Moving Infantry Target

(MIT)

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General

The Moving Infantry Target (MIT) emplacement is used for the installation of a MIT target. There are two standard MIT track lengths, 15m and 40m. The emplacement adds an additional 2m space at the up-range end for the installation of the electrical equipment. See the standard Civil and Electrical detail drawings for dimensions and details. The MIT emplacement is normally at a 45-degree angle from the engagement point but can vary between 90 degrees (perpendicular to the shooter) and 30 degrees, with 30 degrees being the minimum. The block outs for the Load Center (LC) and Master Target Data Panel (MTDP) are located at the end of the emplacement closest to the engagement point.

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 this type of emplacement. 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 MIT uses a concrete emplacement with a geotextile/gravel drainage layer, treated timber front wall protection, and a protective earthen berm. Either precast or cast-in-place concrete is acceptable. Differential settlement between precast sections is not allowed. Installations may prefer to use other materials, which is acceptable if 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.

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 limited 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/shooter. 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, dirt, and windblown debris, which can cause maintenance problems.

The designer should discuss with the installation whether they desire above- or below-grade MIT 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 along the entire length either in the up or down position. Provide a minimum of 2.3m (7.5ft) clear space from the face of the emplacement wall along the entire length of the MIT.

MIT Slope

The MIT targetry is required to be able to travel on a maximum grade of 10 percent. In general practice, design the emplacement with 0-2% slope along the length of the track. Use a maximum slope of 5 percent to allow for use in adverse weather.

Vertical or horizontal curves are not allowed.

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 660mm (26in). 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 several 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 specific range types 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 MIT emplacement with a 26-inch front wall and a 2-percent slope on the berm provides adequate protection for AOF of +/- two 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 -8° AOF. 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. Note that the direction of fire (angle to the firing line) affects the allowable angle of fire as well.

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 berm must protect the emplacement from all anticipated directions of fire. The berm should be thickest in the expected direction of fire. Use thinner berms to protect the emplacement from occasional directions of fire and ricochets.

Determine the berm thicknesses based on projectile type, soil compaction, and the in-place soil density. However, the designer must also 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 MIT emplacements is 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.

Historical experience shows that, under normal usage, well-compacted berms, designed with the recommended widths require maintenance on 6-month cycles. Heavily used ranges and individual targets often require increased berm thicknesses. Berms within the beaten zone of uprange targets may require additional protection, especially on ARF+ ranges.

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 includes the electrical/communication requirements and equipment installed in a MIT emplacement. 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 to this document to design a complete range. Additionally, since some range types have power and data requirements that differ from the standard, (e.g., CPQC), refer to the specific range section for specific requirements.

Target Emplacement Wall Configuration

The figure below shows a representative MIT wall configuration, The electrical equipment required in a typical MIT emplacement can include:

1) Load Center (LC),

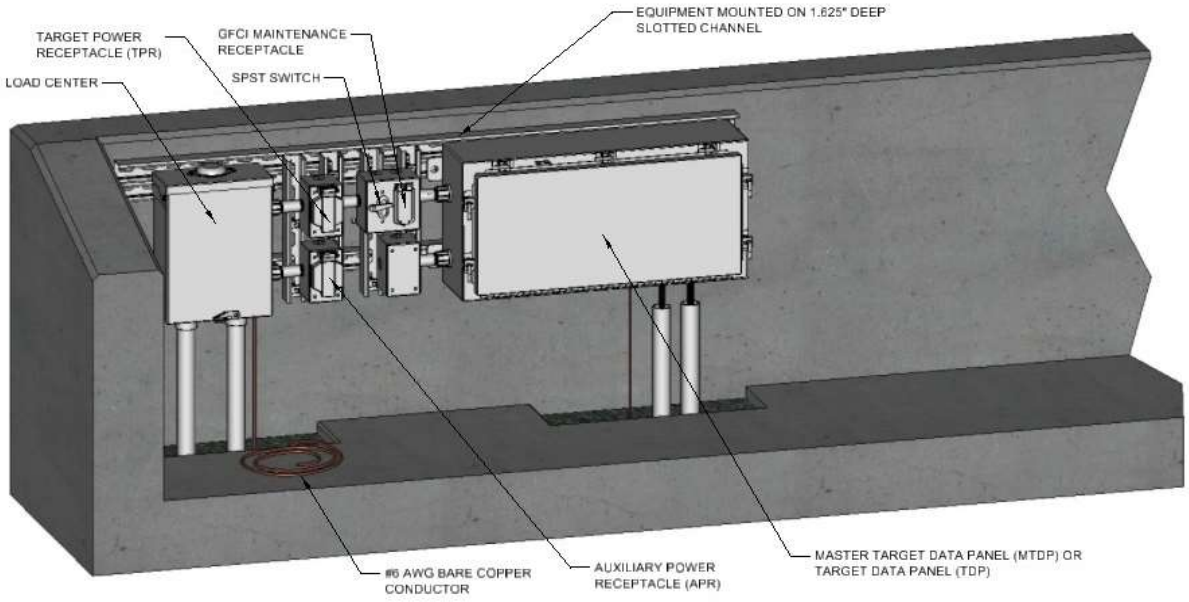
2) Target Power Receptacle (TPR),

3) Auxiliary Power Receptacle(s) (APR),

4) GFCI Maintenance Receptacle (MR), and

5) Data Enclosure (MTDP or TDP).

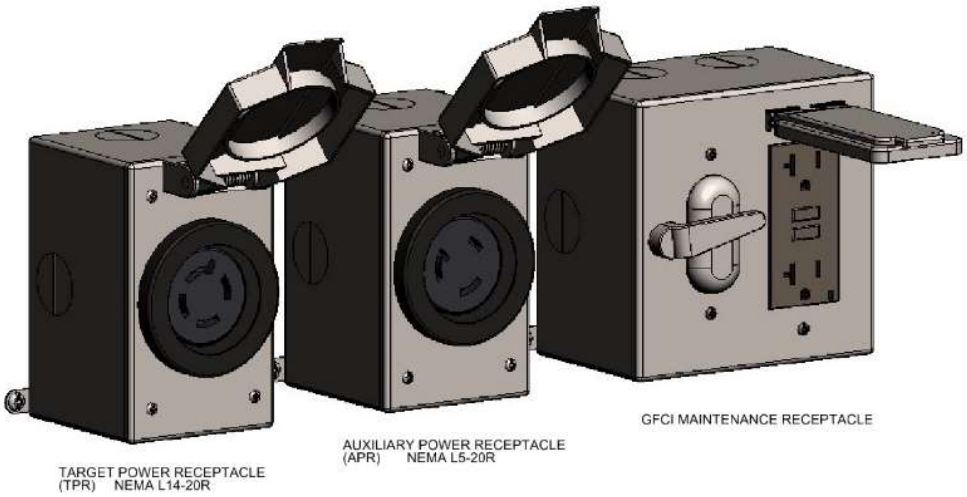
The number and size of the boxes and outlets can vary dependent on the type of MIT and particular range. Mount all boxes and receptacles on slotted strut channel attached to the front wall of the emplacement. **All installed equipment must be a minimum of two inches below the top of the emplacement wall to minimize damage during range use.** The associated wiring and conduits are detailed in other sections of the RDG.



Representative MIT Elevation Drawing (Not to Scale)

Standard Target Interface

Power is supplied to the target through a cord and plug connection. The target emplacement includes a standard 120/240V **Target Power Receptacle (TPR)**, supplied power via the **Load Center**. There is also a minimum of one - 120V **Auxiliary Power Receptacle (APR)** for additional devices or training aids. Thermal blankets are the most common devices that use this power outlet. 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 **GFCI Maintenance Receptacle** is not intended to be used for any unattended devices or training aids. The figure below shows emplacement outlet configurations.



Target Power Receptacles (Not to Scale)

The range data infrastructure consists of data cables installed to the target emplacement and properly terminated inside the target emplacement data enclosures; called the **Master Target Data Panel (MTDP) or Target Data Panel (TDP)**. The MTDP and TDP must be rated NEMA 4, 4X, or 6P depending on environmental conditions. The MTDP/TDP contains the data cable splicing and terminations and the electronics for local target operation. The MTDP and TDP provides space for OPA procured and installed equipment. Target and training device communication is accomplished by this equipment installed inside these data enclosures. The target mechanism installer will connect to the data cables inside these enclosures during the installation of the targets. All networking equipment will be provided with the target mechanism when the target mechanism is purchased. OPA equipment is provided by others and not the MILCON contractor. Refer to the MTDP/TDP details for additional information.

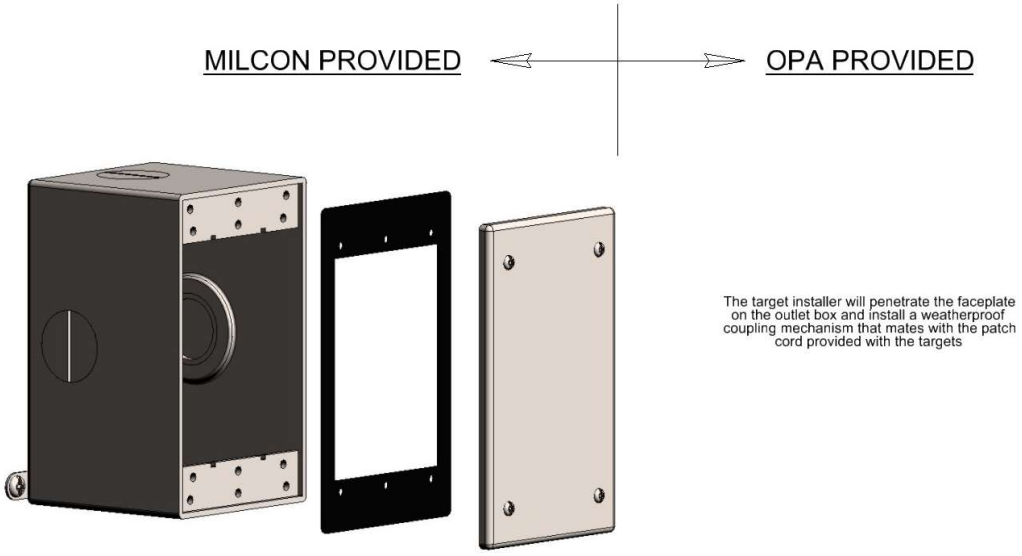
120-volt power is provided in the MTDP/TDP for the OPA installed equipment. The MTDP/TDP and the GFCI maintenance receptacle may utilize the same power circuit, but the MTDP/TDP equipment must be wired ahead to minimize nuisance tripping. 120-volt power is routed through a single pole single throw (SPST) switch adjacent to the MTDP/TDP to allow power to devices installed in the data enclosures to be reset without having to open the NEMA 4 enclosure.

EMPLACEMENT TYPE	POWER FEED TYPE	PEAK	STATIC LOAD	DESIGN LOAD
MIT	120/240VAC Single Phase	2kVA While charging.	50VA	2kVA

MIT Emplacement Target Power Table

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 MILCON installation includes the weatherproof box, sealing gasket, and solid faceplate. The target installer will penetrate the faceplate on the outlet box and install a weatherproof coupling mechanism that mates with the patch cord provided with the targets.



TARGET DATA CONNECTION

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. Sheet ED-01 in the Range Design Guide illustrates the preferred sealing method. **Foam filled conduits are not acceptable.** The MIT 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.

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 or mechanical connections (where accessible). Bond all data cable armor or shields to the ground bar in the MTDP/TDP. The design includes a 3m (10') coil of #6 AWG bare copper wire for the target installer to ground the target track.

Surge Suppression

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