discontinued if lack of crowd control threatens.

Post-Display Activities

The primary safety considerations involved in post-display activities revolve around the identification and disposal of fireworks devices that failed to ignite or function. The NFPA recommends that the operator inspect the entire firing range immediately after the display to locate defective shells. However, if the display occurs at night, as is usually the case, this inspection should be repeated the following morning. If any such shells are found, they should be doused with water, then put into a bucket of water. The operator is responsible for obtaining complete and proper disposal instructions from the supplier of the device. The supplier should supply forms so that the operator can record information on defective shells. These forms will then be returned to the supplier.

Several states, also require that the operator submit a report to the State Fire Marshal within a specified number of days after the display. Such reports will probably include the identification of defective devices by type, size and manufacturer. Several states require that the fire authority having jurisdiction confirm the retrieval of duds. This report will also include a description of any fires that resulted from the display and any personal injuries. The operator must verify that the display was conducted in conformance with all applicable statutes and regulations. A sample report is shown on the following page.

Malfunctioning Shell Report

Date of Display_____ Location_____ Operator_____

Type of shell involved:

Manufacturer_____

Size_____

Effect_____

Type of Malfunction:

Fuse ignited, but nothing else happened_____
Shell exploded in mortar_____
Shell exploded just out of mortar_____
Shell returned to ground and then exploded_____
Shell returned to ground but never exploded_____
Other (explain)_____
_____

Comments: _____

_____

_____

_____
(signature)

Return form promptly to: (name and address of supplier)

FIELD MIXING OF SPECIAL EFFECTS MATERIALS

The use of fireworks to produce "special effects" for television, theater, or movie productions, or for commercial, industrial, education, recreation, or entertainment purposes, as authorized by the authority having jurisdiction, is a subcategory of the use of fireworks for public display. California, probably because of the size of its entertainment industry, regulates the use of special effects fireworks in great detail. These fireworks, as defined by Article 14 of Title 19, Subchapter 6, Fireworks of the California State Fire Marshal's Regulations, include both Special Fireworks Class B Explosives and Common Fireworks Class C Explosives, and present a unique situation to the user because unlike other fireworks, they require field mixing.

The California regulations stipulate that only a licensed manufacturer or licensed Special Effects Pyrotechnic Operator-First Class may perform mixing, assembling, or compounding of special effects materials. Any room where more than 50 pounds of special effects materials are present at one time must be constructed with at least one weak wall, placed so there is the least hazard to workers in other buildings. Rooms of buildings should be constructed to minimize the accumulation of dust, facilitate cleaning, use indirect heating and cooling systems, and have at least two exits, with doors equipped with panic hardware opening outward, separated by a distance at least 1/5 the perimeter of the room. The California regulations specify standards for wiring and electrical equipment, vacuum dust collection systems (dust must not be exhausted to the atmosphere), and shielding of personnel work stations.

According to the amount of special effects material, it may be necessary to put a shield between the operator and the material being processed. Such a shield must be tested and shown capable of withstanding a blast from the maximum amount of special effect materials permitted behind it. The following requirements are stated:

Structure of Shield Wall

Weight of Explosive	Structure of Shield Wall
1-15 pounds	Shield wall constructed of concrete not less than 12 inches thick which is reinforced near both sides by rods not less than 1/2 inch in diameter located on maximum centers of 12 inches both horizontally and vertically. The rods must be staggered on opposite faces.
More than 15 pounds	The shield wall for the protection of workmen must be designed in such a manner to protect against the efforts of not less than 25 percent overload above the expected maximum charge to be processed.

NOTES:

1. One inch of mild steel is equivalent to one foot of reinforced concrete.
2. Explosives shall be located not less than 36 inches from the wall and 24 inches above the floor.

If the required size of the shield becomes so large as to be impractical, then the operator must perform the operations by remote control or be protected by a shelter with a safety factor of no less than 4 to withstand the overpressure from the maximum amount of explosives being worked with.

The California regulations include precautions for minimizing static electricity: maintain relative humidity above 20%, and between 50 and 60% where metal powders are involved; use conductive wheels, which cannot cause sparks, on equipment. At all times, except when being used, bulk special effects materials must be kept in closed containers.

All work stations must meet specified requirements. Each work station must have appropriate receptacles with covers for the disposal of waste, and these must be cleaned no less frequently than at the end of each shift. The safety rules and operating instructions that apply to the process performed must be available in the work station.

Posted signs must indicate the personnel occupancy and explosive limits. Tools appropriate for the material should be used. The operator must scrupulously and immediately clean up spills or dropped special effects materials. All materials, including shipping containers and rags, contaminated with special effects materials must be removed daily and disposed of safely. Special effects materials must never be stored near any source of heat. There must be a warning system, activated when operations are in progress, to alert persons that they are approaching a hazardous operation or area.

The California regulations specify that explosion and flash mortars for special effects purposes must be constructed of steel plate or tubing having a thickness proportional to the strength of explosive used and sufficient to prevent distortion when used. Mortars used for aerial pyrotechnics or cannon effects must conform to the requirements stated for mortars used in public display. Pan type flash mortars must be made of iron or steel not less than 1/8 inch thick or 6 inches in any dimension, at least 2 inches deep with sides at angles of 45°, or as otherwise approved. Converted switch boxes may not be used for special effects flash powder mortars. The amount of flash powders or sheets used must be determined by the pyrotechnic operator on the basis of safety for the specific working conditions, the particular sheet positions, exposure of flammable material, and persons on the set or stage.

It is required that all special effects fireworks and explosives used are connected to firing leads and cleared for actual firing before the electric firing circuit is connected to any power supply. The only exception is a test galvanometer equipped with a silver chloride battery. In fact, it is required that all electrically fired circuits be tested with such an approved blasting galvanometer. Usable power sources for firing are restricted to batteries or individually isolated, ungrounded generators used only for firing purposes. There must be short circuiting shunts on all electrically fired items during loading, settling, and adjustment operations.

A major safety precaution is the prevention of accidental firing. Therefore all firing switches must have: "(1) an automatic short circuiting shunt across the firing leads until the switch is intentionally thrown to the firing position, and (2) an automatic positive disconnection when the switch is released by the operator."

Firing boxes must be designed so that firing cannot occur unless the switch is manually operated. For explosive charges set in or on water or other liquid, an individual two-wire circuit must be used for firing. In all cases, a prerequisite to firing is that the pyrotechnic operator or his assistant must have the special effects item in full view at the time of discharge.

California's requirements for the storage of special effects materials can be found under STORAGE.

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GLOSSARY

American Table of Distances (also known as Quantity Distance Tables): The American Table of Distances for Storage of Explosives as revised and approved by the Institute of Makers of Explosives, June 5, 1964.

Barricade: A natural or artificial barrier that will effectively screen a magazine, building, railway, or highway from the effects of an explosion in a magazine or building containing explosives.

Black powder: A ground mixture of potassium nitrate, sulfur and charcoal

Class B fireworks: Fireworks designed primarily to produce visible or audible effects by combustion, deflagration, or detonation.

Class C fireworks: Fireworks designed primarily to produce visible effects by combustion. Also Common fireworks.

Common fireworks: See Class C fireworks.

End fuse: A fuse inserted into any fireworks or pyrotechnic device at the end as distinguished from the side of such item.

Explosive materials: Explosives, blasting agents, and detonators.

Firecracker: A small noise-making cylinder up to 1½" in length containing small amounts of pyrotechnic material.

Fireworks: Any composition or device for the purpose of producing a visible or audible effect by combustion, deflagration or detonation and classified as common or special fireworks by the Bureau of Explosives.

Fireworks plant: All lands, and buildings thereon, used for or in connection with the manufacture or processing of fireworks; includes storage buildings used with or in connection with plant operation.

Fountain: Either a cylinder or cone containing pyrotechnic composition.

Fuse: An igniting device in the form of a cord consisting of a flexible fabric tube.

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

Licensee: Any licensed importer, manufacturer, or dealer.

Magazine: Any building or structure other than an expolosive manufacturing building, designed and/or approved for the storage of explosive materials.

Mortars: The tubes from which shells are fired.

Nonprocess Building: Office buildings, warehouses, and other fireworks plant buildings where no fireworks or explosive compositions are processed or stored.

Oxidizer or oxidizing materials: A substance, such as a nitrate, that readily yields oxygen or other oxidizing substances to stimulate the combustion of organic matter or other fuel.

Party popper: Pyrotechnic device which contains less than 0.25 grain of pyrotechnic composition per unit load, designed to be held in the hand and when fired propels soft paper, cloth inserts, or other similar fill material into the air.

Passenger railway: Any steam, electric, diesel electric or other railroad or railway which carries passengers for hire.

Permissible fireworks: The DOT Class C common fireworks

Permittee: Any user of explosives for lawful purposes who has obtained a user permit.

Process building: Any mixing building; any building in which pyrotechnic or explosive composition is pressed or otherwise prepared for finishing and assembly; or any finishing or assembling building, including a building used for preparation of fireworks for shipment.

Public highways: Any public street, public alley, or highway.

Pyrotechnic composition: A chemical mixture which, on burning and without explosion, produces visible or brilliant displays of bright lights or whistles.

Pyrotechnics: See Fireworks.

Pyrotechnic operator: Any licensed operator who, by examination, experience, and training, has demonstrated the required skill and ability in the use and discharge of fireworks as authorized by the license granted.

Rocket: A cylinder frequently topped by a cone to stabilize its flight, attached to a long stick. Among the oldest pyrotechnic devices; used as weapons in the Middle East.

Roman candle: A 6 - 12" tube containing alternating layers of compacted black powder and single stars.

Safety cap: A paper tube, closed at one end, that is placed over the end of the fuse of an aerial shell to protect from accidental ignition; the cap is not removed until just before firing of the shell.

Shell: A cartridge that contains the pyrotechnic composition used in aerial display fireworks.

Sparkler: A steel wire commonly about 9" long and partially coated with pyrotechnic composition.

Special effects: Articles containing any pyrotechnic composition manufactured and assembled, designed, or discharged in connection with television, theatre, or motion picture productions, which may or may not be presented before live audiences and any other article containing any pyrotechnic composition used for commercial industrial, educational, recreational, or entertainment purposes when authorized by the authority having jurisdiction.

Wheel: A device which consists of several cylinders of pyrotechnic material (called drivers) placed end-to-end in a circle on a frame and fused consecutively. When the drivers are ignited, the wheel spins around a central axis and ejects sparks or colors.

APPENDIX A

CHEMICAL HAZARDS AND PRECAUTIONS

Abbreviations:

S:	Synonyms
U:	Uses
CH:	Combustion Hazard
TH:	Toxic Hazard
HS:	Handling and Storage Precautions
FP:	Fire Precautions
HP:	Hygienic Practices
SL:	Handling Spills and Leaks
TLV:	Threshold Limit Value

Aluminum Powder

U: Fireworks

CH: Flammable when contacting fire. May explode with liberation of hydrogen in contact with water, acids, or alkalis. Hazardous reaction with metal oxides.

TH: Chronic dust inhalation may produce dermatitis, bronchial asthma, anorexia, shortness of breath, cough, gastrointestinal pain, and pulmonary fibrosis.

HS: Protect from moisture. Keep away from CCl_4, CS_2, halogens, acids, and alkalis. Keep away from sources of ignition. Wear heavy gloves, safety glasses, and coveralls.

FP: Cover fire with sand or other inert smothering solid. Do not use water.

HP: Use adequate ventilation. Include chest x-ray in regular medical examination.

Ammonium Perchlorate

U: Pyrotechnics

CH: Strong oxidizer, shock sensitive. Highly ignitable when combined with combustible materials, or zinc powder and moisture. Forms explosive mixtures with ammonium sulfate, or ammonium nitrate and metal powders.

TH: Strong skin irritant.

HS: Store away from strong acids, combustible materials, metal powders, and sources of ignition. Wear rubber gloves, a face shield, a body shield, and coveralls.

FP: In early stages of fire spray water from behind protective barrier. In advanced fires, evacuate area. Spray fire exposed containers with water to keep cool.

HP: In case of contact irrigate eyes for at least 15 minutes. Wash skin with soap and water.

SL: Cover with weak reducing agents (e.g., sodium thiosulfate, or bisulfites or ferrous salts in dilute H_2SO_4), transfer to a large container of water, neutralize, and drain into sewer with abundant water.

Barium Chlorate

U: Fireworks

CH: May ignite when mixed with combustible materials.

TH: Toxic when ingested. Symptoms uncertain but may include severe abdominal pain, vomiting, dyspnoea, rapid pulse, paralysis of arm and leg, and cyanosis. Other symptoms include dermatitis and irritation of the eyes, nose, throat, and skin.

HS: Wear rubber gloves, a face shield, and coveralls.

FP: Flood with water from a safe distance. Wear a full body shield.

HP: In case of contact wash eyes with water, skin with soap and water. Stomach wash followed by saline catharsis if swallowed. Give 2 tablespoons magnesium sulfate (epsom salts) in warm water.

SL: Cover spills with weak reducing agents (e.g., sodium thiosulfate, or bisulfites or ferrous salts in dilute H_2SO_4), transfer to a container of water, neutralize with soda ash, and flush into sewer with large amounts of water.

Barium Nitrate

U: Fireworks

CH: Rapidly decomposes at high temperature. Can flame up and explode when mixed with certain fuels and ignited. Emits toxic nitrogen oxides on decomposition.

TH: Highly toxic (see barium chlorate).

HS: Store away from inflammable or oxidizable materials, and away from possible ignition sources in a fireproof storage area. Wear self contained breathing apparatus.

FP: Flood with water at initial stage. If fire spreads, evacuate area.

HP: Persons with diseases of the kidney or lungs should not be exposed. In case of contact wash eyes with water, skin with soap and water. Stomach wash, if swallowed, followed by saline catharsis. Give 2 tablespoons magnesium sulfate (epsom salts) in warm water.

Carbon Black

U: Fireworks, gunpowder

CH: Dust may cause an explosion

TH: Can cause dust irritation of eyes, conjunctivitis, corneal hyperplasia, eczema of the eyelids, bronchitis, and pneumatotumor.

HS: Wear safety glasses and a chemical cartridge respirator.

HP: Persons with pulmonary diseases should not be exposed. In case of contact flush eyes with water.

Magnesium

U: Pyrotechnics

CH: Powder, thinsheets, chips, turnings are easily ignited and burn with intense heat. Powder forms explosive mixture in air. Finely divided powder may explode on contact with water, oxidizing materials, halogens, and acids.

TH: Irritates mucosa resulting in chronic atrophic nasopharyngitis. Small particles embedded in body tissue liberate hydrogen and produce swelling, vesiculation, necrosis, and ulceration. Inhalation may cause "metal fume fever".

HS: Protect containers from damage. Store powder, chips or shavings in a detached, fire resistant building away from moisture, halogens, acids, or sources of ignition. Wear mechanical respirator.

FP: Do not use water, foam, CO_2, or CCl_4 extinguishers. Smother fire with dry graphite or similar dry powder (talc, G-1). Eye damage can result from viewing magnesium fires. Protect eyes and skin from flying particles.

HP: Thoroughly cleanse all wounds.

Phosphorus (Red)

U: Fireworks

CH: Explodes when mixed with oxidizing agents.

TH: (Not known in detail LDL oral Human 1.4 mg/kg).

HS: Protect against direct sunlight. Store in a cool, detached location separate from sources of ignition. Do not co-load with explosives, oxidizing materials, poisons, corrosive materials. Wear rubber gloves and a large face shield.

FP: Flood with water. Cover with wet sand or dirt. Use extreme caution, as reignition is possible. Wear flameproof full protective clothing.

SL: Collect in iron pan. Burn in hood.

Potassium Chlorate

S: Potcrate

U: Pyrotechnics

CH: Powerful oxidizing material. Forms explosive mixtures with combustible, organic or other easily oxidizable materials. These mixtures are very sensitive and easily ignited by friction or heat.

TH: Nausea, vomiting, abdominal pain, diarrhea, hypotension, abnormally slow pulse, cyanosis, hepatomegaly, jaundice, oliguria, anuria, hemoglobinuria; albumin, red blood cells and casts in a dark brown urine, fits.

HS: Protect containers against damage. Keep separate from combustible, organic or other readily oxidizable materials, acids, ammonium salts, sulfur and flammable vapors. Avoid storage on wood floors. Immediately remove and dispose of any spilled chlorate. Wear rubber gloves, face shield and coveralls. May ignite or explode on contact with sulfur, carbon disulfide, organic sulfur, sulfides, phosphorus red, ammonium rhodanate, ammonium rhodanate + copper + alcohol, hydrazine, hydroxylamine, zinc chloride, sugar + ferricyanides, sodium hyposulfite, powder of combustible materials, amines.

HP: Encourage personal cleanliness. Stomach wash if swallowed, followed by saline catharsis.

FP: Flood with water

SL: Cover with weak reducing agent (e.g., sodium thiocyanate, or bisulfites or ferrous salts in dilute sulfuric acid), pour into water, neutralize, pour down drain with abundant water.

Potassium Nitrate

S: Saltpeter, niter

U: Gunpowder, fireworks

TH: Symptoms include nausea, diarrhea, diuresis, muscular debility, collapse.

HS: Avoid contacts with organics and store in a dry place. Never put together with inflammable powders. Keep away from easily combustible substances and acids. Mixed loading together with powders, inflammable fluids, inflammable solids, corrosive substances, toxic material, organic oxides is prohibited. Wear rubber gloves, safety glasses, protective work gowns. May explode on contact with sodium acetate + tartarates, oxalates + citrates, sodium phosphite, sodium hyposulfite, tin, solder, tin plate, stannates, lead phosphite, lead nitrite.

FP: Use abundant amount of water in early stages of fire. When large quantities are involved in fire, nitrate may fuse or melt. In such conditions, application of water may result in extensive scattering of molten material.

SL: Sweep into a beaker, dilute with water, add soda ash, mix, and neutralize with dilute HCl. Drain into the sewer with abundant water.

Potassium Perchlorate

S: Potassium hyperchlorate, peroidin

U: Fireworks

CH: Powerful oxidizing material.

TH: Irritates skin, eyes, throat and nose; liberates toxic gases when involved in fire.

HS: Protect against physical damage. Keep away from organic, combustible, readily oxidizable materials; sulfur; aluminium; and magnesium. Immediately remove and carefully dispose of any spills. May explode or ignite on contact with hydrazine or the hydrate, hydroxylamine or the salts, combustible materials, organic materials, metallic powder, strong oxiding agent, oxides, arsenic, antimony.

FP: Flood with water, wear self contained breathing apparatus.

SL: Cover with weak reducing agents such as sodium thiosulfate or bisulfites or ferrous salts in dilute sulfuric acid. Transfer to a large container of water and neutralize. Drain into a sewer with abundant water.

Sulfur

U: Gunpowder, fireworks

CH: Easily ignitible and combustible. Forms explosive mixture with oxidizing agents.

TH: Conjunctivitis, skin inflammation, respiratory irritation.

HS: Store in cool, well ventilated room away from chlorates or other oxidizers. Guard against dust aspiration or accumulation. Wear safety goggles, mask, and self contained breathing apparatus.

FP: Use water spray. Avoid scattering molten sulfur.

HP: In case of contact wash eyes with water, skin with soap and water.

APPENDIX B

LIST OF EXPLOSIVE MATERIALS

DEPARTMENT OF THE TREASURY

Bureau of Alcohol, Tobacco and Firearms

LIST OF EXPLOSIVE MATERIALS

1978

Federal explosives licensees and permittees and others concerned:

[4810-31]

DEPARTMENT OF THE TREASURY

Bureau of Alcohol, Tobacco, and Firearms

[Notice No. 78-5]

COMMERCE IN EXPLOSIVES

List of Explosive Materials

Pursuant to the provisions of section 841(d) of title 18, United States Code, and 27 CFR 181.23, the Director, Bureau of Alcohol, Tobacco, Firearms, must publish and revise at least annually in the FEDERAL REGISTER a list of explosives determined to be within the coverage of 18 U.S.C. chapter 40, Importation, Manufacture, Distribution, and Storage of Explosive Materials. This chapter covers not only explosives, but also blasting agents and detonators, all of which are defined as explosive materials in section 841(c) of title 18, United States Code.

Accordingly, the following is the 1978 list of explosive materials subject to regulation under 18 U.S.C. chapter 40, which includes both the list of explosives (including detonators) required to be published in the FEDERAL REGISTER and blasting agents. The list is intended to also include any and all mixtures containing any of the materials in the list. Materials constituting blasting agents are marked by an asterisk. While the list is comprehensive, it is not all inclusive. The fact that an explosive material may not be on the list does not mean that it is not within the coverage of the law if it otherwise meets the statutory definitions in section 841 of title 18, United States Code. Explosive materials are listed alphabetically by their common names followed by chemical names and synonyms in brackets. This revised list supersedes the List of Explosive Materials dated March 18, 1977 (42 FR 15162).

LIST OF EXPLOSIVE MATERIALS

A.

Acetylides of heavy metals.
Alluminum containing polymeric propellant.
Alluminum ophorite explosive.
Amatex.
Amatol.
Ammonal.
Ammonium nitrate explosive mixtures (cap sensitive).
*Ammonium nitrate explosive mixtures (noncap sensitive).
Aromatic nitro-compound explosive mixtures.
Ammonium perchlorate having particle size less than 15 microns.
Ammonium perchlorate composite propellant.
Ammonium picrate [picrate of ammonia, Explosive D].
Ammonium salt lattice with isomorphously substituted inorganic salts.
*ANFO [ammonium nitrate-fuel oil].

B

Baratol.
Baronol.
BEAF [1,2-bis (2,2-difluoro-2-nitroacetoxyethane)].
Black powder.
Black powderbased explosive mixtures.
*Blasting agents, nitro-carbo-nitrates, including non-cap-sensitive slurry and water-gel explosives.
Blasting caps.
Blasting gelatin.
Blasting powder.
BTNEC [bis (trinitroethyl) carbonate].
BTNEN [bis (trinitroethyl) nitramine].
BTTN [1,2,4 butanetriol trinitrate].
Butyl tetryl.

C

Calcium nitrate explosive mixture.
Cellulose hexanitrate explosive mixture.
Chlorate explosive mixtures.
Composition A and variations.
Composition B and variations.
Composition C and variations.
Copper acetylide.
Cyanuric triazide.
Cyclotrimethylenetrinitramine [RDX].
Cyclotetramethylenetetranitramine [HMX].
Cyclotol.

D

DATB [diaminotrinitrobenzene].
DDNP [diazodinitrophenol].
DEGDN [diethyleneglycol dinitrate].
Detonating cord.
Detonators.
Dimethylol dimethyl methane dinitrate composition.
Dinitroethyleneurea.
Dinitroglycerine [glycerol dinitrate].
Dinitrophenol.
Dinitrophenolates.
Dinitrophenyl hydrazine.
Dinitroresorcinol.
Dinitrotoluene-sodium nitrate explosive mixtures.
DIPAM.
Dipicryl sulfone.
Dipicrylamine.
DNDP [dinitropentano nitrile].
DNPA [2,2-dinitropropyl acrylate].
Dynamite.

E

EDNA.
Ednatol.
EDNP [ethyl 4,4-dinitropentanoate].
Erythritol tetranitrate explosives.
Esters of nitro-substituted alcohols.
EGDN [ethylene glycol dinitrate].
Ethyl-tetryl.
Explosive conitrates.
Explosive gelatins.
Explosive mixtures containing oxygen releasing inorganic salts and hydrocarbons.
Explosive mixtures containing oxygen releasing inorganic salts and nitro bodies.
Explosive mixtures containing oxygen releasing inorganic salts and water insoluble fuels.
Explosive mixtures containing oxygen releasing inorganic salts and water soluble fuels.
Explosive mixtures containing sensitized nitromethane.
Explosive mixtures containing tetranitro methane (nitro form).
Explosive nitro compounds of aromatic hydrocarbons.
Explosive organic nitrate mixtures.
Explosive liquids.
Explosive powders.

F

Fulminate of mercury.
Fulminate of silver.
Fulminating gold.
Fulminating mercury.
Fulminating platinum.
Fulminating silver.

G

Gelatinized nitrocellulose.
Gem-dinitro aliphatic explosive mixtures.
Guanyl nitrosamino guanyl tetrazene.
Guanyl nitrosamino guanylidene hydrazine.
Guncotton.

H

Heavy metal azides.
Hexanite.
Hexanitrodiphenylamine.
Hexanitrostilbene.
Hexogene or octogene and a nitrated N-methylaniline.
Hexolites.
HMX [cyclo-1,3,5,7-tetramethylene-2,4,6,8-tetranitramine; Octogen].
Hydrazinium nitrate/hydrazine/aluminum explosive system.
Hydrazoic acid.

I

Igniter cord.
Igniters.

K

KDNBF [potassium dinitrobenzo-furoxane].

L

Lead azide.
Lead mannite.
Lead mononitroresorcinate.
Lead picrate.
Lead salts, explosive.
Lead styphnate [styphnate of lead, lead trinitroresorcinate].
Liquid nitrated polyol and trimethylolethane.
Liquid oxygen explosives.

M

Magnesium ophorite explosives.
Mannitol hexanitrate.
MDNP [methyl 4,4-dinitropentanoate].
Mercuric fulminate.
Mercury oxalate.
Mercury tartrate.
Minol-2 [40 percent TNT, 40 percent ammonium nitrate, 20 percent aluminum].
Mononitrotoluene-nitroglycerin mixture.
Monopropellants.

N

NIBTN [nitroisobutametriol trinitrate].
Nitrate sensitized with gelled nitroparaffin.
Nitrated carbohydrate explosive.
Nitrated glucoside explosive.
Nitrated polyhydric alcohol explosives.
Nitrates of soda explosive mixtures.
Nitric acid and a nitro aromatic compound explosive.
Nitric acid and carboxylic fuel explosive.
Nitric acid explosive mixtures.
Nitro aromatic explosive mixtures.
Nitro compounds of furane explosive mixtures.
Nitrocellulose explosive.
Nitroderivative of urea explosive mixture.
Nitrogelatin explosive.
Nitrogen trichloride.
Nitrogen tri-iodide.
Nitroglycerine [NG, RNG, nitro, glyceryl trinitrate, trinitroglycerine].
Nitroglycide.
Nitroglycol [ethylene glycol dinitrate, EGDN].
Nitroguanidine explosives.
Nitroparaffins and ammonium nitrate mixtures.
Nitronium perchlorate propellant mixtures.
Nitrostarch.
Nitro-substituted carboxylic acids.
Nitrourea.

O

Octogen [HMX].
Octol [75 percent HMX, 25 percent TNT].
Organic amine nitrates.
Organic nitramines.

P

PBX [RDX and plasticizer].
Pellet powder.
Penthrinite composition.
Pentolite.
Perchlorate explosive mixtures.
Peroxide based explosive mixtures.
PETN [nitropentaerythrite, pentaerythrite tetranitrate, pentaerythritol tetranitrate].
Picramic acid and its salts.
Picramide.
Picrate of potassium explosive mixtures.
Picratol.
Picric acid.
Picryl chloride.
Picryl fluoride.
PLX [95 percent nitromethane, 5 percent ethylenediamine].
Polynitro aliphatic compounds.
Polyolpolynitrate-Nitrocellulose explosive gels.
Potassium chlorate and lead sulfocyanate explosive.
Potassium nitrate explosive mixtures.
Potassium nitroaminotetrazole.

R

RDX [cyclonite, hexogen, T4, cyclo-1,3,5,-trimethylene - 2,4,6 - trinitramine; hexa hydro-1,3,5-trinitro-S-triazine].

S

Safety fuse.
Salts of organic amino sulfonic acid explosive mixture.
Silver acetylide.
Silver azide.
Silver fulminate.
Silver oxalate explosive mixtures.
Silver styphnate.
Silver tartrate explosive mixtures.
Silver tetrazene.
Slurried explosive mixtures of water, inorganic oxidizing salt, gelling agent, fuel and sensitizer (cap sensitive).
Smokeless powder.
Sodatol.
Sodium amatol.
Sodium dinitro-ortho-cresolate.
Sodium nitrate-potassium nitrate explosive mixture.
Sodium picramate.
Squibs.
Styphnic acid.

T

Tacot [tetranitro-2,3,5,6-dibenzo-1,3a,4,6a-tetrazapentalene].
TATB [triaminotrinitrobenzene].
TEGDN [triethylene glycol dinitrate].
Tetrazene [tetracene, tetrazine, 1(5-tetrazolyl)—4-guanyl tetrazene hydrate].
Tetranitrocarbazole.
Tetryl [2,4,6 tetranitro-N-methylaniline].
Tetrytol.
Thickened inorganic oxidizer salt slurried explosive mixture.
TMETN (trimethyloletnane trinitrate).
TNEF [trinitroethyl formal].
TNEOC [trinitroethylorthocarbonate].
TNEOF [trinitroethyl orthoformate].
TNT [trinitrotoluene, trotyl, trilite, triton].
Torpex.
Tridite.
Trimethylol ethyl methane trinitrate composition.
Trimethylolthane trinitrate-nitrocellulose.
Trimonite.
Trinitroanisole.
Trinitrobenzene.
Trinitrobenzoic acid.
Trinitrocresol.
Trinitro-meta-cresol.
Trinitronaphthalene.
Trinitrophenetol.
Trinitrophloroglucinol.
Trinitroresorcinol.
Tritonal.

U

Urea nitrate.

W

Water bearing explosives having salts of oxidizing acids and nitrogen bases, sulfates, or sulfamates (cap sensitive).

X

Xanthamonas hydrophilic colloid explosive mixture.

Signed: July 24, 1978.

JOHN G. KROGMAN,
Acting Director.

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Federal Register Reprint; July 27, 1978
(43 FR 32492)

APPENDIX C

ATF REGIONAL OFFICES

ATF Regional Offices

CENTRAL REGION

Office of the Regional Regulatory Administrator

Federal Building, Room 6510-A
550 Main Street
Cincinnati, Ohio 45202
Phone: 513-684-3333
Firearms and Explosives
Coordinator—Phone: 513-684-3715
Indiana, Kentucky, Michigan,
Ohio and West Virginia

MID-ATLANTIC REGION

Office of the Regional Regulatory Administrator

2 Penn Center Plaza, Room 360
Philadelphia, Pennsylvania 19102
Phone: 215-597-2248
Firearms and Explosives Coordinator—
Phone: 215-597-2220
Delaware, District of Columbia,
Maryland, New Jersey, Pennsylvania,
and Virginia

MIDWEST REGION

Office of the Regional Regulatory Administrator

230 S. Dearborn Street
15th Floor
Chicago, Illinois 60604
Phone: 312-353-3778
Firearms and Explosives Coordinator—
Phone: 312-353-3883
Illinois, Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota, and Wisconsin

NORTH ATLANTIC REGION

Office of the Regional Regulatory Administrator

6 World Trade Center, 6th Floor
New York, N.Y. 10048
(Mailing: P.O. Box 15, Church
Street Station, New York, N.Y. 10008)
Phone: 212-264-8007
Firearms and Explosives Coordinator—
Phone: 212-264-3993
Connecticut, Maine, Massachusetts,
New Hampshire, New York, Rhode Island,
Vermont, Puerto Rico, and Virgin Islands

SOUTHEAST REGION

Office of the Regional Regulatory Administrator

3835 Northeast Expressway
Atlanta, Georgia 30340
(Mailing Address: P.O. Box 2994, 30301)
Phone: 404-455-2631
Firearms and Explosives Coordinator—
Phone: 404-455-2675
Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina, and Tennessee

SOUTHWEST REGION

Office of the Regional Regulatory Administrator

1200 Main Street
Main Tower, Room 345
Dallas, Texas 75202
Phone: 214-767-2260
Firearms and Explosives Coordinator—
Phone: 214-767-2282
Arkansas, Colorado, Louisiana, New Mexico, Oklahoma, Texas, and Wyoming

WESTERN REGION

Office of the Regional Regulatory Administrator

525 Market Street, 34th Floor
San Francisco, California 94105
Phone: 415-556-2021
Firearms and Explosives Coordinator—
Phone: 415-556-2610
Alaska, Arizona, California, Guam, Hawaii, Idaho, Montana, Nevada, Oregon, Utah, and Washington

APPENDIX D

GUIDE TO OSHA FIRE PROTECTION REGULATIONS
NFPA 101 - 1970

CHAPTER 5. MEANS OF EGRESS

SECTION 5-1. GENERAL PROVISIONS

5-111. Application

5-1111. Means of egress for both new and existing buildings shall comply with this Chapter except as may be modified for individual occupancies by Chapters 8 through 16.

5-1112. Any alteration or addition that would reduce means of egress below the requirements for new buildings is prohibited.

5-1113. Any change of occupancy that would reduce means of egress below the requirements for new buildings is prohibited.

5-112.* Definitions

5-1121. A means of egress is a continuous and unobstructed way of exit travel from any point in a building or structure to a public way and consists of 3 separate and distinct parts: (a) the way of exit access, (b) the exit and, (c) the way of exit discharge. A means of egress comprises the vertical and horizontal ways of travel and shall include intervening room spaces, doorways, hallways, corridors, passageways, balconies, ramps, stairs, enclosures, lobbies, escalators, horizontal exits, courts and yards.

a. Exit access is that portion of a means of egress which leads to an entrance to an exit.

b. Exit is that portion of a means of egress which is separated from all other spaces of the building or structure by construction or equipment as required in this Code to provide a protected way of travel to the exit discharge.

c. Exit discharge is that portion of a means of egress between the termination of an exit and a public way.

5-113.* Permissible Exit Components

5-1131. An exit shall consist only of the approved components that are described, regulated, and limited as to use by Sections 5-2 through 5-11. Exit components shall be constructed as an integral part of the building or shall be permanently affixed thereto.

5-114. Protective Enclosure of Exits

5-1141. When an exit is required to be protected by separation from other parts of the building by some requirement of this Code, the separating construction shall meet the following requirements:

a. The separation shall have at least a 1-hour fire resistance rating when the exit connects 3 stories or less. This applies whether the stories connected are above or below the story at which exit discharge begins.

b. The separation shall have at least a 2-hour fire resistance rating when the exit connects 4 or more stories, whether above or below the floor of discharge. It shall be constructed of noncombustible materials, and shall be supported by construction having at least a 2-hour fire resistance rating.

c. Any opening therein shall be protected by an approved self-closing fire door.

d. Openings in exit enclosures shall be confined to those necessary for access to the enclosure from normally occupied spaces and for egress from the enclosure.

5-115. Width and Capacity of Means of Egress

5-1151.* Except as further modified for individual occupancies by Chapters 8 through 16, the capacity in number of persons per unit of exit width for approved components of means of egress shall be as follows:

Level Egress Components (including Class A Ramps) 100
Inclined Egress Components (including Class B Ramps) 60

5-1152.* Means of egress shall be measured in units of exit width of 22 inches. Fractions of a unit shall not be counted, except that 12 inches added to one or more full units shall be counted as one-half a unit of exit width.

5-1153.* Units of exit width shall be measured in the clear at the narrowest point of the means of egress except that a handrail may project inside the measured width on each side not more than 3½ inches and a stringer may project inside the measured width not more than 1½ inches. An exit or exit access door swinging into an aisle or passageway shall not restrict the effective width thereof at any point during its swing to less than the minimum widths hereafter specified.

5-116. Egress Capacity and Occupant Load

5-1161.* The capacity of means of egress for any floor, balcony, tier, or other occupied space shall be sufficient for the occupant load thereof. The occupant load shall be the maximum number of persons that may be in the space at any time, as determined by the

authority having jurisdiction, but shall not be less than the number computed in accordance with the requirements of Chapters 8 through 16 for individual occupancies. Where both gross and net area figures are given for the same occupancy class, the gross area figure shall be applied to the building or structure as a whole. A separate calculation shall then be made for those spaces where occupant load is determined on the basis of net area and if the total occupant load determined on the net area basis exceeds that on the gross area basis, the exit facilities shall be based on the larger occupant load figure.

5–1162. Where exits serve more than 1 floor, only the occupant load of each floor considered individually need be used in computing the capacity of the exits at that floor, provided that exit capacity shall not be decreased in the direction of exit travel. When means of egress from floors above and below converge at an intermediate floor, the capacity of the means of egress from the point of convergence shall be not less than the sum of the two.

5–117. Arrangement of Exits

5–1171.* When more than 1 exit is required from a story, at least 2 of the exits shall be remote from each other and so arranged as to minimize any possibility that both may be blocked by any one fire or other emergency condition.

5–118.* Exit Distance and Dead-End Limits

5–1181. The maximum travel distance in any occupied space to at least one exit, measured in accordance with the following requirements, shall not exceed the limits specified for individual occupancies by Chapters 8 through 16. Means of egress shall be so arranged that there are no dead-end pockets, hallways, corridors, passageways or courts whose depth exceeds the limits specified for individual occupancies by Chapters 8 through 16.

5–119. Measurement of Travel Distance to Exits

5–1191.* The travel distance to an exit shall be measured on the floor or other walking surface along the center line of the natural path of travel, starting 1 foot from the most remote point, curving around any corners or obstructions with a 1-foot clearance therefrom, and ending at the center of the doorway or other point at which the exit begins. Where measurement includes stairs, it shall be taken in the plane of the tread nosing.

5–1192. In the case of open areas, distance to exits shall be measured from the most remote point subject to occupancy. In the case of individual rooms subject to occupancy by not more than 6 persons, distance to exits shall be measured from the doors of such

rooms provided the path of travel from any point in the room to the room door does not exceed 50 feet.

5-1193. Where open stairways or ramps are permitted, as a path of travel to required exits, such as between mezzanines or balconies and the floor below, the distance shall include the travel on the stairway or ramp, and the travel from the end of the stairway or ramp to reach an outside door or other exit, in addition to the distance to reach the stairway or ramp.

5-1194. Where any part of an exterior way of exit access is within 15 feet horizontal distance of any unprotected building opening, as permitted by 5-4121 for outside stairs, the distance to the exit shall include the length of travel to ground level.

5-120. Access to Exits

5-1201. Exits shall be so located and exit access shall be so arranged that exits are readily accessible at all times. Where exits are not immediately accessible from an open floor area, safe and continuous passageways, aisles, or corridors leading directly to every exit and so arranged as to provide convenient access for each occupant to at least 2 exits by separate ways of travel, except as a single exit or limited dead ends are permitted by other provisions of this Code, shall be maintained.

5-1202. A door from a room to an exit or to a way of exit access shall be of the side-hinged, swinging type. It shall swing with exit travel when the room is occupied by more than 50 persons or used for a high hazard occupancy. Such access doors shall conform to the appropriate requirements of Section 5-2, Exit Doors.

5-1203. In no case shall access to an exit be through a bathroom, bedroom, or other room subject to locking, except where the exit is required to serve only the bedroom or other room subject to locking, or adjoining rooms constituting part of the same dwelling or apartment used for single family occupancy.

5-1204.* Ways of exit access and the doors to exits to which they lead shall be so designed and arranged as to be clearly recognizable as such. Hangings or draperies shall not be placed over exit doors or othe wise so located as to conceal or obscure any exit. Mirrors shall not be placed on exit doors. Mirrors shall not be placed in or adjacent to any exit in such a manner as to confuse the direction of exit.

5-1205. Exit access shall be so arranged that it will not be necessary to travel toward any area of high hazard occupancy in order to reach the nearest exit, unless the path of travel is effectively shielded from the high hazard location by suitable partitions or other physical barriers.

5–1206. The minimum width of any way of exit access shall be as specified for individual occupancies by Chapters 8 through 16; but in no case shall such width be less than 28 inches. Where a single way of exit access leads to an exit, its capacity in terms of width shall be at least equal to the required capacity of the exit to which it leads. Where more than one way of exit access leads to an exit, each shall have a width adequate for the number of persons it must accommodate.

5–121. Exterior Ways of Exit Access

5–1211. Access to an exit may be by means of any exterior balcony, porch, gallery, or roof that conforms to the requirements of this Chapter.

5–1212. Exterior ways of exit access shall have smooth, solid floors, substantially level, and shall have guards on the unenclosed sides at least equivalent to those specified in 5–316.

5–1213. Where accumulation of snow or ice is likely because of the climate, the exterior way of exit access shall be protected by a roof, unless it serves as the sole normal means of access to the rooms or spaces served, in which case it may be assumed that snow and ice will be regularly removed in the course of normal occupancy.

5–1214. A permanent, reasonably straight path of travel shall be maintained over the required exterior way of exit access. There shall be no obstruction by railings, barriers, or gates that divide the open space into sections appurtenant to individual rooms, apartments, or other uses. Where the authority having jurisdiction finds the required path of travel to be obstructed by furniture or other movable objects, he may require that they be fastened out of the way or he may require that railings or other permanent barriers be installed to protect the path of travel against encroachment.

5–1215.* An exterior way of exit access shall be so arranged that there are no dead ends in excess of 20 feet. Any unenclosed exit served by an exterior way of exit access shall be so located that no part of the exit extends past a vertical plane 20 feet and one-half the required width of the exit from the end of and at right angles to the way of exit access.

5–1216. Any gallery, balcony, bridge, porch or other exterior exit access that projects beyond the outside wall of the building shall comply with the requirements of this Chapter as to width and arrangement. The materials of construction may be as permitted for the building served.

5–122. Discharge from Exits

5–1221.* All exits shall discharge directly to the street, or to a yard, court, or other open space that gives safe access to a public way. The

streets to which the exits discharge shall be of width adequate to accommodate all persons leaving the building. Yards, courts, or other open spaces to which exits discharge shall also be of adequate width and size to provide all persons leaving the building with ready access to the street.

5-1222. Where permitted for individual occupancies by Chapter 8 through 16, a maximum of 50 percent of the exits may discharge through areas on the floor of discharge provided:

a. Such exits discharge to a free and unobstructed way to the exterior of the building, which way is readily visible and identifiable from the point of discharge from the exit.

b. The floor of discharge into which the exit discharges is provided with automatic sprinkler protection and any other portion of the level of discharge with access to the discharge area is provided with automatic sprinkler protection or separated from it in accordance with the requirements for the enclosure of exits (see 5-114).

Exception: If the discharge area is a vestibule or foyer with no dimension exceeding 10 feet and separated from the remainder of the floor of discharge by construction providing protection at least the equivalent of wired glass in steel frames and serving only for means of egress including exits directly to the outside the requirements of 5-1222(b) may be waived.

c. The entire area on the floor of discharge is separated from areas below by construction having a minimum of 2-hour fire resistance rating.

5-1223. Stairs and other exits shall be so arranged as to make clear the direction of egress to the street. Exit stairs that continue beyond the floor of discharge shall be interrupted at the floor of discharge by partitions, doors, or other effective means.

5-1224. Stairs, ramps, bridges, balconies, escalators, moving walks and other components of an exit discharge shall comply with the detailed requirements of this Chapter for such components.

5-1225. Subject to the approval of the authority having jurisdiction, exits may be accepted where discharging to roofs or other sections of the building or adjoining buildings, where the roof has a fire resistance rating at least the equivalent of that required for the exit enclosure, where there is a continuous and safe means of egress from the roof, and all other reasonable requirements for life safety are maintained.

5-123. Headroom

5-1231. Means of egress shall be so designed and maintained as to provide adequate headroom as provided in other sections of this

Code but in no case shall the ceiling height be less than 7 feet 6 inches nor any projection from the ceiling be less than 6 feet 8 inches from the floor.

5-124. Changes in Elevation

5-1241. Where a means of egress is not substantially level, such differences in elevation shall be negotiated by stairs or ramps conforming to the requirements of this Chapter for stairs and ramps.

5-125. Interior Finish in Exits

5-1251. Except where further limited for individual occupancies by Chapters 8 through 16, the flame spread of interior finish shall not exceed Class B in vertical exits.

5-126. Maintenance and Workmanship

5-1261. Doors, stairs, ramps, passages, signs, and all other components of means of egress shall be of substantial, reliable construction and shall be built or installed in a workmanlike manner.

5-1262. Means of egress shall be continuously maintained free of all obstructions or impediments to full instant use in the case of fire or other emergency.

5-1263. Any device or alarm installed to restrict the improper use of an exit shall be so designed and installed that it cannot, even in case of failure, impede or prevent emergency use of such exit.

SECTION 5-2. DOORS

5-211. Application

5-2111. A door assembly, including the doorway, frame, door, and necessary hardware, may be used as a component in a means of egress when it conforms to the general requirements of Section 5-1 and to the special requirements of this section. As such, the assembly is designated as a door or exit door.

5-2112. Every exit doorway and every principal entrance which are required to serve as an exit shall be so designed and constructed that the way of exit travel is obvious and direct. Windows which because of their physical configuration or design and the materials used in their construction could be mistaken for doors shall be made inaccessible to the occupants by barriers or railings conforming to the requirements of 5-316.

5-212. Swing and Force to Open

5-2121.* Any door used in an exit, and unless exempt by 5-2122 or other provisions of this Code, shall be so designed and installed

that when pressure is applied to the door on the side from which egress is to be made, it shall swing in the direction of exit travel from any position to the full instant use of the opening in which it is installed. During its opening process or when fully opened, a door shall not obstruct the exit width as determined by 5-2141.

5-2122. Any door in a means of egress shall swing in the direction of exit travel when serving a high hazard area or an occupant load of more than 50.

5-2123. A door giving access to a stairway shall swing in the direction of exit travel. A door during its swing shall not block stairs or landings and in no case in new buildings shall any door at any point in its swing reduce the effective width of stair or landing to less than one unit of exit width, nor when open interfere with the full use of the stairs.

5-2124. The force required to fully open doors shall not exceed 50 pounds applied to the latch stile.

5-213. Locks, Latches, Alarm Devices

5-2131.* An exit door shall be so arranged as to be readily opened from the side from which egress is to be made at all times when the building served thereby is occupied. Locks, if provided, shall not require the use of a key for operation from the inside of the building.

5-2132.* A latch or other fastening device on an exit door shall be provided with a knob, handle, panic bar, or other simple type of releasing device, the method of operation of which is obvious, even in darkness.

5-2133. A door designed to be kept normally closed in a means of egress, such as a door to a stair enclosure or horizontal exit, shall be provided with a reliable self-closing mechanism, and shall not at any time be secured in the open position except as permitted by 5-2134 below. An exit door designed to be kept normally closed shall bear a sign reading substantially as follows:

FIRE EXIT
Please keep door closed

5-2134. In any building of low or moderate hazard contents, as defined in 4-2122 and 4-2124, where the authority having jurisdiction approves the installation and finds that the circumstances are such that reasonable life safety from fire and smoke is not en-

dangered thereby, stairway doors, smokestop doors, and doors on horizontal exits may be normally open, where

a. Upon release, the door becomes self-closing, and

b. An approved release device is provided, so arranged that upon interruption of electric current, the door will be released, and

c. The electric current will be positively interrupted by (1) the operation of an approved automatic sprinkler system which protects the entire building, including both sides of any horizontal exit the door of which is held open by any release so controlled, or, (2) the operation of an approved automatic fire detecting system installed to protect the entire building, so designed and installed as to provide for actuation of the system so promptly as to preclude the generation of heat or smoke sufficient to interfere with egress before the system operates, or (3) by the operation of approved smoke detectors installed in such a way to detect smoke or other products of combustion on either side of the door opening.

d. Any sprinkler or fire detection system or smoke detector is provided with such supervision and safeguards as are necessary to assure complete reliability of operation in case of fire, and

e. The release device is so designed that it may be instantly released manually, by some simple and readily obvious operation.

5-214. Units of Exit Width

5-2141. In determining the units of exit width for an exit doorway, only the clear width of the doorway when the door is in the open position shall be measured. Any projections into the doorway by doorstops or by the hinge stile shall be disregarded.

5-2142. Where an exit door has 2 or more leaves separated by mullions, the allowable units of exit width for the entire exit door shall be the sum of the units of exit width calculated separately for each individual leaf in the opening.

5-215. Width and Floor Level

5-2151.* No single leaf in an exit door shall be less than 28 inches wide.

5-2152. No single leaf in an exit door shall exceed 48 inches in width.

5-2153. The floor on both sides of an exit door shall be substantially level and shall have the same elevation on both sides of the door, for a distance on each side at least equal to the width of the widest single leaf of the door. When the exit door discharges to the outside or to a balcony or other exterior exit or exit access, the floor level outside the door may be one step lower than inside, but not more than 7½ inches lower.

5–216. Panic Hardware

5–2161.* When an exit door is required to be equipped with panic hardware (fire exit bolts) by some other provision of this Code, the panic hardware shall cause the door latch to release when pressure of not to exceed 15 pounds is applied to the releasing devices in the direction of exit travel.

Such releasing devices shall be bars or panels extending not less than two-thirds of the width of the door and placed at heights suitable for the service required, not less than 30 nor more than 44 inches above the floor.

Only approved panic hardware shall be used on an exit door.

5–2162. Required panic hardware shall not be equipped with any locking or dogging device, set screw, or other arrangement which can be used to prevent the release of the latch when pressure is applied to the bar.

5–217. Maintenance

5–2171. No lock, padlock, hasp, bar, chain, or other device, or combination thereof, shall be installed or maintained at any time on, or in connection with any door on which panic hardware is required by this Code if such device prevents, or is intended to prevent, the free use of the door for purposes of egress.

5–218. Power-Operated Doors

5–2181. Where required doors are operated by power, such as doors with photo-electric actuated mechanism to open the door upon the approach of a person, or doors with power-assisted manual operation, the design shall be such that in event of power failure the door may be manually opened to permit exit travel or closed where necessary to safeguard means of egress.

5–2182. No power-operated door shall be counted as a required exit unless it swings with the exit travel by mechanical or manual means.

5–219. Screen and Storm Doors

5–2191.* No screen door or storm door in connection with any required exit shall swing against the direction of exit travel, in any case where doors are required to swing with the exit travel.

5–220. Revolving Doors

5–2201. A revolving door shall not be used as an exit door except where specifically permitted by some individual occupancy chapter

of this Code for an exit from the floor of discharge directly to the outside. It shall not be used at the foot or top of stairs at the floor of discharge. Where permitted, the revolving exit door or doors shall not be given credit for more than 50 percent of the required units of exit width except as provided in 5-2203, following.

5-2202.* Each revolving door may receive credit as constituting ½ unit of exit width.

Except as provided in 5-2203, below, the number of revolving doors used as exit doors shall not exceed the number of swinging doors used as exit doors within 20 feet thereof.

5-2203. Revolving doors may serve as exits, without adjacent swinging doors, for street floor elevator lobbies if no stairways or doors from other parts of the building discharge through the lobby, and the lobby has no occupancy other than as a means of travel between elevators and street.

5-2204.* Revolving doors shall be equipped with means to prevent their rotation at too rapid a rate to permit orderly egress.

5-221. Turnstiles

5-2211.* No turnstile or similar device to restrict travel to one direction, or to collect fares or admission charges, shall be so placed as to obstruct any required means of egress, except that approved turnstiles not over 3 feet high, which turn freely in the direction of exit travel, may be used in any occupancy where revolving doors are permitted. Turnstiles over 3 feet high shall be subject to the requirements for revolving doors.

5-2212. Turnstiles in or furnishing access to required exits shall be of such design as to provide 22 inches clear width as the turnstile rotates.

5-2213. No turnstile shall be placed in any required exit, or barring the way of access thereto or travel therefrom, unless immediately adjacent or within 20 feet there is a swinging door or gate opening freely in the direction of exit travel, or an open passage serving the same general path of travel as the turnstile.

5-2214. Turnstiles shall be rated the same as revolving doors as regards units of exit width and rates of travel.

5-222. Doors in Folding Partitions

5-2221. When permanently mounted folding or movable partitions are used to divide a room into smaller spaces, a swinging door or open doorway shall be provided as a way of exit access from each such space, except that under the following conditions the swinging

door may be omitted and the partition may be used to enclose the space completely.

a. The subdivided space shall not be used by more than 20 persons at any time.

b. The use of the space shall be under adult supervision.

c. The partitions shall be so arranged that they do not extend across any aisle or corridor used as a way of access to the required exits from the floor.

d. The partitions shall conform to the interior finish and other applicable requirements of this Code.

e. The partitions shall be an approved type, shall have a simple method of release, and shall be capable of being opened quickly and easily by inexperienced persons in case of emergency.

SECTION 5-3. INTERIOR STAIRS AND SMOKEPROOF TOWERS

5-311. General

5-3111. All stairs serving as required means of egress shall be of permanent fixed construction.

5-312. Classes of Stairs

5-3121. Stairs shall be of Class A or Class B types in accordance with the following table:

	Class A	*Class B*
Minimum width clear of all obstructions except handrails which may project not more than 3½ in. each side	44 in.	44 in.; 36 in. where total occupancy of all floors served by stairway is less than 50.
Maximum height of risers	7½ in.	8 in.
Minimum width of tread exclusive of nosing or projection	10 in.	9 in.
Winders	None	None
Minimum headroom	6 ft. 8 in.	6 ft. 8 in.
Maximum height between landings	9 ft.	12 ft.
Minimum dimension of landings in direction of travel	44 in.	44 in.
Doors opening immediately on stairs, without landing at least width of door	No	No

5-313. Treads and Risers

5-3131. The height of every riser and the width of every tread shall be so proportioned that the sum of 2 risers and a tread, exclusive of its nosing or projection, is not less than 24 nor more than 25 inches.

5-3132. The minimum number of risers in any one flight of stairs shall be 3.

5-314. Enclosures

5-3141. All interior stairways shall be enclosed in accordance with the provisions of Section 6-1 of this Code, except in so far as open stairways are permitted by 6-1112.

5-315. Stair Details

5-3151. Each new stair and platform, landing, etc., used in connection therewith in buildings 4 stories or more in height, and in all new buildings, required by this Code to be of fire-resistive construction, shall be of noncombustible material throughout except that handrails are exempted from this requirement. Treads of stairs and landing floors shall be solid.

5-3152. Each stair, platform, landing, balcony, and stair hallway floor shall be designed to carry a load of 100 pounds per square foot, or a concentrated load of 300 pounds so located as to produce maximum stress conditions.

5-3153. There shall be no variation exceeding $\frac{3}{16}$ inch in the width of treads or in heights of risers in any flight, except as permitted by 5-3181 for monumental stairs.

5-3154. Every tread less than 10 inches wide shall have a nosing or an effective projection of approximately 1 inch over the level immediately below.

5-3155. Where material of stair treads and landings is such as to involve danger of slipping, nonslip material shall be provided on tread surface.

5-3156. There shall be no enclosed usable space under stairs in an exit enclosure nor shall the open space under such stairs be used for any purpose.

5-3157. No arrangement of treads known as winders shall be permitted in new stairways, except as permitted by 5-3181 for curved monumental stairways.

5-3158. Stairways and intermediate landings shall continue with no decrease in width along the direction of exit travel.

5-316. Guards and Handrails

5-3161. Each new stair, stair landing, and balcony appurtenant thereto for all exits and all aisles located along the edge of open-sided floors, service stairs and stairs leading from mezzanines which form part of a path of travel to such exits, shall be guarded against falls over the open edge and shall have handrails on both sides, except that handrails shall not be required on level landings or balconies.

5-3162. Required guards and handrails shall continue for the full length of each flight of stairs.

5-3163. The design of guards and handrails and the hardware for attaching handrails to guards, balusters, or masonry walls shall be such that there are no projecting lugs on attachment devices or nonprojecting corners or members of grilles or panels which may engage loose clothing. Openings in guards shall be designed to prevent loose clothing from becoming wedged in such openings.

5-3164. *Handrail Details.*

a. Handrails on stairs shall be not less than 30 inches nor more than 34 inches above the upper surface of the tread, measured vertically to the top of the rail, from a point on the tread 1 inch back from the leading edge, except that on stairways designed for use by children an additional handrail may be provided lower than the main handrail.

b. Handrails shall provide a clearance of at least 1½ inches between handrail and wall to which fastened. Handrails shall be of such design and so supported as to withstand a load of not less than 200 pounds applied at any point, downward or horizontally.

c. Handrails shall be so designed as to permit continuous sliding of hands on them.

d. Every stairway required to be more than 88 inches in width shall have intermediate handrails dividing the stairway into portions not more than 88 inches in width, except that on monumental outside stairs 2 handrails may be permitted.

5-3165. *Guard Details.*

a. The height of guards required by 5-3161 shall be measured vertically to the top of the guard from a point on the tread 1 inch back from the leading edge or from the floor of landings or balconies.

b. No guards shall be required for inside stairs which reverse

direction at intermediate landings, where the horizontal distance between successive flights is not more than 1 foot.

c. Guards shall be not less than 42 inches high. Guards protecting changes in level one story or less on interior balconies and mezzanines shall be not less than 36 inches high.

d. Guards shall be so constructed that the area in the plane of the guard from the top of floor, riser, or curb to the minimum required height of guard shall be subdivided or filled in one of the following manners:

(1.) A sufficient number of intermediate longitudinal rails so that the clear distance between rails measured at right angles to the run of rail does not exceed 10 inches. The bottom rails shall not be more than 10 inches from the top of floor, tread, or curb measured vertically. The point of measurement from treads shall be as provided in 5–3165a.

(2.) Vertical balusters spaced not more than 6 inches apart.

(3.) Areas filled wholly or partially by panels of solid wire mesh or expanded metal construction or by ornamental grilles which provide protection against falling through the guard equivalent to that provided by the intermediate rails or vertical balusters specified in the two preceding paragraphs.

(4.) The lower part of the area may consist of a continuous substantial curb, the top of which is parallel to the run of stairs or level areas, and the height of which is not less than 3 inches on stairs (measured at right angles to the curb from its top to the nosing of the tread) and not less than 6 inches for level areas.

(5.) Masonry walls may be used for any portion of the guard.

(6.) Any combination of the foregoing that provides equivalent safety.

e. Enclosure walls and guards consisting of masonry, railings, or other construction shall either be designed for loads transmitted by attached handrails or shall be designed to resist a horizontal thrust of 50 pounds per lineal foot applied at the top of the guard, whichever condition produces maximum stresses. For walls or guards higher than minimum height the specified thrust shall be applied at a height of 42 inches above the floor or tread.

f. Intermediate rails, balusters, and panel fillers shall be designed for a uniform load over the gross area of the guard (including the area of any openings in the guard) of which they are a part of not less than 25 pounds per square foot. Reactions due to this loading need not be added to the loading specified by 5–3165e in designing the main supporting members of guards.

5–317. Smokeproof Towers

5–3171. A smokeproof tower, as herein specified, shall be a continuous fire-resistive enclosure protecting a stairway from fire or

smoke in the building served, with communication between the building and the tower by means of balconies directly open to the outer air.

5-3172. Stairs, enclosure walls, vestibules, balconies and other components of smokeproof towers shall be of noncombustible materials, and all other requirements hereinbefore specified for inside stairs shall apply to stairs in smokeproof towers.

5-3173. Stairways shall be completely enclosed by walls having a 2-hour fire resistance rating and comprised of noncombustible material. There shall be no openings in walls separating the enclosure from the interior of the building. Fixed or automatic fire windows are permitted in an exterior wall not subject to severe fire exposure hazard from the same or nearby buildings.

5-3174. Access to the smokeproof tower shall be provided from every story through vestibules open to the outside on an exterior wall or from balconies overhanging an exterior wall, but not subject to severe fire exposure hazard. Every such vestibule, balcony or landing shall have an unobstructed length and width not less than the required width of exit doors serving same, and shall be directly open to a street or alley or yard or to an enclosed court open at the top not less than 20 feet in width and 1,000 square feet in area. Balconies or vestibules shall have guards not less than 42 inches high and shall conform with 5-3165d. Wall openings exposing balconies or vestibules shall be protected in accordance with 5-4121.

5-3175.* Access from a building to vestibules or balconies shall be through doorways not less than 40 inches wide for new and 36 inches wide for existing towers. These openings and the entrances to the towers shall be provided with approved, self-closing fire doors swinging with the exit travel. Clear wired glass not exceeding 720 square inches shall be provided in all doors giving access to the enclosure.

5-3176. The level of a vestibule or balcony floor shall be placed approximately 7½ inches below the floor level of each story where climatic conditions involve the possibility of blocking doors by snow or ice. In mild climates in which this hazard is not presented, the floors shall be approximately level. There shall be no step from the vestibule or balcony into the stair enclosure.

5-318. Monumental Stairs

5-3181. Monumental stairs, either inside or outside, may be accepted as required exits if all requirements for exit stairs are complied with, including required enclosures and minimum width of treads, except that curved stairs may be accepted with a radius of 25 feet or more at the inner edges.

SECTION 5-4. OUTSIDE STAIRS

5-411. General

5-4111. Any permanently installed stair outside of the building served is acceptable as a required exit under the same condition as an inside stair, provided that such stairs comply with all the requirements hereinbefore stated for inside stairs, except as modified by the following paragraphs of this Section.

5-4112. Outside stairs, serving as required exits, shall be so arranged as to avoid any handicap to the use of the stairs by persons having a fear of high places. For stairs more than 3 stories in height any arrangement intended to meet this requirement shall be at least 4 feet in height.

5-4113. Subject to the approval of the authority having jurisdiction, outside stairs may be accepted where leading to roofs of other sections of the building or adjoining building, where the construction is fire resistive, where there is a continuous and safe means of exit from the roof, and all other reasonable requirements for life safety are maintained.

5-412. Enclosures

5-4121. Under all conditions where enclosure of inside stairways is required, outside stairs shall be separated from the interior of the building by fire-resistive walls the same as required for inside stairway enclosures, with fire doors or fixed wired glass windows protecting any openings therein. Such protection shall not be required where the stairs are located on the side of the balcony or corridor away from the building if separated from the building by the full required width of the balcony or corridor, if 3 stories or less in height. If 4 stories or more in height openings shall be protected as follows:

a. Horizontally. If within 15 feet of any balcony, platform, or stairway, constituting a part of the exit. This provision does not apply to a platform or walkway leading from the same floor to the exit. Protection need not extend around a right angle corner (outside angle 270 degrees) of the building except where there is only one exit.

b. Below. If within 3 stories or 35 feet of any balcony, platform, walkway, or stairway constituting a part of the exit, or within 2 stories or 20 feet of a platform or walkway leading from any story to the exit.

c. Above. If within 10 feet of any balcony, platform, or walkway, as measured vertically, or from any stair treads, as measured vertically from the face of the outside riser.

d. Top story. Protection for wall openings in the top story shall not be required where stairs do not lead to the roof.

5-4122. Where a stairway is located in a court the least dimension of which is less than one-third its height, or in an alcove having a width less than one-third its height and a depth greater than one-fourth its height, all openings below shall be protected.

5-4123. Outside stairs in climates subject to snow and ice shall be protected to prevent accumulation of snow or ice, except in the case of main entrance stairs providing the principal access to a building where it may be assumed that normal use of the building will require removal of snow and ice as a necessary condition for the entrance of occupants. Balconies, to which access doors lead, shall be approximately level with the floor of the building, or in climates where balconies may be subject to accumulation of snow or ice, one step, not to exceed 7½ inches below the level of the inside floor.

5-413. Stair Details

5-4131. For outside stairs of monumental type, constructed of stone or concrete, the requirement for a nosing may be waived if treads are at least 11 inches wide.

5-4132. Treads shall be solid.

5-4133. Risers shall be solid except that the skirt type having 1 inch space for drainage may be permitted.

5-4134. Except where embedded in masonry or concrete or where a suitable fire-resistive and waterproof covering is provided, no structural metal member shall be employed the entire surface of which is not capable of being inspected and painted.

5-4135. All supporting members for balconies and stairs, which are in tension and are fastened directly to the building, shall pass through the wall and be securely fastened on the opposite side, or they shall be securely fastened to the framework of the building. Where metal members pass through walls, they shall be protected effectively against corrosion.

5-4136. Balcony and stair enclosures and railings shall be designed to resist horizontal thrust of 50 pounds per lineal foot of railing or enclosure applied at the top of the railing or to the enclosure 42 inches above the floor or tread.

SECTION 5-5. HORIZONTAL EXITS

5-511. Application

5-5111.* A horizontal exit is a way of passage from one building

to an area of refuge in another building on approximately the same level, or a way of passage through or around a fire wall or fire partition to an area of refuge on approximately the same level in the same building, which affords safety from fire or smoke from the area of escape and areas communicating therewith.

5–5112.* Horizontal exits may be substituted for other exits to an extent that the total exit capacity of the other exits (stairs, ramps, doors leading outside the building) will not be reduced below half that required for the entire area of the building or connected buildings if there were no horizontal exits.

Exception: For institutional occupancies, the total exit capacity of the other exits (stairs, ramps, doors leading outside the building) shall not be reduced below ⅓ that required for the entire area of the building.

5–512. Egress from Area of Refuge

5–5121. Every fire section for which credit is allowed in connection with a horizontal exit shall have in addition to the horizontal exit or exits at least one stairway, doorway leading outside, or other standard exit. Any fire section not having a stairway or doorway leading outside shall be considered as part of an adjoining section with stairway.

5–5122. Every horizontal exit for which credit is given shall be so arranged that there are continuously available paths of travel leading from each side of the exit to stairways or other standard means of egress leading to outside the building.

This requirement is complied with where the entire areas from each side of the horizontal exit to the stairways or other standard means of egress are occupied by the same tenant; or where there are public corridors or other continuously available passageways leading from each side of the exit to stairways or other standard means of egress leading to outside the building.

5–5123. Whenever either side of the horizontal exit is occupied, the doors used in connection with the horizontal exit shall be unlocked.

5–5124. The floor area on either side of a horizontal exit shall be sufficient to hold the occupants of both floor areas allowing not less than 3 square feet clear floor area per person.

5–513. Bridges and Balconies

5–5131. Each bridge or balcony utilized in conjunction with horizontal exits shall comply with the structural requirements for outside stairs and shall have guards and handrails in general con-

formity with the requirements of Section 5–3 for stairs and smokeproof towers.

5–5132. Every bridge or balcony shall be at least as wide as the door leading to it, and not less than 44 inches for new construction.

5–5133. Every door leading to a bridge or balcony serving as a horizontal exit from a fire area, shall swing with the exit travel out of the fire area.

5–5134. Where the bridge or balcony serves as a horizontal exit in one direction, only the door from the bridge or balcony into the area of refuge shall swing in.

5–5135. Where the bridge or balcony serves as a horizontal exit in both directions, doors shall be provided in pairs swinging in opposite directions, only the door swinging with the exit travel to be counted in determination of exit width, unless the bridge or balcony has sufficient floor area to accommodate the occupant load of either connected building or fire area on the basis of 3 square feet per person or in existing buildings by specific permission of the authority having jurisdiction, in which case doors on both ends of the bridge or balcony may swing out from the building.

5–5136. The bridge or balcony floor shall be level with the building, except that where there is a possibility of blocking doors by snow or ice the bridge or balcony floor shall be approximately 7½ inches below the building floor level.

5–5137.* Where there is a difference in level between connected buildings or floor areas, ramps shall be employed. Steps may be used where the difference in elevation is greater than 21 inches. Ramps and stairs shall be in accordance with the sections of this Code pertaining to ramps, stairs, and outside stairs.

5–5138. All wall openings, in both of the connected buildings or fire areas, any part of which are within 10 feet of any bridge or balcony as measured horizontally or below shall be protected with fire doors or fixed metal frame wired glass windows; provided, however, that where bridges have solid sides not less than 6 feet in height, such protection of wall openings may be omitted.

5–514. Openings through Walls for Horizontal Exits

5–5141. Walls or partitions separating areas between which there are horizontal exits shall be of noncombustible material having a 2-hour fire resistance rating. They shall provide a separation continuous to ground except that fire partitions may be omitted on the street floor in accordance with 5–515 when they are supported on

other construction having at least a 2-hour fire resistance rating continuous to the ground.

5-5142.* Any opening in such walls, whether or not such opening serves as an exit, shall be adequately protected in an approved manner against the passage of fire or smoke therefrom.

5-5143.* Swinging fire doors on horizontal exits shall swing with the exit travel. Where a horizontal exit serves areas on both sides of a wall there shall be adjacent openings with swinging doors at each, opening in opposite directions, with signs on each side of the wall or partition indicating as the exit the door which swings with the travel from that side; or other approved arrangements providing doors always swinging with any possible exit travel.

5-5144.* Sliding fire doors shall not be used on a horizontal exit except where the doorway is protected by a fire door on each side of the wall in which it occurs. In this case, one fire door shall be of the swinging type as provided in 5-5143 and the other may be an automatic sliding fire door that shall be kept open whenever the building is occupied.

5-515. Omission of Fire Partition on Certain Floors

5-5151. Where a fire partition is used to provide a horizontal exit in any story of a building it may be omitted in any lower story under the following conditions:

a. The open fire area story from which the fire partition is omitted shall be separated from the stories above by construction having at least a 2-hour fire resistance rating.

b. Required exits from the stories above the open fire area story shall be separated therefrom by construction having a 2-hour fire resistance rating and shall discharge outside without travel through the open fire area story.

c. Vertical openings between the open fire area story and the stories above shall be enclosed with construction having a 2-hour fire resistance rating. Other details shall be in accordance with the applicable provisions of Section 6-1.

5-5152. Where a fire partition is used to provide a horizontal exit for any story below the discharge level, it may be omitted at the level of discharge under the following conditions:

a. The open fire area story from which the fire partition is omitted shall be separated from the stories below by construction having at least a 2-hour fire resistance rating.

b. Required exits from stories below the open fire area story shall be separated from the open fire area story by construction having a

2-hour fire resistance rating and shall discharge directly outside without travel through the open fire area story.

c. Vertical openings between the open fire area story and the floors below shall be enclosed with construction having a 2-hour fire resistance rating. Other details shall be in accordance with the applicable provisions of Section 6–1.

SECTION 5–6. RAMPS

5–61. INSIDE RAMPS

5–611. Application

5–6111. A ramp may be used as a component in a means of egress when it conforms to the general requirements of Section 5–1 and to the special requirements of this Section. As such, it is designated as either a ramp or an exit ramp.

5–612. Classification

5–6121. A ramp shall be designated as Class A or Class B in accordance with the following table:

	Class A	*Class B*
Width	44 in. and greater	30 to 44 in.
Slope	1 to 1 3/16 in 12	1 3/16 to 2 in 12
Maximum height between landings	No limit	12 ft.
Capacity in persons per unit of exit width (except as modified by Chapters 8 through 16)		
Down	60	45
Up	45	45

5–613. Protective Enclosure

5–6131. When a ramp inside a building is used as an exit or exit component, it shall be protected by separation from other parts of the building, as specified in 5–114.

5–6132. Fixed wired glass panels in steel sash may be installed in such a separation in a fully sprinklered building.

5–6133.* There shall be no enclosed usable space under ramps in an exit enclosure nor shall the open space under such ramps be used for any purpose.

5–614. Other Details

5–6141. A ramp and the platforms and landings associated therewith shall be designed for not less than 100 pounds per square foot live load.

5–6142. The slope of a ramp shall not vary between landings. Landings shall be level and changes in direction of travel if any shall be made only at landings.

5–6143. An exit ramp in a building more than 3 stories in height, or in a building of any height of noncombustible or fire-resistive construction, shall be of noncombustible construction. The ramp floor and landings shall be solid and without perforations.

5–6144. A ramp shall have a nonslip surface.

5–6145. Guards and handrails complying with 5–316 shall be provided in comparable situations for ramps except that handrails are not required on Class A ramps.

5–62. OUTSIDE RAMPS

5–621. General

5–6211. Any ramp permanently installed on the outside of the building served may be accepted as a component in a means of egress under the same conditions as an inside ramp, provided it complies with all requirements for inside ramps except as modified by the following provisions of 5–62.

5–6212.* Outside ramps shall be so arranged as to avoid any handicap to their use by persons having a fear of high places. For ramps more than 3 stories in height, any arrangement intended to meet this requirement shall be at least 4 feet in height.

5–622. Enclosures

5–6221. Under all conditions where enclosure of inside ramps is required, outside ramps serving as exits shall be separated from the interior of the building by wall construction that has a fire resistance rating equal to that required for such enclosure. Such protection shall not be required where the ramp is located on the side of the outside balcony or corridor away from the building if separated from the building by the full required width of balcony or corridor, if 3 stories or less in height. If the ramp is 4 stories or more in height, the openings shall be protected as follows:

a. Horizontally. If within 15 feet of any balcony, platform or ramp, serving as component part of the exit. This provision does

not apply to a platform or walkway serving as access to the exit. Protection need not extend around a right angle corner (outside angle 270 degrees) of the building except where there is only one exit.

b. Below. If within 3 stories or 35 feet of any balcony, platform walkway, or ramp constituting a part of the exit, or within 2 stories or 20 feet of a platform or walkway leading from any story to the exit.

c. Above. If within 10 feet of any balcony, platform, or walkway, as measured vertically, or from the surface of a ramp.

d. Top story. Protection for wall openings in the top story shall not be required where the ramp does not lead to the roof.

5-6222. Where a ramp exit is located in a court the least dimension of which is less than ⅓ its height, or in an alcove having a width less than ⅓ its height and a depth greater than ¼ of its height, all openings below shall be protected.

5-6223. Outside ramps in climates subject to snow and ice shall be protected to prevent accumulation of snow or ice, except in the case of main entrance ramps providing the principal access to a building where it may be assumed that normal use of the building will require removal of snow and ice as a necessary condition for the entrance of occupants. Balconies, to which access doors lead, shall be approximately level with the floor of the building, or in climates where balconies may be subject to accumulation of snow or ice, one step, not to exceed 7½ inches below the level of the inside floor.

5-623. Ramp Details

5-6231. Except where embedded in masonry or concrete or where a suitable fire-resistive and waterproof covering is provided, no structural metal member shall be employed the entire surface of which is not capable of being inspected and painted.

5-6232. All supporting members for balconies and ramps, which are in tension and are fastened directly to the building, shall pass through the wall and be securely fastened on the opposite side, or they shall be securely fastened to the framework of the building. Where metal members pass through walls, they shall be protected effectively against corrosion.

5-6233. Balcony and ramp enclosures and railings shall be designed to resist a horizontal thrust of 50 pounds per running foot of railing or enclosure applied at the top of the railing or to the enclosure 42 inches above the floor.

SECTION 5–7. EXIT PASSAGEWAYS

5–711.* Application

5–7111. Any hallway, corridor, passage, tunnel, underfloor passageway, or overhead passageway may be designated as an exit passageway and used as an exit or exit component as provided in 5–1121 and 5–1131 when conforming to all other requirements of Section 5–1 as modified by the provisions of this Section.

5–712. Protective Enclosure and Arrangement

5–7121. An exit passageway shall be protected by separation from other parts of the building as specified in 5–114.

5–7122. Fixed wired glass panels in steel sash may be installed in such a separation in a fully sprinklered building.

5–713. Width

5–7131. The width of an exit passageway shall be adequate to accommodate the aggregate capacity of all exits discharging through it.

5–714. Floor

5–7141. The floor shall be solid and without perforations.

SECTION 5–8. ESCALATORS AND MOVING WALKS

5–811. Application

5–8111.* An escalator or moving walk may be accepted as a component in a means of egress when it conforms to the general requirements of Section 5–1 and to the special requirements of this Section. As such, the escalator is designated as an exit escalator and the moving walk as a moving walk exit.

5–8112.* A sign indicating the direction of the nearest approved exit shall be placed at the point of entrance to any escalator or moving walk that does not conform to or serve as a means of egress.

5–812. Escalators

5–8121.* An exit escalator shall comply with the applicable requirements for exit stairs of Section 5–3 except as modified in this Section.

5–8122. No escalator capable of being operated in the direction contrary to normal exit travel shall be used in a means of egress.

5–8123. An exit escalator shall be of the horizontal tread type and shall be of noncombustible construction throughout except for the step tread surfaces, handrails and step wheels.

5–8124. A single escalator 32 inches wide shall be given credit for 1 unit of exit width. An escalator 48 inches wide shall be given credit for 2 units of exit width.

5–8125. There shall be an unobstructed space of at least 4 inches outside the handrail and above the handrail for the full length of the escalator.

5–8126. No single exit escalator shall have an uninterrupted vertical travel of more than 1 story.

5–8127.* An exit escalator shall be designed and operated according to generally accepted standards of safe engineering practice.

5–813. Moving Walks

5–8131. Except as modified by this Section, an inclined moving walk exit shall comply with the applicable requirements of Section 5–6 for ramps, and a level moving walk exit shall comply with the applicable requirements of Section 5–7 for exit passageways.

5–8132. No moving walk capable of being operated in the direction contrary to normal exit travel shall be used in a means of egress.

5–8133.* A moving walk exit shall be designed and operated according to generally accepted standards of safe engineering practice.

SECTION 5–9. FIRE ESCAPE STAIRS, LADDERS AND SLIDE ESCAPES

5–91. FIRE ESCAPE STAIRS

5–911. General

5–9111.* Fire escape stairs may be used as required means of exit only in existing buildings, subject to the provisions of the occupancy chapter applying. Fire escape stairs shall not constitute more than 50 percent of the required exit capacity in any case. Fire escape stairs shall not be accepted as constituting any part of the required exits for new buildings.

5–9112. Fire escape stairs shall provide a continuous unobstructed safe path of travel to the ground or other safe area of refuge to which they lead. Where the fire escape is not continuous, as in cases where stairs lead to an adjoining roof, which must be crossed before continuing downward travel, the direction of travel shall be clearly indicated, and suitable walkways with handrails shall be provided where necessary. Where a single exit way consists of a

combination of inside stairs and fire escape stairs, each shall comply with the applicable provisions of this Code, and the two shall be so arranged and connected as to provide a continuous safe path of travel.

5–912. Types

5–9121. The following types of fire escape stairs are recognized by this Code:

Return platform type, superimposed runs

Straight run type, with platforms continuing in the same direction.

Either of these may be parallel to or at right angles to the building. They may be attached to buildings or erected independently of them and connected by bridges.

5–913. Stair Details

5–9131.* Fire escape stairs, depending upon the requirements of Chapters 8 through 16 of this Code, shall be in accordance with the following table and subsequent paragraphs.

	Existing Stairs	*Existing Stairs for Very Small Buildings*
Minimum widths	22 in. clear between rails	18 in. clear between rails
Minimum horizontal dimension any landing or platform	22 in.	18 in.
Maximum rise	9 in.	12 in.
Minimum tread, exclusive of nosing	9 in.	6 in.
Minimum nosing or projection	1 in.	No requirement
Tread construction	Solid, ½ in. dia. perforations permitted	Flat metal bars on edge, or square bars secured against turning, spaced 1¼ in. max. on centers
Winders (spiral)	None	Permitted subject to capacity penalty
Risers	None	No requirement
Maximum height between landings	12 ft.	No requirement
Headroom, minimum	7 ft.	6 ft. 6 in.
Access to escape	Door or casement windows 24 in. x 6 ft. 6 in. or double hung windows 30 x 36 in. clear opening	Windows

	Existing Stairs	*Existing Stairs for Very Small Buildings*
Level of access opening	Not over 12 in. above floor; steps if higher	Same
Discharge to ground	Swinging stair section permitted	Swinging stair, or ladder if approved
Capacity, number of persons	45 per unit,* access by door; 20 if access by climbing over window sill.	10; if winders or ladder from bottom balcony, 5; if both, 1

*See 5-1152 for counting fractions of a unit for stairs more than 1 unit wide.

5–914. Arrangement and Protection of Openings

5–9141. Fire escape stairs shall be so arranged that they will be exposed by the smallest possible number of window and door openings. There shall be no transoms over doors. Every opening, any portion of which is in the limits specified below, shall be completely protected by approved fire doors or metal frame wired glass windows as follows:

a. Horizontally. If within 15 feet of any balcony, platform, or stairway, constituting a part of the escape proper. This provision does not apply to a platform or walkway leading from the same floor to the escape proper. Protection need not extend around a right angle corner (outside angle 270 degrees) of the building except where stairs are close to such corner.

b. Below. If within 3 stories or 35 feet of any balcony, platform, walkway, or stairway constituting a part of the escape proper, or within 2 stories or 20 feet of a platform or walkway leading from any story to the escape proper.

c. Above. If within 10 feet of any balcony, platform, or walkway, as measured vertically, or from any stair treads, as measured vertically from the face of the outside riser.

d. Top story. Protection for wall openings shall not be required where stairs do not lead to the roof.

5–9142. Where a fire escape stair is located in a court the least dimension of which is less than one-third its height, or in an alcove having a width less than one-third its height, and depth greater than one-fourth its height, all openings below shall be protected.

5–9143. The provisions of 5–9141 and 5–9142 may be waived or modified by the authority having jurisdiction in consideration of automatic sprinkler protection, low hazard occupancy or other special conditions.

5–915. Access

5–9151.* Access to fire escape stairs shall be provided in accordance with 5-9131 and the general provisions of 5–120. Where access is by way of double hung windows, such windows shall be so counterbalanced and maintained that they can be readily opened with a minimum of physical effort. Insert screens, if any, on any type of opening giving access to fire escape stairs shall be of types that may be readily opened or pushed out. No storm sash shall be used on any window providing access to fire escape stairs.

5–9152. Fire escape stairs shall extend to the roof in all cases where the roof is subject to occupancy, or is so constructed and arranged as to provide an area of refuge from fire. In all cases where stairs do not extend to the roof, access thereto shall be provided by a ladder in accordance with 5–92, except that such ladders are not required in the case of roofs with pitch steeper than 2 inches to the foot.

5–9153. Balconies to which access doors lead shall be approximately level with the floor of the building, or in climates where balconies may be subject to accumulation of snow or ice, one step, not to exceed 7½ inches, below the level of the inside floor.

5–9154. Balconies, to which access is secured through windows with sills above the inside floor level, shall be not more than 18 inches below the sill. In no case shall the balcony level be above the sill.

5–916. Materials and Strength

5–9161. Iron, steel, or concrete or other approved noncombustible material, shall be used for the construction of fire escape stairs, balconies, railings, and other features appurtenant thereto.

5–9162. Balconies and stairs shall be designed to carry a load of 100 pounds per square foot, or a concentrated load of 300 pounds so located as to produce maximum stress conditions.

5–9163. Except where embedded in masonry or concrete or where a suitable fire-resistive and waterproof covering is provided, no structural metal member shall be employed the entire surface of which is not capable of being inspected and painted.

5–9164. All supporting members for balconies and stairs, which are in tension and are fastened directly to the building, shall pass through the wall and be securely fastened on the opposite side, or they shall be securely fastened to the framework of the building. Where metal

members pass through walls, they shall be protected effectively against corrosion.

5–9165. Balcony and stair enclosures and railings shall be designed to withstand a horizontal pressure of 50 pounds per running foot of railing or enclosure without serious deflection, and support at walls for such railings or enclosures shall be in the manner specified in 5–9162 for tension members, except as provided in 5–9166.

5–9166. Notwithstanding the provisions of 5–9162 and 5–9165, the authority having jurisdiction may approve any existing fire escape stair for a very small building when it has been shown by load test or other evidence satisfactory to him to have adequate strength.

5–917. Guards and Handrails

5–9171. All fire escapes shall have walls or guards on both sides, in accordance with 5–3161 and 5–3165, except for height, which shall be 42 inches, and 36 inches for fire escapes for very small buildings, the height being measured vertically from a point on the stair tread one inch back from the leading edge, or vertically above any landing or balcony floor level.

5–9172. All fire escapes shall have handrails on both sides, not less than 30 inches nor more than 42 inches high, measured vertically from a point on the stair tread one inch back from the leading edge, all in general conformity to the requirements for stair handrails, 5–3161 through 5–3164.

5–9173. Handrails and guards shall be so constructed as to withstand a force of 200 pounds applied downward or horizontally at any point.

5–918. Swinging Stairs

5–9181. Swinging stair sections shall not be used for fire escape stairs except where termination over sidewalks, alleys, or driveways makes it impracticable to build stairs permanently to the ground. Where used, swinging stairs shall comply with 5–9182–5–9189.

5–9182. Swinging section of stairs shall not be located over doors, over the path of travel from any other exit, nor be in any location where there are or are likely to be obstructions.

5–9183. Width of swinging section of stairs shall be at least equal to that of the stairs above.

5–9184. Pitch shall not be steeper than that of the stairs above.

5–9185. Railings shall be provided similar in height and construction to those required for the stairs above. Railings shall be designed to prevent any possibility of injury to persons at head of stairs or on balconies when stairs swing downward. Minimum clearance between moving sections where hands might be caught shall be 4 inches.

5–9186. If distance from lowest platform to ground exceeds 12 feet, an intermediate balcony not more than 12 feet from the ground nor less than 7 feet in the clear underneath, shall be provided with width not less than that of the stairs and length not less than 4 feet.

5–9187. Counterweight shall be provided for swinging stairs and this shall be of type balancing about a pivot, no cables being used. Counterweight shall be securely bolted in place, except that sliding ball weights or their equivalent may be used to hold stairs up and to help lower them. Counterbalancing shall be such that a weight of 150 pounds, one step from pivot will not start swinging section downward, and a weight of 150 pounds, one quarter of the length of the swinging stairs from the pivot will positively cause stairs to swing down.

5–9188. Pivot for swinging stairs shall either have a bronze bushing or have sufficient clearance to prevent sticking on account of corrosion.

5–9189.* No latch to lock swinging stair section in up position shall be installed.

5–92. FIRE ESCAPE LADDERS

5–921. Use

5–9211. No form of ladder shall be used as a fire escape under the provisions of this Code, except that ladders conforming to the following specifications may be used to provide access to unoccupied roof spaces as permitted by 5–9152, to provide a means of escape from boiler rooms, grain elevators and towers as permitted by Chapters 15 and 16, elevated platforms around machinery or similar spaces subject to occupancy only by able-bodied adults, not more than three in number. Existing ladders may also be accepted to provide access to the street from the lowest balcony of fire escape stairs for very small buildings, if approved by the authority having jurisdiction, subject to the limitations in capacity specified in 5–9131.

5–922. Installation

5–9221.* All ladders shall be permanently installed in fixed position, supported by rigid connection to the building or structure at intervals not exceeding 10 feet.

5–9222. Where ladders provide access to roofs or elevated platforms, rails shall extend not less than 45 inches above roof line or platform floor, or 45 inches above coping or parapet if there is one. Extension of side rails to roof shall be carried over coping or parapet to afford hand hold.

5–9223. Ladders shall be arranged parallel to buildings, or structures, with travel either between ladder and building, in which case minimum clearance between center of rungs and building shall be 27 inches, or outside of ladder, in which case minimum clearance between center of rungs and building shall be 6½ inches.

5–9224. Ladders shall be vertical, or may be positively inclined. No negative incline (ladder sloping out over head of person using it) shall be permitted.

5–923. Construction

5–9231. Ladders shall be constructed of iron or steel, or of other metal in design having equivalent strength and resistance to corrosion.

5–9232. Rails of iron or steel ladders shall be not less than ½ inch x 2 inches in section, not less than 16 inches apart.

5–9233. Rungs shall be not less than ⅞ inch diameter, and shall be riveted or welded in position, not less than 10 inches nor more than 12 inches on centers.

5–9234. The lowest rung of any ladder shall be not more than 12 inches above the level of the ground or balcony floor beneath it.

5–93. SLIDE ESCAPES

5–931. Use and Capacity Rating

5–9311. A slide escape may be used as a required exit where specifically authorized by Chapters 8 through 16.

5–9312. Slide escapes, where permitted as required exits, shall be rated at one exit unit per slide, with rated travel capacity of 60 persons.

5–9313. Slide escapes, except as permitted for high hazard manufacturing buildings or structures, shall not constitute more than 25 percent of the required number of units of exit width from any building or structure or any individual story or floor thereof.

5–9314. Slide escapes used as exits shall comply with the applicable requirements of Chapter 5 for other types of exits subject to the discretion of the authority having jurisdiction.

5–932. Types

5–9321. Each slide escape shall be of an approved type.

SECTION 5–10. ILLUMINATION OF MEANS OF EGRESS

5–1011. General

5–10111.* Illumination of means of egress shall be provided for every building and structure as provided by Chapters 8 through 16.

5–10112. Such illumination shall be continuous during the time that the conditions of occupancy require that the means of egress be available for use. Artificial lighting shall be employed at such places and for such periods of time as required to maintain the illumination to the minimum foot-candle values herein specified.

5–10113.* The floors of means of egress shall be illuminated at all points including angles and intersections of corridors and passageways, stairways, landings of stairs, and exit doors to values of not less than 1.0 foot-candle measured at the floor.

5–10114. Any required illumination shall be so arranged that the failure of any single lighting unit, such as the burning out of an electric bulb, will not leave any area in darkness.

5–10115. The same equipment or units installed to meet the requirements of Section 5–11 may also serve the function of illumination of means of egress provided that all applicable requirements of this Section for such illumination are also met.

5–1012. Sources of Illumination

5–10121. Illumination of means of egress shall be from a source of reasonably assured reliability, such as public utility electric service.

5–10122.* Where electricity is used as a source of illumination of means of egress the installation shall be properly made in accordance with recognized good practice.

5–10123. No battery operated electric light nor any type of portable lamp or lantern shall be used for primary illumination of means of egress, but may be used as an emergency source to the extent permitted under Emergency Lighting, 5–1021.

5–10124.* No luminescent or fluorescent or reflective material may be used as a substitute for any of the required illumination herein specified.

5–1021. Emergency Lighting

5–10211.* In occupancies as specified in Chapters 8 through 16, emergency lighting facilities shall be provided for means of egress so arranged that they will be maintained in the event of failure of the normal lighting of the building.

5–10212.* Emergency lighting facilities shall be arranged to maintain the specified degree of illumination in the event of failure of the normal lighting for a period of at least ½ hour, and for a period of at least 1 hour in hospitals and institutions.

5–10213.* Type 1, 2, or 3 emergency lighting shall be provided as specified in Chapters 8 through 16, subject to the approval of the authority having jurisdiction as to the suitability of the equipment for its intended use and the conditions in the individual premises.

5–10214.* Electric battery operated emergency lights shall use only reliable types of storage batteries, except as permitted by 5–10223c, suitable for their intended use, and shall be provided with suitable facilities for maintenance in properly charged condition.

5–10215.* Required emergency lighting facilities shall be automatic, not requiring any manual action to put them into operation after failure of normal lighting.

5–10216. Where maintenance of illumination depends upon changing from one energy source to another, there shall be no appreciable interruption of illumination during the change-over except that in hospitals where emergency lighting is provided by a prime mover operated electric generator, a delay of not to exceed 10 seconds may be permitted.

5–1022. Type 1 Emergency Lighting

5–10221. Type 1 emergency lighting shall be so arranged as to provide the required illumination automatically in the event of any failure of normal lighting in the circuits serving areas requiring temporary lighting due to any failure of public utility or other outside electric power supply, or any single manual act such as accidental opening of a switch controlling normal lighting facilities.

5–10222. Type 1 emergency lighting shall be either continuously in operation, or shall be capable of repeated automatic operation without manual intervention.

5–10223. Type 1 emergency lighting, subject to the approval of the authority having jurisdiction, may be provided by any method or combination of methods which will produce the desired results, such as:

a. Two separate electric lighting systems, with independent wiring, each adequate alone to provide the specified exit lighting, one supplied from an outside source such as a public utility service and the other from an electric generator on the premises driven by an independent source of power, both sources of illumination being in regular simultaneous operation whenever the building is occupied during periods of darkness.

b. An electric circuit or circuits used only for means of egress illumination, with 2 independent electric sources so arranged that on the failure of one the other will come automatically and immediately into operation. One such source shall be a connection from a public utility or similar outside power source and the other an approved storage battery with suitable provision to keep it automatically charged. Such battery shall also be so provided with automatic controls that after the battery comes into operation due to failure of the primary power source, or due to turning off the primary electric source for the exit lights, it will be shut off after its specified period of operation and will be automatically recharged and ready for further service when the primary current source is again turned on.

c. Unit devices with individual batteries providing for the same functions as specified in item b. above, except that the battery supplied light may be operated on a separate circuit at a voltage different from that of the primary light. Dry cell batteries may be used in unit equipment subject to specific approval by the authority having jurisdiction (see 5–10214).

d. Two separate sources of illumination, one electric and the other of the incandescent gas mantle type, supplied by city gas, propane or gasoline vapor, utilizing only approved gas lighting devices and with reliable arrangements acceptable to the authority having

jurisdiction to assure that both gas and electric lighting sources will be in regular continuous operation during occupancy of the building in periods of darkness. Such gas lighting devices shall be so installed as not themselves to create a fire or explosion hazard within the building.

5–1023. Type 2 Emergency Lighting

5–10231.* Type 2 emergency lighting shall be so arranged as to provide the required illumination automatically in the event of any failure of normal lighting due to any fault within the building, such as opening of a circuit breaker or melting of a fuse due to short circuit due to fire or other cause or due to overloading.

5–10232. Type 2 emergency lighting shall be either continuously in operation or shall be capable of repeated automatic operation without manual intervention.

5–10233.* Type 2 emergency lighting may be provided by any method or combination of methods that will produce the desired results, subject to the approval of the authority having jurisdiction, such as an arrangement whereby means of egress illumination are on a separate electric circuit or circuits, used for no purpose other than lights and signs in means of egress, such circuit or circuits being connected to the electric service wires ahead of any circuit breakers or fuses controlling the normal electric supply to the building.

5–1024. Type 3 Emergency Lighting

5–10241.* Type 3 emergency lighting shall be such as to maintain the required means of egress illumination automatically in the event of failure of public utility electric service or other outside source of energy.

5–10242. Type 3 emergency lighting shall either be continuously in operation while the building is occupied, or shall come into operation automatically and, where automatic, shall be capable of repeated operation without manual intervention.

5–10243.* Type 3 emergency lighting may be provided by any method or combination of methods that will produce the desired results.

SECTION 5–11. EXIT MARKING

5–1111. Signs

5–11111.* Where required by the provisions of Chapters 8 through 16 exits shall be marked by a readily visible sign. Access to exits shall be marked by readily visible signs in all cases where the exit or way to reach it is not immediately visible to the occupants and in any case where required by the applicable provisions of Chapters 8 through 16 for individual occupancies.

5–11112.* Any door, passage, or stairway which is neither an exit nor a way of exit access, and which is so located or arranged as to be likely to be mistaken for an exit, shall be identified by a sign reading "NOT AN EXIT" or similar designation, or shall be identified by a sign indicating its actual character, such as "TO BASEMENT," "STOREROOM," "LINEN CLOSET" or the like.

5–11113.* Every required sign designating an exit or way of exit access shall be so located and of such size, color, and design as to be readily visible. No decorations, furnishings, or equipment which impair visibility of an exit sign shall be permitted, nor shall there be any brightly illuminated sign (for other than exit purposes), display, or object in or near the line of vision to the required exit sign of such a character as to so detract attention from the exit sign that it may not be noticed.

5–11114.* Every exit sign shall be distinctive in color and shall provide contrast with decorations, interior finish, or other signs.

5–11115. A sign reading "EXIT," or similar designation, with an arrow indicating the direction, shall be placed in every location where the direction of travel to reach the nearest exit is not immediately apparent.

5–1112. Illumination of Signs

5–11121. Every exit sign shall be suitably illuminated by a reliable light source giving a value of not less than 5 foot-candles on the illuminated surface. Such illumination shall be continuous as required under the provisions of Section 5–10, Illumination of Means of Egress, and where emergency lighting facilities are required, exit signs shall be illuminated from the same source. Artificial lights giving illumination to exit signs other than the internally illuminated types shall have screens, discs, or lenses of not less than 25 square inches area made of translucent material to show red or other specified designating color on the side of the approach.

5–11122. Each internally illuminated exit sign shall be provided in all occupancies where reduction of normal illumination is permitted, as in motion-picture theaters, and may be used in any occupancy.

5–1113. Size of Signs

5–11131. Every exit sign shall have the word ("EXIT") in plainly legible letters not less than 6 inches high, with the principal strokes of letters not less than ¾ inch wide.

APPENDIX E

NATIONAL ELECTRICAL CODE
NFPA NO. 70-1975

ARTICLE 502 — CLASS II LOCATIONS

502-1. General. The general rules of this Code shall apply to the electric wiring and equipment in locations classified as Class II locations in Section 500-5.

Exception: As modified by this Article.

"Dust-ignition-proof," as used in this Article shall mean enclosed in a manner that will exclude ignitible amounts of dusts or amounts that might affect performance or rating and that, where installed and protected in accordance with this Code, will not permit arcs, sparks, or

heat otherwise generated or liberated inside of the enclosure to cause ignition of exterior accumulations or atmospheric suspensions of a specified dust on or in the vicinity of the enclosure.

Equipment installed in Class II locations shall be able to function at full rating without developing surface temperatures high enough to cause excessive dehydration or gradual carbonization of any organic dust deposits that may occur.

Dust that is carbonized or excessively dry is highly susceptible to spontaneous ignition.

In general, the maximum surface temperatures under actual operating conditions shall not exceed 165°C (329°F) for equipment that is not subject to overloading and 120°C (248°F) for equipment (such as motors or power transformers) that may be overloaded.

Equipment and wiring of the type defined in Article 100 as explosion-proof shall not be required and shall not be acceptable in Class II locations unless approved for such locations.

502-2. Transformers and Capacitors.

(a) Class II, Division 1. In Class II, Division 1 locations, transformers and capacitors shall comply with the following:

(1) Containing Liquid That Will Burn. Transformers and capacitors containing a liquid that will burn shall be installed only in approved vaults complying with Sections 450-41 through 450-48, and in addition: (1) doors or other openings communicating with the hazardous location shall have self-closing fire doors on both sides of the wall, and the doors shall be carefully fitted and provided with suitable seals (such as weather stripping) to minimize the entrance of dust into the vault, and (2) vent openings and ducts shall communicate only with the outside air; and (3) suitable pressure-relief openings communicating with the outside air shall be provided.

(2) Not Containing Liquid That Will Burn. Transformers and capacitors that do not contain a liquid that will burn shall: (1) be installed in vaults complying with Sections 450-41 through 450-48; or (2) be approved as a complete assembly, including terminal connections for Class II locations.

(3) Metal Dusts. No transformer or capacitor shall be installed in a location where dust from magnesium, aluminum, aluminum bronze powders, or other metals of similarly hazardous characteristics may be present.

(b) Class II, Division 2. In Class II, Division 2 locations, transformers and capacitors shall comply with the following:

(1) Containing Liquid That Will Burn. Transformers and capacitors containing a liquid that will burn shall be installed in vaults complying with Sections 450-41 through 450-48.

(2) Containing Askarel. Transformers containing askarel and rated in excess of 25 kVA shall: (1) be provided with pressure-relief vents; and (2) be provided with a means for absorbing any gases generated by arcing inside the case, or the pressure-relief vents shall be connected to a chimney or flue that will carry such gases outside the building; and (3) have an air space of not less than 6 inches between the transformer cases and any adjacent combustible material.

(3) **Dry-Type Transformers.** Dry-type transformers shall be installed in vaults or shall: (1) have their windings and terminal connections enclosed in tight metal housings without ventilating or other openings; and (2) operate at not over 600 volts.

502-3. Surge Protection, Class II, Divisions 1 and 2. In geographical locations where lightning disturbances are prevalent and where supplied from overhead lines, wiring systems in Class II locations shall be suitably protected against high-voltage surges. This protection shall include suitable lightning protective devices, interconnection of all grounds, and surge-protective capacitors.

Interconnection of all grounds shall include grounds for primary and secondary lightning protective devices, secondary system grounds, if any, and grounds of conduit and equipment of the interior wiring system.

For ungrounded secondary systems, secondary lightning protective devices may be provided both at the service and at the point where the secondary system receives its supply. The intervening secondary conductors shall be permitted as the metallic connection between the secondary protective devices, if grounds for the primary and secondary devices are metallically interconnected at the supply end of the secondary system, and if the secondary devices are grounded to the raceway system at the load end of the secondary system.

Surge-protective capacitors shall be of a type designed for the specific duty, shall be connected to each ungrounded service conductor, and shall be grounded to the interior conduit system. Capacitors shall be protected by 30-ampere fuses of suitable type and voltage rating, or by automatic circuit breakers of suitable type and rating, and shall be connected to the supply conductors on the supply side of the service disconnecting means.

502-4. Wiring Methods. Wiring methods shall comply with (a) and (b) below.

(a) **Class II, Division 1.** In Class II, Division 1 locations, threaded rigid metal conduit or Type MI cable with termination fittings approved for the location shall be the wiring method employed. Type MI cable shall be installed and supported in a manner to avoid tensile stress at the termination fittings.

(1) **Fittings and Boxes.** Fittings and boxes shall be provided with threaded bosses for connection to conduit or cable terminations, shall have close fitting covers, and shall have no openings (such as holes for attachment screws) through which dust might enter or through which sparks or burning material might escape. Fittings and boxes in which taps, joints, or terminal connections are made, or that are used in locations where dusts are of a combustible electrically conductive nature, shall be approved for Class II locations.

(2) **Flexible Connections.** Where necessary to employ flexible connections, dust-tight flexible connectors, liquidtight flexible metal conduit with approved fittings, or flexible cord approved for extra-hard usage and provided with bushed fittings shall be used, except that where dusts are of an electrically conducting nature flexible cords shall be provided with dust-tight seals at both ends. An additional conductor for ground-

ing shall be provided in the flexible cord unless other acceptable means of grounding is provided. Where flexible connections are subject to oil or other corrosive conditions, the insulation of the conductors shall be of a type approved for the condition or shall be protected by means of a suitable sheath.

(b) Class II, Division 2. In Class II, Division 2 locations, rigid metal conduit, electrical metallic tubing, dust-tight wireways, or Type MI, MC, ALS, CS, or SNM cable with approved termination fittings shall be the wiring method employed.

(1) Wireways, Fittings, and Boxes. Wireways, fittings, and boxes in which taps, joints, or terminal connections are made shall be designed to minimize the entrance of dust, and: (1) shall be provided with telescoping or close fitting covers or other effective means to prevent the escape of sparks or burning material, and (2) shall have no openings (such as holes for attachment screws) through which, after installation, sparks or burning material might escape or through which adjacent combustible material might be ignited.

(2) Flexible Connections. Where flexible connections are necessary, (a) (2) above shall apply.

502-5. Sealing, Class II, Divisions 1 and 2. Where a raceway provides communication between an enclosure that is required to be dust-ignition-proof and one that is not, suitable means shall be provided to prevent the entrance of dust into the dust-ignition-proof enclosure through the raceway. One of the following means shall be permitted: (1) a permanent and effective seal; (2) a horizontal raceway not less than 10 feet long; or (3) a vertical raceway not less than 5 feet long and extending downward from the dust-ignition-proof enclosure. Sealing fittings shall be accessible.

502-6. Switches, Circuit Breakers, Motor Controllers, and Fuses.

(a) Class II, Division 1. In Class II, Division 1 locations, switches, circuit breakers, motor controllers, and fuses shall comply with the following:

(1) Type Required. Switches, circuit breakers, motor controllers, and fuses, including pushbuttons, relays, and similar devices that are intended to interrupt current during normal operation or that are installed where dusts of a combustible electrically conductive nature may be present shall be provided with dust-ignition-proof enclosures, which, together with the enclosed equipment in each case, shall be approved as a complete assembly for Class II locations.

(2) Isolating Switches. Disconnecting and isolating switches containing no fuses and not intended to interrupt current and not installed where dusts may be of an electrically conductive nature shall be provided with tight metal enclosures that shall be designed to minimize the entrance of dust, and that shall: (1) be equipped with telescoping or close fitting covers or with other effective means to prevent the escape of sparks or burning material, and (2) have no openings (such as holes for attachment screws) through which, after installation, sparks or burning material might escape or through which exterior accumulations of dust or adjacent combustible material might be ignited.

(3) Metal Dusts. In locations where dust from magnesium, alu-

minum, aluminum bronze powders, or other metals of similarly hazardous characteristics may be present, fuses, switches, motor controllers, and circuit breakers shall have enclosures specifically approved for such locations.

(b) Class II, Division 2. In Class II, Division 2 locations, enclosures for fuses, switches, circuit breakers, and motor controllers, including pushbuttons, relays, and similar devices, shall comply with (a)(2) above.

502-7. Control Transformers and Resistors.

(a) Class II, Division 1. In Class II, Division 1 locations, control transformers, solenoids, impedance coils, resistors, and any overcurrent devices or switching mechanisms associated with them shall have dust-ignition-proof enclosures approved for Class II locations. No control transformer, impedance coil, or resistor shall be installed in a location where dust from magnesium, aluminum, aluminum bronze powders, or other metals of similarly hazardous characteristics may be present unless provided with an enclosure approved for the specific location.

(b) Class II, Division 2. In Class II, Division 2 locations, transformers and resistors shall comply with the following:

(1) Switching Mechanisms. Switching mechanisms (including overcurrent devices) associated with control transformers, solenoids, impedance coils, and resistors shall be provided with enclosures complying with Section 502-6(a)(2).

(2) Coils and Windings. Where not located in the same enclosure with switching mechanisms, control transformers, solenoids, and impedance coils shall be provided with tight metal housings without ventilating openings.

(3) Resistors. Resistors and resistance devices shall have dust-ignition-proof enclosures approved for Class II locations.

Exception: Where the maximum normal operating temperature of the resistor will not exceed 120°C (248°F), nonadjustable resistors or resistors that are part of an automatically timed starting sequence shall be permitted to have enclosures complying with (b)(2) above.

502-8. Motors and Generators.

(a) Class II, Division 1. In Class II, Division 1 locations, motors, generators, and other rotating electric machinery shall be dust-ignition-proof or totally enclosed pipe-ventilated and shall be approved for Class II locations.

(b) Class II, Division 2. In Class II, Division 2 locations, motors, generators, and other rotating electric machinery shall be dust-ignition-proof or totally enclosed pipe-ventilated, for which maximum surface temperatures shall not exceed 120°C (248°F).

Exception: If the authority having jurisdiction believes accumulations of nonconductive nonabrasive dust will be moderate; and if machines can be easily reached for routine cleaning and maintenance, the following may be installed:

a. Standard open-type machines without sliding contacts, centri-

fugal or other types of switching mechanism (including motor overcurrent devices), or integral resistance devices.

b. Standard open-type machines with such contacts, switching mechanisms, or resistance devices enclosed within tight metal housings without ventilating or other openings.

c. Self-cleaning textile motors of the squirrel-cage type.

502-9. Ventilating Piping. Ventilating pipes for motors, generators, or other rotating electric machinery, or for enclosures for electric equipment shall be of metal not lighter than No. 24 MSG, or of equally substantial noncombustible material, and shall comply with the following: (1) lead directly to a source of clean air outside of buildings; (2) be screened at the outer ends to prevent the entrance of small animals or birds; and (3) be protected against physical damage and against rusting or other corrosive influences.

Ventilating pipes shall also comply with (a) and (b) below.

(a) Class II, Division 1. In Class II, Division 1 locations, ventilating pipes, including their connections to motors or to the dust-ignition-proof enclosures for other equipment, shall be dust-tight throughout their length. For metal pipes, seams and joints shall comply with one of the following: (1) be riveted and soldered; (2) be bolted and soldered; (3) be welded, or (4) be rendered dust-tight by some other equally effective means.

(b) Class II, Division 2. In Class II, Division 2 locations, ventilating pipes and their connections shall be sufficiently tight to prevent the entrance of appreciable quantities of dust into the ventilated equipment or enclosure, and to prevent the escape of sparks, flame; or burning material that might ignite dust accumulations or combustible material in the vicinity. For metal pipes, lock seams and riveted or welded joints shall be permitted; and tight-fitting slip joints shall be permitted where some flexibility is necessary, as at connections to motors.

502-10. Utilization Equipment.

(a) Class II, Division 1. In Class II, Division 1 locations, all utilization equipment shall be approved for Class II locations. Where dust from magnesium, aluminum, aluminum bronze powders, or other metals of similarly hazardous characteristics may be present, such equipment shall be approved for the specific location.

(b) Class II, Division 2. In Class II, Division 2 locations, all utilization equipment shall comply with the following:

(1) Heaters. Electrically heated utilization equipment shall be approved for Class II locations.

(2) Motors. Motors of motor-driven utilization equipment shall comply with Section 502-8(b).

(3) Switches, Circuit Breakers, and Fuses. Enclosures for switches, circuit breakers, and fuses shall comply with Section 502-6(a)(2).

(4) Transformers, Impedance Coils, and Resistors. Transformers, solenoids, impedance coils, and resistors shall comply with Section 502-7(b).

502-11. Lighting Fixtures. Lighting fixtures shall comply with (a) and (b) below.

(a) Class II, Division 1. In Class II, Division 1 locations, lighting fixtures for fixed and portable lighting shall comply with the following:

(1) Approved Fixtures. Each fixture shall be approved for Class II locations and shall be clearly marked to indicate the maximum wattage of the lamp for which it is approved. In locations where dust from magnesium, aluminum, aluminum bronze powders, or other metals of similarly hazardous characteristics may be present, fixtures for fixed or portable lighting and all auxiliary equipment shall be approved for the specific location.

(2) Physical Damage. Each fixture shall be protected against physical damage by a suitable guard or by location.

(3) Pendant Fixtures. Pendant fixtures shall be suspended by threaded rigid metal conduit stems, by chains with approved fittings, or by other approved means. For rigid stems longer than 12 inches, permanent and effective bracing against lateral displacement shall be provided at a level not more than 12 inches above the lower end of the stem, or flexibility in the form of a fitting or a flexible connector approved for the purpose and for the location shall be provided not more than 12 inches from the point of attachment to the supporting box or fitting. Threaded joints shall be provided with set-screws or other effective means to prevent loosening. Where wiring between an outlet box or fitting and a pendant fixture is not enclosed in conduit, flexible cord approved for hard usage shall be used, and suitable seals shall be provided where the cord enters the fixture and the outlet box or fitting. Flexible cord shall not serve as the supporting means for a fixture.

(4) Supports. Boxes, box assemblies, or fittings used for the support of lighting fixtures shall be approved for the purpose and for Class II locations.

(b) Class II, Division 2. In Class II, Division 2 locations, lighting fixtures shall comply with the following:

(1) Portable Lamps. Portable lamps shall be approved for Class II locations. They shall be clearly marked to indicate the maximum wattage of lamps for which they are approved.

(2) Fixed Lighting. Lighting fixtures for fixed lighting, where not of a type approved for Class II locations, shall provide enclosures for lamps and lampholders that shall be designed to minimize the deposit of dust on lamps and to prevent the escape of sparks, burning material, or hot metal. Each fixture shall be clearly marked to indicate the maximum wattage of the lamp that shall be permitted without exceeding an exposed surface temperature of 165°C (320°F) under normal conditions of use.

(3) Physical Damage. Lighting fixtures for fixed lighting shall be protected from physical damage by suitable guards or by location.

(4) Pendant Fixtures. Pendant fixtures shall be suspended by threaded rigid metal conduit stems, by chains with approved fittings, or by other approved means. For rigid stems longer than 12 inches, permanent and effective bracing against lateral displacement shall be provided at a level not more than 12 inches above the lower end of the stem, or flexibility in the form of a fitting or a flexible connector approved for the purpose shall be provided not more than 12 inches from

the point of attachment to the supporting box or fitting. Where wiring between an outlet box or fitting and a pendant fixture is not enclosed in conduit, flexible cord approved for hard usage shall be used. Flexible cord shall not serve as the supporting means for a fixture.

(5) **Supports.** Boxes, box assemblies, or fittings used for the support of lighting fixtures shall be approved for the purpose.

(6) **Electric-Discharge Lamps.** Starting and control equipment for electric-discharge lamps shall comply with the requirement of Section 502-7(b).

502-12. Flexible Cords, Class II, Division 1 and 2. Flexible cords used in Class II locations shall comply with the following: (1) be of a type approved for extra-hard usage; (2) contain, in addition to the conductors of the circuit, a grounding conductor complying with Section 400-23; (3) be connected to terminals or to supply conductors in an approved manner; (4) be supported by clamps or by other suitable means in such a manner that there will be no tension on the terminal connections; and (5) be provided with suitable seals to prevent the entrance of dust where the flexible cord enters boxes or fittings that are required to be dust-ignition-proof.

502-13. Receptacles and Attachment Plugs.

(a) **Class II, Division 1.** In Class II, Division 1 locations, receptacles and attachment plugs shall be of the type providing for connection to the grounding conductor of the flexible cord and shall be approved for Class II locations.

(b) **Class II, Division 2.** In Class II, Division 2 locations, receptacles and attachment plugs shall be of the type providing for connection to the grounding conductor of the flexible cord and shall be so designed that connection to the supply circuit cannot be made or broken while live parts are exposed.

502-14. Signaling, Alarm, Remote-Control, and Local Loud-Speaker Intercommunication Systems.

See Article 800 for rules governing the installation of communication circuits as defined in Article 100.

(a) **Class II, Division 1.** In Class II, Division 1 locations, signaling, alarm, remote-control, and local loud-speaker intercommunication systems shall comply with the following:

(1) **Wiring Methods.** Where accidental damage or breakdown of insulation might cause arcs, sparks, or high temperatures, the wiring method shall be rigid metal conduit, electrical metallic tubing, or Type MI cable with approved termination fittings. For conduit or electrical metallic tubing, the number of conductors shall be limited only by the requirement that the cross-sectional area of all conductors shall not exceed 40 percent of the area of the raceway. Where limited flexibility is desirable or where exposure to physical damage is not severe, flexible cord approved for extra-hard usage shall be permitted.

(2) **Contacts.** Switches, circuit breakers, relays, contactors, and fuses that may interrupt other than voice currents, and current-breaking contacts for bells, horns, howlers, sirens, and other devices in which sparks or arcs may be produced shall be provided with enclosures approved for a Class II location.

Exception: Where current-breaking contacts are immersed in oil, or where the interruption of current occurs within a chamber sealed against the entrance of dust, enclosures shall be permitted to be of the general-purpose type.

(3) Resistors and Similar Equipment. Resistors, transformers, choke coils, and similar equipment that may carry other than voice currents, and rectifiers, thermionic tubes, and other heat-generating equipment shall be provided with enclosures approved for Class II locations.

(4) Rotating Machinery. Motors, generators, and other rotating electric machinery shall comply with Section 502-8(a).

(5) Combustible Electrically Conductive Dusts. Where dusts are of a combustible electrically conductive nature, all wiring and equipment shall be approved for Class II locations.

(6) Metal Dusts. Where dust from magnesium, aluminum, aluminum bronze powders, or other metals of similarly hazardous characteristics may be present, all apparatus and equipment shall be approved for the specific conditions.

(b) Class II, Division 2. In Class II, Division 2 locations, signaling, alarm, remote-control, and local loudspeaker intercommunication systems shall comply with the following:

(1) Contacts. Enclosures shall comply with (a)(2) above; or contacts shall have tight metal enclosures designed to minimize the entrance of dust, and shall have telescoping or tight-fitting covers and no openings through which, after installation, sparks or burning material might escape.

(2) Transformers and Similar Equipment. The windings and terminal connections of transformers, choke coils, and similar equipment shall be provided with tight metal enclosures without ventilating openings.

(3) Resistors and Similar Equipment. Resistors, resistance devices, thermionic tubes, rectifiers, and similar equipment shall comply with (a)(3) above.

Exception: Enclosures for thermionic tubes, nonadjustable resistors, or rectifiers for which maximum operating temperature will not exceed 120°C (248°F) shall be permitted to be of the general-purpose type.

(4) Rotating Machinery. Motors, generators, and other rotating electric machinery shall comply with Section 502-8(b).

502-15. Live Parts, Class II, Divisions 1 and 2. Live parts shall not be exposed.

502-16. Grounding, Class II, Divisions 1 and 2. Wiring and equipment shall be grounded in accordance with (a) through (f) below.

(a) Exposed Parts. Exposed noncurrent-carrying metal parts of equipment, such as the frames or metal exteriors of motors, fixed or portable lamps, lighting fixtures, or other utilization equipment, or cabinets, cases, and conduit shall be grounded as specified in Article 250.

(b) Bonding. The locknut-bushing and double-locknut type of contact shall not be depended upon for bonding purposes; but bonding jumpers with proper fittings or other approved means shall be used.

Such means of bonding shall apply to all intervening raceways, fittings, boxes, enclosures, etc., between hazardous areas and the point of grounding for service equipment. Where flexible conduit is used as permitted in Section 502-4, bonding jumpers with proper fittings shall be provided around such conduit.

(c) Lightning Protection. Each ungrounded service conductor of a wiring system in a Class II location, where supplied from an ungrounded overhead electric supply system in an area where lightning disturbances are prevalent, shall be protected by a lightning protective device of proper type. Lightning protective devices shall be connected to the service conductors on the supply side of the service disconnecting means, and shall be bonded to the raceway system at the service entrance.

(d) Grounded Service Conductor Bonded to Raceway. Wiring in a Class II location, where supplied from a grounded alternating-current supply system in which a grounded conductor is a part of the service, shall have the grounded service conductor bonded to the raceway system and to the grounding conductor for the raceway system. The bonding connection to the grounded service conductor shall be made on the supply side of the service disconnecting means.

(e) Transformer Ground Bonded to Raceway. Wiring in a Class II location, where supplied from a grounded alternating-current supply system in which no grounded conductor is a part of the service, shall be provided with a metallic connection between the supply system ground and the service-equipment enclosure. The metallic connection shall comply with Section 250-23(b).

(f) Multiple Grounds. Where, in the application of Section 250-21, it is necessary to abandon one or more grounding connections to avoid objectionable passage of current over the grounding conductors, the connection required in (d) or (e) above shall not be abandoned while any other grounding connection remains connected to the supply system.

APPENDIX F

CALIFORNIA STATE SPECIFICATIONS

986.6. Specifications. The provisions of this section shall apply to all handle goods, stick, dowel, spike and California candle fireworks having a stick dowel or inside diameter greater than ⅛ inch and other devices as noted.

Handle goods are exempt from compliance with the provisions of subsections (a), (d) and (e) of this section if they incorporate all of the following features: (1) a soft, crushable type paper tube, (2) an inside diameter of ⅜ inch or less, (3) 3 inches or less of combustible chemical composition, and having an overall length not exceeding 12 inches without any choke or other muzzle restriction.

(a) The chemical composition tubes or cases of all stick or handle fireworks items, whether spike or dowel, excepting colored port fire or flares, shall not exceed 9 inches in length or have an inside diameter greater than ⅝ inch and shall be convolute or spiral wound of chip board or other paper having equivalent strength and shall be well glued. The above dimensions do not include the stick, dowel or tubular handles of such items.

The chemical composition tubes in all fireworks items shall be sealed in a manner that prevents leakage of the pyrotechnic composition during shipping, handling, or normal operation and shall be constructed in a manner to allow functioning without burnout or blowout.

(b) The use of any choke or other muzzle restriction in any stick or handle fireworks item, whether spike or dowel or California candle is prohibited.

(c) Compositions in all devices shall be designed and manufactured to prevent loosely compacted charges. Pyrotechnic compositions shall not discharge a flame longer than 8 inches or throw sparks farther than 10 feet from the composition tube muzzle. Handle goods shall not throw sparks further than 6 feet from the composition tube muzzle.

(Register 76, No. 38—9-18-76)

(d) Clay base shall have a minimum finished thickness of ½ inch and shall be formed in place inside the tube. In no case shall the final composition charge and the clay be formed in a combined operation. All clay used as clay base shall be sufficiently moistened to insure permanent effective adhesion to the inside of the tube or case.

(e) Fireworks devices which are intended to be hand-held and are so labeled shall incorporate a handle at least 4 inches in length. Handles shall remain firmly attached during transportation, handling and full operation of the device, or shall consist of an integral section of the device at least 4 inches below the pyrotechnic chamber.

Spikes and dowels shall be inserted into the chemical composition tubes a minimum distance not less than 25% of the length of tubes 6 inches or less in length and not less than 2 inches into tubes over 6 inches long. They shall be cemented firmly in place against the clay base. There shall be no void space within the chemical composition tube.

Spiked provided with fireworks devices shall protrude at least 2 inches from the base of the device and shall have a blunt tip not less than ⅛ inch in diameter or ⅛ inch square.

(f) All fuse or match of every type and kind on fireworks items shall be securely fixed in contact with the composition charge to insure against accidental loss. Each fuse and match shall be capable of either supporting the combined weight of the fireworks item plus eight ounces dead weight, or double the weight of the item, without separation from the fireworks article.

Fuses on all items shall burn for not less than 3 seconds but not more than 6 seconds.

Fuses on all items shall be treated or coated in such a manner as to reduce the possibility of side ignition.

Fireworks items sold or offered for sale at retail which are not enclosed in sealed packages, shall have their fuses or other igniting means protected in a manner approved by the State Fire Marshal to provide reasonable protection from unintentional ignition.

(g) All pyrotechnic devices having a base shall provide stable support to maintain the item in a vertical position when firing. When bases are added to the device, they shall be firmly and evenly glued in place.

Bases shall have a dimension not less than ⅓ the length of the pyrotechnic device except that bases on single pyrotechnic items 12 inches or less in length may have a base not less than 3 inches. Pyrotechnic items provided in multiples shall have a base with a dimension not less than ⅓ the length of the longest item attached to the base.

(h) Appearance of any fireworks items in close resemblance to those articles classified by statute as "dangerous fireworks" shall constitute sufficient grounds for their classifications, by the State Fire Marshal, as "dangerous fireworks." Special reference is intended, though not by way of limitation, to cherry bombs and sky rockets and other fireworks which normally explode or rise in the air during discharge.

(i) Pinwheels shall be limited to a maximum overall diameter of 15 inches, shall be substantially constructed and all driver gerbs, firepots and other elements shall be firmly fixed to the wheel.

Drivers shall be securely attached to the device so that they will not come loose in transportation, handling, and normal operation. Wheel devices intended to operate in a fixed location shall be designed in such a manner that the axle remains attached to the device during normal operation.

(j) Smoke devices shall conform to the following:

(1) Smoke devices shall be so constructed that they will neither burst nor produce external flame (excluding the fuse and first fire upon ignition).

(2) Smoke devices shall not be of such color or configuration so as to be confused with dangerous fireworks, such as firecrackers or cherry bombs.

(3) Smoke devices shall not incorporate plastic as an exterior material if the pyrotechnic composition would come in direct contact with the plastic.

986.7. Party Poppers. (a) General. Party Poppers, as defined in Section 980, to be sold at retail without benefit of a State Retail sales License, shall be submitted to the State Fire Marshal for test and classification in accordance with this Section.

(b) In addition to the tests required by this Section, Party Poppers shall conform to the following:

(1) The device shall contain not more than 0.20 grains of explosive.

(2) The device shall not contain any materials specified in Section 12505 of the Health and Safety Code.

(3) The tube casing or body shall be constructed so as to eliminate any emission into the hand of the user.

(4) The tube casing, body, streamers or other fill material shall be fire retardant when tested in accordance with Section 986.7(c).

(5) Every individual fireworks item shall bear the classification label of the State Fire Marshal, including the manufacturer's or wholesaler's registration number and the words "party poppers" shall apppear in legible print on such label.

(6) The body of every party popper shall have in legible print operating instructions and warning labels as may be required by the State Fire Marshal.

(c) The testing of Party Poppers shall require the submission of a minimum of six samples. The streamers or other fill material from all of the six samples shall be arranged in a loose pile and subjected to the flame from a common paper match for not less than 5 seconds. The test material shall not continue to burn or smolder for more than 2 seconds after the match has been removed.

The tube casing or body of 6 samples, individually, shall be subjected to the flame from a common paper match for not less than 5 seconds. The body or casing shall not continue to burn or smolder for more than 2 seconds after the match has been removed.

If any body or tube of the test samples, or the fill material fails the above tests, the device shall be rejected and classified as dangerous.

(Register 76, No. 38—9-18-76)

Article 8. Labeling

937. **Labeling.** All fireworks or pyrotechnic devices shall be classified and labeled in accordance with the provisions of this article. In addition, the license or registration number of the registrant must appear on such label.

Exception: Special Effects items developed and compounded on location for single time usage.

Labels bearing the State Fire Marshal's seal of registration showing the classification and registration number shall be attached to each package or item of fireworks offered for sale. Safe firing instructions shall be legibly printed on each item or package and all fireworks items which are not specifically designed to be held in the hand while firing shall prominently display the wording "DO NOT HOLD IN HAND".

Every package or carton, and every individual item of unpackaged fireworks and every carton or shipping container in which they are packed, shall bear the Seal of Registration of the State Fire Marshal and the license number of the registrant. Immediately above such seal shall appear in legible type the classification of such fireworks. Such labeling may be by stamp, stencil or printing, or by a firmly attached printed adhesive label.

987.1. **Instruction Labeling.** (a) In addition to the labeling provisions of Section 987, the following listed fireworks or similar type devices shall be labeled as indicated herein. Any fireworks device not required to have a specific label as indicated shall carry a warning label indicating to the user where and how the item is to be used and necessary safety precautions to be observed.

(1) Fountains, Spike Fountains, Whistles, Toy Smoke Devices and Flitter Devices.

Warning (or Caution)
Emits Showers of Sparks

Use only under close adult supervision
For outdoor use only
Place on level surface
Stick firmly in ground in an upright position (Spike items only)
Light fuse and get away

(2) Handle Fountains, California Candles

Warning (or Caution)
Emits Showers of Sparks

Use only under close adult supervision
For outdoor use only
Hold in hand at bottom of tube or handle
Point away from body so that neither end points toward body

(3) Sparklers

(on front & back panels)

Warning (or Caution)

(on the side, front, back, top, or bottom panel)

Caution

Use only under close adult supervision
For outdoor use only
Do not touch glowing wire
Hold in hand with arm extended away from body
Keep burning end or sparks away from wearing apparel or other flammable material

(4) Wheels

Warning (or Caution)
Emits Showers of Sparks

Use only under close adult supervision
For outdoor use only
Attach securely by means of a nail through the hole
Light fuse and get away

Article 9. Seal of Registration

988. Description. The State Fire Marshal's Seal of Registration required by these regulations shall conform to the provisions of this Article. The Seal of Registration shall be applied to all classified fireworks and pyrotechnic devices by a licensed manufacturer, importer, exporter or wholesaler, and shall indicate whether the fireworks or device is "Safe and Sane," "Dangerous," "Agricultural," "Model Rockets," "Emergency Signaling Device," or "Exempt."

The licensee registration number shall appear in the boxes below the seal as illustrated in this article.

988.1. Unlawful Use. No person or concern shall produce, reproduce or use the Seal of Registration in any manner or for any purpose except as herein provided.

988.2. Permissive Use. (a) Licensed manufacturers, importer/exporters, or wholesalers may, after review by the State Fire Marshal, use the Seal of Registration bearing their license registration number for any of the following:

(1) Printed matter including advertising and copy for publication.
(2) Letterhead, personal cards and similar stationery.
(3) Stencils for any of the foregoing.

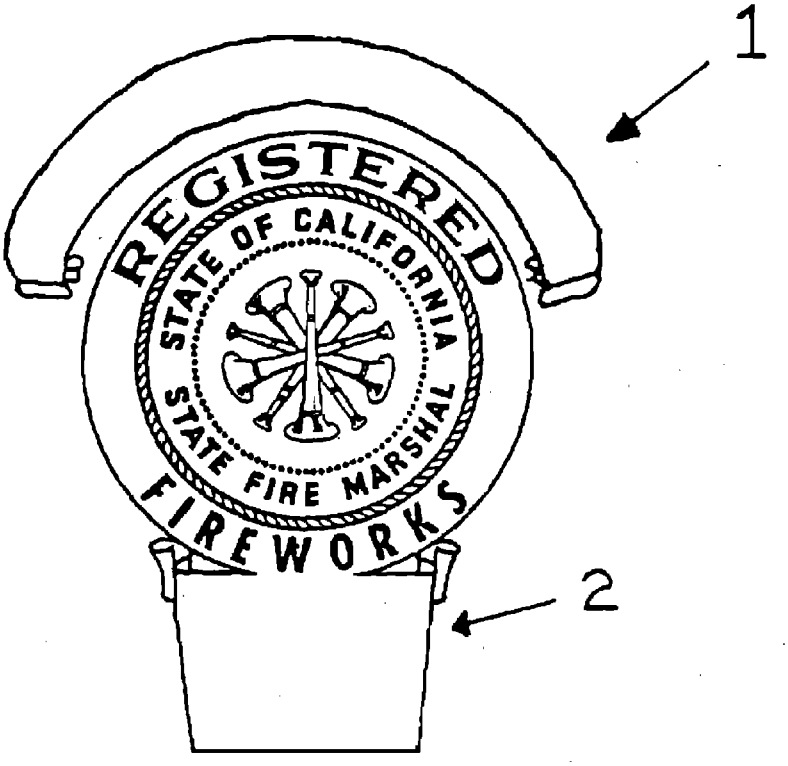
988.3. Reproduction. No person shall reproduce the fireworks Seal of Registration which does not conform to the approved copy as issued at the time the license and registration number is granted. Such reproductions shall be made in accordance with the instructions for use thereon. No alteration shall be made to the original and copy, or to any reproduction of the Seal of Registration as approved by the State Fire Marshal.

(Register 76, No. 38—9-18-76)

988.4. **Registration Numbers.** Before reproduction of the Seal of Registration, there shall be inserted in the box provided, the registration number assigned by the State Fire Marshal to designate the licensees category. The category shall be designated by the capital letter proceeding the registration number as follows: "M" for manufacturing, "I/E" for importer/exporter, "W" for wholesaler. The designation for model rockets and signaling devices shall be as follows: "MR" for model rockets, "L" for land signaling devices, "S" for sea signaling devices and "A" for air signaling devices. Signaling devices intended for more than one function shall use all of the appropriate letters.

988.5. **Cease Use Order.** No person or concern shall continue use of the Seal of Registration in any manner or for any purpose after receipt of a notice in writing from the State Fire Marshal to discontinue such use.

STATE FIRE MARSHAL'S SEAL OF REGISTRATION



1 Enter one of of the appropriate titles listed below:
(a) Dangerous
(b) Safe & Sane
(c) Agricultural
(d) Model Rocket Engine
(e) Emergency Signaling Device
(f) Exempt

2 Enter the State Fire Marshal Registration Number

APPENDIX G

FEDERAL EXPLOSIVES STORAGE REQUIREMENTS

Federal Explosives Storage Requirements

Following, in table form, are construction, housekeeping and storage requirements for Types 1 through 5 explosives storage facilities. These requirements are the minimum acceptable under Federal law and regulations (27 CFR, Part 181, Subpart J—Storage). In specific instances, variance from a particular requirement or requirements may be granted by the Regional Director.

This section includes (a) a table of the classes of explosives which may be stored in each of the five types of magazines; (b) a table of housekeeping and construction requirements that apply to all types of storage facilities; and (c) tables setting forth in detail the requirements that apply specifically to each of the five types of magazines.

Types of Storage Facilities

(18 USC, Section 842(j)) (27 CFR, Section 181.183)

Storage Type	Classes of Explosive Materials Which May Be Stored Therein
Type 1 (permanent)	High Explosives Low Explosives Blasting Agents
Type 2 (portable)	High Explosives Low Explosives Blasting Agents
Type 3 ("day-box" for temporary storage)	High Explosives Low Explosives Blasting Agents
Type 4	Low Explosives Blasting Agents *Electric Blasting Caps
Type 5	Blasting Agents

*As a result of tests with electric blasting caps, it has been determined that these blasting caps are not subject to sympathetic detonation. Therefore, a Type 4 storage facility meets the necessary requirements for storage of electric blasting caps.

Note: 1. Blasting caps shall not be stored with other explosive materials in the same storage facility.

2. Explosives storage limitations and quantity restrictions are stated in 27 CFR Sections 181.186, 181.188(b), 181.188(c), 181.189, 181.190(b), and 181.193. For tables of distances for high explosives, low explosives, and blasting agents, see 27 CFR Sections 181.198, 181.199, and 181.200, respectively.

Housekeeping and Construction Requirements Common to All Types of Storage Facilities

(18 USC, Section 842(j)) (27 CFR, Sections 181.187, 181.194, and 181.195)

Item	Requirements
Hinges and Hasps	Shall be attached to doors by either Welding, OR Riveting, OR Bolting (nuts on inside of door).
Locks	Each door shall be equipped with either 2 mortise locks, OR 2 padlocks fastened in separate hasps and staples, OR A combination of a mortise lock and a padlock, OR Mortise lock requiring 2 keys to open, OR Three-point lock. Locks shall be five-tumbler proof. Padlocks shall be protected with 1/4" steel caps constructed to prevent sawing or lever action on locks or hasps. Note: Outdoor-mobile storage facilities with one steel, case-hardened, five-tumbler padlock, having at least a 7/16" shackle diameter, have been determined by the Director to meet necessary requirements.
Lighting	No lighting shall be placed or used in a magazine of type 1, 2, 3, or 4 except battery-activated safety lights or battery-activated safety lanterns: Provided, That electrical illumination may be used when explosion-proof fixtures and wiring in rigid conduit are used inside and all electric switches are located outside the magazine.

Item	Requirements
Housekeeping	Storage facilities shall be kept clean, dry, and free of grit, paper, empty packages and containers, and rubbish. Explosive materials shall not be placed directly against interior walls of storage facility. Brooms and other cleaning utensils shall have no spark-producing metal parts. Only tools made of nonsparking materials shall be used in Types 1, 2, 3, and 4 magazines. (Metal slitters may be used for opening fiberboard containers. Metal tools other than nonsparking transfer conveyors shall not be stored in any magazine containing high explosives.) Area surrounding storage facilities shall be kept clear of rubbish, brush, dry grass, or trees for not less than 25 feet in all directions. Any other combustible materials shall be kept a distance of not less than 50 feet from outdoor storage facilities.

Type 1 Storage

(18 USC, Section 842(j)) (27 CFR, Sections 181.187 and 181.197)

A type 1 storage facility shall be a permanent structure: a building, an igloo or Army-type structure, a tunnel, or a dugout; and shall be bullet-resistant, weather-resistant, theft-resistant, and well-ventilated.

Item	Requirements
Masonry Wall	Shall be constructed of either Brick, not less than 6" thick, OR Concrete, not less than 6" thick, OR Tile, not less than 6" thick, OR *Cement block, not less than 6" thick, OR *Cinder block, not less than 6" thick. *Hollow masonry units shall have all hollow spaces filled with well-tamped coarse dry sand or weak concrete.

Type 1 Storage (Continued)

Item	Requirements
Metal Wall	Sectional sheets of one of the following shall be securely fastened to a metal framework: Steel, not less than 14 gauge, OR Aluminum, not less than 14 gauge. Shall be lined with either Brick, OR Solid cement blocks, OR Hardwood, not less than 4" thick, OR Shall have at least 6" sand fill between inner and outer walls.
Wood Wall	Exterior shall be covered with either Iron, not less than 26 gauge, OR Aluminum, not less than 26 gauge. Inner wall shall be constructed to provide not less than 6" between outer and inner walls, space filled with either Coarse dry sand, OR Weak concrete.
Foundations	Shall be constructed of either Brick, OR Concrete, OR Cement block, OR Stone, OR Wood posts (If piers or posts are used, space under buildings shall be enclosed with metal).
Floors	Shall be constructed of nonsparking material. Shall be strong enough to bear weight of maximum quantity to be stored.
Roof	Outer roof (except fabricated metal roofs) shall be covered with either 26-gauge iron, fastened to 7/8" sheathing, OR 26-gauge aluminum fastened to 7/8" sheathing. Where possible for a bullet to be fired directly through roof and into storage facility, magazine shall be protected by either A sand tray, filled with not less than 4" of coarse dry sand, covering the entire ceiling area, except that necessary for ventilation, OR Fabricated metal roof construction of 3/16" plate steel, lined with 4" hardwood (for each additional 1/16" of plate steel, hardwood may be decreased 1").

Type 1 Storage (Continued)

Item	Requirements
Doors	Shall be constructed of 1/4" steel. Shall be lined with 2" of hardwood.
Hinges, Hasps, and Locks	See construction requirements common to all types of facilities.
Interior	Shall be constructed of or covered with a nonsparking material. No sparking metal construction shall be exposed below top of walls in interior. All nails shall be blind-nailed or countersunk.
Ventilation	2" air space shall be left around ceiling and perimeter of floors, except at doorways. Foundation ventilators shall be not less than 4"×6". Vents in foundation, roof, or gables shall be screened and offset.
Ground	Ground around storage facility shall slope away for drainage.
Igloos, Army-Type Structures, Tunnels and Dugouts	Shall be constructed of reinforced concrete, masonry, metal, or a combination of these materials. Shall have an earthmound covering of not less than 24" on the top, sides and rear. Interior walls and floors shall be covered with a nonsparking material. Floor, door, lock, ventilation, exposed metal, and lighting requirements are as stated above.
Lighting	See construction requirements common to all types of facilities.
Housekeeping	See housekeeping requirements common to all types of facilities.

Type 2 Storage

(18 USC, Section 842(j)) (27 CFR, Sections 181.188 and 181.197)

A type 2 storage facility shall be a box, a trailer, a semi-trailer, or other mobile facility. It shall be bullet-resistant, fire-resistant, weather-resistant, theft-resistant, and well ventilated.

Item	Requirements
Hinges, Hasps, and Locks	See construction requirements common to all types of storage facilities.

Type 2 Storage (Continued)

Item	Requirements
Lighting	See construction requirements common to all types of storage facilities.
Housekeeping	See housekeeping requirements common to all types of storage facilities.
Restrictions on Type 2 Outdoor Storage Facilities	
Size	Shall be at least 1 cubic yard in size.
Ground	Outdoor storage facilities shall be supported in such a manner so as to prevent direct contact with the ground. Ground around storage facility shall slope away for drainage.
Construction	Sides, bottoms, tops, and covers or doors shall be constructed of 1/4" steel and lined with 2" of hardwood.
Unattended Storage	Unattended vehicular storage facilities shall have wheels removed or shall be immobilized by kingpin locking devices.
Restrictions On Type 2 Indoor Storage Facilities	
Location	No indoor storage facility for storage of high explosives shall be located in a residence or dwelling. Storage facilities located in a warehouse, or wholesale or retail establishment, shall be provided with substantial wheels or casters to facilitate removal therefrom. No more than two indoor storage facilities shall be located in any one building. Two storage facilities may be kept in the same building only when one is used for storage of blasting caps and the other for storage of other high explosives. Each storage facility shall be located on the floor nearest ground level and within 10 feet of an outside exit. Indoor storage facilities within one building shall be separated by a distance of not less than 10 feet.
Quantity Restrictions	No indoor storage facility shall contain a quantity of high explosives in excess of 50 pounds or more than 5,000 blasting caps.

Type 2 Storage (Continued)

Item	Requirements
Construction	Shall be of either *Wood* (Shall have sides, bottoms, and covers or doors constructed of 2" hardwood and shall be well braced at corners. They shall be covered with sheet metal (not less than 20 gauge). Exposed nails shall be countersunk), OR *Metal* (Shall have sides, bottoms, and covers or doors constructed of 12-gauge metal and shall be lined inside with a nonsparking material. Edges of metal shall overlap sides at least 1").
Cap Boxes	
	Storage facilities for blasting caps in quantities of 100 or less shall have sides, bottoms, and covers constructed of 12-gauge metal, with hinges and hasps attached by welding. One five-tumbler proof lock shall be sufficient for locking purposes.

Type 3 Storage

(18 USC, Section 842(j)) (27 CFR, Sections 181.188(a), 181.189, and 181.197)

A type 3 storage facility shall be a "day-box" or other portable facility. It shall be constructed in the same manner prescribed for type 2 outdoor storage facilities in 181.188(a), except that it may be less than 1 cubic yard in size, and shall be bullet-resistant, fire-resistant, weather-resistant, theft-resistant, and well ventilated.

Item	Requirements
Construction	Doors or covers, sides, bottoms, and tops shall be constructed of 1/4" steel and lined with 2" of hardwood. Edges of metal covers shall overlap sides at least 1".
Hinges, Hasps, and Locks	See housekeeping and construction requirements common to all types of storage facilities.
Ground	Ground around storage facility shall slope away for drainage.

Type 3 Storage (Continued)

Item	Requirements
Unattended Storage	No explosive materials shall be left in storage facility if unattended. Explosive materials must be removed to types 1 or 2 storage facilities for unattended storage.
Lighting	See construction requirements common to all types of storage facilities.
Housekeeping	See housekeeping requirements common to all types of storage facilities.

Type 4 Storage

(18 USC, Section 842(j)) (27 CFR, Sections 181.187(a)(5), (11); 181.190; and 181.197)

A type 4 storage facility may be a building, an igloo or Army-type structure, a tunnel, a dugout, a box, a trailer, or a semitrailer or other mobile facility; and shall be fire-resistant, weather-resistant, and theft-resistant.

Item	Requirements
Construction	Shall be of either Masonry, OR Metal-covered wood, OR Fabricated metal, OR Combinations of these materials.
Doors or Covers	Shall be constructed of either Metal, OR Solid wood covered with metal.
Foundations	Shall be constructed of either Brick, OR Concrete, OR Cement block, OR Stone, OR Wood posts (If piers or posts are used, space under buildings shall be enclosed with metal).
Interior	Shall be lined with nonsparking material. No sparking metal construction shall be exposed below top of walls in interior. All nails shall be blind-nailed or countersunk.

Type 4 Storage (Continued)

Item	Requirements
Hinges, Hasps, and Locks	See construction requirements common to all types of storage facilities.
Lighting	See construction requirements common to all types of storage facilities.
Housekeeping	See housekeeping requirements common to all types of storage facilities.
Restrictions On Type 4 Outdoor Storage Facilities	
Ground	Ground around storage facility shall slope away for drainage.
Unattended Storage	Unattended vehicular storage facilities shall have wheels removed or shall be immobilized by kingpin locking devices.
Restrictions On Type 4 Indoor Storage Facilities	
Location	No indoor facility for the storage of low explosives shall be located in a residence or dwelling. Storage facilities located in a warehouse, or wholesale or retail establishment, shall be provided with substantial wheels or casters to facilitate removal therefrom. No more than one indoor storage facility shall be kept in any one building. Storage facility shall be located on floor nearest ground level and within 10 feet of an outside exit.
Quantity Restrictions	No indoor facility shall contain a quantity of low explosives in excess of 50 pounds.

Type 5 Storage

(18 USC, Section 842(j)) (27 CFR, Sections 181.191 and 181.197)

A Type 5 storage facility may be a building, an igloo or Army-type structure, a tunnel, a dugout, a bin, a box, a trailer, or a semitrailer or other mobile facility; and shall be theft-resistant.

Item	Requirements
Doors or Covers	Shall be constructed of either Solid wood, OR Metal.
Hinges, Hasps, and Locks	See construction requirements common to all types of storage facilities.
Housekeeping	See housekeeping requirements common to all types of storage facilities.
Restrictions on Type 5 Outdoor Storage Facilities	
Ground	Ground around storage facility shall slope away for drainage.
Unattended Storage	Unattended vehicular storage facilities shall have wheels removed or shall be immobilized by kingpin locking devices.
Restrictions on Type 5 Indoor Storage Facilities	
Location	No indoor storage facility for storing of blasting agents shall be located in a residence or dwelling.

APPENDIX H

CALIFORNIA PRACTICES AND PROCEDURES FOR PUBLIC FIREWORKS DISPLAYS

Article 15. Public Display

993. Insurance. (a) Any person, firm, or corporation applying for a public display license shall furnish to the State Fire Marshal a policy of public liability and property damage insurance, without deductible, with limits of bodily injury of not less than fifty thousand dollars ($50,000) for one person or one hundred thousand dollars ($100,000) for each occurrence annually and with a limit of property damage liability of not less than twenty-five thousand dollars ($25,000) for each occurrence as payment for damages to persons or property which may result from; or be caused by such public display of fireworks, or any negligence on the part of the licensee or his or its agents, servants, employees, or subcontractors presenting such public display.

(b) The certificate of insurance shall provide all of the following:

(1) That the insurer will not cancel the insured's coverage without 15 days prior written notice to the State Fire Marshal.

(2) That the duly licensed pyrotechnic operator required by law to supervise and discharge the public display, acting either as an employee of the insured or as an independent contractor and the State of California, its officers, agents, employees, and servants are included as additional insureds, but only insofar as any operations under contract are concerned.

(3) That the State shall not be responsible for any premium or assessments on the policy.

993.1. Reports. General public display licensees shall report to the State Fire Marshal, prior to date of each display, all public displays of fireworks contemplated under their general license. The report shall contain the information set forth in Section 993.2(a) (1), (2), (4), (5), (8) and (12).

993.2. Local Permit, Application For: (a) When applying for permit as required by Section 982(a) (5), applicant shall submit information and evidence to local fire authorities covering the following:

(1) The name of the organization sponsoring the display, together with the names of persons actually in charge of the display.

(2) The date and time of day at which the display is to be held.

(3) The exact location planned for the display.

(4) The name and license number of the pyrotechnic operator who is to supervise discharge of the fireworks.

(5) The class of fireworks to be discharged and the number of set pieces, shells (specify single or multiple break), and other items including experimental or model rockets or missiles.

(6) The manner and place of storage of such fireworks prior to and during the display.

(7) A diagram of the grounds on which the display is to be held showing the point at which the fireworks are to be discharged, the location of all buildings, highways, and other lines of communication, the lines behind which the audience will be restrained, the location of all nearby trees, telegraph or telephone lines, or other overhead obstruction.

(8) Proof that satisfactory compensation insurance is carried for all employees.

(9) Documentary proof of conformance with Section 993.

(10) A State Fire Marshal's license for the public display of fireworks.

(11) The name and license number of the wholesaler who supplied all items used in the display.

(12) Permittee shall be responsible for compliance with the provisions under which a public display permit has been granted.

994. Investigation. The officer to whom the application for permit is made shall make, or cause to be made, an investigation of the site of the proposed display for the purpose of determining if the fireworks will be of such a character or so located as to be hazardous to property or dangerous to any person. He shall also determine whether the provisions of the Health and Safety Code and these rules and regulations are complied with in the case of a particular display. He shall, in the exercise of reasonable discretion, grant or deny the application subject to reasonable conditions, if any, as he may prescribe, taking into account locations, parking of vehicles, controlling spectators, storage and firing fireworks, and precautions in general against danger to life and property from fire, explosion, and panic.

995. Public Display Permits. No permit for a public display of any type shall be granted unless a public display license general, special or limited has first been obtained from the State Fire Marshal.

996. Spectators. Spectators at public displays of fireworks shall be restrained behind lines or barriers as designated by local authorities. Only authorized persons and those in actual charge of the display shall be allowed inside these lines or barriers during the unloading, preparation, or firing of fireworks.

997. Pyrotechnic Operators. (a) No public display permit shall be granted unless at least two experienced pyrotechnic operators are provided, one of whom shall be a regularly licensed pyrotechnic operator. The licensed operator shall:

(1) Be responsible for and have charge of the display with respect to preparation for transporting, unloading, storing, preparing special effects, set and mechanical pieces, setting mortars and rocket launchers, loading, arming and firing and disposing of all unfired or defective (dud) rockets, missiles and fireworks articles or items;

(2) Be responsible for setting all fireworks including mortars, finale batteries (hedgehogs) and rocket launchers at locations designated by the authority having jurisdiction and take into account wind direction and velocity predicted for the firing time in setting the firing angles. Shells, rockets and/or missiles shall not be permitted to cross or burst above areas occupied by persons;

(3) Be responsible for acts of all persons employed in connection with fireworks for the display. He shall have authority to dismiss or discharge any employee or person whether renumerated or not at any time from delivery to final firing of the display who, through smoking, drinking, carelessness or negligence or any other act, endangers the safety of himself, any other person, or any property.

998. Public Display Storage Magazines. All fireworks articles and items at places of public display shall be stored in a manner and in a place secure from fire, accidental discharge and theft, and in a manner approved by the fire authority having jurisdiction.

999. Mortars. (a) Mortars shall be made of Shelby seamless steel tubing or equivalent (cast iron and other fragmenting types of metal are prohibited) having a smooth bore and a steel bottom plate equal in thickness to the tube welded continuously around its perimeter except as follows:

(1) Wooden base plugs in good condition may be substituted for welded steel bottom plates where such plugs have a minimum thickness of 1 inch per inch of bore diameter and are securely cross bolted with ½ inch iron bolts placed at right angles alternately starting 1 inch from the top of the plug and placed 1 inch apart thereafter. Wooden base plugs shall be discarded and replaced when split, cracked, shrunken, charred to less than minimum required thickness, or otherwise damaged. Screw type caps or plugs are prohibited.

(2) Mortars limited solely for the firing of single break shells and finale batteries (Hedgehogs) may be made of spiral or convolute wound chipboard or kraft paper tubes. Tubes for 2 inch shells shall have a wall thickness of not less than ¼ inch. Tubes for 3 inch shell shall have a wall thickness of not less than ⅜ inch. Tubes for 4, 5, and 6 inch shells shall have a wall thickness of not less than ½ inch. All tubes shall have a base plug in good condition the thickness of which shall be not less than the inside diameter of the tube. The base plug shall be securely glued and nailed to the tube.

(3) For single break shells 3 inch mortar tubes may be made of 10 gauge or heavier galvanized iron riveted along their seams, beginning at a point within 1 inch of each end and spaced not more than 3 inches between rivets and having a 2 inch wooden base plug cross bolted in position with not less than ½ inch by 3½ inch carriage bolts 1 inch apart at right angles to each other.

(4) The minimum inside length of mortars shall be not less than five times their inside diameter for mortars up to 7 inches inside diameter and not less than four times their inside diameter for mortars having an inside diameter greater than 7 inches.

(5) Any damaged mortars (split or bulged tube, base, seam, or with loose rivets, bolts, or wooden base plug) shall not be used for firing.

(Register 76, No. 38—9-18-76)

1000. Metallic Mortars. Salutes and detonating shells shall not be fired from metallic mortars.

1001. Setting Mortars. All mortars excepting finale batteries (hedgehogs), shall be set upon a heavy plank or timber footing and buried in solidly tamped clean earth when required by the fire authority having jurisdiction. (See Section 1003 for finale batteries). The top of the mortar shall not protrude more than 2 inches above ground level.

1002. Special Setting of Mortars. (a) On locations where it is impossible to bury mortars in suitable clean earth or where the authority having jurisdiction and the licensed pyrotechnic operator in charge are in agreement that public safety will be increased thereby, mortars may be set for firing in approved sand-filled containers. Heavy steel drums or troughs constructed of 2 inch thick board, in accordance with the following details, shall be used for setting mortars:

(1) The diameter of the drum or width of the trough shall be not less than three times the diameter of the mortar tube.

(2) The depth of the drum or trough shall permit burial in wet sand of each mortar to within 1 inch of its muzzle. Heavy wood blocking shall fill the space between the bottom of the mortar and the container, and in every case there shall be not less than a 2 inch thickness of board under each mortar.

(3) The length of the trough shall permit spaces between all mortars and between the first and last mortars and the ends of the trough equal to the diameter of the largest mortar. These spaces shall be filled with blocks of 2 inch wood. Bulkheads of 2 inch board shall separate troughs into compartments not more than 6 feet in length. The top of drums shall be similarly blocked.

(4) The sides, ends, bottom and any bulkheads required to limit compartment length to 6 feet shall be 2 inch boards in good condition, nailed securely with 20d common nails. The ends of the trough shall be set 6 inches in from the ends of the side and bottom boards, and 2½ inch threaded rods used to bolt the sides in place at both ends of the trough just outside of the trough ends.

(5) The containers shall be set and the mortars blocked and secured at the angle determined as safe for firing.

1003. Finale Batteries. (a) Finale batteries (hedgehogs) shall be limited to 10 tubes per unit set squarely upon a 2 inch thick timber, the width of which shall be equal to the outside diameter of the largest tube, and boxed by a 1 inch x 6 inch board along either side at the top and bottom. Blocks with the same dimensions as the bottom plank shall be placed between each tube and the 1 inch x 6 inch boards shall be nailed firmly to the vertical blocks.

(1) Batteries may consist of as many approved 10 tube units as required for the display, but each unit shall be independently set, braced, and secured, as indicated by the wind direction and velocity predicted for the firing time.

(2) Batteries after being loaded and having quick match connected shall have a piece of tape placed over the muzzle of each tube. Finale batteries need not be buried.

Note: For typical mortar construction and setting, see the accompanying diagrams.

1004. Ready Boxes. (a) Before any firing begins, the entire complement of shells for any licensed public display shall be brought to the firing site and stored in ready boxes at a point not less than 25 feet distant upwind (with relation to the firing time) from the nearest mortar. These ready boxes shall be substantially constructed and may be of wood not less than ½ inch nominal thickness or ⅜ inch thick plywood, chipboard, prestwood, or equivalent.

(1) They shall be set with their bottoms facing the mortars and arranged to open away from the mortars with the front of the box elevated not less than 30 degrees from horizontal, or

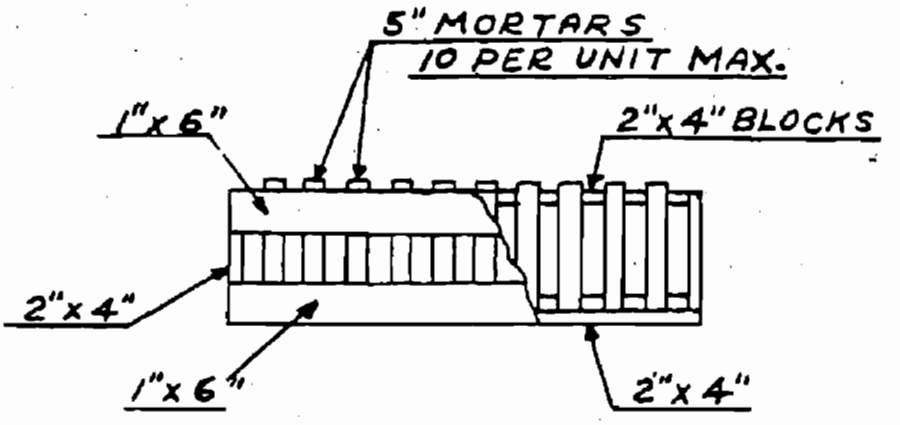
(2) They may be set on their bottoms with the lids opening towards the mortars provided that the lids are equipped with a stop which will prevent the lid from being opened more than 60 degrees. Latches, hooks or other types of hold open devices shall not be permitted.

(3) A flameproof water repellent canvas cover shall protect all ready boxes from the time they are placed in position until they are emptied, except that the canvas cover may be lifted when shells are taken from or returned to the boxes.

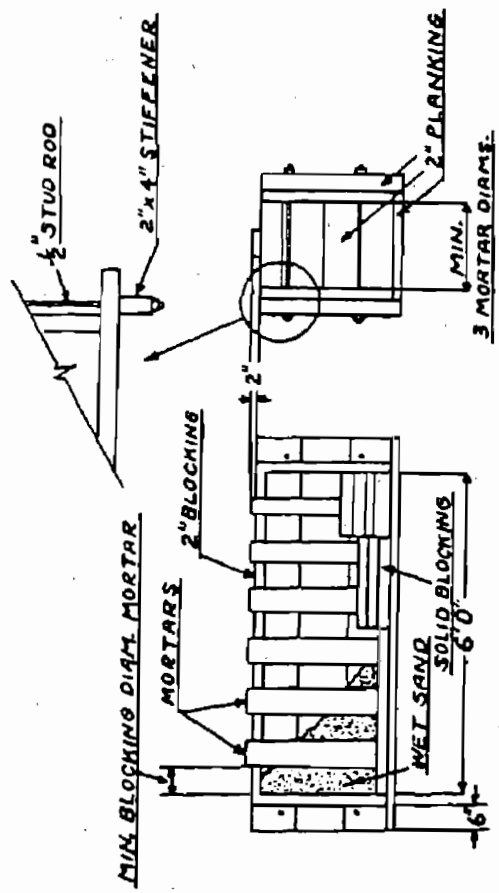
Note: The use of compartmentation, to avoid the mixing of shell sizes is recommended. In large displays individual boxes should be used for each different shell size.

1005. Loading Mortars. (a) Mortars shall be cleared of paper or other burning material after being fired. It is not required that mortars be swabbed. No duds shall be cleared from mortars for at least 2 hours after being fired and the mortar has been filled with water.

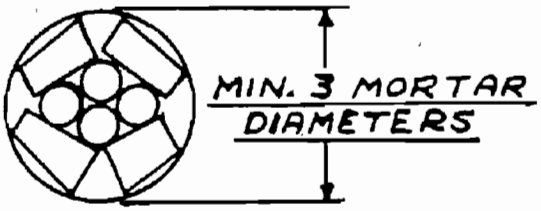
(b) Finale batteries (Hedgehogs) shall not be reloaded.

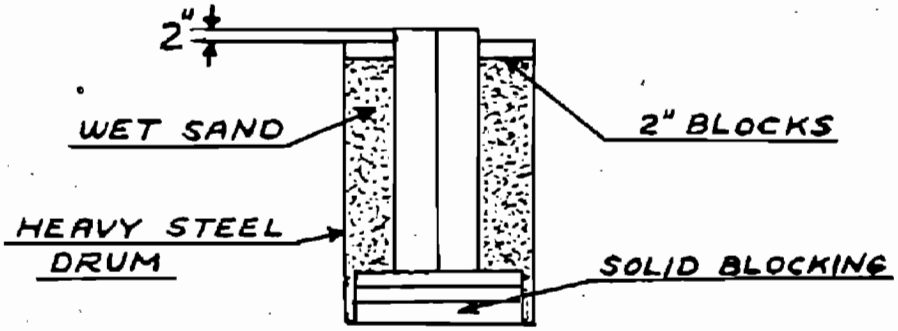


FINALE BATTERY



TROUGH SETTING





DRUM SETTING

1006. Firing. All firing shall be done upon order or signal of the licensed pyrotechnic operator directing the public display. No safety cap shall be removed from any shell match except by the pyrotechnician immediately before he applies his portfire. Used portfire shall not be discarded in the area between the mortars and the loading magazine.

1007. Operator in Charge. The operator in charge of loading shall be responsible for maintaining safe working conditions at the firing site, and he shall have on his person a valid license as a pyrotechnic operator. He shall adjust mortar setting bursts being downwind from the spectators.

1008. Duds. Loaders and magazine tenders or persons responsible for arming rockets or missiles shall maintain close observation during firing to detect duds in mortars or which return unexploded from aloft, or dud or misfire rockets or missiles, and take necessary action as planned by the licensed pyrotechnic operator in charge. Retrieval of all duds shall be confirmed by the fire authority having jurisdiction and so indicated on the report required by Section 1026.

1009. Magazine Tenders. Magazine tenders are directly responsible to the pyrotechnic operator in charge of loading and they shall not lift the canvas on the side toward the mortars or open more than a single magazine at any given time.

1010. Set Pieces. Set displays shall be securely braced and guyed to prevent accidental displacement from any cause. Set pieces and mechanical displays shall not be left unattended from the time of delivery to discharge.

1011. Match. All match shall be located and protected to prevent unintentional firing.

1012. Flying Pigeons. Installations incorporating flying pigeons and similar flying devices, whether controlled or free or a combination of controlled and free, shall be so installed as to prevent flight in the direction of spectators.

1013. Unfired Fireworks. Any fireworks remaining unfired after the display is concluded shall be secured against accidental discharge or theft in an approved manner.

1014. Smoking. No person shall smoke in the firing area except at a place approved by the authority having jurisdiction.

1015. Fire Equipment. The type and number of first-aid or other fire fighting equipment required shall be determined by the authority having jurisdiction.

(Register 75, No. 38—9-18-75)

1016. Reports. (a) Within ten (10) days following every public display, the licensed pyrotechnic operator in charge of the display shall submit a complete, accurate and factual report directly to the State Fire Marshal, covering:

(1) A brief report of any duds, defective shells, with manufacturer's name, and the type and size of shell. (Retrieval of duds to be confirmed, in writing, by fire authority.)

(2) A brief account of the cause of injury to any person from fireworks and such person's name and address.

(3) A brief account of any fires caused by fireworks.

(4) Any violation of the Health and Safety Code or of these regulations relating to public display fireworks.