



Stationary Infantry Targets



SIT, DTASIT, WSIT, and IM



RANGE AND TRAINING LAND PROGRAM – MANDATORY CENTER OF EXPERTISE

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General

The Stationary Infantry Targets section covers the following targets and emplacements: Stationary Infantry Targets (SIT), Double Target Arm SIT (DTASIT), Widened SIT (WSIT), 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 requirements; refer to the separate Infantry Target Clusters Section.

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 equipments requires additional front wall space. Iron Maiden (IM) Targets are non-automated steel targets that do not require power or data. 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, 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 that 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 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, e.g. it is harder to qualify on a MRF when only half of the target 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 +/- 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 -10° 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.

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 SIT 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.

Weather Considerations

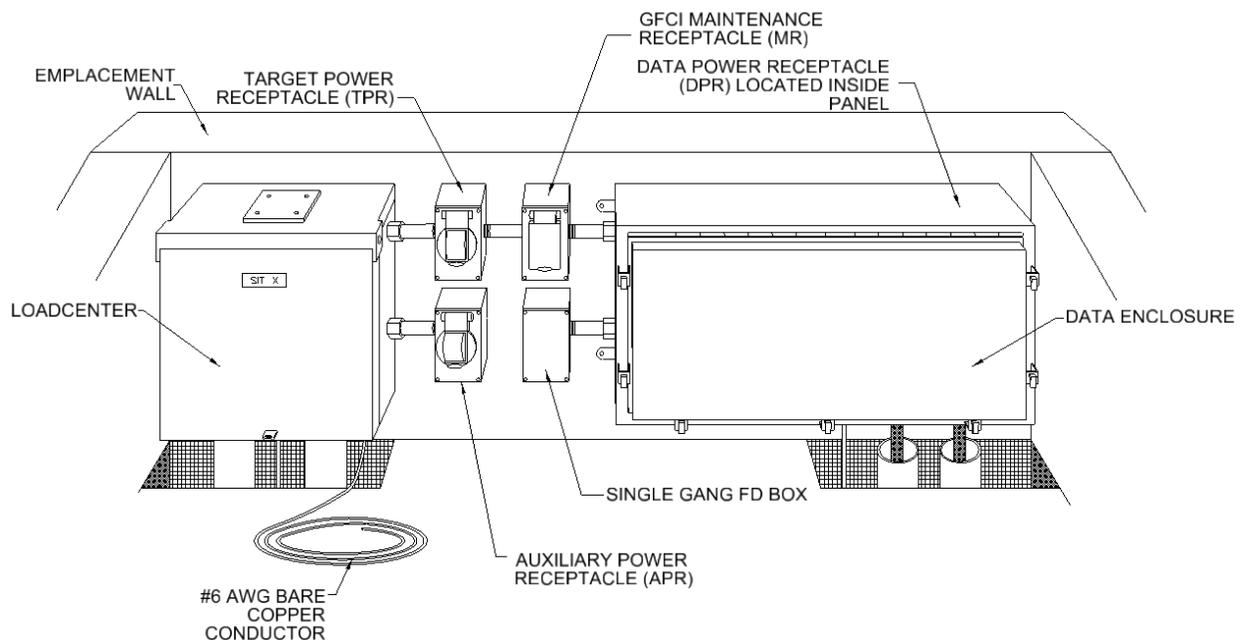
In regions with large quantities of blowing sand or snow, consider providing elevated target mechanism platforms and emplacement covers. The elevated target mechanism platform allows for shoveling out snow and sand, while the emplacement cover keeps the accumulation of blown or fallen material to a minimum.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

Electrical/Communications

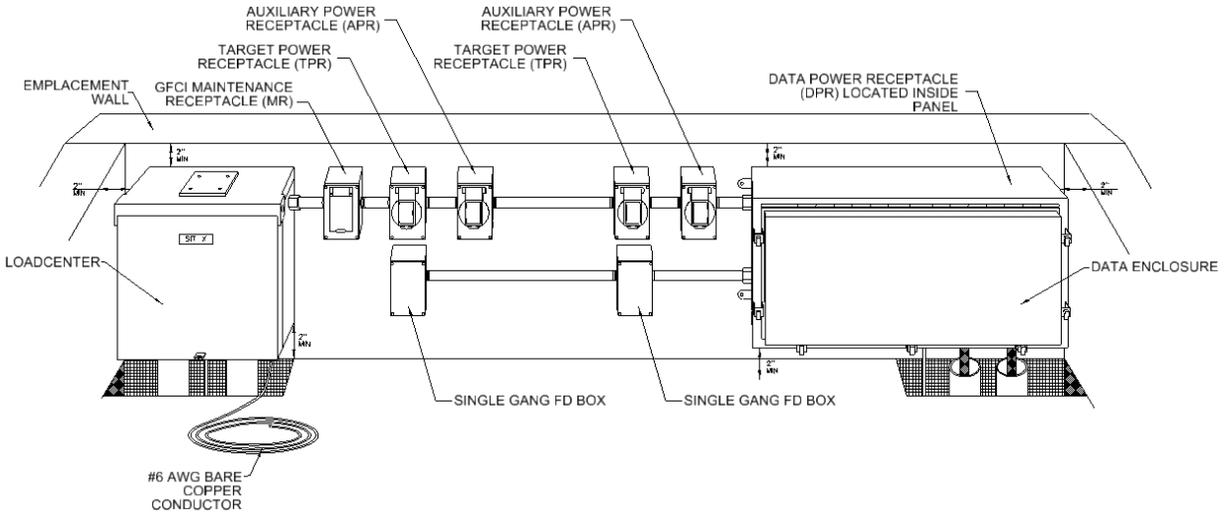
This section discusses electrical/communication considerations unique to this specific emplacement type. Downrange power, communication, transformers, trenching requirements, etc., are discussed in the Downrange Distribution Section of this document.

Target Emplacement Wall Configuration

Refer to Emplacement Elevation Drawings for a typical target emplacement wall configuration. The electrical equipment required in each 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. 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. A detailed drawing of the electrical equipment requirements for SIT emplacements is provided in the Appendix of this design guide.



REPRESENTATIVE SIT ELEVATION DRAWING (NOT TO SCALE)



REPRESENTATIVE WIDENED SIT 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 (3/4 in) by 3,050mm (10ft) copper-clad steel ground rod will be driven to a depth of 305mm (1 ft) below finished grade at each emplacement or equipment location. The MTDP/TDP and load center 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 MTDP/TDP. The design will leave an 1829 mm (6') coil of #6 AWG bare copper that will be used to ground the target mechanism.

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.

Conduit and Cable Fittings

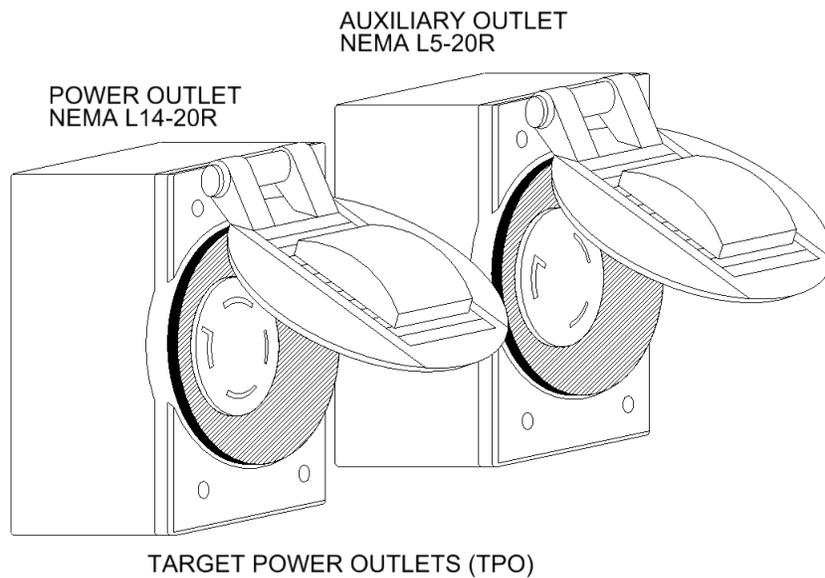
All penetrations into the MTDP or TDP must be made with fittings approved for use with a NEMA 4, 4X or 6P enclosure. Non-compliance with this requirement will result in equipment failure. Sheet ED-01 in the Range Design Guide illustrates the preferred sealing method. **Foam filled conduits are not acceptable.**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

SIT EMPLACEMENT TARGET INTERFACE SPECIFICS



TARGET POWER RECEPTACLE (TPR) – AUXILIARY RECEPTACLE (AR)

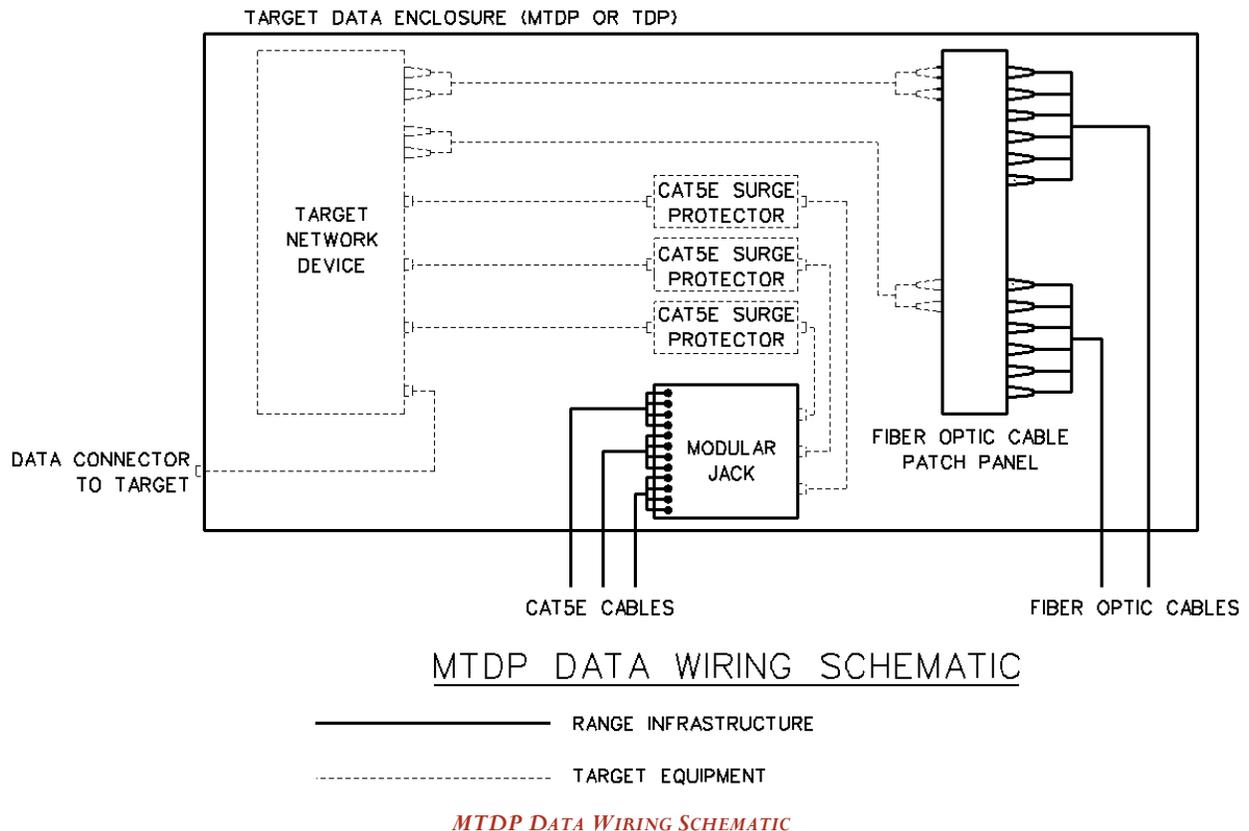
| EMPLACEMENT TYPE | POWER FEED TYPE | PEAK | STATIC LOAD | DESIGN LOAD |
|--------------------------|------------------------|--|----------------------------|--------------|
| SIT with Thermal Blanket | 120/240V, Single Phase | 700VA while raising or lowering target. Add 260VA if Thermal Blanket is utilized | 50VA Thermal Blanket 260VA | 960VA |
| | | | Total | 960VA |

SIT EMPLACEMENT TARGET POWER TABLE

Standard Target Interface

All targets operate at 240 V. Power is supplied to the target through a 120/240V cord and plug connection. The target emplacement shall be provided with a standard 120/240V receptacle that is supplied power through a circuit breaker that is located inside the target emplacement. An auxiliary 120 V outlet is provided in the target emplacement for additional devices or training aids that may be added to the target mechanism. Thermal blankets are the most common devices that are added to the target mechanisms that utilize 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.

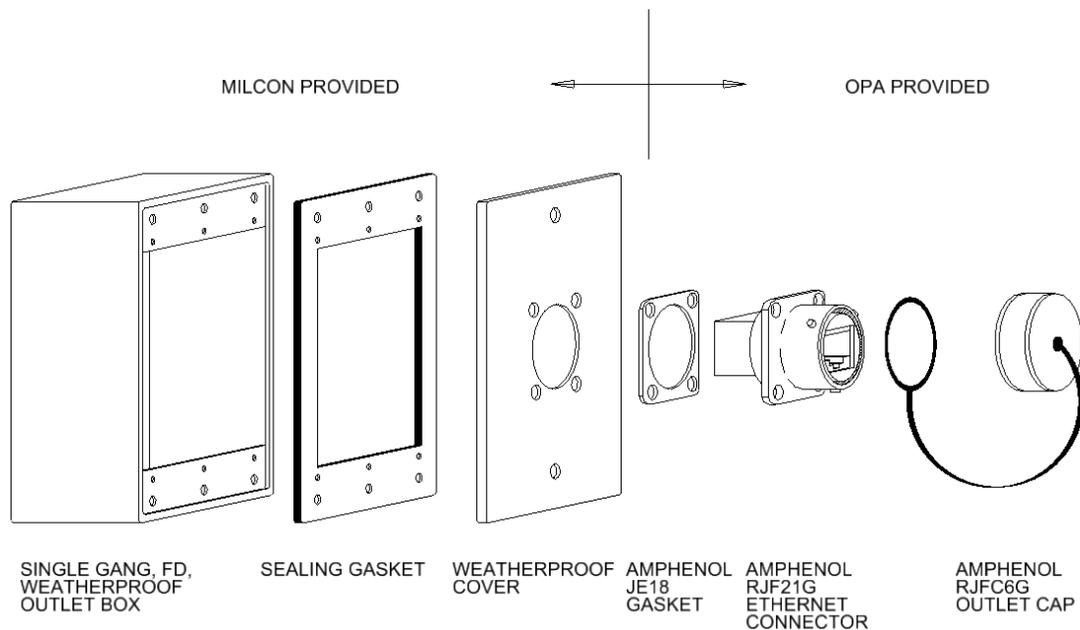
Target and training device communication is accomplished by equipment installed inside the data enclosure located in each target emplacement. All networking equipment will be provided with the target mechanism when the target mechanism is purchased. The target mechanisms are normally purchased with Other 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.



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 face plate on the outlet box and install a weatherproof coupling mechanism that mates with the patch cord provided with their targets.



TARGET DATA CONNECTION

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).

Iron Maiden Targets

Iron Maiden (IM) targets are non-automated, steel targets primarily used in sniper training. They do not require any power 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.

