

## Category Group 42, Ammunition Storage

### Overview.

#### 1.1. Overview

**1.1.1. Basis for Requirements.** The quantity and type of explosives storage facilities required at an installation varies with the following conditions:

1.1.1.1. Operating requirements (i.e., the number and type of functions, operations, or specialized munitions activities to be performed);

1.1.1.2. The quantity and type of munitions to be stored or handled, such as war readiness materiel (WRM) munitions, operating and training munitions, combat munitions, munitions for specialized activities such as area reserve storage and redistribution, and munitions airlift;

1.1.1.3. Site characteristics such as physical limits and expansion capabilities of the ammo storage area, type and arrangement of existing storage facilities, and objectives of the base master plan; and

1.1.1.4. The type of proposed storage structures preferred or required at the storage site.

**1.2. Security Criteria for Facilities Protecting Arms, Ammunition, and Explosives (AA&E).** Refer to the following documents for further information: *U.S. Air Force Installation Force Protection Guide*; MIL HDBK 1013/1A, *Design Guidelines For Physical Security of Facilities*; MIL HDBK 1013/10, *Design Guidelines For Security Fencing, Gates, Barriers, and Guard Facilities*; DODI 2000.16, *DoD Antiterrorism (AT) Standards*; UFC 4- 010-01, AFMAN 32-1071, Volumes 1, 2, and 3, *Security Engineering Manuals (FOUO)*; and DoD 5100.76-M, *Physical Security of Sensitive Conventional Arms, Ammunition, and Explosives*.

1.2.1. Ensure facilities used to store AA&E meet the following minimum requirements.

1.2.1.1. Walls should consist of 200 mm (8 in) of concrete reinforced with No. 4 reinforcing bars. Place the reinforcing bars 225 mm (9 in) on center both horizontally and vertically and staggered on each face to form a grid approximately 113 mm (4.5 in) square. Walls may also be constructed of 200 mm (8 in) concrete blocks with No. 4 reinforcing bars threaded through the blocks. Fill all block cavities with mortar or concrete. Walls require horizontal joint reinforcement at every course, or at a minimum, 200 mm (8 in) of brick interlocked between inner and outer courses.

1.2.1.2. Design ceilings and roofs to meet the load and structural safety requirements of the spans. The slabs should offer security equal to that provided by the walls. Reinforcing bar spacing, using No. 4 reinforcing bars, should form a grid where the area of any opening does not exceed  $0.062 \text{ m}^2$  (96 in<sup>2</sup>). If the ceiling or roof is of concrete pan-joint construction, the thinnest portion may not be less than 150mm (6 in). The reinforcing grid requirements for flat slab construction apply. Ensure roof structures and ceilings of existing facilities provide an equal or greater degree of security than the windows and doors.

1.2.1.3. Design and construct floors to meet load and structural safety requirements. Ensure floors are a minimum of 15 cm (6 in) of concrete construction reinforced with 150 mm x 150 mm (6 in x 6 in) W4xW4 mesh or equivalent bars. For the purposes of security, the ceiling standard applies where the floor slab acts as the ceiling of an underlying room or area.

1.2.1.4. Doors should be 4.5 cm (1-3/4 in) solid or laminated wood with 12 gauge steel plate on the outside face, or standard 44 mm (1-3/4 in) hollow metal industrial type construction, with a minimum of 2 mm (14 gauge) steel skin plate, internally reinforced vertically with continuous steel stiffeners, spaced 150 mm (6 in) maximum on center. Ensure door bucks, frames, and keepers are rigidly anchored and have anti-spread space filler reinforcement to prevent disengagement of the lock bolt by prying or jacking of the door frame. Design and install the frames and locks for both interior and exterior doors to prevent the removal of the frame facing or the built-in locking mechanism sufficiently to disengage the lock bolt from the outside when the door is locked. Construction requirements for door frames and thresholds are as exacting as for the doors. A Class 5 steel vault door with a built-in three position dial type changeable combination lock may be used in lieu of other doors or locks.

1.2.1.5. Ensure door hinges are fixed pin security hinge type or equivalent. Peen the exposed hinge pins by spot welding or some other means to prevent removal. Hinge mounting screws may not be exposed to the outside of the room.

1.2.1.6. Provide exterior and interior lighting for all arms storage rooms or buildings.

### 1.3. Pertinent Documents.

1.3.1. Munitions levels are described in the following documents or publications.

1.3.2. **Levels for War Readiness Materiel.** The War Consumables Distribution Objectives (WCDO) lists the number and type of munitions items (along with other war consumables such as POL, chaff, film, etc.) that are desired to be prepositioned at the listed base. Subject to command guidance, this document provides the basis for WRM munitions storage guidance.

1.3.3. **Operating and Training Levels.** Each active air base has a requirement to store and maintain certain day-to-day usage munitions and residue generated during explosives operations. These normally include training munitions per AFI 11-212; AFCAT 21-209, Volume 1; AFCAT 21-209 Volume 2, *Demolition Munitions*; *Air Force Standard for Non-Expendable Air Munitions Training Authorizations*; and current operational plans (OPLAN).

1.3.4. Nuclear weapons storage facilities are additive to those required for other explosives storage and are computed on the assigned and projected weapons requirements using applicable criteria in 11N series TOs, AFMAN 91-201, and DoD S- 5210.41-M, Vols. 1-3.

1.3.5. Basic reference documents for facility planning purposes consist of: AFI 32-1021, AFMAN 91-201, and pertinent TOs of the 11A, 11C, 11N, and 11P series.

#### 1.4. General Guidance.

1.4.1. Explosives are normally stored in a secure area reserved exclusively for explosives storage as defined in AFMAN 91-201 and AFI 21-201, *Conventional Munitions Maintenance Management*.

1.4.2. **Requirements Determination.** An installation's explosive storage requirements are based on the unit's mission, support, training, and OPLAN requirements. The manner in which this requirement is met is in accordance with pertinent TOs of the 11A, 11C, 11N, and 11P series as well as AFMAN 91-201. Supplemental documentation may include master storage plans and Storage Capability Reports.

1.4.2.1. **Calculating Storage Requirements.** Storage space requirements involve several factors unique to each individual installation. These factors may include Q-D limitations of existing storage facilities, availability of existing facilities, possible re- warehousing of existing stock, Net Explosive Weight (NEW) of items to be stored, physical size of the item to be stored, length of time the item is expected to be stored, frequency of replacement stockage, regulatory requirements as to type of facility, and storage configuration. The general guidance provided in Figure 1.1, 1.2 and 1.3 provides only some of the factors to be considered in calculations.

**Figure 1.1. Example A: Explosive Weight Limited Items (EWL).**

Computing Explosives Storage Requirements:

EWL items have a high explosive weight to total weight ratio. The number of this type of item that may be stored in any one facility is limited by the total allowable NEW for any given facility or location. This is based upon the limits imposed by explosives Q-D criteria to existing and programmed facilities or other exposures and/or maximum net explosives weight permitted for the particular explosives class or facility design. To determine the number of storage structures required, use the following formula:

$$A / B = C, \text{ and } D / C = \text{Number of Storage Structure Locations}$$

Where:

A = Total allowable NEW for any single location.

B = NEW of one type of EWL item to be stored (from references in paragraph 4.2.3.)

C = Number of EWL items to be stored in a single location.

D = Total number of each type of EWL item authorized (from published documents).

Example:

To store: 8,000 items of type M117, 340 kg (750 pound) bombs.

Total allowable NEW for any single location = 45,000 kg (100,000 pounds).

NEW of one item = 175 kg (386 pounds).

$$A / B = C \qquad 45,000 \text{ kg} / 175 \text{ kg} = 257$$

$$D / C = \text{Number of storage } 8,000 / 257 = 31.1 \text{ (31 rounded) structure locations.}$$

### Figure 1.2. Example B: Cube Limited (CL) Items.

Computing Explosives Storage Requirements:

CL items are bulky with a low explosive weight ratio. The number that may be stored in any one facility is normally limited by their size and gross weight. However, give full consideration to limits imposed by Q-D criteria, storage compatibility criteria, and lot separation requirements. To determine the number of storage structures required, use the following formula for each grouping of compatible items to be stored. (See TO 11A-1-61 for storage drawings for some high density magazine loading guidance.)

$$PF \times N = TC$$

Where:

PF = Package Cubic Meters (m<sup>3</sup>) Listed Per Item (from federal stock class [FSC] 1300)

N = Total number of each type of CL items

TC = Total cube of each type of CL items

$$TC / SH = SF$$

Where:

SH = Planned stack height for each type of CL item

SM = Preliminary floor space requirement in square meters

$$SM \times 1.38 = AFS$$

Where:

1.38 = Factor to allow for aisle space

AFS = Actual floor space required

$$AFS / TF = \text{Number of structures required.}$$

Where:

TF = Total floor space available in type of structure selected for storage

Example:

To Store: 350,000 rounds of 20 mm ammo

Cube for 100-round T-46 Ammo Box = 0.037 m<sup>3</sup> (1.3 ft<sup>3</sup> from FSC 1300)

Cube for one round of ammo = 0.00037 m<sup>3</sup> (0.013 ft<sup>3</sup>)

Stack height (selected) = 1.9 m (6.25 ft)

Floor space available in selected storage structure = 74 m<sup>2</sup> (800 ft<sup>2</sup>)

$$PF \times N = TC \quad 0.00037 \text{ m}^3 \times 350,000 = 129.5 \text{ m}^3$$

$$TC / SH = SM \quad 129.5 \text{ m}^3 / 1.9 \text{ m} = 68 \text{ m}^2$$

$$SM \times 1.38 = AFS \quad 68 \text{ m}^2 \times 1.38 = 94 \text{ m}^2$$

AFS / TF = Number of 94 m<sup>2</sup> / 74 m<sup>2</sup> = 1.27 (2.0 rounded) structures required structures required.

**Figure 1.3. Example C: Storage Involving EWL and CL Factors.**

Computing Explosives Storage Requirements:	
To store 5,500 items of type M117, 340 kg (750 lb) bombs	
Cube for bomb body (from FGS 1300) = 0.217 m <sup>3</sup> (7.67 ft <sup>3</sup> )	
Stack height (selected) = 1.8 m (6.0 ft)	
NEW of bomb = 175 kg (386 pounds)	
Maximum explosive weight per structure = 113,000 kg (250,000 pounds) (unless otherwise limited by A-D or structure design).	
PF x N = TC	0.217 m <sup>3</sup> x 5,500 = 1,194 m <sup>3</sup>
TC / SH = SM	1,194 m <sup>3</sup> / 1.8 m = 663 m <sup>2</sup>
SM x 1.38 = AFS	663 m <sup>2</sup> x 1.38 = 915 m <sup>2</sup>
A / B = C	113,000 kg / 175 kg = 646 bombs
D / C = Number of storage structure locations	5,500 / 646 bombs = 8.5 (9.0 rounded) storage structure locations

**1.4.3. Scope Determination.** Explosives safety criteria applicable to all aspects of planning for explosives facilities are contained in AFMAN 91-201. Consider Q-D class and storage compatibility groups for all items. Base all planned and programmed facility requirements on a site plan which has been reviewed and approved under procedures given in AFMAN 91-201. Equip explosives storage and operating facilities with lightning protection which may necessitate grounding and bonding as required by AFMAN 91-201. Where two or more commands occupy an installation, integrate the explosives storage facilities to the maximum extent possible in accordance with the restrictions/requirements of AFMAN 91-201 and as specified in AFI 32-1065.

**1.4.4. Dimensions.** See paragraph 1.4.5 below.

**1.4.5. Design Considerations.** Planning and land acquisition for explosives storage should ensure the following.

1.4.5.1. Each existing and proposed facility is always able to store a reasonable weight of explosives (i.e., at or near design capacity of the structure or the capacity as originally sited) without violating Q-D criteria given in AFMAN 91-201.

1.4.5.2. The multi-mission concept of base development is met or maintained. See AFI 32-1021 for additional guidance.

1.4.5.3. In planning storage requirements at overseas locations, consider host

country Q-D criteria in providing protection to their exposures. However, follow AFMAN 91-201 criteria in connection with all planning and operations involving exposures of U.S. personnel and property (equipment, buildings, etc.) to explosives hazards, unless otherwise specifically authorized to deviate from this procedure.

1.4.5.4. Developing storage requirements involves joint efforts by munitions, explosives safety, and civil engineering offices. Munitions offices develop explosives storage facility requirements including basic floor space requirements, determine special functional requirements, and justify the need to build or modify facilities. Using this information, civil engineering offices will, in coordination with explosives safety, perform site selection, develop site plans and land requirements, establish design specifications, and forward completed plans for explosives safety review as required by AFMAN 91-201. (T-1). The foregoing applies to all facilities being sited that affect Q-D criteria in any way or that involve manufacturing, processing, storing, handling, using, and disposing of explosives. When major modifications to explosives facilities or to associated structures within inhabited building distance of explosives facilities are planned, forward a change to the site plan in accordance with AFMAN 91-201.

1.4.5.5. Planning for explosives storage areas gives recognition to other facilities used in processing, handling, maintaining, using, and disposing of weapons such as Explosives Ordnance Disposal (**CATCODE 141165**), Weapons and Release Systems Shop (**CATCODE 215552**), Surveillance and Inspection Shop (**CATCODE 215582**), Conventional Munitions Shop (**CATCODE 216642**), and Demolition and Burning Facility (**CATCODE 831173**).

1.4.5.6. Design all structures used in the storage of high explosives to resist the effects of accidental explosions approved by the Department of Defense Explosive Safety Board (DDESB) and the United States Army Corps of Engineers (USACE), which meet the criteria for explosive storage.

1.4.5.7. An environmental assessment is needed, in accordance with AFI 32-7045.

1.4.5.8. Because of the potentially damaging effects of explosives mishaps, separate facilities should be provided for explosives operations based on the type of hazards involved.

1.4.5.9. Numbers such as AD 33-15-63 refer to USACE drawings, which are available from the USACE Huntsville Division, 106 Wynn Drive, Huntsville, Alabama, 35805-1957.