

# USMC Range Safety Pocket Guide

Version 1.7



**This portable guide provides references to MCO 3570.1B and DA PAM 385-63. It is not intended for use as a sole source of information for the MCO 3570.1B and/or DA PAM 385-63. For further information, consult the full versions of MCO 3570.1B and DA PAM 385-63.**

**Surface Danger Zone templates included in this guide are shown at a scale of 1:25,000 and 1:50,000 and are for reference only.**

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## Table of Contents

<b>Summary</b> .....	<b>1</b>
<b>Purpose of this Pocket Guide</b> .....	<b>1</b>
<b>Excerpts from Army Regulation 385-63, MCO 3570.1B, 19 May 2003</b> .....	<b>1</b>
Applicability .....	1
General .....	1
Surface danger zones (SDZs).....	1
Deviation limitations .....	2
<b>Excerpts from Department of the Army Pamphlet (DA PAM) 385-63, 10 April 2003</b> .....	<b>3</b>
Range Safety Responsibilities .....	3
The unit commander .....	3
Officer in Charge (OIC) .....	3
Qualifications.....	3
Duties.....	4
The RSO .....	4
Qualifications.....	4
Duties.....	5
Table 1. OIC/RSO appointment requirements .....	6
Positioning and issuing ammunition and explosives .....	7
Ammunition Malfunction Data Collection Guide (8025) .....	9
Suspension of ammunition and explosives involved in malfunctions.....	10
Unexploded ordnance (UXO) and misfire procedures and reporting .....	10
Disposition of ammunition and explosives involved in malfunctions and accidents.....	10
Police of the training complex .....	10
Small arms firing conditions .....	11
Table 2. Minimum thickness of material for positive protection against caliber ammunition listed .....	12
Overhead small arms fire .....	12
Flanking fire.....	13
Shotgun ranges.....	13
Surface danger zone (batwing) .....	13
Blank ammunition .....	13
Batwing surface danger zones .....	14
Firing conditions for batwing SDZs .....	14
Surface danger zone.....	14
Table 3. SDZs for direct-fire weapons without explosive projectiles .....	14
Table 3a. SDZ for direct-fire weapons with explosive projectiles.....	15
Hand grenades.....	16
High explosive, loaded-type grenades (M67) .....	16
Firing conditions for fragmentation and offensive grenades .....	16
Firing conditions for chemical and incendiary hand grenades .....	17
Surface danger zones .....	18

Grenade launchers and grenade machineguns .....18  
     General firing conditions ..... 18  
     Firing precautions for M79/M203 grenade launchers ..... 18  
     General firing precautions for machinegun, MK19, MOD 3 ..... 19  
     Static firing restrictions for vehicle mounted machinegun, MK19, MOD 3 ..... 19  
     Moving firing restrictions for machinegun, MK19, MOD 3..... 19  
     Surface danger zones ..... 20  
 Table 4. Surface danger zone dimensions for 40mm machinegun, MK 19, MOD 3 .....20  
 Antitank rocket firing conditions .....20  
 Mortar firing conditions.....20  
 Mortar surface danger zones .....21  
 Table 5. Mortar surface danger zone criteria, in meters .....21  
 Table 6. Basic impact area dimensions .....21  
 Fundamentals of laser range safety.....22  
**TECOM Safety Of Use Memorandums (SOUMS).....22**  
**Operational Risk Management Worksheet .....24**  
**Range Live-Fire Safety Brief (sample) .....24**  
**OIC/RSO Sample Checklists .....26**  
     Administrative tasks ..... 26  
     Pre-fire tasks/briefs ..... 27  
     Shooter briefs..... 27  
         Brief 1: Appointments ..... 27  
         Brief 2: Range layout ..... 27  
     System of work..... 27  
     Duties during live fire (sample) ..... 28  
     After-firing duties (sample)..... 28  
**SDZ Templates .....29**

## Summary

This pocket guide provides revised range safety policy for the U.S. Marine Corps. It establishes:

- Surface danger zones as minimum safety standards
- Range safety responsibilities for the unit commander, Officer in Charge (OIC), and Range Safety Officer (RSO) for all ranges, especially for live-fire operations;
- Procedures for ammunition and explosives: positioning and issuing; suspension of ammunition and explosives involved in malfunctions; UXO and misfire procedures and reporting; and disposition of ammunition and explosives involved in malfunctions and accidents;
- Risk-management principles and deviation authorities, and employs the operational risk management process to identify and control range hazards.

The only changes to this Pocket Guide from version 1.5 are the inclusion of additional SOUM's.

For guidance beyond this pocket guide, refer to MCO 3570.1B and Department of the Army Pamphlet (DA PAM) 385-63

## Purpose of this Pocket Guide

The purpose of this pocket guide is to provide the user with a quick ready reference for the field, in order to assist in developing a training plan. It provides standards and procedures for the safe firing of ammunition, demolitions, lasers, guided missiles, and rockets for training. When standards conflict with those of other military services, Federal agencies, or host nations, the standards providing the higher degree of protection apply.

## Excerpts from Army Regulation 385-63, MCO 3570.1B, 19 May 2003

### Applicability

- a. The regulation/order applies to:
  - (1) Marine Corps commands, active and reserve. Local Standing Operating Procedures (SOPs) and range policies will reinforce this order.
  - (2) Any person or organization utilizing an Army or Marine Corps controlled real estate or range.
  - (3) Range training and target practice activities
  - (4) All areas designated for live-fire weapons firing, including laser ranges, recreational ranges, and rod and gun club ranges located on Army or Marine Corps property controlled by the Army or Marine Corps
- b. The regulation/order also applies to personnel training outside the United States. Army or Marine Corps commanders will apply the provisions of this regulation/order and host nation agreements as appropriate.

### General

- a. The commander is responsible for the safe conduct of soldiers/Marines involved in training operations.
- b. All military commands and all Federal, state, local, and/or private organizations using Army and USMC ranges will adhere to the provisions MCO 3570.1B, DA PAM 385-63, and required publications.

**Surface danger zones (SDZs)**

- a. Surface danger zones shall be prepared and updated as appropriate according to DA PAM 385-63 for all munitions and laser systems. Munitions and hazardous laser systems (such as class 3b and 4 lasers) will not be fired or employed on training ranges except within the confines of approved SDZs. Deviations from this policy shall be in accordance with the provisions of Chapter 3, MCO 3570.1B and DA PAM 385-63. For Marine Corps air-to-ground ranges, OPNAV Instruction 3550.1 will be considered.
- b. SDZs published in DA PAM 385-63 represent Army and USMC minimum safety requirements. They are adequate only when employed with properly functioning safety equipment and devices, and when trained and competent personnel follow published firing procedures.
- c. If a round exits an approved SDZ, firing of that munition and weapon will cease locally until the cause of the round-out-of-impact (ROI) has been determined.
- d. SDZs will be updated on the basis of data derived from research and development, testing, and/or actual firing experience. SDZs for new ammunition and weapons and modifications of existing SDZs will be approved and disseminated using the same procedures described in MCO 3570.1B and DA PAM 385-63.

**Deviation limitations**

- a. Deviations are limited to:
  - (1) Reducing SDZ dimensions when terrain, artificial barriers, or other compensating factors make smaller SDZs safe.
  - (2) Modifying prescribed firing procedures to increase training realism (such as accepting increased risk when these risks have been incorporated into an approved SDZ) as appropriate for the proficiency of participating soldiers and Marines.
  - (3) Allowing personnel who are not directly participating in the actual conduct of training within the SDZ.
- b. Deviations shall not be applied to other Federal agency directives/regulations such as airspace or water traffic requirements.
- c. For live-fire training operations conducted under an approved deviation by nonresident units, the host installation commander must approve training at a host Installation.
- d. Deviations may be authorized by the following personnel:
  - (1) MACOM commanders
  - (2) COMMARCORBASESLANT, COMMARCORBASESPAC, COMMARFORRES. and CGs, Marine Corps Installations (MCI). \*
  - (3) The Superintendent of the U.S. Military Academy
  - (4) Director, Army National Guard
- e. Delegation of deviation authority
  - (1) MACOM commanders, COMMARCORBASESLANT, COMMARCORBASESPAC, and CGs, MCI may subdelegate deviation authority to base and station CGs and commanders with the rank of Colonel. This authority shall not be further sub delegated. \*

\* MCO 3570.1B w/ch. 1 (MARADMIN 216-06)

**Excerpts from Department of the Army Pamphlet (DA PAM) 385-63,  
10 April 2003****Range Safety Responsibilities****The unit commander:**

- a. Ensures compliance with MCO 3570.1B and DA PAM 385.63, applicable Technical Manuals (TMs), Field Manuals (FMs), and Fleet Marine Force Manuals (FMFMs) (Marine Corps), installation range guidance, and applicable SOPs for safe training and firing for each weapon system within the command.
- b. Ensures all personnel within the command are briefed on and comply with installation range procedures and safety requirements including required personal protective equipment.
- c. Designates an OIC and RSO for each firing exercise and/or maneuver in accordance with Table 1. (Except as designated below, the RSO may have no additional duties during the firing exercise.)
- d. Ensures personnel performing duties of OIC and RSO are certified in accordance with established installation safety certification program.
- e. Complies with range safety certification guidance in MCO 3570.1B and DA PAM 385.63 for OICs and RSOs to ensure they are:
  - (1) Competent and properly instructed in the performance of their duties.
  - (2) Knowledgeable in the weapon systems for which they are held responsible and in safe ammunition handling and use procedures.
- f. Develops SOPs for laser operations to include provision for immediate medical attention for personnel who incur eye or other overexposure to laser energy and reporting laser overexposure incidents in accordance with TB MED 524, MIL-HDBK 828A, and MCO 5104.1.
- g. Applies risk management and develops controls and procedures for all phases of training events.

**Officer in Charge (OIC):**

- a. **Qualifications:**
  - (1) Commissioned, warrant, or noncommissioned officer (NCO, U.S. Army), staff noncommissioned officer (SNCO, Marine Corps) or civilian (U.S. Army). NCOs serving as OIC will be in the grade as shown in Table 1 at a minimum.
  - (2) OICs will be certified in the weapon systems for which they are responsible. (*Weapon System Knowledgeable: An individual, military or civilian, who has completed a standard program of instruction for a particular weapon system or has completed familiarization training established by the installation commander. Familiarization training may involve live fire training. Proponent school should approve familiarization training.*) For weapon systems equipped or dependent on lasers, the OIC will be knowledgeable of laser hazards and proper employment. The OIC holds responsibility and accountability for the conduct of the activity and the adherence to governing regulations and guidance. He/she must be able to fully influence the conduct of the event. For aviation weapons systems, the OIC must be weapons systems knowledgeable.
  - (3) The OIC must have satisfactorily completed a range safety certification program. Marine Corps battalion/squadron commanders are responsible for establishing and maintaining a certification program for the OICs and RSOs commensurate to the assigned duties and responsibilities.

**b. Duties:**

- (1) Ensures the overall safe conduct of training and proper use of the installation-training complex
- (2) Receives a range safety briefing from installation range control organization on use of the training complex
- (3) Ensures the RSO is physically present at the training site
- (4) Determines when it is safe to fire in accordance with applicable regulations and installation range requirements
- (5) Ensures receipt of final clearance to fire from range control
- (6) Ensures proper supervision of personnel performing misfire, hang-fire, and cook-off procedures
- (7) Ensures required communications are established and maintained
- (8) Ensures safe laser operations
- (9) Ensures adequate medical support is available
- (10) Ensures ammunition and explosives are properly handled, transported, stored, and accounted for within the training complex from the time of receipt to the time of expenditure or turn-in
- (11) Ensures a written log is maintained of pertinent safety and control data concerning the operation of firing ranges, weapons training facilities, and maneuver areas, authorized operating times, impact areas entries and exits, and cease-fire authorizations
- (12) Ensures plans for firing exercises and maneuvers are coordinated with range control
- (13) Ensures control of target areas to prohibit entry by unauthorized personnel
- (14) Ensures all ammunition malfunctions and accidents are reported to range control in accordance with MCO P5102.1 and MCO 8025.1
- (15) Ensures coordination and approval has been gained from the range control agency for all civilian personnel that will be entering the training site
- (16) Briefs the RSO on the duties to be performed in support of the training event. Clearly establishes the requirement for the RSO to brief the OIC on the safety of the facility and unit, and the readiness to commence live-fire operations prior to the start of firing
- (17) Implements operational risk management in all phases of the training events

**The RSO:****a. Qualifications:**

- (1) Commissioned officer, warrant officer, NCO (Army), SNCO (Marine Corps) or civilian. For field artillery applications, the position commander or OIC may assume RSO duties. Grade requirements will be in accordance with Table 1. Personnel assigned as RSO will have no other duties during that period of training, except for aviation weapons systems training where instructor pilots may assume RSO duties. Assistant range safety officers (ARSO) may be appointed as required.
- (2) Weapon system qualified. (*Weapon System Qualified: An individual, military or civilian, who has successfully completed a standard program of instruction for a particular weapon system.*)
- (3) Certification of satisfactory completion of unit or installation range safety certification program.

**b. Duties:**

- (1) Receives range safety briefing from the installation range control organization on use of the ranges and training areas.
- (2) Ensures before granting clearance to fire:
  - (a) Weapons and personnel are properly positioned.
  - (b) Authorized ammunition and explosives to include proper charge, fuze, and fuze settings are used.
  - (c) Firing settings and weapons systems are within prescribed safety limits and verified.
  - (d) SDZ is clear of all unauthorized personnel.
  - (e) Personnel within noise-hazard areas wear proper hearing protection.
  - (f) Personnel within eye-hazard areas wear proper eye protection.
  - (g) Permission is received from range control to commence training and live-fire operations.
  - (h) Marine Corps RSOs (Stinger) will comply with responsibilities listed in local SOPs.
- (3) Prior to commencing live-fire operations, conducts final coordination with the OIC. This coordination will include a summary of checks, inspections, and actions that the RSO has completed, verification that required communications has been established, and that a "hot status" has been received from range control.
- (4) Orders immediate cease-fire or check-fire when any unsafe condition occurs.
- (5) Is physically present at the training site.
- (6) Reports all accidents and ammunition malfunctions to the range OIC.
- (7) Verifies, upon completion of firing or firing order, to the OIC that all weapons and weapon systems are clear and safe before allowing the removal of weapons from the firing area.
- (8) During laser operations, the Laser Range Safety Officer (LRSO):
  - (a) Ensures unit personnel employing lasers receive thorough safety briefings to include explanations of specific laser-related hazards, safety equipment, and detailed range safety procedures, and complies with procedures in Chapter 18, DA PAM 385-63.
  - (b) Knows and observes horizontal and vertical safety limits of the laser range.
  - (c) Follows unit SOPs for laser operations and training exercises.
  - (d) Ensures all personnel engaged in laser operations, to include personnel in target areas, maintain continuous communications.
  - (e) Ceases laser operations immediately if communications or positive control of the laser beam is lost.
  - (f) Allows the LRSO, as required, to serve as the RSO.
- (9) During ADA range firing with crew-served guided missiles and rockets:
  - (a) Receives missile and rocket firing advisory information from the senior RSO and advises the OIC accordingly.
  - (b) Ensures the entire range is clear of unauthorized personnel and equipment prior to firing and maintains clearance throughout the entire firing sequence.

**Table 1. OIC/RSO appointment requirements**

Weapon System	OIC <sup>1</sup>			RSO <sup>1</sup>		
	OFF	WO	NCO	OFF	WO	NCO
Practice hand grenades; sub-caliber training devices; laser devices; firing devices; simulators and trip flares; small arms and machineguns	X	X	E-6	X	X	E-5
Chemical agents and smokes <sup>2</sup>	X	X	E-6	X	X	E-5
Aerial gunnery and air defense weapons; flamethrowers; live grenades, grenade launchers, and grenade machineguns; live mines and demolitions; tank and fighting vehicle cannons; recoilless rifles	X	X	E-7	X	X	E-6
Field Artillery <sup>3</sup>	X	X	E-7	X	X	E-6
Mortars	X	X	E-6	X	X	E-6 <sup>6</sup>
ADA rockets and guided missiles		X			X <sup>4</sup>	
Direct-fire antitank rockets and missiles	X	X	E-7	X	X	E-6
Live-fire exercises using organic weapons, squad through company, battery, troop	X	X	E-7	X	X	E-6
Combined arms live-fire exercises using outside fire support, troop, battery, squad, platoon, company; or battalion and larger <sup>5</sup>	X	X	E-7	X	X	E-6

Notes: (includes changes from SOUM 2-04)

1. Civilians in the grade of GS-07 or above may act as OIC, and GS-05 or above, or equivalent for RSO. Civilian contractors may act as OIC/RSO when approved by the installation commander
2. OIC and RSO must be nuclear, biological, and chemical (NBC) qualified when conducting NBC or smoke training.
3. Use of E-7s as OICs is authorized only when approved by the installation commander. Either the battery executive officer or platoon leader normally performs duties of the RSO.
4. SRSO will be a field grade officer, CW4 or CW5 (Army) or civilian in the grade of GS-12 or above.
5. OIC will be a field grade officer for battalion or larger CALFEX.
6. RSO for Marine Corps can be E-5 for mortar training activities.

**Positioning and issuing ammunition and explosives**

- a. Ammunition and explosives (to include pyrotechnics) will be positioned to minimize the potential for ignition from external sources, explosion, rapid burning, or sympathetic detonation and will be located and stored in accordance with this pamphlet and requirements NAVSEA OP5 and MCO P8020.10A as appropriate.
- b. Training situations require ammunition and explosives at various locations that are temporary or transient by nature. It is not intended that these locations require approval by the Department of Defense Explosives Safety Board (DDESB) if ammunition and explosives are in total support of a training mission. Installation and service controls will be established to ensure quantity-distance standards are applied to the extent possible.
- c. Distribution of ammunition to personnel will occur only in areas designated for that purpose, for example, ammunition breakdown buildings, ready lines, firing lines, attack positions, assembly areas, or defilade positions. Blank and live-fire ammunition will not be stored in or issued from the same building at the same time. Additionally, blank and live ammunition will not be utilized or stored on ranges at the same time.
- d. Fuel and ammunition re-supply operations and points shall be located a minimum of 300 meters apart. General officer installation commanders may authorize deviation from this standard based on quantity-distance (Q-D) criteria. Distances will not be reduced below the public traffic route (PTR) distance for troops in training. Forward arming and refueling point operations and separation distances for fuel, ready ammunition storage areas, and basic load storage areas will be in accordance with the applicable tactical manual. Distance will not be reduced below the PTR distance for training.
- e. The quantity of ammunition unpacked at the breakdown building or firing line will be kept to the minimum number of rounds needed for efficient firing of the exercise. Packaging material, propelling increments, and fuzes will be retained until firing is complete. Units will not burn wooden containers or indiscriminately fire or dispose of ammunition to preclude its return to a storage facility. (Exception: Smoky Sam rockets, a pyrotechnic, are issued by the case with a quantity of 12 rockets and 12 igniter rods. Planning use of these pyrotechnics requires careful consideration of the effects of moisture on unpacked items. All unpacked rockets must be expended and only full, unbroken cases returned to the ammunition supply point.) Broken and/or unserviceable increments (powder bags) will be handled in accordance with installation range and environmental requirements.
- f. Guided missiles, rockets and components, such as fuels, propellants, oxidizers, and explosives in ready storage or at the firing location will be positioned to minimize the possibility of ignition or detonation by motor exhaust or by an accident involving the firing of a missile or rocket. Items will be stored in dry locations, protected from direct rays of the sun, and adequately ventilated. Marine Corps Smoky Sams, Smoky Guns, and pyrotechnics will be stored as outlined in appropriate Marine Corps TMs, or Commander, Naval Air Systems Command (NAVAIR) technical publications.
- g. During pre-fire preparation, guided missiles, rockets, and components will be handled and assembled in a manner consistent with this pamphlet, local range requirements, and appropriate FMs and TMs. Any alteration to guided missiles or rockets and their associated equipment is prohibited except as authorized by official publications or by CG, Army Materiel Command (AMC).
- h. All ammunition, unpacked for firing but not fired, will be repackaged into its original packing configuration prior to return to the ammunition supply point.

- i.* Ammunition that is easily degraded by short-term exposure to moisture, such as propelling charges, pyrotechnic signals, and simulators, will be unpacked only for the minimum amount of time consistent with mission requirements.
- j.* Requests for current status of ammunition not listed in NAVSEA TWO24-AA-ORD-010 will be sent to NAVAMMOLOGCN, Mechanicsburg, PA, DSN 430-2107/Comm (717) 605-2107 (Marine Corps).
- k.* Defective ammunition will be reported in accordance with MCO P8025.1D and Ammunition Malfunction Data Collection Guide (8025) NAVMC on the following page.

**Ammunition Malfunction Data Collection Guide (8025)**

Ammunition that fails to perform as expected can normally be attributed to a malfunction, human error, or a weapon/equipment deficiency. In every instance, it is imperative that certain facts surrounding the matter be immediately noted and appropriately reported so that remedial action can be initiated to preclude recurrence. Attention is invited to the fact that the cognizant design agent will conduct a detailed technical investigation predicated in part on the data provided by the user in the malfunction report. To insure that the report contains the essential data, personnel on the scene must take notes on the elements enumerated below as they relate to the particular situation. MCO 8025.1 contains the specific reporting requirements.

NOTE: The following is not a complete list of the data elements required in the malfunction report but rather is limited to those elements that must be immediately noted at the scene to enhance report accuracy.

1. Note the details of what actually occurred and the actions of appropriate personnel immediately prior to the malfunction (this is essential in determining whether human error caused or contributed to the situation as a result of inattention, carelessness or deviation from standard procedures). Check for residue from the item(s) involved. If present, accumulate and retain.
2. Record time, date and weather conditions.
3. Identify the item(s) involved. FSN/DODIC and lot number of the complete item and lot numbers of the major components, if identifiable. Or, FSN/DODIC and lot number of each individual item used to make up the complete round (e.g., 155mm projectile, fuze, primer, and propellant charge).
4. Condition of the ammunition prior to use. Was item or packaging wet or discolored? Did either appear deteriorated? Was item adversely exposed to the environment? (e.g., prolonged exposure to the direct rays of the sun, exposed to rain, snow, etc.) Any indications of rough handling or unauthorized alteration/tampering?
5. Identify the weapon utilized. Model and serial number. Condition of the weapon prior to and after firing. Number of rounds fired on this date. Elevation, zone in which fired, increments used, range to target, fuze setting. Was the weapon operated properly and did it function normally? Length of recoil. Any evidence of unburned propellant or residue in the tube? Could foreign material have entered the tube prior to firing. Any indication of nonstandard conditions or practices?

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**Suspension of ammunition and explosives involved in malfunctions**

- a. When any round or item of ammunition, explosives, or their components malfunction, the firing unit will notify the range control office. The range control office will report the incident(s) to the installation ammunition officer. Marine Corps units will report defective ammunition in accordance with MCO 8025.1. Appropriate action will be taken as required by. Firing suspensions and restrictions are published in NAVSEA TWO24-AA-ORD-010, and appropriate technical manuals.
- b. For guided missiles, rockets, or components thereof that have malfunctioned and when it is evident that personnel safety or equipment is at risk, the affected lot will be locally suspended immediately. Marine Corps will use procedures set forth in MCO 8025.1.
- c. Any ammunition suspended and listed in NAVSEA TWO24-AA-ORD-010 and supplements will not be fired in training.
- d. Firing of any ammunition listed in NAVSEA TWO24-AA-ORD-010 and supplements as being "restricted" will be conducted only in accordance with the restriction requirements.

**Unexploded ordnance (UXO) and misfire procedures and reporting**

- a. The range OIC will report all UXO (dud) ammunition to the installation range control officer. In the case of grenades or other munitions that may be immediately hazardous to personnel (that is, bursting radius), firing will be halted until qualified EOD personnel clear the dud. In other cases, firing need not be halted. Duds not cleared by EOD personnel before the unit departs the training complex will be reported in writing to the installation range control officer for data compilation and determination of clearance scope.
- b. Misfire procedures in training manuals for the appropriate weapon system will be followed. In the event misfires present an immediate hazard to personnel or a cease-fire is necessary, they will be reported to range control.
- c. When dud and misfire rates equal or exceed the rates given in Enclosure 2 of MCO 8025.1, the affected lot(s) will be reported as a malfunction.

**Disposition of ammunition and explosives involved in malfunctions and accidents**

- a. Materiel involved in malfunctions or accidents and any evidence such as components or fragments of the weapon system, ammunition, missile, or rocket will be carefully preserved in the position and at the location it occupied at the time of the incident. If the material has been involved in a class A or B accident, as defined in MCO P5210.1, it will remain in position until disposition is directed by the investigating authority unless immediate hazard to life or property are present.
- b. Damaged or malfunctioned guided missiles and rockets will be reported per the applicable TM.

**Police of the training complex**

- a. Removal of spent brass, unfired rounds, or components of fired rounds from UXO contaminated impact areas without the consent of the installation RCO is not authorized.
- b. Dumping ammunition or explosives into impact areas or other unauthorized disposal or disposition areas is prohibited.
- c. Unauthorized removal of ammunition, pyrotechnics, explosives, or residue from munitions or from the range or installation training complex is prohibited.
- d. The collection of spent brass is not required when ammunition is expended from mounted or dismounted weapons over extended terrain.

**Small arms firing conditions**

- a. Range safety information and small arms SDZs for direct fire weapons as listed in MCO-3570.1B and DA PAM 386-63 (Chapter 6, cone) are the standard. When designing ranges that involve fire and movement, or where ricochet hazards outside the range complex boundary may endanger non-participating personnel or the general public, SDZs in Appendix B (batwing) of DA PAM 385-63 should be used.
- b. All personnel within the hearing hazard zone will wear approved single hearing protection. The size of the hazard zone varies with the weapon. For mixed-use ranges, it is usually convenient to establish the zone based on the loudest weapon used. For administrative convenience, the size of the hearing protection zones can be increased to encompass areas within convenient access or demarcation points. The Marine Corps requires that all personnel exposed to gunfire or artillery or missile firing, under any circumstances, will wear hearing protective devices. The following list of distances to the hazard contours for common military weapons is conservative:
  - (1) 0.50 caliber: 55m to the side; 12m to the rear
  - (2) 0.45 caliber: 12m to the side; 4.5m to the rear
  - (3) 9mm: 9m to the side; 6m to the rear
  - (4) 7.62mm: 20m to the side; 8m to the rear
  - (5) 5.56mm: 24m to the side; 6m to the rear
- c. Approved eye protection (or eye armor) shall be worn, especially during force-on-force training maneuvers or scenarios. The installation commander may, based on risk management, reduce or eliminate requirement for eye protection, if his/her decision is that reduced vision created by use of eye protection outweighs its value.

**Table 2. Minimum thickness of material for positive protection against caliber ammunition listed**

Nature of Cover	Thickness, in centimeters, by ammunition caliber		
	5.56mm	7.62mm	.50 cal
Concrete (5000 psi)	12.7	17.8	30.5
Broken stone	35.6	50.8	76.2
Dry sand	40.6	61.0	81.3
Wet sand	63.5	91.4	121.9
Wire oak logs	71.12	101.6	142.2
Packed earth	81.3	121.9	152.4
Undisturbed compact earth	88.9	132.1	167.6
Freshly turned earth	96.5	142.2	182.9
Plastic clay	111.8	165.1	254.0

**Overhead small arms fire**

- a. Overhead small arms fire above protected troops is authorized when minimum protection shown in Table 2 is provided. Table 2 shows the thickness of various materials needed to positively protect against individual projectile impacts. The material thickness will provide adequate protection against single round impacts but not automatic fire. The data shown for 5.56mm is for M193 Ball ammunition. The 5.56mm M855 Ball ammunition may have greater penetration.
- b. Overhead fire above unprotected troops with small arms may be conducted when authorized by the installation commander and specifically approved by the installation range control officer.
- c. Weapon systems authorized for overhead fire of unprotected troops are 5.56mm, 7.62mm, and .50 caliber machineguns on ground tripods or vehicle mounts (ring mount excluded) firing from a stationary position. Overhead fire of unprotected troops from Marine Corps high multi-purpose wheeled vehicles (HMMWV) is not authorized.
- d. Only ammunition certified as cleared for overhead fire in TB 9-1300-385/NAVSEA TWO24-AA-ORD-010 will be used. Currently the only small arms ammunition certified for overhead fire is de-linked (DODIC) A151.
- e. Hand-held, shoulder-fired, or flex-mounted weapon systems will not be fired over the heads of troops on infiltration courses.
- f. Rates of fire will not exceed 70 rounds per minute for 5.56mm and 7.62mm machineguns and 40 rounds per minute for .50 caliber machineguns. Tracer ammunition may be used to assist in monitoring projectile paths.
- g. Overhead fire with machineguns in live-fire exercises will be as follows:
  - (1) Firing positions for weapons delivering overhead fire will provide unobstructed field(s) of fire.
  - (2) Applicable ballistic tabular firing tables will be used to determine the minimum angle of elevation for all overhead fire. Projectiles will not be permitted to impact between the firing position and unprotected troops downrange. All impacts shall be at least 30m beyond the personnel most distant from the weapon.
  - (3) Positive stops must be used to prevent crossfire and depression of weapon systems during overhead firing.
  - (4) Weapon systems will be test fired before delivery of overhead fire to verify the effectiveness of positive traverse and depression stops.

- (5) Minimum vertical clearance requirements: A minimum vertical clearance of 2.5m over the heads of unprotected troops or the highest obstruction within the field of fire will be maintained. This minimum vertical clearance is the distance between the lowest shot in the dispersion pattern as determined by test firing and the highest point of ground, log, or other obstacle over which troops must travel or heights of barbed wire strands or posts on the course, whichever is higher.

**Flanking fire**

- a. Ground-mounted or vehicle-mounted small arms may be used to provide low angle flanking fire when a minimum angle of 15° between the limit of fire and exposed troops is maintained.
- b. Positive means will be employed to ensure that the firing unit knows the location of the maneuver units while fire support is being provided.
- c. The route and location of maneuver units and the location of the weapons providing flanking fire support will be described in detail using recognizable natural and/or manmade terrain features or other positive identification features to all involved personnel.
- d. Because of the danger of lateral ricochets, flanking fire should be planned using the SDZ data (batwing) in Appendix B, DA PAM 385-63. However, if this is not feasible, the following minimum conditions apply:
  - (1) Weapons will be mounted on ground-mount tripods or vehicle mounts.
  - (2) Projectiles must not impact any closer to unprotected personnel than 100m.
  - (3) Only non-explosive and non-discarding sabot projectiles may be used.
  - (4) An angle of 15° or more must be maintained between the limit of fire and near flank of the closest individual or maneuvering unit.

**Shotgun ranges**

Training used for shotgun firing will be in accordance with SDZ requirements as found in DA PAM 385.63, Figure 6-1 and Table B-1.

**Surface danger zone (batwing)**

- a. SDZ template numbers 1, 2, 4, and 5 depict the SDZ for small arms, machineguns, and shotguns firing from a single firing position along the line of fire, also known as a gun target line (GTL), to a single target.
- b. When the nature or extent of training requires multiple firing positions, the SDZs in the included templates will be bisected longitudinally and the GTL expanded to accommodate multiple targets. This establishes left and right limits of fire.
- c. When the nature or extent of training requires moving targets, the SDZs in the included templates will be bisected longitudinally and the GTL expanded to accommodate moving targets. This establishes the left and right limits of fire.
- d. Live-fire maneuver areas requiring multiple or composite SDZs must be constructed based on each weapon, ammunition, and target engagement scenario.

**Blank ammunition**

- a. The following precautions will be observed during the use of blank ammunition:
  - (1) The blank firing attachment (BFA) is a necessary component for operational safety. Weapon systems for which approved BFAs are manufactured will not be fired without the proper BFA. The distance at which weapons can be safely fired at unprotected troops without causing injury is somewhat reduced with the BFA. However, 5m safe-separation distance (SSD) will not be reduced. This distance, with a dispersion angle of 10 degrees left and right of the GTL, does not exclude

possible injury to the unprotected eye. Hearing protection (ear plugs) should be worn while firing blank ammunition.

- (2) Utility uniforms offer skin protection and should be worn at all times. Firers should use eye-protection.
- b. A violation of the SSD could result in serious injury. If the SSD is decreased to within .9m, fatal injuries may occur.

**Batwing surface danger zones**

**Firing conditions for batwing SDZs**

Batwing SDZs provide for greater containment of all ricochets. They should be considered when designing ranges involving fire and movement or where ricochet hazards outside the range complex boundary may endanger non-participating personnel or the general public. Where batwing SDZs have already been applied or can be employed without significant impact on range operations, the batwing SDZs should be implemented.

**Surface danger zone**

- a. SDZ template numbers 1, 2, 4, 5 depict the SDZ for small arms, machineguns, shotguns, and other direct-fire weapons without explosive projectiles firing from a single firing position along the GTL to a single target.
- b. SDZ template numbers 6 and 7 depict the SDZ for direct-fire weapons with explosive projectiles firing from a single firing position along the GTL to a single target.
- c. When the nature or extent of training requires multiple firing positions or moving targets, bisect the GTL longitudinally and expand the GTL to accommodate multiple or moving targets. This establishes left and right limits of fire.
- d. Table 3 provides SDZ dimensions with corresponding deflection values (area *W*, angles *P* and *Q*) for engaging various target media, earth, water, steel, or concrete for small arms, machine guns, shotguns, and other direct-fire weapons without explosive projectiles.

**Table 3. SDZs for direct-fire weapons without explosive projectiles**

Caliber	Impact media	Dist. X	Dist. Y	Area W	Vertical hazard	Angle P	Angle Q
		(Meters)				(Degrees)	
12-gauge slug	Earth/Water	1073	710	125	136	21.96	33.34
	Steel/Concrete	1073	830	287	197	56.91	40.17
.22 cal Long Rifle, M24	Earth/Water	1400	1033	155	96	24.00	15.90
	Steel/Concrete	1400	1125	386	245	63.40	30.30
.38 cal M41 Ball	Earth/Water	1806	1110	153	89	22.57	16.07
	Steel/Concrete	1806	1258	389	245	60.95	35.36
9mm M882 Ball	Earth/Water	1800	1077	158	93	23.10	15.80
	Steel/Concrete	1800	1211	399	253	61.10	30.40
.45 cal, M1911 Pistol/SMG	Earth/Water	1690	1016	117	100	21.11	16.69
	Steel/Concrete	1690	1111	290	186	54.74	30.77
5.56mm, M193 Ball	Earth/Water	3100	2004	458	319	35.20	23.10
	Steel/Concrete	3100	1666	323	219	19.00	26.90
5.56mm, M196 Tracer	Earth/Water	3100	2066	362	355	35.10	26.80
	Steel/Concrete	3100	2023	243	243	19.20	22.80

Caliber	Impact media	Dist. X	Dist. Y	Area W	Vertical hazard	Angle P	Angle Q
		(Meters)				(Degrees)	
5.56mm, M855 Ball	Earth/Water	3437	2029	462	325	34.20	22.40
	Steel/Concrete	3437	1810	334	229	18.80	25.20
5.56mm, M856 Tracer	Earth/Water	3089	1607	355	261	32.80	23.20
	Steel/Concrete	3089	1592	277	261	18.60	21.00
5.56mm, M862 Plastic	Earth/Water	250	165	24	16	15.40	20.00
	Steel/Concrete	250	136	5	4	3.30	7.30
7.62mm, M118 Special	Earth/Water	5288	4800	1545	752	43.81	38.73
	Steel/Concrete	5288	5137	990	490	20.17	41.29
7.62mm, M80 Ball	Earth/Water	4100	4073	1461	706	43.54	38.90
	Steel/Concrete	4100	4053	861	447	20.04	75.54
.50 cal, M858 Ball, Plastic	Earth/Water	700	398	20	41	4.28	9.16
	Steel/Concrete	700	415	53	41	11.65	21.14
.50 cal, M860 Tracer, Plastic	Earth/Water	700	398	20	41	4.28	9.16
	Steel/Concrete	700	415	53	41	11.65	21.14
.50 cal M2 AP	Earth/Water	6100	5142	1659	904	40.80	69.60
	Steel/Concrete	6100	4300	718	462	16.30	33.10
.50 cal M2 Ball	Earth/Water	6500	5211	1652	901	38.19	63.35
	Steel/Concrete	6500	4147	714	478	16.03	44.13
20mm, M220 TP-T	Earth	3940	3340	581	317	25.83	22.83
	Water	3940	3040	558	311	26.08	30.96
	Steel	3940	3290	804	513	36.66	47.76
	Concrete	3940	3260	765	447	34.33	34.09
20mm, M55A2 TP	Earth	4500	3780	733	357	25.74	33.20
	Water	4500	3500	737	350	26.16	36.66
	Steel	4500	4053	1025	585	38.14	36.82
	Concrete	4500	3750	969	509	34.12	37.78
30mm, M788 TP-T	Earth	4020	3116	636	311	24.93	40.37
	Water	4020	3252	730	298	25.19	28.65
	Steel	4020	3631	1023	524	36.78	33.18
	Concrete	4020	3600	874	451	30.66	35.59

**Table 3a. SDZ for direct-fire weapons with explosive projectiles**

Caliber	Impact media	Dist. X	Dist. Y	Area W	Vert. Hazard	Area A	Area B	Angle P	Angle Q
		(Meters)						(Degrees)	
20mm, M246 HEI-T-SD	Earth	4230	3537	685	360	156	156	26.73	39.83
	Water	4230	3316	716	354	156	156	25.81	35.87
	Steel	4230	3937	991	590	156	156	38.63	38.58
	Concrete	4230	3758	952	531	156	156	34.99	50.31
20mm, M56a3 HEI	Earth	4250	3940	771	403	156	156	26.89	34.54
	Water	4250	3980	864	396	156	156	27.21	40.82
	Steel	4250	4160	1219	664	156	156	38.36	58.05
	Concrete	4250	4240	1189	577	156	156	34.65	43.79
30mm, M789 HEDP	Earth	4122	3305	654	318	275	275	25.37	39.65
	Water	4122	3263	746	302	275	275	24.71	34.53
	Steel	4122	3947	1058	534	275	275	36.26	39.59
	Concrete	4122	3684	886	460	275	275	31.56	42.14

**Hand grenades****a. High explosive, loaded-type grenades (M67)**

- (1) These contain explosive charges that detonate after a short delay (3 to 5 seconds). Every precaution will be taken to prevent injury from flying fragments. For training purposes, fragmentation and offensive hand grenades will be thrown from a trench or barrier equivalent to a screen of sandbags 0.5m thick. When throwing bays are used for protection, they will be built to a minimum height of 1.5m and wide enough to accommodate one thrower and one ARSO. Bay height may be reduced to less than 1.5m if approved by the installation commander. However, it must provide positive protection against high-velocity, low-angle fragments. (See MIL HDBK 1027/3B for other dimensions and additional information.) Throwing bays will be separated from adjacent bays by a distance of 20m. If this requirement cannot be met, separation between throwing bays may be by physical barriers (that is, earthen berms, concrete walls, or wooden revetments) long and high enough to attenuate high-velocity, low-angle fragments.

**b. Firing conditions for fragmentation and offensive grenades**

- (1) Personnel within the 150m-danger area when casualty-producing hand grenades are thrown will wear approved protective helmets, protective body armor (flak jackets), single hearing protection, and proper eye protection.
- (2) Safety clips on fragmentation and practice grenades will not be removed until immediately before the safety pin is removed. Once the safety pin has been pulled, the grenade will be thrown. No attempt will be made to reinsert the safety pin or tape the safety lever (spoon). The safety lever will not be released for any reason on HE grenades until the grenade exits the throwing hand at the command of the ARSO.
- (3) All personnel must be proficient in the safety precautions for handling and throwing grenades before live grenade training begins. Successful completion of practice grenade training (usually referred to as mock bay) is mandatory prior to live grenade training.
- (4) OIC, RSOs, and live bay ARSOs for live grenade training events must be certified to perform these duties. Certification will include training detailing actions in the event of a dropped grenade, short throw, grenade thrown other than

downrange, SDZ, control of observers, misfire/dud grenade procedures, arming, throwing techniques, and pre-live bay requirements. Marine Corps battalion and squadron commanders are responsible for establishing and maintaining a certification program for their OICs and RSOs commensurate to the assigned duties and responsibilities. Marines Corps battalion and squadron commanders are responsible for certifying OICs and RSOs.

- (5) High explosive grenades that fail to function (dud) will not be approached except by EOD personnel. During training, if a grenade fails to explode, the throwing of live grenades in any bay within the uninterrupted fragmentation radius of the dud grenade will cease. Only EOD personnel will destroy dud grenades. Unauthorized personnel will not approach, move, touch, or handle dud grenades.
  - (6) During demonstrations, fragmentation and blast/concussion type grenades will be thrown from a barricaded position so grenades burst at least 150m from unprotected personnel.
  - (7) When direct viewing of hand grenade detonations is required within the 150m-danger area, composite (laminated) viewing ports will be used.
    - (a) Viewing ports will be constructed to the following criteria or equivalent:
      1. 10mm glass (outside)
      2. 7mm polycarbonate
      3. 6mm glass
      4. 6mm polycarbonate
      5. 6mm glass
      6. 6mm polycarbonate
    - (b) These criteria provide minimum essential one-time protection against worst-case fragmentation detonated within 6m of the viewing port. Additionally, 12.7mm or equivalent exterior polycarbonate protective sheet (scar shield) should be installed in front of the viewing port. The shield absorbs the majority of damage and is more easily replaced than the entire viewing port.
  - (8) Live grenades will not be thrown into standing water, deep snow, or dense vegetation.
  - (9) When training with live grenades in a tire house, trench line, or like environment and a dud grenade is experienced, all activities within the structure or danger area will stop, personnel will remain within a safe area for a minimum of 5 minutes and then evacuate the structure or area until EOD clears the dud.
  - (10) Range cadre and commanders are cautioned that multiple employments of grenades in a training scenario significantly increase the difficulty of determining the actual number of grenades that detonated. Dud grenades may be activated by subsequent training and generate an unplanned detonation.
  - (11) The use of hand grenades during live-fire exercises shall conform to the provisions provided by Chapter 19, DA PAM 385.63.
  - (12) For the DWBS, MK141 Mod O grenade, see TECOM SOUM 2-03
- c. **Firing conditions for chemical and incendiary hand grenades**
- (1) Chemical grenades will not be held in the hand after the safety lever is released. The incendiary hand grenade may be taped or tied in place if the incendiary effect is desired at a specified location. In this case, safety pins will not be pulled from the grenade until the desired time of functioning. Remote safety pin removal is preferred.
  - (2) Burning type grenades (riot control, smoke, and incendiary) are ignited by pulling the safety pin and releasing the safety lever. After the safety pin has been pulled,

the safety lever will not be released until the grenade exits the throwing hand. Once the safety lever is released, there is no way to stop the grenade from functioning. When the burning type grenade is fired in place, the firer will keep his/her face turned away from the grenade. After releasing the safety lever, the firer will quickly move at least 10m away to avoid contact with incendiary particles and fumes emitted during burning.

- (3) Personnel will be instructed on the proper method of holding the M25 bursting type, riot control grenade before commencing training exercises. The arming sleeve will remain depressed until the grenade is thrown. M25 grenades will not be thrown closer than 25m to unprotected personnel.
- (4) Burning type grenades burn oxygen. Standard protective masks filter particles but will not supply oxygen. Therefore, burning grenades will not be used in enclosed or confined spaces (such as occupied tunnels) or in other confined spaces into which personnel will enter until those spaces are ventilated. Specific fuze burning delay times and functioning characteristics are in TM 9-1330-200-12 and TM 43-0001-29. (See paragraph 16-3, DA PAM 385-63 for safety of use data for chemical smoke.)
- (5) Burning type CS grenades will not be fired closer than 10m to other personnel or 50m to spectators upwind.
- (6) M8, Hexachloroethane (HC) smoke grenade restrictions are the same as those for HC smoke pots. These grenades will ignite combustible materials and will cause burns. A separation distance of at least 10m should be maintained from burning grenades. Personnel will wear protective respirators or masks before exposure to any concentration of smoke produced by M8 white smoke grenades. (See Chapter 16, DA PAM 385-63, for detailed information concerning smoke hazards.)
- (7) Burning particles of white phosphorous are frequently projected from the M34 grenade to a distance of 40m from the bursting point. Therefore, M34 grenades should be thrown only on standard live grenade ranges during training as prescribed in FM 3-23.30. White phosphorous particles cause serious, painful, slow-healing burns.
- (8) Direct viewing of thermite grenades will not be conducted due to the high potential of permanent eye damage.

**d. Surface danger zones**

- (1) Surface danger zone requirements for hand grenades are provided in Figure 7-1, DA PAM 385-63.

**Grenade launchers and grenade machineguns**

**a. General firing conditions**

- (1) Personnel will be instructed in the proper use of grenade launchers and grenade machineguns and applicable safety precautions before firing with live ammunition.
- (2) All duds will be reported by the OIC to the range control office. When fired or launched HE grenades cannot be cleared from an impact area, the impact area must be designated as a dedicated, high-hazard impact area. Dedicated high-hazard impact areas will be fenced off and posted with signs to warn and keep out unauthorized personnel.

**b. Firing precautions for M79/M203 grenade launchers**

- (1) Hazardous fragmentation from M433 HEDP grenade ammunition may be experienced to 165m from the point of detonation. Appropriate HE no-fire lines

- will be established. Training practice (TP) ammunition, M781, does not require areas A or B.
- (2) Although 40mm grenade launchers M79 and M203 are designed to prevent accidental chambering of 40mm high-velocity ammunition, OICs and RSOs will ensure only low-velocity grenade cartridges are fired from M79 and M203 grenade launchers.
  - (3) Single hearing protection will be worn within 2m of firing these grenade launchers. A helmet and flak jacket must be used while conducting firing of HE M203 40mm grenades.
  - (4) Snow depth of 10cm or more and standing water will increase the potential of 40mm duds. These conditions must be considered prior to firing.
- c. **General firing precautions for machinegun, MK19, MOD 3**
- (1) Targets will be engaged only at ranges greater than 75m with TP ammunition.
  - (2) Targets will be engaged only at ranges greater than 310m with HE ammunition.
  - (3) Firing through obstructions will be avoided.
  - (4) Personnel within a 310m radius of impact point will wear protective helmet, body armor/flak jacket, and ballistic eye protection at all times.
  - (5) Range firing procedures and physical setup must be adequate to prevent rounds from impacting closer than 310m from the firing vehicle, other vehicles, or personnel.
  - (6) Firing over open hatches is not authorized. Serious injury can result from burns caused by weapon flash or by expended or ejected cartridge cases striking personnel.
  - (7) Approved single hearing protection is required for all personnel within the noise hazard contour of a 20m radius of the weapon system. Eye protection should be worn.
  - (8) Daily exposure limit within the noise hazard contour is 1,000 rounds per day.
- d. **Static firing restrictions for vehicle mounted machinegun, MK19, MOD 3**
- (1) A gunner's quadrant and/or MK64, MOD 7 mount depression stop will be used to keep the minimum elevation above 30 mil when firing.
  - (2) M998T interim squad carrier:
    - (a) Soft tops must be installed over the drivers and passenger compartments for safe operation of the vehicle when firing the MK19.
    - (b) Visual inspection of the adaptive engineering team collar-mounting bolts must be performed prior to, during, and after firing operations. All bolts must be present with nuts firmly tightened prior to firing.
- e. **Moving firing restrictions for machinegun, MK19, MOD 3.**
- (1) To preclude unintentional impacts of HE and HEDP ammunition at ranges less than 310m:
    - (a) Restrict speeds to not greater than 16km per hour when firing from the HMMWV M1025/1026 armament carrier and the M998T interim squad carrier over paved and improved roads that are in good condition, and not greater than 8km per hour over rough roads, trails, and cross country.
    - (b) Restrict speeds to not greater than 16km per hour when firing from the M113 and M106 family of armored carriers, and the M88A1 tracked recovery vehicle over roads, trails, and cross country.

**f. Surface Danger Zone**

- (1) SDZ requirements for M79 and M203 grenade launchers are provided in SDZ Template 6. A minimum separation distance of 6m is required between firing positions. Cartridge M433 requires an area *A* and *B* of 165m. All other M79 and M203 HE cartridges require 130m as illustrated in Figure 7-2, DA PAM 385-63.
- (2) SDZ criteria for the machinegun, MK19, MOD 3 are shown in Table 4 below. Minimum target engagement range for HE cartridges is 310m. Surface danger zone dimensions for 40mm machinegun, MK19, MOD3

**Table 4. Surface danger zone dimensions for 40mm machinegun, MK 19, MOD 3**

Cartridge	Impact Media	Distance X	Distance Y	Area W	Area A	Area B	Angle P	Angle Q
		(Meters)						(Degrees)
M383	Earth	2,095	1,250	167	310	310	23	15
HE	Armor	2,095	1,250	471	310	310	60	28
M385A1	Earth	1,984	1,250	167	N/R	N/R	23	15
TP	Armor	1,984	1,250	471	N/R	N/R	60	28
M430	Earth	2,037	1,250	167	310	310	23	15
HEDP	Armor	2,037	1,250	471	310	310	60	28
M918	Earth	2,095	1,250	167	N/R	N/R	23	15
TP	Armor	2,095	1,250	471	N/R	N/R	60	28

Legend for Table 7-1:  
N/R = Not required

**Antitank rocket firing conditions**

- a. All loading and unloading for separate loading rockets (for example, 35mm, M73, practice rocket and 66mm M74 incendiary rocket) will be on the firing line with the muzzle pointed downrange. Procedures and precautions in appropriate FM's and TM's will be observed in all preparation and firing operations.
- b. Personnel will not stand or have any portion of the body directly in front of or behind a loaded rocket launcher.
- c. Before firing, the SDZ to the rear of the launcher (area *F*) will be cleared of personnel, materiel (including expended cartridge cases), and readily combustible vegetation. Area *F* for antitank rockets is an isosceles triangle with the apex at the breech and the width of the triangle corresponding with a rearward extension of the gun target line.
- d. Prone or foxhole firing of HE AT4 (M136) is not authorized. In training, an individual may fire one round from the sitting position or three rounds from the standing or kneeling positions in a 24-hour period.

**Mortar firing conditions**

- a. Firing mortars over the heads of unprotected troops by Marine Corps units is not authorized. Overhead fire is allowed when soldiers are in tanks with hatches closed 100 meters or more from the line of fire.
- b. Marine Corps personnel participating in mortar firing will wear flak jackets and approved protective helmets.
- c. Propellant increments removed from rounds before firing will be placed in metal or wooden covered containers located outside the firing vehicle or positioned a distance of at least 25m from the firing point when firing dismounted.
- d. Marine Corps will observe restrictions in TM 08655A-10A for light armored vehicle-mortar variants.

- e. The target engagement distance will not be less than the distance required for area *B* of the respective caliber of mortar to be fired from protected positions.
- f. Unused powder increments must be safeguarded and handled in accordance with installation range and environmental regulations.

**Mortar surface danger zones**

- a. Surface danger zone requirements for 60mm, 81mm, 4.2-in, and 120mm mortars are provided in Table 5.
- b. Distance *X* will not be less than the maximum range of the greatest charge to be fired.
- c. Basic dimensions of the impact area will be computed as specified in Table 6.
- d. Firing table probable errors corresponding to the maximum range of charge employed will be used for this computation. These basic dimensions are based on standard conditions. They do not compensate for errors or nonstandard conditions.
- e. To compute the probable errors in range and deflection, multiply the constant (listed in the SDZ diagram) by the data found in the tabular firing tables. These data are drawn in meters from the downrange edge of the target area for PED and PER.
- f. When firing ammunition with explosive warheads at distances equal to or less than the lateral hazard area (area *A*), the angle between the weapon target line/lateral limits and the firing point will increase by the width of area *A*.

**Table 5. Mortar surface danger zone criteria, in meters<sup>1,2,3</sup>**

Caliber	Area A	Area B
60mm	250	300
81mm	400	400
4.2-in	400	500
120mm	600	600

Notes:

- 1. Quadrant elevation limits must be modified to take into account the distance to the minimum and maximum limits of the impact area. After registration, corrections must be applied to the deflection quadrant elevation limits. When firing the 4.2-in mortar, if registration firing is not conducted, metro and velocity error corrections will be applied to these limits, or all targets will continue to be selected in the central portion of the impact area.
- 2. Dimensions of areas *A* and *B* may be reduced by 50% when firing illumination cartridges.
- 3. Cartridges without HE filler (for example, M880, M931) do not require areas *A* and *B*.

**Table 6. Basic impact area dimensions**

Limits	Dimensions
Left	Eight deflection probable errors (PE <sub>D</sub> ) from the left limit of target area
Right	Eight (PE <sub>D</sub> ) from the right limit of target area
Far edge	Eight range probable errors (PE <sub>R</sub> ) from the far edge of target area

**Fundamentals of laser range safety**

The fundamental concept of laser range safety is to prevent direct and collateral injury or damage resulting from laser use. Personnel using or supervising the use of lasers must be thoroughly familiar with all aspects of laser operations and associated dangers. The following guidelines will be used in conjunction with the guidance provided in referenced publications when employing lasers.

- a. MIL-HDBK-828A and MCO 5104.1B are definitive guidance for laser operations, characteristics, and general procedures. MIL-HDBK-828A may be ordered from the following address: Standardization Documents Order Desk, Bldg 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.
- b. Tactical lasers will be treated as direct-fire weapons. Precautions associated with direct-fire weapons shall be applied to all lasers operated on military ranges.
- c. RCOs will establish boundaries for laser range operations and strictly control laser use in training to conform to the provisions of this pamphlet and applicable TMs. Deviations may be approved after applying risk management techniques, minimizing hazards and accepting the residual risk at the appropriate command level. Reduced SDZs for lasers terminated within the range boundary do not require deviation.
- d. MCO 5104.1B outlines general laser radiation safety requirements. A laser safety orientation will be given to all personnel who use or work with laser devices to include an explanation of hazards and safety requirements before they commence laser operations.

**TECOM Safety Of Use Memorandums (SOUMS)**

To address the Marine Corps unique range safety requirements, CG, TECOM will publish TECOM SOUMS. These will be directive in nature and will apply to the total force. SOUMS will remain in effect until changed or rescinded by CG, TECOM (C465).

TECOM SOUM 1-02: 9mm Cartridge Special Effects Small Arms Marking System (SESAMS) (Cancelled See SOUM 2-10)

**TECOM SOUM 2-02:** Use of Steel Reactive Targets (SRT) at Close Ranges with Small Arms

**TECOM SOUM 1-03:** Shoulder-Launched Multi-Purpose Assault with Novell Explosive Warhead (SMAW-NE)

**TECOM SOUM 2-03:** Diversionary Charge MK 141 (DODIC DWBS)

**TECOM SOUM 1-04:** Tube Launched, Optically Tracked, Wire Guided Missile Weapon System

TECOM SOUM 1-05: MK44, 30mm Automatic Cannon (Cancelled)

**TECOM SOUM 2-05:** Dated 30 Jun 2005 Control of Close Air Support (CAS) Aircraft by Joint Terminal Attack Controllers (JTAC) on USMC Ranges

**TECOM SOUM 2-05:** Dated 09 Aug 2005 M72 Lightweight Anti-Armor Weapon System (LAW)

**TECOM SOUM 4-05:** Anti-Personnel Obstacle Breaching System (APOBS) MK7 MOD 2

**TECOM SOUM 1-06:** Joint Service Revised MILES XXI MGLT and SAT LASER Hazards

TECOM SOUM 2-06: MK44, 30mm Automatic Cannon (Cancelled)

**TECOM SOUM 3-06:** AK-47 Assault Rifle

- TECOM SOUM 4-06:** 120MM M1002 Multi-Purpose Anti-Tank Target Practice Tracer (MPAT-TP-T) Cartridge
- TECOM SOUM 1-07: MK44, 30mm Automatic Cannon (Cancelled)
- TECOM SOUM 1-08:** Use of the Reduced SDZ for AH-1W Direct Fire Hellfire (AGM-114) Launches
- TECOM SOUM 2-08:** M72 Light Anti-Armor Weapon (LAW) System
- TECOM SOUM 3-08:** Unmanned Aircraft System (UAS) Training Operations
- TECOM SOUM 4-08:** OMEGA 36/B2 and 60/B2 Simulator Systems
- TECOM SOUM 1-09: MK44, 30mm Automatic Cannon (Cancelled)
- TECOM SOUM 2-09:** M327 120mm Rifled Mortar Expeditionary Fire Support System (EFSS)
- TECOM SOUM 3-09:** Non-Pyrotechnic Improvised Explosive Device (IED) Simulator
- TECOM SOUM 4-09:** Improvised Explosive Device (IED) Training Aids for Classroom Instruction
- TECOM SOUM 5-09: MK44, 30mm Automatic Cannon Testing (Cancelled)
- TECOM SOUM 6-09:** Implementation of the Range Managers Toolkit (RMTK)
- TECOM SOUM 7-09:** MK44 30mm Automatic Cannon
- TECOM SOUM 8-09:** Implementation of the Range Managers Toolkit (RMTK) Probabilistic Surface Danger Zone (PSDZ) Tool
- TECOM SOUM 1-10:** Grenade, 66mm Smoke Screening Infrared (IR), Vehicle Launched MK 1 MOD 0
- TECOM SOUM 2-10:** SESAMS with 9mm and 5.56mm Marking Cartridges
- TECOM SOUM 3-10:** Suspension of Low Angle Firing of Projectile 155mm Smoke, White Phosphorous, M825 (D528), Screening
- TECOM SOUM 1-11:** MK248 MOD 1, MK316 MOD 0, MK318 MOD 0, MK319 MOD 0 Cartridges
- TECOM SOUM 2-11:** Grenade, M76 66mm Smoke IR Screening

For the complete list of TECOM SOUMS, refer to: <https://rtam.tecom.usmc.mil>.

Operational Risk Management Worksheet

Operational Risk Management Matrix Example										
Training Evolution:		Organization:		Prepared By:		Date:				
Operational Phase	Hazard	Causes	Initial RAC	Develop Controls	Residual RAC	How to Implement	How to Supervise			
<b>Hazard Severity</b> <b>I Catastrophic:</b> Death, permanent disability, major property damage <b>II Critical:</b> Permanent partial disability, major system or minor property damage <b>III Marginal:</b> Minor injury, minor system or property damage <b>IV Negligible:</b> First aid, minor system repair <b>Mishap Probability</b> A Frequent B Likely C Occasional D Unlikely <b>Risk Assessment Code (RAC)</b> 1 Critical 2 Serious 3 Moderate 4 Minor 5 Negligible				RAC Assessment Code Matrix				Command Review/Approval		
				Mishap Probability				OIC: _____ XO: _____ CO: _____ RCO: _____		
				H A Z A R D	A	B	C			D
				I	1	1	2			3
				II	1	2	3			4
III	2	3	4	5						
SE V E R I T Y	IV	3	4	5	5					

Range Live-Fire Safety Brief (sample)

- a. This is your range \_\_\_\_\_ safety brief.
- b. The Officer in Charge (OIC) is \_\_\_\_\_.
- c. The Range Safety Officer (RSO) is \_\_\_\_\_.
- d. The four weapons safety rules are:
  - (1) Treat every weapon as if it were loaded.
  - (2) Never point your weapon at anything you do not intend to shoot.
  - (3) Keep your finger straight and off the trigger until you are ready to fire.
  - (4) Keep your weapon on "safe" until you are ready to fire.
- e. The misfire pit is located \_\_\_\_\_ (if required).

## Range Live-Fire Safety Brief (sample) Cont.

- f. Safety is paramount. **Safety will always be priority NUMBER ONE.** No movement on the range will be permitted before informing the RSO. All road guards will be briefed and placed by the RSO only. Anyone departing or entering the range will notify the RSO before doing so.
- g. Everybody is a safety officer. If you observe a situation that you feel is unsafe, call an immediate **cease-fire** (check fire for mortars) or **stop** (for individuals, Javelins, SMAWs, blasting caps). A cease-fire must be given verbally and physically by giving the hand-and-arm signal to cease fire. In the case of a cease-fire, all weapons will go to Condition 4. Do not wait to be told. OIC/RSOs will check the backblast area to ensure it is properly cleared.
- h. During firing, the ROIC will be located \_\_\_\_\_ and the RSO will be located \_\_\_\_\_. The corpsman will be located \_\_\_\_\_.
- i. The dedicated safety vehicle is located \_\_\_\_\_. The safety driver is \_\_\_\_\_. Strip map to hospital. Vehicle keys are located \_\_\_\_\_.
- j. MEDEVAC will be handled by the safety corpsman and the OIC or RSO in conjunction with Range Control. All other personnel will stay clear of the emergency. (Go over routes to hospital or nearest LZ.) Muster at the assembly area for accountability.
- k. Duds (UXO) (are/are not) found on this range. Do not pick up, kick, or hit any ordnance on this range. Notify the RSO immediately of possible dud locations. Dud procedures for this range are as follows: \_\_\_\_\_.
- l. There (will be/will not be) maneuvering on this range. If a Marine is within 15 degrees of your muzzle, **DO NOT FIRE**. Be aware of your position and the Marines around your position. If you are in doubt of the situation, **DO NOT FIRE**.
- m. Overhead fire (is/is not) authorized for this range. The overhead firing procedures for this range are as follows: \_\_\_\_\_.
- n. If you should encounter a stoppage, apply immediate and/or remedial action (which ever is appropriate for the weapon being fired) and complete the drill. Continue with the drill until you hear the command to cease-fire, at which point you will comply unless told to do otherwise by a safety officer. (Go over immediate and/or remedial action for all weapons being fired on the range. If you should hear or feel an audible pop, immediately cease-fire and notify your OIC or RSO. *An audible pop is a strange noise made when a primer detonates but fails to ignite any or all of the propellant. This is sometimes accompanied by excessive smoke escaping from the chamber area. The primer has enough power to kick the projectile out of the case and if a small portion of the propellant ignites, it can lodge the projectile partway down the barrel.*)
- o. The uniform for this range is \_\_\_\_\_. Hearing protection (is/is not) required on this range while conducting live fire.
- p. Observe the downrange area. Your left lateral limit is \_\_\_\_\_, your right lateral limit is \_\_\_\_\_. Your internal lateral limits are the left and right of your targets. Your limit of advance is \_\_\_\_\_. All of your rounds will impact in this SDZ. You will fire on your designated targets only. Muzzles will be pointed in a safe direction at all times.
- q. The only types of ammunition that will be used on this range are \_\_\_\_\_. Note: Brief any notice of ammunition re-classification or ammunition information notice. Information of this type will be in a message.

**Range Live-Fire Safety Brief (sample) Cont.**

- r. The weapons to be used on this range are \_\_\_\_\_. (Go over the condition codes for all weapons to be fired.)
- s. Are there any left-handed shooters (or throwers for hand grenades)?
- t. Does anybody wear glasses or contact lenses that does not have them?
- u. Brief any local range regulations that might apply.
- v. The designated smoking area is \_\_\_\_\_. Smoking is not allowed near ammunition.
- w. Helmets, flak jackets, and hearing protection will be properly worn and used.
- x. Ammunition issue point is located \_\_\_\_\_ and ammunition is properly stored and guarded.
- y. No cross-range firing.
- z. This concludes the range safety brief. Are there any questions?
- aa. Continually check range impact area to ensure it is clear of all personnel and equipment. Be sure to check for low-flying aircraft and helicopters.
- bb. Shakedown of all personnel will take place to ensure 100% accountability of ammunition.  
 Note: Expenditure reports for ammunition will be filled out after the shakedown.
- cc. All ammunition dunnage will be taken \_\_\_\_\_. Ensure it is separated.
- dd. Report all Marines trained, ammunition expended, by type, to Range Control. Officer-in-Charge and Range Safety Officer.

**OIC/RSO Sample Checklists**

**Administrative tasks**

- \_\_\_ Ensure all range flags are up and red lights are set.
- \_\_\_ Ensure gates are secured or manned, if necessary.
- \_\_\_ Read SOP
- \_\_\_ Ensure all targets are set up.
- \_\_\_ Targets in stands.
- \_\_\_ Targets type \_\_\_\_\_.
- \_\_\_ Establish solid/dual communication with range control via radio.
- \_\_\_ Assign person to prepare ammo for issue for all relays.
  - \_\_\_ Rounds per shooter
  - \_\_\_ Relays
  - \_\_\_ Ensure the range is laid out correctly:
    - \_\_\_ Range perimeters are within the SDZ.
    - \_\_\_ Target line is in correct location; spot check.

**OIC/RSO Sample Checklists Cont.**

- Firing lines are in the correct location.
- Ammo issue point is in the correct location.
- First aid kit is in the correct location.

**Pre-fire tasks/briefs**

- Count off and assign relays, if necessary.
- Conduct a complete safety check (**clear extra weapons!**).
- Prepare weapons for firing.
- Brief the ammo SNCO/NCO: \_\_\_\_\_ will be the ammo NCO. Ammo NCO will break ammo down into \_\_\_\_\_ piles of \_\_\_\_\_ rounds each with one set of earplugs per pile. Ammo NCO will also be responsible for the first aid kit.
- OIC/RSO will read all local range regulations before firing.
- Brief the course of fire.
- Brief the conduct of fire.
- Brief the medical emergency plan.
- Brief the range-specific environmental policies and issues.
- Read the local safety brief.

**Shooter briefs**

**Brief 1: Appointments**

- The OIC is \_\_\_\_\_.
- The RSO is \_\_\_\_\_.
- The safety supervisors are \_\_\_\_\_.
- The Ammo SNCO/NCO is \_\_\_\_\_.
- The corpsman is located \_\_\_\_\_.
- The safety vehicle and driver are located \_\_\_\_\_.

**Brief 2: Range layout**

Note: Read all local range regulations before firing.

- Brief the left and right limits of range.
- Brief the location of the ammo issue point.
- Brief the location of the first aid kit.

**OIC/RSO Sample Checklists Cont.****System of work**

- Brief the scoring system.
- Brief the ammo issue.
- Brief road guard positions. Note: Road guards should be positioned in pairs.

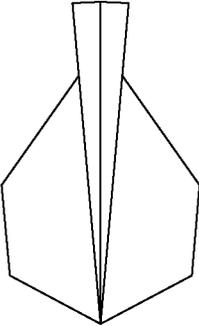
**Duties during live fire (sample)**

- Ensure that shooters are wearing ear protection.
- Brief the details of each drill. Explain each drill before it is fired.
- Follow the course of fire. Do not deviate.
- Conduct the shoot safely. **As always, safety is paramount.**
- Check for errors and corrections. Ensure that SNCOs/NCOs conduct proper checks and use correct coaching techniques.
- Conduct radio checks.

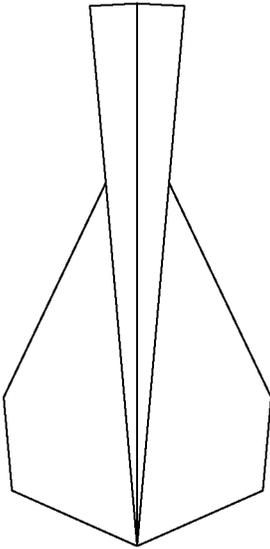
**After-firing duties (sample)**

- Police call
- Conduct a complete safety check.
- Unload, show-clear. Do not forget about extra weapons.
- Ensure details are appointed to take down targets, police call, etc.
- Return range property.
- Take down range flags. Regroup at a convenient location.

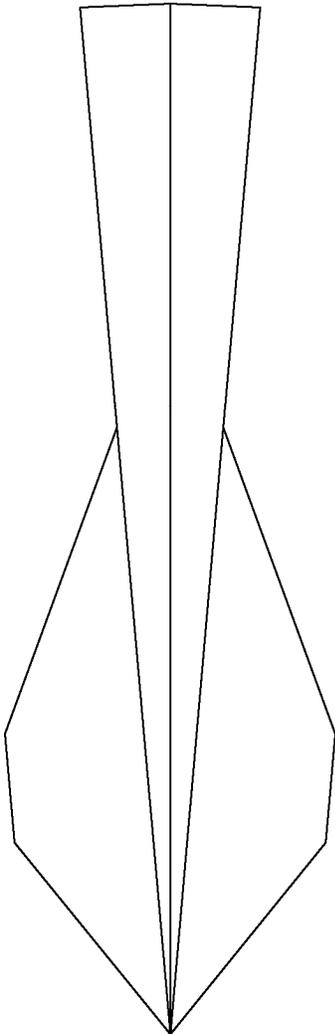
**SDZ Templates**



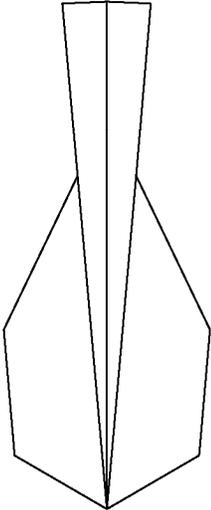
**12 Gauge Slug**  
Scale: 1:25,000  
Distance X: 1,073m  
Impact Media: worst case  
Vertical Hazard: 197m



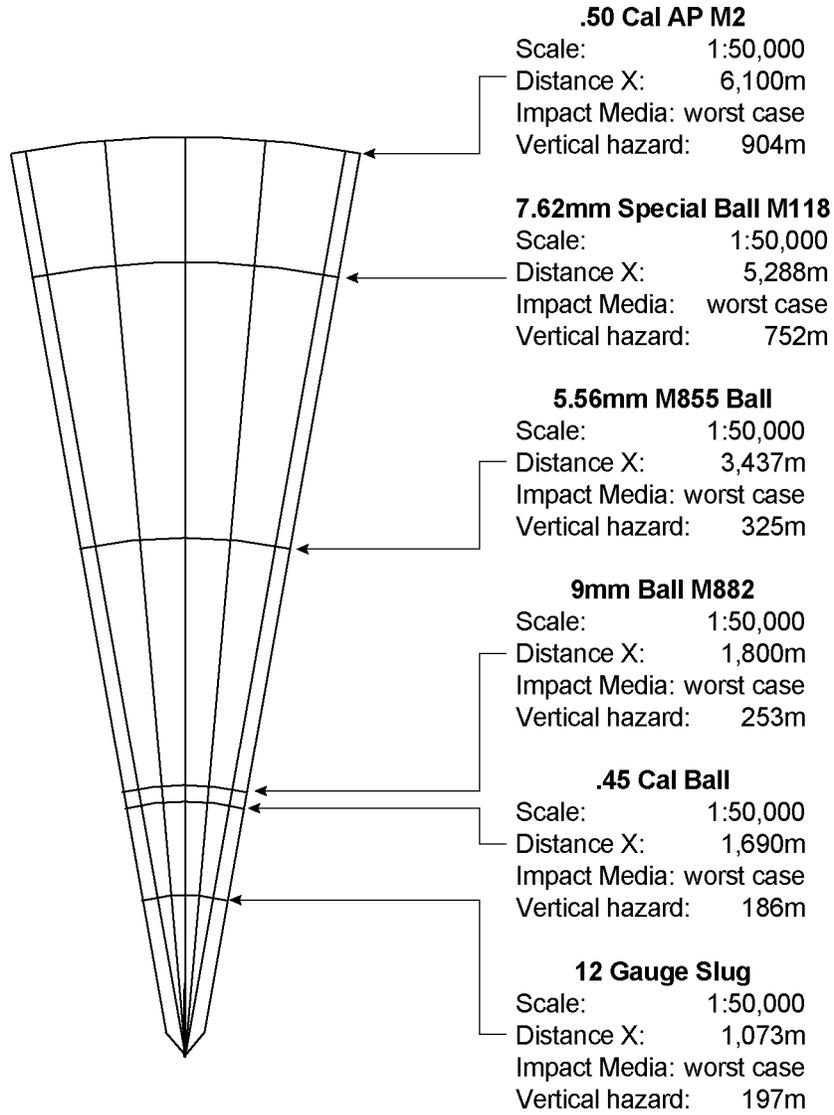
**M9 9mm M882**  
Scale: 1:25,000  
Distance X: 1,800m  
Impact Media: worst case  
Vertical Hazard: 253m

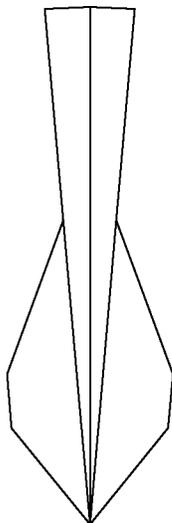


**5.56mm M855 Ball**  
Scale: 1:25,000  
Distance X: 3,437m  
Impact Media: worst case  
Vertical Hazard: 325m



**.45 Cal Ball**  
Scale: 1:25,000  
Distance X: 1,690m  
Impact Media: worst case  
Vertical Hazard: 186m





**5.56mm Ball M855**  
Scale: 1:50,000  
Distance X: 3,437m  
Impact Media: worst case  
Vertical Hazard: 325m



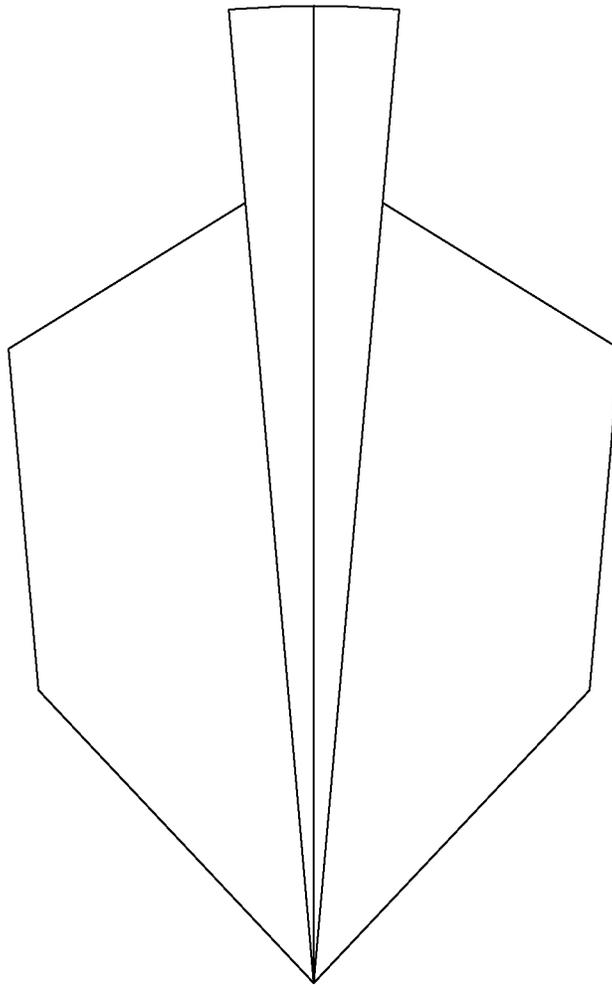
**M9 9mm M882**  
Scale: 1:50,000  
Distance X: 1,800m  
Impact Media: worst case  
Vertical Hazard: 253m



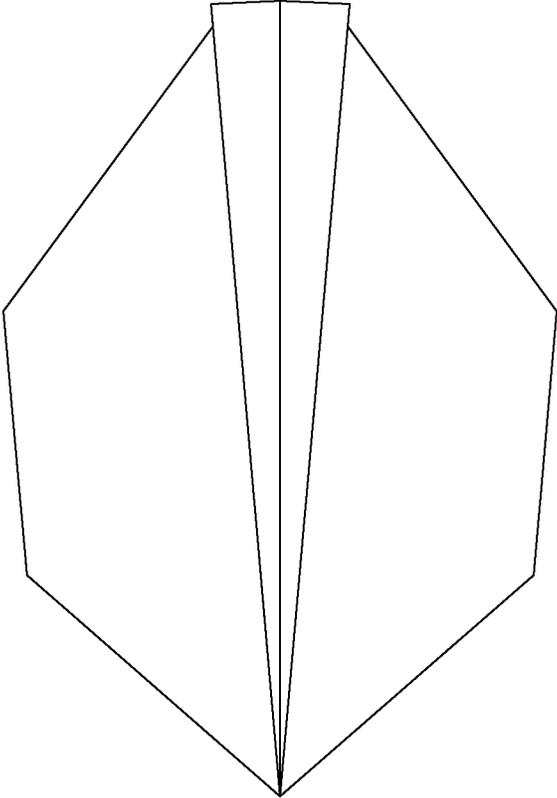
**12 Gauge Slug**  
Scale: 1:50,000  
Distance X: 1,073m  
Impact Media: worst case  
Vertical Hazard: 197m



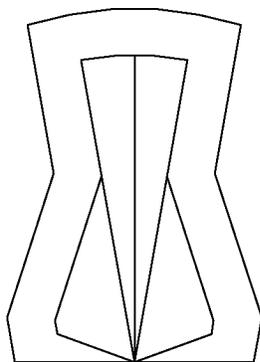
**.45 Cal Ball**  
Scale: 1:50,000  
Distance X: 1,690m  
Impact Media: worst case  
Vertical Hazard: 186m



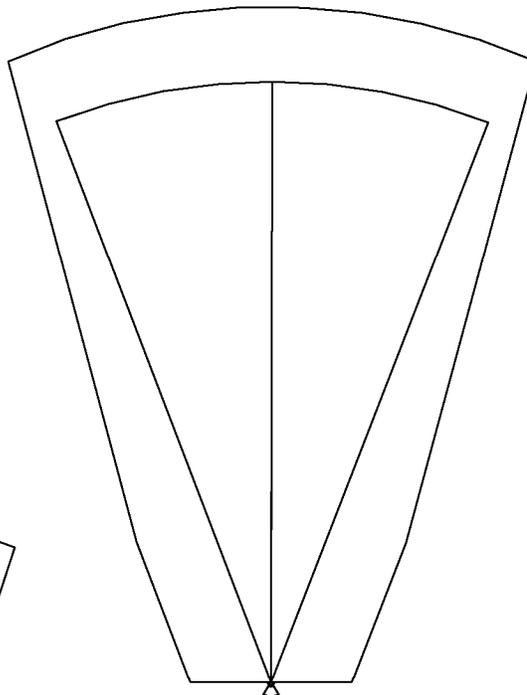
**.50 Cal M2 Ball**  
Scale: 1:50,000  
Distance X: 6,500m  
Impact Media: worst case  
Vertical Hazard: 904m



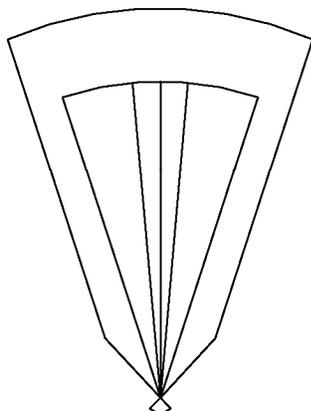
**7.62mm Special Ball M118**  
Scale: 1:50,000  
Distance X: 5,288m  
Impact Media: worst case  
Vertical Hazard: 752m



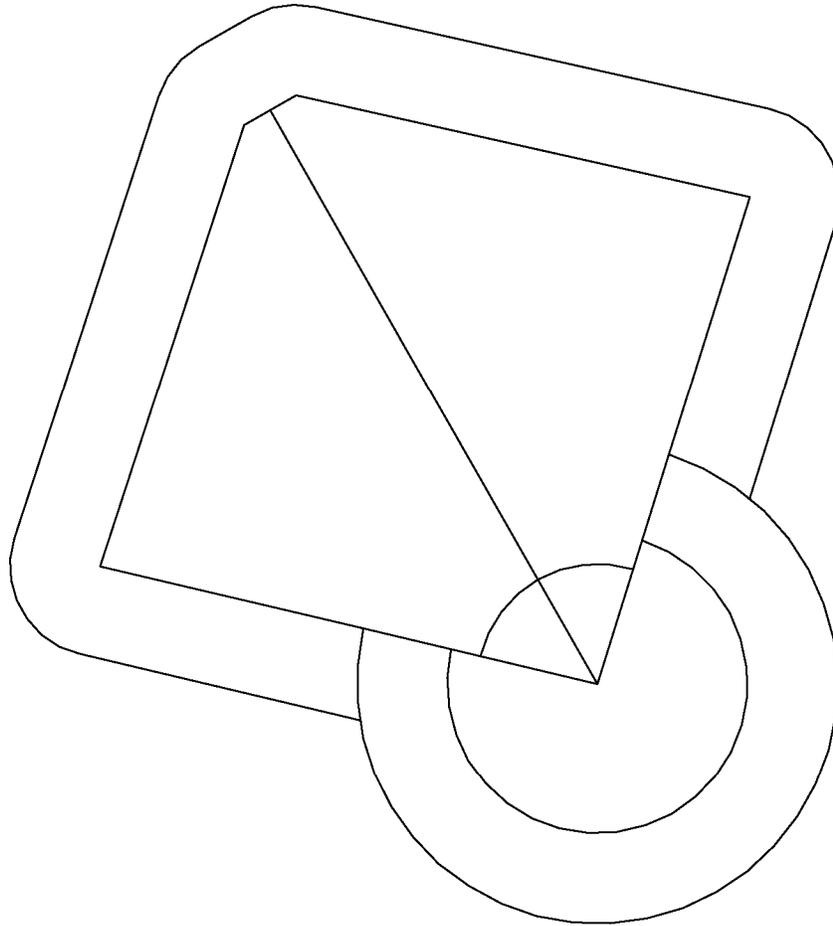
**40mm MK19 Mod 3  
M430 HEDP**  
Scale: 1:50,000  
Distance X: 2,037m  
Impact Media: worst case



**Javelin HE Warhead**  
Scale: 1:50,000  
Distance X: 4,000m  
Impact Media: worst case  
5° launcher angle



**AT4 84mm HEAT**  
Scale: 1:50,000  
Distance X: 2,100m  
Impact Media: worst case  
5° rocket angle



**TOW 2BH HE Warhead**  
Scale: 1:50,000  
Distance X: 4,400m  
Impact Media: worst case  
5° Launcher Angle