



MOVING ARMOR TARGET (MAT)



General

The MAT is used to present moving and stationary vehicle target silhouettes, including friendly and foe targets; heavy, medium, and light armor vehicles; technical trucks, etc. It is used to support tank, antitank, Stryker, Bradley Fighting Vehicle (BFV), and aerial gunnery training. The standard MAT track is 350m (1,148ft) long. Coordinate non-standard MAT lengths with TCM-L and the RTLP-MCX.

The Entry Control Point station of the Convoy Live Fire Range (CLF) uses a 225m (738ft) long serpentine moving target (ECPMT).

Space is provided behind the MAT berm for electrical equipment. An electrical power center is often collocated behind the MAT. The MAT target, provided by OPA, consists of a track, carrier, target lifter, Battle Effects Simulator, and charging station. The “home” end of the MAT is where the charging station and electrical equipment are placed. Normally, the home end is placed at the end of the MAT closer to the engagement point because, it is more easily protected. The selection of the home end is based on target protection and the location of power; training scenarios also affect the selection. Refer to the standard Civil and Electrical detail drawings for additional details.

Checklist

Range designers should refer to the Design and the Construction Checklists provided in the RDG to ensure that all required items are included.

Civil/Siting

This section covers the Civil Engineering and Siting issues unique to this type of emplacement for all types of ranges. The sections below address the standard MAT; the ECPMT is covered in a separate paragraph below. Siting issues for specific ranges are covered in the separate sections of the RDG.

Mat Emplacement

The MAT emplacement includes a track bed, target protection berm, berm retaining wall, electrical equipment, and service road. The minimum horizontal curve allowed on a MAT is 152m (500ft). The MAT target is required to be able to traverse a 10% grade. It is recommended whenever possible that the grade be limited to 3% with a maximum of 5% to allow for use in adverse weather conditions. The last 40m (131ft) at each end must have a slope of less than 1%.

A 3 meter area is provided at the home end for placing electrical equipment. See Civil Details in the Appendix of this document.

Retaining Wall

A retaining wall is normally used to as part of a MAT emplacement. Typical retaining walls are designed using concrete gravity block or wood timbers and steel piles. The wall must be designed for local geotechnical conditions. Walls are typically designed so that the top section can be replaced in case of damage. Filter fabric is normally required. The wall and berm must be tall enough to protect the MAT targetry while still allowing line of sight to the silhouette when in the raised position. Standard wall heights are 1530mm (5ft) and 1829mm (6ft) for aerial gunnery, measured from the top of the aggregate pavement. These heights provide protection target equipment protection up to a 10 degree angle of fire, 15 degrees for aerial gunnery wall height; provided that the berm is designed to protect the wall. (Note that a positive angle is used for a downward shot at the target.)

Service Road/Track Bed

The area behind the berm includes a 5.2m (17ft) wide area for the MAT track, lifter, and silhouette and a 3m (10ft) wide service road. The trackbed and service road must be designed for local conditions per the site specific geotechnical report. Typically the top 305mm (12in) of the subgrade is compacted as specified in ASTM D1557, Method D; 90-percent laboratory maximum dry density for cohesive soils and 95-percent laboratory maximum dry density for cohesionless soils. The top of the subgrade should be sloped toward the back of the emplacement away from the protective wall in order to facilitate drainage. An additional 152mm (6in) of aggregate pavement is placed above the subgrade; filter fabric is sometimes used. The final subgrade and aggregate pavement should not show deviations greater than 13mm (1/2in) when tested with a 3658mm (12ft) straightedge after compaction. The targetry equipment contractor is responsible for all construction above aggregate subgrade including anchoring for the specific targetry system.

Berm Criteria

The widths for protective berms of MAT emplacements are determined by using the Target Protection Design Curves in the Appendix of this document. The berm's thickness is 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 thickness for each target, since individual target sites may dictate added target protection. 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.



Representative MAT Photos

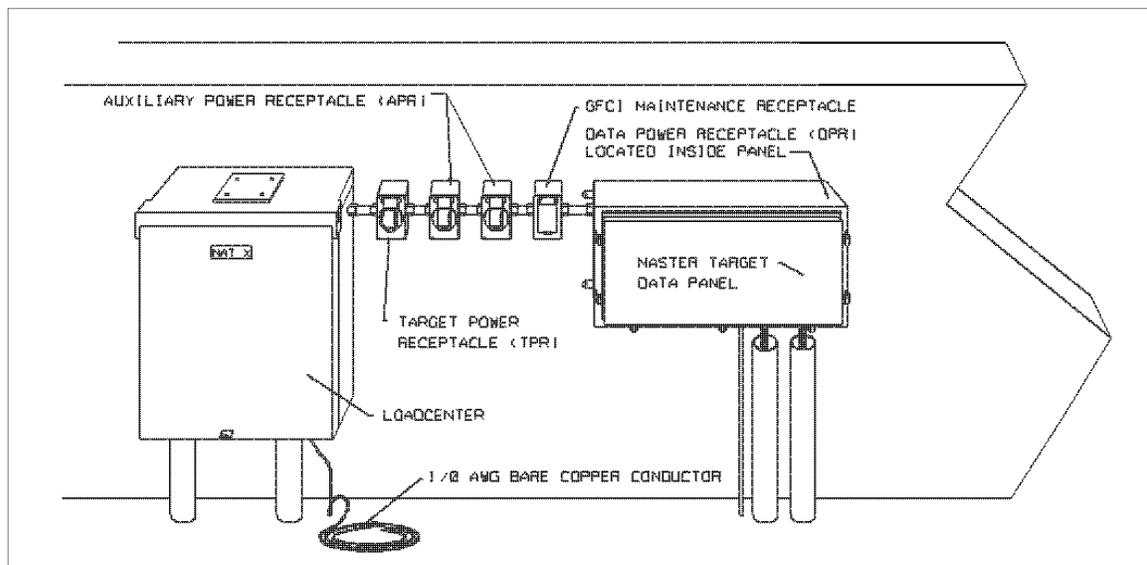
Electrical/Communications

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. Electrical interface for the ECPMT is different from the standard MAT; refer to the separate paragraph below.

Target Emplacement Wall Configuration

Refer to Emplacement Elevation Drawings for a typical target emplacement wall configuration. The electrical equipment required in each MAT 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 120v AC 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 MAT 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 a 3048mm (10ft) 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

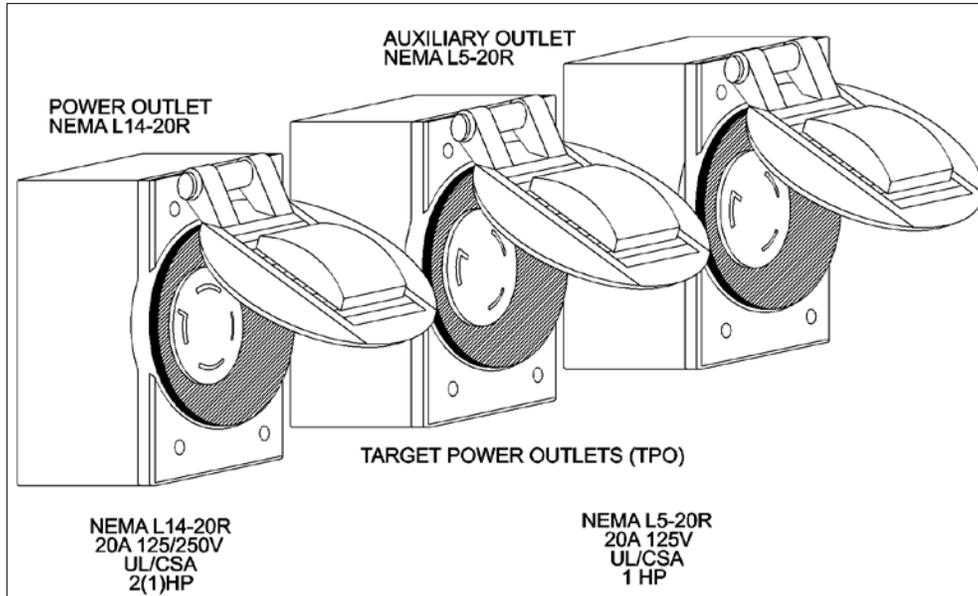
All penetrations into the MTDP or TDP must be made with fittings approved for use with a NEMA 4, 4X or 6P enclosure. Non-compliance with this requirement will result in equipment failure. Sheet ED-01 in the Range Design Guide illustrates the preferred sealing method. **Foam filled conduits are not acceptable.**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

MAT Emplacement Target Interface Specifics



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

EMPLACEMENT TYPE	POWER FEED TYPE	PEAK	STATIC LOAD	DESIGN LOAD
MAT with Thermal Blanket	120/240VAC Single Phase	3.8kVA during system charging.	100VA	3.8kVA
				Total Design Load 3.8kVA

MAT Emplacement 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).

ECPMT

The Entry Control Point Moving Target (ECPMT), or Serpentine Mover, has a different electrical interface than the standard MAT. It requires a 30 amp 120/240 circuit with a L14-30R receptacle for the ECPMT charging station. The charging station is placed behind a protective berm at the downrange end of the track. Refer to the Convoy Live Fire Range detail drawings for additional details.

The ECPMT is used to simulate a vehicle entering an access control point. The vehicle has SIT targets inside to simulate occupants and a hit sensor to simulate an engine kill shot. The track and mechanism are protected using concrete walls and berms. A line of sight analysis must be done to ensure that the track and mechanism are protected from all firing positions while the target is visible along the entire length. A berm and retaining wall is placed at the far end of the track to protect the electrical tie-in and charging station. The track has a nominal radius of 7.62m (25ft) and a sweep of 26 degrees.

