

MIL-HDBK-1027/3

MIL-HDBK-1027/3
 NOTICE 1
 15 April 1988

MILITARY HANDBOOK

RANGE FACILITIES AND MISCELLANEOUS TRAINING FACILITIES,
 OTHER THAN BUILDINGS

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NEW PAGE	DATE	SUPERSEDED PAGE	DATE
ix	15 APR 88	ix	30 NOV 87
x	15 APR 88	x	30 NOV 87
35	15 APR 88	35	30 NOV 87
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2. RETAIN THIS NOTICE AND INSERT BEFORE TABLE OF CONTENTS.

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2.5 Protective Baffling for Small Arm Ranges.

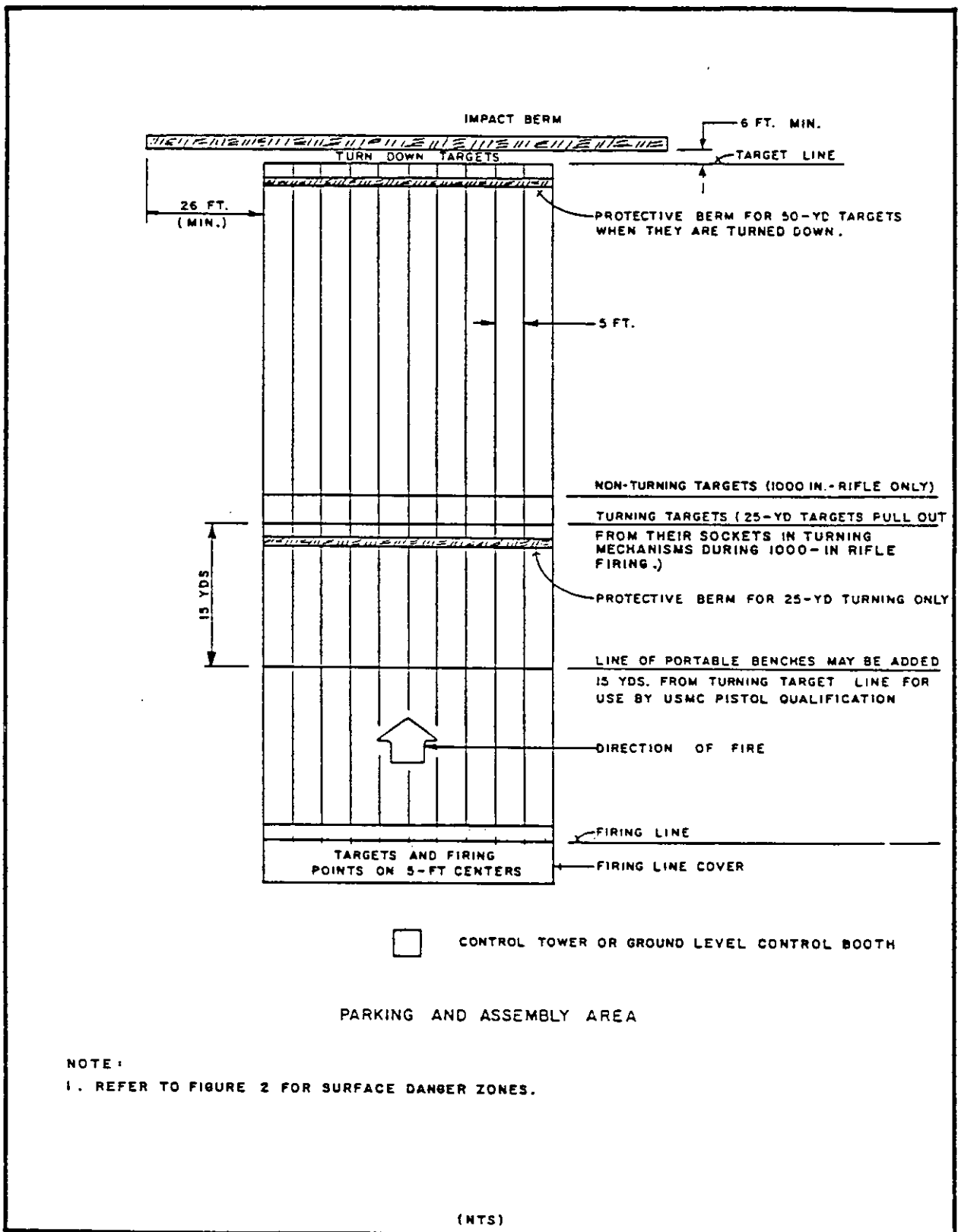
2.5.1 Geometry of Baffle System. The geometry of the baffle system shall be designed to minimize the chances of a projectile that is fired downrange from the firing line from leaving the range. Figure 4 shows the line of sight arrangement using vertical overhead baffles forward of the firing line. Baffles shall overlap line of sight by a minimum of 6 in. (152.4 mm). It is important that any baffle system be designed to not obscure the shooter's view of the entire target in both prone and standing firing positions. Additional baffles should be added downrange to assure that the bullet will impact the earth berm not less than 5 ft (60.96 m) from the top of the berm. Every overhead baffle beyond 200 yards should be figured for the prone firing position. In certain cases total baffling may not be required. Generally baffles should be provided to the extent of protection required. In an overhead system the firing line should be fixed. On variable distance ranges the target lines are movable.

2.5.2 Firing Line Canopy Shield. The overhead baffle or canopy shield extends at least 12 ft (11.64 m) in front of the firing line. This distance will be increased depending upon the position of the muzzle of the weapon in the most critical firing position. Appendix A, Figure A-8 shows one type of canopy shield. Overhead baffle designs may be used as canopy shield if appropriate for the weapons and ammunition to be used.

2.5.3 Overhead Baffles. Overhead baffles shall be spaced in such a manner as to prevent a bullet from being fired out of the range provided that the weapon is fired from the firing line and that it is fired downrange. The overhead baffles will extend horizontally to within one foot of the surface of side berms or protective side walls. Overhead baffles may be of any design shown in Appendix A, Figure A-6 or Figure A-7 provided the design selected is appropriate for the weapons and ammunition to be used. Baffles will be designed to withstand local windloads. Range baffles and supports in relation to side berms or walls will be arranged to allow equipment access to inside of range for maintenance.

2.5.4 Ground Baffles. Ground baffles, normally on pistol ranges only, shall be designed to contain bullets accidentally fired toward the ground and ground ricochets. Ground baffles have caused some problems with training techniques at some activities and are not recommended for combat ranges where baffles present a greater hazard to personnel as a trip hazard than for control of ricochets. For pistol ranges, a ground baffle just in front of the 25 yard (22.86 m) and 50 yard (45.72 m) line of targets may be required to protect the target mechanisms. Figure 5 shows three methods of target mechanism protection in order of preference: below grade mechanism trench; ground baffle; turf covered berm. These baffles should be just high enough to protect the target mechanisms. Because additional ground baffles add to range cost, they should not be added until other options to control ground ricochets have proven ineffective.

2.5.5 Side Berms or Protective Side Walls. Side protection may be in the form of earthen berms, continuous walls, or wing walls. Wing walls are discontinuous side protection walls set at angles to the line of fire. Wing walls will be arranged and overlapped so that a shooter at any firing point cannot shoot through openings in side walls. Side berms and walls shall be a minimum of eight feet above grade at the highest firing point in order to



NOTE:
1. REFER TO FIGURE 2 FOR SURFACE DANGER ZONES.

(NTS)

Figure 9
Outdoor Pistol (And Rifle) Range Layout - Open Range

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protect inhabited areas or occupants of adjacent ranges from misdirected fire. When side walls or wing walls are combined with overhead baffles in a fully protected range, they will be at least as high as the top of the overhead baffle, but shall be designed to prevent the escape of any round that is fired from the firing line and also passes just under the bottom of the last downrange overhead baffle.

2.5.6 Multiple Firing Line Baffle Ranges. For the design of a multiple firing line baffling system the same procedures and requirements should be followed as in the case of designing a single firing line baffle system except that the designing begins at the firing line closest to the backstop; then working back from that line, follow the same procedures outlined for a single firing line system. For a fully baffled system, a canopy shield must be provided at each firing line.

2.5.7 Fixed Firing Lines and Movable Target Lines. Commercial pop-up and turning targets are recommended where funding is available. Protective berms will protect the mechanisms (see Figure 5 for examples). Where short range turning targets must be removable to enable shooting at a longer range target consideration should be given to the various commercially available target transport systems.

2.5.8 Material Choices for Baffle Design. The construction of the baffled system shall be designed for ease of maintenance, economy of construction, availability of material, sound abatement, and prevention of ricocheting. Para. 2.1.3.6 and Figures A-6 and A-7 of Appendix A provide some material options.

2.5.8.1 Roof Structures. Roof canopies forward of the firing line will incorporate the firing line canopy shield and will be constructed at least equivalent to the overhead baffles. That portion of the roof back of the firing line may be normal roof construction and shall slope for drainage. Roof construction will incorporate sound reduction material, if noise reduction is required.

2.5.8.2 Concrete Baffles. Concrete vertical overhead baffles may be precast or poured in place and shall be designed and clad with wooden covering to prevent ricocheting. A vertical unclad concrete overhead or ground baffle is susceptible to impact erosion, while unclad dense concrete set at 27° or less with direction of fire will actually allow the bullet to travel along the concrete surface with little damage.

2.5.8.3 Composite Overhead Baffles. The use of wood and steel laminated baffles is permitted. Where only one steel plate is used, it must be capable of withstanding the most powerful cartridge normally fired on the range, .357 magnum for pistol ranges and 7.62 mm for rifle ranges. Single plate design will be faced with 3/4-in. (19.05 mm) exterior grade plywood. The plywood should be positioned to provide an air space of approximately 3/4-in. between the wood and steel plate. Another option, Type OB-5 in Appendix A, see Figure A-7, using timber poles for support, is a steel plate faced with 3/4-in. exterior grade plywood and a second unsheathed plate behind it, separated by the diameter of the timber pole. The bullet tumbles as it passes through the first plate and is stopped by the second plate. The two plate design using 1/4-inch steel is suitable for 7.62 mm, 5.56 mm, and cal. 30 (30-60) Ball ammunition.

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2.5.8.4 Wood Baffles. Wood in wood baffles shall be a minimum of 2-1/2 in. (63.5 mm) in actual thickness. Each layer of wood in all wood baffles will be laid at right angles to the adjoining layer. Joints in each layer will be staggered in relation to joints in adjoining layers, to prevent the penetration of projectiles at the joints. Refer to Appendix A, Figure A-6 for wood and wood combination panels.

2.5.8.5 Protection of Structural Members. Wood will be applied to wood structural members and shall be of adequate thickness to prevent damage to the structure by the penetration of projectiles. The outer layer of wood must be readily replaceable after projectile damage. The damaged outer layer may be covered with a new layer of wood to eliminate the cost of removal of damaged layer and to further protect structural members. Structural members in wooden overhead baffles may be further protected with plate metal behind the outer wood layer. Wood 3/4-in. minimum actual thickness (or commercial baffle specifically designed for the purpose) positioned to provide approximately 3/4 in. interface airspace will be applied to steel and concrete baffle support posts to reduce ricochets and support damage. Cannot shoot through openings in side walls. Side berms and walls shall be a minimum of eight feet above grade at the highest firing point in order to protect inhabited areas or occupants of adjacent ranges from misdirected fire. When side walls or wing walls are combined with overhead baffles in a fully protected range, they will be at least as high as the top of the overhead baffle, but shall be designed to prevent the escape of any round that is fired from the firing line and also passes just under the bottom of the last downrange overhead baffle.

2.5.8.6 Grade of Lumber. Material for firing side of all baffles will be middle grade lumber; pine, oak or redwood is acceptable. Exterior grade plywood will be acceptable for baffle construction. Exceptionally hard or knotty wood shall not be used. Material on the back side of baffles may be of lower grade and/or higher density. Preservative treated lumber will be used in the construction of wood baffles. Wood posts in ground contact shall be pressure treated with preservatives and stamped for use in ground contacts or below ground.

2.5.8.7 Material Connectors. Metal connectors for structural members, fasteners and bolts larger than 1/4-in. within 25 yards (22.86 m) of the firing line must be recessed and covered to prevent striking by projectiles and ricochets.

2.5.8.8 Side Berms or Protective Side Wall Construction. Side berms or Protective side wall construction is designed to contain bullets accidentally fired to either side of the range. Side protection may be of various materials and material combinations. Wood, earthen berms, 8 inches poured concrete, and concrete block construction may be used. Concrete block walls used for side protection shall be hollow core and a minimum of 12 in. (304.8 mm) thick. The cavities of the concrete blocks shall be filled with concrete or gravel. Downrange when the angle to fire line is approximately 27° to direction of fire, precast concrete panels without cladding may be used to deflect ricochets back into the range. Other designs will be acceptable, such as 8 in. heavy timber or laminated wood/steel panels matching overhead baffles, if steel plate in the panels is appropriate for weapons and ammunition to be fired.

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2.5.8.9 Berm Construction. Embankments will be constructed of approved fill materials for the locale. The front of the berm facing the inside of the range shall have three feet of rock-free material. Periodic maintenance of face of berm is essential. Danger of backsplatter and ricochet increases as accumulation of lead increases. Fill shall be placed in layers and compacted to minimize erosion. The requirements of para. 2.3.7 shall be adhered to.

2.6 Machinegun Ranges. The standard firing distance is 25 m. The M-16 and the .22 caliber rifle may also be fired on the machinegun range.

2.6.1 Surface Danger Zone. Provide an open range surface danger zone as indicated in Figures 2, 2a, or 2b.

2.6.2 Targets. The following are types of targets which may be used.

2.6.2.1 Stationary Targets. Stationary targets shall be spaced in the field to suit local conditions and training requirements.

2.6.2.2 Moving Targets. One type of rolling target is shown in Figure A-10. Other types are commercially available and should be considered in making the layout. Targets will be engaged within specified limits. Bullet impact berms and vertical baffles must cover all shots within these limits.

2.6.3 Salvage Wall (Impact Berm). When available, a cut slope or hillside should be used as a salvage embankment to the rear of the targets or an earth impact berm will be provided as shown in Appendix A, Figure A-10. Newly constructed machinegun ranges will have either a salvage wall or a salvage wall and an impact berm.

2.6.4 Storehouse and Toilet. A target storehouse and toilet should be placed adjacent to the range, unless such facilities are located nearby.

2.6.5 Other Facilities. Provide electric power, protected ready ammunition, and a first aid station. For criteria, refer to Rifle Ranges.

2.7 Composite Small Arms Ranges. Where site conditions permit, rifle, pistol, and machinegun ranges should be located close to each other. Composite ranges may overlap under controlled conditions, if necessary for use. Common support facilities may then be located for convenient use by personnel on all ranges (refer to Section 3).

2.8 Shot Gun Ranges. Criteria for shot gun ranges shall be as defined in paras. 2.8.1 through 2.8.3.

2.8.1 Surface Danger Zone, Riot Gun Ranges. For design criteria, refer to MCO P3570.1A, Figure 6-3, for firing 12-gauge riot guns using cartridges loaded with 00 buckshot or smaller.

2.8.2 Maximum Range. Refer to Table 3 for riot gun ranges.

2.8.3 Skeet and Trap Ranges. Refer to Planning and Design of Outdoor Sports Facilities, NAVFAC P-457 for electrically operated skeet and trap ranges. Design for 12-gauge, shot size 7-1/2, 8, or 9 standard and reduced

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loads. Maximum range for 7-1/2 shot is 740 yards, for 8 shot is 720 yards and for 9 shot 670 yards in accordance with NRA references. Magnum loads of any size and shot sizes heavier than 7-1/2 are prohibited. This range may be used to teach shotgun marksmanship.

2.9 Combat Marksmanship Course. Design the combat marksmanship course for a five-man team or as determined during range planning phase.

2.9.1 Targets. Equip the course with electrically controlled pop-up targets, spaced intermittently throughout a course length of approximately 300 yards (274.3 m).

2.9.2 Control Tower. Provide a control tower of adequate height for observing targets and personnel using the course. Equip the tower with a control board to regulate the operation of the targets.

2.9.3 Power. Provide electric power and furnish a subsurface duct to carry electrical wiring from control tower to target manholes.

2.9.4 Target Storage. Provide a storehouse for targets, and manholes to house pop-up targets.

2.10 Protection of Personnel. Refer to Table 4 for protection of personnel against individual hits of small-arms and for required thicknesses of cover. These thicknesses will not provide positive protection against continued burst firing.