

USMC Range Safety Pocket Guide

Version 2.4



This portable guide provides references to MCO 3570.1C and DA PAM 385-63. It is not intended for use as a sole source of information for the MCO 3570.1C and/or DA PAM 385-63. For further information, consult the full versions of MCO 3570.1C 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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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), Range Safety Officer (RSO), Assistance Range Safety Officer (ARSO) and 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 risk management process to identify and control range hazards.

The Pocket Guide has been updated to include changes in Table 1-1, Note 5, Table 5-2, Note 1, and addition of current and applicable SOUMS.

For guidance beyond this pocket guide, refer to MCO 3570.1_.

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, explosives, 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 should apply.

Excerpts from MCO 3570.1C, 30 January 2012

Applicability

This regulation/order applies to the active Army, the Army National Guard/Army National Guard of the United States and the U.S. Army Reserve, unless otherwise stated. It also applies to the following: the United States Military Academy; Departments of the Army and the Navy civilian employees and contractors; Reserve Officers' Training Corps students training on Army or Marine Corps controlled ranges; the Marine Corps Total Force; any person or organization using Army or Marine Corps controlled real estate or operational ranges; operational range training and target practice activities; military real estate areas that are being or have been used as bombing ranges; artillery impact areas or target areas; all areas designated for live fire weapons firing; recreational ranges and rod and gun club ranges located on Army or Marine Corps real property controlled by the Army or the Marine Corps; personnel training outside the continental United States; and operational training conducted on test and evaluation ranges (it does not apply to testing and evaluation conducted on such ranges). This regulation/order is advisory for deployed units engaged in combat operations. Army or Marine Corps commanders will apply the provisions of this regulation/order and/or host nation agreements as appropriate. Local standard operating procedures and range policies will reinforce this regulation/ order. Contracts for work on Army/Marine Corps ranges will comply with applicable provisions of this regulation/order. During contingency operations, chapters and policies contained in this regulation/order may be modified by the Director Army Staff/Commandant of the Marine Corps.

General

- a. Base/Station Commander is responsible for the safe conduct of Marines involved in training operations.
- b. Marine Corps indoor firing ranges will be designed by Naval Facilities Engineering Command, inspected in accordance with Bureau of Medicine instructions, and certified per MCO 3550.9_.
- c. Marine Corps laser ranges will be certified in accordance with MCO 3550. 9_ and MCO 3570. 1C.

Other military services and/or agencies

Military Services other than the Army and the Marine Corps, as well as local, State, and Federal agencies may use Marine Corps-controlled ranges at the discretion of the installation commander/senior commanders. Agencies wishing to use Marine Corps-controlled ranges must comply with the provisions of this regulation/order. Requests for range use shall include all technical data regarding munitions and weapons systems in order that the Risk Management process can be applied, and a determination made regarding the adequacy of the range for the proposed operation.

Danger zones

- a. Danger zones will be created for all weapons used on operational ranges.
- b. The goal of danger zones is to contain munitions and hazardous fragments with a probability of escapement from the danger zone not to exceed 1:1,000,000.
- c. Danger zones shall be prepared and updated as appropriate according to MCO 3570.1C for all munitions and laser systems. Hazardous laser systems (such as, class 3B and 4 lasers) will not be fired or employed on operational ranges except within the confines of approved laser SDZs. Deviations from this policy shall be in accordance with the provisions of chapter 3 of the MCO 3570.1C.
- d. Danger zones published in MCO 3570.1C represent Army and Marine Corps minimum safety requirements. Revised danger zones and danger zones for new munitions/weapons will be approved and disseminated in accordance with the provisions in paragraph 1-4 of MCO 3570.1C. They are adequate only when employed with properly functioning safety equipment and devices, and when trained and competent personnel follow published firing procedures. Only those personnel authorized by MCO 3570.1C will be allowed within the danger zone.
- e. If a round exits an approved danger zone, firing of that munitions and weapon will cease locally until the cause of the round-out-of-impact (ROI) has been determined.
 - (1) If firing occurred with an approved range safety deviation and if the investigation determines all controls required by the deviation were in place, the deviation will be rescinded immediately.
 - (2) If firing occurred without any deviations from this order; if the investigation determines all required controls are in place and there was no ammunition malfunction, Marine Corps organizations will report incidents to CMC Safety Division (SD) through the installation RCO and safety office, with an information copy provided to CG, Training and Education Command (TECOM) (C465).
- f. Baffled firing ranges - those providing containment of projectiles, fragments, and ricochets designed and maintained in accordance with host nation design requirements or approved Corps of Engineers designs do not require application of danger zone restrictions

outside of the baffled area. Marine Corps organizations will use guidance from MCO 3550.9 and CG, MCCDC (C465) for approving authorities for this type of range.

g. The creation of new or the expansion of existing impact areas that contain UXO must be approved by CG, MCCDC (C465), in conjunction with Deputy Commandant I&L and other Headquarters, Marine Corps (HQMC) agencies. Existing dedicated areas will be used to the maximum extent feasible when firing dud-producing munitions.

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 the risks have been incorporated into an approved SDZ) as appropriate for the proficiency of participants

(3) Allowing personnel not authorized by MCO 3570.1C, chapter 3, within the SDZ, unless prohibited.

b. Guidelines for preparing a range safety deviation are contained in MCO 3570.1C.

c. Deviations shall not be applied to other Federal agency directives/regulations such as airspace or water traffic requirements.

d. Approved deviations will be effective for 1 year or less.

(1) Expired deviations may be renewed by the respective approval authority provided conditions cited in the original deviation have not changed.

(2) The need to incorporate conditions, requirements, controls, and so forth in approved deviations into range development plans will be addressed at each installation range development plan meeting as required by MCO 3550.9, and MCO P3550.10.

e. Any accident or incident occurring under an approved deviation will cause automatic termination of the approval until an investigation is completed and the deviation revalidated by the respective approving authority.

f. Conflicts regarding level of risk determination will be resolved by the commander holding the deviation authority for the highest level of risk deemed in conflict.

g. For live-fire training operations conducted under an approved deviation by nonresident units, the base/station commander/senior commander must approve training at a host installation.

h. Delegation of deviation authority

(1) Commander, MCICOM and regional commanders of Marine Corps installations with RTA complexes may sub delegate deviation authority to base and station commanders with the rank of colonel (O-6).

(2) This authority shall not be further sub-delegated.

Range Safety Responsibilities

The Unit Commander:

a. Ensures compliance with this order, MCO 3570.1C, applicable technical manuals (TMs), field manuals (FMs), doctrinal publications (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 1-1 of MCO 3570.1C. Except as designated in paragraph 1-9h (1) (a) MCO 3570.1C, 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 range safety certification program.
- e. Complies with range safety certification program requirements in MCO 3570.1C for OICs and RSOs to ensure they are:
 - (1) Competent and properly instructed in the performance of their duties.
 - (2) Knowledgeable or qualified in the weapon systems for which they are held responsible and in safe ammunition handling and use procedures.
 - (3) 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 828B, and MCO 3570.1C.
 - (4) Applies risk management and develops controls and procedures for all phases of training events.

Officer in Charge (OIC):

a. Qualifications.

- (1) Commissioned officer, warrant officer, SNCO/NCO, or civilian equivalent. NCOs serving as OIC will be in the grade as shown in table 1-1 of MCO 3570.1C at a minimum.
- (2) OICs will be knowledgeable in the weapon systems for which they are responsible. 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.
- (3) Proof of satisfactory completion of installation range safety certification program.

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 RTA complex.
- (3) Ensure the using unit is on the correct range, firing point, or firing area as assigned by the range control office, and has the weapons and munitions approved for use on the range.
- (4) Ensures the RSO is physically present at the training site.
- (5) Determines when it is safe to fire in accordance with applicable regulations and installation range requirements.
- (6) Ensures receipt of final clearance to fire from range control.
- (7) Ensures proper supervision of personnel performing misfire, hang-fire, and cook-off procedures.
- (8) Ensures required communications are established and maintained.
- (9) Ensures safe laser operations.
- (10) Ensures adequate medical support is available.
- (11) 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.
- (12) 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.

- (13) Ensures plans for firing exercises and maneuvers are coordinated with range control.
- (14) Ensures control of target areas to prohibit entry by unauthorized personnel.
- (15) Ensures all ammunition malfunctions and accidents are reported to range control in accordance with MCO P5102.1 and MCO 8025.1
- (16) Ensures coordination and approval has been gained from the range control agency for all civilian personnel who will be entering the training site.
- (17) 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.
- (18) Implements risk management in all phases of the training events.

The Range Safety Officer (RSO):

a. Qualifications.

- (1) Commissioned officer, warrant officer, SNCO/NCO, or civilian equivalent.
Civilian contractors may act as RSOs when approved by the installation commander/senior commander. For field artillery applications, the position commander or OIC may assume RSO duties. Grade requirements will be in accordance with table 1-1 of MCO 3570.1C. Personnel assigned as RSO will have no other duties during that period of training, except for aviation weapons systems training where instructor pilots, standardization instructors, or flight instructors may assume RSO duties. Assistant range safety officers (ARSO) may be appointed as required.
- (2) Weapon system qualified. For combined arms live-fire exercises (CALFEXs) (Army) or combined arms exercises (CAXs) (Marine Corps), an exercise RSO will be assigned who may not be weapon system qualified on all weapons used during the training exercise. The exercise RSO will supervise and coordinate the activities of weapon system RSOs who are qualified on those systems. The exercise RSO grade requirements are in accordance with table 1-1 of MCO 3570.1C.
- (3) Proof of satisfactory completion of installation range safety certification program.

b. Duties.

- (1) Receives range safety briefing from the installation range control organization on use of the RTAs.
- (2) Ensures before granting clearance to fire:
 - (a) The unit is on the correct range, firing point, or firing area as assigned by the range control office.
 - (b) Weapons and personnel are properly positioned.
 - (c) Authorized ammunition and explosives to include proper charge, fuze, and fuze settings are used.
 - (d) Firing settings and weapons systems are within prescribed safety limits and verified.
 - (e) Danger zone is clear of all unauthorized personnel.
 - (f) Proper hearing protection is worn by personnel within noise hazard areas.
 - (g) Proper eye protection is worn by personnel within eye hazard areas.
 - (h) Permission is received from range control to commence training and live-fire operations.
 - (i) Compliance 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 have 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 weapons systems are clear and safe before allowing the removal of weapons from the firing area.
- (8) During laser operations:
 - (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 MCO 3570.1C.
 - (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 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.

c. Assistant Range Safety Officer (ARSO):

Assistant RSOs (ARSO) may be appointed and supervised by the RSO as required. The ARSO should be weapons system qualified and thoroughly familiar with the weapons systems they are directed to supervise. ARSOs will be in position to directly influence the portion of the training activity to which they are responsible in order to enforce proper weapons handling and employment procedures. The RSO will brief the ARSO on roles and responsibilities to ensure that they are understood.

Table 1-1. OIC/RSO appointment requirements

Weapon System	OIC ¹			RSO ¹		
	OFF	WO	NCO	OFF	WO	NCO
Practice hand grenades; sub-caliber training devices; laser devices; firing devices; simulators & trip flares; small arms and machine guns	X	X	E-6	X	X	E-5
Chemical agents and smokes ²	X	X	E-6	X	X	E-5
Aerial gunnery & air defense weapons; flamethrowers; live grenades, grenade launchers, and grenade machineguns; live mines & demolitions; tank & fighting vehicle cannons	X	X	E-7	X	X	E-6
Field Artillery ³	X	X	E-7	X	X	E-6
Mortars	X	X	E-6	X	X	E-6 ⁴
Air defense artillery rockets and guided missiles.		X			X ⁵	
Direct fire antitank rockets and missiles	X	X	E-7	X	X	E-6
Live-fire exercises using organic weapons, squad through company, battery, and troop.	X	X	E-7	X	X	E-6
CALFEX/CAX using outside fire support, troop, battery, squad, platoon, company; or battalion and larger ⁶	X	X	E-7	X	X	E-6
<p>Notes:</p> <p>¹ Civilians in the grade of GS-07 and above, or equivalent, may act as OIC; GS-05 and above, or equivalent, may act as RSO</p> <p>² For the Marine Corps, OIC and RSO must be E-4 and above and be chemical, biological, radiological, and nuclear (CBRN) MOS 5702/5711 when conducting CBRN or smoke training. For the Army, OIC and RSO must be CBRN qualified when conducting CBRN or smoke training.</p> <p>³ Use of E-7s as OICs is authorized only when approved by the senior commander (Army)/installation commander (Marine Corps). Duties of the RSO are normally performed by either the battery executive officer or the platoon leader.</p> <p>⁴ RSO for Marine Corps can be an E-5 for mortar training activities.</p> <p>⁵ Senior Range Safety Officer (SRSO) will be a CWO4 or higher or civilian in the grade of GS-12 or above.</p> <p>⁶ For battalion or larger CALFEX/CAX, OIC will be a field grade officer; exercise RSO will be E-7 or above</p>						

Positioning and issuing of ammunition and explosives

- a. Positioning and issuing of ammunition and explosives, to include quantity-distance determinations, will be in accordance with NAVSEA OP5 Volume 1. The RMTK may be used to plan for positioning and issuing of ammunition and explosives on operational ranges.
- b. Operational ranges require ammunition and explosives at various locations that are temporary or transient by nature. These locations do not require approval by the DDESB if ammunition and explosives are in total support of a training mission. However, permanent structures on ranges used for the handling and storage of ammunition and explosives must be sited and approved by the DDESB.
- c. Distribution of ammunition to personnel will occur only in areas designated for that purpose, for example, 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 location at the same time.
- d. Fuel storage areas will be located at separation distances from ammunition storage areas based on the amount of fuel.
 - (1) Fuel quantities up to 500 gallons will be separated from each potential explosion site by at least 50 ft.
 - (2) Fuel quantities between 500 to 5,000 gallons will be separated from each potential explosion site by at least 100 ft.
 - (3) For fuel quantities greater than 5,000 gallons, refer to NAVSEA OP5.
- e. All ammunition, unpacked for firing but not fired, will be repackaged into its original packing configuration prior to return to the ASP. 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.
- f. Requests for current status of ammunition not listed in Naval Supply Systems Command (NAVSUP) P801 will be sent to Navy Operational Logistics Support Center (NOLSC) Mechanicsburg, PA, DSN 430–2107/Comm. (717)605–2107 (Marine Corps).
- g. Defective ammunition will be reported in accordance with MCO 8025.1_ (Marine Corps).

AMMUNITION MALFUNCTION REPORTING INSTRUCTIONS **(Report Control Symbol DD-8025-02)**

1. All ammunition malfunctions are to be reported.
2. Malfunctions of all types are monitored by the Marine Corps System Command (MARCORSYSCOM), Program Manager for Ammunition (AM) to provide a basis for appropriate action to determine cause of the failure. It is imperative that malfunction reports contain accurate information regarding the specific ammunition lot number(s) and all components involved. A complete description of the circumstances surrounding the malfunction shall be provided to MARCORSYSCOM, (AM).
3. Malfunctions shall be reported as indicated in the two categories below:
 - a. Malfunctions involving injuries/fatalities or resulting in a local suspension will be telephonically reported IMMEDIATELY to MARCORSYSCOM, (AM) DSN 378-8773 or commercial (703) 432-8773 during working hours, 703-501-3117 after working hours. This is essential to ensure that other Marines training with like ammunition worldwide are protected from possible further injuries. Additionally, the written malfunction report must be submitted within 24 hours of the incident. This initial telephonic report does not negate the requirement for submission of a written message report.
 - b. All other malfunctions (i.e. duds, misfires) shall be reported within 96 hours of the malfunction.
4. The report will provide information on the elements contained in paragraphs 4(a) (I) through 4(a) (7), as they relate to the particular malfunction being reported. In case of multiple malfunctions, separate reports shall be submitted for each malfunctioning ammunition lot number. It is recognized that not all of the elements indicated will be applicable to every malfunction.

NOTE: Submission of the malfunction report shall not be delayed due to non-availability of all pertinent information. A supplemental message report may be submitted (annotated "Supplemental" on report subject line) in those instances when all of the data is not available for inclusion in the initial report or at any time when additional facts or details are uncovered after the initial report has been submitted. At a minimum, the initial report must contain information identifying the Ammunition Department of Defense Identification Code (DODIC), National Stock Number (NSN), Lot Number, and preliminary details of malfunction. It is recognized that, in the case of certain malfunctions, it would be virtually impossible to gather all of the pertinent details and report within the four-day period established for submission of the malfunction report. In these cases, a supplemental report shall be submitted within 15 days of the malfunction.

Suspension/disposition of ammunition and explosives involved in malfunctions and accidents

- a. The suspension/disposition of ammunition and explosives involved in malfunctions and accidents will be in accordance with MCOs 8025.1_ and P5102.1B. Firing suspensions are published in TB 9–1300–385, NAVSUP P–801, and appropriate TMs.
- b. Any ammunition suspended and listed in TB 9–1300–385 or NAVSUP P–801 and supplements will not be fired in training.
- c. Firing of “restricted” ammunition listed in TB–9–1300–385 or NAVSUP P–801 and supplements will be conducted in accordance with the restriction requirements.
- d. Ammunition determined to be defective will not be fired. Defective ammunition will be reported to the installation Quality Assurance Specialist, Ammunition Surveillance office or the explosives safety office via the RCO.
- e. Examples of defects include, but are not limited to:
 - (1) Fuzes or fuzed rounds that are inadequately tightened, insecurely staked, or missing safety devices.
 - (2) Safe and arming mechanisms, if so equipped, in an armed position.
 - (3) Ammunition showing deterioration or corrosion.
 - (4) Ammunition showing evidence of defects in material or assembly.
 - (5) Ammunition and unopened ammunition packaging which shows evidence of tampering. It will not be issued until cleared by competent explosives safety authority.

Unexploded ordnance and misfire procedures and reporting

- a. The range OIC will report all UXO to the installation RCO. In the case of grenades or other munitions that may be immediately hazardous to personnel (for example, 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 RCO for determination of clearance scope.
- b. Misfire procedures in training manuals/current operating 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. Ammunition malfunctions or defects will be reported in accordance with MCO 8025.1_
- d. Range clearance and destruction of UXO on operational ranges will be in accordance with DODI 3200.16 and approved Service procedures.

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.

Range personal protective equipment requirements

- a. Training casualties on operational ranges must be minimized through the use of appropriate personal protective equipment (PPE). This pamphlet provides recommendations as to the level of PPE to be used with specific weapon systems. These PPE levels are found in table 2–2. Ultimately, the commander must decide the appropriate level of PPE based on thorough risk assessment.
- b. All personnel within the hearing hazard zone will wear approved 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) is encouraged, especially during force-on-force training maneuvers or scenarios by personnel undergoing training, as well as those in close proximity (for example, evaluators, observers, and very important persons). Based on risk assessment, the installation commander may reduce or eliminate requirement for eye protection, if the decision is made that reduced vision created by use of eye protection outweighs its value.

Table 2–2	
Personal protective equipment	
Personal protective level	Personal protection required
0¹	Army combat uniform/standard utility uniform, hearing/eye protection
1¹	Body armor and helmet, hearing/eye protection
2¹	Body armor with front/back enhanced small arms protective insert (E–SAPI) plates and helmet, hearing/eye protection
3	Body armor with front/back/side E–SAPI plates and helmet, hearing/eye protection
Notes:	
¹ Eye protection is encouraged. Based on risk assessment, the unit commander may require ballistic and/or laser eye protection.	

Small Arms firing conditions

- a. For the purpose of this pocket guide, small arms are man-portable, individual and crew-served weapon systems of 30mm or less used primarily against personnel and lightly armored or unarmored equipment. Small arms SDZ diagrams and tables provided in this chapter are the standard for the proper construction of small arms direct fire SDZs with or without exploding projectiles.
- b. The cone SDZ may be applied when designing or conducting training on static/known distance style ranges that do not involve fire and movement or fire and maneuver.
- c. The batwing SDZ provides for greater containment of all ricochets. It will be applied when designing or conducting training on ranges that involve fire and movement, fire and maneuver, flanking fire, and/or when ricochet hazards outside the range boundary may endanger nonparticipating personnel.
- d. When firing small arms with or without exploding projectiles on small arms ranges with known distance and unknown distances involving hand-held and shoulder-fired weapons or weapons firing from ground or vehicle-mounted platforms, the standard 5 degree dispersion area for the SDZ may be reduced to 2 degrees when:
 - (1) Conducting static (non-fire and movement/maneuver) training on known distance and unknown distance small arms ranges with hand-held or shoulder-fired weapons when firing from fixed or stationary positions.
 - (2) Training on ranges involving personnel conducting precision fires from stationary positions.
 - (3) Ground-mounted weapons conducting static (non-fire and movement/maneuver) training on known distance and unknown distance small arms ranges that are mounted on appropriate tripods. The traversing and elevation mechanism for that weapon system will be used for all fires.
 - (4) Vehicle-mounted weapons conducting static (non-fire and movement/maneuver) training on known distance and unknown distance small arms ranges are mounted on appropriate vehicle mounts. The traversing and elevation mechanism for that weapon system will be used and locked in place for all fires.
 - (5) Risk management process documentation for the unit conducting training has been approved by the installation RCO or other appropriate approving authority. Training events in which the SDZ dispersion area has been reduced from 5 to 2 degrees will be specifically addressed in the risk management worksheet.

Overhead firing

- a. Overhead fire of personnel may be authorized, provided they have positive protection from the munitions being fired. Protected positions for personnel and vehicles are discussed in FM 5-103.
- b. The installation commander (or designated representative) can authorize overhead fire above unprotected personnel except for specifically prohibited weapon systems.
- c. Weapons specifically authorized for overhead fire of unprotected personnel are:
 - (1) All artillery cannon firing indirect fire. See chapter 10, 10-6 MCO 3570.1C for safety precautions.
 - (2) Machine-guns (5.56mm, 7.62mm, and .50 caliber) on ground tripods or vehicle mounts (ring mounts excluded) firing from a stationary position.
 - (3) Firing mortars over the heads of troops by Marine Corps units is not authorized except when firing the Expeditionary Fire Support System (EFSS) M327 120mm rifled towed mortar. For the Marine Corps, mortars must be fired at the edge of a high hazard impact area. Requirements for overhead fire using the 120mm rifled towed mortar can be found in chapter 10, MCO 3570.1C.

- d. Only ammunition certified for overhead fire will be used.
- e. All firing of direct-fire weapons will be from positions that provide an unobstructed field of fire.
- f. Overhead fire with machine guns in live-fire exercises will be as follows:
 - (1) Bullets will not be permitted to impact between the firing position and the rear of the line of unprotected personnel. All impacts should be a minimum of 50m beyond the forward line of unprotected personnel.
 - (2) Positive stops must be used to prevent crossfire and depression of the muzzle during firing.
 - (3) A minimum clearance or safety limit must be established using the guidelines for overhead fire in FM 3–22.65 and FM 3–22.68. Marine Corps personnel use Marine Corps Warfighting Publication 3–15.1.
 - (4) The rate of fire will not exceed 70 rounds per minute for 5.56mm and 7.62mm machine guns and 40 rounds per minute for .50 caliber machine guns.
 - (5) Weapons will be test fired before delivery of overhead fire to verify effectiveness of the positive traverse and depression stops.
 - (6) Tracer ammunition may be used as a check to track the projectile flight path.
- g. In addition to the requirements of paragraph 17–4f MCO 3570.1C, the following precautions will apply to overhead fire with machine guns for a confidence infiltration course:
 - (1) Firing will be from approved platforms as described in FM 3–21.75.
 - (2) Qualified field maintenance/ordnance personnel will inspect the mounts and weapons before being declared safe to deliver overhead fire.
 - (3) A minimum clearance of 2.5m over the heads of personnel or the highest obstruction within the field of fire will be maintained. Minimum clearance is the distance between the lowest shot in the dispersion pattern (as determined by the test firing) and the bodies of individuals in erect positions on the highest point of ground, log, or other obstacle over which personnel must travel, or heights of barbed wire strands or posts on the course, whichever is higher.
- h. All firing of indirect fire weapons will be from positions in which the site to mask allows engagement of the targets nearest to the forward line of troops. Selection of firing positions, direction of fire, and fall of shot must prevent the projectiles from striking trees or other obstacles in the area from the weapon position to a point forward of unprotected personnel. The forward point is defined as the bursting radius of the round, plus 12 range probable errors.
- i. When field artillery is fired during CALFEX/CAX with maneuvering personnel, the impact area will be adjusted according to the maneuver location of troops to maintain safe separation distance. The troop side of the impact area will be determined in relation to the movement of the personnel.
 - Unprotected troops must not be permitted to enter danger zones after firing has commenced.
- j. Weapons will be grouped by muzzle velocity as cited in FM 6–40 or pertinent Marine Corps TMs.
 - Weapons will be bore-sighted as prescribed in FM 6–50. Tubes will be clean and dry before start of exercise and will be cleaned during the exercise in accordance with appropriate weapon TMs.
- k. All ammunition to be fired should be uniformly conditioned to ambient temperature consistent with the tactical situation.

Flanking fire

a. The batwing SDZ provides for greater containment of all ricochets. It will be applied when designing or conducting training on ranges that involve fire and movement, fire and maneuver, flanking fire, and/or when ricochet hazards outside the range boundary may endanger nonparticipating personnel.

Figure 4–3 is a batwing SDZ for firing small arms direct-fire weapons without exploding projectiles.

Figure 4–4 is a batwing SDZ for firing small arms direct-fire weapons with exploding projectiles.

b. Cannon and mortar flanking fire must not impact any closer to unprotected personnel than the fragmentation radius (Area A) prescribed for each weapon.

c. Flanking Fire (5.56mm, 7.62mm, and .50 caliber) Small arms, ground-mounted or vehicle-mounted machine guns may be fired at low angles of elevation (near the flank of an individual or unit). For the SDZ, there must be angle of 15 degrees or 100 meters (whichever is greater) between the limit of fire and near flank of the closest individual or unit and all impacts are beyond the individual or unit. For the batwing SDZ, all non-participating personnel must be outside the SDZ. Tripod, traversing and depression stops will be used on machine guns to maintain the required angle and distance between the line of fire and the near flank of the individual or unit.

d. Range SOPs will address firing and maneuver unit locations to ensure no unprotected personnel are exposed to training fires.

Shotgun ranges

Training used for shotgun firing will be in accordance with SDZ requirements as found in MCO 3570.1C, Figure 4-1 and Table 4-1.

Blank ammunition

a. The following precautions will be observed during the use of blank ammunition:

(1) The blank firing adapter (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 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) Army combat uniform and Marine Corps combat utility uniforms offer skin protection and should be worn at all times. Eye protection should be used.

b. A violation of the safe separation distance could result in serious injury, and within 1 meter may cause fatal injuries.

Types of danger zones

There are three types of danger zones:

a. **Laser surface danger zone (air-to-ground; ground-to-ground).** A laser surface danger zone consists of the target area in addition to horizontal and vertical buffer zones. It reflects the minimum land and air requirement, to include terrain mitigation, needed to safely employ a given laser. The laser surface danger zone accounts for direct hazards (main beam) and indirect hazards (reflections). The boundaries of the laser surface danger zone depend on which of the two overlapping zones, direct or indirect, are larger. If there are no specular reflectors on the range and the laser does not present a diffuse reflection

hazard, there will not be an indirect hazard zone. Laser surface danger zones must accommodate stationary firing points (fixed positions) as well as mobile firing positions, in addition to fixed and moving targets. Figure 3–1 contains the basic elements of a laser surface danger zone.

b. **Surface danger zone (ground-to-ground).** An SDZ delineates that portion of the earth and the air above in which personnel and/or equipment may be endangered by ground weapons firing or demolition activities. These SDZs are designed to make the probability of hazardous fragment escapement from installation boundaries unlikely and minimize the danger to the public, installation personnel, facilities/equipment, or property. Two basic SDZs are the cone or and the “batwing.” The batwing SDZ provides for greater containment of ricochets. Figures 3–2 and 3–3 contain cone and batwing SDZs for small arms direct-fire weapons without explosive projectiles. Figures 3–4 and 3–5 are cone and batwing SDZs for small arms direct-fire weapons with explosive projectiles. Figures 3–6 and 3–7 are SDZs for mortars and field artillery cannon in the indirect fire mode. Certain weapons, for example tube-launched, optically-tracked, wire-guided (TOW) and FGM–148 Javelin missiles have unique SDZs. They will be addressed in the appropriate chapter.

(1) Multiple firing point/target surface danger zones. A single SDZ for a particular weapon system may be expanded to accommodate multiple firing positions and/or targets for that weapon system. Figure 3–8 contains a SDZ for multiple fixed firing positions and multiple fixed targets. Figure 3–9 contains a SDZ for a single fixed firing position and multiple fixed targets. Figure 3–10 contains a SDZ with multiple fixed firing points and single fixed target. Figure 3–11 contains a SDZ with multiple fixed firing points and multiple fixed or moving targets.

(2) Movement box. A movement box is designed to accommodate movement to an objective. Shooters move within the designated “box” and may engage multiple targets or moving targets down range. Movement boxes for live-fire maneuver/movement exercises will use the batwing SDZ. Figure 3–12 contains a movement box with the batwing SDZ. Target engagement scenarios must ensure fires remain within the established SDZ.

(3) Composite danger zones.

(a) CAXs involve combined arms teams conducting coordinated fire and maneuver training in executing the assault, seizure, and defense of appropriate objectives. Tactical air support may be included with appropriate weapon danger zones. Combining multiple danger zones for a CAX scenario is the definitive application of danger zones. Regardless of the number and types of danger zones a CAX requires, a systematic approach will result in successful definition of each laser surface danger zone/SDZ/weapon danger zone and allow training to be safely accomplished.

(b) Danger zones of multiple weapon systems in a CAX scenario result in a composite laser surface danger zone/SDZ/weapon danger zone. The composite laser surface danger zone/SDZ/weapon danger zone identifies total real estate requirements at a given sequence (or phase) of the exercise. Numerous sequenced or time-phased composite danger zones may exist depending on the complexity of a particular CAX. Figure 3–13 is a composite SDZ.

c. **Weapons danger zone (air-to-ground).** A weapon danger zone encompasses the ground and airspace for lateral and vertical containment of projectiles, fragments, debris, and components resulting from the firing, launching, and detonation of aviation-delivered ordnance. It reflects the minimum land and air requirement, to include terrain mitigation, needed to safely employ a given weapon. The weapon danger zone accounts for inaccuracy, failures, ricochets, and broaching/porpoising of a specific weapon/munition type delivered by a specific aircraft type. The weapon danger zone “footprint” is based on weapon characteristics, type of delivery being executed, platform (aircraft) delivering the

ordnance, target and soil characteristics, terrain, and level of containment acceptable to the senior commander (Army)/installation commander (Marine Corps). Figure 3–14 depicts the basic elements of a weapon danger zone.

Surface danger zone templates

- a. SDZ template on pages 50 thru 55 of this pamphlet 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 on pages 56 and 57 depict the SDZ for weapons with explosive projectiles, to include the Javelin and Tow missiles, firing from a single firing position along the GTL to a single target.
- c. The tables below provide 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 4-1

Surface danger zone data for 12-gauge ammunition small arms direct-fire weapons

Ammunition 12-gauge	Impact media	Dist. X (m)	Dist. Y (m)	Dist. W (m)	Area A ¹ (m)	Area B (m)	Angle P (deg)	Angle Q (deg)	Vertical hazard (m)
12-gauge slug, shot size larger than 7½	Earth/ Water	1,073	710	125	100	NR	21.96	33.34	136
	Steel/ Concrete	1,073	830	287	100	NR	56.91	40.17	197
12-gauge 7½, 8, and 9 shot	Earth/ Water	275	NR	NR	NR	NR	NR	NR	NR
	Steel/ Concrete	275	NR	NR	NR	NR	NR	NR	NR
12-gauge XM1030 Breaching	Earth/ Water	375	NR	NR	NR	NR	12.50	NR	NR
	Steel/ Concrete	375	NR	NR	NR	NR	12.50	NR	NR

Legend for Table 4-1:

NR=Not required

Notes:¹ Area A applies to cone SDZ only.

Table 4–2**Surface danger zone data for all small arms blank ammunition with blank firing adapter**

Ammunition blank	Impact media	Dist. X (m)	Dist. Y (m)	Dist. W (m)	Area A¹ (m)	Area B (m)	Angle P (deg)	Angle Q (deg)	Vertical hazard (m)
Small arms 5.56mm, 7.62mm, .50 caliber	NR	5	NR	NR	NR	NR	NR	NR	NR

Legend for Table 4-2:

NR=Not required

Notes:¹ The dispersion and ricochet area for all ammunition is 10 degrees.**Table 4–4****Surface danger zone data for 9mm small arms direct-fire weapons**

Ammunition 9mm¹	Impact media	Dist. X (m)	Dist. Y (m)	Dist. W (m)	Area A² (m)	Area B (m)	Angle P (deg)	Angle Q (deg)	Vertical hazard (m)
Ball M882, M1, Subsonic	Earth/ Water	1,800	1,077	158	100	NR	23.10	15.80	93
	Steel/ Concrete	1,800	1,211	399	100	NR	61.10	30.40	253

Legend for Table 4-4:

NR=Not required

Notes:¹ SDZ data for Special Effects Small Arms Marking System (SESAMS) and CCMCK ammunition is located in chapter 14 of this publication.² Area A applies to cone SDZ only.

Table 4–7
Surface danger zone data for 5.56mm small arms direct-fire weapons

Ammunition 5.56mm ¹	Impact media	Dist. X (m)	Dist. Y (m)	Dist. W (m)	Area A ² (m)	Area B (m)	Angle P (deg)	Angle Q (deg)	Vertical hazard (m)
M193 Ball	Earth/ Water	3,100	2,004	458	100	NR	35.20	23.10	319
	Steel/ Concrete	3,100	1,666	323	100	NR	19.00	26.90	219
M196 Tracer	Earth/ Water	3,100	2,066	362	100	NR	35.10	26.80	355
	Steel/ Concrete	3,100	2,023	243	100	NR	19.20	22.80	243
M855 Ball	Earth/ Water	3,437	2,029	462	100	NR	34.20	22.40	325
	Steel/ Concrete	3,437	1,810	334	100	NR	18.80	25.20	229
M856 Tracer	Earth/ Water	3,089	1,607	355	100	NR	32.80	23.20	261
	Steel/ Concrete	3,089	1,592	277	100	NR	18.60	21.00	261
4 Ball/1 Tracer F/SAW	Earth/ Water	3,437	2,029	462	100	NR	34.20	22.40	325
	Steel/ Concrete	3,437	1,810	334	100	NR	18.80	25.20	261
M862 Plastic Short Range	Earth/ Water	250	165	24	100	NR	15.40	20.00	16
	Steel/ Concrete	250	136	5	100	NR	3.30	7.30	4

Legend for Table 4-7:

NR=Not required

Notes: ¹ SDZ data for CCMCK ammunition located in chapter 14 in this publication. ² Area A applies to cone SDZ only.

Table 4-9

Surface danger zone data for 7.62mm small arms direct-fire weapons

Ammunition 7.62mm ¹	Impact media	Dist · X (m)	Dist · Y (m)	Dist. W (m)	Area A ² (m)	Area B (m)	Angle P (deg)	Angle Q (deg)	Vertical hazard (m)
M59,M80 Ball, M62, M276 Tracer	Earth/ Water	4,100	4,073	1,461	100	NR	43.54	38.90	706
	Steel/ Concrete	4,100	4,053	861	100	NR	20.04	75.54	447
7.62 X 39mm A1022 intermediate designed for AK series, SKS, RPK	Earth/ Water	4,100	4,073	1,461	100	NR	43.54	38.90	706
	Steel/ Concrete	4,100	4,053	861	100	NR	20.04	75.54	447
M118 Spec Ball, M85	Earth/ Water	5,288	4,800	1,545	100	NR	43.81	38.73	752
	Steel/ Concrete	5,288	5,137	990	100	NR	20.17	41.29	490

Legend for Table 4-9:

NR=Not required

Notes:¹ For the 7.62 39mm (AK) the only authorized standard DODIC to be used is A102.² Area A applies to cone SDZ only.

Table 4–10

Surface danger zone data for M993 7.62mm armor piercing

Elevation (feet)	Impact media	Dist. X ¹ (m)	Dist. Y (m)	Dist. W (m)	Area A ¹ (m)	Area B (m)	Angle P (deg)	Angle Q (deg)	Vertical hazard (m)
0	Earth Steel	4,100 4,100	4,084 4,084	330 330	100 100	NR NR	33.3 2 33.3 2	5.97 5.97	224 224
1,000	Earth Steel	4,195 4,195	4,179 4,179	338 338	100 100	NR NR	33.5 1 33.5 1	6.00 6.00	229 229
2,000	Earth Steel	4,290 4,290	4,274 4,274	346 346	100 100	NR NR	33.6 9 33.6 9	6.03 6.03	234 234
3,000	Earth Steel	4,385 4,385	4,368 4,368	354 354	100 100	NR NR	33.8 7 33.8 7	6.06 6.06	239 239
4,000	Earth Steel	4,480 4,480	4,463 4,463	362 362	100 100	NR NR	34.0 3 34.0 3	6.09 6.09	244 244
5,000	Earth Steel	4,575 4,575	4,558 4,558	370 370	100 100	NR NR	34.2 0 34.2 0	6.12 6.12	249 249
6,000	Earth Steel	4,670 4,670	4,652 4,652	378 378	100 100	NR NR	34.3 5 34.3 5	6.14 6.14	254 254
7,000	Earth Steel	4,765 4,765	4,747 4,747	386 386	100 100	NR NR	34.5 1 34.5 1	6.17 6.17	259 259

							34.5 1		
Legend for Table 4-10: NR=Not required Notes: ¹ Area A applies to cone SDZ only.									

Table 4-11 Surface danger zone data for M973 Ball and M974 Tracer 7.62mm short range training ammunition									
Elevation (feet)	Impact media	Dist. X ¹ (m)	Dist. Y (m)	Dist. W (m)	Area A ¹ (m)	Area B (m)	Angle P (deg)	Angle Q (deg)	Vertical hazard (m)
0	Earth	540	500	105	100	NR	38	45	178
	Steel	540	500	30	100	NR	10	20	178
1,000	Earth	565	520	110	100	NR	38	45	184
	Steel	565	520	32	100	NR	10	20	184
2,000	Earth	590	540	115	100	NR	38	45	190
	Steel	590	540	34	100	NR	10	20	190
3,000	Earth	615	560	120	100	NR	38	45	196
	Steel	615	560	36	100	NR	10	20	196
4,000	Earth	640	580	125	100	NR	38	45	202
	Steel	640	580	38	100	NR	10	20	202
5,000	Earth	665	600	130	100	NR	38	45	208
	Steel	665	600	40	100	NR	10	20	208
6,000	Earth	690	620	135	100	NR	38	45	214
	Steel	690	620	42	100	NR	10	20	214

	Steel	690	620	42	100	NR	10	20	214
7,000	Earth	715	640	140	100	NR	38	45	220
	Steel	715	640	44	100	NR	10	20	220

Legend for Table 4-11:

NR=Not required

Notes:

¹ Area A applies to cone SDZ only.

Table 4-12
Surface danger zone data for .50 caliber small arms direct-fire

Ammunition .50 caliber	Impact media	Dist. X (m)	Dist. Y (m)	Dist. W (m)	Area A ¹ (m)	Area B (m)	Angle P (deg)	Angle Q (deg)	Vertical hazard (m)
M8 API, M2 API, M20, M1	Earth/ Water	6,100	5,142	1,659	100	NR	40.80	69.60	904
	Steel/ Concrete	6,100	4,300	718	100	NR	16.30	33.10	462
M33 Ball, M2 Ball, M17, M10, M17, Spotter Tracer	Earth/ Water	6,500	5,211	1,652	100	NR	38.19	63.35	901
	Steel/ Concrete	6,500	4,147	714	100	NR	16.03	44.13	478
M858 Ball Plastic, M860 Tracer Plastic	Earth/ Water	700	398	20	100	NR	4.28	9.16	41
	Steel/ Concrete	700	415	53	100	NR	11.65	21.14	41

Legend for Table 4-12:

NR=Not required

Notes:

¹ Area A applies to cone SDZ only.

Table 4-13

Surface danger zone data for M903 .50 caliber sabot light armor penetrator

MSL Elevation (feet)	Impact media	Dist. X (m)	Dist. W (m)	Dist. D (m)	Area A (m)	Angle B (deg)	Angle P (deg)	Vertical hazard (m)
0	Sand/Steel	8,62 5	1,130	1,074	NR	NR	47.3 4	1,130
1,000	Sand/Steel	8,88 5	1,155	1,101	NR	NR	47.3 4	1,155
2,000	Sand/Steel	9,14 5	1,180	1,128	NR	NR	47.3 8	1,180
3,000	Sand/Steel	9,40 5	1,205	1,155	NR	NR	47.3 9	1,205
4,000	Sand/Steel	9,66 5	1,230	1,182	NR	NR	47.4 0	1,230
5,000	Sand/Steel	9,925	1,255	1,209	NR	NR	47.4 2	1,255
6,000	Sand/Steel	10,185	1,280	1,236	NR	NR	47.4 3	1,280

7,000	Sand/Steel	10,445	1,305	1,263	NR	NR	47.4 4	1,305
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Legend for Table 4-13:
NR=Not required

Table 4-14 Surface danger zone data for M962 .50 caliber sabot light armor penetrator-T								
MSL Elevation (feet)	Impact media	Dist. X (m)	Dist. W (m)	Dist. D (m)	Area A (m)	Angle B (deg)	Angle P (deg)	Vertical hazard (m)
0	Sand/Steel	9,560	1,240	1,001	NR	NR	48.0 0	1,240
1,000	Sand/Steel	9,870	1,270	1,025	NR	NR	48.0 0	1,270
2,000	Sand/Steel	10,180	1,300	1,049	NR	NR	48.0 1	1,300
3,000	Sand/Steel	10,490	1,330	1,073	NR	NR	48.0 2	1,330
4,000	Sand/Steel	10,800	1,360	1,098	NR	NR	48.0 3	1,360
5,000	Sand/Steel	11,110	1,390	1,122	NR	NR	48.0 4	1,390

6,000	Sand/Steel	11,420	1,420	1,146	NR	NR	48.0 4	1,420
7,000	Sand/Steel	11,730	1,450	1,170	NR	NR	48.0 4	1,450

Legend for Table 4-14:
NR=Not required

Table 4-15 Surface danger zone data for .50 caliber MK211, MK211-0/API-T								
MSL Elevation (feet)	Impact media	Dist. X (m)	Dist. W (m)	Dist. D (m)	Area A ¹ (m)	Angle B (deg)	Angle P (deg)	Vertical hazard (m)
0	Sand/Steel	7,955	1,075	530	NR	NR	49.48	1,075
1,000	Sand/Steel	8,104	1,100	528	NR	NR	50.26	1,100
2,000	Sand/Steel	8,325	1,125	526	NR	NR	51.02	1,125
3,000	Sand/Steel	8,515	1,150	524	NR	NR	51.76	1,150
4,000	Sand/Steel	8,700	1,175	522	NR	NR	52.49	1,175

5,000	Sand/Steel	8,885	1,120	520	NR	NR	53.20	1,120
6,000	Sand/Steel	9,075	1,225	518	NR	NR	53.89	1,225
7,000	Sand/Steel	9,260	1,250	516	NR	NR	54.56	1,250

Legend for Table 4-15:

NR=Not required

Notes:

[†] Area A applies to cone SDZ only.

Table 4-18

Surface danger zone data for MK 248 MOD 0 .300 Winchester Magnum small arms direct-fire ammunition¹

Altitude (feet)	Impact media	Dist. X ² (m)	Dist. Y (m)	Dist. W (m)	Area A ³ (m)	Area B (m)	Angle P ⁴ (deg)	Angle Q (deg)	Vertical hazard (m)
0	Earth Armor	5,919 5,919	4,200 2,300	390 180	100 100	NR NR	40 28	10 12	322 128
1,000	Earth Armor	6,078 6,078	4,336 2,358	399 187	100 100	NR NR	40.45 27.75	10.30 12.15	340 138
2,000	Earth Armor	6,242 6,242	4,472 2,416	408 194	100 100	NR NR	40.90 27.50	10.60 12.30	358 150
3,000	Earth Armor	6,411 6,411	4,608 2,474	417 201	100 100	NR NR	41.35 27.25	10.90 12.45	382 160

4,000	Earth Armor	6,584 6,584	4,744 2,532	426 208	100 100	NR NR	41.80 27.00	11.20 12.60	410 165
5,000	Earth Armor	6,763 6,763	4,880 2,590	435 215	100 100	NR NR	42.25 26.75	11.50 12.74	433 180
6,000	Earth Armor	6,947 6,947	5,016 2,648	444 222	100 100	NR NR	42.70 26.50	11.80 12.90	457 194
7,000	Earth Armor	7,137 7,137	5,152 2,706	453 229	100 100	NR NR	43.15 26.25	12.10 13.05	484 208

Legend for Table 4-18

NR=Not required

Notes:

1 Single hearing protection should be worn by all personnel within 34 meters when MK248 MOD 0 ammunition is being fired.

2 Distance X must increase by 25 meters m/sec or 13 meters/knot of tail wind, measured along the line of fire.

3 Area A applies to cone SDZ only.

4 Dispersion angle of 5 degrees must increase by 0.24 degree per meter/second or 0.12 degree per knot of cross wind, measured perpendicular to the line of fire.

Hand grenades

a. High explosive loaded type grenades

These contain explosive charges that detonate after a short delay (3 to 5 seconds). Every precaution will be taken to prevent injury from blast, concussion, and fragment. For training purposes, fragmentation and offensive hand grenades will be thrown from a trench or barrier equivalent to a screen of sandbags 0.5m (1.65 ft) thick. When throwing bays are used for protection, they will be built to a minimum height of 1.5m (5ft) high and 2.7m (8.8 ft) wide or enough to accommodate one thrower and one assistant range safety officer (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 FM 3-23.30 and TC 25-8 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, then throwing bays may be separated from one another by physical barriers (earthen berms, concrete walls, or wooden revetments) long and high enough to attenuate high-velocity, low-angle fragments. It is recommended that all throwing pits for live grenade training have knee walls at the rear of the bay. Knee walls provide the quickest and safest means of reacting to a dropped grenade. Knee walls should be 0.6m (2 ft) high.

b. Firing conditions for fragmentation and offensive grenades

(1) Personnel within the 150m danger area when casualty-producing hand grenades are thrown shall wear, at a minimum, PPE Level 1 and eye protection is encouraged. Refer to table 2–2. Approved single hearing protection is required for all participating personnel when throwing bays are used. Approved single hearing protection is recommended for all personnel participating in tactical exercises.

(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.

(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, these pits will replicate the physical layout of live-bay pits) is mandatory prior to live grenade training.

(4) OICs, 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/squadron commanders are responsible for establishing and maintaining a certification program for their OICs and RSOs commensurate to the assigned duties and responsibilities. RSOs and ARSOs must be qualified with the hand grenade prior to assuming their duties.

(5) HE 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. Dud grenades will be destroyed by EOD personnel only. Unauthorized personnel will not approach, move, touch, or handle dud grenades. All duds will be reported by the OIC to the range control office.

(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 (see fig 5–1).

(7) When direct viewing of hand grenade detonations within the 150m danger area is required the following information is provided:

(a) Viewing positions will be constructed so as to provide positive protection from high-velocity, low-angle fragments and low-velocity high-angle fragments.

(b) Composite (laminated) viewing ports will be constructed using the following criteria or equivalent:

1. 10mm (.40 in) glass (outside)
2. 7mm (.28 in) polycarbonate
3. 6mm (.24 in) glass
4. 6mm (.24 in) polycarbonate
5. 6mm (.24 in) glass
6. 6mm (.24 in) polycarbonate

(c) Alternatives:

1. Provide a single pane of UL 752 Level 1-, Level 2-, or Level 3-rated bullet-resisting laminated glass glazing (with a minimum total thickness of at least 1–3/16 inches). Also, as an alternative, two panes of other UL 752 Level 1-, Level 2-, or Level 3-rated bullet-resisting glazing types may be used provided each pane contains a minimum of 30 percent glass by thickness. In cases where the protected side of the glazing is made of a glass layer, the interior surface should have a spall shield/film applied to that surface by the manufacturer.

2. These criteria provide minimum essential one-time protection against worst case fragmentation detonated within 6m of the viewing port. Additionally, 12.7mm (.50 in) or equivalent exterior polycarbonate protective sheet (scar shield) should be installed in front of the viewing port.

(8) Live grenades will not be thrown into standing water, deep snow, or dense vegetation which would obscure the grenade (for example, deeper than 5cm (2 in)).

(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, generating an unplanned detonation.

(11) Simultaneous employment of multiple fragmentation grenades into a single impact point is prohibited, as a live grenade could be propelled into the "safe area" by the detonation of another grenade (Marine Corps).

(12) The use of hand grenades during live-fire exercises shall conform to the provisions provided by chapter 17 MCO 3570.1C.

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, illumination, 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 their 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 shall 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.

(5) Burning type 0-chlorobenzyl denemalononitrite (CS) grenades will not be fired closer than 10m to other personnel or 50m to spectators upwind.

(6) Hexachloroethane (HC) smoke grenade restrictions are the same as those for HC smoke pots. These grenades will ignite combustible materials and 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 HC smoke grenades. (See chap 13 for detailed information concerning smoke hazards.)

(7) Burning particles of white phosphorous (WP) are frequently projected from the M15 and M34 grenades to a distance of 40m from the bursting point. Therefore, M15 and M34 WP grenades should be thrown only on standard live grenade ranges during training

as prescribed in FM 3–23.30. Trainers should consider use of protective cover when using the M15 and M34. White phosphorous particles cause serious, painful, slow-healing burns. Refer to FM 4–25.11 for appropriate first-aid measures.

(8) Direct viewing of thermite grenades will not be conducted due to the high potential of permanent eye damage.

(9) M84 Stun Grenade. All personnel within 1.52m (5 ft.) will wear single hearing protection if employing 2 rounds per day. All personnel within this distance will wear double hearing protection if employing 3 to 41 rounds per day.

d. Hand Grenades surface danger zones

Surface danger zone requirements for hand grenades are provided in MCO 3570.1C.

Grenade launchers and grenade machine guns

a. General firing conditions

(1) Personnel will be instructed in the proper use of grenade launchers and grenade machine guns 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, which must be designated as a dedicated, high-hazard impact area. Dedicated, high-hazard impact areas will be posted with signs to warn and keep out unauthorized personnel, and fenced off, if practical.

(3) PPE Level 1 will be worn when firing HE ammunition; eye protection is encouraged. Refer to table 2–2.

(a) Hazardous fragmentation from HE grenade ammunition may be experienced up to 165m from the point of detonation. Appropriate HE no-fire lines will be established.

(b) Although the MK32, M79, M203, and M320 40mm grenade launchers are designed to prevent accidental chambering of 40mm high-velocity ammunition, OICs and RSOs will ensure only low-velocity grenade cartridges are fired from MK32, M79, M203, and M320 grenade launchers.

(c) Single hearing protection will be worn within 2m of firing these grenade launchers. PPE Level 1 must be used while conducting firing of HE 40mm grenades. Eye protection is encouraged. Refer to table 2–2.

(d) Snow depth of 10cm (4 in) or more and standing water will increase the potential of 40mm duds. These conditions must be considered prior to firing.

(e) Minimum target engagement for MK32, M79, M203, and M320 grenade launchers firing HE ammunition is 130m or 165m, depending on type of ammunition.

b. General firing precautions for the MK19, MOD 3 grenade machine gun

(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) Gunners, crew members and other personnel at the firing position will wear PPE Level 1 at all times when firing HE ammunition. Eye protection is encouraged. Refer to table 2–2.

(a) Use only ammunition authorized for use with the MK19 Machine Gun.

(b) Do not attempt to fire low velocity 40mm grenade cartridges from the MK19.

(c) Do not reload or fire ammunition which has been cycled through the weapon.

(5) Range firing procedures and physical setup must be adequate to prevent HE rounds from impacting closer than 310m from the firing position, firing vehicle, other vehicles, or personnel.

(6) Firing over open vehicle 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.

(9) Marine Corps EOD personnel recovering dud M918 40mm TP projectiles will follow procedures outlined in EODB 60 series publications.

c. Static firing restrictions for vehicle mounted grenade machine gun

(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) M998 (high multipurpose wheeled vehicle) HMMWV interim squad carrier:

(a) Soft tops must be installed over the driver and passenger compartments for safe operation of the vehicle when firing the MK19.

(b) Visual and physical 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.

(3) M88A1 Heavy Equipment Recovery Combat Utility Lift and Evacuation System (HERCULES) medium-tracked recovery vehicle:

(a) Operator and mechanic hatches must be closed when firing off the left side, forward, or off the right side of the vehicle.

(b) Personnel doors on the vehicle sides may remain open during firing forward or to the rear, but will be closed when firing to the left or right side of the vehicle.

d. Moving firing restrictions for grenade machine gun

(1) Moving firing restrictions for the MK19, MOD 3 grenade machine gun to preclude unintentional impacts of HE and high explosive dual purpose (HEDP) ammunition at ranges less than 310m.

(a) Restrict speeds to not greater than 20 km per hour (12 mph) when firing from the M1025/1026 HMMWV armament carrier and the M998T interim squad carrier over paved and improved roads that are in good condition, and not greater than 10 km per hour (5 mph) over rough roads, trails, and cross-country.

(b) Restrict speeds to not greater than 20 km (12 mph) when firing from the M113 and M106 family of armored carriers, and the M88A1 tracked recovery vehicle over roads, trails, and cross-country.

e. Grenade launchers and grenade machine guns surface danger zone

(1) SDZ requirements for MK32, M79, M203, and M320 grenade launchers are provided in table 5-1 and figure 5-2. A minimum 6m separation distance is required between firing positions. Cartridge M433 requires an Area A and B of 165m. All other MK32, M79, M203, and M320 HE cartridges require 130m as illustrated in figure 5-2.

(2) SDZ criteria for the MK19, MOD 3 grenade machine gun are shown in table 5-2 and figure 5-3. Minimum target engagement range for HE cartridges is 310m.

Table 5–1**Surface danger zone dimensions for MK32 / M79 / M203 / M320 / 40mm grenade launcher**

Cartridge	Impact media	Dist. X	Area A	Area B	Vertical hazard
		Meters			
M381 HE	Earth Armor	470	130	130	216
		470	130	130	216
M433 HEDP ¹	Earth Armor	470	165	165	216
		470	165	165	216
M781, M407A1 TP	Earth Armor	470	NR	NR	216
		470	NR	NR	216
M576	Earth	85	NR	NR	75

Multi Projectile	Armor	85	NR	NR	75
M713, 715, 716 Smoke	Earth Armor	470 470	NR NR	NR NR	216 216
M661, M662, XM583/E1 Illumination	NA	470 470	NR NR	NR NR	216 216
M651E1 CS ²	Earth Armor	470 470	NR	NR	216
<p>Legend for Table 5-1:</p> <p>N/A=not applicable</p> <p>NR=Not required</p> <p>Notes:</p> <p>¹ For the use of 0-chlorobenzyl denemalononitrite (CS) see chapter 13.</p> <p>² Minimum target engagement range is 75m for training practice, 130m for all others except M433 which is 165m.</p>					

Table 5-2**Surface danger zone dimensions for MK19, MOD3 40mm grenade machine gun**

Cartridge	Impact media	Dist. X	Dist. Y	Dist. W	Area A	Area B	Vertical hazard	Angle P	Angle Q
		meters						degrees	
M383 HE	Earth Armor	2,095 2,095	1,25 0 1,25 0	167 471	310 310	310 310	See note	23 60	15 28
M385A1 TP	Earth Armor	1,984 1,984	1,25 0 1,25 0	167 471	NR NR	NR NR	See note	23 60	15 28
M430 HEDP	Earth Armor	2,037 2,037	1,25 0	167 471	310 310	310 310	See note	23 60	15 28

			1,25 0						
M918 TP	Earth Armor	2,095 2,095	1,25 0 1,25 0	167 471	NR NR	NR NR	See note	23 60	15 28
MK281 MOD 0 TP	Earth Armor	2,200 2,200	1,25 0 1,25 0	167 471	NR NR	NR NR	See note	23 60	15 28
XM1001 Canister	Earth Armor	1,750 1,750	1,74 3 1,74 3	370 370	NR NR	NR NR	See note	35 35	25 25

Legend for Table 5-2:

NR=Not required

Notes:

¹ Use the sum of the values of Dist W and Area A (if applicable) until validated test data is available.

Antitank rockets firing conditions

a. General

(1) All loading and unloading for separate loading rockets (for example, 35mm training practice rocket and 66mm M74 incendiary rockets) will be on the firing line with the muzzle pointed downrange. Procedures and precautions in FM 3–23.25 and appropriate TMs will be observed in all preparation and firing operations.

(2) Personnel will not stand or have any portion of the body directly in front of or behind a loaded rocket launcher.

(3) 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 a cone with the apex at the breech and radius corresponding with a rearward extension of the rocket target line.

(4) The use of manned target vehicles is prohibited when firing HE or high explosive anti-tank (HEAT) ammunition. Moving target vehicles must be operated by remote control. Unprotected operating personnel shall be located outside the SDZ.

(5) Approved single hearing protection will be worn by personnel within 390m of the firing point when firing antitank rockets. Approved single hearing protection will be worn by personnel within 500m of the firing point when firing HE, HEAT, TP, smoke and illumination from the multi-role antiarmor antipersonnel weapons system (MAAWS). The gunner and all other personnel within a 100m radius of the MAAWS must wear properly inserted foam earplugs as well as properly fitting ear muffs (double hearing protection).

(6) Gunners and other personnel within 20m will wear personal protective gear such as improved body armor (IBA), ballistic eyewear, and helmets. Sleeves should be down and collars up. A minimum PPE Level 1 must be worn (see tab 2-2). Eye protection is encouraged when firing shoulder-launched multipurpose assault weapons (SMAW).

(7) During training with the SMAW, the gunner and assistant gunner are authorized to fire only five rounds per day because of sound pressure levels.

(8) All personnel are required to wear approved hearing protection when firing the M72AS light antitank weapon (LAW) training system.

b. Special firing conditions

(1) SMAW—common practice round HX-07 Areas A and B are not required.

(2) All personnel within 100m of the SMAW launcher will wear, at a minimum, PPE Level 1, eye protection is encouraged. Refer to table 2-2.

(3) For SMAW MK80 novel explosive (SMAW NE) (DODIC HA34), SMAW- MK6 high explosive anti-armor assault (HEAA) (DODIC HX06), SMAW-MK3 HEDP (DODIC HX05), and SMAW-MK7 Common Practice Round (CPR) (SMAW) (DODIC HX-07), danger zone occupation could result in fatalities or serious casualties including severe burns, eye damage, or permanent hearing loss. The hazards are base plate fragments, debris, fireball, high noise levels, and overpressure.

(4) When the M72 LAW is fired in temperatures below freezing, all back blast areas (Area F) will be doubled. Operating personnel should wear approved face protection during firing.

(5) Extending the M72 weapon system too slowly can result in a failure to cock the weapon.

(6) All M72AS 21mm training system weapons will be visually inspected for damage before firing. Damaged weapons will be destroyed per standard explosive ordnance disposal procedures.

(7) Rockets, MAAWS, or the M136 AT4 shoulder-launched munition will not be fired from within buildings unless fired in accordance with FM 3-06.11 or within 50m of a vertical or nearly vertical backstop, barrier or obstacle due to the risk of debris ricochets.

(8) 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.

(9) Prone firing of HE or TP ammunition in the MAAWS is not authorized due to overpressure hazards.

(10) The firing of antitank rockets over unprotected troops from a moving vehicle or aircraft is not authorized.

(11) For HE ammunition, limit the number of daily firings by any individual (gunner or personnel within 20m) to four. There is no limit for the M72AS 21mm LAW training system.

Mortars firing conditions

- a. Firing mortars over the heads of troops by Marine Corps units is not authorized except when firing the Expeditionary Fire Support System (EFSS) M327 120mm rifled towed mortar. For the Marine Corps, mortars must be fired at the edge of a high hazard impact area. Requirements for overhead fire using the 120mm rifled towed mortar can be found in chapter 10.
- b. All personnel who take part in mortar firing will wear, PPE Level 1. Refer to table 2–2. At the commander's discretion, the gunner may remove their protective helmet while sighting the mortar. All personnel within the hearing hazard zone for the mortar, cartridge, or charge increment used will wear approved single hearing protection. The hearing hazard zone is usually defined in the manuals for the mortar or cartridges. If the hearing hazard zone information cannot be determined, single hearing protection will be required within 200m.
- c. Propellant increments removed from rounds before firing will be placed in metal or wooden covered (waterproofed) containers located outside the firing vehicle or positioned a distance of at least 25m from the firing point when firing dismounted. Unused powder increments must be safeguarded and handled in accordance with installation range and environmental regulations.
- d. M720, M721, M722, and M888 cartridges will not be fired above propellant charge 2 in the M2/M19 (60mm) mortar.
- e. M720 cartridges will not be fired in the hand-held mode with a charge greater than 1.
- f. No 800 series cartridges may be fired in the M29 (81mm) mortar except the M880 short-range target practice round. This also applies when using the M303 insert.
- g. When firing the 120mm mortar from the carrier, all crew members and personnel inside the carrier must wear double hearing protection. Double hearing protection is required regardless of the carrier ramp position (opened or closed). Double hearing protection is defined as any approved earplugs plus either a combat vehicle crewman helmet or a communication aural protective system/artillery communication aural protective system with personnel armored system for ground troops helmet. Personnel outside the carrier within 200m must wear single hearing protection.
- h. Crew members and all personnel within 5m of the 120mm mortar must wear double hearing protection when firing.
- i. When firing the 120mm ground mount and carrier mount configuration, using the M933E1 HE cartridge, all personnel within 5m of the mortar are required to wear double hearing protection. Exposure is limited to 140 rounds in any 24 hours.
- j. Firing restrictions and limitations in TM 43–0001–28 apply to all cartridges and fuzes. Marine Corps fires will observe restrictions in TM 08655A–10A for light armored vehicle-mortar variants.
- k. The target engagement distance will not be less than the distance required for Area B of the respective caliber of mortar to be fired, unless fired from protected positions.

Mortar surface danger zones

- a. SDZ requirements for 60mm, 81mm, and 120mm mortars are provided in table 9–1 and figure 9–1.
- b. Distance X is the maximum range of the weapon system at a given charge. 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 9–2.
- 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 tab 9–2 and fig 9–1) by the data found in the tabular firing tables. These data are drawn in meters from the downrange edge of the target area for deflection probable errors (PED) and range probable error (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.

g. The 25 degree angle for Area A must be increased to 70 degrees when firing HE ammunition at ranges equal to or less than 600m for 60mm mortars; 940m for 81mm mortars; and 1500m for 120mm mortars. Only the personnel required to fire the mortar system are authorized to be within this area.

h. Only the mortar crew is authorized to be in Area A.

Table 9–1
Mortar surface danger zone criteria (in meters) ^{1 2 3}

Caliber	Area A	Area B
60mm	250	300
81mm	400	400
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.

² Dimensions of Areas A and B may be reduced by 50 percent when firing illumination cartridges.

³ Cartridges without HE filler (for example, M880, M931) do not require Areas A and B.

Table 9–2
Basic impact area dimensions

Limits	Dimensions
Left	Eight deflection probable errors (PE ^D) from the left limit of target area.
Right	Eight PE ^D from the right limit of target area.

Far edge	Eight range probable errors (PE ^R) from the far edge of target area.
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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 will be thoroughly familiar with all aspects of laser operations; systems employed, and associated dangers during training.

- a. Safe use of military lasers and laser systems. Chapter 16 MCO 3570.1C provides guidance for the safe use of military lasers and laser systems on military ranges as listed in MIL-HDBK-828B and Joint Publication 3-09.
- b. Lasers will be treated as direct-fire weapons.
- c. Laser systems will be directed only at approved targets and from approved operating positions/ areas or on designated headings and altitudes.
- d. Unfiltered Class 3B or 4 lasers will be used only on certified laser ranges approved for laser usage in accordance with paragraph 16-3.
- e. The nominal ocular hazard distance (NOHD) is the distance from an operating laser to the point where the laser is no longer an eye hazard (for example, the irradiance or radiant exposure during operation is not expected to exceed the appropriate maximum permissible exposure (MPE) level).
- f. Unprotected personnel must not be exposed to laser radiation within the NOHD of the laser system.
- g. Personnel within the laser surface danger zone will wear Laser Eye Protection (LEP) during laser operations. Eyewear must be appropriate for the wavelength and corresponding optical density (OD) required of the laser system in use. Skin protection should be worn when appropriate.
- h. Aided viewing involves the use of optical devices including binoculars, scopes, rangefinders, and so forth. The magnification of laser energy can significantly increase the NOHD of the laser. The use of magnifying optical devices to observe the target during laser operation is permitted if specular surfaces have been removed from the laser surface danger zone, appropriate laser filters are used, or it is being viewed beyond the NOHD-magnified. Optical devices not marked with the level of protection at the laser wavelength should be assumed to offer no protection unless verified. Personnel should not deliberately view direct laser radiation with magnifying optical instruments within NOHD-magnified unless the optical devices have the appropriate filtration to limit the exposure to below the MPE level.
- i. Optical Interrupt (OI) laser systems use intense light to cause visual field obscuration in targeted individuals. OIs are intended to be primarily a warning device, with an inherent and secondary capability to achieve ocular suppression effects as the situation dictates. The OI device should meet stringent safety criteria and be able to deliver a warning effect to targeted personnel by obscuring their vision. The devices currently in use may be Class 3R or greater laser systems that can be safely employed for training. However, due to the intensity of the laser beam, it can pose an eye hazard within the NOHD if incorrectly employed. If exposure distances are known and briefed prior to use which are equal to or less than the NOHD of the system, the OI laser system must be terminated.
- j. Backstops, natural or manmade, are features downrange from the target which terminate the beam, thus limiting the hazard distance. The optimal use of backstops is key to minimizing laser hazards.
- l. The laser surface danger zone (LSDZ) is the designated region or ground area where laser radiation levels may exceed MPE levels, thereby requiring control during laser

operation. When used in conjunction with live-fire weapons, the LSDZ might be more elongated than the SDZ/weapon danger zone if not terminated by an adequate backstop. Laser surface danger zones can be generated, either manually or by using the RMTK laser range management tool, to support training plans, map data, information requests, and so forth. This effort includes inputting the laser system and range data (for example, firing points and targets) and performing analysis to mitigate risk to ensure the laser training can be safely conducted on a given operational training range.

m. Unless otherwise specifically authorized, when lasers are not in use, hazardous laser output should be prevented by removing batteries, installing such devices as output covers, or rotating the laser into the stowed position.

n. The laser exit port must be covered or stowed and the device turned off when not engaged in training. Non-laser operations such as viewing through common optics can be conducted in a non-laser controlled area with the laser exit port cover removed if the laser is turned off.

o. When laser systems have both training and combat operating modes, the combat mode will be employed only if safely contained in the laser training range's controlled area. SOPs will enforce this measure.

p. Force-on-force laser operations involve combat simulation, target acquisition, illumination and/or pointing, target designation, weapons guidance, or range-finding against friendly and/or opposing forces. Force-on-force laser tactical exercises are approved on a case-by-case basis, dependent on the scheme of maneuver and risk analysis submitted by the using unit. Tactical exercises involving force-on-force units using laser systems other than Multiple Integrated Laser Engagement System (MILES) may require approval by the senior commander (Army)/installation commander (Marine Corps). Only Service-approved laser devices are used in force-on-force tactical exercises. Risk management (RM) procedures are completed in accordance with ATP 5-19 and MCO 3500.27B.

Laser procedural guidance

The policies and responsibilities for laser usage on ranges and training areas are defined in MCO 3570.1C. Provided is procedural guidance on how to fulfill those policies and responsibilities.

a. Specific unit level guidance on laser range safety.

(1) Implement the policies and procedures set forth by the installation to ensure safe use of lasers.

(2) Prepare and submit laser training plans for approval to perform laser activities on a specific laser range or training area. A unit laser training plan should include the following factors:

(a) Determine laser operations in support of training requirements.

(b) Review training to be accomplished against local SOPs.

(c) Coordinate to select a range whose laser range certification supports the laser system(s) to be used and training exercise to be accomplished.

(d) Review laser modes/tactics to be employed to ensure they support the laser system and range.

(e) Identify targets, laser firing area/line/points, laser-to-target orientation, and orbit points that can be supported by the LSDZ. The laser must be terminated or the NOHD fully contained within the controlled area of the range.

(f) Identify ground personnel locations.

(g) Identify range hazard concerns (such as, conflicts, impact areas, and clearing requirements).

(h) Employ RM in order to identify administrative controls to be implemented by the units.

(i) Identify PPE requirements.

- (j) Identify communications requirements.
 - (k) Review the installation SOP to be aware of local emergency response procedures and laser injury response protocol.
- (3) Range Laser Safety Inspection. The unit conducts laser safety inspections of the range and its operations prior to use and confirm the following areas are covered:
- (a) Laser warning signs are posted.
 - (b) Range configuration is acceptable (targets/backstop, range boundaries, laser firing area/line/points).
 - (c) LSDZ is clear of specular reflectors (this can be conducted via range sweep in accordance with local SOPs).
 - (d) Laser range or training area is clear of non-participating personnel and equipment (this can be conducted via range sweep in accordance with local SOPs).
 - (e) Participating personnel in the area are aware of lasing activities and using appropriate PPE.
 - (f) Laser systems are authorized per the training plan.
 - (g) Training filters/modes are used, as applicable.
 - (h) Communication and terminology are agreed upon with range control.
 - (i) Correct any discrepancies prior to training.
- (4) Safety Brief/Pre-mission Brief. The range OIC or laser range safety officer (LRSO) provides safety briefs/permission briefs to laser range users and observers prior to laser operations. At a minimum, the brief should include as appropriate—
- (a) Laser systems to be used and their purpose (for example, range finding, target acquisition/pointing, designating, or sensor disruption).
 - (b) Control measures specific to the lasers employed and the range upon which they are used.
 - (c) Authorized tactics, laser firing positions (ground and air), laser-to-target orientation, weapons release points, and weapon performance.
 - (d) Drawings, photographs, descriptions or grid points of authorized targets.
 - (e) Communication procedures that include specific frequencies (or channels), controlling authorities, and standardized terminology.
 - (f) Acquisition, identification, and tracking procedures for targets.
 - (g) Missile/ordnance mode of operation.
 - (h) Requirements for beam termination and means to accomplish it.
 - (i) Control measures to minimize the risk of unauthorized personnel, vehicles, or aircraft entering the range area.
 - (j) Run-in headings and flight profiles to be used for airborne laser operations or permissible laser surface danger zone for ground-based laser operations.
 - (k) Review of mission profiles to prevent misdirection of laser guided weapons.
 - (l) Type of eye protection to be worn and description of proper use.
 - (m) Potential hazards posed by the laser system (for example, backscatter, ignition of flammables, sensor disruption, or misdirection of laser guided weapons) and any other associated non-laser hazards.
 - (n) Risk considerations for location of personnel within the SDZ/weapon danger zone for observing/lasing the target area to weapons impact.
 - (o) A review of applicable range SOP information.
- (5) Guidance prior to laser operations. The OIC and LRSO also perform the following functions in advance of laser operations:
- (a) Review and approve laser systems and targets.
 - (b) Use only approved lasers on the range.
 - (c) Laser systems are used only at the approved operating position or firing points and always pointed toward the target; verify laser firing area/line/points and laser-to-target orientation.

- (d) Laser systems engage only authorized targets.
- (e) Target is positively identified in accordance with appropriate safety procedures before operation of a laser system.
- (f) Ensure all non-participating personnel in the immediate area of the laser firing position are outside the laser surface danger zone.
- (g) Target area is clear of all non-participating personnel.
- (h) Supervise pre-fire checks. Pre-fire checks that require operation of the laser system may be made in a controlled area with the laser beam terminated by an approved backstop. Pre-fire checks that do not require operation of the laser, but require use of the optics, may be safely made in any area. To use the optics without firing the laser, follow SOP to ensure power to the laser is turned off.
- (6) General guidance during laser operations includes the following:
 - (a) Communications are maintained between the laser system operators, Range Control, and all affected range personnel.
 - (b) Personnel follow safety procedures in accordance with local SOP.
 - (c) Training filters/modes are used, as required.
 - (d) PPE is being used, as required.
 - (e) Approved training plan is followed.
 - (f) Coordinate emergency response, as necessary.
- (7) Cease Fire Operations. If unsafe conditions are observed laser operations must be stopped. All/any personnel have the responsibility to call a CEASE FIRE when appropriate. The following are reasons to cease laser operations:
 - (a) Any specular reflection is detected in the target area.
 - (b) Poor target tracking is observed.
 - (c) Non-participating personnel and/or traffic enter the laser range or training area.
 - (d) Loss of communication with Range Control.
- (8) Procedures for laser incident investigations include the following actions:
 - (a) Ensure laser system involved in the incident is quarantined.
 - (b) Report the incident to the installation laser range authority in accordance with the local SOP and in accordance with paragraph 16–6.
 - (c) Provide information on training activity/exercise, as necessary.
 - (d) Provide information on what happened, where, when, and how.
 - (e) Provide information on personnel who may have been exposed to a laser hazard.
 - (f) Provide the essential parts of the pre-operational briefing.

Other safety considerations

- a. Laser-guided munitions and other laser detectors may unintentionally acquire radiation sources within the field of detection other than the target. Fields of detection vary and are specific to individual weapons and detectors or sensors. Training will be planned to ensure that the angle between the laser designator line of sight and laser detectors (such as laser-guided munitions or laser-spot trackers) will not allow the munitions to impact on the laser source or scattered radiation from the laser platform.
- b. Extreme caution will be taken when using a target designating laser in conjunction with ordnance delivery aircraft. The potential exists for the laser seeker of the munition to lock onto the designator or its radiated energy (beam or reflected beam) instead of the target. The following procedures will be followed to reduce this risk.
 - (1) The pilot of the attacking aircraft will confirm the location of the designator and the target before releasing munitions.

(2) Approach paths will be designated and briefed to both the designating and forward air controller personnel and the aircrews prior to conducting the mission. Aircraft approach paths will be planned to preclude crossing laser designator beams with the laser seeker. The laser seeker should intersect the designator beam well forward of the laser firing point, angling toward the target.

(3) Only participating personnel will be within the danger zone of the weapon employed. Additionally, only participating personnel will be located at the designator or close to a direct or reflected beam of the laser designator during operations.

(4) Munitions will not be launched or released toward the laser designator. See applicable TMs, FMs, current MIL-HDBK-828B, and doctrinal publications for recommended employment procedures.

c. NVDs can detect laser energy but they will not be used for LEP. These devices are not "cover-all" goggles; laser energy may enter the eye from offset angles where protection is not afforded. The damage threshold for NVDs may be as low as or lower than the damage threshold for the human eye. These devices can be bloomed (white out), damaged, or destroyed from exposure to laser radiation thus creating ancillary safety hazards.

Laser accident/incident reporting

Report all suspected laser accidents/incidents, regardless of injury, in accordance with AR 385-10, DA Pam 385-24, DA Pam 385-40, TB MED 524, BUMEDINST 6470.23, and AFOSH 48-139. The expeditious examination and treatment of laser eye injuries is critical in minimizing loss of visual acuity. Expeditious medical guidance is available through the Tri-Service Laser Injury Hotline at 1-800-473-3549 or 937-938-3764, DSN (312) 798-3764, or esoh.service.center@wpafb.af.mil.

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

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 2-11: Grenade, M76 66mm Smoke IR Screening

TECOM SOUM 3-11: Update on the Suspension of Firing of Projectile 155MM Smoke, White Phosphorous, M825 (D528), Screening

TECOM SOUM 4-11: Establishing Red Line Safe Distance for Known Distance Rifle Ranges

TECOM SOUM 5-11: MK312 MOD 0 40MM LV IR Tactical Marker Cartridge

TECOM SOUM 1-12: Employment of HLM Marker on Marine Corps Ranges

TECOM SOUM 3-12: THOR III Dismounted Crew 3.1 system

TECOM SOUM 3-13: MK322_1 and MK322 .50 CAL Reduced Range Ammunition

TECOM SOUM 3-13: .50 CAL Reduced Range Ammunition Enclosure 1

TECOM SOUM 1-14: Extension of Interim Period for Guidance for the Use and

Maintenance of Shock Absorbing Concrete (SACON) and Ballistic Concrete

TECOM SOUM 2-14: Extension of the Interim Period for Guidance for the Use of MK318

MOD 0 and MK319 MOD 0 Cartridges

TECOM SOUM 3-14: Interim Update to DA PAM 385-63 Tube Launched, Optically

Tracked, Wire-Guided (TOW) Missile

TECOM SOUM 4-14: Stinger Tracking and Launch Simulator (STLS)

TECOM SOUM 5-14: PAN Tool

TECOM SOUM 6-14: .50 CAL API

TECOM SOUM 7-14: Contractor-Owned Contractor-Operated Non-Standard Weapons

TECOM SOUM 8-14: Use of 5.56mm Ball, Carbine/Rifle, Barrier – MK318 MOD 0 and

7.62mm Ball, Carbine/Rifle, Barrier – MK319 MOD 0 Cartridges

TECOM SOUM 9-14: Training Conducted in Explosive Entry Techniques

TECOM SOUM 1-15: Multiple Cartridges 3-15

TECOM SOUM 2-15: Interim Update to MCO 3570.1C

TECOM SOUM 4-15: MK 20 MOD 0 IFBG

TECOM SOUM 5-15: 40mm Cartridge Red White Blue Signal

TECOM SOUM 6-15: RMTK

TECOM SOUM 7-15: SACON Extension

TECOM SOUM 8-15: SDZs for 5.56mm M855 Ball and 7.62mm M80 Ball Cartridges

TECOM SOUM 9-15: SDZ for MK330 MOD 0 .338 cal Lapua Magnum Cartridge

TECOM SOUM 11-15: SDZ for Fuze Multioption PGK XM1 156

TECOM SOUM 12-15: Use of the SKS and AK 7.62x39mm Variant Weapon System with

Blank-Firing Adapters and Blank Ammunition

TECOM SOUM 13-15: M769 60mm, M879, M879A1 81mm Full Range Practice

Cartridges

TECOM SOUM 2-16: Interim WDZ for GBU-12F_B 4-16

TECOM SOUM 3-16: Guidance for Use and Maintenance of SACON 5-13-16

TECOM SOUM 4-16: Interim replacement of DOD ID Code AB43 300 Winchester

Magnum 220 Grain Cartridge

TECOM SOUM 5-16: 9MM Blank Cartridges DODIC AC07

TECOM SOUM 6-16: Use of Contractor-Owned Weapon System with Internal and

External Blank-Firing Adapters

TECOM SOUM 7-16: F-35 Joint Strike Fighter's Electro-Optical Targeting System

TECOM SOUM 8-16: Small Unmanned Aircraft Systems Use Within Installation Ranges

and Training Areas

TECOM SOUM 1-17: Range Safety Guidance for Testing of the Compact Laser

Weapon System

TECOM SOUM 2-17: Interim Weapon Danger Zones for Guided Bomb Unit 12f_B

TECOM SOUM 3-17: Deletion of Area H of Tube-Launched, Optically Tracked, Wire-

Guided Missile Surface Danger Zone

TECOM SOUM 4-17: Use of the MK255 MOD 1, 5.56mm Reduced Ricochet Limited

Penetration, MK311 MOD 2, 5.56mm Frangible, MK262 MOD 1, 5.56mm Special Ball

Long Range, MK308 MOD 0, .40 Caliber Jacketed, MK309 MOD 0, .40 Caliber Full

Metal Jacket Ball, and MK326 MOD 0, .40 Caliber Frangible Cartridges

TECOM SOUM 5-17: Surface Danger Zone for 60mm XM1061 Enhanced Mortar Cartridge

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

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																											
Hazard Severity I Catastrophic: Death, permanent disability, major property damage II Critical: Permanent partial disability, major system or minor property damage III Marginal: Minor injury, minor system or property damage IV Negligible: First aid, minor system repair Mishap Probability A Frequent B Likely C Occasional D Unlikely Risk Assessment Code (RAC) 1 Critical 2 Serious 3 Moderate 4 Minor 5 Negligible				RAC Assessment Code Matrix			Command Review/Approval																											
H A Z A R D S E V E R I T Y				Mishap Probability					OIC: _____ XO: _____ CO: _____ RCO: _____																									
				<table border="1"> <tr> <td></td> <td>A</td> <td>B</td> <td>C</td> <td>D</td> </tr> <tr> <td>I</td> <td>1</td> <td>1</td> <td>2</td> <td>3</td> </tr> <tr> <td>II</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> </tr> <tr> <td>III</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> </tr> <tr> <td>IV</td> <td>3</td> <td>4</td> <td>5</td> <td>5</td> </tr> </table>							A	B	C	D	I	1	1	2	3	II	1	2	3	4	III	2	3	4	5	IV	3	4	5	5
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				I	1	1	2	3																										
				II	1	2	3	4																										
III	2	3	4	5																														
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 Assistance Range Safety Officer (ARSO) _____.
- e. The four weapons safety rules are:
 - a. Treat every weapon as if it were loaded.
 - b. Never point your weapon at anything you do not intend to shoot.

- c. Keep your finger straight and off the trigger until you are ready to fire.
- d. Keep your weapon on "safe" until you are ready to fire.
- f. The misfire pit is located _____ (if required).
- g. 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.
- h. 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 back blast area to ensure it is properly cleared.
- i. During firing, the ROIC will be located _____ and the RSO will be located _____ the corpsman will be located _____.
- j. The dedicated safety vehicle is located _____. The safety driver is _____. Strip map to hospital. Vehicle keys are located _____.
- k. 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.
- l. 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: _____.
- m. 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**.
- n. Overhead fire (is/is not) authorized for this range. The overhead firing procedures for this range are as follows: _____.
- o. If you should encounter a stoppage, apply immediate and/or remedial action (whichever 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.
- p. 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.)
- q. The uniform for this range is _____.
Hearing protection (is/is not) required on this range while conducting live fire.
- r. 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.

- s. 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.

- t. The weapons to be used on this range are _____. (Go over the condition codes for all weapons to be fired.)
- u. Are there any left-handed shooters (or throwers for hand grenades)?
- v. Does anybody wear glasses or contact lenses that does not have them?
- w. Brief any local range regulations that might apply.
- x. The designated smoking area is _____. Smoking is not allowed near ammunition.
- y. Helmets, flak jackets, and hearing protection will be properly worn and used.
- z. Ammunition issue point is located _____ and ammunition is properly stored and guarded.
- aa. No cross-range firing.
- bb. This concludes the range safety brief. Are there any questions?
- cc. 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.
- dd. 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.**
- ee. All ammunition dunnage will be taken _____. Ensure it is separated.
- ff. 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
- ___ Conduct a detailed inspection of the terrain to ensure no ricochet hazards are present.
- ___ Ensure all targets are set up.

- ___ Inspect target set-up and target design to ensure no ricochet hazards are present.
- ___ 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.
 - ___ 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.

OIC/RSO Sample Checklists Cont.

- ___ 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 ARSO 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.

System of work

- ___ Brief the scoring system.
- ___ Brief the ammo issue.
- ___ Brief road guard positions.

Note: Road guards should be positioned in pairs.

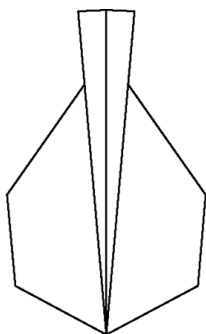
OIC/RSO Sample Checklists Cont.**Duties during live fire (sample)**

- ___ Ensure that shooters are wearing ear protection.
- ___ Check the down range area to ensure the environment did not change in regards to the ricochet hazards. If a hazard is created during training cease fire and correct the hazard. If you cannot correct the hazard, cease fire and contact Range Control.
- ___ 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)

- ___ Unload, show-clear. Do not forget about extra weapons.
- ___ Conduct a complete safety check.
- ___ Police call
- ___ Ensure details are appointed to take down targets, police call, etc.
- ___ Take down range flags. Regroup at a convenient location
- ___ Return range property.
- ___ Ensure during the conduct of your shoot, no new ricochets hazards were created. If ricochets hazards were created, correct the hazard. If you cannot correct the hazard, refer the issue to range Control for maintenance.

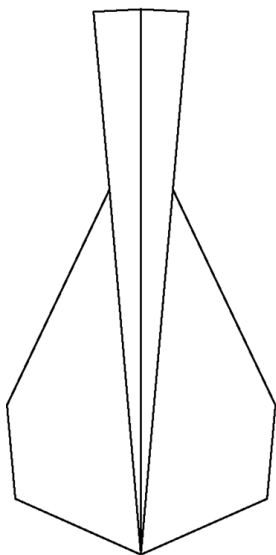
**12 Gauge Slug**

Scale: 1:25,000

Distance X: 1,073m

Impact Media: worst case

Vertical Hazard: 197m

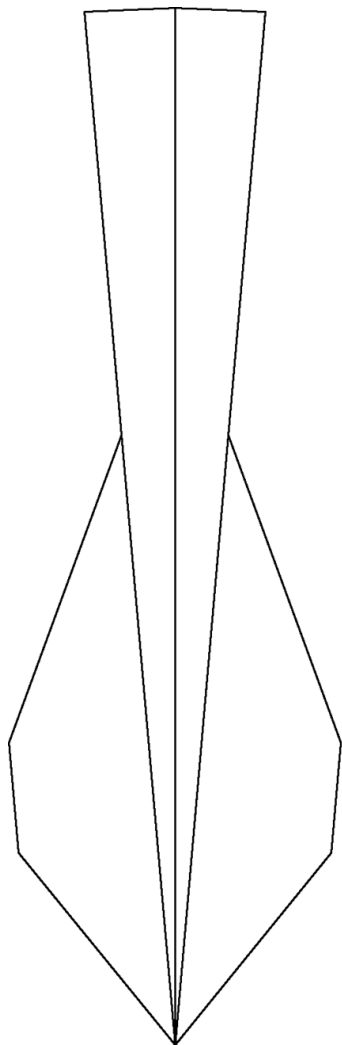
**M9 9mm M882**

Scale: 1:25,000

Distance X: 1,800m

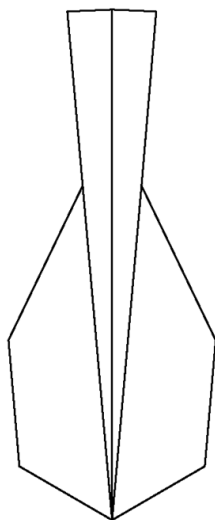
Impact Media: worst case

Vertical Hazard: 253m



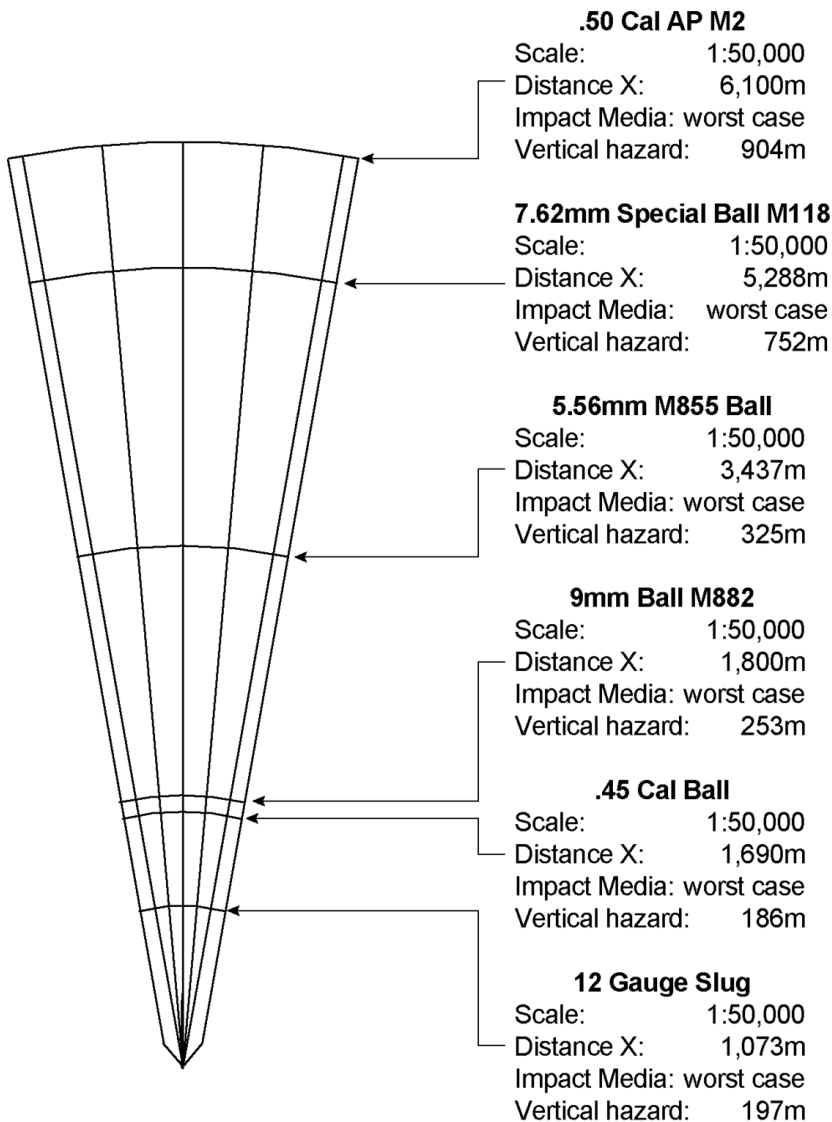
5.56mm M855 Ball

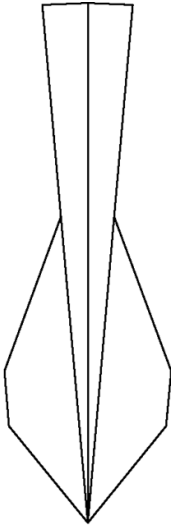
Scale: 1:25,000
 Distance X: 3,437m
 Impact Media: worst case
 Vertical Hazard: 325m



.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



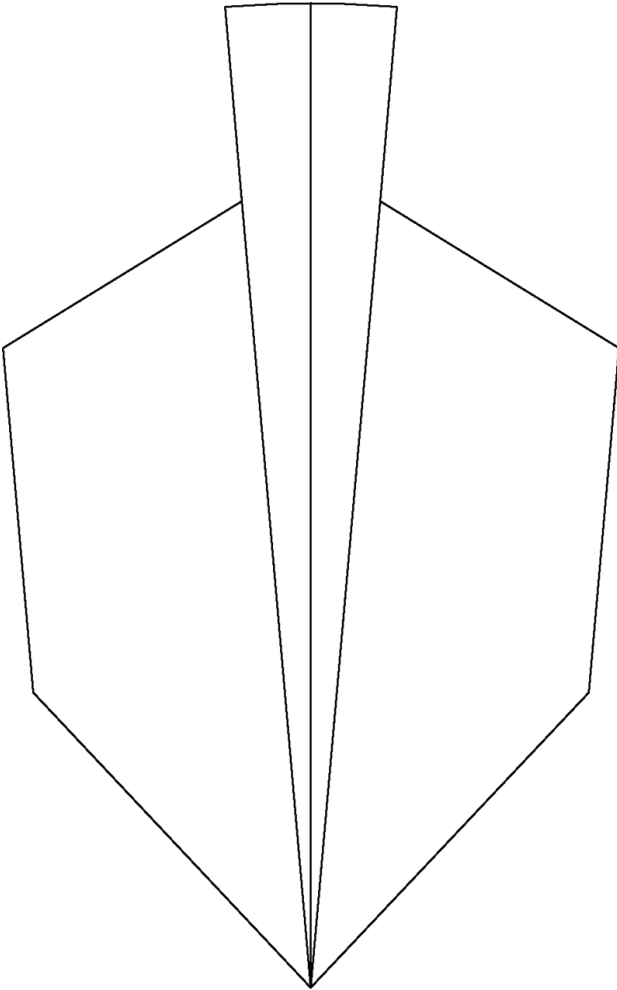
12 Gauge Slug

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



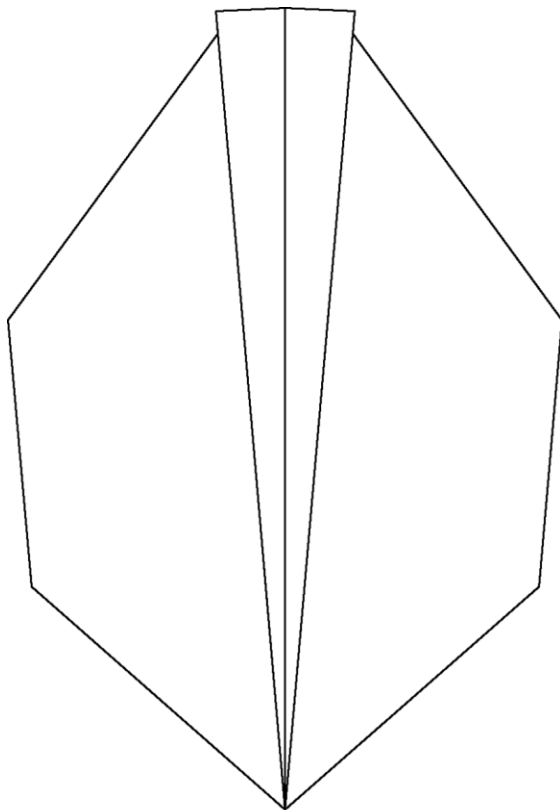
.45 Cal Ball

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



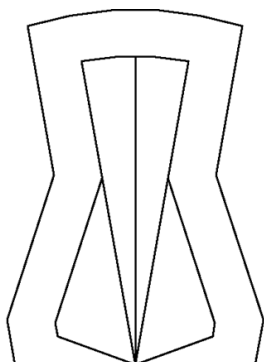
7.62mm Special Ball M118

Scale: 1:50,000

Distance X: 5,288m

Impact Media: worst case

Vertical Hazard: 752m

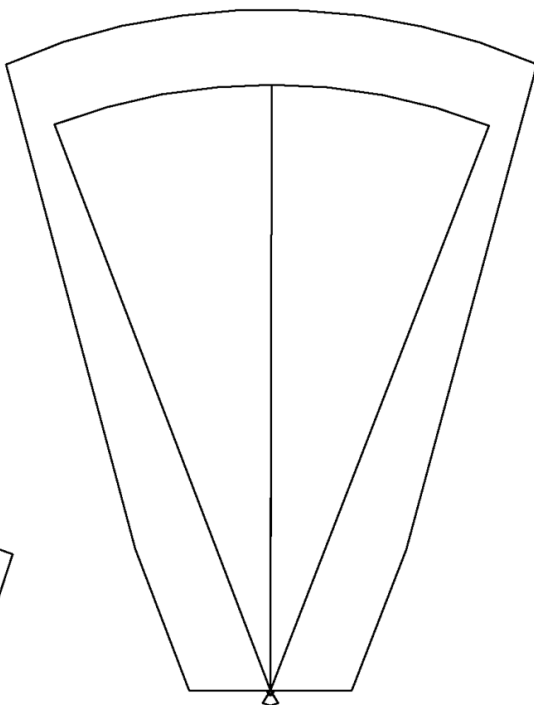


**40mm MK19 Mod 3
M430 HEDP**

Scale: 1:50,000

Distance X: 2,037m

Impact Media: worst case



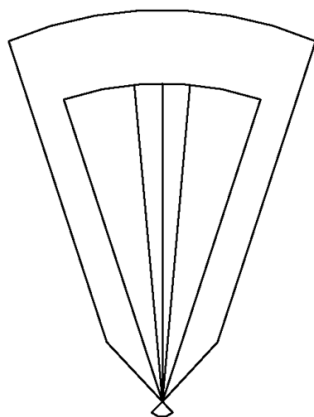
Javelin HE Warhead

Scale: 1:50,000

Distance X: 4,000m

Impact Media: worst case

5° launcher angle



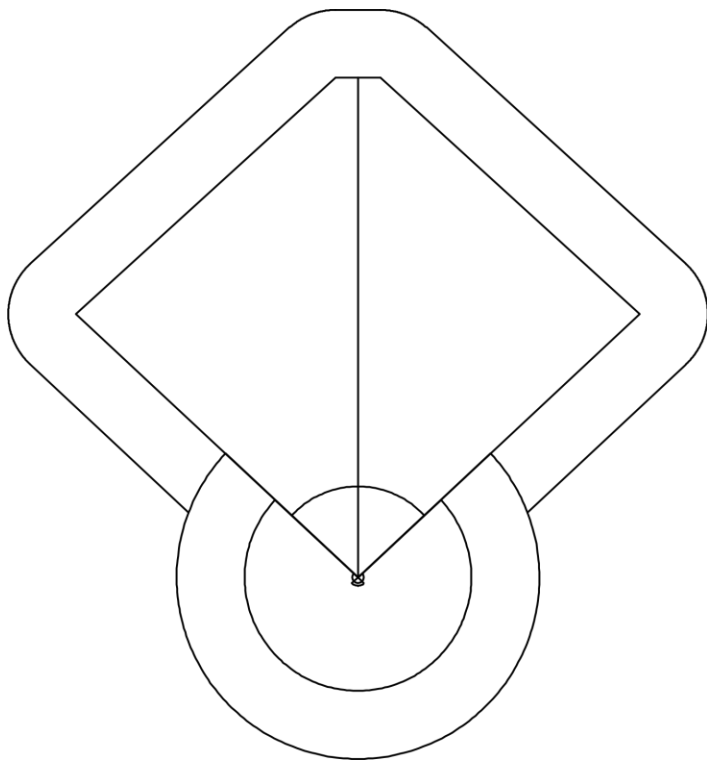
AT4 84mm HEAT

Scale: 1:50,000

Distance X: 2,100m

Impact Media: worst case

5° rocket angle

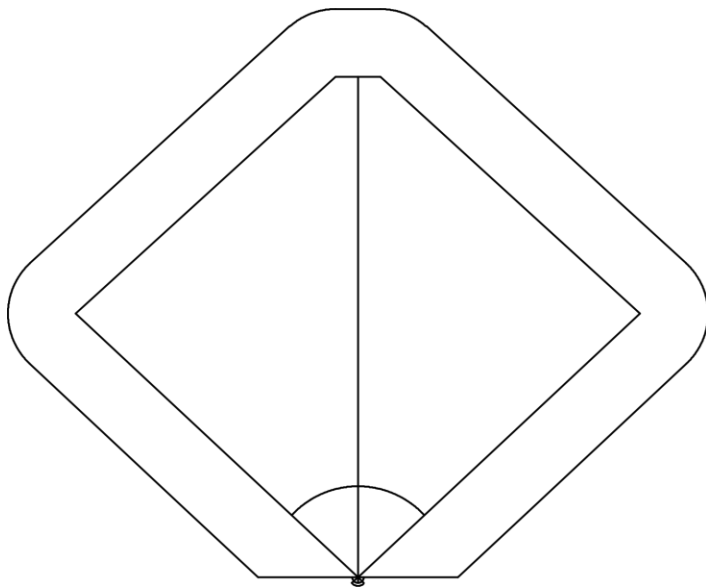
**TOW 2B HE Warhead**

Scale: 1:50,000

Distance X: 4,400m

Impact Media: worst case

5° launcher angle



TOW 2B HE Warhead
No area H

Scale: 1:50,000

Distance X: 4,400m

Impact Media: worst case

5° launcher angle