MOVING INFANTRY TARGET (MIT)

General

The MIT emplacement is used for the installation of a MIT target. There are two standard lengths, 15m and 40m; an additional 2m space is provided at one end for the installation of the electrical equipment. See the standard Civil and Electrical detail drawings for specific dimensions and details. The MIT emplacement is normally positioned at a 30 to 90 degree angle to the engagement point; a 45 degree angle is typical. 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.

Checklist

Range designers should refer to the Design and the Construction 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 for all types of ranges. Siting issues for specific ranges are covered in the separate sections of the RDG.

Emplacement

The standard MIT uses a concrete emplacement with a geotextile/gravel drainage layer, a treated railroad tie 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 are acceptable as long as the material is durable and compatible with, and provides protection for, electrical and target equipment. The compacted earth berm is used to protect the equipment from all anticipated directions of fire; the concrete emplacement does not provide significant protection. All MIT emplacement permanent electrical and communication boxes are mounted on the front wall of the emplacement a minimum of 50mm (2in) below the top of the emplacement wall. This mounting height provides protection from rounds that might skim over the top of the berm. The targetry provider will install the target mechanism on the floor of the concrete emplacement as far forward as practical, thus minimizing the potential of being hit by a low rounds, yet still allowing access to the electrical/data boxes.

Above-Grade Emplacement

Above-grade emplacements are more 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, 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.

Target Clearance

No obstruction may be present which interferes with travel of the target from the up to down position. A minimum of 2.3m (7.5ft) clear space must be provided from the face of the emplacement wall along the entire length of the MIT.

Wall Height

The minimum front wall height is 660mm (26in). The front wall and berm must be high enough to protect the targetry equipment while still allowing a minimum of 90% of the target to be visible from the firing position. The minimum wall height provides target equipment protection, including target arms and clamps, up to an 8^{o} angle of fire; provided that the berm is designed to protect the wall. (Note: a positive angle is used for a downward shot at the target.) The berm slope may need to be adjusted for positive angles of fire. It also allows 90% visibility up to -1^{o} angle of fire. A geometric analysis is required for angles of fire greater than 8^{o} or less than -1^{o}. Note that the direction of fire (angle to the firing line) affects the allowable angle of fire as well. Excessive angles of fire may require increasing the height of the front wall or installing the emplacement off-level to match the angle of fire. Angles of fire less than -1^{o} may require raising the target lifter or installing longer target arms. Leaning the emplacement forward is not generally recommended due to drainage considerations. On ranges where targets are engaged 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 especially critical when used for aviation gunnery.

MIT Slope

The MIT targetry is required to be able to travel on a maximum grade of 10 percent. In general practice, emplacements should be designed with a maximum slope of 5 percent to allow for use in adverse weather.

Vertical or horizontal curves are not allowed.

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.

Berm Criteria

Recommended widths for protective berms of MIT emplacements are determined from the Target Protection Design Curves in the Appendix of this document. The berm must protect the emplacement from all anticipated directions of fire.

These berm widths are based upon projectile type, soil compaction, and the in-place soil density. However, the designer must also coordinate with the range trainer or user in order to determine the appropriate berm width for each target, since individual target sites may dictate added target protection. For example, when MIT emplacements are sited in front of or behind a Moving Armor Target (MAT) or Stationary Armor Target (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.

Weather Considerations

In regions with large quantities of blowing sand or snow, consideration should be given to 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

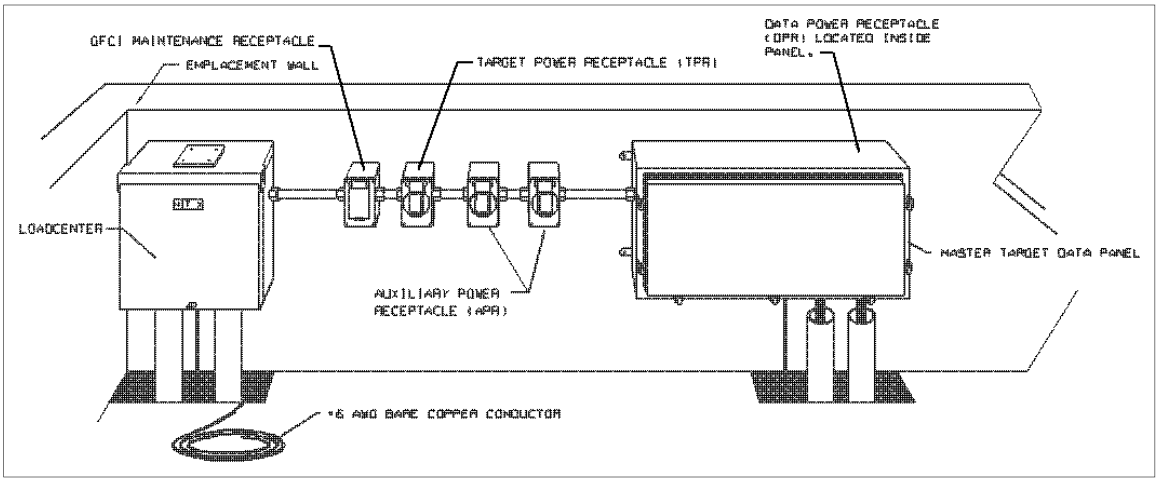
This section discusses electrical/communication considerations unique to this specific emplacement type. Downrange power, communication, transformers, trenching requirements, etc., are discussed in the Downrange Distribution Section of this document.

Target Emplacement Wall Configuration

Refer to Emplacement Elevation Drawings for a typical target emplacement wall configuration. The electrical equipment required in each MIT emplacement are the 1) Load Center (LC), 2) Target Power Receptacle (TPR), 3) Auxiliary Power Receptacles, 4) GFCI Maintenance Receptacle (MR), 5) and the Master Target Data Panel (MTDP), along with the associated wiring and conduits which are not detailed in this document. The LC contains the secondary branch circuits and provides feed-through capability to the next adjoining LC. The LC branch circuit

breakers provide power to the TPR, APR, MR and the TDR. The TDR is located inside the data panel (not visible in the details).

The Master Target Data Panel (MTDP), or the smaller enclosure called 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 120VAC power outlet is provided in the TDP for "Use by Others". The TDP and the GFCI MR may utilize the same power circuit, but the TDP equipment must be wired ahead of the MR to ensure no nuisance tripping occurs. All boxes and receptacles on the front wall of the emplacement should be mounted no higher than two inches from the top of the emplacement wall; this protects the boxes and receptacles from low rounds that might skim the top of the emplacement wall. 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.



Representative MIT Elevation Drawing (Not to Scale)

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. A 19mm (3/4in) by 3,050mm (10ft) copper-clad steel ground rod will be driven to a depth of 305mm (1ft) below finished grade at each emplacement or equipment location. The MTDP/TDP and LC equipment will be connected to the emplacement's single ground rod with a #6 AWG bare copper conductor and exothermically welded connections. All data cable armor or shields must be bonded to the ground bar in the TDP. The design will leave an 1829mm (6ft) coil of #6 AWG bare copper that will be used to ground the target mechanism.

Surge Suppression

Surge protective devices (SPD) shall be provided in the LC and data surge suppression equipment shall be provided on both ends of the CAT 5e or better data cables entering the MTDP or TDP.

Conduit and Cable Fittings

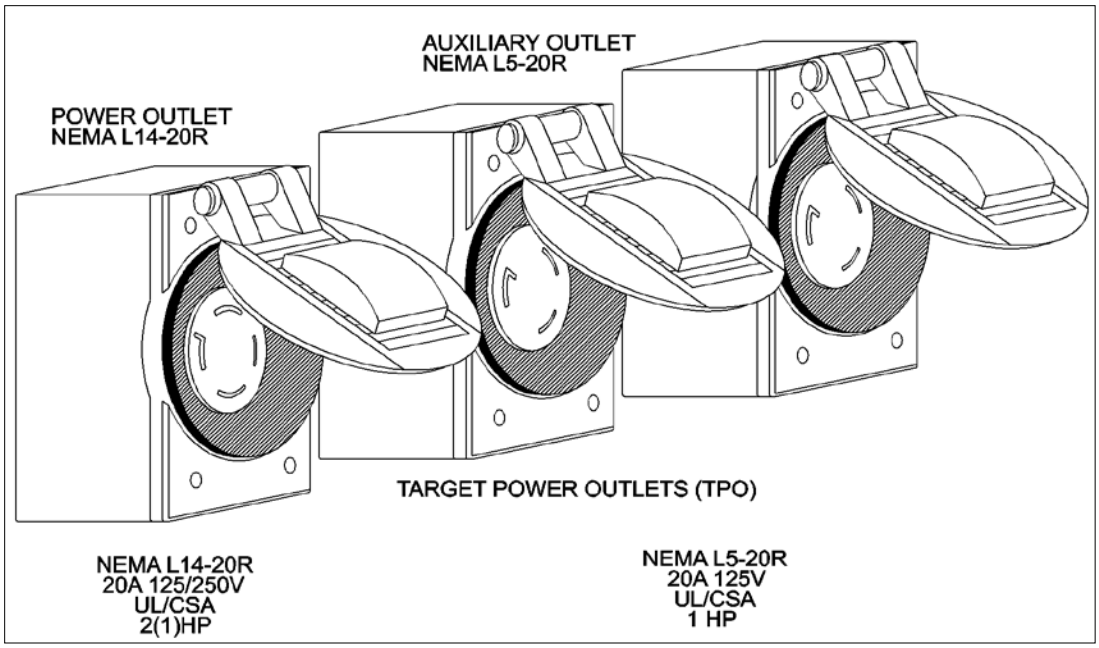
All penetrations into the MTDP or TDP must be made with fittings approved for use with a NEMA 4, 4X or 6P enclosure. Non-compliance with this requirement will result in equipment failure. Sheet ED-01 in the Range Design Guide illustrates the preferred sealing method. **Foam filled conduits are not acceptable.** The SIT LC only requires a NEMA 3R rated enclosure. Provide fittings approved for use with a NEMA 3R enclosure for connection to the LC.

Target Outlets

TPRs and APRs 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 standard TPR configuration is shown in the Table below:

TARGET POWER RECEPTACLE	AUXILIARY POWER RECEPTACLE	FIBER OPTIC CABLE CONNECTORS	CATEGORY 5E OR BETTER CABLE CONNECTORS
NEMA L14-20R	NEMA L5-20R	Type "SC"	MALE, RJ45

MIT Emplacement Target Interface Specifics



Target Power Receptacle (TPR) – Auxiliary Power Receptacle (APR)

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

MIT Emplacement Target Power Table

Environmental Limits

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

Outdoor:

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

Representative MIT Photos