1.0. Introduction.

As an ammunition specialist, you will be responsible for the inspection and surveillance of munitions stored in a field environment. You will be the primary source to advise your commander of discrepancies, and also recommend solutions to correct deficiencies. If your job is not done properly, units in the field may not receive serviceable munitions, thereby not accomplishing their mission. In this lesson you will learn to apply field storage principles and standards.

2.0. Site Selection.

Tactical considerations and additional factors may not permit the selection of a site location having all of the features required. In some cases higher headquarters may have selected a particular location for establishment of the storage point. Aerial photos and maps are good sources for an initial decision for selecting a site for an ammunition supply point (ASP), corps storage area (CSA), or theater storage area (TSA), but before a final decision is made, you should conduct a physical reconnaissance. When selecting a site, there is a need for selecting a primary and an alternate site.

2.1. Primary Site.

When selecting a primary site, the following criteria are important. Try to incorporate as many of them into the site as possible. They are listed in order of importance.

- The area is easy to get to by the units supported.
- The area is near the main supply route (MSR) with access roads into the ASP.
- A roadnet within the site allows vehicles to travel under all weather conditions and requires little or no maintenance.
- The ground is as level as possible. It must be able to support the weight of the munitions as well as be able to drain off quickly. This also makes it easier for MHE to operate.
- There should be natural barricades that can separate field storage units (FSUs) and categories.
- The site should be isolated from hospitals and important military installations.
- The site should be unpopulated and downwind of any populated areas if any hazardous chemicals are stored.
- There should be an adequate water supply for fire fighting and bivouacking.

- There should be a minimum of flammable vegetation.

- There should be features, including natural concealment, that make the site easy to defend against enemy ground attack.

- The area should be large enough to spread out munitions stocks. This protects them against artillery or air attack and makes it easy to expand.

Because of tactical conditions and other influencing factors, an ASP site may not have all ideal features. In fact, higher headquarters may dictate where an ASP will be.

2.2. Alternate Site.

Pick an alternate ASP site close to the primary one, because there maybe some other unit already in the primary site. Another situation to be considered is that the enemy may attack with artillery, mortar fire, or chemical agents as soon as the primary ASP is set up, and the unit may have to evacuate fast. Finally, some units have used their alternate sites as regular ASPs when their stockage objective expanded far more then they expected.

3.0. Storage Planning.

After the site and the system of storage is known, lay out the site, draw up a storage plan and a destruction plan, and write SOPs for each ASP operation IAW AMC Regulation 385-1 and TM 9-1300-206, Chapter 2. A good plan makes a smooth-flowing, safe operation possible. Organize the ASP into areas with specific functions. This makes it easier to do the mission and isolate hazards.

3.1. Storage Planning Considerations.

Make sure the storage plan agrees with the area layout plan. Use the following checklist when creating the storage plan.

- What is the maximum tonnage expected to be in each storage category?

- What are the expected average daily receipts and issues?

- What is the time available before first shipments of munitions arrive?

- What is the expected lifetime of the ASP?

- What is the system of storage that will be used?

- What are the physical characteristics of the terrain that can be used as natural barricades, or that deny or restrict using certain areas?
- What natural cover and concealment are there?
- What engineer construction and other required support is available and necessary?
- What are the area security problems and requirements?
- What are the special security requirements needed for classified munitions?
- What section, FSU, and stack numbering sequences are needed to be sure placement and retrieval of stocks is fast and accurate?

While the storage plan is being prepared, make sure all storage areas are clearly marked. Make sure signs are posted showing traffic direction, entrances, and exists. Draw and reproduce maps of the storage areas. Use it to direct customer units to the proper storage area. To reduce customer waiting, group munitions by combat arms. Name roads to describe the munitions stored along them, for example, Artillery Row or Tank Road.

Prepare and maintain enough directional signs, fire symbols, and FSU stack signs for two ASPs.

3.2. Adjacent Areas.

Refer to Figure 1, Typical ASP Layout, to view the location of adjacent areas.

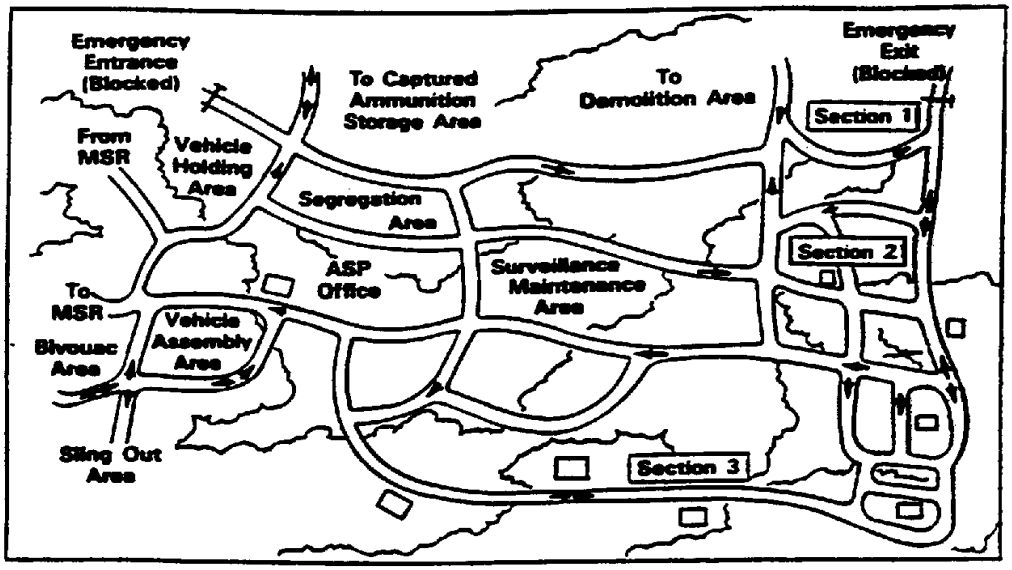
3.2.1. Captured Munitions Storage Area.

The distance from other FSUs should be at least 2400 feet. This distance is arrived at because it is the greatest distance of our most hazardous munitions items. If possible, you should segregate the types of munitions.

3.2.2. ASP Operations Center.

The ASP Operations Center should be located at the main entrance of the ASP for maximum control and service to support units.

ASP AREAs ASSOCIATED WITH UNIT RETURNS



Typical ASP Layout.

Area	Minimum Safety Distances	Purpose	Notes
ASP		The Operations Center for the ASP.	Located at main entrance to ASP for maximum control and service to supported units.
Vehicle Holding Area	Transit area, no QD applied.	A parking area for vehicles waiting to be served. Reduces traffic congestion in your storage sites.	Located near the ASP office where vehicles will not interfere with the flow of traffic.
Segregation Area	Required quantity. distances for ammo storage.	A temporary storage area for segregating hazardous ammo and ammo in mixed lots. Also used to inspect unit turn-in when not possible to inspect at time for receipt.	Unserviceable ammo should be stored by item, lot, and category and a minimum of 700 m from nearest stack of serviceable ammo.
Ammo Storage Area	Required quantity distances	For storing serviceable ammo with respect to its field storage category.	The storage area is divided into storage sections by no., FSUs by letter, and stacks by no. Example: 2D1 is Sec. 2, FSU-D, Stack 1.
Demolition Area	700 m from other areas.	For destroying unserviceable ammo.	Choose an area unusable for other purposes and cleared of vegetation.
Salvage Area	No quantity distance requirement.	For storage of nonexplosive Class V material.	An inert area for boxes, brass, etc.
Survl & Maint Area	IAW TM 9-1300-250, SB 742-1, and other applicable SBs.	To perform ammunition inspection, repack, and minor maintenance.	Depending on the life expectancy of the ASP this area may not be included.

Figure 1, Typical ASP Layout

3.2.3. Vehicle Holding Area.

Use the following checklist for inspecting the vehicle holding area.

- The holding area should be located near the ASP Office.
- There should be a parking area for vehicles waiting to be loaded.
- Vehicles will be inspected before being loaded.
- No minimum quantity distance is required.

3.2.4. Segregation Area.

Use the following checklist for inspecting the segregation area.

- There should be a temporary storage area for segregating hazardous munitions and mixed types.
- The area is being used to inspect unit turn-ins.
- Unserviceable munitions are stored by item, lot, and category.
- It is located a minimum of 700 meters from the nearest stack of serviceable munitions.

3.2.5. Demolition Area.

Use the following checklist for inspecting the demolition area.

- It is being used to destroy unserviceable munitions.
- It is an area that is unusable for anything else.
- It is located a minimum of 700 meters from other areas or storage locations.

3.2.6. Salvage Area.

You should inspect the salvage area to ensure that only non explosive Class V material is being stored. There is no minimum Q-D for the salvage area.

3.2.7. Assembly Area.

Use the following checklist for inspecting the assembly area.

- Vehicles being formed into a convoy are located in the assembly area.
- In some instances the assembly area may be consolidated with the vehicle holding area.
- Vehicles will be inspected here after loading.
- This is a transit area; there is no Q-D requirement.

3.2.8. Munitions Sling-Out Area.

Use the following checklist for inspecting the sling-out area.

- It is only used for aerial resupply.
- It is located so aircraft will not pass over storage or bivouac areas.
- It should be at least 25 meters square.
- It is located 550 meters from munitions storage and bivouac areas.

3.2.9. Bivouac Area.

Ensure that bivouac areas are only being used as living areas for ASP personnel. The bivouac area should be located as far as possible from the storage site or at least a minimum of 700 meters away.

3.2.10. Surveillance and Maintenance Area.

Use the following checklist for inspecting the surveillance and maintenance area.

- Ensure the area is only being used to perform inspection, maintenance, and repack of munitions stocks.

- The area may not be included if the life expectancy of the ASP is short term.

- The area is located a minimum of 2400 feet from any type of Class V that may be in the site.

4.0. Types of Storage Systems.

Selection of the storage system to be used should be determined by the physical characteristics of the site, location of enemy forces (either uniformed or clandestine), expected weather conditions, resource availability, and expected life of the ASP. Storage of munitions in the field should provide adequate shelter, appropriate dunnage, and adequate ventilation.

4.1. Area Storage.

Area storage should be used if the large amount of terrain required is available. In this type of storage the storage are may be divided into sections. Each section is then divided into field storage units. An FSU is a group of munitions stacks located a sufficient distance from adjacent field storage units to provide reasonable protection against the spread of fire, detonation, or contamination. Normally only one category of munitions will be stored in an FSU. The stacks of munitions are arranged in checkerboard fashion in order to obtain the maximum usage of the real estate and are spaced in accordance with quantity-distance requirements. Stacks of munitions will normally contain only one type of munitions. If more than one type of munitions is stored in a stack, the stack should be arranged so as to facilitate inventory and inspection.

4.2. Roadside Storage.

Roadside storage is the storage of explosives and munitions along the edge of roads. The stacks are spaced in accordance with quantity-distance requirements. Storage in depth offers maximum storage per mile of road front, but munitions should be accessible to conveyors, cranes, and material handling equipment. Other storage requirements are the same as for area storage.

4.3. Combination (Area and Roadside Storage).

This system is usually used to compensate for the bad points of both systems. This system allows for the most effective use of the existing road network and a limited area. Storage requirements are the same for an area storage or roadside storage site.

4.4. Modular Storage System.

This is a field storage system for storage of high explosive bombs and other similar cased class 1.1 munitions on pads within earth barricaded areas known as cells. These cells are joined to form modules (no more than 8 cells per module) and in turn modules may be arranged to form module blocks. The modular system is intended for use if the Q-D requirements of the other field storage systems cannot be met due to security, real estate, or operations limitations. The quantity of munitions stored in the cells will be based on net explosive weight rather than gross weight like other field storage systems. Each cell can contain no more than 250,000 pounds NEW. Items in each module must be compatible.

This method of storage is to be used only as an alternate solution when field storage methods for class 1.1 munitions cannot be used. It should be understood that this system does not provide the degree of protection for personnel or munitions stocks that is afforded by regular quantity-distance dispersion. The modular cell system will be employed only when approval is granted by the major command headquarters.

The use of the modular system will under no circumstances preclude adherence, in so far as possible, to other principles of munitions storage such as:

- Maximum feasible separation.
- Proper drainage.
- Dispersion of stocks within available cells to avoid complete loss of a single type munition from one explosion or fire.
- The decision to use the modular system must be made with full realization of its advantages and disadvantages over other field storage systems.

4.4.1. Advantages of Modular Storage.

The advantages of modular storage include:

- Greatly reduced real estate requirements.
- Greatly improved security with comparable forces.
- Reduced vulnerability to direct fire on munitions stocks because of the smaller area and use of barricades.
- Greatly reduced internal road net requirements.

4.4.2. Disadvantages of Modular Storage.

The disadvantages of modular storage include:

- Possibility of explosion or fire on one cell starting fire in other cells because of concentration of stocks.
- Increased vulnerability to enemy direct fire and air-dropped bombs because of concentration of stocks.
- Additional engineer support required for initial construction of modules as opposed to that required for unbarricaded open storage.

5.0. Field Storage Categories.

Storage categories are the primary groups into which munitions are segregated for storage in the field. The groupings are based on:

- How desirable it is to store components of complete rounds in adjacent stacks.
- The hazards of spreading explosions.
- The range of fragments.
- The spread of fires.
- Chemical contamination.

For field storage purposes, munitions are divided into the following field storage categories.

- **Category A.** Fixed and semi-fixed artillery munitions, except incendiary and chemical.
- **Category B.** Propelling charges, fuzes, primers, flash reducers, and separate loading artillery projectiles including HE and AP, but excluding incendiary and chemical projectiles.
- **Category C.** Mortar munitions and hand grenades, except incendiary and chemical.

- **Category D.** Pyrotechnics and chemical munitions of all types, including chemical filled rockets; gas, smoke, and incendiary bombs, gas and smoke artillery ammunition; incendiary and chemical grenades; smoke pots, VX filled mines, and bulk packed incendiary, and small arms tracer cartridges.

- **Category E.** All demolition explosives, antitank and antipersonnel mines (except VX loaded), and components such as blasting caps, firing devices, detonating cord, and safety fuse.

- **Category F.** Rockets, rocket motors, guided missiles and rifle grenades, except chemical.

- **Category G.** Air Force Class V supply - all unfuzed high explosive bombs, aircraft mines, aircraft torpedoes, and fragmentation bombs, fuzes and/or detonators for the above items; and fragmentation bomb clusters, fuzed or unfuzed. The remainder of Air Force Class V items must be stored in applicable categories.

6.0. Definitions.

In order to inspect field storage facilities you must also be knowledgeable with the following terms.

- **Dispersion.** The objective of dispersion of munitions is to minimize the loss by fire, accidental explosion, or enemy action. Each kind of munitions should be stored in two widely separated FSUs to prevent the loss of all of one FSU from handicapping military operations by the loss of the entire supply of any one item.

- **Inter-Stack Distance.** The minimum distance between the near edge of adjacent stacks and other stacks of the same FSU.

- **Inter-FSU Distance.** The distance between the nearest edge of one FSU and the nearest stack in an adjacent FSU.

- **Inter-Category Distance.** The distance from an FSU of one category to the nearest FSU of another category.

- **Optimum Safety Distance.** The limit inside of which danger of structural damage due to blast or from fall of a missile will be serious.

7.0. Inspection Procedures.

The following are some of the inspection points an inspector should be concerned with, but do not limit the inspection to only these points. Remember, the inspection is to ensure the safety of personnel and the ability to efficiently meet mission requirements.

Note: Use an ASIR to record results of inspection. (See attached ASIR)

Arrangement of ASP and supporting areas.

(1) Use map if available, otherwise, measure distances.

Note: Ensure fire breaks are in good order to prevent the spread of fire from one area to another.

(a) Segregation Area:

1 Should be stored by item, lot, and category.

2 Minimum of 700 meters from nearest stack of serviceable stack of munitions.

(b) Demolition Area: Minimum 700 meters from other areas.

(c) Salvage Area:

1 No Q-D requirements.

2 Ensure no explosive items are inadvertently stored at this location.

(d) Assembly Area:

1 No Q-D requirement.

2 Area for loaded vehicles being assembled for a convoy.

3 Can be consolidated with the vehicle holding area.

(e) Bivouac Area:

1 Should be located as far as possible from storage sites for increased safety.

2 Minimum 700 meters from munitions storage or munitions operations.

(f) Ammo Sling Out Area:

1 Locate so aircraft will not pass over storage or bivouac areas.

2 Should be minimum 25 meters square.

3 Used for limited aerial resupply.

4 Minimum 550 meters from ammo storage and bivouac areas.

(g) Surveillance and Maintenance Area:

1 All items being inspected are compatible.

2 Fire extinguishers should be in place and serviceable.

3 SOPs should be strictly adhered to.

4 Strict supervision at all times.

5 Quality control should be as high as possible.

(h) Ammunition Storage Area:

Note: All sections, FSUs, and stacks of munitions must be numbered.

1 ASPs should be divided into sections (preferably 3 sections).

2 Types of munitions should be distributed evenly in all three sections. In case of a fire, all of one size and type of munitions should not be destroyed.

3 FSUs should only contain one category of munitions.

4 FSUs will contain as many stacks as needed to store the required tonnage.

5 Stacks of munitions should contain only one type of munitions, and ideally, only one lot number of one NSN. If that is not possible, provisions must be made to inventory and inspect the munitions mixed in a stack of munitions.

6 Dunnage must be used to provide air circulation under the stacks of munitions.

7 Tarpaulin covers should be placed on stacks of munitions to provide protection from the weather elements, i.e. rain, sun, etc. Framework should be utilized to provide separation of the cover and the stack for air circulation.

8 Check serviceability of munitions using TB 9-1300-385 and periodic inspections.

(2) Inspect incoming and outgoing munitions shipments.

(3) Storage compatibility.

(4) Separation distances between all sections, FSUs, and stacks.

(5) Security.

(6) Fire fighting equipment.

(7) Ensure proper publications are on hand for operation of the ASP.

(8) Inspect for safe handling of munitions at all sites.

DATE

MAGAZINE/SITE INSPECTION REPORT
(LOCAL FORMAT AUTHORIZED)

PART 1 INSTALLATION:_____ DATE:_____
STG LOCATION:_____SECT:_____FSU:_____STACK:_____

TOTAL GROSS WEIGHT:_____ Q-D CLASS:_____ STORAGE CAT:_____
FIRE OR CHEMICAL HAZARD SYMBOL:_____

PART II

ITEM NO: | EXPLANATION (Explain UNSAT) | SAT.UNSAT | REMARKS

1. Vegetation Control
2. Firebreaks Where Required
3. Erosion Control
4. Overhead Transmission Lines
5. Housekeeping
6. Q-D Class, Exp Limits Personnel Limits Posted
7. Segregation of Lots
8. Suspended Items Identified
9. DA Form 3020-R Affixed to Each Stack
10. Stack Stability
11. Separation of Stacks by Safety Distance
12. Compliance with Q-D Limits In Stacks and FSUs
13. Suitability of Storage Buildings for Items in Storage
14. Storage Compatibility
15. Fire Symbols Posted
16. Chemical Hazard Symbols Posted

REMARKS:

8.0 Summary.

During this lesson you have learned what the minimum requirements for inspecting munitions field storage areas are. You must complete the attached practical exercise before you can complete the hands-on practical exercise on this subject during your active duty training.

(NAME) (CLASS) (DATE)

PRACTICAL EXERCISE

INSTRUCTION TO STUDENTS:

Before completing this practical exercise you should review the supplementary reading TM 9-1300-206, Section II, paragraph 4-34 through paragraph 4-54, FM 9-13, Chapter 2 and Chapter 4.

REQUIREMENTS

REQUIREMENT #1: Using the field storage designators below, identify the storage locations by stacks, FSU, etc.

(1) 2A3

(2) A3B6

(3) 1C9

ANSWER: _____

_____

REFERENCE: _____

REQUIREMENT # 2. The modular storage system has been considered as an alternate solution for your field storage activity. Using modular storage criteria, answer the following questions:

(1) What class of munitions is the modular storage system designed to be used for in field storage?

ANSWER: _____

_____

REFERENCE: _____

(2) What is the maximum authorized net explosive weight (NEW) to be stored in each cell and module?

ANSWER: _____

_____

REFERENCE: _____

(3) How is the minimum distance between the explosive stacks in each cell and the nearest stack in the adjacent module determined?

ANSWER: _____

_____

REFERENCE: _____

(4) List the four munitions storage principles that should be adhered to, in so far as possible, when the module storage system is utilized.

ANSWER: _____

_____

REFERENCE: _____

REQUIREMENT # 3: When storage space is limited, is it permissible to store serviceable captured enemy small arms munitions with serviceable United States small arms munitions if they are of the same caliber and type?

ANSWER: _____

_____

REFERENCE: _____

REQUIREMENT #4: Questions for this requirement pertain to Class V storage in field environment in either an TSA, CSA, or ASP. Find the storage category for the type of ammunition described and then use Table 4-4 to answer questions on Q-D for field storage categories.

(1) What is the field storage category assigned to 5-Inch HE rockets?

ANSWER: _____

_____

REFERENCE: _____

(2) How many FSUs are necessary for the storage of 860 short tons of 1315-00-231-4629-C445?

ANSWER: _____

_____

REFERENCE: _____

(3) What is the maximum allowable gross weight per stack when storing 1340-00-021-4480-H557? (Rocket, 66mm, HEAT, M72A2)

ANSWER: _____

_____

REFERENCE: _____

(4) What is the minimum safety distance required between an unbarricaded FSU containing Category "G" material and an FSU containing 400 gross tons of combined stored 1315-00-028-4857-C445 (105mm HE, without Fuze)?

ANSWER: _____

_____

REFERENCE: _____

(5) What is the minimum safety distance required when Category C and Category E items have been combined within the same FSU?

ANSWER: _____

_____

REFERENCE: _____

(6) What is the maximum authorized gross tonnage per individual stack unbarricaded when storing small arms munitions within an FSU devoted to the storage of Category "A" material?

ANSWER: _____

_____

REFERENCE: _____

(7) Is it permissible to store Class V bomb components such as fuzes, primers, and detonators in spaces between FSUs?

ANSWER: _____

_____

REFERENCE: _____

PART 2
QUESTIONS

1. How many days of munitions stockage level will a CSA normally maintain ?

ANSWER: _____

_____

REFERENCE: _____

2. Who has control of all division ATP's ?

ANSWER: _____

_____

REFERENCE: _____

3. Small arms munitions can be stored with almost any field storage category of munitions, What is the exception ?

ANSWER: _____

_____

REFERENCE: _____

4. What field storage category is compatible with fixed and semi-fixed smoke munitions, except WP ?

ANSWER: _____

_____

REFERENCE: _____

5. When can category C munitions be combined with category E ?

ANSWER: _____

_____

REFERENCE: _____

6. When selecting a primary site for storing any hazardous chemicals, what elements must be taken into consideration ?

ANSWER: _____

_____

REFERENCE: _____

7. How will guided missiles stored in the open be protected from the elements ?

ANSWER: _____

_____

REFERENCE: _____

8. What are the four things that should be applied to field storage in order to protect munitions from the elements ?

ANSWER: _____

_____

REFERENCE: _____

9. What height should tarpaulins (tarps) be raised off the stacks of munitions stored in the open for proper air circulation ?

ANSWER: _____

_____

REFERENCE: _____

10. What distance should a sling out area be located from munitions storage locations, working areas, and inhabited areas ?

ANSWER: _____

_____

REFERENCE: _____

11. What is the maximum weight in pounds that a cargo aircraft (C141) can be loaded with ?

ANSWER: _____

_____

REFERENCE: _____

12. What forklift truck is used in the holds of ships transporting munitions ?

ANSWER: _____

_____

REFERENCE: _____

13. What are the three storage subdivisions which provide adequate operational control and dispersion ?

ANSWER: _____

_____

REFERENCE: _____

14. May components of complete rounds be stored in the same field storage unit (FSU) ?

ANSWER: _____

_____

REFERENCE: _____

15. What distance is required between two 300 ton stacks of propelling charges in an FSU ?

ANSWER: _____

_____

REFERENCE: _____

16. In which storage category should incendiary munitions be placed ?

ANSWER: _____

_____

REFERENCE: _____

17. What points are used to measure the inter-FSU distance ?

ANSWER: _____

_____

REFERENCE: _____

18. In which field storage category should photoflash bombs be listed ?

ANSWER: _____

_____

REFERENCE: _____

19. At what distance should back and end (outside) barricades be located from pads using modular storage ?

ANSWER: _____

_____

REFERENCE: _____

20. What should the separation distance be for captured enemy munitions from other stocks and storage locations ?

ANSWER: _____

_____

REFERENCE: _____

21. When storing 100,000 lbs. NEW of munitions in a modular cell storage pad 30 feet wide, what would be the minimum barricaded height above the top of the stack ?

ANSWER: _____

_____

REFERENCE: _____

22. How should distances between modules and other storage locations be determined ?

ANSWER: _____

_____

REFERENCE: _____

PRACTICAL EXERCISE WORKSHEET PART 1
SOLUTION

REQUIREMENT #1:

(1) Answer: Section 2, FSU A, Stack 3.

(2) Answer: Sub-depot A, Section 3, FSU B, Stack 6.

(3) Answer: Section 1, FSU C, Stack 9.
Reference: TM 9-1300-206, paragraph 4-40 c.

REQUIREMENT #2:

(1) Answer: High explosive bombs and similar cased 1.1 munitions.
Reference: TM 9-1300-206, paragraph 4-49 c, (1).

(2) Answer: 250,000 lb (NEW).
Reference: TM 9-1300-206, paragraph 4-49 b.

(3) Answer: Determined by applying the distance given by the formula: d=2.5W 1/3, i.e., distance = 2.5 times the cube root of the NEW in pounds.
Reference: TM 9-1300-206, paragraph 4-49 f, (1) (b), 1.

(4) Answer:
(a) Maximum feasible separation.
(b) Proper drainage.
(c) Dispersion of stocks within available cells.
(d) Safety and security.
Reference: TM 9-1300-206, paragraph 4-48 d, (1), (c).

REQUIREMENT #3:

Answer: No.
Reference: TM 9-1300-206, paragraph 4-54.

REQUIREMENT #4:

(1) Answer: Category F.
Reference: TM 9-1300-206, paragraph 4-41 b, (6).

(2) Answer: 3. (C445 = 105mm HE, W/O Fuze).
Reference: TM 9-1300-206, Table 4-4.

(3) Answer: 20 Tons.
Reference: TM 9-1300-206, Table 4-4.

(4) Answer: 1,500 feet.
Reference: TM 9-1300-206, Table 4-4.

(5) Answer: 300 ft.
Reference: TM 9-1300-206, Table 4-4, Category C.

(6) Answer: 20 Short Tons.
Reference: TM 9-1300-206, Table 4-4.

(7) Answer: Yes.
Reference: TM 9-1300-206, paragraph 4-42 b.

PRACTICAL EXERCISE WORKSHEET PART 2
SOLUTION KEY

1. Answer: 10 Days.
   Reference: FM 9-13, SR-20.

2. Answer: The Division Ammunition Officer (DAO).
   Reference: FM 9-13, SR-21.

3. Answer: Bulk packed incendiary and tracer cartridges must be stored in category D.
   Reference: FM 9-13, SR-24.

4. Answer: Category A.
   Reference: FM 9-13, Table 2-1, SR-26.

5. Answer: Whenever storage space is limited.
   Reference: FM 9-13, Table 2-1, Note 3, SR-26.

6. Answer: The site should be unpopulated and downwind of any populated areas.
   Reference: FM 9-13, SR-28.

7. Answer: With tarps or other suitable cover.
   Reference: FM 9-13 (Guided Missile Storage), SR-45.

8. Answer: Adequate shelter, enough dunnage, good drainage, and good ventilation.
   Reference: FM 9-13, SR-43.

9. Answer: Minimum 18 inches.
   Reference: FM 9-13, SR-43.

10. Answer: 550 Meters.
    Reference: FM 9-13, SR-45.

11. Answer: 26,500.
    Reference: FM 9-13, table 2-3, SR-47.

12. Answer: Electric (battery powered) forklift trucks.
    Reference: FM 9-13, SR-48.

13. Answer: Storage sections, FSU's, and Stacks.
Reference: TM 9-1300-206, paragraph 4-40 b, (1), (2), & (3).

14. Answer: Yes, whenever desirable.
Reference: TM 9-1300-206, paragraph 4-41 a, (3).

15. Answer: 100 feet
Reference: TM 9-1300-206, Table 4-4, Note 2.

16. Answer: D.
Reference: TM 9-1300-206, paragraph 4-41 b, (4).

17. Answer: Measured between the nearest edge of the nearest stack in adjacent FSU's.
Reference: TM 9-1300-206, paragraph 4-45.

18. Answer: Category F.
Reference: TM 9-1300-206, paragraph 4-42 d.

19. Answer: At the same distance as those between the cells.
Reference: TM 9-1300-206, paragraph 4-49 d (3).

20. Answer: Inhabited building distance.
Reference: TM 9-1300-206, paragraph 4-54.

21. Answer: 2 feet.
Reference: TM 9-1300-206, Table 4-5.

22. Answer: By applying the intermagazine distances in Table 4-5.
Reference: TM 9-1300-206, paragraph 4-49 f, (2) (a).

SUPPLEMENTAL READING 55B40C05

(3) Transportation of chemical surety materiel.

(4) Chemical accident and incident control.

(5) Responsibilities of and procedures for technical escorts.

(6) Counterintelligence support.

b. Scope. The regulation applies to all active US Army commands, agencies, organizations, and elements that have responsibility for the life-cycle management of chemical surety materiel, including Government-owned, contractor-operated (GOCO) activities. This regulation does not apply to US Army Reserve commands and active US Army National Guard units.

4-32. Rockets and Rocket Motors

Deleted.

4-33. Unserviceable Ammunition

a. General. Unserviceable ammunition generates from normal deterioration, improper storage and handling, improper packaging and transporting, and from defects inherent in manufacture. Ammunition shipments received from other supply installations should be checked to detect unserviceable items. Ammunition handlers must be trained to recognize indications of unserviceability and report them for inspection.

b. Segregation.

(1) Ammunition in a hazardous condition shall be segregated first for safety reasons and secondly, to minimize rehandling.

(2) Suspended stock of ammunition will be clearly marked and lot-locator and magazine data cards posted to preclude issue.

c. Storage. Hazardous ammunition items must not be stored with serviceable ammunition. Suspect and hazardous munition items shall be segregated and stored separately from serviceable ammunition based on the quantity and type as relates to the appropriate quantity-distance separation standards.

d. Disposition.

(1) Unserviceable ammunition should be reported to Commander, US Army Armament Command, ATTN: AMSMC-DS, Rock Island, Il 61201-6000 for disposition instructions. The Ammunition Condition Report (DA Form 2415) prepared in accordance with TM 38-750 is used for this purpose.

(2) Whenever the commander of an ammunition supply installation discovers ammunition in such a condition that he considers it to be dangerous, he will immediately order the destruction of the ammunition and will report his action to the next higher headquarters.

(3) Ammunition that has been abandoned by using units will be treated as unserviceable until it has been inspected, and determined to be safe to handle.

Section II. THEATER OF OPERATIONS

4-34. General

a. For the purposes of this manual, "Theater of Operations" (TO) comprises all areas other than the "Zone of Interior" (ZI) as defined in section I.

b. Storage in the TO should follow the standards of this manual as outlined for ZI except for the combat zone configuration specified in this chapter. Additional information on storage in the TO is given in FM 9-38 and FM 9-6.

c. In TO areas where the host nation and the major US Commander accept the criteria in NATO document AC/258-D258, the safety criteria established in the NATO standards may be used in lieu of the standards established herein.

4-35. Firebreaks

Firebreaks of sufficient width (50 feet) to prevent the spread of fire should be maintained. Soil containing a high enough proportion of organic matter to burn must be excavated to the mineral subsoil. Since firebreaks around ammunition stacks are easily detected by aerial reconnaissance, restrictions in their use must be considered.

4-36. Buildings

On occasion, existing buildings may be available for the storage of ammunition. Before a decision is made to use buildings, even those formerly used by the enemy for ammunition storage, the general requirements for United States magazines should be reviewed to determine if any hazards are inherent in the construction and if modification is required. Any fireproof building may be utilized for storage of ammunition provided the rated floor load of the structure is adequate. *Chemical incendiary ammunition and white phosphorus (WP) ammunition must never be stored in structures with wooden floors.* Tile construction is preferred to brick or stone, since tile fragments produced by an explosion will travel a much shorter distance.

4-37. Protection from the Elements

a. General. Three fundamental principles to be observed in the protection of ammunition from the elements are:

Adequate shelter

Appropriate dunnage

Adequate ventilation

The lack of these fundamentals, due to manpower and equipment shortages, may create only minor problems because of the rapid turnover of stocks and temporary nature of the operation. The vehicle on which materiel is carried provides a reasonable degree of protection from the elements; however, if not carried on vehicles, special ammunition should receive a high degree of protection, because of the critical nature of the items. In depots, the fundamentals above are very important factors in planning of storage and issue operations, because large stocks and longer term storage are involved. Appropriate storage insures maximum serviceability and shelf-life of stocks and reduces maintenance to the minimum.

b. Temporary Shelters. When covered facilities are not available to provide shelter for ammunition temporary shelters may be fabricated.

(1) Paulins or corrugated metal shelters may be fabricated to shelter stocks in open storage (fig. 4-6). The top of the arch must be raised sufficiently to allow at least 18 inches of airspace around and above the stack. The edges of the paulin must be tied out to stakes to secure it, and to permit the free circulation of air. Paulins are arranged to permit drainage and are sloped between stacks to connect with a gutter to carry off excessive moisture.

(2) Ammunition must not be placed in pits or tunnels which are not provided with drainage or pumps. However, quarries, tunnels, etc., provide desirable storage for some types of ammunition when properly drained.

(3) Heavy, well supported dunnage or raised pads constructed of crushed rock should be used to keep the bottom layer of the stack above the ground and to prevent the stack from settling. If dunnage is not available, raised pads constructed of crushed rock, empty wooden boxes, or empty metal containers may be used.

(4) A recommended method of temporary field stacking and storage of boxed ammunition in ammunition supply points, and in oversea depots, is shown in figures 4-7 through 4-11. This method of stacking provides a degree of ventilation that permits open covered storage of ammunition for a period of several months without accelerating the deterioration of boxes.

(5) Small quantities of ammunition can be stored in unused sections of prefabricated culverts. Culverts fabricated and used for draining are not suitable for temporary storage.

c. Outside Storage. Ammunition in outside storage will be inspected semiannually.

4-38. Ammunition Supply Point

a. General. Supply points should be located so that they are within reasonable support distance from the combat troops being supported. Turnover of stocks is rapid. Consideration must also be given to security and ease of defense. Sites selected should provide a defilade so that direct observation is not possible.

b. Ammunition Supply Points (ASP's). ASP sites are preferably arranged into three storage areas in order to provide dispersion and to expedite the handling, receipt, and issue of material, and to facilitate inventory and segregation. Operation in each area should be rotated daily, if practicable. Each area should be capable of storing approximately 500 tons of explosives and ammunition. Location of ASP's must be such that vehicles may enter and leave any one area without crossing any of the other areas.

c. Special Ammunition Supply Points (SASP's). Nuclear weapons, heavy rockets, missiles, propellants for heavy rockets and missiles are received, stored and issued at SASP's. Stocks at SASP's may be stored on vehicles in order to provide dispersion and rapid displacement to maintain pace with using units. SASP's require greater seclusion, camouflage, and security than ASP's due to the nature and density of the material involved. SASP's may function in conjunction with ASP's or independently, depending upon the tactical situation. Complete integration of ammunition supply activities will take place at the using unit level.

d. Unit Basic Loads (UBL).

(1) Units with basic loads of ammunition stocks will store ammunition and maintain their storage facilities in accordance with the requirements contained in this manual. Stocks may be stored on vehicles to provide dispersion and rapid displacement to maintain pace with using units.

(2) Ammunition stocks in unit basic loads will be inspected annually to determine lot serviceability and storage conditions. Ammunition in outside storage will be inspected semiannually.

(3) Procedures will be established to insure the surveillance of UBL's to include visual and functional evaluation of all stocks (AR 740-1). Qualified surveillance support will be furnished from supporting supply activities; e.g., depots and ASP's. Positive measures will be established to either rotate UBL's stocks or have required cycle inspection and destructive tests performed.

4-39. Army Ammunition Depot

The Army ammunition depot (AAD) is intended for the storage of *large* quantities of explosives and ammunition. The depot is generally located so that interference by enemy action (aside from possible air or missile attacks) is improbable. Army ammunition depots, because of their greater distance from combat

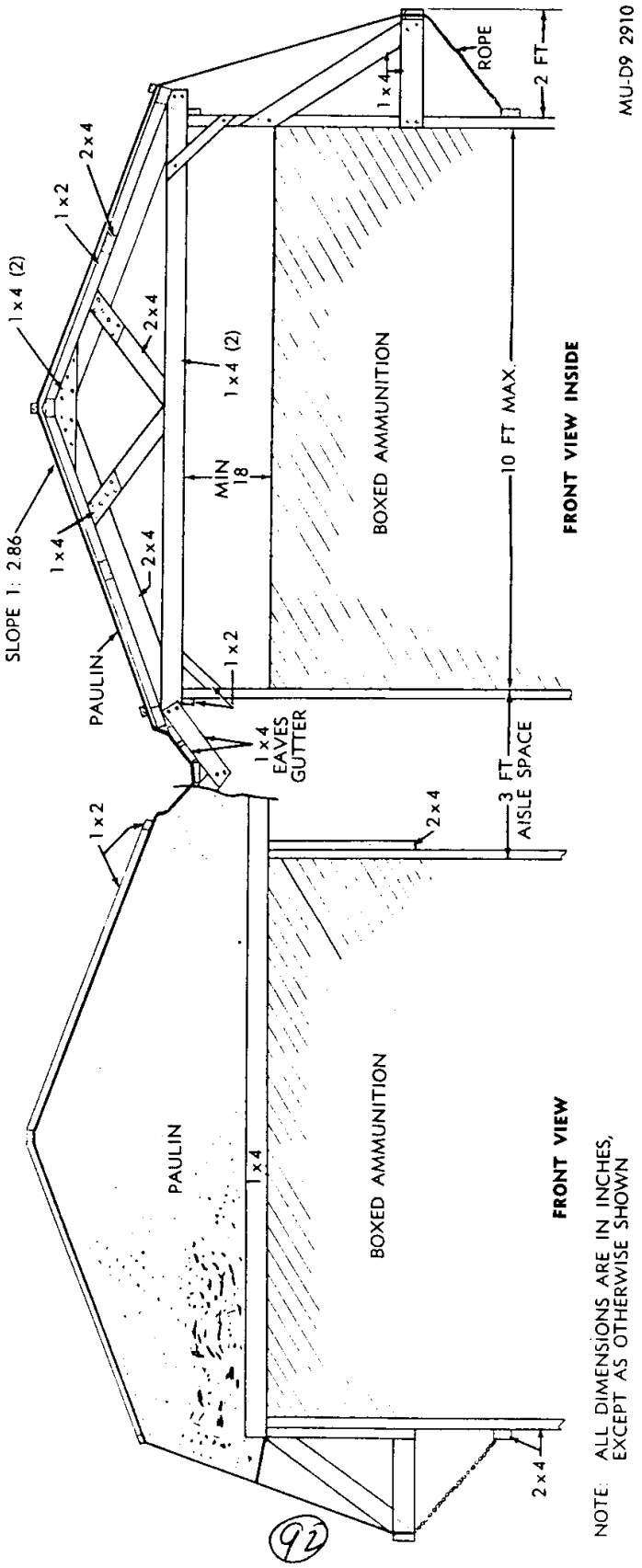


Figure 4-6. Details of A-frame structure - open.

zones, can have more elaborate and stable arrangements than are possible or necessary at ASP's. The AAD can receive, store, and issue efficiently, large quantities of ammunition. In some cases, AAD's can be located at former ASP sites if such sites are susceptible to the necessary expansion. AAD's should be located near main supply lines to eliminate unnecessary hauling, and should contain a portion of every type and size ammunition being stored.

4-40. Storage Systems

a. General. Three systems are utilized for the storage of explosives and ammunition. The choice of the systems used should be based upon the physical characteristics of the site, selected for the supply point.

(1) *Area Storage.* In this type of storage the storage area may be divided into sections. The stacks

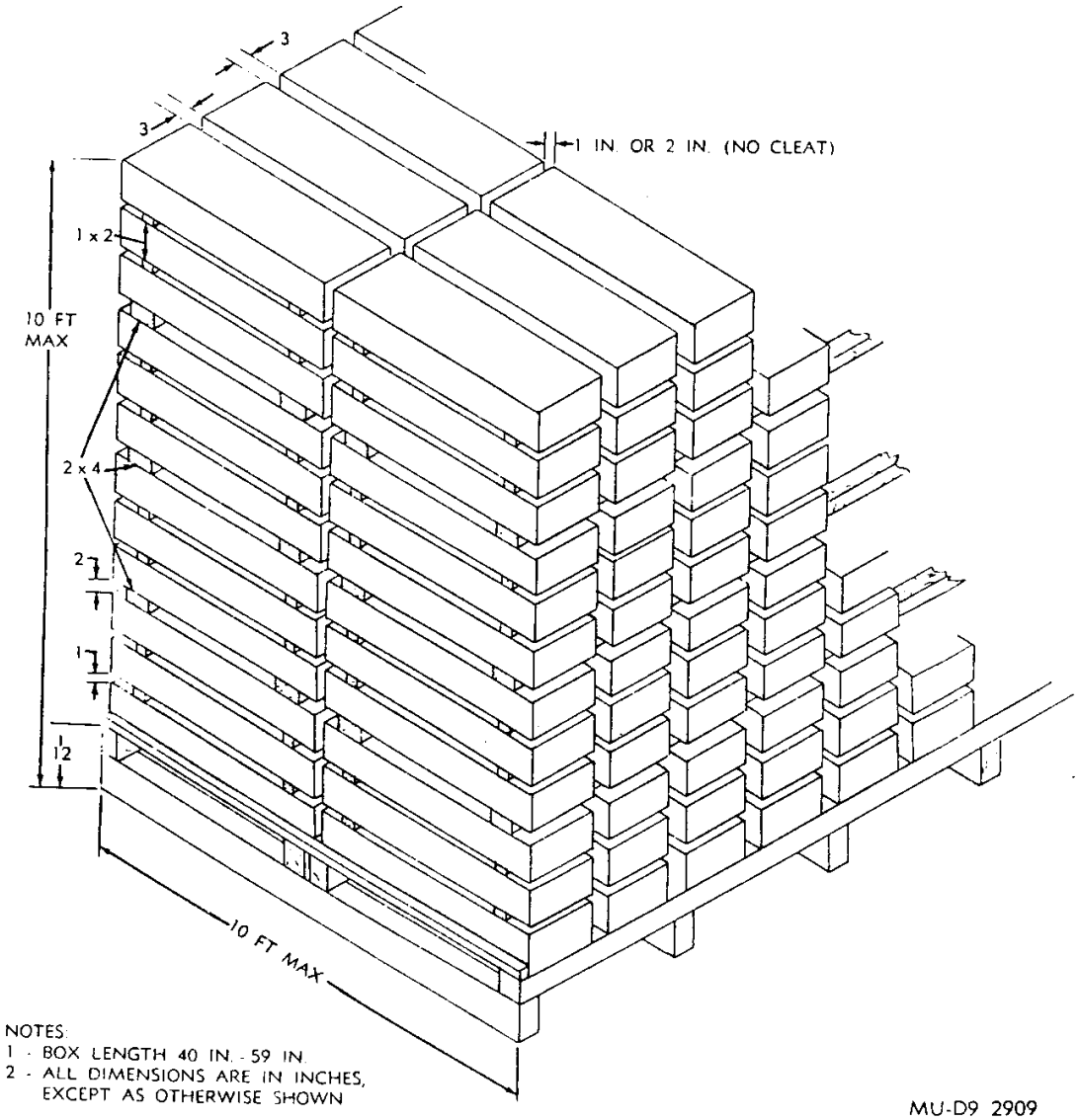


Figure 4-7. Stacking Plan (large box) - open storage

of ammunition are arranged in checkerboard fashion, spaced in accordance with quantity-distance requirements.

(2) *Roadside Storage.* Roadside storage is the storage of explosives and ammunition along the edge of roads. The stacks are spaced in accordance with quantity-distance requirements (table 4-4). Storage in depth offers maximum storage per mile of road front, but ammunition should be accessible to conveyors, cranes and material handling equipment.

(3) *Area and Roadside Storage.* In some situations a combination of area storage and roadside storage is desirable.

b. Storage Subdivisions. Ammunition supply installations such as: AAD's, ASP's, SASP's, and subdepots, are divided and subdivided into the following for purposes of adequate operational control and dispersion:

(1) Storage sections.

(2) FSU (field storage unit). Sections are divided in FSU's.

(3) Stack. A FSU consists of two or more stacks.

c. Designation of Storage Subdivisions. In order to facilitate administration and operation of storage facilities the following method of designation applies. Subdepots are designated by letter, storage sections by number, FSU's by letter, and stacks by

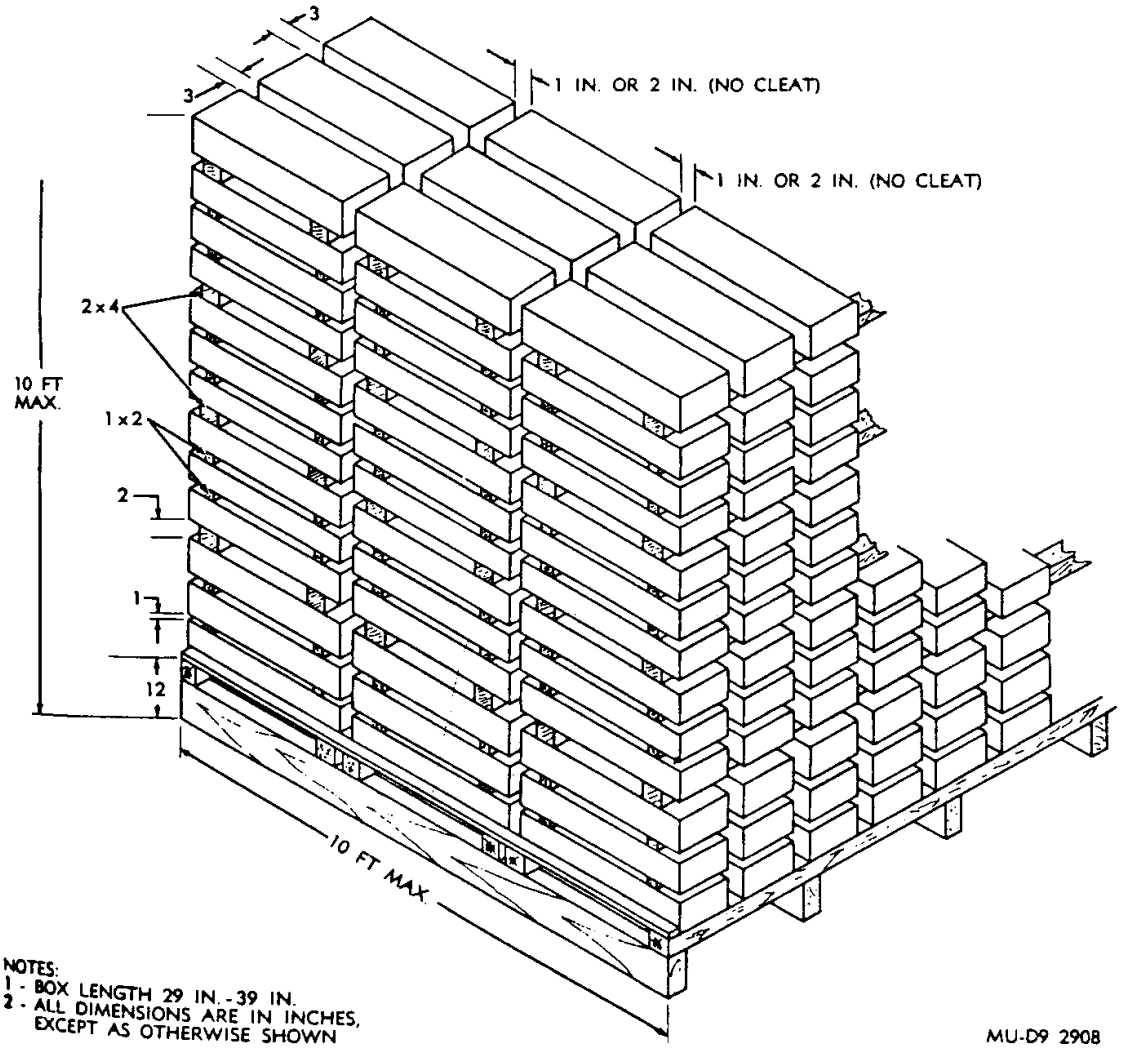


Figure 4–8. Stacking plan (medium box)—open storage.

number. Thus, ammunition may be in storage in subdepot A, Section 1, FSU-A, stack 1 (A1A1).

4-41. Field Storage Categories

a. General. Storage categories are the primary groups into which ammunition is segregated for storage in the field. The groupings are based on consideration of the desirability of storing components of complete rounds in adjacent stacks and on consideration of the hazards of propagation of explosion, range of fragments, spread of fires, and chemical contamination. Safety procedures covering ammunition storage are based on the following factors:

(1) Ammunition items having comparable storage risks are grouped together in the same storage category.

(2) Within each storage category, the maximum quantity of ammunition to be stored within each stack and within each FSU, and the minimum distance between FSU's and the minimum

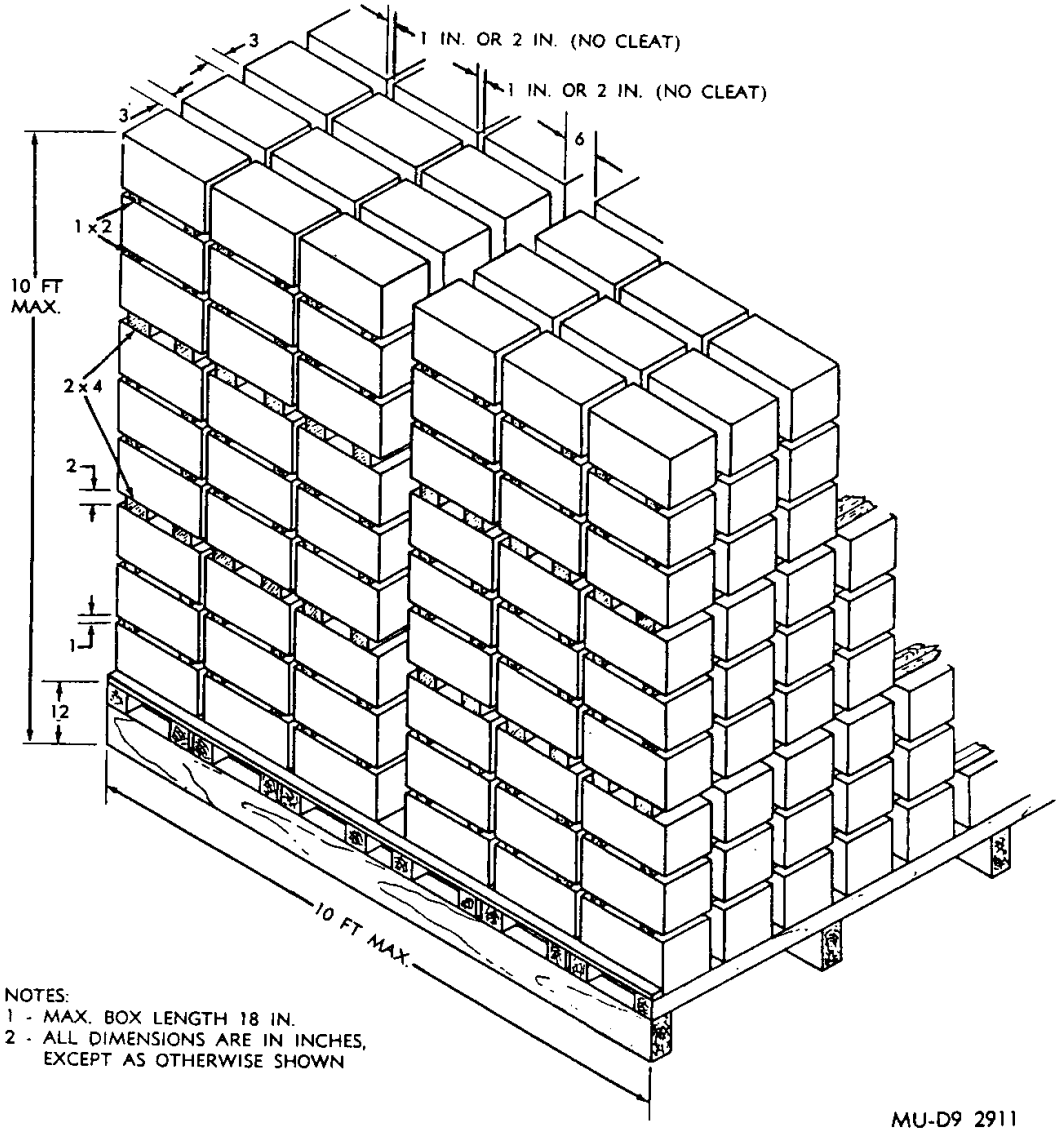


Figure 4-9. Stacking Plan (small box) - open storage

distance between FSU's and categories, are specified in quantity-distance table 4-4 which are based on gross weight to include packaging, for the storage of ammunition in the field.

(3) Normally, only one type of ammunition is stored in a stack. If more than one type of ammunition is stored in a stack, ammunition should be arranged in a manner to facilitate inventory and inspection. Where camouflage is a consideration, stacks may be stepped in toward the top (terraced or pyramid stacking) to decrease shadows. Whenever desirable, components of complete rounds may be stored within the same FSU.

(4) Small-arms ammunition, except bulk packed incendiary and tracer cartridges (which must be stored in category D) may be stored with any category.

b. Categories for Storage of Conventional Ammunition. For storage purposes, conventional ammunition is divided into the following general categories:

(1) *Category A.* Fixed and semifixed artillery ammunition, except incendiary and chemical.

(2) *Category B.* Propelling charges, fuzes, primers, flash reducers and separate loading artillery projectiles including HE and AP, but excluding incendiary and chemical projectiles.

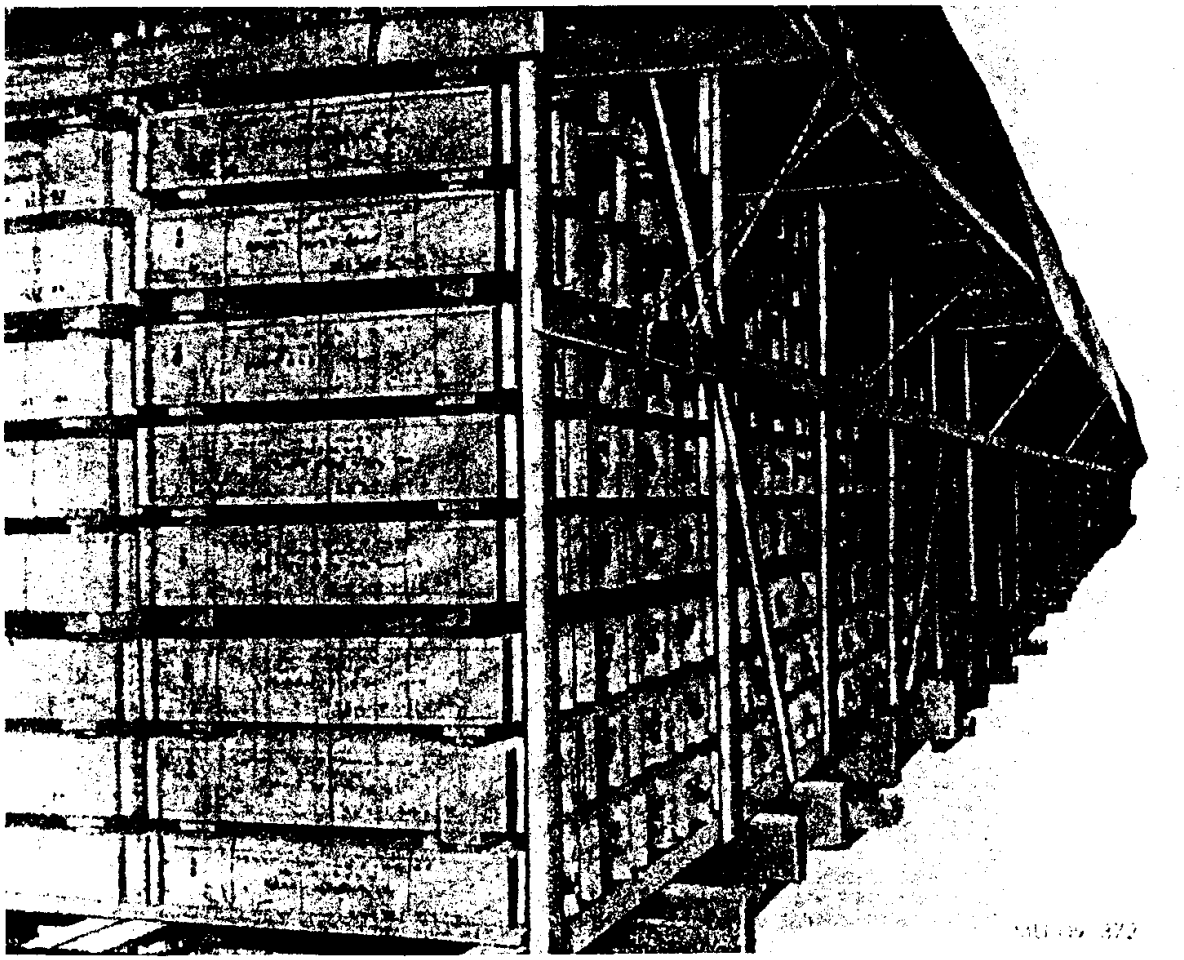


Figure 4-10. Storage of medium-size boxes

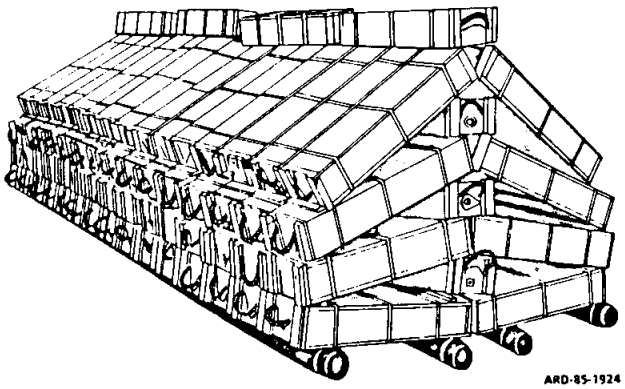


Figure 4-11. Temporary field stacking.

Table 4-4. Quantity-distance for field storage categories

Category A, B, or D

Gross tons per stack	Gross tons per FSU	Minimum distance in feet between			
		Stacks unbarricaded	Stacks barricaded	FSU unbarricaded	Categories
Less than 10	400	40	30	300	750
10-20 maximum	400	50	40	300	750

NOTE 1. If desirable, fixed and semifixed smoke ammunition, except WP., may be stored in category A.
NOTE 2. The minimum distance between a stack of propelling charges and any other stack must be 100 feet whether barricaded or unbarricaded.

Category C

Gross tons per stack	Gross tons per FSU	Minimum distance in feet between			
		Stacks unbarricaded	Stacks barricaded	FSU unbarricaded	Categories
Less than 10	300	75	60	300	900
10-30 maximum	300	105	75	300	900

NOTE: Whenever storage space is limited, category C ammunition may be combined with category E.

Category E

Gross tons per stack	Gross tons per FSU	Minimum distance in feet between			
		Stacks unbarricaded	Stacks barricaded	FSU unbarricaded	Categories
Less than 5	50	75	60	300	900
5-10 maximum	50	105	75	300	900

Table 4-4. Quantity-distance for Field Storage Categories - Continued
Category F

Gross tons per stack	Stacks barricaded and unbarricaded	Gross tons per FSU	Minimum distance in feet between		
			FSU unbarricaded	FSU barricaded	Categories
The maximum allowable gross weight per stack will be 20 tons.	See note beow -	20	200	75	1500
		30	230	90	1500
		40	265	99	1500
		50	295	101	1500
		60	330	120	1500
		80	390	135	1500
		100	455	150	1500

NOTE. The minimum distance between barricaded stacks will be 75 feet. The minimum distance between unbarricaded stacks will be 150 feet.

Category G Class V

Gross tons per FSU	Minimum distance in feet between		
	FSU unbarricaded	FSU barricaded	Categories
20	200	75	1500
30	230	90	1500
40	265	99	1500
50	299	101	1500
60	330	120	1500
80	390	135	1500
100	455	150	1500

NOTE. Under normal conditions, the Department of the Air Force will store and issue all class V supplies; however, depot commanders should always be prepared to handle these supplies in emergencies.

(3) *Category C.* Mortar ammunition and hand grenades, except incendiary and chemical.

(4) *Category D.* Pyrotechnics and chemical ammunition of all types, including chemical filled rockets; gas, smoke, and incendiary bombs; gas and smoke artillery ammunition; incendiary and chemical grenades; smoke pots, VX filled mines, and bulk packed incendiary and small-arms tracer cartridges.

(5) *Category E.* All demolition explosives, antitank and antipersonnel mines (except VX loaded), and components such as blasting caps, firing devices, detonating cord, and safety fuse.

(6) *Category F.* Rockets, rocket motors, guided missiles and rifle grenades, except chemical.

(7) *Category G.* The following items of Air Force Class V supply - all unfuzed high-explosive bombs, aircraft mines, aircraft torpedoes, and fragmentation bombs, fuzes and/or primer-detonators for the above items; and fragmentation bomb clusters, fuzed or unfuzed. The remainder of Air Force Class V items must be stored in other applicable categories.

c. Deleted

4-42. Storage of Class V Supply Category G Air Force Bombs.

a. The FSU is the smallest unit for the storage of Air Force Class V bombs in the field. Not more than 100 tons of bombs will be stored in an FSU.

b. Components of bombs such as fins, fuzes, and primer-detonators may be stored in the space between FSU's. Every attempt should be made to provide protection from heat and moisture for fuzes and primer-detonators.

c. Fuzed fragmentation bombs will not be stored in an FSU with any other type of bombs.

d. Photoflash bombs may be stored as category F. However, if stored as category F, they will be placed in separate FSU's and will be separated by category distance.

4-43. Dispersion

The principal objective in the dispersion of ammunition is to minimize the loss in case of fire, accidental explosion, or enemy action. Adequate dispersion will render a depot an unprofitable target for enemy air attack. Each kind of ammunition should be stored in two widely separated FSU's to prevent the loss of the contents of any one FSU from seriously handicapping military operations by the loss of the entire supply of any item. Under normal conditions, the loss may be limited to one stack, should one item in it take fire or explode. The advent of nuclear weapons requires that particular emphasis be placed on dispersion, in order to minimize the effect of attack with such weapons.

4-44. Interstack Distance

The interstack distance is the minimum distance between the near edge of adjacent stacks. The interstack distances prescribed by the appropriate quantity-distance table are adequate to prevent propagation of detonation from blast pressures, but interstack distances do not constitute safe distances for protection against hazards of missiles resulting from explosion or fire. Agressive fire fighting can prevent the spread of fire from one stack to another at these distances. Since the hazard from hot missiles, and hence from fires, varies approximately inversely as the square of the distance from the point of origin, hence the greater the distance between stacks the less the probability of fire being communicated from stack to stack. Separation of stacks by greater distances than those prescribed in order to help prevent fires and to facilitate fire fighting may be done if practicable.

4-45. Inter-FSU Distance

The inter-FSU distance is the distance between the nearest edge of the nearest stacks in adjacent FSU's. Inter-FSU distances are designed to prevent the spread of fire. Under circumstances where these distances cannot be attained, extraordinary care in the establishment and maintenance of fire protection, fire guards, and fire fighting measures must be exercised.

4-46. Intercategory Distance

The intercategory distance is the distance from an FSU of one category to the nearest FSU of another category.

4-47. Optimum Safety Distance

The optimum safety distance is the limit inside of which danger of structural damage due to blast or from fall of missile will be serious. These distances should be considered when locating ammunition supply installations near gasoline and other storage facilities, airfields, hospitals, permanent radio transmitters, inhabited areas, headquarters, railroads, and highways.

4-48. Storage in Combat Zones and Other Approved Areas

a. Applicability.

(1) The following "combat zone" provisions for explosives storage areas are only authorized for use in specifically designated geographical areas upon the express (separate) approval of the theatre commander.

(2) The criteria will apply to all new construction, after receipt of approval in (1) above. Existing storage facilities which meet or exceed prescribed minimums will not require alteration. Those which are less than minimum will be modified in accordance with this manual.

b. General. Normal explosives safety criteria, procedures, quantity-distance (Q-D) separations, and methods of application set forth in this manual apply in the usual manner except where waivers are granted. Minimum separations between quantities of stored explosives are given. These explosives-to-explosives separations may be expected to prevent simultaneous detonation of explosives on opposite sides of an approved barricade and minimize the possibility of later non-simultaneous propagating explosions. Greater separations should be used where possible.

c. Concept.

(1) Open storage may be used as necessary. However, from the standpoint of safety (as well as reliability) priority for cover should be given to items requiring protection from the elements (upon consideration of the packing method). Single stacks of quantities (above 40,000 pounds) of mass detonating explosives should be avoided. Stacking given quantities of such explosives in several smaller stacks will, in many cases, result in decreased land area requirements by reducing the distance required between the explosives storage area and "outside" exposures such as flight line areas, inhabited buildings, POL storage, etc.

(2) A modular concept of open barricaded storage will be used where compliance with greater separations required by the standard quantity-distance criteria is not feasible. Large quantities of mass detonating explosives may be stored at reduced separations by utilizing the modules described in paragraph 4-49 and AR 385-64.

(3) Where available land is scarce and covered storage is required, consideration will be given to the use of approved steel arch-earth covered igloos (table 4-1). These sectionalized corrugated-arch structures permit storage of maximum amounts of mass detonating explosives with minimum possible spacing between igloos (cells) containing up to 500,000-pounds net explosives weight (table 5-9). These buildings have been tested and found to provide acceptable protection against propagation of an explosion from one igloo to another igloo.

d. Other Storage Systems. Security, real estate, or operational requirements may necessitate the use of a storage system other than the methods outlined above. An alternate method should be employed only if the quantity-distance limitations outlined in chapter 5 cannot be observed and a waiver has been requested and granted pursuant to paragraph 1-3. One such method is the modular storage system.

(1) *Modular Storage System.* This is a field storage system for storage of high explosive bombs and other similar cased class 1.1 ammunition on pads within earth barricaded areas known as cells. These cells are joined to form modules and in turn modules may be arranged to form module blocks (fig. 4-12).

(a) Where to use. In a combat zone where insufficient real estate or limited security is a guiding factor, it is often impossible to store ammunition in accordance with prescribed quantity-distance and compatibility regulations for area, roadside and area/roadside storage. Such a situation may require use of a modular system of storage for optimim safety and security commensurate with the availability of resources. In most instances this system may be the only solution for storing larger quantities in rear areas where there is insufficient real estate. In such a situation, several module blocks may be required.

(b) When to use. The method of storage is to be used only as an alternate solution when field storage methods for class 1.1 ammunition cannot be used. It should be understood that this system does not provide the degree of protection for personnel or ammunition stocks that is afforded by regular quantity-distance dispersion. The modular cell system will be employed only when approval is granted by the major command headquarters.

(c) How to use. The use of the modular system will under no circumstances preclude adherence, in so far as possible, to other principals of ammunition storage such as:

1. Maximum feasible separation.

2. Proper drainage.

3. Dispersion of stocks within available cells to avoid complete loss of a single type munition from one explosion or fire.

4. Safety and security.

(2) *Considerations.* The decision to use the modular system must be made with full realization of its advantages and disadvantages over other field storage systems.

(a) The advantages are:

1. Greatly reduced real estate requirements.

2. Greatly improved security with comparable forces.

3. Reduced vulnerability to direct fire on ammunition stocks because of the smaller area and use of barricades.

4. Reduced transportation requirements within ammunition area.

5. Greatly reduced internal road net requirements.

(b) The disadvantages are:

1. Possibility of explosion or fire on one cell starting fire in other cells because of heat generation or indirect fragment dispersion.

2. Increased vulnerability to enemy indirect fire and air-dropped bombs because of concentration of stocks.

3. Additional engineer support required for initial construction of modules as opposed to that required for unbarricaded open storage.

4-49. Module, Open Storage, Barricaded (AR 385-64)

a. Description. A module is a barricaded area composed of a series of not more than eight connected cells (with hard surface pads) separated from each other by barricades (fig. 4-12). A light shed type metal roof may be used to cover individual cells. Heavy structures or flammable material will not be sued.

b. Explosives Limitation. The maximum net weight of explosives permitted to be stored within each cell is 250,000; and 2,000,000 pounds per module (eight cells).

c. Authorized Storage.

(1) The items which may be stored in modules are limited to high explosive bombs and similar cased class 1.1 ammunition.

(2) Items in each module will be compatible.

d. Barricaded Requirements.

(1) All barricades used in forming the module and its cells shall meet the requirements specified in this paragraph and chapter 5. Minimum barricade height above the top of the stack is influenced by the width (or length) of the stack (storage pad size) and the distance between the stack and the top of the barricade (figs. 4-13 and 4-14). Heights in table 4-5 represent the minimum requirements for barricade locations based upon storage pad sizes and separations shown. Where feasible, barricade heights should be scaled up from 3 to 5 feet greater than those shown in table 4-5. This increased height is based upon a line drawn (figs. 4-13 and 4-14) at an angle of 5 degrees above the horizontal. Such barricades should stop almost all of the fragments capable of propagating an explosion from cell to cell.

(2) Protection is considered effective when barricades for storage module meet the following minimum requirements:

(a) The slope of the barricade shall not be steeper than 1 1/2 to 1; 2 to 1 is preferred. The crest of the barricade shall be at least 3 feet wide and higher than the top of the stack of stored munitions as shown in figures 4 13 and 4-14 and table 4-5.

(b) Earth barricades shall be made of material as indicated in chapter 5.

(c) Heights are based upon the following: A straight line drawn from the top of the far edge of the stack (edge away from the barricade) at a 2 degree angle above the horizontal must pass through the entire 3 foot width of the crest (berm) of the barricade.

(3) The centerline of barricades between cells of the module will be located at a point halfway between adjacent munitions storage pads. Back and end (outside) barricades will be located at the same distance from the pads as those between the cells.

(4) Maximum advantage should be taken of natural barriers existing in the topography in siting these modules. If such obstructions are used to substitute completely for a given portion of the module barricade, the protection provided must be at least equivalent to that of the barricade.

e. Cell Storage Pads. Cell storage pad size may be as required to accommodate stocks. Table 4-5 gives minimum pad sizes necessary to handle most items in the explosives quantities given. Storage pads should be hard surfaced, if possible, in order to minimize the effects of earth shock from an accidental explosion. No restrictions are imposed upon the arrangement of cells within a module or upon the arrangement of groups of modules except cell openings which will not be faced toward each other unless they are barricaded or meet the standard quantity-distance criteria for unbarricaded aboveground magazines.

f. Siting Criteria.

(1) *Separation between cells and modules.*

(a) The spacing required between cells in a module shall be determined by considering each cell as a potential explosion site. The explosive content of the cell requiring the greatest distance shall be the minimum separation between the adjacent cells under consideration. The separation distance between cells shall be measured from the nearest edge of the stack of munitions in one cell to the nearest edge of the stack of munitions in the adjacent cell. Table 4-5 contains spacing requirements between cells for specific quantities of explosives per cell. If cell explosives loading is established for weights other than those shown, minimum distances between stacks shall be determined by applying the distances given by the formula d = 1.1W 1/3, i.e., distance = 1.1 times the cube root of the net weight of explosives in pounds.

(b) The spacing required between modules shall be computed as follows:

1. Each cell of each module will be considered as a potential explosion site. The minimum distance between the explosive stacks in each cell and the nearest stack in the adjacent module shall be determined by applying the distances given by the formula: d = 2.5W 1/3, i.e., distance = 2.5 times the cube root of the net weight of explosives in pounds.

2. The quantity of explosives in that cell of either module which results in the greatest separation distance will determine spacing between the modules being considered. Distance will be measured from the nearest edge of the munitions stack in the controlling cell in the module to the nearest edge of the stack of munitions in the adjacent module (see table 4-5 for module separation for specific quantities of explosives per cell).

(2) *Separation between modules and all other targets.*

(a) Distance between a module and other magazines shall be determined by applying the intermagazine distances specified in table 4-5.

(b) Distances between the explosives in the cells of a module and all other targets will be determined in the normal manner upon the basis of the net explosives weight of single cells. Distances will be measured between the nearest edge of the munitions stack in the controllng cell and the nearest point of the target concerned.

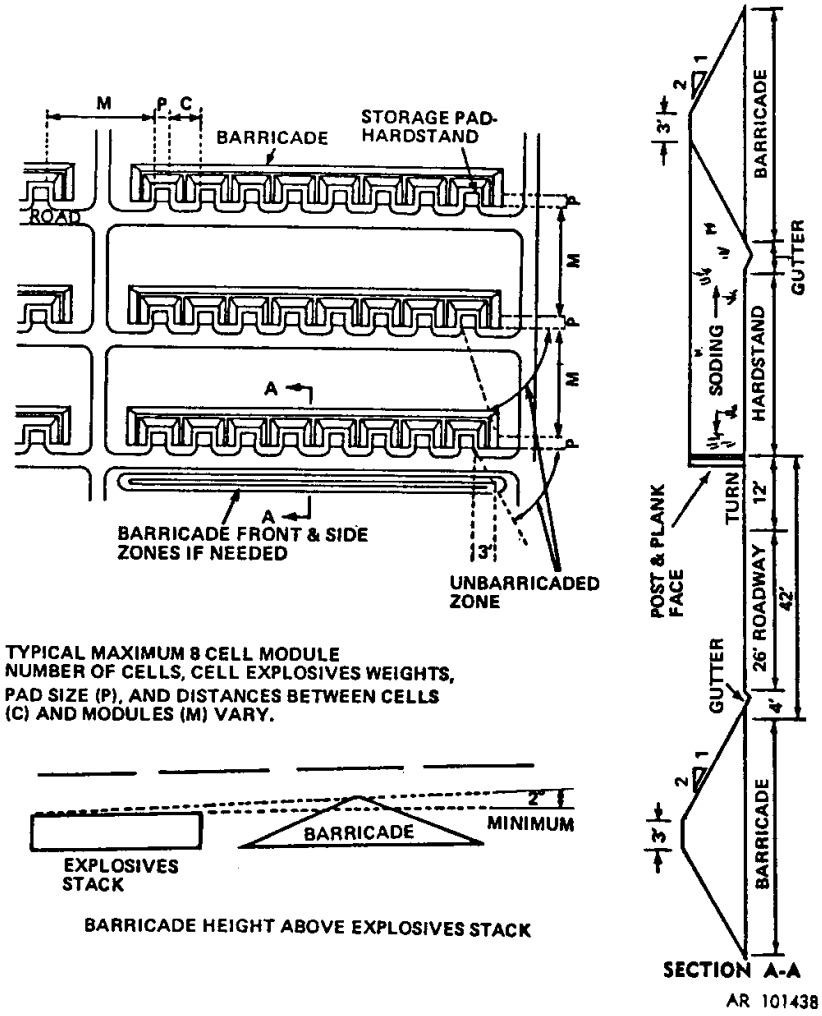


Figure 4-12. Typical 8-cell module.

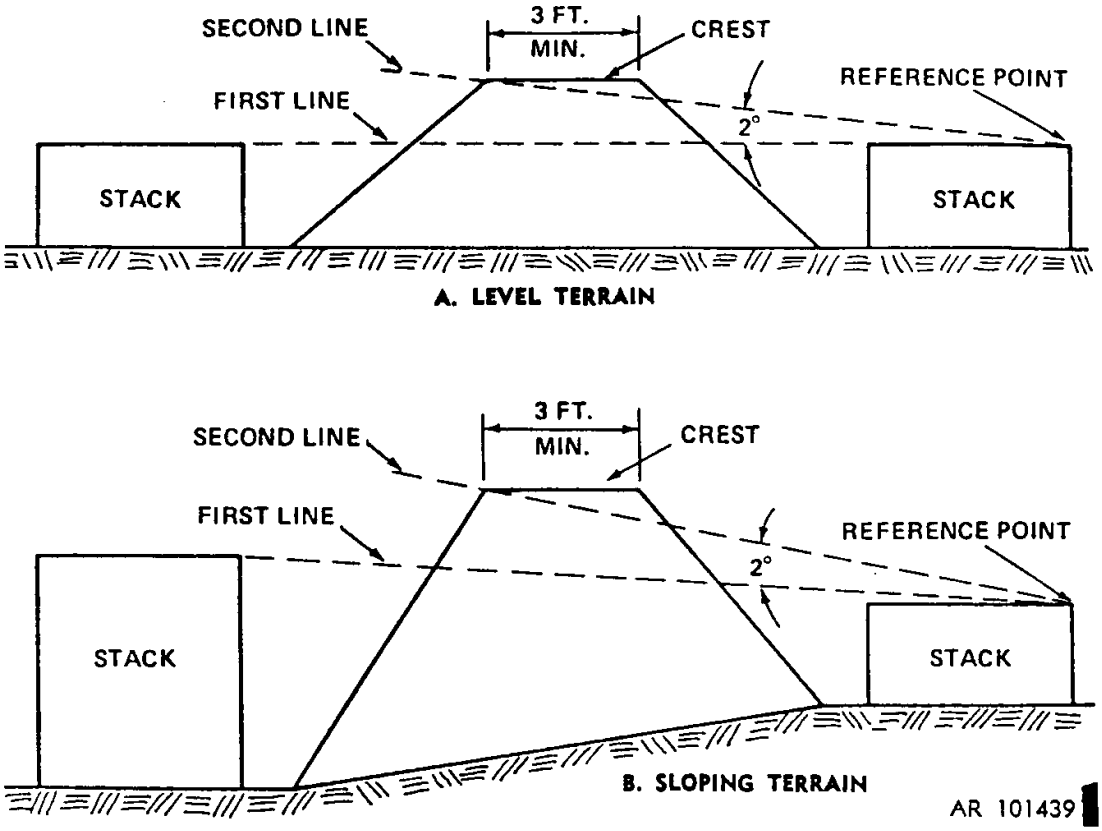


Figure 4-13. Determination of barricade height.

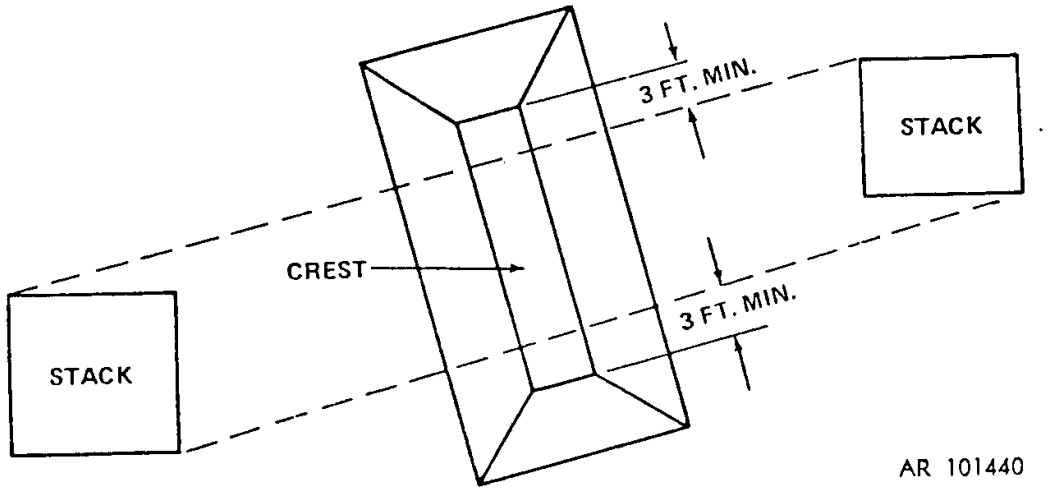


Figure 4-14. Determination of barricade length.

Table 4-5. Intermagazine Separation for Barricaded Storage Modules for Mass-Detonating Explosives

Net pounds of explosives	Minimum explosives-to-explosives distance in feet (barricaded) between		Barricade height based upon storage pad size	
	Cells D = 1.1W1/3	Modules D = 2.5W1/3	Cell storage pad size (width or depth), in ft.	Minimum height of barricade above top of stock in feet
Column 1	Column 2	Column 3	Column 4	Column 5
50,000	40	90	30	2
100,000	50	115	30	2
125,000	55	125	30	2
150,000	60	130	30	2
175,000	60	140	30	2
200,000	65	145	30	2
200,000	65	145	40	2 1/2
225,000	65	150	40	2 1/2
250,000	70	160	40	2 1/2
250,000	70	160	50	3

[1] The barricade height above the explosives stack shown in Column 5 will be increased 6 inches for each 10 foot increase in width or depth of the pad size shown in column 4.

(3) The height and length of the barricade shall be determined as follows:

(a) Height. Establish a reference point at the top of the far edge (i.e., the edge remote from the barricade under consideration) of one of the two stacks under consideration between which the barricade is to be constructed. This reference point, if the tops of the stacks are not at the same elevation, shall be on the stack whose top is at the lower elevation. Draw a line from the reference point to the highest point of the other stack. Draw a second line from the reference point forming an angle of 2 degrees above the line.

(b) Length. The barricade length is determined by extending the barricade 3 feet, exclusive of the end slope, beyond a line between the extremes of the two stacks of ammunition or buildings to be protected.

(4) Earth barricades meeting the above requirements may be modified by substituting a retaining wall, preferably of concrete, for the slope on one side. The remaining side shall be of such slope and thickness as necessary to assure that the width of earth required for the top is held firmly in place.

(5) Other intervening barriers meeting the requirements of paragraph 5-6 and as proven by test may also be used, e.g., earth-filled steel bin barricades for explosives loaded aircraft.

4-50. Desert Storage

Cover rarely exists in the desert. Isolated groups of cover are conspicuous and will invite special attention from enemy reconnaissance. Roads are seldom necessary in desert ammunition storage areas. Shadows and regular shaped patterns are conspicuous and are avoided by the use of small irregular stacks and elimination of regular lines and rows. Definite information as to the quantities of ammunition stored in an ammunition supply point is denied the enemy by using low, irregular stacks covered by brush or stone, or garnished to resemble bushes. In the desert, dispersion of ammunition is extremely important.

4-51. Storage in Cold Climate

Ammunition stacks in the open must be kept off the ground by the use of dunnage. This prevents stacks from sinking in the softened ground after a thaw and allows surface water to flow under or around stacks without touching the ammunition. In the Arctic, native timber for dunnage is scarce; local improvisations may be required. Stacks are covered to keep out snow, wind, and water, but must be ventilated to reduce condensation. Ammunition stacked on frozen ground may become isolated and not easily accessible after a thaw. Depressions and defilades where surface water might accumulate as the result of a thaw should be avoided in locating roads and stacks.

4-52. Storage in the Tropics

The nature of the terrain and climatic conditions in the tropics makes the selection of storage sites for ammunition especially important. On islands, a large part of the area may consist of steep slopes, swamps, end stream beds, all unsuitable for ammunition storage. Heavy rains may convert level, firm ground into a sea of mud. In many regions a short, heavy downpour of rain may be expected daily. Throughout the tropics there are seasons of heavy rainfall. Rain

followed by intense sunlight combine to produce conditions of heat and humidity, which greatly accelerate the deterioration of ammunition and packing materials. The climatic conditions reduce the efficiency of labor and thus the amount of storage work that may be performed. Fungi may attack the cloth components, such as propelling charge bags, fabric machine gun belts, and bandoleers, paulins and ropes. Termites can eat through dunnage and ammunition boxes and fiber containers, causing deterioration of ammunition and packing and dunnage. The importance of adequate dunnage, shelter, and ventilation provided for the storage of ammunition in the tropics cannot be overemphasized.

4-53. Storage Temperature Limits

Ammunition such as rockets and rocket motors, having storage temperature limits stenciled on the containers must be maintained within the storage temperature limits specified. Instructions issued concerning the maintenance of the proper temperature and the reporting and disposition of ammunition which has exceeded the temperature limits must be followed.

4-54. Storage of Captured Enemy Ammunition

Captured enemy ammunition must be inspected as soon as possible after receipt to determine the condition, type, and caliber. Inspectors should be on the lookout for any special characteristics which may be of interest to technical intelligence personnel. Enemy ammunition should be segregated and disposed of when it is found to be in a hazardous condition. Enemy ammunition must not be stored with serviceable United States ammunition. It should be stored in a separate area well isolated by firebreaks and at least inhabited-building distance from other stocks based on greatest quantity of explosives involved.

The following pages are from FM 9-13

FIELD STORAGE OF AMMUNITION

The purpose of field storage is to provide ammunition to Army tactical units. Unlike permanent, magazine storage, ammunition assets in field storage are most often stored on the ground on unimproved surfaces. Munitions are placed in field storage categories separated from each other by appropriate mini- mum field storage quantity distances (QD), which are based on total gross tonnage per individual storage unit (see Appendix C for a DODIC conversion chart). This chapter describes field storage areas, storage categories, site selection for field storage facilities, and storage systems and storage planning.

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FIELD STORAGE AREAS

There are four areas where field storage is likely to be used theater storage areas (TSA), corps storage areas (CSA), ammunition supply points (ASP), and ammunition transfer points (ATP).

THEATER STORAGE AREA

The TSA is in the communications zone (COMMZ) where the reserve stocks are stored. It should have direct access to rail networks or be within short line-haul distance from them. In peace- time, the TSA could consist of permanent storage facilities, igloos, or bunkers. In combat environments, the TSA may be open storage.

CORPS STORAGE AREA

Located in the corps rear area, the CSA normally stores up to 10 days of ammunition. Being in the rear, it is more fixed than the forward combat ammunition supply points (ASP) it supports. For this reason, it can have more permanent storage facilities; however, this depends on the tactical situation.

AMMUNITION SUPPLY POINT

ASPS are in the corps forward area. They provide direct support to the combat division or portions of the division and must store about 3 days of ammunition. The tonnage stored varies depending upon the type of unit supported. Based on their mission, for- ward ASPS are usually temporary. This means ammunition is not stored in igloos or bunkers.

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AMMUNITION TRANSFER POINT

The ATP is a transfer point in the brigade rear. The division ammunition officer (DAO) has control of all division ATPs. ATPs stock high-tonnage, high- usage items. Since this is a transfer point, common field storage principles addressed in this manual do not apply. For the purposes of this manual, the ASP will be spoken of most often because it is the most common of the areas.

THEATER OF OPERATION STORAGE

Storage in a theater of operation, field storage, follows as nearly as possible the principles for storage in the Continental United States (CONUS). Such conditions as mobility requirements, scarce facilities, or enemy air power vary a great deal in theaters of operation. Thus the ideal of CONUS storage, including safety, cannot be fully met or maintained. Even so, explosives and ammunition may be satisfactorily and safely stored in the theater if CONUS regulations are adapted to field conditions. Detailed information on these adaptions is in TM 9-1300-206.

STORAGE CATEGORIES

Storage categories are the primary groups into which ammunition is segregated for storage in the field. The groupings are based on:

How desirable it is to store components of complete rounds in adjacent stacks.
The hazards of spreading explosions.

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The range of fragments.

The spread of fires.

Chemical contamination.

Conventional Ammunition. For storage, conventional ammunition is divided into categories A through G as follows:

Category A. Fixed and semifixed artillery ammunition, except incendiary and chemical.

Category B. Propelling charges, fuzes, primers, flash reducers, and separate loading artillery projectiles including high explosives (HE) and armor piercing (AP) but not incendiary and chemical projectiles.

Category C. Mortar ammunition and hand grenades, except incendiary and chemical.

Category D. Pyrotechnics and chemical ammunition of all types, including chemical filled rockets; gas, smoke, and incendiary bombs; gas and smoke artillery ammunition; incendiary and chemical grenades; smoke pots; VX-filled mines; and bulk-packed incendiary and small-arms tracer cartridges.

Category E. All demolition explosives, antitank and antipersonnel mines (except VX loaded), and components such as blasting caps, firing de- vices, detonating cord, and safety fuses.

Category F. Rockets, rocket motors, and rifle grenades, except chemical.

Category G. The following items of US Air Force Class V supply, all unfuzed high-explosive bombs, aircraft mines, aircraft torpedoes, and

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fragmentation bombs; fuzes and/or primer- detonators for the above items; and fragmentation bomb clusters, fuzed or unfuzed. The remainder of Air Force Class V items must be stored in other proper categories.

Special Ammunition. For storage, special ammunition is divided into the following general categories: Inert material such as missile and large (heavy) rocket bodies (less rocket motors) and test and handling equipment for nuclear ordnance items.

Missile and rocket fuels.

Oxidizers.

Solid propellants.

HE material such as detonators, HE warheads, and HE components of explosive nuclear weapons.

Nuclear material.

SAFETY

Storage categories help provide the basis for safety procedures for ammunition storage. Four of the most important follow. Ammunition items with the same storage risks are grouped together in the same storage category.

Within each storage category, QD tables (see Table 2-1) are the guide for the maximum quantity of ammunition to be stored within each stack and within each field storage unit (FSU) and the minimum distance between stacks, FSUs and categories.

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Most often, only one kind of ammunition is stored in a stack. If more than one kind is stored in a stack, use the storage compatibility mixing chart in TM 9-1300-206 (Chart 5-2). Be sure ammunition is stacked so it is easy to inventory and inspect. Where camouflage is necessary (see more on camouflage later in this chapter), step stacks in towards the top (terraced or pyramid stacking) to cut down shadows. Store components of complete rounds within the same FSU when practical.

Small arms ammunition may be stored with any category with one exception. Bulk packed incendiary and tracer cartridges must be stored in category D.

Table 2-1. Quantity Distance Table by Category.

Category	Gross Tons		Minimum Distance Between (in Feet)				
			Stacks		FSU		
	Per Stack	Per FSU	Unbarricaded	Barricaded	Unbarricaded	Barricaded	Categories
(A, B, or D)[1, 2]	Less than 10	400	40	30	300		750
	10-20 max.	400	50	40	300		750
C[3]	Less than 10	300	75	60	300		900
	10-30 max.	300	105	75	300		900
E[3]	Less than 5	50	75	60	300		900
	5-10 max.	50	105	75	300		900
F	20 max.	20	150	75	230	75	1500
	20 max.	30	150	75	230	90	1500
	20 max.	40	150	75	265	99	1500
	20 max.	50	150	75	295	101	1500
	20 max.	60	150	75	330	120	1500
	20 max.	80	150	75	390	135	1500
	20 max.	100	150	75	455	150	1500

G (Class V)[4]		20			200	75	1500
		30			230	90	1500
		40			265	99	1500
		50			299	101	1500
		60			330	120	1500
		80			390	135	1500
		100			455	150	1500

Notes:

1. If desirable, fixed and semifixed smoke ammunition, except WP, may be stored in category A.
2. The minimum distance between a stack of propelling charges and any other stack must be 100 feet whether barricaded or unbarricaded.
3. Whenever storage space is limited, category C ammunition may be combined with category E.
4. Under normal conditions, the Department of the Air Force will store and issue all class V supplies; however, depot commanders should always be prepared to handle these supplies in emergencies.

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SITE SELECTION

There needs to be a primary site and an alternate site planned for.

Primary Site. When selecting a primary site, the following criteria are important. Try to incorporate as many of them into the site as possible. They are listed in order of importance.

The area is easy to get to by the units supported.

The area is near the main supply route (MSR) with access roads into the ASP.

A roadnet within the site allows vehicles to travel under all weather conditions and requires little or no maintenance.

The ground is as level as possible. It must be able to support the weight of the ammunition as well as be able to drain off quickly. This also makes it easier for MHE to operate. More on MHE later in this chapter.

There should be natural barricades that can separate FSUs and categories.

The site should be isolated from hospitals and important military installations.

The site should be unpopulated and downwind of any populated areas if any hazardous chemicals are stored.

There should be an adequate water supply for fire fighting and bivouacking.

There should be a minimum of flammable vegetation.

There should be features, including natural concealment, that make the site easy to defend against enemy ground attack.

The area should be large enough to spread out ammunition stocks. This protects them against artillery or air attack and makes it easy to expand.

Because of tactical conditions and other influencing factors, an ASP site may not have all ideal features. In fact, higher headquarters may dictate where an ASP will be.

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Alternate Site. Pick an alternate ASP site close to the primary one, because there maybe some other unit already in the primary site. Another consideration: the enemy may attack with artillery, mortar fire, or chemical agents as soon as the primary ASP is set up, and the unit may have to evacuate fast. Finally, some units have used their alternate sites as regular ASPs when their stockage objective expanded- far more than they expected.

STORAGE SYSTEMS

After the site is selected, consider what system to use. There are several basic methods for storage of ammunition in the field. Consider the following:

The physical characteristics of the site.

Where hostile forces, uniformed or clandestine, are.

What the weather is expected to be.

The time and resources available. The expected life of the ASP. The space available and what type operation will most easily allow following QD requirements.

Free movement of vehicles throughout the storage complex. Vehicles must be able to pass other vehicles being loaded or unloaded. There should be no dead-end roads requiring backing or turning around.

The roads should be stabilized to withstand traffic up to fully loaded 40-ton trailers.

AREA STORAGE

In this system, the area is divided into three sections and subdivided into FSUs and stacks. Ammunition is stacked and is spaced to meet QD requirements, ending up looking like a checkerboard. This system provides efficient use of the total area, but it may require a lot of road and pad construction and stabilization of the earth.

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ROADSIDE STORAGE

This system allows ammunition to be stored in stacks along the edges of existing roadways. FSUs and sections are spaced according to QD requirements. Effective use of this method requires a large road network and a total area much larger than the area system needs. However, little construction is necessary. A variation of roadside storage, known as “storage in depth,” is very useful if the existing road network is limited. In this method, one or more additional stacks of ammunition are stored behind the roadside stack, away from the road. The use of this system is restricted in wet climates or if there are poor soil conditions or heavy forests. Under these conditions, the stacks of ammunition would not be easy to reach.

AREA AND ROADSIDE STORAGE

A combination of area and roadside storage is often used to lessen the bad aspects of both systems. It allows the most effective use of the existing road network in a limited area. But, while the combination does not require as much land as roadside storage does, it does involve some road and pad construction.

BARRICADED ABOVE-GROUND MAGAZINES

This system is designed for larger ASPS and depots in the theater of operations. It is two or more storage blocks of barricaded above-ground magazines in various sizes, separated from each other by at least 122 meters. Items stored on an individual pad must be compatible (see TM 9-1300-206).

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The amount of explosives per pad must meet the net explosive weight (NEW) limitations of TM 9-1300-206.

MODULAR STORAGE SYSTEM

This is a field storage system for conventional ammunition stored on pads within earth-barricaded areas called cells. These cells are joined to form modules, which may, in turn, be arranged to form module blocks (Figures 2-1 and 2-2). Security, real estate, or operational requirements may force the use of this storage system. Unlike the other field storage systems, with modular storage, NEW rather than gross tonnage is used in determining the maximum quantity of ammunition that maybe stored in each cell or module. Before deciding to use the modular system, consider the advantages and disadvantages over the other field storage systems. Some of the advantages are reduced real estate requirements, improved security with available forces, reduced danger from direct fire on ammunition stocks in small barricaded areas, reduced transportation needs in the ammunition area, and reduced internal roadnet needs. Some of the disadvantages are the possibility of fire or explosion spreading from cell to cell because of heat or fragment dispersion, increased danger to stock from indirect fire and aerial bombs, and the need for more engineer support for initial construction. The modular method should only be used if the QD requirements of the other field storage systems cannot be met due to security, real estate, or operational limitations.

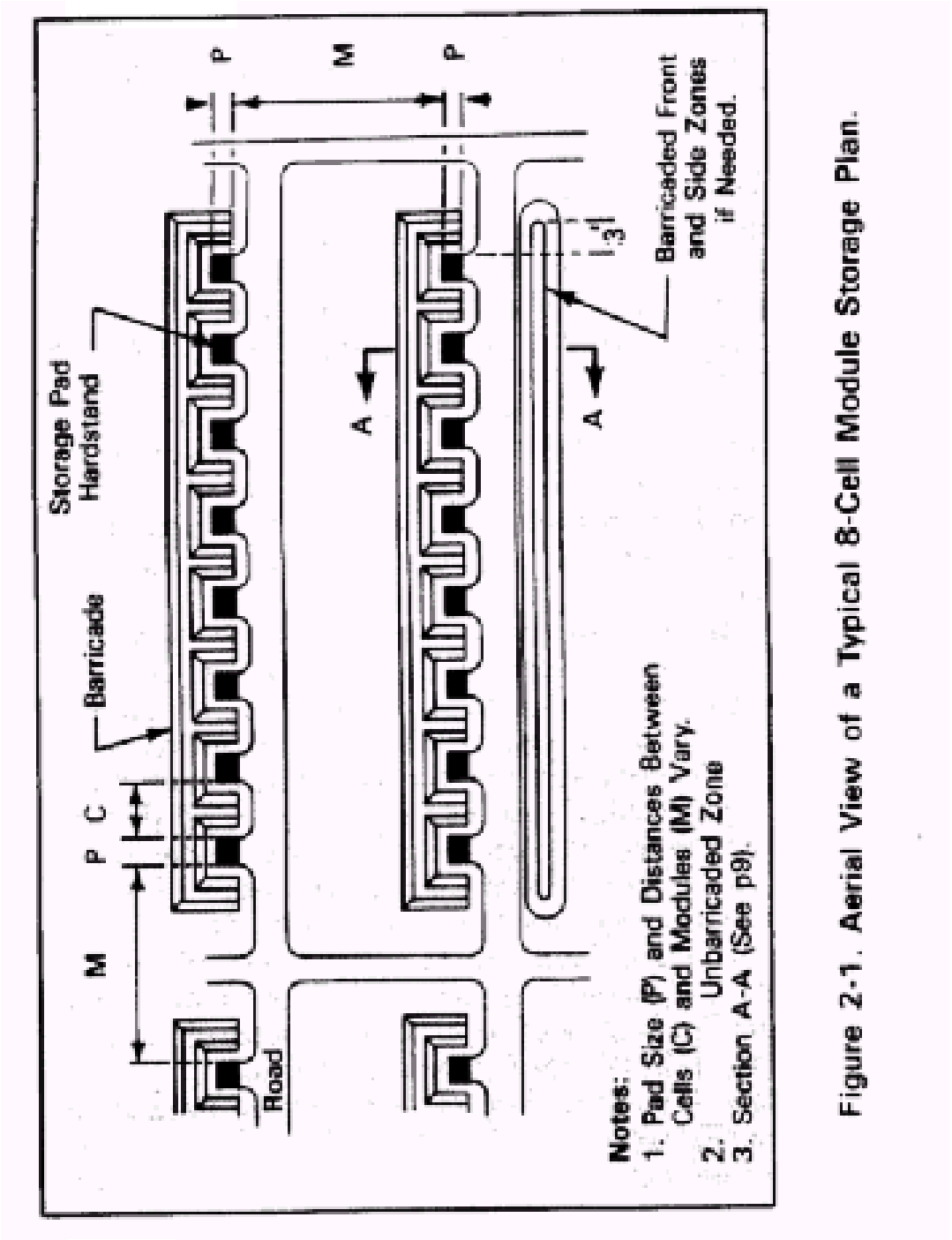

Figure 2-1. Aerial View of a Typical 8-Cell Module Storage Plan.

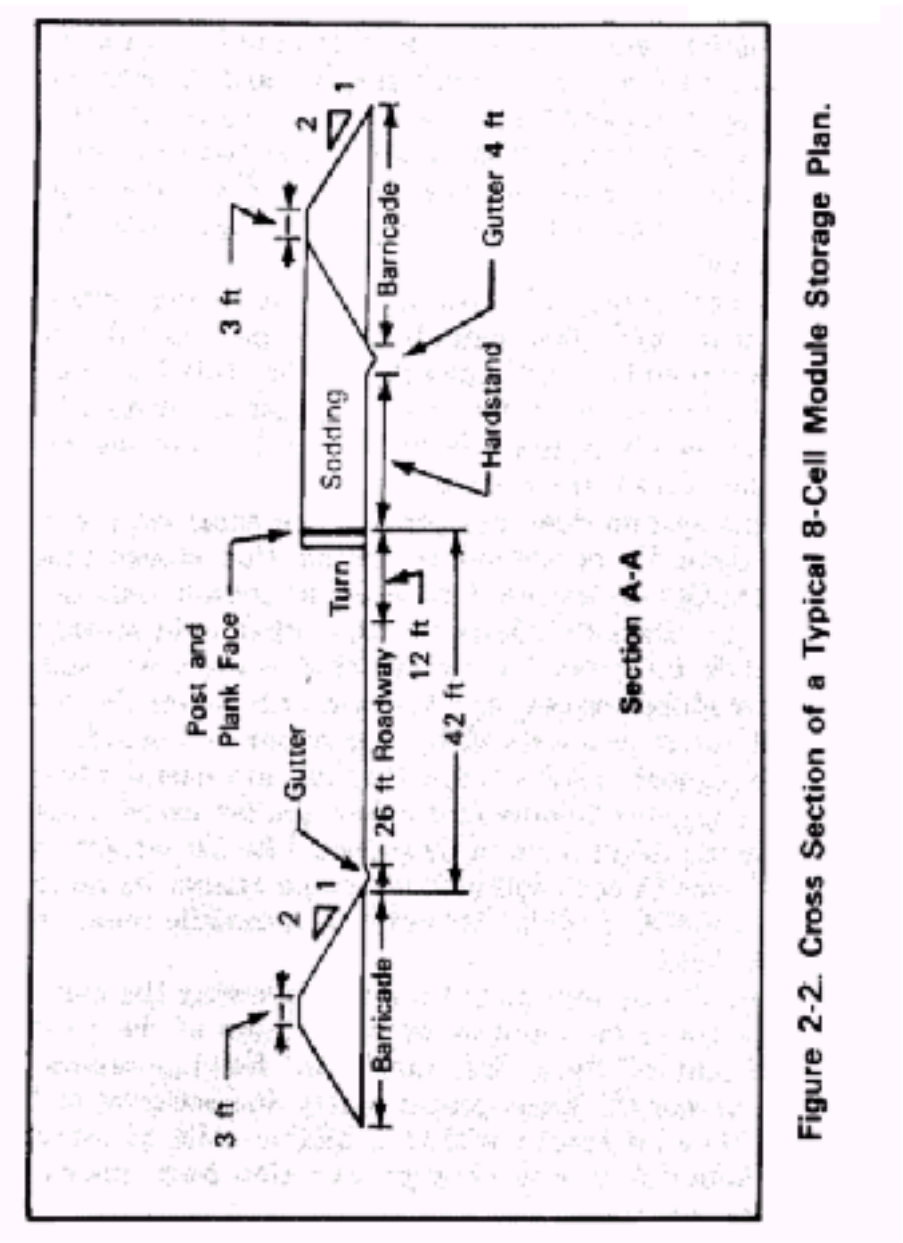

Figure 2-2. Cross Section of a Typical 8-Cell Module Storage Plan.

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Where and How To Use Modular Storage.

In a theater there may be limited space and/or security, making it impossible to store ammunition as prescribed in QD and compatibility regulations for area, roadside, and area/roadaide storage. When this happens, a modular system of storage may be preferred.

In most cases, this system will only be used when less than 2,000,000 pounds NEW per module or 250,000 pounds NEW per cell, will be stored. It may also be the solution for storing larger quantities in rear areas where space is limited and where several module blocks are needed. This system does not provide the same degree of protection for personnel or ammunition stocks that normal QD dispersion does. For this reason, only use it as an alternate solution when other field storage methods for class 1.1 ammunition cannot be used. The modular system can be used only when the request for it is approved by the major command.

Barricaded open storage modules are useful when high explosive bombs and other similar cased class 1.1 ammunition have to be stored. The net weight of explosives in each cell of the module cannot be more than 250,000 pounds. All items in a module must be compatible. Use this system as the others, following the same principles of ammunition storage. Some of the most important of those are, maximum feasible separation, proper drainage, proper safety and security, and dispersion of stocks within available cells to avoid complete loss of a single type munition from one explosion or fire.

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Modular System Construction Characteristics.

A module is a barricaded area with not more than eight cells separated from each other by barricades. The unbarricaded openings of modules and cells must not face each other. One-cell modules may be built if required, but maximum flexibility of stockage and internal movement should be maintained. A module has tonnage and explosive weight limitations specified by the major command that authorized its use. Normal maximum limits are 2,000,000 pounds NEW per module or 250,000 pounds NEW per cell. See Table 4-5, TM 9-1300- 206, for construction dimensions of cells and storage pads. All barricades are standardized earth mounds. If possible, use natural barricades such as hillsides or steep slopes. Carefully check the earth for large rocks or boulders. Make sure there are none because each increases the missile hazard. The slope of the barricade should not be steeper than 1.5 to 1, and the crest should be at least 3 feet wide. Make barricades tall enough that a straight line drawn from the far top edge of the stack (away from the barricade) at an angle 2 degrees above a horizontal line drawn along the top of the stack will pass through the entire width of the barricade crest. See Figure 2-3. Locate the center-line of barricades between cells of the module midway between adjacent storage pads. Put back and end (outside) barricades the same distance from the pads as those between the cells. Make sure the distances between stacks of munitions in adjacent cells and between adjacent modules

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follow TM 9-1300-206. Where NEWs are different from those listed in TM 9-1300-206, determine the required separations as follows:

The footage between stacks in adjacent cells is 1.1 times the cube root of the net weight of most hazardous explosives in the module as determined by the largest required QD separation.

The footage between adjacent modules is 2.5 times the cube root of the net weight of the most hazardous explosives in either module as determined by the largest required QD separation.

Note: Contact a civilian or military ammunition inspector for assistance if needed.

The distance between a module and a standard concrete arch or steel arch igloo magazine must be not less than 185 feet barricaded. All straight lines drawn between the module and the igloo must pass through the module barricade and igloo earth cover. The distance from unbarricaded door of an igloo facing a barricaded module must not be less than 360 feet. Separation distances between a modular storage area and other supply areas, inhabited areas, or roads are the same as required for any other field storage systems (TM 9-1300-206).

Compatibility in Modular Storage. Store only ammunition items of one field storage category (TM 9-1300-206) in a cell. Different kinds of ammunition within one field storage category should be stored in

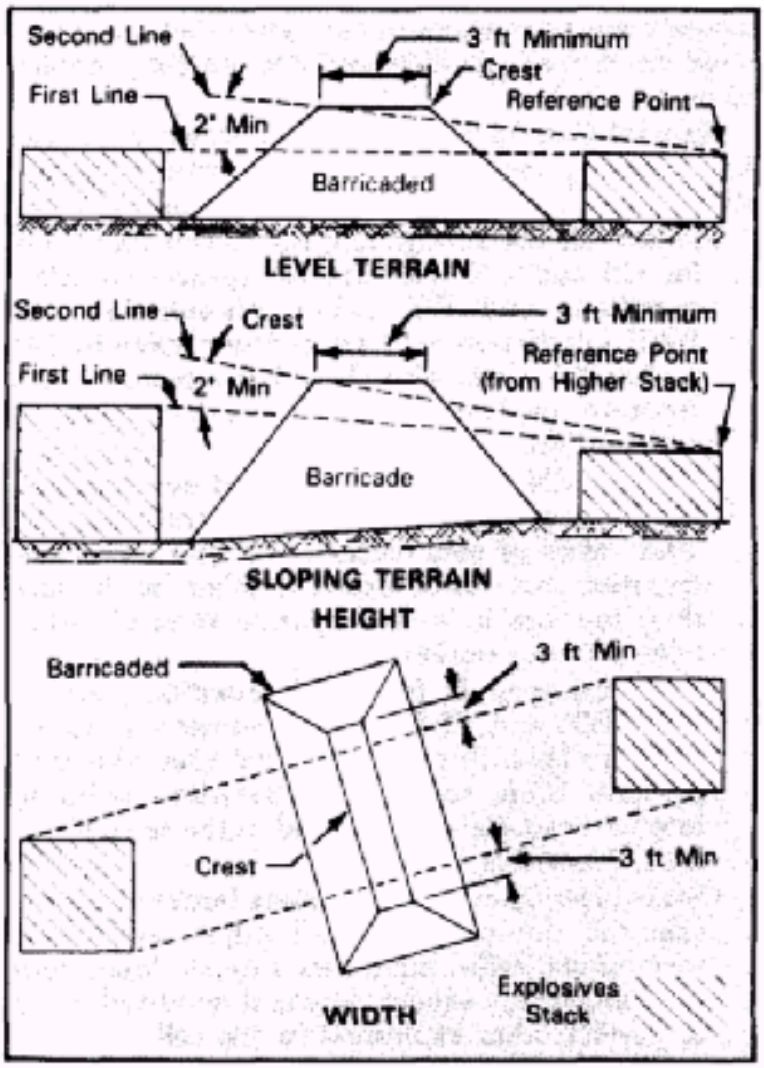

Figure 2-3. Barricade Dimensions Between Explosives Stacks.

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separate stacks if stored in the same cell and separated as far as possible without wasting storage space.

Special Considerations for Modular Storage.

The following items require special storage considerations when in a modular storage system.

Follow all the storage and safety considerations for CS and CN (riot control agents) chemical munitions and WP (white phosphorus) and PWP (plasticized WP) ammunition given in TM 9-1300-206. Cells with these items must be in a separate module, away from other types of ammunition.

CS and CN munitions can be stored together, but be sure they are in a cell separate from all other types of ammunition. WP and PWP ammunition can also be stored together, but be sure they, too, are in a cell separate from all other types of ammunition.

Store category D (chemical munitions, except WP/PWP and CS/CN) and category F munitions (rockets) in end cells of modules whenever possible. Store category F munitions pointing into barricades and all pointed in the same direction, if possible.

Store blasting caps in a separate bunker built inside the cell containing all other category E (demolition items, mines, etc.) items. Make sure the bunker has enough side and overhead cover to protect other explosives in the cell.

Store category B (propellant charges) in a separate module. The module may have one or more cells, depending on the required stockage.

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Store improved conventional munitions (ICM) alone in a separate module. The module may have one or more cells, based on the required stockage objective.

Store unserviceable, hazardous ammunition awaiting destruction and captured enemy ammunition in a separate module. The module may have one or more cells, based on the requirements. Review all other provisions of TM 9-1300-206 regarding safety, storage, handling, etc.

STORAGE PLANNING

After the site and the system of storage is known, lay out the site, draw up a storage plan and a destruction plan, and write SOPs for each ASP operation. (See AMC Reg 385-1 and TM 9-1300-206, Chapter 2) A good plan makes a smooth-flowing, safe operation possible. Organize the ASP into areas with specific functions. This makes it easier to do the mission and isolate hazards, Figure 2-4 is a typical layout and shows the areas most likely needed. Table 2-2 is a list of the ASP areas with important information needed to develop plans.

STORAGE PLAN

Make sure the storage plan agrees with the area layout plan. Use the following checklist when creating the storage plan.

What is the maximum tonnage expected to be in each storage category?

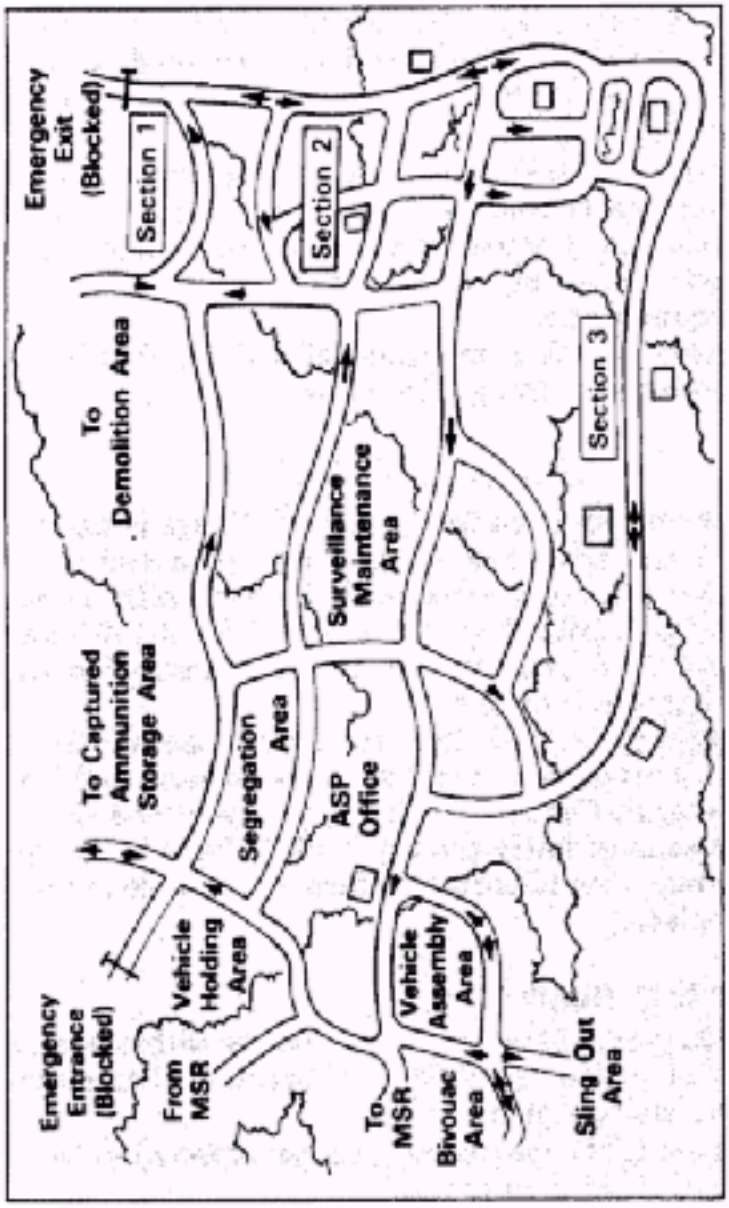

Figure 2-4. Typical ASP Layout.

Table 2-2. ASP Layout Areas.

Area	Minimum Safety Distances	Purpose	Notes
ASP		The Operations Center for the ASP.	Located at main entrance to ASP for maximum control and service to supported units.
Vehicle Holding Area	Transit area, no QD applied.	A parking area for vehicles waiting to be served. Reduces traffic congestion in your storage sites.	Located near the ASP office where vehicles will not interfere with the flow of traffic.
Segregation Area	Required quantity. distances for ammo storage.	A temporary storage area for segregating hazardous ammo and ammo in mixed lots. Also used to inspect unit turn-in when not possible to inspect at time for receipt.	Unserviceable ammo should be stored by item, lot, and category and a minimum of 700 m from nearest stack of serviceable ammo.
Ammo Storage Area	Required quantity distances	For storing serviceable ammo with respect to its field storage category.	The storage area is divided into storage sections by no., FSUs by letter, and stacks by no. Example: 2D1 is Sec. 2, FSU-D, Stack 1.
Demolition Area	700 m from other areas.	For destroying unserviceable ammo.	Choose an area unusable for other purposes and cleared of vegetation.
Salvage Area	No quantity distance requirement.	For storage of nonexplosive Class V material.	An inert area for boxes, brass, etc.
Assembly Area	Transit area, no QD applied.	A parking area for loaded vehicles being assembled for a convoy.	It may have to be consolidated into the vehicle holding area.
Ammo Sling-out	550 m from ammo storage and bivouac areas.	Provides capability of limited aerial resupply.	Located so aircraft will not pass over storage or bivouac areas: should be at least 25 m square having a stabilized base of PSP matting, etc., which will support the weight of stocks and MHE.
Bivouac Area	700 m from ammo storage or other ammo operations.	The living area for the ASP personnel.	Should be located as far as possible from storage sites for increased safety and a minimum signature.
Survl & Maint Area	IAW TM 9-1300-250, SB 742-1, and other applicable SBs.	To perform ammunition inspection, repack, and minor maintenance.	Depending on the life expectancy of the ASP this area may not be included.

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What are the expected average daily receipts and issues?

What is the time available before first shipments of ammunition arrive?

What is the expected lifetime of the ASP?

What is the system of storage that will be used?

What are the physical characteristics of the terrain that can be used as natural barricades, or that deny or restrict using certain areas?

What natural cover and concealment are there?

What engineer construction and other required support is available and necessary?

What are the area security problems and requirements?

What are the special security requirements needed for classified ammunition?

What section, FSU, and stack numbering sequences are needed to be sure placement and retrieval of stocks is fast and accurate?

While the storage plan is being prepared, make sure all storage areas are clearly marked. Make sure signs are posted showing traffic direction, entrances, and exits. Make up and have reproduced a map of the storage areas. Use it to direct customer units to the proper storage area. To reduce customer waiting, group ammunition by combat arms. Name roads to describe the ammunition stored along them, for example, Artillery Row or Tanker Road. Prepare and maintain enough directional signs, fire symbols, and FSU stack signs for two ASPS.

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ASP Planning. Some guidance based on field experience is given below. Be familiar with it when planning an ASP. In laying out an ASP, locate the office far enough from the entrance so a convoy can park until the trucks are directed to various stacks. Make a map of the area showing the location of each stack, what items should be stored there, and the amount to be stored. Make sure there is enough dunnage near proposed storage locations to save time when ammunition receipts arrive. Be sure that traffic flow is smooth. Have one-way traffic wherever possible, few turn-arounds, parking areas at entrances and exits so ammunition can be issued fast, and vehicle holding areas and vehicle assembly areas. Do not allow trucks to back up without a ground guide. Make sure there is a large parking area in case several trucks arrive at once.

Stack Location. Ammunition stacks should be far enough back from the road to allow trucks to be loaded or unloaded without interfering with traffic. Do not jam containers together; stack containers so the markings are plainly seen.

Standard Identifiers. Some units use a standard layout system both as a standard layout practice wherever they are and as a way to identify and locate ammunition. With this system, there are either lettered or numbered locations that always contain certain types of ammunition. Sub-depots are designated by letter; storage sections, by number FSUs, by letter; and stacks, by number. For example, if ammunition is stored in sub-depot A, section 1, FSU-A,

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stack 1; it can be labeled A1A1. Each time a new ASP is established and similar stocks are required, they are placed in the same relative positions as the old ASPS. Of course, ground features must be similar to the old site. There needs to be at least one long road through the area as a reference point before a standard identification system can be used.

Lot Number Storage. All ammunition must be stored by lot number, and each lot number must be separated from other lot numbers. See Appendix D. Ammunition is numbered by lot when it is made. The lot number helps identify the ammunition and is vital for accountability, issue, and storage. Be sure individual lots are marked with tags or signs and each lot is segregated in its storage location—away from other lots.

Protection from the Weather. Basically, four things are necessary to protect ammunition from the weather: adequate shelter, enough dunnage, good drainage, and good ventilation. Tarpaulins (tarps) over stacks help (see Figure 2-5), but unless the tarps are raised clear of the stack (18-in minimum), they will be useless. Tarps can also be used as improvised shelters for VT fuzes and pyrotechnics. In most areas, stacks have to be at least 4 to 6 inches off the ground. If they are not, the ammunition gets wet and air does not circulate. Rounds get rusty and become unserviceable. Lumber on the ground beneath containers acts as dunnage to raise them the appropriate distance. If there is no lumber, or trees are not available for dunnage, try using empty ammunition boxes or use ration boxes filled

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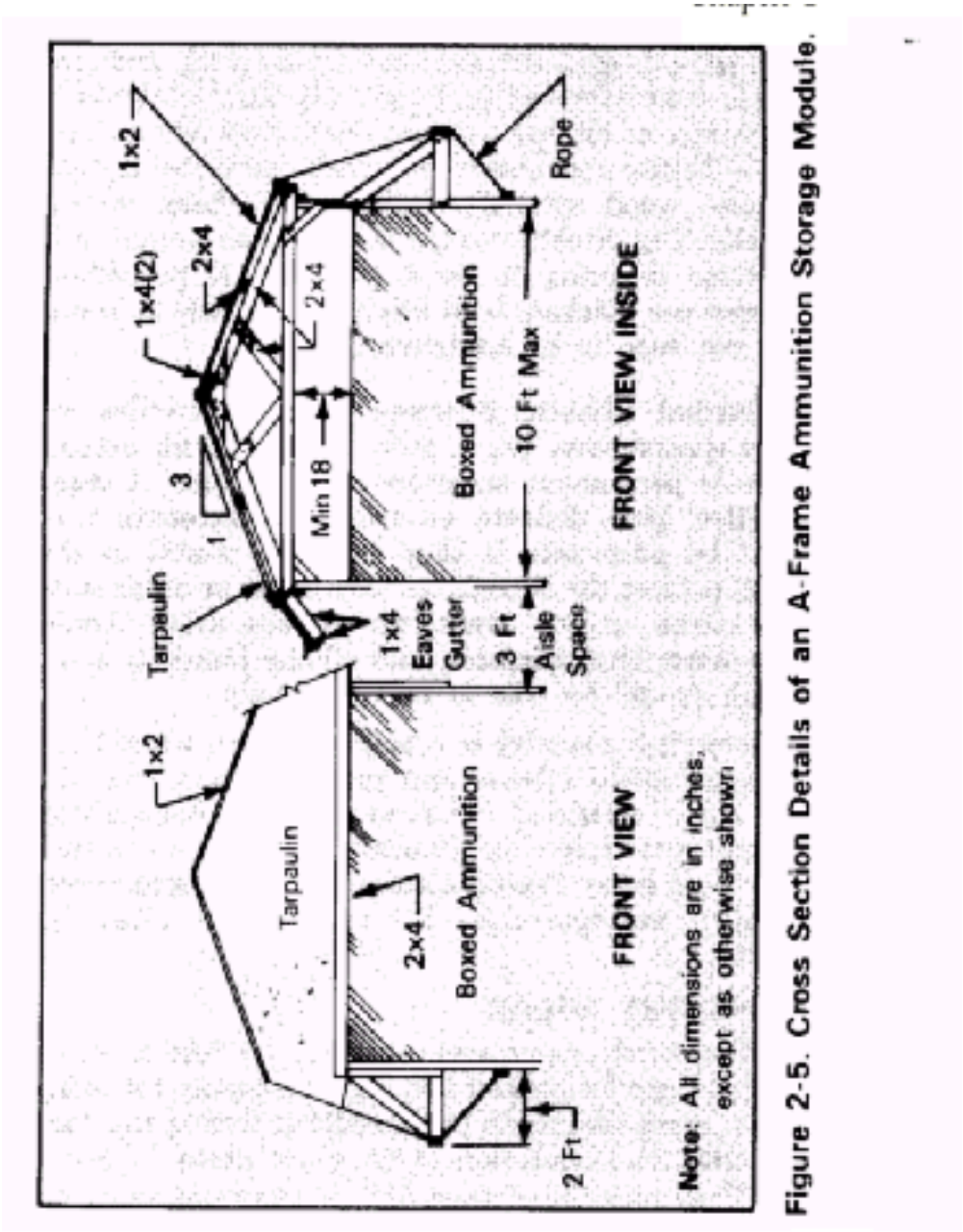

Figure 2-5. Cross Section Details of an A-Frame Ammunition Storage Module.

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with sand or dirt. Bricks, wood from crates, and materials from wrecked buildings will also work. Putting strips of lumber between containers lets air circulate better and makes the stack more stable. But because wood rots and falls apart, check it frequently. Dig ditches around stacks of ammunition if drainage is going to be a problem. If propellant charges are stacked, turn lids down slightly so water will not seep in or accumulate.

Guided Missile Storage.

Guided missiles require special care. Try to store guided missile assemblies in permanent structures. The bodies of these missiles have delicate electronic components that must be protected. If they must be stored in the open, protect the containers with tarps or other suitable cover. In any event, the storage areas should have hard, level surfaces, and all the humidity indicators should be able to be read easily.

Security. Security is a major concern when handling classified missile and rocket components. Do not store classified components with unclassified components. Keep an accurate check on personnel who must enter classified storage areas or structures. If open storage must be used, there must be guards.

SLING-OUT AREAS

Plan for sling-out areas in or near CSAs or ASPS so there can be limited helicopter resupply for using units. Some factors to be considered during the construction and operation of sling-out areas follow:

They must be at least 550 meters from ammunition storage locations, working areas, and inhabited areas.

Consider prevailing winds because helicopters must come in with the wind and take off into the wind. This is also important in limiting downwind contamination in case there is an accident involving chemical weapons.

Sling-out areas must be set up where aircraft will never pass over storage locations, inhabited areas, or public roads while coming to the area, landing, taking off, or leaving the storage area.

Sling-out areas should be at least 25 meters square. They should be made out of the best material available. Perforated steel planking is a good field expedient.

Have on site only that ammunition to be placed in cargo nets. If the situation dictates, cargo nets may be loaded at the designated stock locations and then transported to the sling-out area.

Do not use the sling-out area for storing ammunition because compatibility and quantity distances cannot be maintained at the sling-out areas. Clear immediately all incoming shipment and field returns, and store them properly in the storage facility.

Load and stage cargo nets so aircraft can pick up the load while hovering. Make sure there is a static electricity discharge probe to be used by hookup personnel before they connect the load to the cargo hook. Make sure hookup personnel are properly trained to use the discharge probe.

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Keep MHE clear of the area while aircraft is landing or taking off.

Make sure there is working fire fighting and other emergency equipment at the area whenever the area is being used.

Make sure helicopter teams know the proper hook-up procedures and hand and arm signals.

When planning air shipments, be sure to consider the allowable gross weights for military cargo aircraft as shown in Table 2-3.

Table 2-3. Allowable Gross Weights for Military Cargo Aircraft.

Aircraft	Maximum Gross Weight (Pounds)	Payload (Pounds)
C-130	29,000	24,000
C-141	26,500	21,900
C-5A	43,500	38,900

See Appendix B for information on helicopter rearm points.

CAMOUFLAGE

The ASP must be hidden and blended into the countryside. Its location and size must be disguised. Use natural cover and concealment as much as possible. Using camouflage wisely goes a long way toward keeping the ASP from being discovered. General use of camouflage material is in FM 90-2 and TM 5-200. In ASPs, however, the requirements for camouflage may conflict with the requirements

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for firebreaks and ammunition shelters. Commanders must carefully weight their decisions and try to use camouflage as much as possible without violating explosive safety and proper ammunition storage procedures. Camouflaging should not slow the initial or continual operation of the ASP.

MATERIALS HANDLING EQUIPMENT

MHE is equipment that helps ammunition personnel store, handle, and ship ammunition. It makes it possible for vehicles to be loaded or unloaded rapidly upon their arrival and for ammunition to be properly handled. Included are forklift trucks, towing tractors, cranes, pallets, jacks, platform trucks, conveyor systems, etc. The most common of these are described below. Whatever is used, there are two things to consider when planning for MHE: The individual unit pack, size, and weight of the materiel to be shipped; and the type and size of the means of transport. All MHE must be load tested, and date of test stenciled on equipment.

Forklift Trucks. These pick up, carry, and stack unit loads of supplies and equipment and may be powered by gasoline, diesel, liquid petroleum gas, or battery. Under each of these categories, forklift trucks are broken down by lifting capabilities ranging from 2,000 to 15,000 pounds. Electric (battery- powered) forklift trucks are important because they are the only forklift trucks that may operate in the holds of ships transporting ammunition. They can lift from 2,000 to 10,000 pounds and are generally restricted to hard surfaces.

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The forklift most commonly used at field storage activities is the rough terrain forklift (RTFL). It is an off-road vehicle with pneumatic tires so it can be used on prepared or unstable surfaces including beaches and other deep sand and can be used for loading and unloading flatbed trailers, landing craft, or other similar small cargo vessels. RTFLs can perform the functions of three types of MHE, a forklift truck, a towing tractor, and an RT crane (when the RT crane attachment is installed in place on the work carriage). The RTFL can be used for fording if the water is not over 5 feet (if there are waves, not more than 5 feet to their crest). The RTFL has front and rear -axle steering, so it can move sideways at 20-degree angles and turn with a short radius. It also has 2-wheel and 4-wheel drive so it can go over paved roads, sand, mud, snow, and steep grades with equal ease.

Towing Tractors. Towing tractors are vehicles that pull trailers. Towing vehicles (truck tractors, etc.) are important for moving ammunition efficiently. To get the most benefit, each tractor should be shuttled so that each can be used with at least two trailers. This reduces the time tractors wait for just one trailer to be loaded or unloaded. There is more information on types and characteristics of towing tractors and trailers in TM 9-500. When ammunition is transported by tractor-trailers, precautions in TM 9-1300-206 should be followed.

Cranes. Cranes raise, shift, and lower heavy weights with a projecting boom, swinging arm, or

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other hoisting device that is supported on an overhead track. The crane and the forklift truck equipped with a crane boom both suspend their loads. This makes it unsafe for either to handle a load unless it has been prepared by proper lashing or unless a sling is used, such as a pallet sling for pallets. Cranes in ASPs are used mostly to handle projectiles. Since they can move more than one pallet at a time, they are more efficient than the RTFL, which is limited to one pallet at a time.

Pallets. Essential to the use of MHE are pallets. They are portable platforms of wood or other materials that come in many sizes and are vital to handling, storing, and moving ammunition.

STORAGE SAFETY

Because ammunition is so dangerous, it demands special safety regulations, which are more stringent that those for other classes of supply. Make sure a highly qualified individual has the authority for planning, coordinating, and supervising the ASP safety program. This person must make sure the QD criteria, storage compatibility groupings, are followed. This is the only way to reduce the chance of fire or sympathetic detonation. Consult Chapter 1 for more details on safety programs. There are times the unit will not be able to observe all these requirements, but it must be kept in mind that, as tonnage is increased and distance reduced, the chance of fires and explosions is increased.

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DISPERSION

If assets are dispersed enough, the ASP will not be an inviting target from the air. When possible, store quantities of each type of ammunition in two or three widely separated areas. Then, if the contents of one area are destroyed, the entire supply of any one item will not be lost. When there is not enough space to spread out, it is better to increase the quantity of ammunition in stacks and FSUs than to reduce the safety distances.

INTERSTACK DISTANCE

Interstack distances, the minimum distance between the near edge of adjacent stacks, are setup by appropriate QD tables and help prevent spreading of detonation from blast pressures. Be aware, however, that interstack distances are not always protection from missile fragments resulting from explosions or fire. Aggressive fire fighting can usually help prevent fire spreading from one stack to another at these distances. In fact, the greater the distance between stacks the less likely fire will spread from stack to stack. With this in mind, try to separate stacks by greater distances than those prescribed. This will help prevent fires and make fire fighting easier.

INTER-FSU DISTANCE

The inter-FSU distance, the distance between the nearest edge of the nearest stacks in adjacent FSUs, also helps prevent fire spreading. When distances cannot be met, use extra care when setting up and maintaining fire protection, fire guards, and fire fighting measures.

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INTERCATEGORY DISTANCE

The intercategory distance, the distance from an FSU of one category to the nearest FSU of another category, is based on the hazards of each category of ammunition. This distance cannot be reduced by barricades.

OPTIMUM SAFETY DISTANCE

The optimum safety distance is the limit inside which structural damage from a blast or from missile fragments will be serious. Be sure this distance is considered if ASPS have to be located near gasoline or other storage facilities, hospitals, permanent radio transmitters, railroads, and highways.

BARRICADES

The effect of sympathetic detonation can be reduced if there are sand or earth barricades at least 3 feet wide at the top and 1 foot higher than the stack. Natural barriers of the same dimensions give the same effect. In some cases, barriers can reduce the interstack distance up to 50 percent IAW the applicable QD tables.

CHEMICAL AMMUNITION

Store chemical filled ammunition (Category D) so that each container, item, or bomb can be inspected and easily removed. Keep projectiles containing phosphorus out of the direct sun, and store them with their bases down.

TOXIC AMMUNITION

Store toxic chemical-filled ammunition in the part of the ASP with the lowest elevation and at least 1 mile downwind from inhabited ASP buildings or

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other storage areas. Make sure there are no inhabited buildings or storage areas within 2 miles downwind of the storage site. Make sure there is maximum security for this kind of area. Water-filled barrels for immersion of leakers should be placed nearby.

ROCKETS

The safety requirements for storage of rockets are stricter than for most other types of conventional ammunition. Store both small caliber rockets and large caliber, free-flight rockets on the outer edge of the ASP. Point their noses away from all other stored ammunition and from all inhabited areas. Store small caliber rockets so they are pointed into an artificial or natural barrier of sand or earth at least 3 feet thick. Locate the rockets so that there is nothing, other than their own containers, between the rockets and the barrier. Do not make stacks more than one row deep.

CATEGORY G AMMUNITION (BOMBS)

Category G ammunition is usually stored and issued by the US Air Force. However, depot and ASP commanders handle it in emergencies. For this reason, the following restrictions must be studied. The FSU is the smallest storage unit authorized. Fuzed fragmentation bombs in the same FSU may not be stored with other bombs. Components of bombs (fins, fuzes, primer-detonators, etc.) can be stored between the FSUs. If that is done, remember to protect fuzes and primer-detonators from heat and moisture. Category G photoflash bombs can be stored with Category F. If this is done, do not store

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them in the same FSU with other Category G- ammunition.

FIREBREAKS

Build firebreaks wide enough (at least 50 feet) to prevent the spread of fire. If they are available, use bulldozers with specially constructed ground clearing machinery. Underbrush and grass can also be burned over. Any burning must be done before ammunition is received.

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AMMUNITION MAINTENANCE, INSPECTION, AND SURVEILLANCE

This chapter provides general information and guidance for ammunition personnel who are responsible for the maintenance of conventional ammunition, to include its demilitarization. Detailed maintenance and surveillance procedures for specific items of ammunition are in TM 9-1300 series publications. Still more surveillance procedures are covered in SB 742-1. Doctrine and policies that apply to direct support (DS) and general support (GS) ammunition companies are in FM 9-6 and FM 9-38.

MAINTENANCE

REPAIR PARTS, TOOLS, AND EQUIPMENT.

Tables of allowance (TA), tables of organization and equipment (TOE), and the repair parts and special tools lists (RPSTL) of the technical manual for

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the specific class of ammunition all authorize the tools and equipment ammunition handlers need. Special tools are also listed in SC 4940-95-CL-A11 for DS units and in SC 4925-95-CL-A03 for GS units. Consumable and expendable supplies needed for maintenance are listed in the proper technical manual. Packing materials are listed as repair parts.

LEVELS

There are three levels of maintenance for which Army ammunition personnel are responsible. They are detailed in technical manuals and related publications and regulations as listed earlier. Levels of ammunition maintenance are briefly discussed below.

Organizational. All activities having conventional ammunition on hand, including using units, perform organizational maintenance. It prevents deterioration of ammunition from rough handling and exposure. It involves cleaning, removing minor rust and corrosion, repairing and replacing boxes, and restenciling containers as prescribed in the proper -10, -12, or -20 technical manual and as required by the maintenance allocation chart (MAC). Direct Support. TOE 9-64 conventional ammunition companies perform direct support (DS) maintenance. It includes surveillance and limited maintenance of stocks under the companies' control. DS maintenance involves cleaning and protecting individual items and/or packing material; removing light rust; making minor repairs on boxes, containers, and crates; spot painting and restenciling, and replacing

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readily removal external parts and components such as fuzes of artillery and mortar ammunition, propelling charges and primed cartridge cases for semifixed and mortar ammunition, grommets, and nose plugs. Packing containers and packing material authorized at DS level are limited because storage space for them is limited. These materials are listed in TM 9-1300-250.

General Support. TOE 9-74 conventional ammunition companies in the COMMZ perform GS maintenance. GS maintenance units perform that part of the maintenance mission that the DS ammunition company cannot.

DS/GS Maintenance Planning. The objective of all DS/GS planning is the construction of a maintenance line that processes an item as efficiently as possible. The planning process is as follows:

DS/GS support units perform ammunition maintenance and demilitarization only after they receive a properly validated work authorization. Such work authorization may be a maintenance request (DA Form 2407), an endorsement to the Ammunition Condition Report (DA Form 2415), or a letter of authorization. Instructions for using these forms are in DA Pam 738-750. The maintenance officer may create an assignment sheet (work order) when the validated work authorization does not furnish enough information.

All the information on the item to be processed

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should be collected from the validated work authorization and/or the appropriate data sheets and carefully studied in order to decide how the job can be completed. A process flow sheet should then be prepared. This is a compact chart for recording the proper sequence of everything that has to be done. For more details on making one see TM 9-1300-250. Next, write the SOP to supplement the flow sheet. Get instructions for preparing the SOP in TM 9-1300-250. Depot maintenance work requirements (DMWRs) for renovation, repair, or demilitarization of ammunition provide information concerning the technical features of various maintenance operations. They consist of a series of sheets in pamphlet form. Approval for the DMWR is by the commanding officer of the US Army Armament Munitions and Chemical Command, Rock Island, IL, but a qualified staff member can also be delegated the responsibility for reviewing and the authority for approving the DMWR. When a DMWR is received in the field, it should be used as a guide for making up the maintenance SOP for that particular operation. TM 9-1300-250 provides a sample page of a DMWR.

When flow sheet and SOP (to include the index of operations and operations format) are done, the ammunition officer with the help of the key NCOs should give the service section a list of all the special tools that will be needed.

Now, determine the shape of the maintenance line based on the flow sheet. It is usually a

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straight line or a “U” shaped line. The straight line is most often used when two roads are available, one at the incoming end of the line and the other at the outgoing. TM 9-1300-250 shows a sample straight-line operation. The U line is usually used when there is only one road available for supplying and removing processed items, TM 9-1300-250 also shows a sample U line operation.

SAFETY

Safety in ammunition maintenance is covered in AR 385-10, TM 9-1300-206, and maintenance manuals for specific items of ammunition. Explosives safety, covering fire fighting procedures, the handling and storing of ammunition, operational precautions, QD requirements, barricades, operational shields, personnel and explosives limits, and safety tools and equipment, is covered in Chapter 1 of this manual.

AMMUNITION INSPECTIONS AND SURVEILLANCE

INSPECTIONS

Inspections in maintenance organizations are one of the requirements of the Ammunition Surveillance and Quality Evaluation Program (see AR 702-6, AR 740-1, and SB 742-l). A QASAS, or MOS 55X soldier under the guidance of a QASAS, periodically inspects ammunition items to determine the serviceability of the ammunition according to SB 742-1 as well as other pertinent

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SBs for the specific classes of ammunition. Inspections to determine serviceability will also be done when ammunition is turned in by using units. An additional inspection will be done after maintenance to see if unserviceable items have been made serviceable. The inspector performs and certifies this inspection before the ordnance goes back to the storage area.

SURVEILLANCE

Ammunition surveillance is the observation, inspection, and classification of ammunition and ammunition components during movement, storage, and maintenance. It includes the inspection of all ammunition, equipment, facilities, and operations. Surveillance is conducted at all theater installations responsible for the storage, maintenance, disposal, and shipment of ammunition and components. Surveillance ends when the ammunition is expended or destroyed. Within theater ammunition units, surveillance is performed by attached civilian and assigned military ammunition inspectors. The civilians, the QASAS, are inspectors with over a year of technical training plus an apprenticeship. Periodically, throughout their careers, they receive additional resident training. The military inspector (MOS-55X) is recruited from the ammunition career management field and receives additional formal school training. This training concentrates on the practical inspection of conventional ammunition and small missiles. The training and experience of the military inspectors provide adequate technical expertise for them to

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work with QASAS. Surveillance will in general be accomplished as specified in SB 742-1.

Responsibilities. Theater Army headquarters

has general supervision over ammunition surveillance in the theater of operations. The COSCOM or ammunition group has this function within the corps. The commanding officer of any ammunition service unit conducts a Quality Assurance Ammunition Surveillance Program for all ammunition and ammunition operations under that command. The ammunition inspectors carry out this responsibility. Military inspectors help conduct the surveillance program as directed by the proper battalion or group commander.

Functions. The duties of military and civilian ammunition inspectors are as follows:

Inspect storage buildings and outdoor storage sites to make sure they comply with all safety standards of storage.

Inspect surrounding areas for fire hazards and other nonstandard conditions.

Take and record maximum and minimum temperature and humidity readings.

Look for nonstandard conditions that could speed up the normal deterioration rate of the items in storage, thus create a hazard.

Help inspect and test the lightning protection system in magazines or explosives areas.

Help pick samples to ship to CONUS proving grounds and laboratories for ballistic and surveillance tests or investigations.

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Teach surveillance and ammunition safety.

Prepare and keep proper correspondence, records, and reports to cover all ammunition activities.

Observe, inspect, and investigate to determine the current degree of serviceability of ammunition and components.

Monitor methods of storage, handling, and maintenance, and recommend changes for increased safety or operational effectiveness.

Recommend to the commanding officer the controls needed to maintain approved standards of security.

Act as technical advisors to the commanding officer on all ammunition surveillance matters.

Conduct unit basic load inspections.

Help investigate ammunition malfunctions and accidents.

Help plan, coordinate, and administer the explosives safety program. The program includes review, evaluation, and inspection of all operations, procedures, equipment, and facilities used with ammunition and explosives operations to assure application of and compliance with pertinent safety standards.

Help plan construction of explosives storage facilities based on current QD and storage criteria.

Help prepare waivers for ammunition facilities as required.

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Prepare and maintain accurate records of all observations, inspections, and investigations performed.

Maintain files and indexes for all drawings and specifications covering ammunition and methods of packing and storing.

Inspect all incoming and outgoing shipments of ammunition for sabotage devices; proper blocking, bracing, and loading condition and serviceablilty, and compliance with existing instructions and regulations.

Inspect dunnage used and methods of storage for compliance with specifications, drawings, and safety regulations.

Furnish safety advice to the unit's operating elements. Inspect all facilities and methods used in connection with storage, handling, shipping, assembling, loading, preserving, maintaining, salvaging, and destroying ammunition for compliance with existing regulations.

Maintain and update ammunition suspension file, both local and worldwide. Refer to Appendix E for ammunition condition codes.

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