Stationary Infantry Targets

SIT, DTASIT, WSIT, and IM
General

The Stationary Infantry Targets section covers the following targets and emplacements:
Stationary Infantry Targets (SIT), Double Target Arm SIT (DTASIT), Widened SIT (WSIT),
Narrow SIT (NSIT), and Iron Maiden (IM) Targets. Use the requirements in this RDG section
for target arrays and grouped targets on small arms ranges. Target clusters on mounted maneuver
ranges have special additional requirements; refer also to the separate Infantry Target Clusters
Section of the RDG.

Use the standard SIT emplacement for the installation of a SIT target and/or for the installation
of a DTASIT or other downrange devices such as the Mortar Simulation Device (MSD), Battle
Effects or Sound Effects Simulator (BES or SES), Hostile Fire Simulator (HFS), Radio
Frequency (RF) mesh network access point (NAP), etc. Use the WSIT for the installation of two
SIT lifters in the same emplacement, when two or more devices are required at the same
location, or when the amount of electrical power and/or data equipment requires additional front
wall space. Use the NSIT for emplacements that do have all of the standard power and data
requirements, (e.g. some pistol and RF controlled target ranges). Iron Maiden (IM) Targets are
non-automated steel targets that do not require power or data, refer to the section at the end of
this document. See the standard Civil and Electrical detail drawings for additional specific
dimensions and details for each type.

Range designers should refer to the Inspection Checklists provided in the RDG to ensure that all
required items are included in the design.

Civil/Siting

This section covers the Civil Engineering and Siting issues unique to these types of
emplacements. Refer to the separate range sections of the RDG for additional siting issues
specific to a particular range. See the special sections below for additional information particular
to a specific target type.

Emplacement

The standard SIT emplacement is typically a concrete emplacement (coffin) with a protective
earthen berm. It has a treated timber, to help protect the front wall, and a gravel drainage layer.
Either precast or cast-in-place concrete is acceptable. Installations may prefer other materials for
the coffin, which is acceptable as long as it is durable, provides protection, and is compatible
with the electrical and target equipment. The compacted earth berm provides the protection for
the coffin and installed equipment from all anticipated directions of fire. The concrete
emplacement does not provide significant protection. Orient the emplacement toward the
anticipated direction of fire.

Mount all SIT emplacement permanent electrical and communication boxes on the front wall of
the emplacement no less than 50 mm (2 in) below the top of the emplacement wall. This
mounting height helps protect them from rounds that might skim over the top of the berm. The
targetry provider installs the target mechanism on the floor of the concrete emplacement as far
forward as practical to minimize its potential to be hit by a low round, yet still allow access to the
electrical/data boxes.
Above-Grade Emplacement:

Above-grade emplacements are the most common in range construction due to their ease of drainage, ease of obtaining line-of-sight, and small disturbance to the existing grade.

Below-Grade Emplacement:

Below grade emplacements blend with the natural terrain and do not present the target position profile to the soldier/firer. Unfortunately, below-grade emplacements present several design issues as follows:

Drainage:

Positive drainage is harder to achieve on a below grade emplacement. Floor drains are problematic in that they require a lower elevation nearby for a daylight drain and tend to clog. Drainage swales increase excavation requirements.

Unexploded Ordnance (UXO):

UXO disturbance potential increases with the depth of excavation. While an above-grade emplacement might only require disturbing the surface to 150mm (6in) below natural grade, below-grade emplacements often require excavation of 1m (3ft) or more. For medium and high-risk areas, normally a subsurface clearance to a depth of one foot below the construction footprint is required.

Line-of-Sight:

Line-of-sight between the firing position and the target emplacement may not be possible using the natural terrain.

Other debris:

Below-grade emplacements also tend to gather more sand, snow, dirt, trash, and other windblown objects, which can cause maintenance problems.

The designer should discuss with the installation whether they desire above or below-grade SIT emplacements, while ensuring that the installation understands the design issues and costs associated with either choice.

Drainage

Ensuring proper drainage is critical in the design and construction of target emplacements. Even though the electrical and target equipment is designed for outdoor installation, many of the issues with range targetry can be avoided with proper emplacement drainage. The ground should slope away from the emplacement whenever possible; add swales as necessary to ensure positive drainage. The floor of the emplacement must slope to the rear. Special care is required in the use of floor and trench drains, as they tend to clog easily and freeze in some climates. Ensure proper compaction under the emplacement to avoid differential settlement. Drainage is especially critical on newly constructed ranges before vegetation is fully established.

Target Clearance
No obstruction may be present which interferes with travel of the target from the up to down position. Provide a minimum of 2.3m (7.5ft) clear space from the face of the emplacement wall.

**Wall Height**

The front wall and berm must be high enough to protect the targetry equipment while still allowing the target to be visible from the firing position. The standard (minimum) front wall height is 457 mm (18 in). The height has been coordinated within the program as the minimum that hides both the electrical equipment and the targetry based on a relatively flat angle of fire from the shooter to the target, generally +/- 2 degrees.

**Angle of Fire**

The angle of fire (AOF) from the gun barrel to the target is a critical parameter on a range and affects the functionality in a number of ways. Certain range and weapon types have a limit on the allowable angle of fire, e.g. a Known Distance range limits the AOF to +/-2 degrees. Refer to the installation trainers, applicable training manuals, and the RDG section for additional information and guidance. In addition, the amount of the target that is visible to shooters can affect the ability to qualify, i.e. it is harder to hit the target when only half of it is visible. Finally, rounds can hit and damage targetry and electrical equipment on higher angles of fire.

The standard SIT emplacement with an 18-inch front wall and a 2-percent slope on the berm provides adequate protection for AOF of +/-2 degrees. Greater angles require special design consideration. Higher negative angles may require increasing the front wall height, adjusting the slope of the berm to match the AOF, or some other method. Theoretically, the minimum wall height hides the electrical equipment, including the target arms and clamps, up to a -10° AOF, but the berm does not protect the concrete. In situations with a positive AOF, greater than 2 degrees, the berm itself begins to hide the target. Adjustments to the berm slope may be necessary.

On ranges where target engagement is from multiple points, the designer must coordinate closely with the installation and the targetry provider to determine the correct front wall height. The emplacement protection is also critical for aviation gunnery.

**Berm Criteria**

The Target Protection Design Curves in the RDG provide the recommended thickness for emplacement protective berms. The curve thicknesses provide protection from many bullet impacts; the amount of soil needed to stop a single round is significantly less. The berm must protect the emplacement from all anticipated directions of fire, but is thickest in the expected direction of fire. Use thinner berms to protect the emplacement from occasional directions of fire and ricochets. The standard berm extensions are ¼ of the berm thickness; see figure below.

Determine the berm thicknesses based on projectile type, soil compaction, and the in-place soil density. In addition, the designer must coordinate with the range trainer or user to determine the appropriate berm thickness for each target, since individual target siting may dictate added target protection. For example, when SIT emplacements are in front of or behind a MAT or SAT, the
Emplacements will need to be designed to withstand the largest weapon system that will engage that group of targets. At a minimum, berm widths will be at least 4 feet to facilitate ease of maintenance.

The worst case for berm wear on SIT targets is on small arms qualification ranges, MRF/ARF/AFF. Historical experience shows that, under normal usage, well-compacted berms, designed with the recommended widths require maintenance cycles of 6-months or more on these type of ranges. Ranges without fixed firing positions and those with lower usage can go much longer between maintenance cycles.

**Direction of Fire**

The direction of fire (DOF) is the horizontal angle from perpendicular to the target. The standard berm provides full thickness protection for DOF of +/- 20 degrees and adequate protection to +/- 30 degrees or more. Due to SDZ and range safety considerations, it is uncommon to engage targets regularly at larger DOF; coordinate with the RTLP MCX in those cases. The standard berm will protect the electronics and mechanism from errant rounds and ricochets to much higher DOF, up 90 degrees.

**Weather Considerations**

In regions with large quantities of blowing sand or snow, consider providing elevated target mechanism platforms and emplacement covers. The elevated target mechanism platform allows
for shoveling out snow and sand, while the emplacement cover keeps the accumulation of blown or fallen material to a minimum. Consider access for snow removal equipment as well.

**Electrical/Communications**

This section documents the electrical/communication requirements and equipment installed in a SIT emplacement. It primarily focuses on standard targets with hardwired power and data; a paragraph below has information on battery-operated targets. The Downrange Power & Data Distribution Sections of the RDG describe requirements for downrange power distribution, data networks, transformers, trenching, etc. Use those sections in addition this document to design a complete range. In addition, since some range types have power and data requirements that differ from the standard, (e.g. CP/MPFQC), refer to the specific range section for details.

**Target Emplacement Wall Configuration**

Refer to the emplacement elevation figures below and the electrical detail drawings for typical wall configurations. The electrical equipment required in each SIT emplacement are the 1) Load Center (LC), 2) Target Power Receptacle (TPR), 3) Auxiliary Power Receptacle, 4) GFCI Maintenance Receptacle (MR), 5) and the data enclosure, along with the associated wiring and conduits which are not detailed in this document. The load center contains the secondary branch circuits and provides feed-through capability to the load center in the next adjoining target emplacement. Mount all boxes and receptacles on the front wall of the emplacement no higher than two inches below the top of the emplacement wall; this protects the boxes and receptacles from low rounds that might skim the top of the emplacement wall. The standard electrical detail drawings in the RDG include detailed drawings of the electrical equipment requirements for SIT emplacements.

![Representative SIT Elevation Drawing (Not to Scale)](image-url)
Routing

All conduits and/or cables should enter and exit from the side or rear of the emplacement. This cable routing helps to minimize damage to the cables from range operations and maintenance crews performing berm repair.

Grounding

Grounding is required for safety at each downrange emplacement or equipment location. Install a 19mm (3/4 in) by 3,050mm (10ft) copper-clad steel ground rod to a depth of 305mm (1 ft) below finished grade at each emplacement or equipment location. Connect the MTDP/TDP and load center equipment to the emplacement’s single ground rod with a #6 AWG bare copper conductor using exothermic welded connections. Bond all data cable armor or shields to the ground bar in the MTDP/TDP. The design includes an 1829 mm (6’) coil of #6 AWG bare copper wire for the target installer to ground the target mechanism.

Surge Suppression

Provide surge protective devices (SPD) in the load center of all target emplacements. The target vendor provides surge suppression for the data communication cables during the installation of targets.

Conduit and Cable Fittings

All penetrations into the MTDP or TDP must be made with fittings approved for use with a NEMA 4, 4X or 6P enclosure. Non-compliance with this requirement will result in equipment failure. The standard electrical detail drawings in the RDG illustrate the preferred sealing method. Foam filled conduits are not acceptable. The SIT load center only requires a
NEMA 3R rated enclosure. Provide fittings approved for use with a NEMA 3R enclosure for connection to the load center.

**Target Outlets**

Target Power Receptacles and Auxiliary Power Receptacles must be equipped with a waterproof enclosure approved for use with the power plug inserted and unattended, according to NEC 406.8(B) (2). The tables and figures below show emplacement outlet configurations:

<table>
<thead>
<tr>
<th>TARGET POWER RECEPTACLE</th>
<th>AUXILIARY POWER RECEPTACLE</th>
<th>FIBER OPTIC CABLE CONNECTORS</th>
<th>CATEGORY 5e OR BETTER CABLE CONNECTORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEMA L14-20R</td>
<td>NEMA L5-20R</td>
<td>Type “SC”</td>
<td>MALE, RJ45</td>
</tr>
</tbody>
</table>

**SIT Emplacement Target Interface Specifics**

**TARGET POWER OUTLETS (TPO)**

TARGET POWER RECEPTACLE (TPR) – AUXILIARY RECEPTACLE (AR)
Standard Target Interface

All targets operate at 240 Volts. Power is supplied to the target through a 120/240V cord and plug connection. The target emplacement includes a standard 120/240V receptacle, supplied power through a circuit breaker. There is also an auxiliary 120V outlet for additional devices or training aids. Thermal blankets are the most common devices that use this power outlet. The specific components used to supply power to the target mechanisms installed inside each target emplacement is fully defined in the remaining sections.

Target and training device communication is accomplished by equipment installed inside the data enclosure located in each target emplacement. All networking equipment will be provided with the target mechanism when the target mechanism is purchased. The target mechanisms are normally purchased with Other Appropriations-Army (OPA) funded target installation contracts. The range data infrastructure should be installed with data cables to the target emplacement and these cables should be properly terminated inside the target emplacement data enclosures. These data enclosures are referred to as either a Target Data Panel (TDP) or a Master Target Data Panel (MTDP), and they are fully defined in other sections of this document. The target mechanism installer will interface with the data cables inside these enclosures during the installation of the targets. The schematic below provides an overview of the wiring responsibilities inside the data enclosures.

<table>
<thead>
<tr>
<th>EMPLACEMENT TYPE</th>
<th>POWER FEED TYPE</th>
<th>PEAK LOAD</th>
<th>STATIC LOAD</th>
<th>DESIGN LOAD</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIT with Thermal Blanket</td>
<td>120/240V, Single Phase</td>
<td>700VA while raising or lowering target. Add 260VA if Thermal Blanket is utilized</td>
<td>50VA Thermal Blanket 260VA</td>
<td>960VA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td>960VA</td>
</tr>
</tbody>
</table>

*EMPLACEMENT TARGET POWER TABLE*
The Master Target Data Panel (MTDP), or the Target Data Panel (TDP) must be rated NEMA 4, 4X, or 6P depending on environmental conditions (refer to Conduit and Cable Fittings section below for connections). The MTDP/TDP contains the electronics for local target operation, including data cable splicing and terminations. Data cabling shall enter and exit the data panels through approved cable seal fittings (refer to Conduit and Cable Fittings below). All fiber optic cabling will be terminated with SC type connectors, and the network cables will be terminated with CAT 5e or better rated RJ45 connectors. The MTDP and TDP provides space for Other Appropriations-Army (OPA) funded equipment which may include the fiber optic jumpers, switch/media converter, target data outlet, and network cables. The OPA equipment is installed by others and not the MILCON contractor. The designer must ensure the dimensions of the data panel are consistent with those dimensions stated on the detail plans for the MTDP and TDP equipment. A 120v AC power outlet is provided in the TDP for “Use by Others”. The TDP and the GFCI maintenance receptacle may utilize the same power circuit, but the TDP equipment must be wired ahead of the maintenance to ensure no nuisance tripping occurs. Reference the Electrical and Civil Details in the directory of the Range Design Guide for more information pertaining to the MTDP, TDP and their mounting requirements.

**Target Data Connection**

All automated targets are connected to the data cable infrastructure through copper patch cables provided by the target vendor. The interface point between the facility infrastructure and the target installation occurs through the faceplate in the weatherproof outlet box installed immediately adjacent to the MTDP or TDP enclosure. The target vendor will penetrate the
faceplate on the outlet box and install a weatherproof coupling mechanism that mates with the patch cord provided with their targets.

**Environmental Limits**

The temperature and humidity limits for electronic equipment are as follows:

- Non-operating and operating temperature: -34°C (-30°F) to 60°C (140°F).
- Humidity: 5% to 95% RH (non-condensing).

**Battery Operated Targets**

Targets that are battery operated do not need any of the electrical equipment in the SIT. Depending on the soil conditions and other factors, a ground rod may be necessary; coordinate with the RTLP-MCX.

**Iron Maiden Targets**

Iron Maiden (IM) targets are non-automated, steel targets primarily used in sniper training. They do not require any power or data connections. OPA provides the targets. Range Personnel typically place the targets at unknown distances around the range. However, there are certain instances where a prepared gravel pad is necessary. Some ranges, e.g. Sniper Field Fire, require a gravel pad with line of sight from the firing position at specific distances. The gravel pad should be 2 meters (6 feet) square. On ranges where the terrain does not allow sufficient areas for placement of IMs at unknown distances or in high risk for Unexploded Ordnance (UXO), prepared IM positions may be required. This should be coordinated with the installation and trainers during the planning and design process.
1. CONCRETE Rail DEVELOP A MINIMUM COMpressive STRENGTH OF 30MPa (4250psi) 28 DAYS AFTER PLACING.

2. EMPLACEMENTS SHALL Be CONSTRUCTED OF STABILE MATERIALS THAT WILL NOT DISPLACE OR FAIL UNDER SERVICE CONDITIONS.

3. ALL REINFORCING STEEL SHALL Be PER ASTM STEEL, GRADE A500B.

4. AREAS DISTURBED BY CONSTRUCTION ACTIVITIES SHALL Be REVEGETATED OR ENSURED FROM WATER INTRUSION.

5. BASES OF TARGETS Shall Be COMPLETE With CONCRETE.

6. ALL DIMENSIONS ARE INDICATED As FOLLOWS: METRIC UNITS [ENGLISH] For INSTANCE, "1200mm x 152mm x 300mm"

7. HORIZONTAL CONTROL POINT (A) IS LOCATED 7.5m FROM THE VARIOUS POINT.

8. PERCUT 1200mm (4') Walls, CHAMPS ON ALL EXPOSED CONCRETE SURFACES.

9. LABEL EACH EMPLACEMENT COORDINATE 16T HANGING CONTROL, For HISTORY SCHEME.

DESIGNER NOTES:
1. REFER TO THE STATIONARY INFANTRY TARGETS WRITING UP THE FROG FOR ADDITIONAL INFORMATION AND REQUIREMENTS.

2. THE MINIMUM FRONT WALL HEIGHT OF 3000mm (10') PROVIDES FURTHER PROTECTION FOR THE TARGETS AND ELECTRICAL EQUIPMENT. INCLUDING THE TARGET Arms, SPAN A VARIABLE DIRECTION WALLS OF MAXIMUM 914mm (3') ON CENTER. ATTACH STRENGTHENING TO THE WALLS, REDUCE TARGET VISIBILITY.

3. RETAINING WALLS MUST Be CONSTRUCTED OUT OF ADEQUATELY CONNECTED TREATED TIMBER 152mm x 152mm, 203mm x 203mm, 914mm x 914mm. THE FULL HEIGHT OF WALL DESIGNED BASED ON LOCAL CONDITIONS.

4. REFER TO THE TARGET EMPLACEMENT PROTECTION SECTION OF THE RIF FOR THE REQUIRED REINFORCEMENT AND BERM EXTENSION.

5. SIX EXTENSIONS OF 0.75 OF THE BERM THICKNESS PROVIDES FURTHER PROTECTION FOR DIRECTIONS OF FIRE UP TO 30 DEGREES AND ADEQUATE PROTECTION UP TO 45 DEGREES.

6. THE DESIGN MUST Include positive drainage away from the target, INCLUDIN BELOW GRADE EMPLOYMENT.

7. THE 30mm (1') BERM Slopes Are TYPICAL, ADJUST BASED ON A SITE-SPECIFIC GEOLOGICAL REPORT.

8. THE 30mm (1') CLEAR SPACE BEHIND THE FRONT WALL OR TARGET INDICATIONS IS TYPICAL.

Stationary Infantry Target Emplacement