



A Guide to the Safe Storage of Explosive Materials



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Acknowledgments

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This guide is intended to be consistent with all existing OSHA standards; therefore, if an area is considered by the reader to be inconsistent with a standard, then the OSHA standard should be followed.

To obtain additional copies of this guide, or if you have questions about N.C. occupational safety and health standards or rules, please contact:

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Additional sources of information are listed on the inside back cover of this guide.

The projected cost of the NCDOL OSH program for federal fiscal year 2008–2009 is \$17,042,662. Federal funding provides approximately 30 percent (\$4,090,400) of this total.



Contents

Foreword	iv
Storage	1
Regulations Governing the Storage of Explosive Materials	1
Classes of Explosive Materials	1
Types of Magazines	2
Storage of Classes of Explosive Materials	2
Storage Within Magazines, Types 1, 2, 3 and 4	2
Quantity and Storage	3
Construction of Magazines	3
Construction Specifications for Types of Magazines	3
Type 1 Magazine	3
Type 2 Magazine	5
Type 2 Indoor Magazine	5
Type 3 Magazine	6
Type 4 Magazine	6
Type 4 Indoor Magazine	7
Type 5 Magazine	8
Specifications for Bullet Resistant Construction	15
Exterior of Steel	15
Exterior of Any Type	15
Masonry Construction	15
Use of Magazines	16
Lighting	16
Repairs	16
Housekeeping	16
Smoking and Open Flames	16
Posting	16
Inspection	17
Location of Magazines	17
Notes	23
North Carolina Occupational Safety and Health Standards in Construction for Blasting and Use of Explosives	24
Glossary	37
References	38

Foreword

North Carolina employers and employees who store and handle explosives accept a great responsibility. They must guard against the theft or loss of materials that if mishandled could lead to tragedy for the American people. Such tragedies can be avoided by building proper storage magazines and by following good safety and security procedures.

This guide provides information on how to store different types and amounts of explosive materials safely. Several charts included in this guide can help the reader find information relating directly to specific situations.

In North Carolina, the N.C. Department of Labor enforces the federal Occupational Safety and Health Act through a state plan approved by the U.S. Department of Labor. NCDOL offers many educational programs to the public and produces publications to help inform people about their rights and responsibilities regarding occupational safety and health.

When reading this guide, please remember the mission of the N.C. Department of Labor is greater than just regulatory enforcement. An equally important goal is to help citizens find ways to create safe and healthy workplaces. Everyone profits when managers and employees work together for safety. This booklet, like the other educational materials produced by the N.C. Department of Labor, can help.

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Storage

Proper storage prevents unauthorized access to explosive materials and reduces their deterioration. All explosive materials, including blasting agents, detonators, detonating cord, boosters, blasting caps, and electric and nonelectric detonators should be stored in magazines. The magazines should be properly designed and located to comply with all applicable federal, state and local laws, rules and regulations.

Regulations Governing the Storage of Explosive Materials

The storage of explosive materials is regulated by the N.C. Department of Labor, U.S. Department of Justice, U.S. Department of Labor and U.S. Department of the Treasury. Table 1 offers more details about the various government agencies that regulate the storage of explosive materials.

Table 1

Federal and State Control of Explosive Materials

Agency	Responsibility	Regulations	Subject of Regulations
N.C. Department of Labor Occupational Safety and Health Division	Health and safety of general industry and construction employees.	29 CFR 1910 and 29 CFR 1926	Use of explosives in general industry and in construction.
N.C. Department of Labor Mine and Quarry Bureau	Health and safety of surface and underground miners.	30 CFR 56, 30 CFR 57; and Sections .0525, .0526*	Use of explosives in surface and underground metal and nonmetal mines.
U.S. Department of Interior Office of Surface Mining Reclamation and Enforcement	Protects general public and the environment from the effects of coal mining.	30 CFR 715	The environmental effects of blasting such as ground vibration, air blast, flyrock, etc., and the safety of the general public in the surrounding area.
U.S. Department of Labor Mine Safety and Health Administration	Health and safety of surface and underground miners.	30 CFR 56 and 30 CFR 57	Use of explosives in surface and underground metal and nonmetal mines.
U.S. Department of Justice Bureau of Alcohol, Tobacco and Firearms	Issues licenses to manufacture, import, distribute and use explosive materials. Storage of explosive materials to prevent their illegal use.	27 CFR 555	Licensing, recordkeeping and storage.

*Health and Safety Standards for Metal and Nonmetal Mines, N.C. Gen. Stat. Chapter 74, Article 2A.

Classes of Explosive Materials

Explosive materials may be divided into three classes:

- *High explosives* are explosive materials that, when unconfined, can be caused to detonate by means of a blasting cap. An example is dynamite.
- *Low explosives* are explosive materials that, when confined, can be caused to deflagrate. Black powder, safety fuses, igniters, igniter cords and fuse lighters are examples.
- *Blasting agents* are substances classified by the U.S. Department of Transportation in 49 CFR 173.50 as blasting agents. These are substances that have a mass explosion hazard but are so insensitive that there is very little probability of initiation or of transition from burning to detonation under normal conditions of transport. Ammonium nitrate, fuel oil and particular water gels are examples.

Familiarity with the classes of explosive materials is essential to an understanding of the type of magazine in which they may be stored.

Types of Magazines

There are five types of magazines for the storage of explosive materials:

- *Type 1 magazines* are permanent magazines for the storage of high explosives. Other classes of explosive materials may also be stored in Type 1 magazines.
- *Type 2 magazines* are mobile or portable indoor and outdoor magazines for the storage of high explosives.
- *Type 3 magazines* are portable outdoor magazines for the temporary storage of high explosives while attended (a day box, for example).
- *Type 4 magazines* are for the storage of low explosives. Blasting agents, Class C detonators, safety fuses, squibs, igniters and igniter cords may also be stored in Type 4 magazines.
- *Type 5 magazines* are for the storage of blasting agents.

Storage of Classes of Explosive Materials

In Table 2, the classes of explosive materials are paired with types of magazines.

Table 2

Storage of Classes of Explosive Materials by Magazine Type¹

Class of Explosive Materials	Magazine Type				
	1	2	3	4	5
High Explosives (dynamite; cap sensitive water gels; slurries; emulsions; cast boosters)	•	•	•		
Low Explosives (black powder)	•	•	•	•	
Class A Detonators	•	•	•		
Detonating Cords	•	•	•		
Class C Detonators*	•	•	•	•	
Safety Fuses, Electric Squibs, Igniters and Igniter Cords**	•	•	•	•	
Blasting Agents	•	•	•	•	•

Note: Detonators must not be stored in the same magazine with other explosives.

*Includes electric detonators with leg wires 4 feet long or longer or detonators with empty plastic tubing 12 feet long or longer that contain not more than 1 gram explosives (excluding ignition and delay charges).

**Detonators are not to be stored in the same magazine with other explosive materials, except that Class C detonators and those described above may be stored with safety fuses, electric squibs, igniters or igniter cords in Type 1, 2, 3 or 4 magazines.

Storage Within Magazines, Types 1, 2, 3 and 4

When explosive materials are stored within Type 1, 2, 3 and 4 magazines, the following rules should be observed:

- Explosive materials must not be placed directly against interior walls and must be placed so as not to interfere with ventilation.
- Containers of explosive materials must be stored so that marks are visible.
- Except with respect to fiberboard or other nonmetal containers, containers of explosive materials must not be unpacked or repacked inside a magazine or within 50 feet of a magazine.
- Tools used to open or close containers of explosive materials must be of a nonsparking material, except that metal slitters may be used for opening fiberboard containers. A wood wedge and a fiber, rubber or wooden mallet must be

used for opening or closing wood containers of explosive materials. Metal tools other than nonsparking transfer conveyors must not be stored in any magazine containing high explosives.

Quantity and Storage

Detonators must not be stored in the same magazine with other explosive materials, except under the following circumstances:

- In a Type 4 magazine, detonators that will not mass detonate may be stored with electric squibs, safety fuses, igniters and igniter cords.
- In a Type 1 or 2 magazine, detonators may be stored with delay devices and stored with electric squibs, safety fuses, igniters and igniter cords.

Unless approved, explosive materials in excess of 300,000 pounds or detonators in excess of 20 million must not be stored in one magazine.

Construction of Magazines

In Table 3, the types of magazines are paired with applicable construction features.

Table 3

Construction Features of Types of Magazines

Construction Features	Magazine Type				
	1	2	3	4	5
Permanent	•			•	•
Portable		•	•	•	•
Bullet Resistant	•	•			
Fire Resistant	•	•	•	•*	•*
Theft Resistant	•	•	•	•	•**
Weather Resistant	•	•	•	•	•
Ventilated	•	•	•	•*	•*

*Over-the-road trucks or semitrailers used for temporary storage as Type 4 or 5 magazines need not be fire resistant or ventilated.

**Each door of a mobile Type 5 magazine should be equipped with at least one five-tumbler padlock having a 3/8-inch case-hardened shackle. The lock need not be hooded.

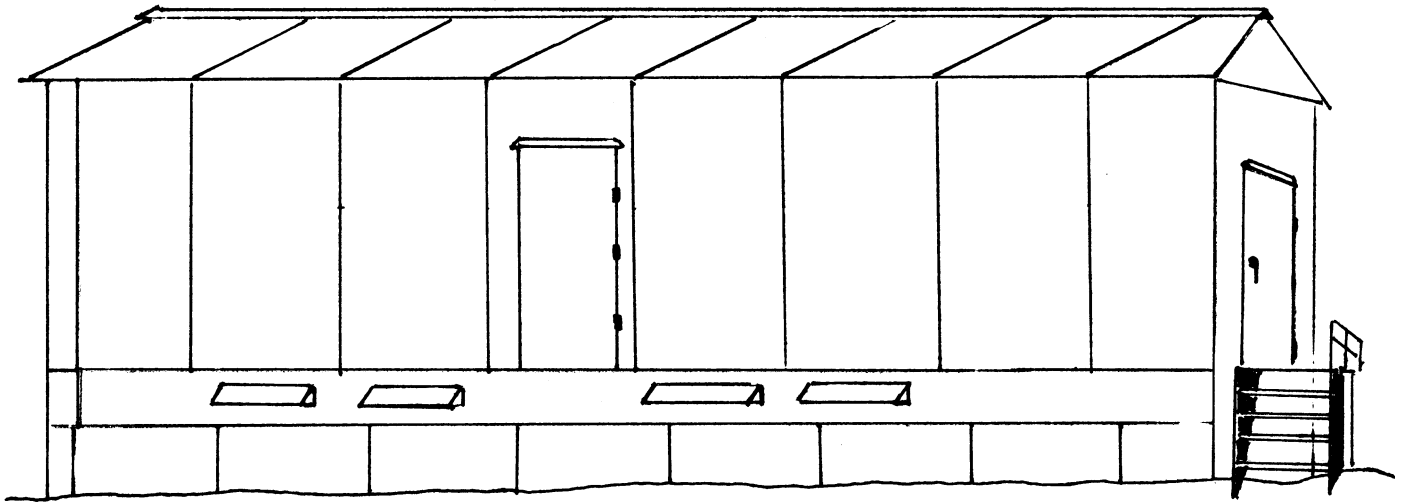
Construction Specifications for Types of Magazines

This section discusses construction specifications for various aspects (walls, floors, roofs, doors and locks, ventilation, bonding and grounding) of the types of magazines. The discussion frequently refers to plates or drawings that appear at the end of this section.

Type 1 Magazine

A Type 1 magazine is a permanent structure such as a building, igloo, tunnel or dugout. Figure 1 depicts a Type 1 magazine.

Figure 1
Type 1 Magazine



Type 1 magazine, constructed of 1/4-inch steel and 3-inch hardwood

The Type 1 magazine must be bullet resistant, fire resistant, weather resistant, theft resistant and ventilated. It should conform to the following specifications:²

Walls. Walls must be constructed of a combination of steel, masonry or other materials that are fire resistant and structurally sound (see Plates 1, 2 and 6). Any wood on the exterior of the magazine must be covered with a fire-resistant material. Voids in standard concrete blocks must be filled with well-tamped dry sand or well-tamped sand and cement mixture. Lattice lining must be installed to aid in ventilation (see Plates 1 and 2).

Floor. The floor must be constructed of wood or other suitable materials. Plates 1, 2 and 3 show a masonry magazine with a foundation, ventilation and wood flooring.

Roof or Ceiling. The roof or ceiling may be constructed of any type of structurally sound material that is or has been made fire resistant on its exterior. When the natural terrain around the magazine makes it possible to shoot a bullet through the ceiling or roof that could hit the explosive material, the roof or ceiling must be of bullet-resistant construction. A bullet-resistant roof can be constructed according to any of the specifications for wan sections shown in Plate 6.

Other verified bulletproof construction for ceilings includes that with 20 gauge steel with 4 inches of hardwood or 18 gauge aluminum with 7 inches of hardwood.

Doors and Locks. The doors and locks must be constructed according to any of the wall sections shown in Plate 6. Commonly used door construction and details are shown in Plates 7 and 8.

Doors must be tightly fitted. Hinges, hasps and all locking hardware must be rigidly secured and fastened by welding or by through bolts that cannot be removed when the door is locked. Methods of locking are:

- Two mortise locks.
- Two padlocks fastened in separate hasps and staples. Padlocks must be steel, have at least five tumblers, and be at least 3/8-inch diameter case-hardened shackle. All padlocks must be protected by steel hoods made from 1/4-inch minimum thickness steel and installed so as to discourage the insertion of bolt cutters, saws, files or levering devices.
- A combination of a mortise lock and a hooded padlock.
- A mortise lock that requires two keys to open.
- A three-point lock that secures the door to the frame at more than one point.

Ventilation. The generally accepted minimum ventilation area is 0.2 square inches per cubic foot of magazine space. Recommended ventilation is as follows:

- Wall and foundation—4×8 inches opening on 6-foot centers.

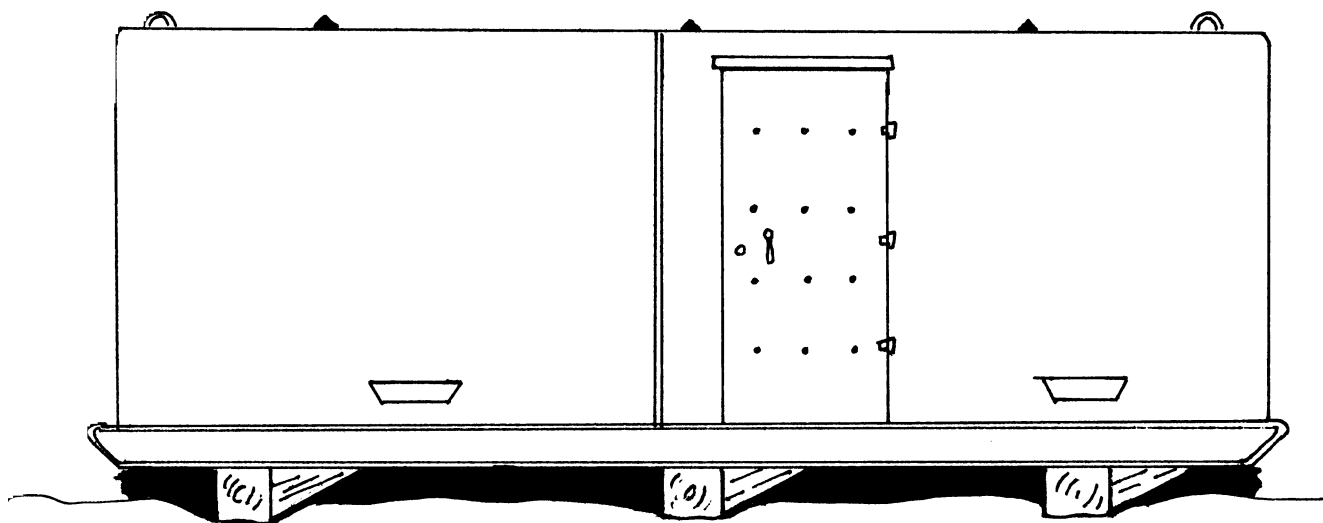
- Roof—(Globe type ventilation)—one 12-inch diameter per each 12 feet of magazine length or one 10-inch diameter per 10 feet of magazine length.
- Ventilating openings must be screened as shown in Plate 4 to prevent entrance of sparks and rodents.
- Ventilation openings must be offset or shielded for bullet resistant purposes.
- For security, ventilating openings should not be larger than 6×12 inches or 12 inches in diameter.

Bonding and Grounding. Experience over the years indicates that electrical bonding and grounding of field commercial explosives magazines is not needed. The Bureau of Alcohol, Tobacco and Firearms; the National Fire Protection Association (NFPA); and the Institute of Makers of Explosives (IME) do not require the bonding or grounding of magazines. However, one Mine Safety and Health Administration standard requires that magazines made of metal be electrically bonded and grounded.

Type 2 Magazine

A Type 2 magazine,³ depicted in Figure 2, is a portable or mobile structure such as a skid magazine, tractor or semi-trailer.

Figure 2
Type 2 Magazine



Type 2 magazine, constructed of 1/4-inch steel and 3-inch hardwood

Any of the details for the requirements shown for a Type 1 magazine are acceptable for the Type 2 outdoor magazine. A magazine of less than 1 cubic yard in size must be fastened to a fixed object to prevent theft of the entire magazine.

Hinges, hasps, locks and locking hardware must conform to provisions for Type 1 magazines. Vehicular magazines must be immobilized by removing the wheels, by locking with a king pin locking device or by other approved means.

Type 2 Indoor Magazine

Type 2 indoor magazines must be fire resistant and theft resistant. They need not be bullet resistant. No indoor magazine is to be located in a residence or dwelling. Indoor storage of high explosives must not exceed 50 pounds. Detonators must be stored separately and must not exceed 5,000 in number.

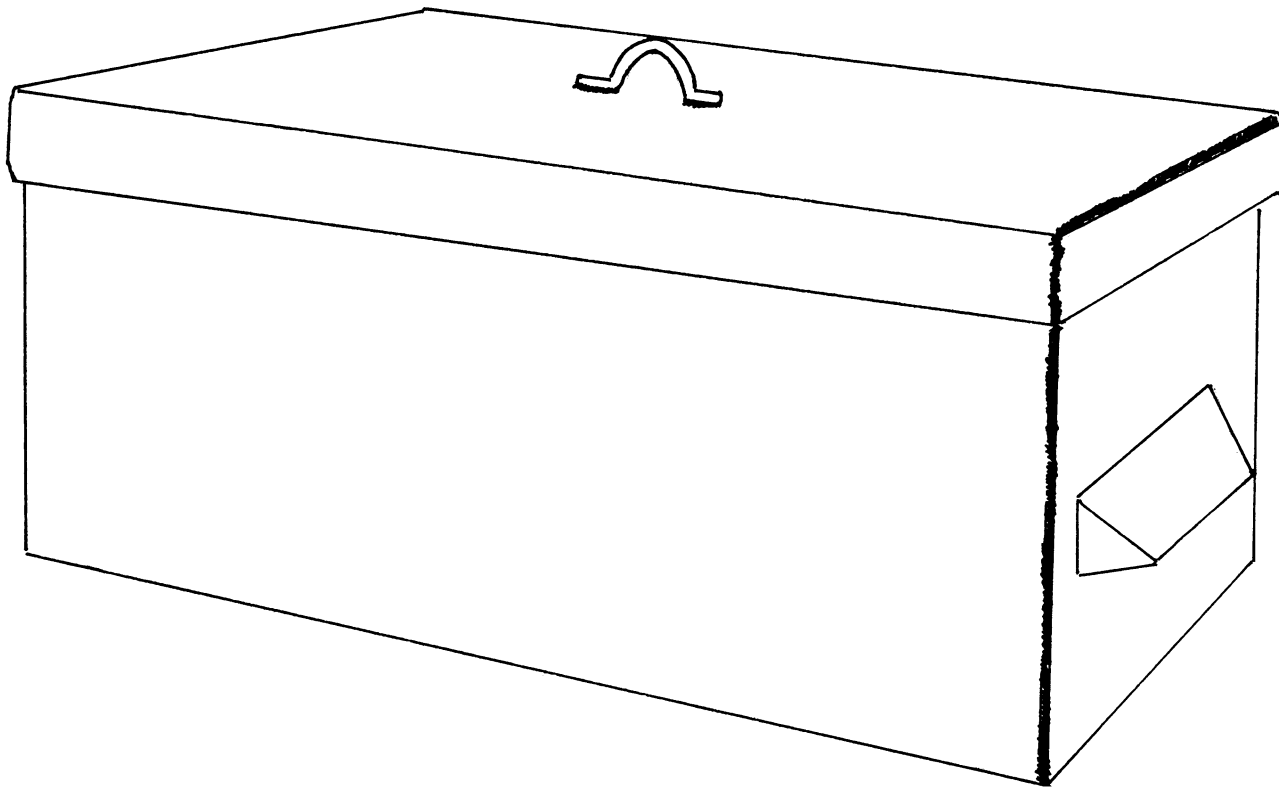
Wood indoor magazines must have the sides, bottom and doors constructed with at least 2 inches of hardwood and be covered with sheetrmetal not less than 26 gauge (.0179 inches). Metal doors must have sides, bottoms, and doors constructed of not less than number 12 gauge (.1046 inches) metal and be lined with a nonsparking material. Hinges and hasps must be attached to doors by welding, riveting or bolting. Each door must be equipped with two mortise locks or two padlocks. Padlocks must have at least five tumblers and a case-hardened 3/8-inch shackle.

Type 2 indoor magazines for detonators in quantities of 100 or less must be constructed of not less than number 12 gauge (0.1046 inches) metal and lined with a nonsparking material. One padlock is required, having at least five tumblers and a 3/8-inch case-hardened shackle. No steel hood is required for protection of the padlock.

Type 3 Magazine

A Type 3 magazine⁴ is a “day box” or other portable magazine. It must be theft resistant, fire resistant, and weather resistant, but not necessarily bullet resistant. Figure 3 depicts a Type 3 magazine.

Figure 3
Type 3 Magazine



Type 3 magazine, constructed of 1/4-inch steel and 3-inch hardwood

The lock for the Type 3 magazine must be at least a five tumbler steel padlock with at least a 3/8-inch case-hardened shackle. The lock need not be protected by a hood. Explosive materials must not be left unattended in a Type 3 magazine. They must be removed to a Type 1 or Type 2 magazine.

Type 4 Magazine

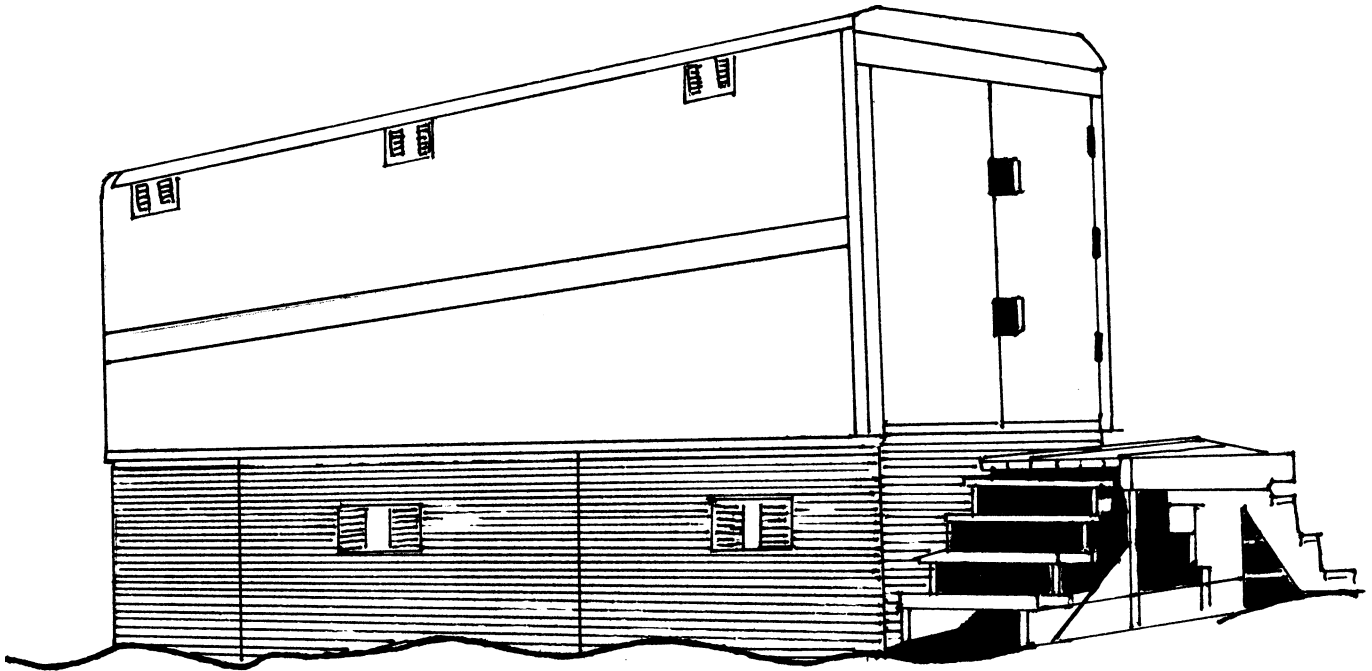
A Type 4 magazine⁵ is a permanent, portable or mobile structure such as a building. It need not be bullet resistant. Figure 4 depicts Type 4 magazines.

Construction must be of wood covered with metal, masonry, fabricated metal or a combination of these materials. The doors must be of metal or wood covered with metal.

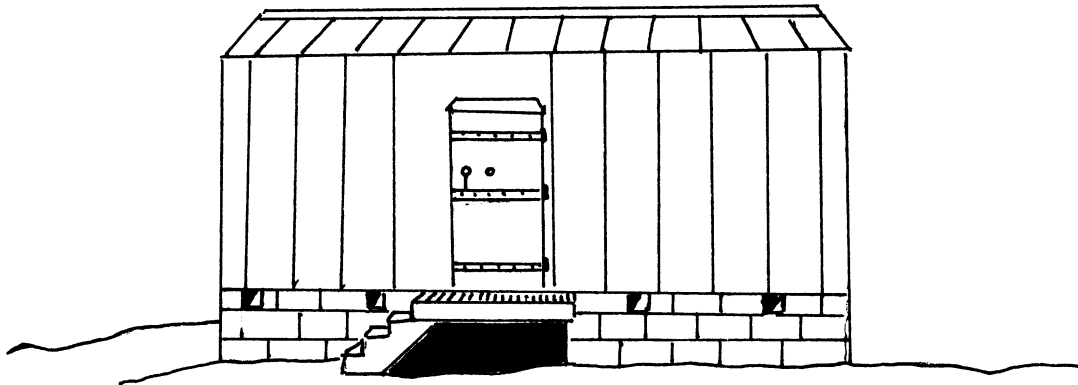
Door locks must be two mortise locks or two padlocks. Padlocks must have at least five tumblers and 3/8-inch case-hardened shackles. Padlocks must be protected by steel hoods of not less than 1/4-inch metal.

When unattended, vehicular magazines must be immobilized, as described for Type 2 magazines.

Figure 4
Type 4 Magazines



Type 4 portable magazine; Fire resistant exterior, nonsparking interior



Type 4 permanent magazine; Fire resistant exterior, nonsparking interior

Type 4 Indoor Magazine

Type 4 indoor magazines must be fire resistant and theft resistant. They need not be weather resistant if the building in which they are stored provides protection from the weather.

No indoor magazine may be located within a residence or dwelling. Storage for low explosives must not exceed 50 pounds. Detonators must be stored in a separate magazine, and the total number may not exceed 5,000.

Type 4 indoor magazines must be constructed of masonry, metal covered wood, fabricated metal or a combination of these materials. The walls and floors must be constructed of or covered with a nonsparking material. The door must be metal or solid wood covered with metal. Hinges and hasps must be attached to doors by welding, riveting or bolting (with nuts on the inside of the door).

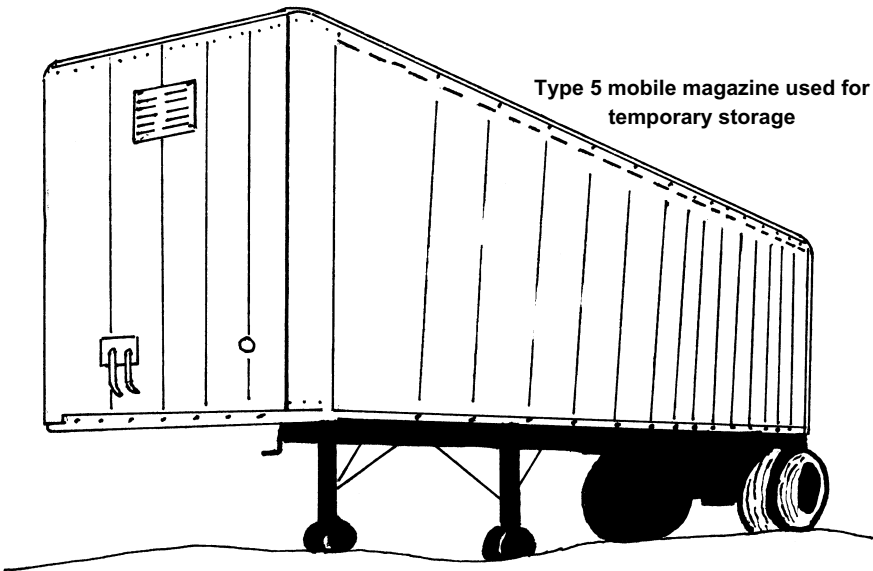
Each door must be equipped with two mortise locks or two padlocks fastened in separate hasps and staples. Padlocks must have at least five tumblers and $\frac{3}{8}$ -inch case-hardened shackles. Padlocks must be protected by $\frac{1}{4}$ -inch metal steel hoods.

Type 5 Magazine

A Type 5 magazine⁶ is a permanent, portable or mobile structure such as a building, igloo, box, bin, tank, semitrailer, bulk trailer, tank trailer, bulk truck, tank truck or other mobile container. It need not be bullet resistant. Figure 5 depicts Type 5 magazines.

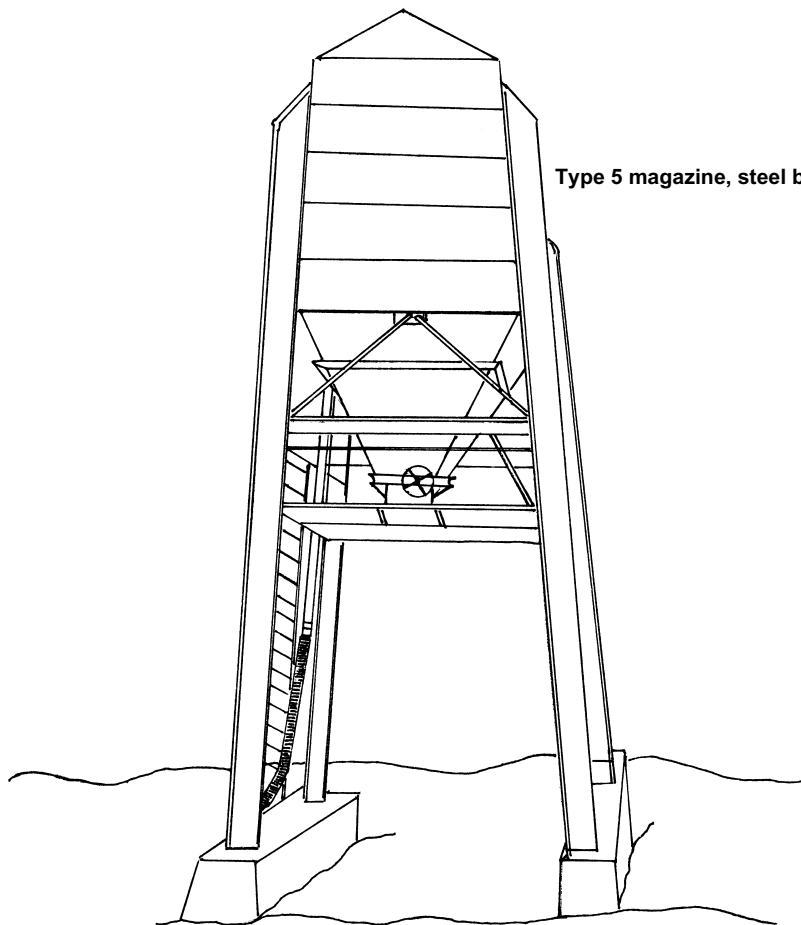
Figure 5

Type 5 Magazines

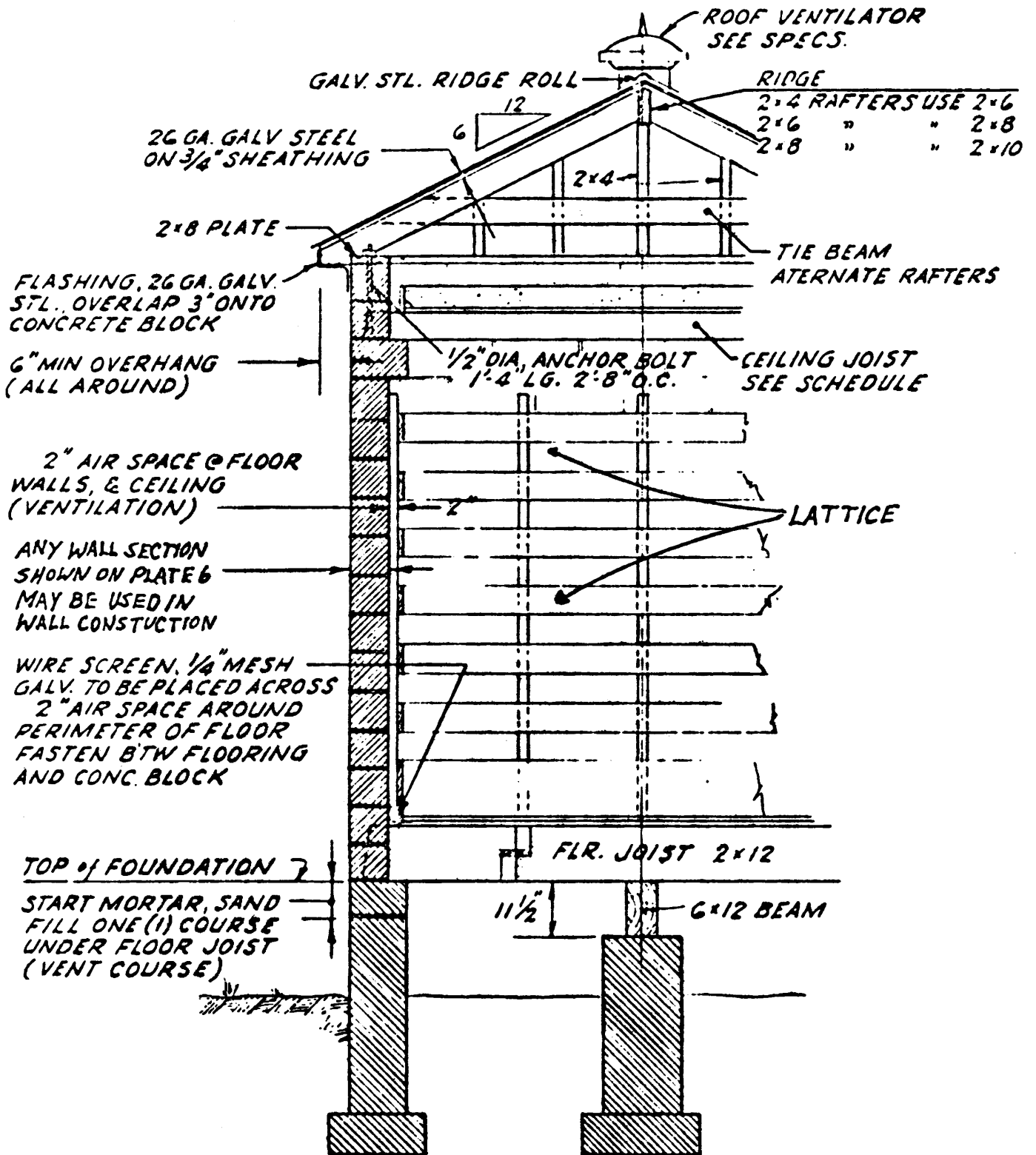


Construction of a Type 5 magazine must be of masonry, wood covered with metal, fabricated metal or a combination of these materials. The doors must be constructed of solid wood or metal.

Permanent Type 5 magazines must be constructed according to Type I magazine detail with respect to the foundation, floors, ventilation and locking devices. When unattended, vehicular magazines must be immobilized, as described for Type 2 vehicular magazines.



Half Cross Section⁷



Half Longitudinal Section⁸

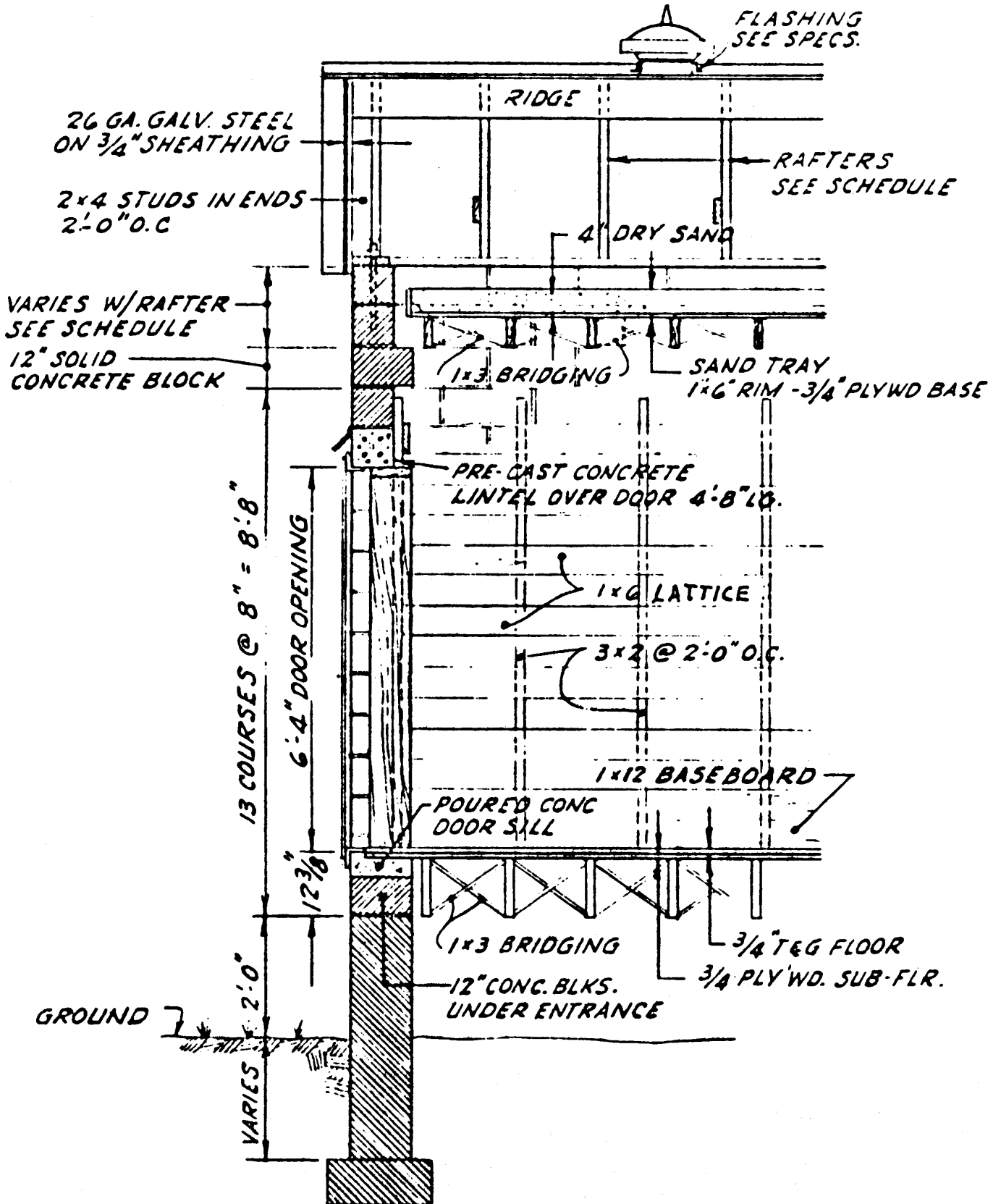


Plate 3

Door Opening Plan Section; Floor and Foundation Plan⁹

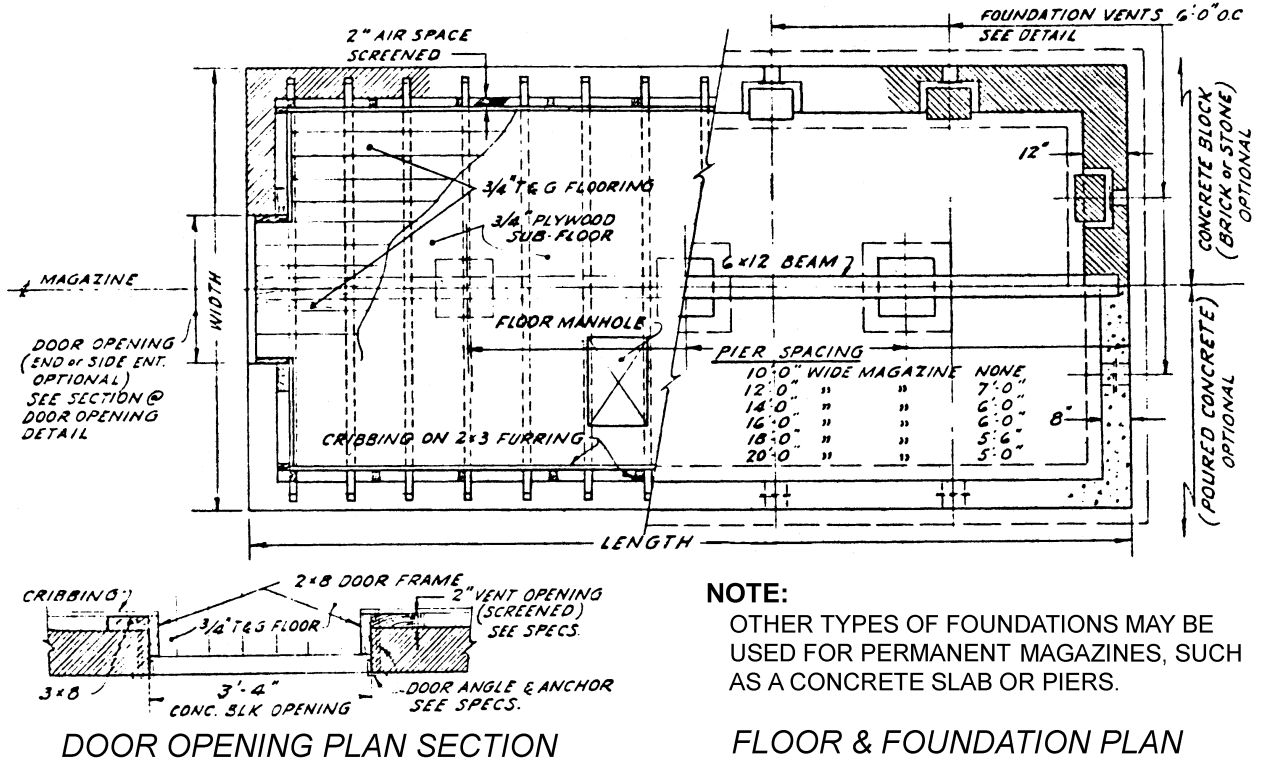
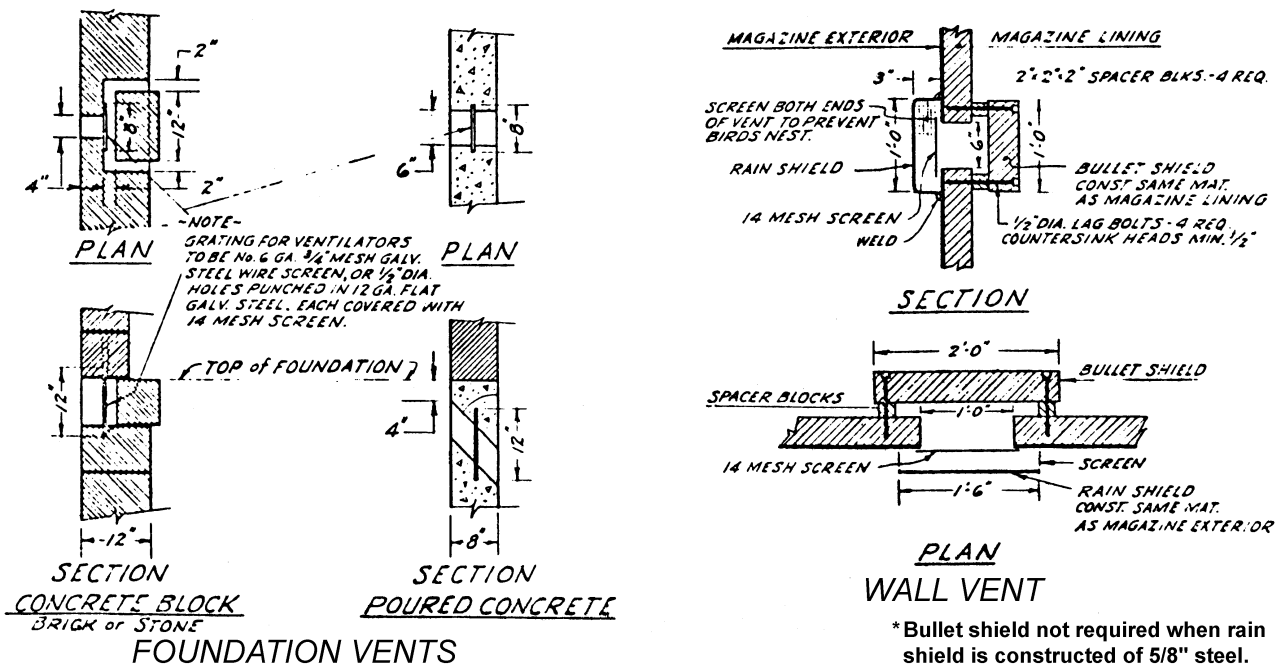
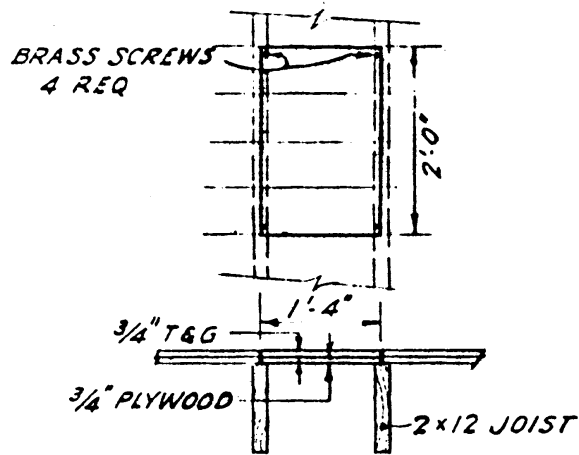


Plate 4

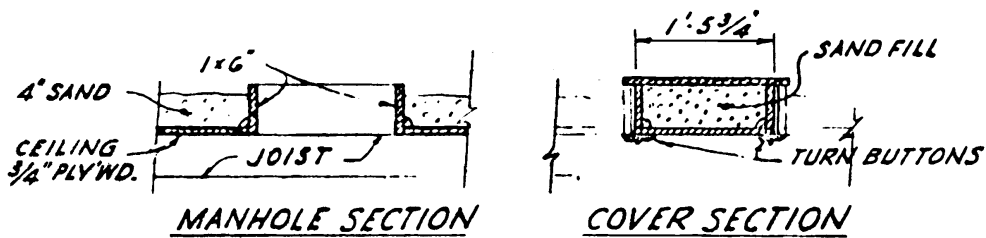
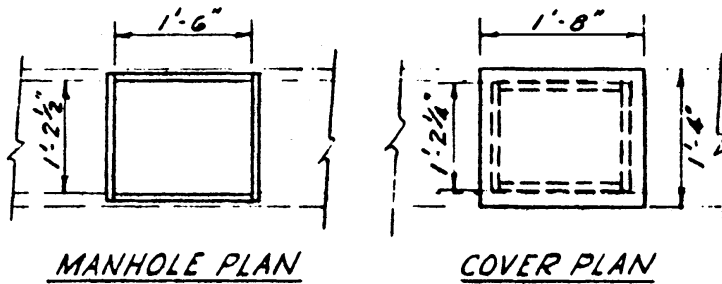
Vent Details—Foundation Vents; Wall Vent¹⁰



Floor Manhole; Ceiling Manhole¹¹



FLOOR MANHOLE
PLAN & SECTION

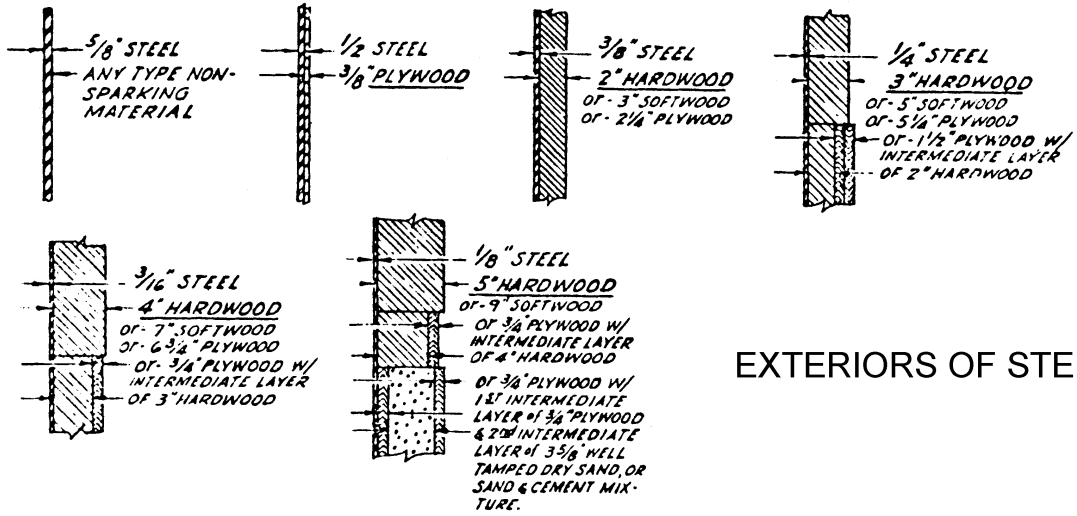


CEILING MANHOLE

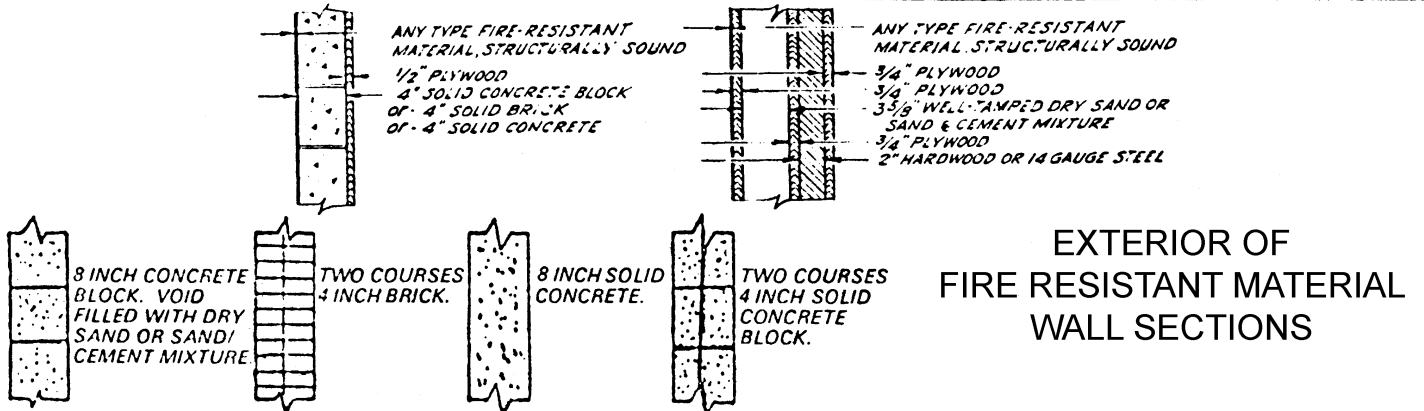
SCHEDULE				
JOIST, RAFTERS, TIE BEAMS				
MAGAZINE WIDTH	FLOOR JOIST 16" O.C.	CEILING JOIST 16" O.C.	RAFTERS 24" O.C.	TIE BEAMS
10'-0"	2x12	2x6	2x4	2x4
12'-0"	2x12	2x8	2x6	2x4
14'-0"	2x12	2x8	2x6	2x4
16'-0"	2x12	2x10	2x6	2x4
18'-0"	2x12	2x10	2x8	2x6
20'-0"	2x12	2x12	2x8	2x6

MANHOLE DETAILS & JOIST - RAFTER SCHEDULE

Exterior of Fire Resistant Material Wall Sections¹²



EXTERIORS OF STEEL



EXTERIOR OF FIRE RESISTANT MATERIAL WALL SECTIONS

Plate 7

Door—Frame; Door on Frame¹³

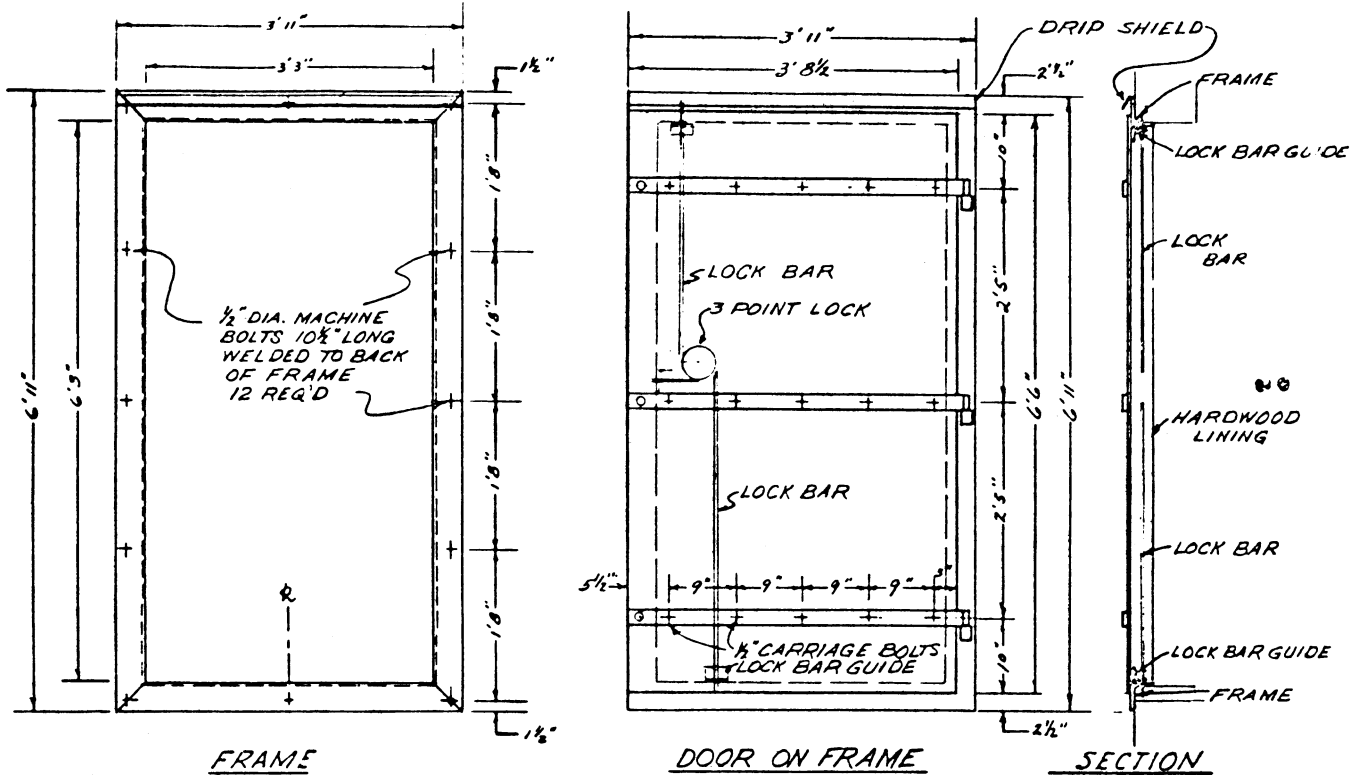
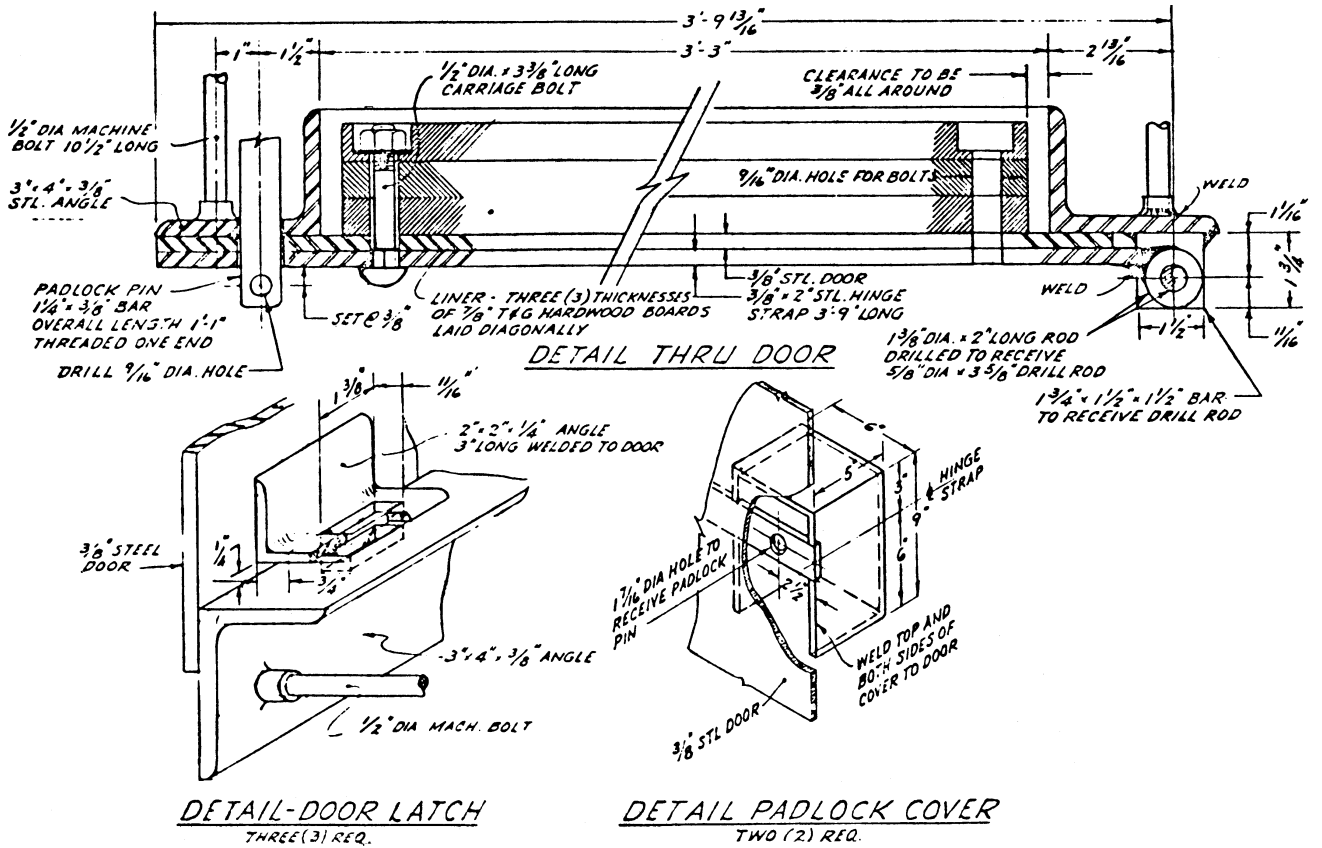


Plate 8

Door Details—Door Latch; Padlock Cover¹⁴



Specifications for Bullet-Resistant Construction

Magazines constructed to the specifications listed below have been tested and determined to be bullet resistant.

Exterior of Steel

A magazine with a steel exterior will be bullet resistant if composed of:

- $\frac{5}{8}$ -inch steel with an interior lining of any type of nonsparking material.
- $\frac{1}{2}$ -inch steel with an interior lining of not less than $\frac{3}{8}$ -inch plywood
- $\frac{3}{8}$ -inch steel with an interior lining of
 - 2 inches of hardwood, or
 - 3 inches of softwood, or
 - $2\frac{1}{4}$ inches of plywood.
- $\frac{1}{4}$ -inch steel with an interior lining of
 - 3 inches of hardwood, or
 - 5 inches of softwood, or
 - $5\frac{1}{4}$ inches of plywood, or
 - $1\frac{1}{2}$ inches of plywood with an intermediate layer of 2 inches of hardwood, or
 - $5\frac{1}{4}$ inches of particle board.
- $\frac{3}{16}$ -inch steel with an interior lining of
 - 4 inches of hardwood, or
 - 7 inches of softwood, or
 - $6\frac{3}{4}$ inches of plywood, or
 - $\frac{3}{4}$ inches of plywood with an intermediate layer of 3 inches of hardwood, or
 - $6\frac{3}{4}$ inches of particle board.
- $\frac{1}{8}$ -inch steel with interior lining of
 - 5 inches of hardwood, or
 - 9 inches of softwood, or
 - $\frac{3}{4}$ inches of plywood with an intermediate layer of 4 inches of hardwood, or
 - $\frac{3}{4}$ inches of plywood with the first intermediate layer of $\frac{3}{4}$ inch plywood and a second intermediate layer of $3\frac{5}{8}$ inches of well-tamped dry sand or sand/cement mixture.

Exterior of Any Type

A magazine with any type of exterior will be bullet resistant if composed of fire-resistant material that is structurally sound and if it includes:

- An interior lining of $\frac{1}{2}$ -inch plywood placed securely against an intermediate layer of
 - 4 inches of solid concrete block, or
 - 4 inches of solid brick, or
 - 4 inches of solid concrete.
- An interior lining of $\frac{3}{4}$ inches of plywood and a first intermediate layer of $\frac{3}{4}$ inches of plywood, a second intermediate layer of $3\frac{5}{8}$ inches of well-tamped dry sand or sand/cement mixture, a third intermediate layer of $\frac{3}{4}$ -inch plywood, and a fourth intermediate layer of 2 inches of hardwood or 14 gauge steel.
- An intermediate 6-inch space filled with well-tamped dry sand or well-tamped sand/cement mixture.

Masonry Construction

A magazine of masonry construction will be bullet resistant if composed of:

- Standard 8-inch concrete block with the void filled with well-tamped dry sand or well-tamped sand/cement mixture, or
- Standard 8-inch solid block or
- 8-inch thickness of solid concrete, or
- Two 4-inch thick blocks of solid concrete.

Use of Magazines

Lighting

Battery-activated safety lights or battery-activated safety lanterns may be used in magazines for the storage of explosive materials. Electric lighting used in any explosives storage magazine must meet the standards prescribed by the National Electrical Code (NFPA 70-81) for the condition present in the magazine at any time. All electrical switches must be located outside of the magazine and must meet the standards prescribed by the National Electrical Code. Copies of invoices, work orders or similar documents indicating that the lighting complies with the National Electrical Code must be available.

Repairs

Before one repairs the interior of a magazine, all explosive materials must be removed. Before one repairs the exterior of a magazine, all explosive materials must be removed if there exists any possibility that repairs may produce sparks or flame. Explosive materials removed from magazines under repair must be:

- Placed in other magazines appropriate for the storage of explosive materials.
- Placed a safe distance from the magazines under repair where the materials are properly guarded and protected until repairs have been completed.

Housekeeping

Magazines must be kept clean, dry, and free of grit, paper, empty packages, containers and rubbish. Floors must be swept regularly. Brooms and other utensils used in cleaning and maintenance of magazines may be kept in magazines, but the utensils must not have spark producing metal parts.

When explosive materials have deteriorated, they must be destroyed in accordance with the advice or instruction of the manufacturer. The area around magazines must be kept clear of rubbish, brush, dry grass and trees (except live trees more than 10 feet tall) for not less than 25 feet in all directions. Volatile materials must be kept a distance of 50 feet from outdoor magazines. Living foliage that is used to stabilize the earthen covering of a magazine need not be removed.

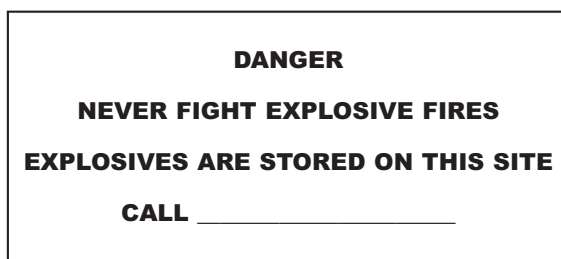
Smoking and Open Flames

Smoking, matches, open flames and spark-producing devices are not permitted:

- In any magazine.
- Within 50 feet of any outdoor magazines.
- Within any room containing an indoor magazine.

Posting

The Mine Safety and Health Administration standard on posting requires a suitable danger sign so located that a bullet passing through the face of the sign will not strike the magazine. The Institute of Makers of Explosives recommends a sign on all normal access routes to explosives storage buildings. The sign should be weather resistant with a reflective surface, and lettering should be at least 2 inches high. The first two lines should be printed with red lettering, and the remaining lines should be printed in black lettering. The sign should read:



Inspection

Magazines must be inspected at least every seven days to determine whether there has been unauthorized entry or attempted entry into the magazines, or unauthorized removal of the contents of the magazines.

Location of Magazines

Outdoor magazines in which high explosives are stored must be located no closer to inhabited buildings, passenger railways, public highways or other magazines in which high explosives are stored than the minimum distance specified in Table 4.

Table 4

Distances for Storage of Explosive Materials^{15*}

Quantity of Explosive Materials ^{1,2,3,4,5}		Distances in Feet							
		Inhabited Buildings ⁹		Public Highways Class A to D ¹¹		Passenger Railways—Public Highways with Traffic Volume of more than 3,000 Vehicles/Day ^{10,11}		Separation of Magazines ¹²	
Pounds Over	Pounds Not Over	Barri-caded ^{6,7,8}	Unbarri-caded	Barri-caded ^{6,7,8}	Unbarri-caded	Barri-caded ^{6,7,8}	Unbarri-caded	Barri-caded ^{6,7,8}	Unbarri-caded
2	5	70	140	30	60	51	102	6	12
5	10	90	180	35	70	64	128	8	16
10	20	110	220	45	90	81	162	10	20
20	30	125	250	50	100	93	186	11	22
30	40	140	280	55	110	103	206	12	24
40	50	150	300	60	120	110	220	14	28
50	75	170	340	70	140	127	254	15	30
75	100	190	380	75	150	139	278	16	32
100	125	200	400	80	160	150	300	18	36
125	150	215	430	85	170	159	318	19	38
150	200	235	470	95	190	175	350	21	42
200	250	255	510	105	210	189	378	23	46
250	300	270	540	110	220	201	402	24	48
300	400	295	590	120	240	221	442	27	54
400	500	320	640	130	260	238	476	29	58
500	600	340	680	135	270	253	506	31	62
600	700	355	710	145	290	266	532	32	64
700	800	375	750	150	300	278	556	33	66
800	900	390	780	155	310	289	578	35	70
900	1,000	400	800	160	320	300	600	36	72
1,000	1,200	425	850	165	330	318	636	39	78
1,200	1,400	450	900	170	340	336	672	41	82
1,400	1,600	470	940	175	350	351	702	43	86
1,600	1,800	490	980	180	360	366	732	44	88
1,800	2,000	505	1,010	185	370	378	756	45	90
2,000	2,500	545	1,090	190	380	408	816	49	98
2,500	3,000	580	1,160	195	390	432	864	52	104
3,000	4,000	635	1,270	210	420	474	948	58	116
4,000	5,000	685	1,370	225	450	513	1,026	61	122
5,000	6,000	730	1,460	235	470	546	1,092	65	130
6,000	7,000	770	1,540	245	490	573	1,146	68	136
7,000	8,000	800	1,600	250	500	600	1,200	72	144
8,000	9,000	835	1,670	255	510	624	1,248	75	150
9,000	10,000	865	1,730	260	520	645	1,290	78	156
10,000	12,000	875	1,750	270	540	687	1,374	82	164
12,000	14,000	885	1,770	275	550	723	1,446	87	174
14,000	16,000	900	1,800	280	560	756	1,512	90	180
16,000	18,000	940	1,880	285	570	786	1,572	94	188
18,000	20,000	975	1,950	290	580	813	1,626	98	196
20,000	25,000	1,055	2,000	315	630	876	1,752	105	210
25,000	30,000	1,130	2,000	340	680	933	1,866	112	224
30,000	35,000	1,205	2,000	360	720	981	1,962	119	238
35,000	40,000	1,275	2,000	380	760	1,026	2,000	124	248
40,000	45,000	1,340	2,000	400	800	1,068	2,000	129	256
45,000	50,000	1,400	2,000	420	840	1,104	2,000	135	270
50,000	55,000	1,460	2,000	440	880	1,140	2,000	140	280
55,000	60,000	1,515	2,000	455	910	1,173	2,000	145	290
60,000	65,000	1,565	2,000	470	940	1,206	2,000	150	300
65,000	70,000	1,610	2,000	485	970	1,236	2,000	155	310
70,000	75,000	1,655	2,000	500	1,000	1,263	2,000	160	320
75,000	80,000	1,695	2,000	510	1,020	1,293	2,000	165	330
80,000	85,000	1,730	2,000	520	1,040	1,317	2,000	170	340
85,000	90,000	1,760	2,000	530	1,060	1,344	2,000	175	350
90,000	95,000	1,790	2,000	540	1,080	1,368	2,000	180	360
95,000	100,000	1,815	2,000	545	1,090	1,392	2,000	185	370
100,000	110,000	1,835	2,000	550	1,100	1,437	2,000	195	390
110,000	120,000	1,855	2,000	555	1,110	1,479	2,000	205	410
120,000	130,000	1,875	2,000	560	1,120	1,521	2,000	215	430
130,000	140,000	1,890	2,000	565	1,130	1,557	2,000	225	450
140,000	150,000	1,900	2,000	570	1,140	1,593	2,000	235	470
150,000	160,000	1,935	2,000	580	1,160	1,629	2,000	245	490
160,000	170,000	1,965	2,000	590	1,180	1,662	2,000	255	510
170,000	180,000	1,990	2,000	600	1,200	1,695	2,000	265	530
180,000	190,000	2,010	2,010	605	1,210	1,725	2,000	275	550
190,000	200,000	2,030	2,030	610	1,220	1,755	2,000	285	570
200,000	210,000	2,055	2,055	620	1,240	1,782	2,000	295	590
210,000	230,000	2,100	2,100	635	1,270	1,836	2,000	315	630
230,000	250,000	2,155	2,155	650	1,300	1,890	2,000	335	670
250,000	275,000	2,215	2,215	670	1,340	1,950	2,000	360	720
275,000	300,000	2,275	2,275	690	1,380	2,000	2,000	385	770

*Approved by the Institute of Makers of Explosives, February 1986.

Table 4 Notes

1. *Explosive materials* means explosives, blasting agents and detonators.

2. *Explosives* means any chemical compound, mixture, or device, the primary or common purpose of which is to function by explosion. A list of explosives determined to be within the coverage of "18 U.S.C. Chapter 40, Importation, Manufacturer, Distribution and Storage of Explosive Materials" is issued at least annually by the director of the Bureau of Alcohol, Tobacco, and Firearms of the Department of the Treasury. For quantity and distance purposes, detonating cord of 50 grains per foot should be calculated as equivalent to 8 pounds of high explosives per 1,000 feet. Heavier or lighter core loads should be rated proportionately.

3. *Blasting agents* means any material or mixture, consisting of fuel and oxidizer, intended for blasting, not otherwise defined as an explosive: Provided that the finished product, as mixed for use or shipment, cannot be detonated by means of a No. 8 test blasting cap when unconfined.

4. *Detonator* means any device containing any initiating or primary explosive that is used for initiating detonation. A detonator may not contain more than 10 grams of total explosives by weight, excluding ignition or delay charges. The term includes, but is not limited to, electric blasting caps of instantaneous and delay types, blasting caps for use with safety fuses, detonating cord delay connectors, and non-electric instantaneous and delay blasting caps which use detonating cord, shock tube, or any other replacement for electric leg wires. All types of detonators in strengths through No. 8 cap should be rated at 1½ pounds of explosives per 1,000 caps. For strengths higher than No. 8 cap, consult the manufacturer.

5. *Magazine* means any building, structure or container, other than an explosives manufacturing building, approved for the storage of explosive materials.

6. *Natural barricade* means natural features of the ground, such as hills or timber of sufficient density that the surrounding exposures which require protection cannot be seen from the magazine when the trees are bare of leaves.

7. *Artificial barricade* means an artificial mound or revetted wall of earth of a minimum thickness of 3 feet.

8. *Barricaded* means the effective screening of a building containing explosive materials from the magazine or other building, railway or highway by a natural or an artificial barrier. A straight line from the top of any sidewall of the building containing explosive materials to the eave line of any magazine or other building or to a point 12 feet above the center of a railway or highway must pass through such barrier.

9. *Inhabited building* means 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.

10. *Railway* means any steam, electric, or other railroad or railway that carries passengers for hire.

11. *Highway* means any public street, public alley or public road. "Public Highways Class A to D" are highways with average traffic volume of 3,000 or less vehicles per day as specified in "American Civil Engineering Practice" (Abbett, Vol. 1, Table 46, Sec. 3-74, 1956 Edition, John Wiley and Sons).

12. When two or more storage magazines are located on the same property, each magazine must comply with the minimum distances specified from inhabited buildings, railways and highways, and, in addition, they should be separated from each other by not less than the distances shown for "Separation of Magazines," except that the quantity of explosive materials contained in detonator magazines must govern in regard to the spacing of said detonator magazines from magazines containing other explosive materials. If any two or more magazines are separated from each other by less than the specified 'Separation of Magazines' distances, then such two or more magazines, as a group, must be considered as one magazine, and the total quantity of explosive materials stored in such group must be treated as if stored in a single magazine located on the site of any magazine of the group and must comply with the minimum of distances specified from other magazines, inhabited buildings, railways and highways.

13. Storage in excess of 300,000 pounds of explosive materials in one magazine is generally not required for commercial enterprises.

14. This table applies only to the manufacture and permanent storage of commercial explosive materials. It is not applicable to transportation of explosives or any handling or temporary storage necessary or incident thereto. It is not intended to apply to bombs, projectiles or other heavily encased explosives.

Outdoor magazines in which low explosives are stored must be located no closer to inhabited buildings, passenger rail-ways, public highways or other magazines in which explosive material is stored than the minimum distances specified in Table 5. No reduction of the distance is allowed for barricades.

Table 5
Distances for Storage of Low Explosives

Pounds		Distance in Feet		
		From Inhabited Building	From Public Railroad and Highway	From Above Ground Magazine
Over	Not Over			
0	1,000	75	75	50
1,000	5,000	115	115	75
5,000	10,000	150	150	100
10,000	20,000	190	190	125
20,000	30,000	215	215	145
30,000	40,000	235	235	155
40,000	50,000	250	250	165
50,000	60,000	260	260	175
60,000	70,000	270	270	185
70,000	80,000	280	280	190
80,000	90,000	295	295	195
90,000	100,000	300	300	200
100,000	200,000	375	375	250
200,000	300,000	450	450	300

For the separation of stores of ammonium nitrate and blasting agents from nearby stores of high explosives or blasting agents, use the distances specified in Table 6.

Table 6

Distances^{1,6} of Ammonium Nitrate and Blasting Agents From Explosives or Blasting Agents¹⁶

Donor Weight		Minimum Separation Distance of Acceptor When Barricaded ² (ft.)		Minimum Thickness of Artificial Barricades ⁵ (in.)
Pounds Over	Pounds Not Over	Ammonium Nitrate ³	Blasting Agent ⁴	
	100	3	11	12
100	300	4	14	12
300	600	5	18	12
600	1,000	6	22	12
1,000	1,600	7	25	12
1,600	2,000	8	29	12
2,000	3,000	9	32	16
3,000	4,000	10	36	15
4,000	6,000	11	40	15
6,000	8,000	12	43	20
8,000	10,000	13	47	20
10,000	12,000	14	50	20
12,000	16,000	15	54	26
16,000	20,000	16	58	25
20,000	25,000	18	65	25
25,000	30,000	19	68	30
30,000	35,000	20	72	30
35,000	40,000	21	76	30
40,000	45,000	22	79	35
45,000	50,000	23	83	35
50,000	55,000	24	86	35
55,000	60,000	25	90	35
60,000	70,000	26	94	40
70,000	80,000	28	101	40
80,000	90,000	30	108	40
90,000	100,000	32	115	40
100,000	120,000	34	122	50
120,000	140,000	37	133	50
140,000	160,000	40	144	50
160,000	180,000	44	158	50
180,000	200,000	48	173	50
200,000	220,000	52	187	60
220,000	250,000	56	202	60
250,000	275,000	60	216	60
275,000	300,000	64	230	60

Table 6 Notes

1. Recommended separation distances to prevent explosion of ammonium nitrate and ammonium nitrate-based blasting agents by propagation from nearby stores of high explosives or blasting agents referred to in the table as the "donor." Ammonium nitrate by itself is not considered to be a donor when applying this table. Ammonium nitrate, ammonium nitrate-fuel oil, or combinations thereof are acceptors. If stores of ammonium nitrate are located within the sympathetic detonation distance of explosives or blasting agents, one-half the mass of the ammonium nitrate should be included in the mass of the donor.

2. When the ammonium nitrate and/or blasting agent is not barricaded, the distances shown in the table shall be multiplied by six. These distances allow for the possibility of high velocity metal fragments from mixers, hoppers, truck bodies, sheet metal structures, metal containers and the like that may enclose the "donor." Where storage is in bullet-resistant magazines recommended for explosives or where the storage is protected by a bullet-resistant wall, distances and barricade thicknesses in excess of those prescribed in the American Table of Distances are not required.

3. The distances in the table apply to ammonium nitrate that passes the insensitivity test prescribed in the definition of ammonium nitrate fertilizer promulgated by the Fertilizer Institute; and ammonium nitrate failing to pass said test shall be stored at separation distances determined by competent persons and approved by the authority having jurisdiction.

4. These distances apply to blasting agents that pass the insensitivity test prescribed in regulations of the U.S. Department of Transportation and the U.S. Department of the Treasury, Bureau of Alcohol, Tobacco and Firearms.

5. Earth, or sand dikes, or enclosures filled with the prescribed minimum thickness of earth or sand are acceptable artificial barricades. Natural barricades, such as hills or timber of sufficient density that the surrounding exposures which require protection cannot be seen from the "donor" when the trees are bare of leaves, are also acceptable.

6. For determining the distances to be maintained from inhabited buildings, passenger railways and public highways, use the Table of Distances for Storage of Explosives in table 6-4b of NFPA 495-1985, *Code for the Manufacture, Transportation, Storage, and Use of Explosive Materials*.

Notes

1. Institute of Makers of Explosives. *Construction Guide for Storage Magazines*. Safety Library Publication No. 1, p. I (hereinafter, for example, IME No. 1, p. 1).
2. IME No. 1, p. 3.
3. IME No. 1, p. 5.
4. IME No. 1, p. 5.
5. IME No. 1, p. 5.
6. IME No. 1, p. 5.
7. IME No. 1, pp. 8, 9.
8. IME No. 1, pp. 8, 9.
9. IME No. 1, pp. 10, 11.
10. IME No. 1, pp. 10, 11.
11. IME No. 1, p. 12.
12. IME No. 1, p. 13.
13. IME No. 1, p. 14.
14. IME No. 1, p. 15.
15. Institute of Makers of Explosives. *The American Table of Distances*. Safety Library Publication No. 2, pp. 4, 5.
16. IME No. 2, p. 10.

North Carolina Occupational Safety and Health Standards in Construction for Blasting and Use of Explosives

The latest changes ATF has made to 27 CFR is dated April 1, 2008. See Web site provided here for listing of ATF standards and complete information as pertained to these and other requirements: <http://www.atf.gov/regulations/index.htm>

1. §555.53—Federal license for manufacturing, importing or dealing in explosives cannot be transferred. In the event of the lease, sale, or other transfer of the business or operations covered by the license, the successor must obtain a new license before commencing business or operation. When a corporate entity is merged or acquired and the licensed entity is dissolved, a new entity cannot operate under the defunct entity's license.

2. §555.63—Any licensee or permittee who adds new magazines or makes construction change to existing magazines must notify ATF prior to using the new or reconstructed magazine. The notification can be made by phone or in writing. However, if the notice is in writing it must be made three business days in advance of making changes in construction to an existing magazine, and at least five business days prior to using any reconstructed or new magazine.

3. §555.201(f)—Any person storing explosives must notify the appropriate officials having jurisdiction for fire safety in the locality where the explosives are to be stored. The notification of the storage of explosives must be made both orally (within the same day) and in writing within 48 hours such storage commences.

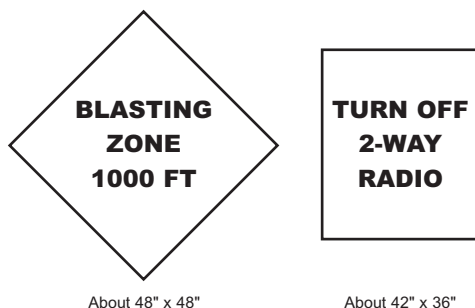
North Carolina has promulgated amendments to the majority of the federal OSHA standards contained in Subpart U (29 CFR 1926.900–914). This document combines those amendments and additions contained in 13 NCAC 7F.0701–.0716 with the original CFR standards that were not amended and remain in effect. Standards marked with an asterisk are amended standards, while standards not marked with an asterisk are CFR standards (Subpart U).

Subpart U—Blasting and Use of Explosives—additions and amendments to 29 CFR 1926.900—General Provisions, through 1926.914—Definitions applicable to this subpart, are as follows:

Section 1926.900 General provisions:

- *(a) The employer shall permit only persons qualified pursuant to §1926.901 to handle and use explosives. A blaster shall be in charge of each blasting operation; hereafter, referred to as the Blaster-in-Charge.
- *(b) Smoking, firearms, sparks, open flame or heat producing devices shall be prohibited where explosives are being stored, handled, transported or used. Exception: This does not apply to devices specifically designed to initiate detonation, which by their nature produce heat or sparks.
- *(c) See 1926.901(b).
- *(d) All explosives shall be accounted for at all times. Explosives not being used and not attended shall be kept in a magazine or container that meets the U.S. Bureau of Alcohol, Tobacco and Firearms (hereafter, ATF) storage and access requirements contained in 27 CFR Part [555], which is incorporated herein by reference, including any subsequent amendments and editions. Each employer shall maintain an inventory and use record of all explosives in that employer's possession. The employer, or employer authorized person, shall comply with all applicable local, State and federal laws and regulations requiring notification of any loss, theft, or unauthorized entry into a magazine or container.
- (e) No explosives or blasting agents shall be abandoned.
- (f) No fire shall be fought where the fire is in imminent danger of contact with explosives. All employees shall be removed to a safe area and the fire area guarded against intruders.
- *(g) Original containers, ATF Type 2, Type 3, Type 4 or Type 5 magazines or Institute of Makers of Explosives (hereafter, IME)—22 containers, shall be used for taking detonators and other explosives from storage magazines to the blast site.
- *(h) In proximity to people, a structure, railway, highway or any other installation, the blaster shall take additional precautions to control the throw of fragments and to prevent bodily injury to employees and people not working directly on the blasting operation. Such additional precautions shall be taken in the loading, delaying, initiation and confinement of each blast and shall include confinement with mats or with mats and other methods.

- * (i) All blast site employees shall follow the directions of the Blaster-in-Charge. All blast site employees shall use and adhere to every precaution to ensure employee safety including, but not limited to, visual and audible warning signals, flags, or barricades.
- (j) Insofar as possible, blasting operations above ground shall be conducted between sunup and sundown.
- * (k) Precautions shall be taken to prevent accidental discharge of electric detonators from current induced by radar, radio transmitters including 2-way radios and mobile telephones, lightning, adjacent powerlines, dust storms, or other sources of extraneous electricity. These precautions shall include:
 - * (1) See Section 1926.906(a) and (b).
 - * (2) At the approach and progress of an electric storm, blasting operations shall be suspended and personnel removed to an area safe from concussion (shock wave), flying material, or gases from an explosion.
 - * (3) (i) The prominent display of adequate signs, warning against the use of mobile radio transmitters, (e.g., telephones and 2-way radios) on all roads within 1,000 feet of electric blasting operations. If adherence to the 1,000-foot distance would create an operational handicap, then a competent person (as defined in 29 CFR 1926 Subparts L and P) shall be consulted to evaluate the particular situation, and alternative provisions may be made which are designed to prevent any premature firing of electric detonators. A description of any such alternatives shall be reduced to writing and shall be certified by the competent person consulted as meeting the purposes of this subdivision. The description shall be maintained at the construction during the duration of the work, and shall be available for inspection by representatives of the Commissioner of Labor.
 - (ii) Examples of signs which would meet the requirements of paragraphs (i) and (k)(3) of this section are the following:



- * (4) Ensuring that mobile transmitters including telephones and 2-way radios which are less than 100 feet away from electric detonators, in other than original containers, shall be de-energized and effectively prevented from operating, (e.g., locked);
- * (5) The Blaster-in-Charge shall comply with the recommendations of IME with regard to blasting in the vicinity of radio transmitters as stipulated in Safety Guide for the Prevention of Radio Frequency Radiation Hazards in the Use of Commercial Electric Detonators (Blasting Caps), IME Safety Library Publication No. 20, 2000, which is incorporated herein by reference, including any subsequent amendments and editions.
- * (l) Empty boxes and associated paper and fiber packing materials, which have previously contained explosives, shall not be used for any purpose, other than that associated with the blasting operation. Such boxes, paper and packing materials shall be disposed of in a manner that prevents reuse and does not constitute a hazard. Disposal may include but shall not be limited to burning. The method used for disposal shall comply with all applicable local, State or federal laws.
- (m) Explosives, blasting agents, and blasting supplies that are obviously deteriorated or damaged shall not be used.
- * (n) Delivery and issue of explosives shall only be made by and to authorized persons (as defined in 27 CFR Part [555]) and into magazines or temporary storage or handling areas that meet the ATF storage requirements contained in 27 CFR Part [555].
- * (o) Blasting operations in the proximity of overhead power lines, communication lines, utility services, or other services and structures shall not commence until the operators or owners have been notified and measures for safe control have been taken.

- (p) The use of black powder shall be prohibited.
- *(q) All loading and firing shall be directed and supervised by the Blaster-in-Charge.
- *(r) All blasts shall be fired under the control of a blaster, with an initiation system in accordance with manufacturer's recommendations. All blasts shall be fired in accordance with the manufacturer's recommendations.
- *(s) Buildings used for the mixing of blasting agents or water-based explosives shall conform to the requirements of this section.
 - (1) Buildings shall be of noncombustible construction or sheet metal on wood studs.
 - (2) Floors in a mixing plant shall be of concrete or of other nonabsorbent materials.
 - *(3) All fuel oil storage facilities shall be separated from the mixing plant and located in such a manner that in case of tank rupture, the oil will be contained and will not drain toward the mixing plant building.
 - *(4) The building shall be adequately ventilated to prevent explosive or hazardous substance hazards.
 - *(5) Heating units may be used in the building if they do not depend on combustion processes, and are properly designed and located to prevent explosive or other hazards. All direct sources of heat shall be provided exclusively from units located outside the mixing building.
 - *(6) All internal-combustion engines used for electric power generation shall be located outside the mixing plant building, or shall be isolated by a firewall and shall be properly ventilated to prevent explosive or exhaust gas hazards to employees. The exhaust systems on all such engines shall be located so any heat or spark generated or emitted cannot be a hazard to any materials in or adjacent to the plant.
- *(t) See .900(s).
 - *(1) See .900(s)(1).
 - *(2) See .900(s)(2).
 - *(3) See .900(s)(3).
 - *(4) See .900(s)(4).
 - *(5) See .900(s)(5).
 - *(6) See .900(s)(6).
- *(u) To guard against unauthorized entry or initiation of a blast, a blast site shall be attended if loading is suspended or loaded holes are awaiting firing. Additionally, the blast site shall be barricaded, posted, and flagged as necessary to prevent unauthorized access.
- *(v) No one shall carry explosives or explosives detonating materials (e.g., blasting caps, detonators, fuse, primers) of any kind on his or her person. This does not prohibit hand-carrying or passing such materials when a hole is being loaded.

Section 1926.901 Blaster qualifications:

- *(a) Blasters shall be able to understand and give written and oral orders.
- *(b) Blasters and others authorized to handle or transport explosive materials or conduct blast site activities shall be in sufficiently good physical condition to perform the work safely and not be addicted to, or under the influence of, narcotics, intoxicants, or similar types of drugs.
- *(c) Blasters shall be qualified, by reason of training, knowledge, or experience, in the field of transporting, storing, handling, and use of explosives, and have a working knowledge of State, federal and local laws and regulations which pertain to explosives.
- *(d) Blasters shall be required by the employer to furnish evidence satisfactory to the employer of competency in handling explosives and performing in a safe manner the type of blasting that will be required.
- *(e) Blasters shall be knowledgeable in the use of each type of blasting method used.

- * (f) Pursuant to 29 CFR 1926.21(b), the employer shall instruct each employee in the recognition and avoidance of unsafe conditions and the regulations applicable to the employee's work and work environment.

Section 1926.902 Surface transportation of explosives:

- * (a) Surface transportation of explosives and blasting agents shall be in accordance with applicable U.S. Department of Transportation (hereafter, DOT) regulations. Where DOT regulations do not normally apply (e.g., off-road vehicles), compliance shall be in accordance with either the directly related DOT regulation or §1926.902(b) through §1926.902(1), as applicable. Where DOT regulations do not exist, §1926.902(b) through §1926.902(1) apply.
- * (b) Motor vehicles or conveyances transporting explosives shall only be driven by, and be in the charge of, a licensed driver. The driver shall be familiar with the local, State, and Federal regulations governing the transportation of explosives.
 - (c) No person shall smoke, or carry matches or any other flame-producing device, nor shall firearms or loaded cartridges be carried while in or near a motor vehicle or conveyance transporting explosives.
- * (d) Explosives, blasting agents, and blasting supplies shall not be transported with other materials or cargoes. Blasting caps and detonators shall not be transported in the same vehicle with other explosives unless the provisions of the IME Safety Publication No. 22, "Recommendations for the Safe Transportation of Detonators in a Vehicle with other Explosive Materials," which is incorporated herein by reference including subsequent amendments and editions, are followed.
- (e) Vehicles used for transporting explosives shall be strong enough to carry the load without difficulty, and shall be in good mechanical condition.
- * (f) When explosives are transported by a vehicle with an open body, an ATF Type 2, ATF Type 3, IME 22 or original manufacturer's container shall be securely attached to the vehicle to contain the cargo.
- (g) All vehicles used for the transportation of explosives shall have tight floors and any exposed spark-producing metal on the inside of the body shall be covered with wood, or other nonsparking material, to prevent contact with containers of explosives.
- * (h) Every motor vehicle or conveyance used for transporting explosives shall be marked or placarded on both sides, the front, and the rear with the word "Explosives" in red letters, not less than 4 inches in height, on white background. The motor vehicle or conveyance may also display, in such a manner that it will be readily visible from all directions, a red flag 18 inches by 30 inches, with the word "Explosives" painted, stamped, or sewed thereon, in white letters, at least 6 inches in height.
- * (i) Each vehicle used for transportation of explosives shall be equipped with a fully charged fire extinguisher, in good condition (as described in 29 CFR 1926.150). An extinguisher, approved by a nationally recognized testing laboratory, of not less than 10-ABC rating will meet the minimum requirement. The driver shall be trained in the use of the extinguisher on the vehicle.
- * (j) Motor vehicles or conveyances carrying explosives or blasting agents, shall not be taken inside a garage or shop for repairs or servicing.
- (k) No motor vehicle transporting explosives shall be left unattended.
- * (l) In order to prevent explosives hazards, explosive materials shall be transported to the storage or blast site without delay.

Section 1926.903 Underground transportation of explosives:

- * (a) In order to prevent explosives hazards, all explosives or blasting agents in transit underground shall be taken to the place of use or storage without delay.
- * (b) The quantity of explosives or blasting agents taken to an underground loading area shall not exceed the amount estimated by the Blaster-in-Charge to be necessary for the blast.
 - (c) Explosives in transit shall not be left unattended.
 - (d) The hoist operator shall be notified before explosives or blasting agents are transported in a shaft conveyance.

- (e) Trucks used for the transportation of explosives underground shall have the electrical system checked weekly to detect any failures which may constitute an electrical hazard. A certification record which includes the date of the inspection; the signature of the person who performed the inspection; and a serial number, or other identifier, of the truck inspected shall be prepared and the most recent certification record shall be maintained on file.
- (f) The installation of auxiliary lights on truck beds, which are powered by the truck's electrical system, shall be prohibited.
- (g) Explosives and blasting agents shall be hoisted, lowered, or conveyed in a powder car. No other materials, supplies, or equipment shall be transported in the same conveyance at the same time.
- *(h) Vehicles containing explosive material shall be occupied only by persons necessary for handling the explosive material while in transit.
 - (i) No person shall ride in any shaft conveyance transporting explosives and blasting agents.
 - (j) No explosives or blasting agents shall be transported on any locomotive. At least two car lengths shall separate the locomotive from the powder car.
 - (k) No explosives or blasting agents shall be transported on a man haul trip.
 - (l) The car or conveyance containing explosives or blasting agents shall be pulled, not pushed, whenever possible.
- *(m) Any powder car or conveyance used for transporting explosives or blasting agents shall bear a reflecting sign on each side with the word "Explosives". The sign's letters shall be a minimum of 4 inches in height and shall be on a background of sharply contrasting color.
- *(n) Compartments for transporting detonators and explosives in the same car or conveyance shall meet IME-22 container specifications or shall be physically separated by a distance of 24 inches or by a solid partition at least 6 inches thick.
 - (o) Detonators and other explosives shall not be transported at the same time in any shaft conveyance.
 - (p) Explosives, blasting agents, or blasting supplies shall not be transported with other materials.
- *(q) Explosives or blasting agents, not in original containers, shall be placed in a nonconductive, closed container when transported manually.
 - (r) Detonators, primers, and other explosives shall be carried in separate containers when transported manually.

Section 1926.904 Storage of explosives and blasting agents:

- *(a) Explosives and blasting agents shall be stored in magazines or containers that meet the applicable provisions of the regulations contained in 27 CFR Part [555], Commerce in Explosives.
- *(b) Blasting caps and other detonators shall not be stored in the same magazine or container with other explosives or blasting agents. Surplus primers shall be disassembled and components stored separately.
- *(c) Smoking and open flames shall not be permitted within 50 feet of explosives, detonators, or blasting agents storage.
- *(d) No explosives or blasting agents shall be permanently stored in any underground operation until the operation has at least two modes of exit.
- *(e) Permanent underground explosive materials storage shall be at least 300 feet from any shaft, adit, or active underground working area.
- *(f) Permanent underground explosive materials storage containing detonators shall not be located closer than 50 feet to any storage containing other explosives or blasting agents.

Section 1926.905 Loading of explosives or blasting agents:

- *(a) Procedures that permit safe and efficient loading shall be established by the Blaster-in-Charge or the employer before loading is started.
- *(b) Drill holes shall be sufficiently large to admit easy insertion of the cartridges of explosives.

- * (c) Tamping shall be done only with non-metal, non-sparking tamping poles without exposed metal parts, except that nonsparking metal connectors may be used for jointed poles. Violent tamping shall be prohibited. The primer shall never be tamped.
- * (d) No holes shall be loaded except those to be fired in the next round of blasting. After loading, remaining explosives and detonators shall be promptly moved to a safe location and attended or stored pursuant to ATF storage requirements contained in 27 CFR Part [555].
- * (e) Drilling shall not be started until all visible butts of old holes are examined for unexploded charges, and if any are found, they shall be disposed of in accordance with §1926.911, before work proceeds.
 - (f) No person shall be allowed to deepen drill holes which have contained explosives or blasting agents.
 - (g) No explosives or blasting agents shall be left unattended at the blast site.
- * (h) Machines, personnel and tools not required for the blasting operation shall be removed from the blast site before explosives are removed from storage or transportation vehicles. Blasting operation related vehicles or equipment shall not be driven over, or near enough to, explosive material or initiation systems to come into contact with the explosive material or initiation systems. Equipment not needed for the final blast shall not be operated within 50 feet of loaded holes.
- * (i) During loading the only activity permitted within the blast site shall be that required to successfully and safely load the hole.
- * (j) Powerlines and portable electric cables for equipment being used shall be kept a safe distance from explosives or blasting agents. The blaster shall assure that cables in the proximity of loaded holes are deenergized and locked out. Additionally, when using electric detonators, the provisions of §1926.906(b) apply.
- * (k) Holes shall be checked prior to loading to determine depth and conditions. Only those holes determined by the Blaster-in-Charge to be satisfactory shall be loaded.
- * (l) When loading a line of holes with more than one loading crew, the crews shall be separated by practical distance consistent with safe and efficient operation and supervision of crews.
- * (m) No explosive shall be loaded or used underground in the presence of combustible gases or combustible dusts, unless the work is performed in accordance with the Mine Safety and Health Administration (MSHA) standards at 30 CFR 75 related to such environments, which are incorporated herein by reference, including subsequent amendments and editions, and unless the explosives have been approved as permissible explosives for use in gassy or dusty environments by MSHA.
- * (n) No explosives other than those in IME Fume Class 1 shall be used. However, explosives complying with the requirements of IME Fume Class 2 and IME Fume Class 3 may be used if adequate ventilation has been provided to prevent explosive or hazardous substance hazards to employees.
 - (o) All blast holes in open work shall be stemmed to the collar or to a point which will confine the charge.
 - (p) Warning signs, indicating a blast area, shall be maintained at all approaches to the blast area. The warning sign lettering shall not be less than 4 inches in height on a contrasting background.
- * (q) A bore hole shall never be sprung when there is a risk of a premature detonation of a loaded hole.
 - (r) Drill holes which have been sprung or chambered, and which are not water-filled, shall be allowed to cool before explosives are loaded.
- * (s) Areas in which loading is suspended or loaded holes are awaiting firing shall be attended, and barricaded, posted, or flagged as needed to guard against unauthorized entry or initiation.
- * (t) The blaster shall keep an accurate, up-to-date record of explosives, blasting agents, and blasting supplies used in each blast and shall keep an accurate running inventory of all explosives and blasting agents in the blaster's custody.
- * (u) When loading blasting agents pneumatically over electric detonators, semiconductive delivery hose shall be used and the equipment shall be bonded and grounded.

- *(v) Primers shall be made up just before their time of use and at the point of use.
- *(w) Holes shall not be drilled in a manner that disturbs or intersects a loaded hole.

Section 1926.906 Initiation of explosive charges—electric blasting:

- *(a) Electric detonators shall not be used where sources of extraneous electricity make the use of electric detonators dangerous. Except during testing, electronic detonator leg wires shall be kept short-circuited (shunted) until they are connected into the circuit for firing.
- *(b) If the presence of extraneous electricity is possible, the blaster shall conduct a stray current survey. No holes shall be loaded using electric detonators until the danger of extraneous electricity is eliminated.
- *(c) In any single blast using electric detonators, all detonators shall be of the same style or function, and of the same manufacture.
- *(d) Electric initiation shall be carried out by using blasting machines or power circuits in accordance with the manufacturer's recommendations.
- *(e) When firing a circuit of electric detonators, an adequate quantity of delivered current must be available, in accordance with the manufacturer's recommendations.
 - (f) Connecting wires and lead wires shall be insulated single solid wires of sufficient current-carrying capacity.
 - (g) Bus wires shall be solid single wires of sufficient current-carrying capacity.
- *(h) When firing electrically, the insulation on all firing lines shall be in good condition and shall be adequate to prevent voltage leaks.
- *(i) A power circuit used for firing electric detonators shall not be grounded.
 - (j) In underground operations when firing from a power circuit, a safety switch shall be placed in the permanent firing line at intervals. This switch shall be made so it can be locked only in the "Off" position and shall be provided with a short-circuiting arrangement of the firing lines to the cap circuit.
- *(k) In underground operations there shall be a "lightning" gap of at least 15 feet in the firing system ahead of the main firing switch; that is, between this switch and the source of power. This gap shall be bridged by a flexible jumper cord just before firing the blast.
 - (l) When firing from a power circuit, the firing switch shall be locked in the open or "Off" position at all times, except when firing. It shall be so designed that the firing lines to the cap circuit are automatically short-circuited when the switch is in the "Off" position. Keys to this switch shall be entrusted only to the blaster.
- (m) Blasting machines shall be in good condition and the efficiency of the machine shall be tested periodically to make certain that it can deliver power at its rated capacity.
- *(n) When firing with blasting machines, the connections shall be made as recommended by the manufacturer of the electric detonators used.
- *(o) The number of electric detonators connected to a blasting machine shall not be in excess of its rated capacity. A series circuit shall contain no more detonators than the limits recommended by the manufacturer of the electric detonators in use.
- *(p) A blaster shall be in charge of the blasting machines.
- *(q) A blaster shall test blasting circuits for:
 - *(1) Continuity of electric detonator in the blast hole prior to stemming and connection of the blasting line.
 - *(2) Resistance of individual series or the resistance of multiple balanced series to be connected in parallel prior to their connection to the blasting line.
 - *(3) Continuity of blasting lines prior to the connection of electric detonator series.
 - *(4) Total blasting circuit resistance prior to connecting to the power source. A blasting galvanometer, or other instrument specifically designed for testing blasting circuits, shall be used to conduct these tests.

- * (r) Whenever the possibility exists that a leading line or blasting wire might be thrown over a live powerline by the force of an explosion, the total length of wires shall be kept too short to hit the lines, or the wires shall be securely anchored to the ground. If neither of these requirements can be satisfied, a nonelectric system shall be used.
- * (s) The blaster shall assure that all connections are made from the bore hole back to the source of firing current, and that the leading wires remain shorted, except during testing, and not connected to the blasting machine or other source of current until the blast is to be fired. Only the blaster, or a qualified person (as described in §1926.900(a) and §1926.901) under the direct control of the blaster, shall make lead wire connections or fire the shot.
- (t) After firing an electric blast from a blasting machine, the leading wires shall be immediately disconnected from the machine and short-circuited.

Section 1926.907 Use of safety fuse:

- * (a) A safety fuse that has been hammered or injured in any way shall not be used.
- (b) The hanging of a fuse on nails or other projections which will cause a sharp bend to be formed in the fuse is prohibited.
- (c) Before capping safety fuse, a short length shall be cut from the end of the supply reel so as to assure a fresh cut end in each blasting cap.
- * (d) Only a cap crimper shall be used for attaching blasting caps to safety fuse. Crimpers shall be kept in good repair and accessible for use.
- (e) No unused cap or short capped fuse shall be placed in any hole to be blasted; such unused detonators shall be removed from the working place and destroyed.
- (f) No fuse shall be capped, or primers made up, in any magazine or near any possible source of ignition.
- (g) No one shall be permitted to carry detonators or primers of any kind on his person.
- * (h) Safety fuses of at least the following minimum lengths shall be used:
 - * (1) At least a 36-inch length for 40-second-per-foot safety fuse and
 - * (2) At least a 48-inch length for 30-second-per-foot safety fuse.
- * (i) At least two people shall be present when multiple cap and fuse blasting is done by hand lighting methods.
- (j) Not more than 12 fuses shall be lighted by each blaster when hand lighting devices are used. However, when two or more safety fuses in a group are lighted as one by means of igniter cord, or other similar fuse-lighting devices, they may be considered as one fuse.
- (k) The so-called “drop fuse” method of dropping or pushing a primer or any explosive with a lighted fuse attached is forbidden.
- (l) Cap and fuse shall not be used for firing mudcap charges unless charges are separated sufficiently to prevent one charge from dislodging other shots in the blast.
- (m) When blasting with safety fuses, consideration shall be given to the length and burning rate of the fuse. Sufficient time, with a margin of safety, shall always be provided for the blaster to reach a place of safety.

Section 1926.908 Use of detonating cord and shock tube:

- * (a) A detonating cord consistent with the type and physical condition of the bore hole and stemming and the type of explosives shall be used.
- * (b) Detonating cord shall be handled and used in the same manner as other explosives.
- (c) The line of detonating cord extending out of a bore hole or from a charge shall be cut from the supply spool before loading the remainder of the bore hole or placing additional charges.
- * (d) Detonating cord shall be handled and used with care to avoid damaging or severing the cord during and after loading and hooking-up. Shock tube shall never be pulled, stretched, kinked, twisted, mashed or abused in any way which could cause the tube to break or otherwise malfunction.

- *(e) Detonating cord connections, shock tube connections and splices shall be competent and positive in accordance with the manufacturer’s recommendations. Knot-type or other cord-to-cord connections shall be made only with detonating cord in which the explosive core is dry. Down-the-hole shock tube splices are prohibited.
- (f) All detonating cord trunklines and branchlines shall be free of loops, sharp kinks, or angles that direct the cord back toward the oncoming line of detonation.
- *(g) All detonating cord connections, shock tube connections and splices shall be inspected before firing the blast.
- *(h) When detonating cord or shock tube millisecond-delay connectors or short-interval-delay electric detonators are used with detonating cord or shock tube, the practice shall conform strictly to the manufacturer’s recommendations.
- *(i) When connecting a detonator to detonating cord or shock tube, the detonator shall be taped or otherwise attached securely along the side or the end of the detonating cord, with the end of the detonator containing the explosive charge pointed in the direction in which the detonation is to proceed.
- (j) Detonators for firing the trunkline shall not be brought to the loading area nor attached to the detonating cord until everything else is in readiness for the blast.
- *(k) Shock tube shall not be connected to the initiation device until the blast is to be fired.

Section 1926.909 Firing the blast:

- *(a) The Blaster-in-Charge shall establish a code of blasting signals and all blast site employees shall familiarize themselves with and conform to the code. As a minimum, the code shall:
 - *(1) contain audible pre-blast and audible all clear signals, and
 - *(2) contain an emergency method for guards, flagmen, or other authorized employees to signal “do not fire”, and
 - *(3) prohibit sounding of the all clear signal until the blaster has checked the blast site for misfires. Table U-1 is an example of a code of blasting signals that would meet these requirements. Further, the Blaster-in-Charge shall require the placement of Danger signs and posting of the blasting signals when personnel not associated with the blasting operation are within the blast area.
- *(b) Before a blast is fired, the Blaster-in-Charge shall make certain that all surplus explosives are in an area meeting the ATF explosive storage requirements contained in 27 CFR [555] and that all persons are at a safe distance, or under sufficient cover.
- *(c) Flagmen shall be safely stationed on highways which pass through the blast area so as to stop traffic during blasting.
- *(d) The Blaster-in-Charge shall fix the time of blasting.
- *(e) Before firing an underground blast, warning shall be given, and all possible entries into the blast area, and any entrances to any working place where a drift, raise, or other opening is about to hole through, shall be carefully guarded to prevent entry into the area. The Blaster-in-Charge shall make sure that all surplus employees have been removed from the blast area and that all personnel are out of the blast area.

TABLE U-1

WARNING SIGNAL	A 1-minute series of long blasts 5 minutes prior to blast signal.
BLAST SIGNAL	A series of short blasts 1 minute prior to the shot.
ALL CLEAR SIGNAL	A prolonged blast following the inspection of blast area.

Section 1926.910 Inspection after blasting:

- (a) Immediately after the blast has been fired, the firing line shall be disconnected from the blasting machine, or where power switches are used, they shall be locked open or in the off position.
- *(b) Sufficient time shall be allowed, not less than 15 minutes in tunnels, for the smoke and fumes to dissipate before returning to the blast site. Subsequently, the blaster shall inspect the blast site and surrounding rubble for signs of misfires. If a misfire is found, employee access to the blast area shall be controlled pursuant to §1926.911. Where fumes, fire, or dust are a potential hazard (e.g., in tunnels), the muck pile shall be wetted down prior to general employees returning to the blast site.

Section 1926.911 Misfires:

- * (a) If a misfire is found, the Blaster-in-Charge shall invoke sufficient safeguards to exclude all employees from the potential blast area.
- * (b) No work shall be done except that necessary to remove the hazard of the misfire. Only those employees necessary to do the work shall enter the potential blast area. Only the Blaster-in-Charge, and the absolute minimum number of competent, personnel (as defined in 29 CFR 1926 Subparts L and P), necessary to assess the situation shall approach the hole to inspect the misfire.
- * (c) The Blaster-in-Charge shall determine the safest steps for removing the hazard of the misfire. During development and implementation of these steps, the Blaster-in-Charge shall comply with the manufacturer's recommendations. Further, the guidelines of the Safety in the Transportation, Storage, Handling and Use of Explosive Materials, IME Safety Library Publication No. 17, which is incorporated herein by reference, including any subsequent amendments and editions, shall be utilized.
- * (d) If there are any misfires while using safety fuse and blasting cap, all employees shall remain out of the potential blast area for at least 30 minutes. If electric detonators, shock tube, gas tube or detonating cord systems or materials were used and a misfire occurred, the waiting period may be reduced to 15 minutes. In either case, the Blaster-in-Charge shall assess the circumstances and invoke a safe waiting period before allowing any personnel to enter the potential blast area. All lines shall be carefully traced and a search made for unexploded charges.
- * (e) No drilling, digging, or picking shall be permitted until all misfires have been detonated or the Blaster-in-Charge approves the work.

Section 1926.912 Underwater blasting:

- * (a) In underwater blasting, no shot shall be fired without the approval of the Blaster-in-Charge.
- (b) Loading tubes and casings of dissimilar metals shall not be used because of possible electric transient currents from galvanic action of the metals and water.
- * (c) Only water-resistant detonators and detonating cords shall be used for all marine blasting. Loading shall be done through a nonsparking loading tube when tube is necessary.
- * (d) No blast shall be fired while any vessel under way is closer than 1,500 feet to the blast site. Those on board vessels or craft moored or anchored within 1,500 feet shall be notified before a blast is fired. Note: The warning signals and personnel safety provisions of §1926.909 also apply.
- (e) No blast shall be fired while any swimming or diving operations are in progress in the vicinity of the blasting area. If such operations are in progress, signals and arrangements shall be agreed upon to assure that no blast shall be fired while any person is in the water.
- (f) Blasting flags shall be displayed.
- * (g) The storage and handling of explosives aboard vessels used in underwater blasting operations shall be in accordance with the provisions of this Standard on handling and storing explosives.
- * (h) Prior to firing the blast, the blaster shall determine the method(s) that will be used for detecting misfires and take preparatory steps (e.g., noting obvious indications of misfire, attaching float(s) that will be released by the firing, staging underwater cameras, or other appropriate means). Misfires shall be handled in accordance with the requirements of §1926.911.

Section 1926.913 Blasting in excavation work under compressed air:

- (a) Detonators and explosives shall not be stored or kept in tunnels, shafts, or caissons. Detonators and explosives for each round shall be taken directly from the magazines to the blasting zone and immediately loaded. Detonators and explosives left over after loading a round shall be removed from the working chamber before the connecting wires are connected up.
- * (b) When detonators or explosives are brought into an air lock, the only employees who shall be permitted to enter the airlock are the powderman, blaster, lock tender and the employees necessary for carrying the detonators or explosives. No other material, supplies, or equipment shall be locked through with the explosives.

- (c) Detonators and explosives shall be taken separately into pressure working chambers.
- *(d) See §1926.900(a) and §1926.901. [*1926.900(a) The employer shall permit only persons qualified pursuant to §1926.901 to handle and use explosives. A blaster shall be in charge of each blasting operation; hereafter, referred to as the Blaster-in-Charge.]
- (e) All metal pipes, rails, air locks, and steel tunnel lining shall be electrically bonded together and grounded at or near the portal or shaft, and such pipes and rails shall be cross-bonded together at not less than 1,000-foot intervals throughout the length of the tunnel. In addition, each low air supply pipe shall be grounded at its delivery end.
- *(f) The explosives suitable for use in wet holes shall be water-resistant and shall be IME Fume Class 1.
- (g) When tunnel excavation in rock face is approaching mixed face, and when tunnel excavation is in mixed face, blasting shall be performed with light charges and with light burden on each hole. Advance drilling shall be performed as tunnel excavation in rock face approaches mixed face, to determine the general nature and extent of rock cover and the remaining distance ahead to soft ground as excavation advances.

Section 1926.914 Definitions applicable to this subpart:

- *(a) “American Table of Distances” (also known as Quantity Distance Tables)—the current edition of the American Table of Distances for Storage of Explosives approved by the Institute of the Makers of Explosives.
- *(b) “Approved storage facility”—A facility for the storage of explosive materials conforming to the requirements of this part and covered by a license or permit issued under authority of the Bureau of Alcohol, Tobacco and Firearms. (See 27 CFR Part [555].)
- *(c) “Blast area”—The area within the influence of flying debris, gases, and concussion from an explosion that may cause injury to property or persons.
- (d) “Blaster”—The person or persons authorized to use explosives for blasting purposes and meeting the qualifications contained in §1926.901.
- *(e) “Blasting agent”—A blasting agent is a mixture consisting of a fuel and oxidizer used for blasting where the finished (mixed) product cannot be detonated with a No. 8 test blasting cap when confined.
- (f) “Blasting cap”—A metallic tube closed at one end, containing a charge of one or more detonating compounds, and designed for and capable of detonation from the sparks or flame from a safety fuse inserted and crimped into the open end.
- (g) “Block holing”—The breaking of boulders by firing a charge of explosives that has been loaded in a drill hole.
- (h) “Conveyance”—Any unit for transporting explosives or blasting agents, including but not limited to trucks, trailers, rail cars, barges, and vessels.
- (i) “Detonating cord”—A flexible cord containing a center core of high explosives which when detonated, will have sufficient strength to detonate other cap-sensitive explosives with which it is in contact.
- *(j) “Detonator”—Blasting caps, electric blasting caps, electric delay blasting caps, and non-electric delay blasting caps.
- *(k) “Electric detonator”—A detonator designed for and capable of detonation by means of an electric current.
- *(l) “Electric blasting circuitry”
 - *(1) Bus wire.—An expendable wire, used in parallel or series, in parallel circuits, to which are connected the leg wires of electric detonators.
 - *(2) Connecting wire.—An insulated expendable wire used between electric detonators and the leading wires or between the bus wire and the leading wires.
 - *(3) Lead wire.—An insulated wire used between the electric power source and the electric detonator circuit.
 - *(4) Permanent firing line.—A permanently mounted insulated wire used between the electric power source and the electric detonator circuit.

- * (m) “Electric delay detonators”—Detonators designed to detonate at a predetermined period of time after energy is applied to the ignition system.
- * (n) “Explosives”
- * (1) Any chemical compound, mixture, or device, the primary or common purpose of which is to function by explosion; that is, with substantially instantaneous release of gas and heat, unless such compound, mixture or device is otherwise specifically classified by the U.S. Department of Transportation (USDOT).
 - * (2) Any material designated as a Class 1 Explosive by the USDOT. Under the USDOT classification system, Class 1 materials are divided into the following six divisions:
 - Division 1.1—Mass exploding (Formerly Class A)
 - Division 1.2—Projection hazard (Formerly Class A or B)
 - Division 1.3—Fire hazard, minor blast or projection hazard (Formerly Class B)
 - Division 1.4—Minor explosion hazard, not mass detonating (Formerly Class C)
 - Division 1.5—Insensitive explosives, very little probability of initiation or transition from burning to detonation during transport. (Formerly Blasting Agent).
 - Division 1.6—Insensitive articles which do not mass detonate. (No commercial explosives in this division)
 - (3) Classification of explosives by the U.S. Department of Transportation is as follows:
 - Class A Explosives. Possessing detonating hazard, such as dynamite, nitroglycerin, picric acid, lead azide, fulminate of mercury, black powder, blasting caps, and detonating primers.
 - Class B Explosives. Possessing flammable hazard, such as propellant explosives, including some smokeless propellants.
 - Class C Explosives. Include certain types of manufactured articles which contain Class A or Class B explosives, or both, as components, but in restricted quantities.
- (o) “Fuse lighters”—Special devices for the purpose of igniting safety fuse.
- * (p) “Magazine”—Any container, building or structure, other than an explosives manufacturing building, used for the storage of explosives.
- (q) “Misfire”—An explosive charge which failed to detonate.
- (r) “Mud-capping” (sometimes known as bulldozing, adobe blasting, or dobying). The blasting of boulders by placing a quantity of explosives against a rock, boulder, or other object without confining the explosives in a drill hole.
- * (s) “Non-electric delay detonator”—A detonator with an integral delay element in conjunction with and capable of being detonated by a detonation impulse or signal from miniaturized detonating cord or shock tube.
- (t) “Primary blasting”—The blasting operation by which the original rock formation is dislodged from its natural location.
- (u) “Primer”—A cartridge or container of explosives into which a detonator or detonating cord is inserted or attached.
- * (v) “Safety fuse”—A flexible cord containing an internal burning medium by which fire is conveyed at a continuous and uniform rate for the purpose of firing detonators.
- (w) “Secondary blasting”—The reduction of oversize material by the use of explosives to the dimension required for handling, including mudcapping and blockholing.
- * (x) “Stemming”—An inert incombustible material or device used to confine or separate explosives in a drill hole, or to cover explosives in mud-capping.
- (y) “Springing”—The creation of a pocket in the bottom of a drill hole by the use of a moderate quantity of explosives in order that larger quantities or explosives may be inserted therein.
- * (z) “Water-based explosives”—Explosive materials that contain substantial quantities of water in their formulation. They may be bulk or packaged products and may be cap sensitive or non cap sensitive (blasting agents). Examples of water-based explosives include emulsions, slurries and water gels.

- (aa) “Semiconductive hose”—A hose with an electrical resistance high enough to limit flow of stray electric currents to safe levels, yet not so high as to prevent drainage of static electric charges to ground; hose of not more than 2 megohms resistance over its entire length and of not less than 5,000 ohms per foot meets the requirement.
- *(bb) “Appropriate authorities” or “Authorities having jurisdiction”—local, State and federal law enforcement authorities required to be notified by law or permit or the Rules in this Standard.
- *(cc) “Blaster-in-Charge”—The person who meets the qualifications contained in §1926.901 and who is authorized to oversee the blasting operations and to use explosives for blasting purposes.
- *(dd) “Blast site”—The area where explosive material is handled during loading, including the perimeter formed by loaded blast holes, and 50 feet (15.2 meters) in all directions from loaded holes. A minimum distance of 30 feet (9.1 meters) may replace the 50 feet (15.2 meters) if the perimeter of loaded holes is demarcated with a barrier. The 50 feet (15.2 meters) and alternative 30 feet (9.1 meters) requirements also apply in all directions along the full depth of the holes. In underground mines, 15 feet of solid rib or pillar may be substituted for the 50 feet distance.
- *(ee) Shock tube”—A small diameter plastic tube used for initiating detonators. Shock tube contains a limited amount of reactive material so that the energy transmitted through the tube by means of detonation wave is guided through, and confined within, the walls of the tube.
- *(ff) “Blasting operation”—Any work or activities associated with the use of explosives on a blast site.
- *(gg) “Attended”—Presence of an individual or continuous monitoring to prevent unauthorized entry or access.

Glossary

American Table of Distances. The current edition of “The American Table of Distances for Storage of Explosives,” published by the Institute of Makers of Explosives.

Approved. Denotes testing and acceptance for a specific purpose by a nationally recognized agency.

Approved Storage Facility. A place where explosive materials are stored, consisting of one or more approved magazines, conforming to the requirements of regulatory agencies.

Barricaded. An obstruction to prevent the passage of flying materials.

Blasting Agent. Any material or mixture, consisting of fuel and oxidizer, that is intended for blasting and not otherwise defined as an explosive, if the finished product, as mixed, cannot be detonated by means of a No. 8 test blasting cap.

Booster. Any unit of explosive or blasting agent used for the purpose of perpetrating or intensifying an initial detonation.

Detonating Cord. A flexible cord containing a solid core of high explosives.

Detonator. Any device containing a detonating charge that is used to initiate an explosive and includes, but is not limited to, blasting caps, electrical blasting caps, and nonelectric instantaneous or delay blasting caps.

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

Hardwood. Oak, maple, ash, hickory or any other hardwood free from loose knots, spaces or similar defects.

Highway. Any public street, public alley or public road.

Inhabited Building. Any building regularly occupied in whole or in 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 occupied in connection with the manufacture, transportation, storage or use of explosive materials.

Magazine. Any building or structure used for the storage of explosives, blasting agents or detonators.

Natural Barricade. Natural features of the ground, such as hills or timber of sufficient density that the surrounding exposures which require protection cannot be seen from the magazine when the trees are bare of leaves.

Plywood. Exterior construction grade (laminated wood) plywood.

Railway. Any steam, electric, or other railroad or railway that carries passengers for hire.

Safety Fuse. A flexible cord containing an internal burning medium by which fire is conveyed at a continuous and uniform rate for the purpose of firing blasting caps or a black powder charge.

Softwood. Fir, pine or other softwood, free from loose knots, spaces or similar defects.

Water Gels. Explosives or blasting agents that contain a substantial proportion of water.

References

Institute of Makers of Explosives. *Construction Guide for Storage Magazines*. Safety Library Publication No. 1. Washington, D.C.: IME.

Institute of Makers of Explosives. *The American Table of Distances*. Safety Library Publication No. 2. Washington D.C.: IME.

U.S. Department of Labor, Mine Safety and Health Administration. Title 30, Code of Federal Regulations, Part 56, Subpart E. Surface Metal and Nonmetal Mining and Milling Operations.

U.S. Department of the Treasury, Bureau of Alcohol, Tobacco and Firearms. Title 18, United States Code, Chapter 40. Subpart K. Storage.

The following industry guides are available from the N.C. Department of Labor's Occupational Safety and Health Division:

- #1. *A Guide to Safety in Confined Spaces*
- #2. *A Guide to Procedures of the N.C. Safety and Health Review Commission* (downloadable PDF **ONLY**)
- #3. *A Guide to Machine Safeguarding*
- #4. *A Guide to OSHA in North Carolina*
- #5. *A Guide for Persons Employed in Cotton Dust Environments* (downloadable PDF **ONLY**)
- #6. *A Guide to Lead Exposure in the Construction Industry* (downloadable PDF **ONLY**)
- #7. *A Guide to Bloodborne Pathogens in the Workplace*
- #8. *A Guide to Voluntary Training and Training Requirements in OSHA Standards*
- #9. *A Guide to Ergonomics*
- #10. *A Guide to Farm Safety and Health* (downloadable PDF **ONLY**)
- #11. *A Guide to Radio Frequency Hazards With Electric Detonators* (downloadable PDF **ONLY**)
- #12. *A Guide to Forklift Operator Training*
- #13. *A Guide to the Safe Storage of Explosive Materials* (downloadable PDF **ONLY**)
- #14. *A Guide to the OSHA Excavations Standard*
- #15. *A Guide to Developing and Maintaining an Effective Hearing Conservation Program*
- #16. *A Guide to Construction Jobsite Safety and Health/Guía de Seguridad y Salud para el Trabajo de Construcción*
- #17. *A Guide to Asbestos for Industry*
- #18. *A Guide to Electrical Safety*
- #19. *A Guide to Occupational Exposure to Wood, Wood Dust and Combustible Dust Hazards* (downloadable PDF **ONLY**)
- #20. *A Guide to Cranes and Derricks*
- #23. *A Guide to Working With Electricity*
- #25. *A Guide to Personal Protective Equipment*
- #26. *A Guide to Manual Materials Handling and Back Safety*
- #27. *A Guide to the Control of Hazardous Energy (Lockout/Tagout)*
- #28. *A Guide to Eye Wash and Safety Shower Facilities*
- #29. *A Guide to Safety and Health in Feed and Grain Mills* (downloadable PDF **ONLY**)
- #30. *A Guide to Working With Corrosive Substances* (downloadable PDF **ONLY**)
- #31. *A Guide to Formaldehyde* (downloadable PDF **ONLY**)
- #32. *A Guide to Fall Prevention in Industry*
- #32s. *Guía de Prevención de las Caídas en la Industria (Spanish version of #32)*
- #33. *A Guide to Office Safety and Health* (downloadable PDF **ONLY**)
- #34. *A Guide to Safety and Health in the Poultry Industry* (downloadable PDF **ONLY**)
- #35. *A Guide to Preventing Heat Stress*
- #38. *A Guide to Safe Scaffolding*
- #40. *A Guide to Emergency Action Planning*
- #41. *A Guide to OSHA for Small Businesses in North Carolina*
- #41s. *Guía OSHA para Pequeños Negocios en Carolina del Norte (Spanish version of #41)*
- #42. *A Guide to Transportation Safety*
- #43. *A Guide to Combustible Dusts*
- #44. *A Guide to Respiratory Protection*

Occupational Safety and Health (OSH) Sources of Information

You may call 1-800-NC-LABOR (1-800-625-2267) to reach any division of the N.C. Department of Labor; or visit the NCDOL home page on the World Wide Web: <http://www.nclabor.com>.

N.C. Occupational Safety and Health Division

Mailing Address:
1101 Mail Service Center
Raleigh, NC 27699-1101
Local Telephone: (919) 807-2900 Fax: (919) 807-2856

Physical Location:
111 Hillsborough St.
(Old Revenue Building, 3rd Floor)

For information concerning education, training and interpretations of occupational safety and health standards contact:

Education, Training and Technical Assistance Bureau

Mailing Address:
1101 Mail Service Center
Raleigh, NC 27699-1101
Telephone: (919) 807-2875 Fax: (919) 807-2876

Physical Location:
111 Hillsborough St.
(Old Revenue Building, 4th Floor)

For information concerning occupational safety and health consultative services and safety awards programs contact:

Consultative Services Bureau

Mailing Address:
1101 Mail Service Center
Raleigh, NC 27699-1101
Telephone: (919) 807-2899 Fax: (919) 807-2902

Physical Location:
111 Hillsborough St.
(Old Revenue Building, 3rd Floor)

For information concerning migrant housing inspections and other related activities contact:

Agricultural Safety and Health Bureau

Mailing Address:
1101 Mail Service Center
Raleigh, NC 27699-1101
Telephone: (919) 807-2923 Fax: (919) 807-2924

Physical Location:
111 Hillsborough St.
(Old Revenue Building, 2nd Floor)

For information concerning occupational safety and health compliance contact:

Safety and Health Compliance District Offices

Raleigh District Office (3801 Lake Boone Trail, Suite 300, Raleigh, NC 27607)

Telephone: (919) 779-8570 Fax: (919) 420-7966

Asheville District Office (204 Charlotte Highway, Suite B, Asheville, NC 28803-8681)

Telephone: (828) 299-8232 Fax: (828) 299-8266

Charlotte District Office (901 Blairhill Road, Suite 200, Charlotte, NC 28217-1578)

Telephone: (704) 665-4341 Fax: (704) 665-4342

Winston-Salem District Office (4964 University Parkway, Suite 202, Winston-Salem, NC 27106-2800)

Telephone: (336) 776-4420 Fax: (336) 776-4422

Wilmington District Office (1200 N. 23rd St., Suite 205, Wilmington, NC 28405-1824)

Telephone: (910) 251-2678 Fax: (910) 251-2654

To make an OSHA Complaint, **OSH Complaint Desk:** (919) 807-2796

For statistical information concerning program activities contact:

Planning, Statistics and Information Management Bureau

Mailing Address:
1101 Mail Service Center
Raleigh, NC 27699-1101
Telephone: (919) 807-2950 Fax: (919) 807-2951

Physical Location:
111 Hillsborough St.
(Old Revenue Building, 2nd Floor)

For information about books, periodicals, vertical files, videos, films, audio/slide sets and computer databases contact:

N.C. Department of Labor Library

Mailing Address:
1101 Mail Service Center
Raleigh, NC 27699-1101
Telephone: (919) 807-2848 Fax: (919) 807-2849

Physical Location:
111 Hillsborough St.
(Old Revenue Building, 5th Floor)

N.C. Department of Labor (Other than OSH)

1101 Mail Service Center
Raleigh, NC 27699-1101
Telephone: (919) 733-7166 Fax: (919) 733-6197