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Materiel Test Procedure 4-3-503
U. S. Army Air Defense BoardU. S. ARMY TEST AND EVALUATION COMMAND
COMMON SERVICE TEST PROCEDUREBATTLEFIELD MOBILITY (BATTLEFIELD MOBILITY, TACTICAL
FLEXIBILITY AND PORTABILITY) (MUNITIONS)1. OBJECTIVE

The objective of this Materiel Test Procedure (MTP) is to describe the procedures used to determine the ability of munitions (ammunition and explosives) to withstand the handling and transportation under simulated battlefield conditions.

2. BACKGROUND

Munitions are subjected to many handling and transportation cycles during tactical operations prior to being fired (or functioned), that may degrade the reliability, storability or serviceability of the munitions beyond acceptable operational limits, thus rendering them unsuitable for military use.

In order to determine the possible effects of handling and transportation, the service test procedure subjects the test item (munitions) to transportation cycles under simulated battlefield conditions and environments, utilizing personnel representative of the troops who would use the test item. The test items are then physically inspected and functionally operated in accordance with applicable technical documentation.

Additionally, the service test provides information on the ability of troops to handle and to conduct the required movements of munitions without experiencing extensive delays or difficulties, with adequate safety, and without the necessity for unrealistic levels of training as special skills.

3. REQUIRED EQUIPMENT

- a. Wheeled Cargo Carriers.
- b. Light Tactical Vehicles
- c. Combat Vehicles
- d. Suitable Maneuver and Operational Areas
- e. Photographic equipment, still and motion picture cameras and film (black and white or color).
- f. Voice Tape Recorders.
- g. Elapsed Time Recorders (Stopwatches).
- h. Meteorological Instrumentation (Temperature, Humidity, Wind Direction and Velocity, Precipitation).
- i. Weighing scales.
- j. General and special tools and ancillary items required for measurement (measuring tapes, scales, and calipers), inspection, repairs, and maintenance of the test item.

4. REFERENCES

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- A. AR 70-10, Army Materiel Testing.
- B. USATECOM Regulation 385-6, Verification of Safety of Materiel During Testing.
- C. USAMC Regulation 385-12, Verification of Safety of Army Materiel.
- D. USAMC Regulation 385-224, AMC Safety Manual.
- E. FM 9-5, Ordnance Ammunition Service.
- F. TM 9-1005, Ordnance Preservation, Packaging, Packing, Storage, and Shipping.
- G. TM 9-1900, Ammunition, General
- H. TM 9-1903, Care, Handling, Preservation, and Destruction of Ammunition.
- I. Applicable Commodity Service Test MTP for Test Item and Associated Weapons System.
- J. MTP 3-1-002, Confidence Intervals and Sample Size.
- K. MTP 4-3-500, Preoperational Inspection and Physical Characteristics.
- L. MTP 4-3-501, Personnel Training.
- M. MTP 4-3-502, Ammunition Functioning and Reliability.
- N. MTP 4-3-514, Safety Hazards.
- O. MTP 4-3-521, Training Manuals and Technical Publications.

5. SCOPE

5.1 SUMMARY

The procedures given in this MTP are applicable to the following classes of ammunition and explosives:

- a. Conventional Ammunition - includes small arms ammunition, mortar ammunition, artillery ammunition, high density-low maintenance missiles.
- b. Special Ammunition - includes missile bodies, missile warheads - nuclear and non-nuclear, nuclear weapons, missile and rocket propellants, spotting rounds and propelling charges for nuclear artillery shells.
- c. Explosive Ordnance - includes grenades, mines, demolitions, chemical and biological munitions.

The specific tests to be performed and their intended objectives are described in succeeding paragraphs:

- a. Preoperational Inspection and Physical Characteristics - The objective of this subtest is to verify the functional integrity, physical characteristics, arrival condition and dimensions of the munitions assigned for testing.
- b. Movement of Munitions to ASP/SASP - The objective of this subtest is to determine how the test item is affected by transportation from the Communications Zone depot to an Ammunition Supply Point (ASP) or Special Ammunition Supply Point (SASP), and what handling requirements are involved in this action. This test and subsequent tests are under simulated tactical conditions of terrain, timing, and environment.
- c. Movement of munitions in Ammunition Trains - The objective of this subtest is to determine how the test item is affected by transportation

from the ASP (or SASP) to the field combat unit, and what handling requirements are involved in this action.

d. Movement of Munitions on the Battlefield - The objective of this subtest is to determine how the test item is affected by transportation (vehicle and manpacked) during simulated tactical maneuvers on the battlefield, what handling requirements are involved, and how well the test item meets the requirements for portability.

e. Evacuation - The objective of this subtest is to determine how the test item is affected by transportation from the battlefield, what handling requirements are involved, and the degree of difficulty in picking up the deposited test items.

5.2 LIMITATIONS

This procedure is limited to battlefield mobility tests of munitions items which are expended when used. Such expenditure by functioning the item is intended as the concluding phase of testing. However, mobility tests of items which are functioned in conjunction with ordnance equipment (guns and launchers) may be combined with service tests of the respective ordnance items. See MTP 5-3-501 for mobility tests of missile and rocket systems.

Tests described in this procedure are arranged sequentially to simulate applicable battlefield experience, exclusive of field storage. Applicable field storage tests of MTP 4-3-520 may be combined with mobility tests as desired.

6. PROCEDURES

6.1 PREPARATION FOR TEST

a. Select and schedule maneuver areas and firing ranges at locations representative of environmental conditions specified in QMR or SDR for the test item and its associated weapons system.

b. Schedule the availability of suitable transport vehicles, applicable combat vehicles, and support facilities.

c. Establish controlled environment storage conditions for the full complement of test items (exposure and control items) provided for the test program.

d. When the availability schedule for the test item lot has been determined, coordinate the availability of the following:

- 1) Engineering safety release or other safety statement.
- 2) Maintenance support facilities, spare parts, and personnel.
- 3) Equipment, special facilities, and instrumentation with special equipment not readily available at the test site. All test equipment and instrumentation selected shall be in keeping with the state-of-the-art, with calibrations traceable to the National Bureau of Standards.
- 4) Assistance of environmental test centers (Yuma Proving Ground, U. S. Army Tropic Test Center, U. S. Army Arctic Test Center) as required for conduct of environmental tests.

e. Ensure that service personnel, representative of troops who would be handling the test item in a theater of operations, have been assigned at each handling point. Ensure that personnel have been trained to handle the test item in accordance with applicable sections of MTP 4-3-501 and applicable TM and FM for the test item.

f. Record the following for all service personnel:

- 1) Identity and rank
- 2) MOS
- 3) Training time in MOS
- 4) Experience in MOS
- 5) Training time with test item

g. Prepare record forms for systematic entry of data, chronology of test, test results, and such observations and measurements that would be of value in analysis and final evaluation of the test item.

h. Ensure that appropriate security measures are instituted to safeguard classified materiel and data.

i. Prepare a test item sample plan to ensure that enough samples of all measurements are taken to provide statistical confidence in the final data in accordance with MTP 3-1-002, and the suggested lot size described in Table A-1, Appendix A.

j. Prepare a plan to provide the appropriate test exposure for the item under test in accordance with Qualitative Materiel Requirements (QMR's), Small Development Requirements (SDR's) or other applicable specifications. Consider combinations of the following:

- 1) Transport vehicles, tactical vehicles, combat vehicles.
- 2) Paved roads, secondary roads, trails, cross-country terrain.
- 3) Tactical terrain, consisting of:
 - a) Desert flats and sand fields.
 - b) Dry washes, rocks and ledges.
 - c) Mountains and hills.
 - d) Forested areas.
 - e) Rivers and marshes.
 - f) Mud fields and muddy trails
 - g) Ocean beaches.
 - h) Snow fields.

6.2 TEST CONDUCT

- NOTE: 1. Safe test procedures shall be followed throughout all phases of testing. All test operations shall be observed by cognizant test project personnel and any unsafe or potentially unsafe condition shall cause testing to be suspended until safety hazards are understood and remedied.
2. Ammunition and explosives submitted for test shall be all from the same lot or other controlled source. No exceptions shall be permitted for items having critical

- hitting accuracy requirements.
3. Tests shall be conducted concurrently or in conjunction with other tests whenever possible, to minimize project elapsed time and use of facilities.
 4. Tests shall be conducted under all weather conditions prevailing at the respective test ranges, including, as applicable:
 - a. Moderate temperatures with rain.
 - b. Frigid temperatures with icing conditions.
 - c. Hot temperatures with:
 - 1) Low humidity
 - 2) High humidity
 - d. Darkness, including tactical blackout.

6.2.1 Preoperational Inspection and Physical Characteristics

Accomplish inspections in accordance with applicable sections of MTP 4-3-500, including the following:

- a. Integrity of packaging and packing, including any overpack.
- b. Condition of individual items, including evidence of deterioration or damage, evidence of compliance with requirements of applicable QMR or SDR, evidence of compliance with applicable instructions for packaging and packing.
- c. Dimensions and weights of individual items.
- d. Lot number or other controlled source identification.

6.2.2 Movement of Munitions to ASP/SASP

- a. Remove the test lot from controlled environment storage and inspect for signs of physical damage or deterioration.
- b. Load the test items aboard suitable wheeled cargo carrier(s) in accordance with applicable loading and securing procedures.
- c. Note, record, and photograph as necessary the method employed to load and secure (tie-down) the test item on the transporting vehicle and any problems incurred in handling of the test item.
- d. Transport the test lot over the specified course, accumulating a minimum of eight hours of transportation time.

NOTE: The transport vehicle shall maintain a speed representative of vehicles operating under tactical conditions, consistent with road and weather conditions.

- e. Inspect the test item(s) prior to offloading, noting any signs of damage caused by transport..
- f. Off-load the test item(s) on prepared ground, representative of an ASP or SASP.
- g. Reinspect the test item(s) in accordance with the procedures

used in paragraph 6.2.1, Preoperational Inspection and Physical Characteristics. Accomplish additional inspections as required to evaluate effects of handling in the field, including:

- 1) Mechanical damage (deformation, cracks, gouges, scratches).
- 2) Entry of contaminants (dust, water, oil, mud).
- 3) Loss of contents (propellant, burster, primer, agent).
- 4) Functional defects (open circuits, inoperative components).

h. Fire or function the test item(s) in accordance with applicable equipment instructions. The corresponding control items shall be fixed or functioned at the same time and evaluated under the same conditions.

NOTE: For instructions covering firing or functioning tests, required equipments and evaluations, refer to applicable MTPs for the associated weapons system or common MTPs describing performance tests.

i. Note and record results of firing (or functioning) tests.

6.2.3 Movement of Munitions in Ammunition Trains

a. Inspect the test item(s) in accordance with procedures described in paragraph 6.2.2.a.

b. Prepare the test items for movement by removing overpack or packing as applicable. Load items aboard appropriate tactical transport vehicles in accordance with applicable loading and securing procedures.

c. Note, record, and photograph as necessary the methods employed to load and secure the test item, and any problems incurred in handling the test item(s).

d. Transport the test lot over the specified test course, accumulating a minimum of four hours transportation time.

e. Inspect the test item(s) prior to offloading in accordance with procedures described in paragraph 6.2.2.e.

f. Off-load the test item(s) on unprepared ground.

g. Reinspect the test item(s) in accordance with procedures described in paragraph 6.2.2.g.

h. Fire or function the test item(s) in accordance with procedures described in paragraph 6.2.2.h.

i. Note and record results of firing (or functioning) tests.

6.2.4 Movement of Munitions on the Battlefield

6.2.4.1 Self-Propelled Weapons Ammunition

a. Inspect the test item(s) in accordance with procedures described in paragraph 6.2.2.a.

b. Prepare the test items for movement by removing packaging and installing in ready racks in broken-down ready to load configuration.

c. Note, record, and photograph as necessary the methods employed to load the test item, and any problems incurred in handling the test item.

- d. Transport the test lot in ready racks by maneuvering the combat vehicle in specified tactical type terrain for a minimum of 24 hours.
- e. Inspect the test item(s) prior to offloading in accordance with procedures described in paragraph 6.2.2.e.
- f. Offload the test item(s) and reinspect in accordance with procedures described in paragraph 6.2.2.g.
- g. Fire or function the test item(s) in accordance with procedures described in paragraph 6.2.2.h.
- h. Note and record results of firing (or functioning) tests.

6.2.4.2 Ammunition for Emplaced Weapons (Mortar Rounds, Tube Artillery Rounds, etc.), and Man-Carried Munitions (Small Arms Ammunition, Grenades, Mines etc.)

- a. Inspect the test items in accordance with procedures described in paragraph 6.2.2.a.

NOTE: Pick up ammunition for Emplaced Weapons at the termination of movement in ammunition trains and break down packaging to ready-for-firing configuration.

- b. For Emplaced Weapons Ammunition, transport the test items by appropriate tactical vehicle, or by man carry, as applicable, a distance of at least 10 kilometers over a cross-country terrain.

For Man-Carried Munitions - Carry the test items over cross-country terrain, packaged for carrying as applicable, for a period of eight hours. Break down packaging to minimum configuration for handling, and carry the test items over cross-country terrain for four hours.

- c. Note and record method of transport used, number of troops used, and any problems incurred in handling the test item(s).
- d. Reinspect the test item(s) in accordance with procedures described in paragraph 6.2.2.g.
- e. Fire or function the test item(s) in accordance with procedures described in paragraph 6.2.2.h.
- f. Note and record results of firing (or functioning) tests.

6.2.4.3 Evacuation

- a. Establish a deposit, on tactical type terrain, of a sample lot of test items. Packaging shall be intact for one-half broken down (ready to load, or individual pack) for the remaining half.
- b. Note and record the condition of all test items. Allow the deposit of sample test items to remain undisturbed for 24 hours.
- c. Pick up the test items in light tactical vehicles and transport at least 50 kilometers over cross-country terrain.
- d. Note and record all conditions of pickup and any handling problems incurred.
- e. Reinspect the test items in accordance with procedures described in paragraph 6.2.2.g.

6.3 TEST DATA

In addition to the data requirements described for each subtest the following data shall be taken throughout the entire test program.

- a. Descriptive data on unsurfaced roads and cross-country terrain, by site location and nature of road surface. Support as required by photographs.
- b. Nomenclature, model number, serial number, and mileage of all vehicles employed in the tests.
- c. Motion picture film of unusually rough or difficult mobility exposures during transportation or handling.
- d. Measurement of ambient environmental conditions taken at 2-hour intervals.
- e. Comments of handling personnel on voice tape recorders.

6.3.1 Preparation for Test

- a. Record data as applicable on training of personnel as collected under MTP 4-3-501.
- b. Record the following for all service personnel:
 - 1) Serial number and rank.
 - 2) MOS.
 - 3) Training time in MOS, weeks.
 - 4) Experience in MOS, months.
 - 5) Training time with test item, weeks.

c. Record quantities of items assigned to test lots and control lots, and record method of identifying respective lots.

6.3.2 Test Conduct

6.3.2.1 Preoperational Inspection and Physical Characteristics

Record data as collected under applicable sections of MTP 4-3-500, including the following:

- a. Photograph items as received. Photograph examples of deterioration or damage to packaging or packing.
- b. Photograph instances of deterioration or damage to test items. Record evidence of deviation from requirements of QMR, SDR or other applicable approved regulations.
- c. Record dimensions in millimeters, weights in grams, (as applicable).
- d. Record identifying data on source of test item lot.

6.3.2.2 Munition Movement to ASP/SASP

- a. Record times to load and unload cargo carriers, and stack the test item lot, in minutes.

- b. Record transportation distances in kilometers.
- c. Record on still and motion picture film any handling operations resulting in excessive wear and tear on test items, or in difficulties of accomplishment for personnel.
- d. Record inspection data in accordance with requirements of the individual subtest.
- e. Record firing or functioning data as collected under applicable MTP's.

6.3.2.3 Munition Movement in Ammunition Trains

- a. Record times to load and unload carrier vehicles, minutes.
- b. Photograph packaging configuration for movement of the test items.
- c. Record transportation distances in kilometers, and travelling times in hours.
- d. Record on still and motion picture film any handling operations resulting in excessive wear and tear on test items, or in difficulties of accomplishment for personnel.
- e. Record inspection data in accordance with requirements of the individual subtest.
- f. Record firing or functioning data as collected under applicable MTP's.

6.3.2.4 Munition Movement on the Battlefield

6.3.2.4.1 Self-Propelled Weapon Ammunition -

Record the following:

- a. Time to prepare test items and load in ready racks.
- b. Photographs of items in ready racks.
- c. Travelling distance in kilometers, and travelling time in hours.
- d. Comments, supported by photographs, concerning any handling difficulties encountered by personnel.
- e. Record inspection data in accordance with requirements of the individual subtest.
- f. Record firing or functioning data as collected under applicable MTP's.

6.3.2.4.2 Ammunition for Emplaced Weapons and Man Carried Munitions -

Record the following:

- a. Times to prepare test items for firing.
- b. Photographs of items in travelling configuration.
- c. Times to load and off-load applicable transport, minutes.
- d. Travelling distances in kilometers, and travelling times in hours.
- e. Photographs of test items in carrying configuration.
- f. Comments concerning size of load and method of carrying for an average man. Record appropriate photographs.

g. Distances carried in kilometers, times to cover the distances in minutes, number of carries (lifts and deposits) required to accomplish the full trip.

h. Comments, supported by photographs, concerning any handling difficulties associated with the test items as experienced by personnel.

i. Record inspection data in accordance with requirements of the individual subtest.

j. Record firing or functioning data as collected under applicable MTPs.

6.3.2.5 Evacuation

a. Photograph the test items prior to evacuation.

b. Record times to load carrier vehicles, minutes.

c. Record distance travelled in kilometers, and travelling times in hours.

d. Record observations concerning ease or difficulty of pick-up of deposited test items, and susceptibility of items to handling and transportation damage.

e. Record inspection data in accordance with requirements of the individual subtest.

6.4 DATA REDUCTION AND PRESENTATION

Data, including observations and comments of handling personnel, obtained from each subtest shall be summarized, compared and evaluated according to procedures described in this MTP and applicable common and commodity service test MTPs for the subject test item and associated weapons system, or according to equivalent current practice where not covered by MTPs. Appropriate charts, graphs, and tables shall be used to display summaries and comparisons of test data. Coordinates and other features of charts, graphs, and tables will be selected for clarity and uniformity with like presentations in other reports.

Special consideration in data presentation shall be given to any condition or circumstance which may have significantly influenced test results. Findings from examinations of control items shall be summarized and presented in juxtaposition with findings on the sample items which the control items represent.

Calculations shall be performed as specified in the individual MTPs, or in accordance with equivalent current practice where not covered by MTPs. All photographs, motion pictures, audio tapes, and other records shall be explicitly identified and referenced; significant frames, transcriptions, and samples shall be selected for illustrative purposes. All illustrations shall be completely identified.

Data collected under adverse weather conditions and blackout conditions shall be separately compared with data collected during normal weather conditions and daylight.

All qualitative data collected shall be evaluated against applicable QMR, SDR, and TC to determine the degree of fulfillment demonstrated, compared with the performance specifications. The conclusions resulting from this evaluation shall be related to the need for equipment improvements to better satisfy the operational requirements for U. S. Army systems.

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APPENDIX A

TEST LOT SIZE

Lot Size - Consistent with economic considerations, lot sizes for each subtest should be large enough to yield statistically significant results when the items are functioned. Table A-I contains suggested lot sizes for various classes of munitions. Control lots are additional.

Table A-I. Suggested Lot Size

Class of Munitions	Lot Size	Remarks
Small Arms Ammunition	1000	Provides for automatic fire
Mortar Rounds	30	Three MPI groups
Tube Artillery Rounds	30	Three MPI groups
Missiles-high density, low maintenance	20	Two MPI groups
Grenades	10	Launcher accuracy and functioning
Mines and Demolitions	5	Functioning data
CB Munitions	5	Functioning data without agent

Test lots shall be segregated, marked for identification, and placed in controlled environment storage. A control lot, normally equal in number to the test lot, will be identified and placed in controlled environment storage at the same time. This control lot will remain in storage until post-test examinations are conducted on the test lot. The same examinations are then to be conducted on the control lot.

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Munitions (Ammunition and Explosives)

Battlefield Mobility

Test Procedures

Test Methods and Techniques

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