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USD(AT&L)

SUBJECT: DoD Ammunition and Explosives Safety Standards: Quantity-Distance Criteria for Airfields and Heliports, Piers and Wharfs, and Specific Facilities

References: See Enclosure 1

V4.1. PURPOSE

V4.1.1. Manual. This Manual is composed of several volumes, each containing its own purpose, and administratively reissues DoD 6055.09-STD (Reference (a)). The purpose of the overall Manual, in accordance with the authority in DoD Directives 5134.01 and 6055.9E (References (b) and (c)), is to establish explosives safety standards (hereafter referred to as “standards”) for the Department of Defense.

V4.1.1.1. These standards are designed to manage risks associated with DoD-titled ammunition and explosives (AE) by providing protection criteria to minimize serious injury, loss of life, and damage to property.

V4.1.1.2. Due to the size and complexity of this Manual, alternate paragraph numbering has been approved for use throughout. The initial numeric set (V#) refers to the volume number within the Manual; the second set (E#) refers to the enclosure number; and subsequent numbers refer to the section, paragraph, and subparagraph numbers. If there is no E#, the reference is to a section above the signature of the volume.

V4.1.2. Volume. This Volume provides quantity-distance (QD) criteria for airfields and heliports, piers and wharfs, and specific facilities.

V4.2. APPLICABILITY. This Volume:

V4.2.1. Applies to:

V4.2.1.1. OSD, the Military Departments, the Office of the Chairman of the Joint Chiefs of Staff and the Joint Staff, the Combatant Commands, the Office of the Inspector General of the

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Department of Defense, the Defense Agencies, the DoD Field Activities, and all other organizational entities within the Department of Defense (hereafter referred to collectively as the “DoD Components”).

V4.2.1.2. DoD-titled AE wherever it is located.

V4.2.1.3. DoD personnel and property when potentially endangered by known host-nation or off-installation AE hazards.

V4.2.1.4. DoD facilities siting and construction, except as indicated in V4.2.2.

V4.2.1.5. The evaluation of non-DoD explosives siting submissions on DoD installations (see section V4.E5.21.).

V4.2.2. Provided the documentation requirements of paragraph V4.E2.3.5. are met, does not apply to:

V4.2.2.1. Existing facilities, or those approved for construction under then-current editions of these standards. This exception applies for the balance of the useful lives of such facilities provided:

V4.2.2.1.1. The facility continues to be used for its intended purpose.

V4.2.2.1.2. The explosives safety hazards are not increased.

V4.2.2.1.3. Redesign or modification is not practicable.

V4.2.2.1.4. The quantity of AE cannot be reduced for reasons of operational necessity.

V4.2.2.2. Those planned facilities that do not meet these standards, but have been certified by the Heads of the DoD Components (see section V1.E.3.4.) as essential for operational or other compelling reasons.

V4.2.2.3. Other situations that, upon analysis by the Heads of the DoD Components and the Department of Defense Explosives Safety Board (DDESB), are determined to provide the required degree of safety through use of protective construction or other specialized safety features.

V4.3. DEFINITIONS

V4.3.1. Abbreviations and Acronyms. See Glossary.

V4.3.2. Terms. See Volume 8 of this Manual.

V4.4. POLICY. As established in Reference (c) and consistent with peacetime, contingency, or wartime operational requirements and corresponding DoD military munitions requirements from the broadest and most fundamental explosives safety management perspective, it is DoD policy to:

V4.4.1. Provide the maximum possible protection to people and property from the potential damaging effects of DoD military munitions (explosive and chemical). Applying the standards herein provides only the minimum protection criteria for personnel and property, and greater protection should always be provided when practicable.

V4.4.2. Minimize exposures consistent with safe and efficient operations (i.e., expose the minimum number of people for the minimum time to the minimum amount of explosives or chemical agents).

V4.5. RESPONSIBILITIES. See Enclosure 2.

V4.6. PROCEDURES. See Enclosures 3 through 5. Criteria provided in this Manual are given in English units (e.g., foot or feet (ft), pounds (lbs), pounds per square inch (psi)), with metric equivalents shown in brackets (e.g., meters (m), kilograms (kg), kilopascals (kPa)).

V4.7. RELEASABILITY. UNLIMITED. This Volume is approved for public release and is available on the Internet from the DoD Issuances Website at <http://www.dtic.mil/whs/directives>.

V4.8. EFFECTIVE DATE. This Volume is effective upon its publication to the DoD Issuances Website.

Enclosures

1. References
2. Responsibilities
3. Airfields and Heliports
4. Piers and Wharfs
5. Specific Facilities

Glossary

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ENCLOSURE 1

REFERENCES

- (a) DoD 6055.09-STD, "DoD Ammunition and Explosives Safety Standards," February 29, 2008 (cancelled by Volume 1 of this Manual)
- (b) DoD Directive 5134.01, "Under Secretary of Defense for Acquisition, Technology, and Logistics (USD(AT&L))," December 9, 2005
- (c) DoD Directive 6055.9E, "Explosives Safety Management and the DoD Explosives Safety Board," August 19, 2005
- (d) Part 77 of title 14, Code of Federal Regulations
- (e) *DoD S-5210.41-M-VI, "Nuclear Weapon Security Manual: The DoD Nuclear Weapon Security Program (U)," July 13, 2009*
- (ef) Defense Transportation Regulation 4500.9-R, "Defense Transportation Regulation," "Part II, Cargo Movement," June 2008
- (fg) National Fire Protection Association 30, "Flammable and Combustible Liquids Code," current version¹
- (gh) Department of Defense Explosives Safety Board, Technical Paper 15, Revision 3, "Approved Protective Construction," May 2010

¹ NFPA, 1 Batterymarch Park, Quincy, MA 02169-7471; Phone: 617-770-3000; Fax: 617-770-0700

ENCLOSURE 2

RESPONSIBILITIES

V4.E2.1. UNDER SECRETARY OF DEFENSE FOR ACQUISITION, TECHNOLOGY, AND LOGISTICS (USD(AT&L)). The USD(AT&L) shall provide overall policy guidance for the DoD Explosives Safety Management Program.

V4.E2.2. CHAIRMAN, DDESB. The Chairman, DDESB, shall report to the Deputy Under Secretary of Defense for Installations and Environment (DUSD(I&E)) and, on behalf of the USD(AT&L) and the DUSD(I&E), shall collaborate with the Military Service-appointed voting DDESB members to maintain explosives safety standards.

V4.E2.3. HEADS OF THE DoD COMPONENTS. The Heads of the DoD Components shall:

V4.E2.3.1. Implement these DoD explosives safety standards.

V4.E2.3.2. Comply with applicable Federal and State laws and regulations. Where this Volume conflicts with such laws and regulations, ensure the safety of DoD personnel and the public while complying and notify the Chairman, DDESB, through the Component's board member, of the conflict. These standards are not intended to be so rigid as to prevent the DoD Components from accomplishing their assigned missions.

V4.E2.3.3. Issue DoD Component guidance that implements these standards and provides DoD Component unique requirements.

V4.E2.3.4. Send a copy of any implementing and supplementary guidance to these standards to the Chairman, DDESB.

V4.E2.3.5. Document the exceptions described in paragraph V4.2.2. in permanent records. These records must include:

V4.E2.3.5.1. The effective date the applicable DoD explosives safety standards were first published.

V4.E2.3.5.2. The date the deviant facility was either approved, from an explosives safety viewpoint, for use or was first used in a manner deviating from the standard.

ENCLOSURE 3

AIRFIELDS AND HELIPORTS

V4.E3.1. SCOPE AND APPLICATION. This enclosure:

V4.E3.1.1. Applies to AE that is under the control and custody of DoD personnel at airfields and heliports. Enclosure 3 of Volume 6 of this Manual applies when these requirements cannot be met for contingencies, combat operations, and military operations other than war.

V4.E3.1.2. Does not apply to AE installed on aircraft (e.g., egress system components, squibs, and detonators for jettisoning external stores, engine-starter cartridges, fire extinguisher cartridges, and destructors in electronic equipment), contained in survival and rescue kits (e.g., flares, signals, explosives components of emergency equipment), and other such items or materials necessary for safe flight operations.

V4.E3.2. MEASUREMENT OF SEPARATION DISTANCES. In applying Tables V4.E3.T1. and V4.E3.T2., measure distances as follows:

V4.E3.2.1. Loaded Aircraft to Loaded Aircraft. Measure the shortest distance between AE on one aircraft to AE on the adjacent aircraft.

V4.E3.2.2. AE Location to Taxiways and Runways. Measure from the nearest point of the AE location to the:

V4.E3.2.2.1. Nearest point of the taxiway.

V4.E3.2.2.2. Centerline of the runway.

V4.E3.3. AE PROHIBITED AREAS. Areas immediately beyond the ends of runways and along primary flight paths are subject to more aircraft accidents than other areas. For this reason, AE is prohibited from accident potential zones I and II and clear zones of all aircraft landing facilities, as designated and described in detail in the DoD Component airfield and airspace criteria directives.

V4.E3.4. ADDITIONAL SITING CRITERIA. This enclosure's QD criteria shall be applied with the airfield clearance criteria that is prescribed by the DoD Component and Federal Aviation Administration (FAA) regulations (part 77 of title 14, Code of Federal Regulations (Reference (d))). For airfields and heliports:

V4.E3.4.1. Used Exclusively by the DoD Components and Allied Nation Military Components. Combat aircraft parking areas, AE cargo areas, alert hangars, and shelters may be

located within the airfield clearance zone, with the exception of AE prohibited areas (see section V4.E3.3.).

V4.E3.4.2. Not Used Exclusively by the DoD Components and Allied Nation Military Components. Combat aircraft parking areas, AE cargo areas, alert hangars, and shelters shall be located as prescribed in Tables V4.E3.T1. and V4.E3.T2.

V4.E3.5. AIRCRAFT PARKING AREAS

V4.E3.5.1. Uploading and downloading of AE shall be conducted at explosives-sited aircraft parking areas.

V4.E3.5.2. QD is not required for:

V4.E3.5.2.1. Aircraft loaded with AE shown in subparagraphs V4.E3.5.2.1.1. through V4.E3.5.2.1.3. and parked in designated aircraft parking areas that meet airfield criteria when evaluated as a potential explosion site (PES):

V4.E3.5.2.1.1. Hazard division (HD) 1.2.2: gun AE, 30 millimeter or less.

V4.E3.5.2.1.2. HD 1.3: Captive missiles, aircraft defensive flares or chaff.

V4.E3.5.2.1.3. HD 1.4 AE.

V4.E3.5.2.2. Uploading and downloading AE listed in subparagraph V4.E3.5.2.1., at a designated aircraft parking area, provided the quantity of AE involved in the operation is limited to a single aircraft load.

V4.E3.6. COMBAT AIRCRAFT SUPPORT FACILITIES. See subparagraph V3.E3.1.1.2.1.11 for separation distance criteria associated with such facilities. When operational necessity dictates, separation distances less than K18 [7.14] may be approved; however, it must be demonstrated that K18 [7.14] equivalent protection is provided.

Table V4.E3.T1. Application of AE Separation Distances for Airfields and Heliports

From → To ↓	Hardened Aircraft Shelter	Combat Aircraft Parking Area	AE Cargo Area	AE Storage Facility	AE Operating Facility	Ready Ammunition Storage Facility
Hardened Aircraft Shelter (HAS)	a	b	b	c	c	d
Maintenance HAS	e	f	f	c	c	g
Combat Aircraft Parking Area	h	h	h	i	i	h
AE Cargo Area	h	h	h	h	h	h
AE Storage Facility	h	h	h	h	h	h
AE Operating Facility	j	j	j	j	j	j
Ready Ammunition Storage Facility	d	h	h	h	h	h
Inhabited Building	k	k	k	k	k	k
Public Traffic Route and Taxiway (joint DoD-Non DoD use)	l	l	l	l	l	l
Runway (joint DoD-Non DoD use)	k	k	k	k	k	k
Runway/Taxiway (DoD Component use only)	None	None	None	m	l	None
Aircraft Parking Area	n	n	n	o	o	n
Aircraft Passenger Loading/Unloading Area	p	p	p	p	p	p
Recreation Area	q	q	r	r	r	q
a	See paragraph V4.E3.7.3.					
b	If the PES Net Explosive Weight for Quantity-Distance (NEWQD) is \leq 22,000 lbs [9,979 kg], see paragraph V4.E3.7.3.; treat the PES as a HAS Ready Service aboveground magazine (AGM) for application of Tables V4.E3.T4. and V4.E3.T6. If the PES NEWQD is $>$ 22,000 lbs [9,979 kg], apply footnote h.					
c	Apply the storage area earth-covered magazine (ECM) or AGM (as applicable) column of Table V4.E3.T6.					
d	For HAS Ready Service AGM or ECM, apply Table V4.E3.T4. for HD 1.1 and apply footnote n for HD 1.2. For any other ready ammunition storage facility, apply footnote h.					
e	See paragraph V4.E3.7.5.					
f	See paragraph V4.E3.7.5. If the PES NEWQD is \leq 22,000 lbs [9,979 kg], the PES may be treated as a HAS Ready Service AGM for application of Table V4.E3.T6. If the PES NEWQD is $>$ 22,000 lbs [9,979 kg], or Table V4.E3.T6. is not applied for aircraft survivability, then intraline distance (ILD) equivalent protection (3.5 psi [24 kPa]) will be provided to personnel within the maintenance HAS.					
g	See paragraph V4.E3.7.5. For HAS Ready Service AGM or ECM, Tables V4.E3.T5. and V4.E3.T6. may be applied. For any other ready ammunition storage facility, or if Tables V4.E3.T5. and V4.E3.T6. are not applied for aircraft survivability, then ILD equivalent protection (3.5 psi [24 kPa]) will be provided to personnel within the maintenance HAS.					

Table V4.E3.T1. Application of AE Separation Distances for Airfields and Heliports, Continued

h	For HD 1.1, use applicable intermagazine distance (IMD). For HD 1.2, apply footnote n. Protects against simultaneous detonation of AE on adjacent aircraft, but does not prevent serious damage to aircraft and possible propagation of detonation due to fragments, debris, or fire. A HAS arch or rear wall may be considered as a barricade for application of K6 [K_m 2.38].
i	Use Table V4.E3.T2. distances for mass-detonating items and applicable public traffic route distance (PTRD) for nonmass-detonating items.
j	Use applicable ILD. Apply ILD per paragraph V4.E3.7.4. when the PES is a HAS.
k	Use applicable inhabited building distance (IBD). Apply IBD per paragraph V4.E3.7.4. when the PES is a HAS.
l	Use applicable PTRD. Apply PTRD per paragraph V4.E3.7.4. when the PES is a HAS.
m	Use 18W^{1/3} [7.14Q^{1/3}] distances For HD 1.1, use unbarricaded ILD per Table V3.E3.T4. from side or rear of ECMs to taxiways; for HD 1.2, HD 1.3 or HD 1.4, no separation is required from side or rear of ECMs to taxiways. Use PTRD from front of ECMs or any other storage locations to taxiways; and use PTRD from all storage locations to runways.
n	Within these areas of airfields and heliports exclusively used by the DoD Components, the separation of aircraft parking areas from combat aircraft parking areas and their ready AE storage facilities and AE cargo areas are considered to be a command function. At joint DoD/non-DoD use airfields and heliports, the combat aircraft parking areas and their ready AE storage facilities and AE cargo area shall be separated from non-DoD aircraft as specified in footnote o.
o	Use Table V4.E3.T2. distances for the DoD Components' aircraft parking areas. Use applicable IBD for non-DoD entity aircraft parking areas; apply IBD per paragraph V4.E3.7.4. when the PES is a HAS.
p	Use applicable PTRD for locations in the open where passengers enplane and deplane; apply PTRD per paragraph V4.E3.7.4. when the PES is a HAS. Use applicable IBD if a structure is included where passengers assemble, such as a passenger terminal building; apply IBD per paragraph V4.E3.7.4. when the PES is a HAS.
q	No distance required to recreational areas that are used exclusively for alert personnel manning the combat-loaded aircraft. Other recreational areas where people are in the open shall be at applicable PTRD; apply PTRD per paragraph V4.E3.7.4. when the PES is a HAS. When structures, including bleacher stands, are a part of such areas, applicable IBD shall be used; apply IBD per paragraph V4.E3.7.4. when the PES is a HAS.
r	Recreational areas, where people are in the open, shall be at applicable PTRDs. When structures, including bleacher stands are part of such areas, applicable IBDs shall be used.

Table V4.E3.T2. HD 1.1 QD for Military Aircraft Parking Areas

NEWQD	Distance for Specific Targets Indicated in Table V4.E3.T1. ^{a, b, c}
(lbs)	(ft)
<i>[kg]</i>	<i>[m]</i>
50	111
<i>22.7</i>	<i>33.7</i>
70	124
<i>31.8</i>	<i>37.7</i>
100	139
<i>45.4</i>	<i>42.4</i>
150	159
<i>68.0</i>	<i>48.6</i>
200	175
<i>90.7</i>	<i>53.5</i>
300	201
<i>136.1</i>	<i>61.2</i>
500	238
<i>226.8</i>	<i>72.6</i>
700	266
<i>317.5</i>	<i>81.2</i>
1,000	300
<i>453.6</i>	<i>91.4</i>
1,500	343
<i>680.4</i>	<i>104.7</i>
2,000	378
<i>907.2</i>	<i>115.2</i>
3,000	433
<i>1,360.8</i>	<i>131.9</i>
5,000	513
<i>2,268.0</i>	<i>156.4</i>
7,000	574
<i>3,175.1</i>	<i>174.9</i>
10,000	646
<i>4,535.9</i>	<i>197.0</i>
15,000	740
<i>6,803.9</i>	<i>225.5</i>
20,000	814
<i>9,071.8</i>	<i>248.2</i>
30,000	932
<i>13,608</i>	<i>284.1</i>
50,000	1,105
<i>22,680</i>	<i>336.9</i>

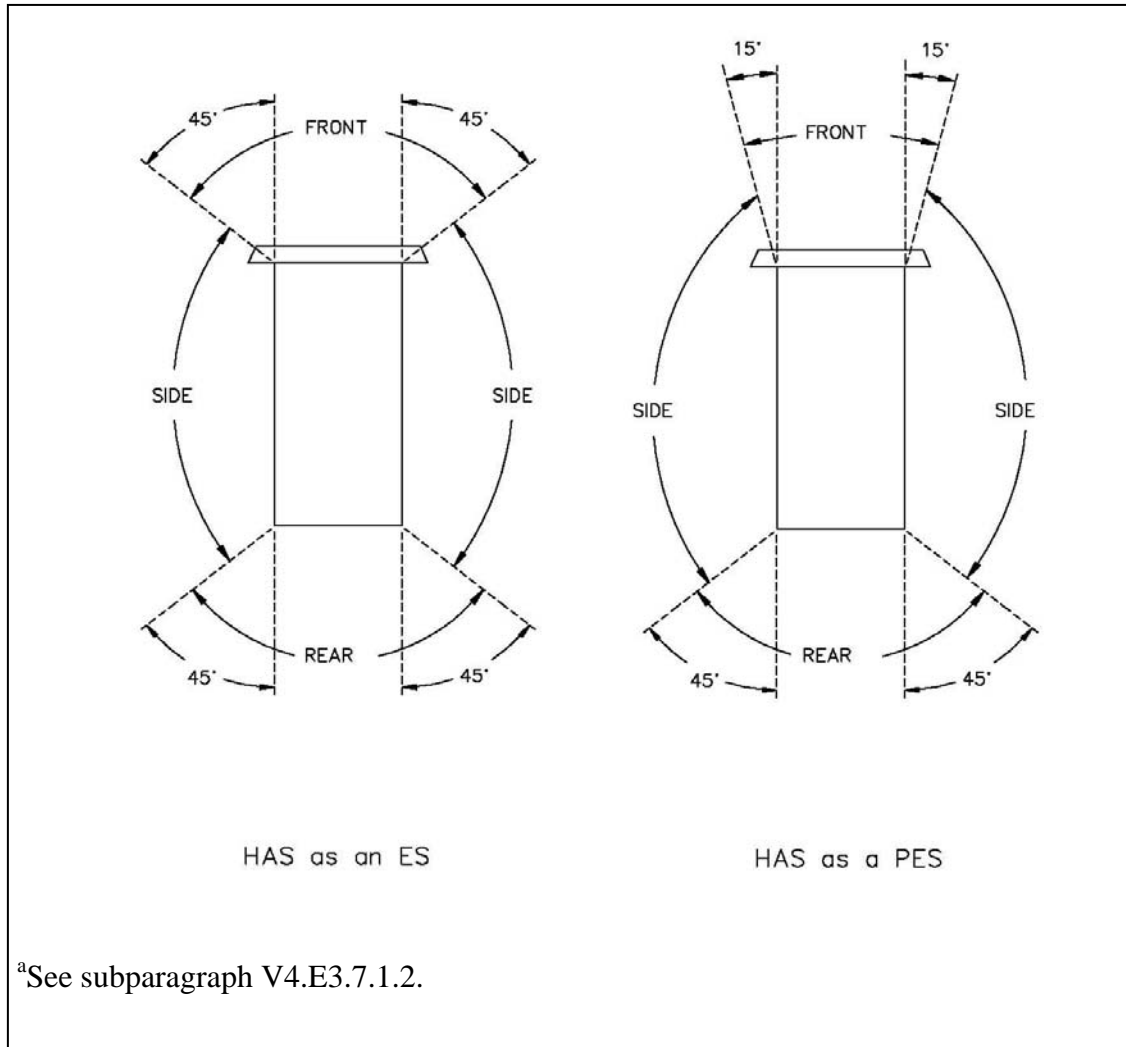
Table V4.E3.T2. HD 1.1 QD for Military Aircraft Parking Areas, Continued

NEWQD		Distance for Specific Targets Indicated in Table V4.E3.T1. ^{a, b, c}
(lbs)		(ft)
<i>[kg]</i>		<i>[m]</i>
70,000		1,236
<i>31,751</i>		<i>376.9</i>
100,000		1,392
<i>45,359</i>		<i>424.4</i>
150,000		1,594
<i>68,039</i>		<i>485.8</i>
200,000		1,754
<i>90,718</i>		<i>534.7</i>
300,000		2,008
<i>136,077</i>		<i>612.1</i>
500,000		2,381
<i>226,795</i>		<i>725.8</i>
a	English equations (EQNs) (D in ft, NEWQD in lbs)	
	D = 30*W ^{1/3} with a minimum distance of 111 ft	EQN V4.E3.T2-1
	NEWQD = D ³ /27,000 with a minimum NEWQD of 50 lbs	EQN V4.E3.T2-2
	<i>Metric EQNs (D in m, NEWQD in kg)</i>	
	<i>D = 11.9*Q^{1/3} with a minimum distance of 33.8 m</i>	<i>EQN V4.E3.T2-3</i>
	<i>NEWQD = D³/1,685.2 with a minimum NEWQD of 22.7 kg</i>	<i>EQN V4.E3.T2-4</i>
b	Minimum fragment distance requirements for HD 1.1 (see paragraph V3.E3.1.2. of Enclosure 3 of this Manual) do not apply to targets for which this table is used.	
c	To protect against low-angle, high-speed fragments, barricades should be provided; however, these distances shall not be reduced.	

V4.E3.7. HASV4.E3.7.1. General

V4.E3.7.1.1. All HASs, except Korean Theatre Air Base Vulnerability (TAB VEE) HAS fronts and Korean Flow-Through HAS fronts and rears, are structures capable of stopping primary fragments when doors are properly secured. HD 1.1 *and HD 1.2.3* parenthetical (xx) fragment distances do not apply except out the front of a Korean TAB VEE and out the front/rear of a Korean Flow-Through HAS.

V4.E3.7.1.2. The front, side, or rear sectors of a HAS as either a PES or an exposed site (ES) are illustrated in Figure V4.E3.F1.

Figure V4.E3.F1. HAS Orientation Effects^a

^aSee subparagraph V4.E3.7.1.2.

V4.E3.7.2. Allowable NEWQD. First generation and Korean TAB VEE HASs are limited to a maximum NEWQD of 5,863 lbs [2,659.4 kg]. Second generation, third generation, and Korean flow-through HASs are limited to a maximum NEWQD of 11,000 lbs [4,989.5 kg]. Flow-Through HAS Pairs are limited to a maximum NEWQD of 4,800 lbs [2,177.2 kg] in each HAS. HAS Pairs with rear walls or with front and rear walls are limited to a maximum NEWQD of 2,390 lbs [1,084.1 kg] in each HAS. HAS Ready Service ECM and AGM are limited to a maximum NEWQD of 22,000 lbs [9,979 kg].

V4.E3.7.3. HAS Separation for IMD and Asset Preservation

V4.E3.7.3.1. HASs shall be separated according to Tables V4.E3.T3. and V4.E3.T4, which provides IMD (or equivalent) protection. For first, second, and third generation HASs, and Korean TAB VEE modified (with hardened front closure) HASs, these distances will also provide a high degree of protection against delayed propagation of explosion when HAS doors

are properly secured. However, the exposed shelter may be damaged heavily and aircraft and AE therein may be rendered unserviceable. For Korean TAB VEE HAS front and Korean flow-through HAS front/rear (due to openings) at these distances there may be serious damage to aircraft and possible delayed propagation of detonation due to fragments, debris, or fire.

V4.E3.7.3.2. HASs separated according to Tables V4.E3.T5. and V4.E3.T6. (and with HAS doors properly secured) shall be provided a higher degree of asset preservation (K30 or equivalent overpressure) than that provided in Tables V4.E3.T3. and V4.E3.T4. An explosion in one shelter or ready storage facility may destroy it and its contents, but aircraft within adjacent shelters will be undamaged provided the doors are closed. These aircraft may not be immediately accessible due to debris.

V4.E3.7.3.3. Tables V4.E3.T3., V4.E3.T4., V4.E3.T5., and V4.E3.T6. criteria are based on first, second, and third generation HAS doors remaining closed, except for aircraft towing, fueling, servicing, run up, or taxi, and during integrated combat turnarounds or short periods when maintenance equipment or munitions are being moved into or out of shelters. If doors are left open for extended periods, apply the following criteria:

V4.E3.7.3.3.1. For prevention of simultaneous detonation, apply default IMD to or from an open front. A HAS arch or rear wall may be considered as a barricade for application of K6 *to or from a "door open" HAS front*. No reduction from K11 is allowed between "door open" HAS front-to-front exposures.

V4.E3.7.3.3.2. For aircraft survivability, apply Table V4.E3.T2. to or from an open front, *and to the arch of a HAS with an open front; apply K25, with a minimum distance of 111 ft [33.8 m], to the rear of a HAS with an open front.*

V4.E3.7.4. HAS Separation to Unhardened ESs

V4.E3.7.4.1. Apply Table V4.E3.T7. for separation of unhardened ESs from third generation HASs, provided the NEWQD limitation of paragraph V4.E3.7.2. is met. Lesser distances may be permitted to hardened ESs that provide equivalent protection when approved by the DDESB.

V4.E3.7.4.2. Provided the NEWQD limitations of paragraph V4.E3.7.2. are met, apply Table V4.E3.T7. for separation of unhardened ESs from second generation and Korean flow-through HASs:

V4.E3.7.4.2.1. To the front, sides, and rear of a second generation HAS.

V4.E3.7.4.2.2. To the sides of a Korean flow-through HAS. For the front and rear, apply default QD criteria.

V4.E3.7.4.3. Provided the NEWQD limitations of paragraph V4.E3.7.2. are met, apply Table V4.E3.T8. for separation of unhardened ESs from first generation and Korean TAB VEE HASs:

V4.E3.7.4.3.1. To the front, sides, and rear of a first generation HAS.

V4.E3.7.4.3.2. To the sides and rear of a Korean TAB VEE HAS. For the front, apply default QD criteria.

V4.E3.7.4.4. Apply Table V4.E3.T7. or V4.E3.T8. for separation of unhardened ESs from HAS pairs, as appropriate, for the HAS pair design involved.

V4.E3.7.4.5. First, second, and third generation and Korean TAB VEE HASs sited for HD 1.2, HD 1.3, or HD 1.4 explosives, *as shown in subparagraphs V4.E3.7.4.5.1. through V4.E3.7.4.5.5.*, do not generate a QD arc out the sides or rear. Korean flow-through HASs sited for HD 1.2, HD 1.3, or HD 1.4 explosives, *as shown in subparagraphs V4.E3.7.4.5.1. through V4.E3.7.4.5.5.*, do not generate a QD arc out the sides. For HAS pairs, apply the requirements for the HAS pair design involved. Default QD criteria apply out the front of all HASs, and out the front and rear of Korean flow-through HASs.

V4.E3.7.4.5.1. HD 1.2.1, with a maximum credible event (MCE) less than 110 lbs [50 kg], and an NEWQD subject to the limitations in paragraph V4.E3.7.2.

V4.E3.7.4.5.2. Mission essential quantities of HD 1.2.2.

V4.E3.7.4.5.3. HD 1.2.3, with a largest single round NEWQD less than 110 lbs [50 kg], and an NEWQD subject to the limitations in paragraph V4.E3.7.2.

V4.E3.7.4.5.4. Mission essential quantities of HD 1.3.

V4.E3.7.4.5.5. Mission essential quantities of HD 1.4.

V4.E3.7.5. Maintenance HASs. A HAS used solely as a maintenance facility would normally be classified as a related facility and would require ILD separation from a supported PES. As an ES, a first, second, or third generation maintenance HAS will provide K30 equivalent protection at the reduced distances shown in Tables V4.E3.T5. and V4.E3.T6. with doors properly secured. If Tables V4.E3.T5. and V4.E3.T6. are not applied for aircraft survivability, then at a minimum, ILD equivalent protection (3.5 psi [24 kPa]) will be provided to personnel within the maintenance HAS.

Table V4.E3.T3. Minimum Hazard Factor for HASs to Prevent Simultaneous Detonation, Part 1^{a, b, c, d}

From → To ↓		1 st Generation HAS			2 nd and 3 rd Generation HAS			Korean TAB VEE HAS ^e		
		S	R	F	S	R	F	S	R	F
1 st Generation HAS	S	2 0.79	2 0.79	2.75 1.09	2 0.79	2 0.79	2.75 1.09	2 0.79	2 0.79	4.5 1.79
	R	2 0.79	2 0.79	2.75 1.09	2 0.79	2 0.79	2.75 1.09	2 0.79	2 0.79	4.5 1.79
	F	6 2.38	4.5 1.79	8 3.17	6 2.38	4.5 1.79	9 3.57	6 2.38	4.5 1.79	11 4.36
2 nd and 3 rd Generation HAS	S	2 0.79	2 0.79	2.75 1.09	2 0.79	2 0.79	2.75 1.09	2 0.79	2 0.79	4.5 1.79
	R	2 0.79	2 0.79	2.75 1.09	2 0.79	2 0.79	2.75 1.09	2 0.79	2 0.79	4.5 1.79
	F	4.5 1.79	2.75 1.09	5 1.98	4.5 1.79	2.75 1.09	6 2.38	4.5 1.79	2.75 1.09	11 4.36
Korean TAB VEE HAS ^e	S	2 0.79	2 0.79	2.75 1.09	2 0.79	2 0.79	2.75 1.09	2 0.79	2 0.79	4.5 1.79
	R	2 0.79	2 0.79	2.75 1.09	2 0.79	2 0.79	2.75 1.09	2 0.79	2 0.79	4.5 1.79
	F	6 2.38	6 2.38	11 4.36	6 2.38	6 2.38	11 4.36	6 2.38	6 2.38	11 4.36
Korean Flow-Through HAS	S	2 0.79	2 0.79	2.75 1.09	2 0.79	2 0.79	2.75 1.09	2 0.79	2 0.79	4.5 1.79
	F/R	6 2.38	6 2.38	11 4.36	6 2.38	6 2.38	11 4.36	6 2.38	6 2.38	11 4.36
HAS Ready Service ECM	S	2 0.79	2 0.79	2.75 1.09	2 0.79	2 0.79	2.75 1.09	2 0.79	2 0.79	6 2.38
	R	2 0.79	2 0.79	2.75 1.09	2 0.79	2 0.79	2.75 1.09	2 0.79	2 0.79	6 2.38
	FB	2.75 1.09	2.75 1.09	5 1.98	2.75 1.09	2.75 1.09	6 2.38	2.75 1.09	2.75 1.09	6 2.38
	FU	6 2.38	4.5 1.79	8 3.17	6 2.38	4.5 1.79	9 3.57	6 2.38	4.5 1.79	11 4.36
HAS Ready Service AGM	B	2.75 1.09	2.75 1.09	6 2.38	2.75 1.09	2.75 1.09	6 2.38	6 2.38	6 2.38	6 2.38
	U	11 4.36	11 4.36	11 4.36	11 4.36	11 4.36	11 4.36	11 4.36	11 4.36	11 4.36
a	Separations are based on first, second, and third generation HAS doors remaining closed, except for aircraft towing, fueling, servicing, run up, or taxi, and during integrated combat turnarounds or short periods when maintenance equipment or munitions are being moved into or out of shelters. If doors are left open for extended periods, apply default IMD to or from an open front. A HAS arch or rear wall may be considered as a barricade for application of K6 [K _m 2.38] <i>to or from a "door open" HAS front</i> . No reduction from K11 is allowed between "door open" HAS front-to-front exposures.									

Table V4.E3.T3. Minimum Hazard Factor for HASs to Prevent Simultaneous Detonation, Part 1,^{a, b, c, d} Continued

b	First generation and Korean TAB VEE HASs are limited to a maximum NEWQD of 5,863 lbs [2,659.4 kg]. Second generation, third generation, and Korean flow-through HASs are limited to a maximum NEWQD of 11,000 lbs [4,989.5 kg]. HAS ready service ECMs and AGMs are limited to a maximum NEWQD of 22,000 lbs [9,979 kg].
c	Flow-through HAS pairs are limited to a maximum NEWQD of 4,800 lbs [2,177.2 kg] in each HAS. For this NEWQD, IMD equivalent protection is provided between each HAS in a HAS pair. IMD equivalent protection between a HAS pair and adjacent HASs and HAS ready service ECMs and AGMs shall be in accordance with (IAW) this table or Table V4.E3.T4. for the HAS designs involved.
d	HAS pairs with rear walls or with front and rear walls are limited to a maximum NEWQD of 2,390 lbs [1,084.1 kg] in each HAS. For this NEWQD, IMD equivalent protection is provided between each HAS in a HAS pair. IMD equivalent protection between a HAS pair and adjacent HASs and HAS ready service ECMs and AGMs shall be IAW this table or Table V4.E3.T4. for the HAS designs involved.
e	A Korean TAB VEE HAS that has been modified to incorporate the hardened front closure of the first generation TAB VEE or TAB VEE modified HAS may be treated as a first generation HAS, <i>provided the doors remain closed except for aircraft towing, fueling, servicing, run up, or taxi, and during integrated combat turnarounds or short periods when maintenance equipment or munitions are being moved into or out of the shelter.</i>

Table V4.E3.T4. Minimum Hazard Factor for HASs to Prevent Simultaneous Detonation, Part 2^{a, b, c, d}

From → To ↓		Korean Flow-Through HAS		HAS Ready Service ECM				HAS Ready Service AGM	
		S	F/R	S	R	FB	FU	B	U
1 st Generation HAS	S	2 0.79	4.5 1.79	2 ^f 0.79 ^f	2 ^f 0.79 ^f	2.75 1.09	2.75 1.09	2.75 1.09	2.75 1.09
	R	2 0.79	4.5 1.79	2 ^f 0.79 ^f	2 ^f 0.79 ^f	2.75 1.09	2.75 1.09	2.75 1.09	2.75 1.09
	F	6 2.38	11 4.36	2 ^f 0.79 ^f	2.75 1.09	6 2.38	9 3.57	6 2.38	9 3.57
2 nd and 3 rd Generation HAS	S	2 0.79	4.5 1.79	2 ^f 0.79 ^f	2 ^f 0.79 ^f	2.75 1.09	2.75 1.09	2.75 1.09	2.75 1.09
	R	2 0.79	4.5 1.79	2 ^f 0.79 ^f	2 ^f 0.79 ^f	2.75 1.09	2.75 1.09	2.75 1.09	2.75 1.09
	F	4.5 1.79	11 4.36	2 ^f 0.79 ^f	2 ^f 0.79 ^f	2.75 1.09	2.75 1.09	2.75 1.09	2.75 1.09
Korean TAB VEE HAS ^e	S	2 0.79	4.5 1.79	2 ^f 0.79 ^f	2 ^f 0.79 ^f	2.75 1.09	2.75 1.09	2.75 1.09	2.75 1.09
	R	2 0.79	4.5 1.79	2 ^f 0.79 ^f	2 ^f 0.79 ^f	2.75 1.09	2.75 1.09	2.75 1.09	2.75 1.09
	F	6 2.38	11 4.36	6 2.38	6 2.38	6 2.38	11 4.36	6 2.38	11 4.36
Korean Flow-Through HAS	S	2 0.79	4.5 1.79	2 ^f 0.79 ^f	2 ^f 0.79 ^f	2.75 1.09	2.75 1.09	2.75 1.09	2.75 1.09
	F/R	6 2.38	11 4.36	6 2.38	6 2.38	6 2.38	11 4.36	6 2.38	11 4.36
HAS Ready Service ECM	S	2 0.79	6 2.38	See Table V3.E3.T6.					
	R	2 0.79	6 2.38						
	FB	2.75 1.09	6 2.38						
	FU	6 2.38	11 4.36						
HAS Ready Service AGM	B	6 2.38	6 2.38						
	U	11 4.36	11 4.36						

a Separations are based on first, second, and third generation HAS doors remaining closed, except for aircraft towing, fueling, servicing, run up, or taxi, and during integrated combat turnarounds or short periods when maintenance equipment or munitions are being moved into or out of shelters. If doors are left open for extended periods, apply default IMD to or from an open front. A HAS arch or rear wall may be considered as a barricade for application of K6 [K_m 2.38] *to or from a "door open" HAS front*. No reduction from K11 is allowed between "door open" HAS front-to-front exposures.

Table V4.E3.T4. Minimum Hazard Factor for HASs to Prevent Simultaneous Detonation, Part 2, ^{a, b, c, d} Continued

b	First generation and Korean TAB VEE HASs are limited to a maximum NEWQD of 5,863 lbs [2,659.4 kg]. Second generation, third generation, and Korean flow-through HASs are limited to a maximum NEWQD of 11,000 lbs [4,989.5 kg]. HAS ready service ECMs and AGMs are limited to a maximum NEWQD of 22,000 lbs [9,979 kg].				
c	Flow-through HAS pairs are limited to a maximum NEWQD of 4,800 lbs [2,177.2 kg] in each HAS. For this NEWQD, IMD equivalent protection is provided between each HAS in a HAS pair. IMD equivalent protection between a HAS pair and adjacent HASs and HAS ready service ECMs and AGMs shall be IAW this table or Table V4.E3.T3. for the HAS designs involved.				
d	HAS pairs with rear walls or with front and rear walls are limited to a maximum NEWQD of 2,390 lbs [1,084.1 kg] in each HAS. For this NEWQD, IMD equivalent protection is provided between each HAS in a HAS pair. IMD equivalent protection between a HAS pair and adjacent HASs and HAS ready service ECMs and AGMs shall be IAW this table or Table V4.E3.T3. for the HAS designs involved.				
e	A Korean TAB VEE HAS that has been modified to incorporate the hardened front closure of the first generation TAB VEE or TAB VEE modified HAS may be treated as a first generation HAS, <i>provided the doors remain closed except for aircraft towing, fueling, servicing, run up, or taxi, and during integrated combat turnarounds or short periods when maintenance equipment or munitions are being moved into or out of the shelter.</i>				
f	If the ECM loading density is ≤ 1.25 lbs/cubic feet (ft^3) [20 kg/cubic meter (m^3)], use:				
	<table border="0"> <tr> <td><u>English EQN (W in lbs, d in ft)</u> $d = 1.25 * W^{1/3}$</td> <td align="right">EQN V4.E3.T4-1</td> </tr> <tr> <td><u>Metric EQN (Q in kg, d in m)</u> $d = 0.5 * Q^{1/3}$</td> <td align="right">EQN V4.E3.T4-2</td> </tr> </table>	<u>English EQN (W in lbs, d in ft)</u> $d = 1.25 * W^{1/3}$	EQN V4.E3.T4-1	<u>Metric EQN (Q in kg, d in m)</u> $d = 0.5 * Q^{1/3}$	EQN V4.E3.T4-2
<u>English EQN (W in lbs, d in ft)</u> $d = 1.25 * W^{1/3}$	EQN V4.E3.T4-1				
<u>Metric EQN (Q in kg, d in m)</u> $d = 0.5 * Q^{1/3}$	EQN V4.E3.T4-2				

Table V4.E3.T5. Minimum Hazard Factor for HASs for Asset Preservation, Part 1^{a, b, c}

From → To ↓		1 st /2 nd /3 rd Generation HAS			Korean TAB VEEHAS ^d			Korean Flow-Through HAS		HAS Ready Service ECM			
		S	R	F	S	R	F	S	F/R	S	R	FB	FU
1 st Generation HAS	S	9 3.57	6 2.38	9 3.57	9 3.57	6 2.38	11 4.36	9 3.57	11 4.36	2.75 1.09	2.75 1.09	8 3.17	8 3.17
	R	8 3.17	5 1.98	8 3.17	8 3.17	5 1.98	11 4.36	8 3.17	11 4.36	2.75 1.09	2.75 1.09	8 3.17	8 3.17
	F	18 7.14	18 7.14	18 7.14	18 7.14	18 7.14	24 9.52	18 7.14	24 9.52	11 4.36	9 3.57	18 7.14	18 7.14
2 nd and 3 rd Generation HAS	S	9 3.57	6 2.38	9 3.57	9 3.57	6 2.38	11 4.36	9 3.57	11 4.36	2.75 1.09	2.75 1.09	8 3.17	8 3.17
	R	8 3.17	5 1.98	8 3.17	8 3.17	5 1.98	11 4.36	8 3.17	11 4.36	2.75 1.09	2.75 1.09	8 3.17	8 3.17
	F	11 4.36	9 3.57	18 7.14	11 4.36	9 3.57	18 7.14	11 4.36	18 7.14	2.75 1.09	2.75 1.09	8 3.17	8 3.17
Korean TAB VEE HAS ^d	S	30 11.9	24 9.52	24 9.52	30 11.9	24 9.52	30 11.9	30 11.9	30 11.9	30 11.9	24 9.52	30 11.9	30 11.9
	R	30 11.9	24 9.52	24 9.52	30 11.9	24 9.52	30 11.9	30 11.9	30 11.9	30 11.9	24 9.52	30 11.9	30 11.9
	F	30 11.9	24 9.52	24 9.52	30 11.9	24 9.52	30 11.9	30 11.9	30 11.9	30 11.9	24 9.52	30 11.9	30 11.9
Korean Flow-Through HAS	S	30 11.9	24 9.52	24 9.52	30 11.9	24 9.52	30 11.9	30 11.9	30 11.9	30 11.9	24 9.52	30 11.9	30 11.9
	F/R	30 11.9	24 9.52	24 9.52	30 11.9	24 9.52	30 11.9	30 11.9	30 11.9	30 11.9	24 9.52	30 11.9	30 11.9
1st Generation Maintenance HAS ^e	S	9 3.57	8 3.17	9 3.57	9 3.57	8 3.17	11 4.36	9 3.57	11 4.36	8 3.17	8 3.17	8 3.17	8 3.17
	R	8 3.17	8 3.17	8 3.17	8 3.17	8 3.17	11 4.36	8 3.17	11 4.36	8 3.17	8 3.17	8 3.17	8 3.17
	F	18 7.14	18 7.14	18 7.14	18 7.14	18 7.14	24 9.52	18 7.14	24 9.52	11 4.36	9 3.57	18 7.14	18 7.14
2nd and 3rd Generation Maintenance HAS ^e	S	9 3.57	8 3.17	9 3.57	9 3.57	8 3.17	11 4.36	9 3.57	11 4.36	8 3.17	8 3.17	8 3.17	8 3.17
	R	8 3.17	8 3.17	8 3.17	8 3.17	8 3.17	11 4.36	8 3.17	11 4.36	8 3.17	8 3.17	8 3.17	8 3.17
	F	11 4.36	9 3.57	18 7.14	11 4.36	9 3.57	18 7.14	11 4.36	18 7.14	8 3.17	8 3.17	8 3.17	8 3.17
a	Separations are based on first, second, and third generation HAS doors remaining closed, except for aircraft towing, fueling, servicing, run up, or taxi, and during integrated combat turnarounds or short periods when maintenance equipment or munitions are being moved into or out of shelters. If doors are left open for extended periods, apply Table V4.E3.T2. to or from an open front, <i>and to the arch of a HAS with an open front; apply K25, with a minimum distance of 111 ft [33.8 m], to the rear of a HAS with an open front.</i>												
b	First generation and Korean TAB VEE HASs are limited to a maximum NEWQD of 5,863 lbs [2,659.4 kg]. Second generation, third generation, and Korean flow-through HASs are limited to a maximum NEWQD of 11,000 lbs [4,989.5 kg]. HAS Ready Service ECMs used to support daily loading are limited to a maximum NEWQD of 22,000 lbs [9,979 kg] and a loading density of not more than 1.25 lbs/ft ³ [20 kg/m ³]. HAS ready service AGMs are limited to a maximum NEWQD of 22,000 lbs [9,979 kg].												
c	Asset preservation is not provided between each HAS in a HAS pair. Flow-through HAS pairs are limited to a maximum NEWQD of 4,800 lbs [2,177.2 kg] in each HAS. HAS Pairs with rear walls or with front and rear walls are limited to a maximum NEWQD of 2,390 lbs [1,084.1 kg] in each HAS. Asset preservation distances between a HAS pair and adjacent HASs and HAS ready service ECMs and AGMs shall be IAW this table or Table V4.E3.T6. for the HAS designs involved.												

Table V4.E3.T5. Minimum Hazard Factor for HASs for Asset Preservation,
Part 1,^{a, b, c} Continued

d	A Korean TAB VEE HAS that has been modified to incorporate the hardened front closure of the first generation TAB VEE or TAB VEE Modified HAS may be treated as a first generation HAS, <i>provided the doors remain closed except for aircraft towing, fueling, servicing, run up, or taxi, and during integrated combat turnarounds or short periods when maintenance equipment or munitions are being moved into or out of the shelter.</i>
e	These distances reflect K30 [K _m 11.9] equivalent protection (when doors are closed) for the aircraft. If this table or Table V4.E3.T6. is not applied for aircraft survivability, then ILD equivalent protection (3.5 psi [24 kPa]) must be provided to personnel.

Table V4.E3.T6. Minimum Hazard Factor for HASs for Asset Preservation, Part 2^{a, b, c}

From → To ↓		HAS Ready Service AGM		Storage Area ECM				Storage Area AGM	
		B	U	S	R	FB	FU	B	U
1 st Generation HAS	S	8 3.17	8 3.17	5 1.98	5 1.98	8 3.17	8 3.17	8 3.17	8 3.17
	R	8 3.17	8 3.17	5 1.98	5 1.98	8 3.17	8 3.17	8 3.17	8 3.17
	F	18 7.14	18 7.14	18 7.14	18 7.14	18 7.14	18 7.14	18 7.14	18 7.14
2 nd and 3 rd Generation HAS	S	8 3.17	8 3.17	5 1.98	5 1.98	8 3.17	8 3.17	8 3.17	8 3.17
	R	8 3.17	8 3.17	5 1.98	5 1.98	8 3.17	8 3.17	8 3.17	8 3.17
	F	8 3.17	8 3.17	5 1.98	5 1.98	8 3.17	8 3.17	8 3.17	8 3.17
Korean TAB VEE HAS ^d	S	30 11.9	30 11.9	30 11.9	24 9.52	30 11.9	30 11.9	30 11.9	30 11.9
	R	30 11.9	30 11.9	30 11.9	24 9.52	30 11.9	30 11.9	30 11.9	30 11.9
	F	30 11.9	30 11.9	30 11.9	24 9.52	30 11.9	30 11.9	30 11.9	30 11.9
Korean Flow-Through HAS	S	30 11.9	30 11.9	30 11.9	24 9.52	30 11.9	30 11.9	30 11.9	30 11.9
	F/R	30 11.9	30 11.9	30 11.9	24 9.52	30 11.9	30 11.9	30 11.9	30 11.9
1st Generation Maintenance HAS ^e	S	8 3.17	8 3.17	5 1.98	5 1.98	8 3.17	8 3.17	8 3.17	8 3.17
	R	8 3.17	8 3.17	5 1.98	5 1.98	8 3.17	8 3.17	8 3.17	8 3.17
	F	18 7.14	18 7.14	18 7.14	18 7.14	18 7.14	18 7.14	18 7.14	18 7.14
2nd and 3rd Generation HAS ^e	S	8 3.17	8 3.17	5 1.98	5 1.98	8 3.17	8 3.17	8 3.17	8 3.17
	R	8 3.17	8 3.17	5 1.98	5 1.98	8 3.17	8 3.17	8 3.17	8 3.17
	F	8 3.17	8 3.17	5 1.98	5 1.98	8 3.17	8 3.17	8 3.17	8 3.17
a	Separations are based on first, second, and third generation HAS doors remaining closed, except for aircraft towing, fueling, servicing, run up, or taxi, and during integrated combat turnarounds or short periods when maintenance equipment or munitions are being moved into or out of shelters. If doors are left open for extended periods, apply Table V4.E3.T2. to or from an open front, <i>and to the arch of a HAS with an open front; apply K25, with a minimum distance of 111 ft [33.8 m], to the rear of a HAS with an open front.</i>								

Table V4.E3.T6. Minimum Hazard Factor for HASs for Asset Preservation,
Part 2,^{a, b, c} Continued

b	First generation and Korean TAB VEE HASs are limited to a maximum NEWQD of 5,863 lbs [2,659.4 kg]. Second generation, third generation, and Korean flow-through HASs are limited to a maximum NEWQD of 11,000 lbs [4,989.5 kg]. HAS ready service ECMs used to support daily loading are limited to a maximum NEWQD of 22,000 lbs [9,979 kg] and a loading density of not more than 1.25 lbs/ft ³ [20 kg/m ³]. HAS Ready Service AGMs are limited to a maximum NEWQD of 22,000 lbs [9,979 kg].
c	Asset preservation is not provided between each HAS in a HAS Pair. flow-through HAS pairs are limited to a maximum NEWQD of 4,800 lbs [2,177.2 kg] in each HAS. HAS pairs with rear walls or with front and rear walls are limited to a maximum NEWQD of 2,390 lbs [1,084.1 kg] in each HAS. Asset preservation distances between a HAS pair and adjacent HASs and HAS Ready Service ECMs and AGMs shall be IAW this table or Table V4.E3.T5. for the HAS designs involved.
d	A Korean TAB VEE HAS that has been modified to incorporate the hardened front closure of the first generation TAB VEE or TAB VEE modified HAS may be treated as a first generation HAS, <i>provided the doors remain closed except for aircraft towing, fueling, servicing, run up, or taxi, and during integrated combat turnarounds or short periods when maintenance equipment or munitions are being moved into or out of the shelter.</i>
e	These distances reflect K30 [K _m 11.9] equivalent protection (when doors are closed) for the aircraft. If this table or Table V4.E3.T5. is not applied for aircraft survivability, then ILD equivalent protection (3.5 psi [24 kPa]) must be provided to personnel.

Table V4.E3.T7. QD from a Third Generation HAS PES to an Unhardened ES^{a, b, c, d}

NEWQD	Front	Sides	Rear
(lbs)	(ft)	(ft)	(ft)
[kg]	[m]	[m]	[m]
$\leq 5.0^e$	50	50	50
$\leq 2.3^e$	15.2	15.2	15.2
$5 < \text{NEWQD} \leq 500$	230	50	50
$2.3 < \text{NEWQD} \leq 226.8$	70.1	15.2	15.2
$500 < \text{NEWQD} \leq 1,100$	230	394	164
$226.8 < \text{NEWQD} \leq 498.9$	70.1	120.1	50
$1,100 < \text{NEWQD} \leq 11,000^f$	K50	K62	K40
$498.9 < \text{NEWQD} \leq 4,989.5^f$	$K_m 19.84$	$K_m 24.60$	$K_m 15.86$
a This table may be applied to the front, sides, and rear of a second generation HAS, and to the sides of a Korean flow-through HAS, as allowed per subparagraph V4.E3.7.4.2.; it may be applied to HAS pairs as allowed per subparagraph V4.E3.7.4.4.			
b Separation distances are based on shelter doors remaining closed, except for aircraft towing, fueling, servicing, run-up, or taxiing and during integrated combat turnarounds or short periods when maintenance equipment or munitions are being moved into or out of the shelter. Where doors are left open for extended periods, normal combat aircraft parking area criteria of Table V4.E3.T1. apply from the front.			
c Separate AE from the HAS walls by a distance sufficient to prevent breaching. For less than 1,100 lbs [498.9 kg] NEWQD, a 3-ft [0.91 m] separation from the wall is sufficient.			
d These QD criteria apply to IBD, PTRD, and ILD exposures for quantities $\leq 1,100$ lbs [498.9 kg] NEWQD.			
e The 50-ft [15.2 m] distance shown is not for QD purposes, but represents a minimum fire separation distance.			
f For quantities $> 1,100$ to 11,000 lbs [498.9 to 4,989.5 kg] NEWQD, these QD only apply to IBD exposures. Use 50 percent of the IBD criteria for PTRD exposures with a 300-ft [91.4 m] minimum distance out the front or rear or a 394-ft [120.1 m] minimum distance off the sides. Use 35 percent of the IBD criteria for intraline exposures with a 300-ft [91.4 m] minimum distance out the front and rear or a 394-ft [120.1 m] minimum distance off the sides.			

Table V4.E3.T8. QD from a First Generation HAS PES to an Unhardened ES^{a, b, c, d}

NEWQD	Front	Sides	Rear
(lbs)	(ft)	(ft)	(ft)
[kg]	[m]	[m]	[m]
$\leq 2.63^e$	50	50	50
$\leq 1.19^e$	15.2	15.2	15.2
$2.63 < \text{NEWQD} \leq 263.8$	230	50	50
$1.19 < \text{NEWQD} \leq 119.6$	70.1	15.2	15.2
$263.8 < \text{NEWQD} \leq 586.3$	230	394	164
$119.6 < \text{NEWQD} \leq 265.9$	70.1	120.1	50
$586.3 < \text{NEWQD} \leq 5,863^f$	K50	K62	K40
$265.9 < \text{NEWQD} \leq 2,659.4^f$	$K_m 19.84$	$K_m 24.60$	$K_m 15.86$
a	This table may be applied to the front, sides, and rear of a first generation HAS, and to the sides and rear of a Korean TAB VEE HAS, as allowed per subparagraph V4.E3.7.4.3.; it may be applied to HAS pairs as allowed per subparagraph V4.E3.7.4.4.		
b	Separation distances are based on shelter doors remaining closed, except for aircraft towing, fueling, servicing, run-up, or taxiing and during integrated combat turnarounds or short periods when maintenance equipment or munitions are being moved into or out of the shelter. Where doors are left open for extended periods, normal combat aircraft parking area criteria of Table V4.E3.T1. apply from the front.		
c	Separate AE from the HAS walls by a distance sufficient to prevent breaching. For less than 1,100 lbs [498.9 kg] NEWQD, a 3-ft [0.91 m] separation from the wall is sufficient.		
d	These QD criteria apply to IBD, PTRD, and ILD exposures for quantities ≤ 586.3 lbs [265.9 kg] NEWQD.		
e	The 50-ft [15.2 m] distance shown is not for QD purposes, but represents a minimum fire separation distance.		
f	For quantities > 586.3 to 5,863 lbs [265.9 to 2,659.4 kg] NEWQD, these QD only apply to IBD exposures. Use 50 percent of the IBD criteria for PTRD exposures with a 300-ft [91.4 m] minimum distance out the front or rear or a 394-ft [120.1 m] minimum distance off the sides. Use 35 percent of the IBD criteria for intraline exposures with a 300-ft [91.4 m] minimum distance out the front and rear or a 394-ft [120.1 m] minimum distance off the sides.		

V4.E3.8. HELICOPTER LANDING AREAS FOR AE OPERATIONS. Helicopter landing areas for loading and unloading AE within storage sites and quick reaction alert sites shall be considered AGMs and may be sited at IMD based only upon the NEWQD carried by the helicopter. Such helicopter landing areas shall meet the following requirements:

V4.E3.8.1. Flight clearance criteria are met.

V4.E3.8.2. Landing and takeoff approaches shall not be over any AE facilities.

V4.E3.8.3. Helicopter operations are to be limited to AE support of the facilities concerned.

V4.E3.8.4. Carrying of passengers is not permitted.

V4.E3.8.5. During helicopter takeoff, landing, or loading or unloading, AE operations shall not be conducted at any PES located within IBD of the helicopter landing area. During landing or takeoff, PES doors shall be closed.

V4.E3.8.6. Safety precautions normal to other modes of transportation are to be observed.

ENCLOSURE 4

PIERS AND WHARFS

V4.E4.1. SCOPE AND APPLICATION. QDs herein are for HD 1.1 AE. If only AE of other HDs are involved, the applicable QD shall be applied. This enclosure:

V4.E4.1.1. Applies to:

V4.E4.1.1.1. Ship and barge units, hereafter referred to as ships.

V4.E4.1.1.2. Piers, wharfs, and associated facilities where AE may be handled or may be present in ships' holds or conveyances.

V4.E4.1.1.3. Loading, off-loading, stowing, and shifting of AE from ships' magazines.

V4.E4.1.2. Does not apply to (i.e., no QD is required for):

V4.E4.1.2.1. AE in static storage in ships' magazines and intended for the service of shipboard armament or aircraft, provided the Secretary of the Military Department concerned formally accepts any explosives risk associated with such storage.

V4.E4.1.2.2. Handling ≤ 300 lbs [136.1 kg] net explosive weight (NEW) of combined HD 1.3 and HD 1.4 AE that are necessary for ship security and safety at sea.

V4.E4.2. DETERMINING THE QUANTITY OF EXPLOSIVES IN A SHIP

V4.E4.2.1. The NEWQD on board a ship shall be determined per section V1.E7.2.

V4.E4.2.2. When ships are separated by $11W^{1/3}$ [$4.36Q^{1/3}$] distances or greater, QD shall be based individually on the quantity of each ship. Lesser separation distances require that the AE in all ships be totaled.

V4.E4.3. MEASUREMENT OF SEPARATION DISTANCES

V4.E4.3.1. Moored Ships

V4.E4.3.1.1. Measurement of separation distances between ships or barges shall be from the nearest point of one ship's magazine (i.e., the PES) or the barge:

V4.E4.3.1.1.1. For IMD, to the nearest point of another ship's magazine or a barge.

V4.E4.3.1.1.2. For IBD and PTRD, to the nearest point of another ship or a barge.

V4.E4.3.1.2. Measurement of separation distances between ships or barges and shore ESs shall be from the nearest point of a ship's magazine or the barge to the nearest point of the ES.

V4.E4.3.2. Pier Operations. Measurement of separation distances from piers to surrounding facilities shall be from the nearest point that AE will be handled to the nearest point of an ES. Movement of railcars or trucks passing through the clear space between ships at a pier or between piers is considered an operational risk. It is generally impracticable to separate berths at a single pier by enough distance to prevent mass detonation of HD 1.1. To the extent operationally feasible, the number of such exposures and total time required should be reduced to the maximum extent practicable through scheduling.

V4.E4.3.3. Anchorages. Measurements from anchorages generally shall be from the boundary of the area designated for the explosives anchorage. The explosives anchorage for a single ship is a circle, the radius of which is the distance from the mooring buoy or a ship's anchor to the stern of the ship or of the AE lighters alongside when riding to the full scope of the chain. For an explosives anchorage, the separation distance to an ES will depend upon whether any ships are separated properly (see section V4.E4.2.2.).

V4.E4.4. SITING CRITERIA AND APPLICATION OF QD

V4.E4.4.1. Maritime Pre-positioning Ships (MPSs)

V4.E4.4.1.1. Reduced QD criteria may be applied to those MPSs that contain up to 1,300,000 lbs [589,667 kg] NEWQD of AE stored in standard International Standardization Organization (ISO) shipping containers.

V4.E4.4.1.2. IBD and PTRD for MPSs can be determined using $K = 40.85$ [16.21] with a 3,700-ft [1,128-m] minimum fragment distance for IBD and $K = 24.01$ [9.52] with a 2,220-ft [677-m] minimum fragment distance for PTRD for MPS loads where no more than 52 percent of the NEWQD is HD 1.1. When the percentage of HD 1.1 is:

V4.E4.4.1.2.1. Between 52 and 65 percent, use the IBD and PTRD columns of Table V4.E4.T19.

V4.E4.4.1.2.2. Above 65 percent, use the Other PES columns of Table V3.E3.T1. with a 3,700-ft [1,128-m] minimum fragment distance for IBD and a 2,220-ft [677-m] minimum fragment distance for PTRD.

V4.E4.4.1.3. The QD between applicable MPS piers/anchorages and non-explosives loading piers/anchorages can be determined using $K = 32$ [12.69] with a 3,500-ft [1,067-m] minimum fragment distance for MPS loads, where no more than 52 percent of the total NEWQD is HD 1.1. (An exception for non-explosive MPSs is provided in subparagraph V4.E4.4.8.1.) When the percentage of HD 1.1 is:

V4.E4.4.1.3.1. Between 52 and 65 percent, use the ship-to-ship column in Table V4.E4.T19.

V4.E4.4.1.3.2. Above 65 percent, use $K = 40$ [15.87] with a minimum fragment distance of 3,500 ft [1,067 m].

Table V4.E4.T19. Variation of MPS QD Factors with Loadout

Percentage of HD 1.1	IBD ^a	PTRD ^b	Ship-to-Ship ^c
	(ft/1b ^{1/3})	(ft/1b ^{1/3})	(ft/1b ^{1/3})
	[m/kg ^{1/3}]	[m/kg ^{1/3}]	[m/kg ^{1/3}]
up to 52	40.85	24.01	32.00
	16.21	9.52	12.69
53	40.97	24.08	32.10
	16.25	9.55	12.73
54	41.10	24.16	32.19
	16.30	9.58	12.77
55	41.22	24.23	32.29
	16.35	9.61	12.81
56	41.35	24.30	32.39
	16.40	9.64	12.85
57	41.47	24.37	32.48
	16.45	9.67	12.88
58	41.59	24.44	32.58
	16.50	9.70	12.92
59	41.71	24.52	32.67
	16.55	9.73	12.96
60	41.83	24.59	32.77
	16.59	9.75	13.00
61	41.95	24.66	32.86
	16.64	9.78	13.04
62	42.07	24.73	32.95
	16.69	9.81	13.07
63	42.19	24.80	33.05
	16.74	9.84	13.11
64	42.30	24.86	33.14
	16.78	9.86	13.15
65	42.42	24.93	33.23
	16.83	9.89	13.18
a	With a minimum fragment distance of 3,700 ft [1,128 m].		
b	With a minimum fragment distance of 2,220 ft [677 m].		
c	With a minimum fragment distance of 3,500 ft [1,067 m].		

V4.E4.4.2. Scuttling Site. A properly located scuttling site will, when feasible, be provided for positioning a ship for its flooding or sinking in the event it catches fire and must be moved to avert damage to other ships or piers. The location of a scuttling site shall depend on the greatest NEWQD that may be in a single ship *to be scuttled* at any one time. (~~Table V3.E3.T1~~ *Figure V4.E4.F2* provides the applicable QD.) Additional considerations for the scuttling site include:

V4.E4.4.2.1. The site should have sufficient maneuvering room and depth to permit sinking the largest vessel that may be handled at the installation so that the holds will be flooded completely at low tide.

V4.E4.4.2.2. The scuttling site should provide the best available protection to other ships, piers, and shore installations in the event of a mass explosion.

V4.E4.4.3. Explosives Anchorages

V4.E4.4.3.1. Separation of Explosives Anchorages from Main Ship Channels. Explosives anchorage shall be separated from the main ship channel and from normally traversed routes of ships entering or leaving the harbor by the following distances (occasional watercraft passing through the arcs, while outside both the main ship channel and normally traversed routes of ships entering and leaving the harbor, are not subject to QD requirements):

V4.E4.4.3.1.1. The PTRD from “Other PES” column of Table V3.E3.T1 (*regardless of traffic density*).

V4.E4.4.3.1.2. The turning circles and stopping distances of other ships passing the anchorage but not less than 3,000 ft [914.4 m].

V4.E4.4.3.2. Separation of Ships at Explosives Anchorages. When explosives anchorages are used for both loading and unloading ships and for mooring loaded ships, they shall be separated as follows:

V4.E4.4.3.2.1. Loaded ships shall be separated one from another by $18W^{1/3}$ [7.14Q^{1/3}].

V4.E4.4.3.2.2. Loading and unloading ships shall be separated one from another by $11W^{1/3}$ [4.36Q^{1/3}] and, when possible, by $18W^{1/3}$ [7.14Q^{1/3}].

V4.E4.4.3.2.3. Loaded ships shall be separated from ships loading and unloading by $40W^{1/3}$ [15.87Q^{1/3}].

V4.E4.4.3.3. Separation of Explosives Anchorages from Explosives Piers. Explosives anchorages shall be separated from explosives piers by $40W^{1/3}$ [15.87Q^{1/3}] except when the anchorage is used only for the loading or unloading of ships. In that case, $18W^{1/3}$ [7.14Q^{1/3}] may be used.

V4.E4.4.4. Separation Distances of Ships at the Same Pier

V4.E4.4.4.1. Berthing of two ships in tandem helps decrease the fragment hazard to the AE cargo of the second ship because of the additional protection afforded by the bow or stern.

V4.E4.4.4.2. When two ships, which cannot be separated by $11W^{1/3}$ [$4.36Q^{1/3}$], are being loaded through all hatches at the same time, the spotting of railcars or trucks and the loading of hatches in both ships should be planned in a manner that puts the greatest possible distance both between the open hatches and the trucks and railcars serving the two ships. When possible, the loading of the ships shall be staggered.

V4.E4.4.5. Separation of Wharf Yard from the Pier. A wharf yard shall be separated from the pier, which it serves, by $11W^{1/3}$ [$4.36Q^{1/3}$] to prevent propagation. If this separation distance cannot be met, then the wharf yard shall be considered as part of the ship or barge and added to it for computation of the total amount of explosives for QD purposes.

V4.E4.4.6. Separation of Explosives Ships from Other Ships. Explosives ships being loaded or unloaded shall be separated from non-explosives carrying ships and from loaded explosives ships that are not underway by $40W^{1/3}$ [$15.87Q^{1/3}$] distances. The PTRD from “Other PES” column of Table V3.E3.T1. shall be used for protection of ships that are underway.

V4.E4.4.7. Barge Piers *and Anchorages*

V4.E4.4.7.1. Barge Piers. Piers and wharfs used exclusively for loading or unloading AE on barges or utility craft ~~may be sited from other shore facilities as loading docks IAW section V4.E5.7. Shore facilities shall be sited under the same criteria as pier and wharf facilities, in relation to barge piers (i.e., barge piers) shall be sited at IMD from all other PESs (to include from another barge pier or a barge anchorage). As a PES, barge piers and anchorages shall be sited in accordance with Figure V4.E4.F2.~~

V4.E4.4.7.2. Barge Anchorages. Anchorages used only to moor AE-loaded barges and where AE loading or unloading is not permitted (i.e., barge anchorages) shall be sited at IMD from all other PESs (to include from another barge anchorage or a barge pier). As a PES, barge anchorages shall be sited in accordance with Figure V4.E4.F2. See subparagraph V4.E4.4.3. for criteria to apply to anchorages used for AE loading or unloading.

V4.E4.4.8. Separation of Pre-position Program Ships at Anchorages. The Military Sealift Command’s Pre-positioning Program (i.e., Combat Pre-positioning Force, Maritime Pre-positioning Force, Logistics Pre-positioning Ships) operates both explosives-loaded and non-explosives carrying ships that are then deployed to key locations around the world. These ships are pre-loaded with military equipment and supplies necessary to support military forces on a short-notice basis and thus support a common mission. The following criteria apply to Pre-positioning Program ships at anchorage:

V4.E4.4.8.1. Non-explosives carrying ships shall be separated from explosives-loaded ships by a minimum of $18W^{1/3}$ [$7.14Q^{1/3}$].

V4.E4.4.8.2. Non-explosives carrying ships shall be separated from non-Pre-positioning Program explosives-loaded ships by $40W^{1/3}$ [15.87Q^{1/3}].

V4.E4.4.8.3. Non-explosives carrying ships not associated with the Pre-positioning Program shall be separated from all explosives carrying ships by $40W^{1/3}$ [15.87Q^{1/3}].

V4.E4.4.8.4. All non-explosives carrying ships shall be separated from explosives ships being loaded or unloaded by $40W^{1/3}$ [15.87Q^{1/3}].

V4.E4.5. QD TABLES

V4.E4.5.1. Figure V4.E4.F42. illustrates required hazard factors. Table V3.E3.T8. provides the corresponding separation distances.

V4.E4.5.2. Table V3.E3.T1. separation distances shall be maintained between explosives pier and wharf facilities and other ESs (e.g., administration and industrial areas, terminal boundaries, main ship channels, and public traffic routes).

V4.E4.5.3. As an ES, ships must be separated from AE operating and storage facilities (including holding yards) by the ~~“Other PES-appropriate IBD”~~ column of Table V3.E3.T1.

V4.E4.5.4. As a PES, ships must be separated from AE operating facilities by either the barricaded IMD (K6 [2.38]) or unbarricaded IMD (K11 [4.36]) ~~of Table V3.E3.T6.~~, as applicable. An exception (see subparagraph V3.E3.1.1.2.1.10.) is permitted when the ES is a container stuffing and unstuffing operation that routinely supports AE ship loading and unloading operations. QD requirements of paragraph V4.E4.5.3. shall apply from such container stuffing and unstuffing operations (as a PES) to an AE ship (as an ES).

V4.E4.6. GENERAL CARGO AND VEHICLES AT AE TERMINALS

V4.E4.6.1. Concurrent movements of mission-related general cargo, vehicles, and AE through a terminal may be conducted for the purpose of loading or unloading the same ship.

V4.E4.6.2. Concurrent operations involving other ships shall be conducted at applicable QD separations. (See Figure V4.E4.F42.)

V4.E4.6.3. Separation of inert materials and equipment in holding areas shall be consistent with section V4.E5.4.

V4.E4.6.3.1. Personnel entering inert holding areas that are located within explosives safety QDs shall be limited both in number and time of exposure.

V4.E4.6.3.2. Any labor intense activity shall take place at IBD or PTRD, as applicable.

Figure V4.E4.F1. Application of Separation Distances for Ship or Barge

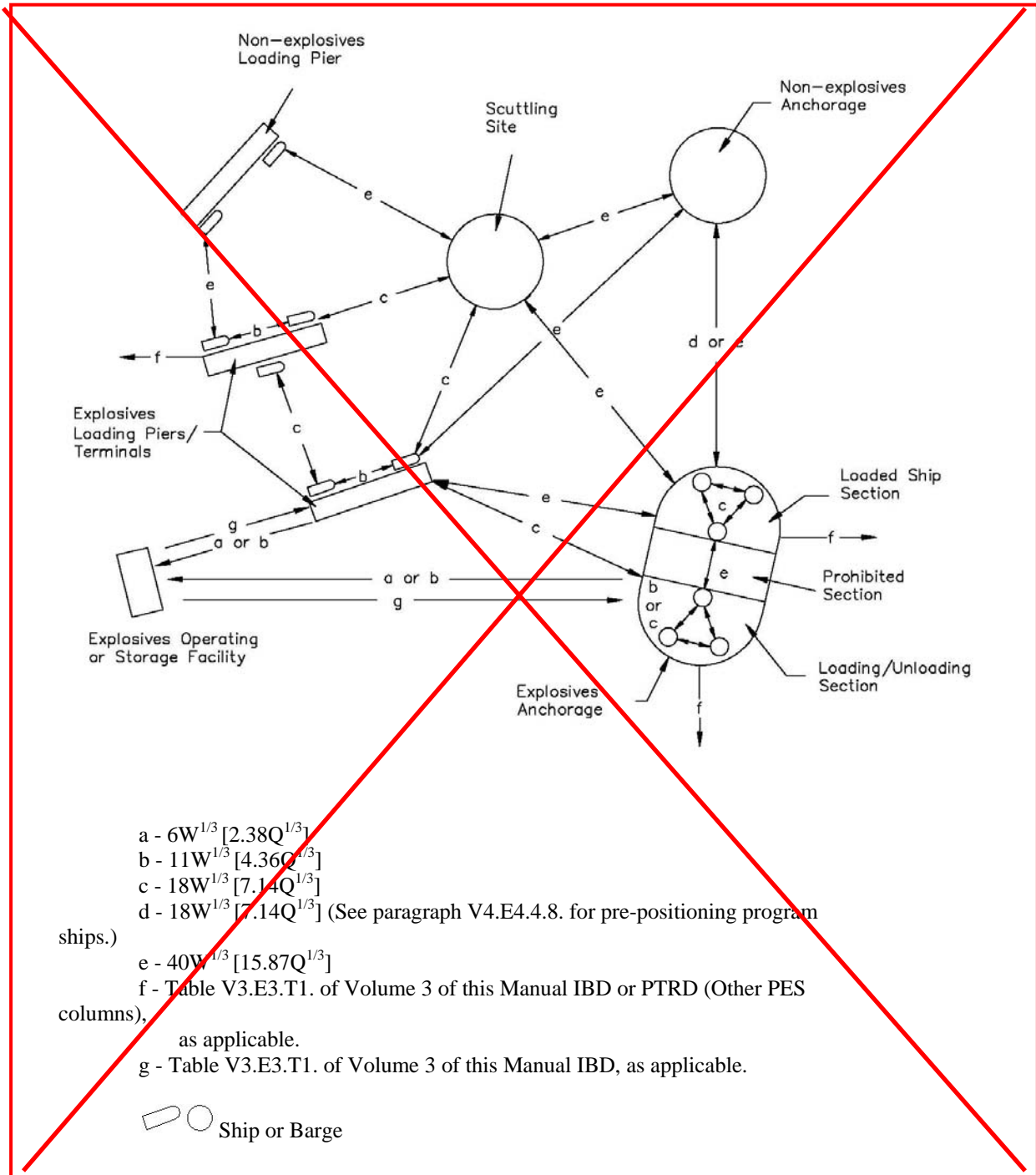
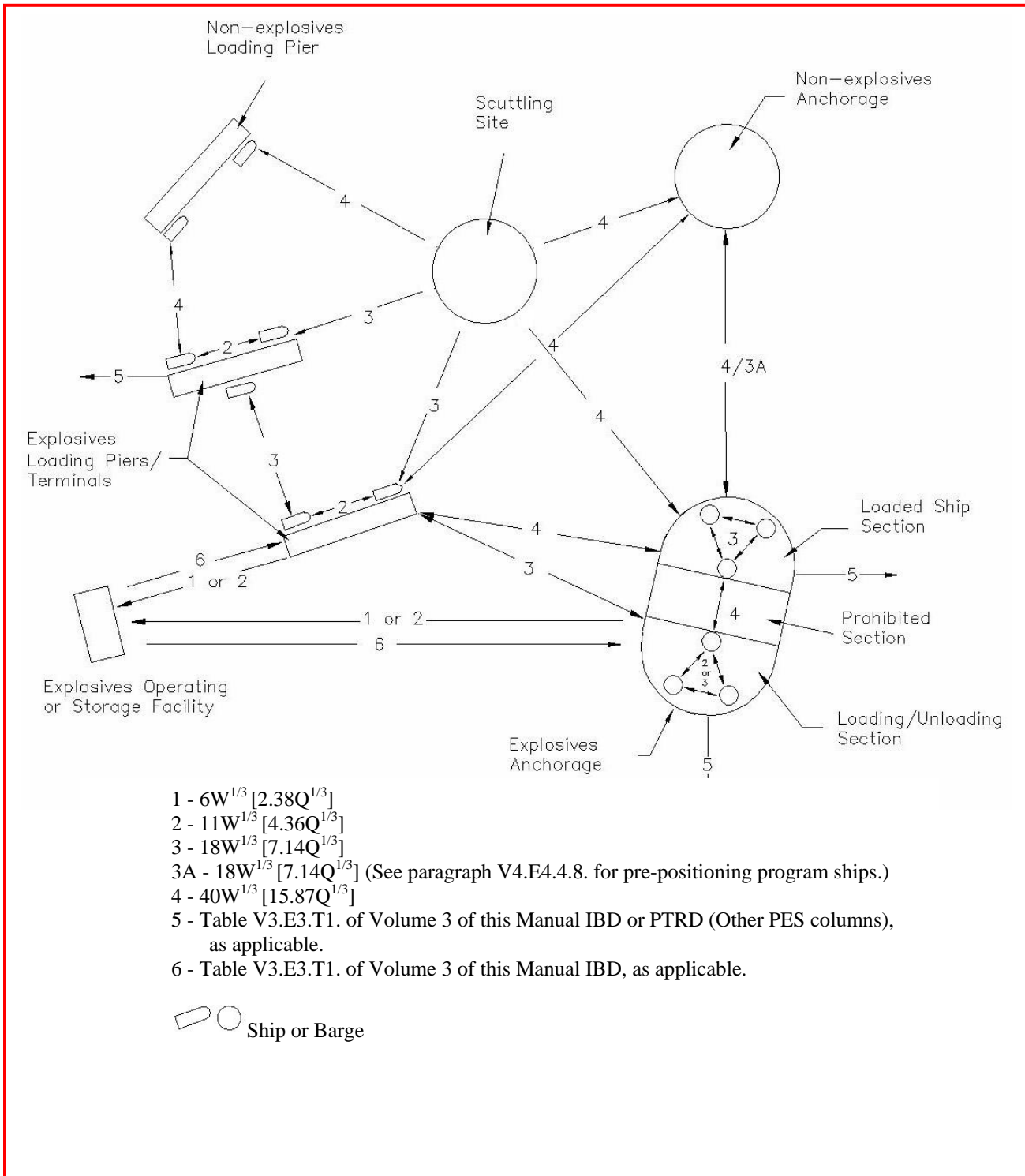


Figure V4.E4.F2. Application of Separation Distances for Ship or Barge



ENCLOSURE 5

SPECIFIC FACILITIES

V4.E5.1. SCOPE AND APPLICATION. This enclosure establishes criteria for siting specific AE and non-AE facilities with respect to PESs.

V4.E5.2. ADMINISTRATION AND INDUSTRIAL AREAS AND AUXILIARY FACILITIES

V4.E5.2.1. Administration and industrial areas shall be separated from a PES by IBD.

V4.E5.2.2. Auxiliary facilities (e.g., heating plants, line offices, break areas, briefing rooms for daily work schedules or site safety matters, joiner shops, security posts, and similar functions) located at or near AE operations and servicing only one building or operation may be located at fire protection distance (50 ft [15.2 m] for non-combustible structures, 100 ft [30.5 m] for combustible structures) from the building or operation they support.

V4.E5.2.3. Security response facilities that support response force personnel meeting DoD S-5210.41-M-V1(Reference (e)) mission requirements, and are hardened against small arms fire, require no QD separation from the PESs they support.

V4.E5.3. CLASSIFICATION YARD

V4.E5.3.1. For protection of the classification yard from a PES, separation distances shall be at least the applicable IMD.

V4.E5.3.2. Specific QD separation is not required from the classification yard to ESs when the classification yard is used exclusively for:

V4.E5.3.2.1. Receiving, dispatching, classifying, and switching of cars.

V4.E5.3.2.2. Interchanging of trucks, trailers, or railcars between the common carrier and the DoD activity.

V4.E5.3.2.3. Conducting external inspection of motor vehicles or railcars, or opening of free-rolling doors of railcars for the purpose of removing documents and making a visual inspection of the cargo.

V4.E5.3.3. Specific QD separation applies if the classification yard is used for any other purpose.

V4.E5.4. INERT STORAGE. Locations for inert storage shall be determined only after consideration of personnel exposure, the importance of the materiel in relation to the explosives mission, the operational conditions, and the availability of space.

V4.E5.4.1. The DoD Components shall determine acceptable locations for inert storage that is directly related to the explosives mission, and for inert storage that is not directly related but where control of and access to such inert storage is restricted only to personnel directly related to the explosives mission. The DoD Components shall determine what constitutes “directly related.” Site plans meeting these conditions are not required to be submitted to the DDESB for review and approval (see paragraph V1.E5.2.8.).

V4.E5.4.2. Inert storage that will be accessed by personnel not related to the explosives mission shall be sited per subparagraphs V3.E3.1.1.4.7. and V3.E3.1.1.6.9. (based on blast only). Minimum fragment distances do not apply (see subparagraph V3.E3.1.2.1.3.4.).

V4.E5.5. INTERCHANGE YARDS

V4.E5.5.1. Truck, trailer, or railcar interchange yards are not subject to QD requirements, when used exclusively:

V4.E5.5.1.1. For the interchange of vehicles or railcars containing AE between the commercial carrier and DoD activities.

V4.E5.5.1.2. To conduct external inspection of the trucks, trailers, or railcars containing AE.

V4.E5.5.1.3. To conduct visual inspection of the external condition of the cargo in vehicles (e.g., trucks, trailers, and railcars) that passed the external inspection.

V4.E5.5.2. Truck, trailer, or railcar interchange used, at any time, for any purpose other than those listed in subparagraphs V4.E5.5.1.1. through V4.E5.5.1.3. are subject to applicable QD tables. (See paragraph V1.E7.4.3.)

V4.E5.6. INTER-DoD COMPONENT SUPPORT AND TACTICAL FACILITIES

V4.E5.6.1. General

V4.E5.6.1.1. The separation distances in paragraph V4.E5.6.2. shall apply between facilities of one DoD Component to those of another DoD Component regardless of the location of the boundaries.

V4.E5.6.1.2. Other safety criteria (e.g., toxicity, noise, radiation, flight trajectory) may require greater distances. In these situations, the predominant hazard criteria shall apply.

V4.E5.6.2. Minimum QD Relationships. The following minimum QD relationships apply:

V4.E5.6.2.1. AE storage facilities shall be separated by IMD.

V4.E5.6.2.2. AE storage or operating locations of one DoD Component shall be separated from AE operating locations of another DoD Component by IBD. (See subparagraph V4.E5.6.2.3. for an exception to this criterion.)

V4.E5.6.2.3. Explosive operations that present a similar degree of hazard or involve joint or support operations shall be separated by ILD.

V4.E5.6.2.4. AE storage or operating locations of one DoD Component shall be separated from AE tactical facilities of another DoD Component by IBD. For joint or support operations, determine the separation distance as though both facilities belonged to a single DoD Component.

V4.E5.7. DETACHED LOADING DOCKS. Detached loading docks that service multiple facilities shall be sited based on use with regard to the facilities serviced. They shall be sited as AGMs with regard to all other facilities.

V4.E5.7.1. When servicing magazines, such docks must be separated from magazines by IMD based only on the explosives limit of the loading dock.

V4.E5.7.2. When servicing operating buildings, such docks must be separated from the operating buildings by ILD based only on the explosives limit of the loading dock.

V4.E5.8. HOLDING YARDS FOR RAILCARS AND TRUCKS CONTAINING AE

V4.E5.8.1. Railcar groups containing AE shall be separated from each other by AGM distance in a railcar-holding yard. For example:

V4.E5.8.1.1. If the railcar-holding yard is formed by two parallel ladder tracks connected by diagonal spurs, the parallel tracks and the diagonal spurs shall be separated by AGM distance for the quantities of AE involved.

V4.E5.8.1.2. If the railcar-holding yard is a “Christmas tree” arrangement, consisting of a ladder track with diagonal dead-end spurs projecting from each side at alternate intervals, the spurs shall be separated by AGM distance for the quantities of AE involved.

V4.E5.8.2. Truck groups containing AE in holding yards shall be separated from each other by AGM distance.

V4.E5.8.3. Railcar and truck holding yards containing AE shall be separated from other facilities by the applicable IBD, PTRD, ILD, or IMD.

V4.E5.8.4. In addition to the temporary parking of railcars, trucks, or trailers containing AE, holding yards may be used to interchange truck, trailers, or railcars between the commercial carrier and the DoD activity, and also to conduct visual inspections.

V4.E5.9. INSPECTION STATIONS FOR RAILCARS AND TRUCKS CONTAINING AE

V4.E5.9.1. Inspection stations for railcars and trucks containing AE that are used exclusively for the activities listed in subparagraphs V4.E5.9.1.1. through V4.E5.9.1.3. are not subject to QD criteria. However, these stations should be located as far as practical from other hazards or populated areas. Allowable activities are:

V4.E5.9.1.1. External visual inspection of the railcars or motor vehicles.

V4.E5.9.1.2. Visual inspection of the external condition of the cargo packaging in vehicles that have passed the external inspection indicated in subparagraph V4.E5.9.1.1.

V4.E5.9.1.3. Interchange of trucks, trailers, or railcars between the common carrier and the DoD activity.

V4.E5.9.2. Inspection stations used for any other purpose shall comply with applicable QD criteria.

V4.E5.10. HOLDING AREAS FOR SUSPECT RAILCARS OR TRUCKS CONTAINING AE. Railcars or trucks that are suspected of being in a hazardous condition shall be separated (isolated) from other PESs or ESs by the applicable QD before any other action.

V4.E5.11. AE TRANSPORTATION MODE CHANGE LOCATIONS. Movement and transfer of DoD-titled AE must comply with national, international, and host country-specific transportation regulations. QD criteria apply to all transfer operations involving DoD-titled AE, except roll-on/roll-off (RO/RO) operations that meet these requirements:

V4.E5.11.1. If a sited location is available, it shall be used. If a sited location is not available, then the location selected shall be as remote as practicable from populated areas to minimize exposure of unrelated personnel.

V4.E5.11.2. The total NEWQD present shall not exceed 30,000 lbs.

V4.E5.11.3. All AE present (e.g., trailers, trucks, barges) must be associated only with the RO/RO operation being conducted.

V4.E5.11.4. AE should be located on-site for the minimum time necessary, but the operations shall not exceed 24 hours following arrival of the AE.

V4.E5.12. SECURE HOLDING AREA. An area designated for the temporary parking of commercial carriers' motor vehicles transporting DoD-owned arms, ammunition, and explosives; classified (Secret or Confidential) materials; and controlled cryptographic items. There are two types of secure holding areas and the criteria for each are provided in subparagraphs V4.E5.12.1. and V4.E5.12.2. (Although the intent of such areas is to provide a secure storage location for commercial carriers while in transit, or during emergencies or other circumstances that are beyond a carrier's control, this Manual imposes no requirement for installations to have such areas. The term "secure holding area" is applicable to areas (continental United States, Hawaii, Alaska, and Puerto Rico) governed by Defense Transportation Regulation 4500.9-R (Reference (ef)).

V4.E5.12.1. Secure Explosives Holding Area. Site as a holding yard per section V4.E5.8.

V4.E5.12.2. Secure Non-explosives Holding Area. No siting required if located outside all QD arcs. If located within a QD arc, site as an administrative parking lot per subparagraph V3.E3.1.1.4.6. The holding of HD 1.4S materials, without regard to QD, is permitted at this location.

V4.E5.13. STORAGE TANKS FOR HAZARDOUS MATERIALS

V4.E5.13.1. Unprotected, aboveground bulk storage tanks shall be separated from PESs by IBD per Table V3.E3.T1. A dike system satisfying National Fire Protection Association (NFPA) 30 (Reference (fg)) is required. Aboveground storage tanks that are provided protection against rupture or collapse from blast and fragment hazards may be sited at distances less than Table V3.E3.T1. when supported by testing or analysis.

V4.E5.13.2. For installation of smaller bulk storage tanks, weigh the cost of distance or protective construction against the strategic value of the stored material, the ease of replacement in the event of an accident, and the potential environmental impact. Reduced distances may be approved if:

V4.E5.13.2.1. The losses are accepted by the DoD Component.

V4.E5.13.2.2. The tanks are sited.

V4.E5.13.2.3. Spill containment is provided so other exposures are not endangered.

V4.E5.13.3. Unprotected service tanks solely supporting AE storage or operating complexes that are supplied by a pipe system designed to resist blast and fragments may be sited at IBD based on blast only with a minimum distance of 400 ft [121.9 m] if:

V4.E5.13.3.1. A dike system meeting the requirements of Reference (fg) is provided.

V4.E5.13.3.2. The DoD Component accepts the possible loss of the tanks and any collateral damage that a fire might cause as a result of the tanks being punctured by fragments.

V4.E5.13.4. A service tank supporting a single PES shall be separated from that PES by the applicable NFPA fire protection distance. The distance from this service tank to any other PES shall be the larger of the required distance between the two PESs or the applicable NFPA fire protection distance.

V4.E5.13.5. Buried tanks and buried pipelines should be separated from all PESs containing HD 1.2, HD 1.3, HD 1.4, or HD 1.6 AE by at least 80 ft [24.4 m]. The required separation distance for HD 1.1 or HD 1.5 AE is K3 [1.19] with a minimum of 80 ft [24.4 m]. If the PES is designed to contain the effects of an explosion, then no QD is required.

V4.E5.13.6. Small quantities of petroleum, oils, and lubricants or other hazardous materials used for operational purposes require no specific separation distance for explosives safety; however, operating procedures shall be implemented to limit adverse environmental impacts in the event of an accidental explosion.

V4.E5.13.7. For underground AE facilities, it is not practical to specify QD criteria that cover all tank storage configurations. The DoD Component shall assess each configuration per, Enclosure 5 of Volume 5 of this Manual, to ensure that equivalent protection of paragraphs V4.E5.13.1. through V4.E5.13.6. is provided.

V4.E5.14. STORAGE TANKS FOR WATER

V4.E5.14.1. Unprotected aboveground water storage tanks shall meet the siting requirements of paragraph V4.E5.13.1. if loss of the tank is unacceptable to the DoD Component. Buried tanks and associated components of like value shall meet the siting requirements of paragraph V4.E5.13.5. Aboveground storage tanks that are provided protection against rupture or collapse from blast and fragment hazards may be sited at distances less than Table V3.E3.T1. when supported by testing or analysis. No dike is required.

V4.E5.14.2. QD criteria do not apply to water storage tanks and associated components if loss is acceptable to the DoD Component.

V4.E5.15. UNDERGROUND TANKS OR PIPELINES FOR NON-HAZARDOUS MATERIALS. See paragraph V4.E5.13.5.

V4.E5.16. TEMPORARY CONSTRUCTION OR MAINTENANCE OPERATIONS. Construction and maintenance personnel who are temporarily near a PES to perform their job shall be provided the maximum practicable protection from the effects of an explosion if one occurs at a PES. The DoD Component shall determine the minimum practicable separation distance from PESs for such personnel and shall control operations at the PES to minimize

exposure of these personnel to hazards from an explosion. Documentation of the rationale for the control measures taken shall be maintained until construction or maintenance operations are completed.

V4.E5.17. MILITARY WORKING DOG (MWD) EXPLOSIVES SEARCH TRAINING.

MWD training involves searches to detect explosives that have been hidden in various public places. These training operations typically include handling explosives, cutting or dividing explosive training aids, removing explosives from shipping and storage containers, and repackaging explosives into other containers. For these reasons, training operations shall:

V4.E5.17.1. Be conducted by personnel meeting the DoD Component qualifications.

V4.E5.17.2. Be conducted in facilities that meet the requirements of this Manual.

V4.E5.17.3. Store explosives in facilities that meet the requirements of this Manual.

V4.E5.17.4. Provide non-essential personnel:

V4.E5.17.4.1. $40W^{1/3}$ [$15.87Q^{1/3}$] separation distance from the training site if more than 15 lbs [6.8 kg] NEWQD are being used for the exercise.

V4.E5.17.4.2. 100-ft [30.5 m] separation distance from the training site for NEWQD \leq 15 lbs [6.8 kg].

V4.E5.17.5. Minimize the number of samples and the quantity of explosives for each sample. The DoD Component shall determine the total quantity of explosives permitted during an exercise considering:

V4.E5.17.5.1. The value and importance of the exposed facilities.

V4.E5.17.5.2. The exercise operating conditions.

V4.E5.17.5.3. The available separation distance for nonessential personnel.

V4.E5.17.6. Separate samples a sufficient distance apart to prevent an explosion from propagating from one sample to another.

V4.E5.17.7. Not use any initiating devices or initiating explosives.

V4.E5.17.8. Not place explosives near any heat or spark producing items (e.g., bare electrical wiring, radiators, electric heaters, heating vents).

V4.E5.17.9. Not place explosives in metal containers or other means of confinement that could produce fragments in the event of an accidental explosion.

V4.E5.18. DEMILITARIZATION PROCESSING EQUIPMENT AND OPERATIONS FOR EXPENDED .50-CALIBER AND SMALLER CARTRIDGE CASINGS

V4.E5.18.1. A demilitarization operation for processing expended .50-caliber and smaller cartridge cases can be treated as a non-explosive operation provided:

V4.E5.18.1.1. Cartridge casings to be processed are screened prior to processing. Screening is intended to ensure that only .50-caliber and smaller are processed, and to remove unused .50-caliber and smaller cartridges.

V4.E5.18.1.2. Demilitarization processing equipment is tested to be capable of containing overpressure, fragment, and thermal hazards associated with a worst-case reaction involving a single live round of the most energetic cartridge that could be processed in the equipment.

V4.E5.18.1.3. Demilitarization processing equipment is operated within the manufacturer's specifications and restricted only to the processing of expended .50-caliber and smaller cartridge casings.

V4.E5.18.1.4. Demilitarization processing equipment is inspected and maintained to ensure safe operation.

V4.E5.18.2. The DoD Components shall:

V4.E5.18.2.1. Approve the use of specific demilitarization processing equipment.

V4.E5.18.2.2. Establish and implement procedures for:

V4.E5.18.2.2.1. Screening and segregating the material to be processed.

V4.E5.18.2.2.2. Operating, inspecting, and maintaining the demilitarization processing equipment to ensure safe operation.

V4.E5.18.2.2.3. Dispositioning of processed material.

V4.E5.18.3. Explosives safety siting requirements are as follows:

V4.E5.18.3.1. Demilitarization processing operation locations meeting paragraphs V4.E5.18.1. and V4.E5.18.2., and located outside of IBD from all PESs, do not require submission of a site plan to the DDESB (see paragraph V1.E5.2.9.).

V4.E5.18.3.2. Locations used for demilitarization processing operations that are located within IBD arcs:

V4.E5.18.3.2.1. Require submission of a site plan to the DDESB.

V4.E5.18.3.2.2. Shall be sited at ILD, except from the PES to which it is integral.

V4.E5.19. CONVEYANCE LOADING AND UNLOADING AT A MAGAZINE. A conveyance (e.g., truck, trailer, railcar, ISO, or military van container) loading and unloading operation is permitted at a magazine without regard to QD between the magazine and the operation. “At a magazine” means loading and unloading operations at a loading dock attached to the magazine, or on the pad or apron in front of the magazine, or within the established boundaries of an AGM. Detached ramps or loading docks that normally service multiple facilities will be sited IAW section V4.E5.7.

V4.E5.20. REDUCED QD MAGAZINES. The criteria in this section address the use of DDESB-approved reduced QD magazines (e.g., GOLAN 5, 10, and 15, NABCO SV-23 and SV-50, Explosive Ordnance Disposal (EOD) Magazine, Advanced EOD Magazine, and other similar magazines listed in Table AP1-4. of DDESB Technical Paper 15 (Reference (*gh*))) for AE storage.

V4.E5.20.1. Siting of Reduced QD Magazines

V4.E5.20.1.1. Reduced QD magazines shall be sited as AGMs, using the reduced QD distances established as part of the DDESB approval package for each type of magazine.

V4.E5.20.1.2. A DDESB-approved site plan is required prior to the use of a reduced QD magazine for AE storage. However, when circumstances dictate, use of a magazine may proceed before DDESB approval provided the Service-level explosives safety office (i.e., U.S. Army Technical Center for Explosives Safety; Naval Ordnance Safety & Security Activity; Marine Corps Systems Command, Program Manager, Ammunition; or Air Force Safety Center) has reviewed and approved the submission, the submission is at the DDESB for review and approval, and the DoD Component accepts that the DDESB approval process may impose different or additional requirements.

V4.E5.20.1.3. Siting of reduced QD magazines shall comply with specific provisions for their use (e.g., venting, grounding) identified as part of the DDESB approval package for each type of magazine.

V4.E5.20.1.4. The QD distances approved by the DDESB for reduced QD magazines do not account for the hazards presented to surrounding exposures when the magazine door is open or when authorized AE operations are conducted at the magazine. The following criteria are intended to minimize these hazards:

V4.E5.20.1.4.1. The reduced QD magazine should be located and oriented to maximize protection of surrounding exposures. The selection of a location for the reduced QD magazine shall not be simply for convenience, but shall consider the direction of the door, planned operations, and the need to minimize exposure of personnel and facilities.

V4.E5.20.1.4.2. The reduced QD magazine door should be directed away from occupied spaces and facilities, or at a minimum directed away from the highest exposures.

V4.E5.20.1.4.3. For a reduced QD magazine authorized to contain up to 30 lbs [13.60 kg] NEWQD of HD 1.1, a minimum 50-ft [15.24-m] separation distance should be maintained from the door of the magazine, and from any authorized AE operation at the magazine, to the nearest occupied space or facility. For a reduced QD magazine authorized to contain 30 to 50 lbs [13.60 to 22.68 kg] NEWQD of HD 1.1, a minimum 100-ft [30.50-m] separation distance should be maintained from the door of the magazine, and from any authorized AE operation at the magazine, to the nearest occupied space or facility. At these separation distances, only minor damage to exposed facilities is expected as a result of blast overpressure; however, window breakage will likely occur and may present some risk to personnel in exposed facilities. Fragmentation hazards are not addressed by these separation distances. Barricades (see subparagraph V4.E5.20.2.2.6.) may be used to stop low-angle, high-velocity fragments, which present the greatest threat to surrounding exposures.

V4.E5.20.2. Authorized Operations at Reduced QD Magazines. Significant personnel exposure and risk reductions are obtained by the use of reduced QD magazines for AE storage, even when short-duration explosives operations are conducted at such magazines. Therefore, certain AE operations are authorized at a reduced QD magazine, without regard to QD. AE operations not authorized in subparagraphs V4.E5.20.2.1.1. through V4.E5.20.2.1.9. require siting as an operating location.

V4.E5.20.2.1. The following AE operations may be conducted at reduced QD magazines, without regard to QD, provided the requirements of subparagraph V4.E5.20.2.2. are met (the criteria and guidance in subparagraphs V4.E5.20.2.1.1. through V4.E5.20.2.1.9. and subparagraph V4.E5.20.2.2. modify the criteria and guidance for AE operations identified as part of the DDESB approval package for each type of magazine):

V4.E5.20.2.1.1. The movement of packaged AE into and out of reduced QD magazines.

V4.E5.20.2.1.2. The removal of internal packaged AE items from outer packaging (e.g., removal of individually packaged dog scent kit samples from their larger shipping container).

V4.E5.20.2.1.3. The rotation and replacement of dynamite samples in dog scent kits, as required to meet DoD criteria.

V4.E5.20.2.1.4. The issuance of security or reaction force AE for installation force protection, antiterrorism, or other similar mission.

V4.E5.20.2.1.5. The removal and replacement of EOD materials contained in the large pumice containers in the advanced EOD magazine (because the pumice containers are too large to transport in and out of the magazine).

V4.E5.20.2.1.6. The conduct of surveillance or inventory inspections that only involve a visual serviceability inspection of AE.

V4.E5.20.2.1.7. The placement of munitions and explosives of concern that EOD personnel or unexploded ordnance-qualified personnel have assessed and determined acceptable for movement and storage in an appropriate reduced QD magazine located at a munitions response site.

V4.E5.20.2.1.8. The conduct of other similar AE operations provided:

V4.E5.20.2.1.8.1. No direct energy is applied to the AE being handled (e.g., cutting, dividing, or crushing), except as allowed in subparagraph V4.E5.20.2.1.9.

V4.E5.20.2.1.8.2. The AE being handled have not been sensitized or made more sensitive to initiation (e.g., primed).

V4.E5.20.2.1.8.3. The AE being handled are not in a configuration that makes them more susceptible to an unintentional detonation.

V4.E5.20.2.1.9. The cutting of non-fragmenting AE (e.g., detonation cord, C4) designed to be cut using authorized cutting tools, provided all nonessential personnel are removed to a $40W^{1/3}$ [$15.87Q^{1/3}$] separation distance with a 100-ft [30.5 m] minimum.

V4.E5.20.2.2. The following requirements apply to authorized AE operations at reduced QD magazines:

V4.E5.20.2.2.1. The total NEWQD present (i.e., within the magazine and involved in the operation) shall not exceed the rated NEWQD of the reduced QD magazine.

V4.E5.20.2.2.2. To minimize the size and effects of an unintentional detonation, operations conducted at reduced QD magazines shall be limited to the smallest MCE possible.

V4.E5.20.2.2.3. AE operations should not be conducted inside reduced QD magazines unless necessary (as in the case of the advanced EOD magazine). Conducting AE operations inside a magazine increases the MCE and the directional effects of an internal explosion out the door.

V4.E5.20.2.2.4. AE operations at reduced QD magazines should be conducted at times when the exposure of unrelated personnel is at a minimum (i.e., at night, before or after work shifts, on weekends).

V4.E5.20.2.2.5. To take advantage of the barricade-type protection offered by the reduced QD magazine structure, AE operations outside of reduced QD magazines shall be conducted:

V4.E5.20.2.2.5.1. As close to the base of the magazine as possible, with the magazine door closed and secured (not required if the magazine does not contain AE).

V4.E5.20.2.2.5.2. On the side of the magazine that is oriented away from the surrounding area having the greatest exposure to be protected.

V4.E5.20.2.2.6. Consideration should be given to constructing a barricade (to defeat high-velocity, low-angle fragments) for AE operations at reduced QD magazines. Acceptable barricading materials include sandbags and timber sand-filled walls; the barricade shall not generate additional debris hazards. The barricade must be at least 6 ft [1.83 m] high, provide line-of-sight protection between AE operations and exposures to be protected, and be the equivalent of two side-by-side sandbags.

V4.E5.21. CRITERIA FOR NON-DoD EXPLOSIVES ACTIVITIES (AE OPERATIONS AND STORAGE) ON DoD INSTALLATIONS

V4.E5.21.1. Non-DoD explosives activities shall only be conducted on DoD property per Table V4.E5.T10. These non-DoD explosives activities must also comply with Bureau of Alcohol, Tobacco, Firearms and Explosives, FAA, and other Federal, State, and local regulations. Definitions for the terminology used in Table V4.E5.T10. can be found in Volume 8.

V4.E5.21.2. For these types of non-DoD explosives activities, the Department of Defense shall be responsible for ensuring that IMD requirements only, as outlined in explosives site plan submissions, are met. DoD oversight of these non-DoD explosives activities is not intended.

V4.E5.21.3. Non-DoD, explosives activities shall be evaluated based on IMD between multiple PES to ensure non-propagation. Where IMD is not met, then the NEW at each site not meeting IMD separation requirements shall be added together to determine the basis for the applicable IMD or IBD to use for separation of DoD sites.

V4.E5.21.4. In Table V4.E5.T10., “Check for IMD” means that, if IMD is not maintained between each PES, explosives quantities shall be totaled.

V4.E5.21.5. IBD shall be determined based on the standards in this Manual.

V4.E5.21.6. The DoD site approval for non-DoD explosives activities is limited to the area encumbered by the IBD arcs.

V4.E5.21.7. Review of building design, lightning protection, etc., is not necessary unless design features are used as justification to reduce the IBD arc.

Table V4.E5.T10. Criteria for Non-DoD Explosives Activities on DoD Installations

From → To ↓	Non-DoD Storage	Non-DoD Operations	Shared Launch Facilities	DoD/Joint Storage	DoD Operations
Non-DoD Storage	Check for IMD	Check for IMD	IBD	IMD	IBD
DoD/Joint Storage	IMD	IBD	IBD	IMD	ILD
Non-DoD Operations	Check for IMD	Check for IMD	IBD	IBD	IBD
DoD Operations	IBD	IBD	IBD	ILD	ILD
Shared Launch Facilities	IBD	IBD	ILD	IBD	IBD
DoD Non-Explosives Facilities/Operations Non-Related	IBD	IBD	IBD	IBD	IBD

GLOSSARY

ABBREVIATIONS AND ACRONYMS

AE	ammunition and explosives
AGM	aboveground magazine
DDESB	Department of Defense Explosives Safety Board
DUSD(I&E)	Deputy Under Secretary of Defense for Installations and Environment
ECM	earth-covered magazine
EOD	explosive ordnance disposal
EQN	equation
ES	exposed site
ft	foot or feet
ft ³	cubic feet
FAA	Federal Aviation Administration
HAS	hardened aircraft shelter
HD	hazard division
IAW	in accordance with
IBD	inhabited building distance
ILD	intra-line distance
IMD	intermagazine distance
ISO	International Standardization Organization
kg	kilogram
kPa	kilopascal
lbs	pounds
m	meter
m ³	cubic meter
MCE	maximum credible event
MPS	maritime pre-positioning ship
MWD	military working dog
NEW	net explosive weight
NEWQD	net explosive weight for quantity-distance

NFPA	National Fire Protection Association
PES	potential explosion site
psi	pounds per square inch
PTRD	public traffic route distance
QD	quantity-distance
RO/RO	roll-on/roll-off
TAB VEE	Theatre Air Base Vulnerability
USD(AT&L)	Under Secretary of Defense for Acquisition, Technology, and Logistics