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Materiel Test Procedure 4-3-071
U. S. Army Armor and Engineer Board

U. S. ARMY TEST AND EVALUATION COMMAND
COMMODITY SERVICE TEST PROCEDURE

FLAMETHROWER, MECHANIZED

1. OBJECTIVE

This Materiel Test Procedure (MTP) outlines procedures for determining the degree that mechanized flamethrowers with their associated tools and equipment perform the mission(s) described in the Qualitative Materiel Requirement (QMR), Small Development Requirement (SDR) or other approved criteria and to determine the suitability of the flamethrowers and their associated maintenance test packages for use by the U. S. Army.

2. BACKGROUND

A flamethrower is a weapon that projects incendiary fuel and has provisions for ignition of this fuel. A mechanized flamethrower consists of a flamethrower gun and a fuel and pressure unit with ancillary equipment installed in a full-tracked armored vehicle. The gun has a dummy barrel containing the flame gun tubes and high voltage spark plugs and has holes in the side for entrance of air for combustion. A barrel cover or shroud is provided for access to ignition components. Compressed air and gasoline are atomized in the forward part of the gun tube and ignited by the high voltage spark (igniter) plugs. This air-atomized mixture ignites the fuel leaving the main fuel nozzle. The fuel and pressure unit can be divided into four sections: the pressure system which propels the main, atomizer, and secondary fuels; the fuel system which consists of containers and related parts for transporting main, atomizer, and secondary fuels; the ignition system which is used for igniting the fuel; the safety devices, both manual and automatic, for protection of personnel and vehicle.

The mechanized flamethrower has the primary mission of dislodging or destroying personnel in emplacements such as fortified positions, caves, underground installations, and buildings that resist assault by other weapons. It has a secondary mission of destroying materiel. Mechanized flamethrowers should attack in conjunction with other ground attack weapons to exploit the advantages gained by flame. Coordination and detailed planning with supported and supporting arms is of primary importance to the successful employment of mechanized flamethrowers.

All flame guns have a high flame fuel consumption rate. But because the flame fuel capacity of a mechanized flamethrower is much greater than that of the man-portable type, it can deliver a greater amount of effective flame before its tanks must be refilled. Its speed and mobility facilitate its reservicing and reemployment. Its capability of sustained operation should not be measured in seconds or minutes of continuous firing. It should be measured in terms of the number of effective flame bursts (shots) that it can deliver. In other words, each flame burst should be thought of as a round of ammunition.

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The term mechanized flamethrower as used in this MTP is defined as a flamethrower mounted in a tank turret in lieu of the main armament, or in the cupola of an armored personnel carrier along with a coaxial machine gun. Both of these types of vehicles have the necessary communication equipment to facilitate their control within the tank-infantry team.

The service test should require the test item to be operated in its designed role under as great a variety of use and environmental conditions as practicable. In order to determine the extent to which its functional performance and military characteristics conform to requirements of the applicable QMR, SDR, or other appropriate criteria, each type of mechanized flamethrower must be tested in the field by personnel representative of those who will actually operate and maintain the item under combat conditions.

3. REQUIRED EQUIPMENT

- a. Maintenance Facilities (organizational, direct support and general support).
- b. Appropriate Cross-Country Driving Courses.
- c. Appropriate Primary (Paved Highway) and Secondary (Gravel) Road Driving Courses.
- d. Fording Course.
- e. Inland Waterway Operation Course.
- f. Firing Ranges as Appropriate for the Flamethrower and other Vehicular Weapons.
- g. Wrecker or Recovery Vehicle.
- h. Cameras, Still, Motion or Video as available with necessary Film and Video Recorder when applicable.
- i. Pertinent Cargo or Appropriate Substitute Material.
- j. Companion Vehicles for Comparison Purposes.
- k. Platform Scales.
- l. Stopwatches.
- m. Appropriate Transporter(s).
- n. Ambulance with Medical Aid Personnel and Equipment.
- o. Applicable Vehicular Kits.
- p. Meteorological Equipment as required for measuring:
 - 1) Wind speed and direction.
 - 2) Ambient temperature.
 - 3) Relative humidity.
- q. Appropriate Flamethrower Service Unit.
- r. Equipment and Facilities as Required by Referenced Materiel

Test Procedures.

4. REFERENCES

- A. USATECOM REG 385-6, Verification of Safety of Materiel During Testing.

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- B. MTP 10-3-501, Operator Training and Familiarization.
- C. MTP 2-3-501, Safety Hazards.
- D. AR 385-63, Safety Regulations for Firing Ammunition for Training, Target Practice, and Combat.
- E. MTP 2-3-500, Preoperational Inspection and Physical Characteristics.
- F. MTP 6-3-500, Physical Characteristics.
- G. MTP 6-3-501, Pre-Test Inspection for Service Test.
- H. MTP 2-3-516, Human Factors Engineering.
- I. MTP 2-3-514, Kit Installation and Evaluation.
- J. MTP 2-3-508, Stowage.
- K. MTP 4-3-519, Compatibility with Fire Control Equipment.
- L. MTP 3-3-505, Speed and Precision of Lay.
- M. MTP 3-3-504, Close-In Fields of View and Fire.
- N. MTP 3-3-516, Obscuration.
- O. MTP 2-3-505, Road Mobility.
- P. MTP 2-3-504, Cross-Country Mobility.
- Q. MTP 2-3-513, Fuel and Oil Consumption.
- R. MTP 3-3-503, Boresight and Zero.
- S. MTP 3-3-525, Vehicular-Mounted Automatic Weapons Dispersion.
- T. MTP 3-3-510, Weapons Functioning.
- U. MTP 4-3-522, Combat Vehicle Ammunition Functioning.
- V. MTP 2-3-512, Compatibility with Related Equipment.
- W. MTP 3-3-501, Personnel Training.
- X. MTP 2-3-511, Security (Susceptibility to Detection).
- Y. MTP 2-3-509, Fording.
- Z. MTP 2-3-510, Inland Waterway Operation.
- AA. MTP 2-3-506, Simulated Tactical Operation.
- AB. MTP 2-3-519, Surface Transportability (Vehicles).
- AC. MTP 7-3-515, Air Portability, Internal - Suitability of Supplies and Equipment for.
- AD. MTP 7-3-516, Air Portability, External - Suitability of Supplies and Equipment for.
- AE. MTP 2-3-520, Logistics Over-the-Shore (LOTS).
- AF. MTP 2-3-502, Maintainability.
- AG. MTP 2-3-527, Maintenance Evaluation - Tools and Test Equipment.
- AH. MTP 2-3-528, Maintenance Evaluation - Technical Manuscripts and Manuals.
- AI. MTP 2-3-507, Reliability.
- AJ. MTP 6-3-503, Communications Equipment.

5. SCOPE

5.1 SUMMARY

This MTP describes procedures to be used in evaluating mechanized flamethrowers as follows:

- a. Preparation for Test. Arrange for required facilities and review the safety release to determine the operational limitations, if any, placed on the test item due to safety hazards.

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b. Operator Training and Familiarization. Procedures for conducting the necessary pretest training and familiarizing personnel with the test item and recording related data.

c. Safety Hazards. A determination of the inherent safety hazards and a continuous evaluation of safety aspects of the test item throughout the service test to support the safety confirmation (safe for intended use) statement required in service test reports.

d. Preoperational Inspection and Physical Characteristics. Pre-test inspection, service and repair of the test materiel as required to ensure that it is in proper condition for test operation, and to determine whether physical characteristics meet specified requirements.

e. Human Factors Engineering. An evaluation to determine the human factors engineering aspects of the test item and its compatibility with the skills and aptitudes of personnel who will operate and service it.

f. Kit Installation and Evaluation:

- 1) Procedures for inspecting, unpackaging, inventorying, installing and removing kits and evaluating instructions for these tasks.
- 2) A test to determine whether accessory kits are compatible with the parent vehicle and/or other kits, functionally suitable, maintainable and reliable.

g. Stowage. A test to determine whether required items can be readily stowed and properly secured and protected throughout test operations.

h. Communications Equipment. A test to determine whether radios and their related components are physically and electrically compatible with the test vehicle and the maximum reliable range of communication under various weather conditions and types of terrain.

i. Compatibility with Fire Control Equipment. A test to determine the suitability of fire control equipment for use with conventional ammunition - direct fire weapon combinations.

j. Speed and Precision of Lay. A test to determine the time required to accurately lay the weapon sight(s) on a clearly defined target under various conditions and modes of operation.

k. Close-In Fields of View and Fire. A test to determine the minimum distance from the vehicle that the earth surface can be seen and brought under fire by one or more of the vehicular-mounted weapons and the maximum elevation of each weapon.

l. Obscuration. Procedures for determining the degree (and time)

that targets are obscured from the gunner's/crew's view by smoke, muzzle flash, dust, and blast created by firing the weapons.

m. Road Mobility. A test to determine the capability of the test item to move over paved highways and gravel roads alone and in convoy, under varying weather conditions, with other vehicles with which it will be associated.

n. Cross-Country Mobility. A test to determine the capability of the test item to move over various types of cross-country terrain under varying weather and soil conditions alone and with associated vehicles.

o. Fuel and Oil Consumption. A test to determine the cruising range of the test item, fuel and oil consumption and compatibility with refueling equipment.

p. Boresight and Zero. A test to determine:

- 1) Whether the test weapon and associated fire control equipment can be alined on a common aiming point at the prescribed ranges.
- 2) Whether there is sufficient movement of the sights or mount to permit zeroing the system with sufficient reserve movement left to accommodate normal production tolerances.
- 3) The degree to which boresight alinement can be maintained under varying climatic and operating conditions.

q. Automatic Weapons Dispersion. A test to determine the dispersion characteristics and hitting capability of each type automatic weapon system.

r. Weapon Functioning. Procedures for collecting and recording data relative to the malfunctioning of all vehicular weapons.

s. Ammunition Functioning. Procedures for collecting and recording data relative to the as-received condition and the malfunctioning of all types of ammunition.

t. Compatibility with Related Equipment. A series of tests to determine:

- 1) The compatibility of the test item with applicable recovery vehicles, transporters and emergency starting facilities.
- 2) Whether the test item can tow and be towed by similar weight vehicles with which it will be associated.
- 3) The self-recovery and winching capability of the test item, if applicable.

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u. Functional Suitability of Flamethrower. A series of tests to determine the:

- 1) Compatibility of the flamethrower with service unit.
- 2) Adequacy of fire control equipment and published procedures for zeroing the flame gun.
- 3) Compatibility of sight reticles with the flight characteristics of the flame rod(s).
- 4) Hitting capability of a stationary flame gun against:
 - a) Known range stationary targets.
 - b) Unknown range stationary targets.
- 5) Hitting capability of the flame gun and vehicular-mounted machine gun(s) against a stationary target from a moving flamethrower.
- 6) Time required to reservice and get the flamethrower back into action under simulated combat conditions.

v. Security (Susceptibility to Detection). A test to determine the susceptibility of the test item to detection by visual, aural and infrared techniques.

w. Fording. A test to determine the shallow and, if applicable, the deep water fording capabilities of the test item.

x. Inland Waterway Operations. A test to determine the swimming and floating capability of the test item in inland waterways.

y. Simulated Tactical Operation. A test to determine whether typical personnel can use the test item to satisfactorily perform simulated tactical operations.

z. Transportability. A series of tests and/or studies to determine the ease with which the test item can be prepared for transport and whether it can withstand the shocks, vibration and other extraneous forces and impacts encountered while being transported by the following modes:

- 1) By rail and ship.
- 2) By aircraft.
 - a) Internally
 - b) Externally

aa. Logistics Over-the-Shore (LOTS). A test to determine whether the test item can be off-loaded from a ship and moved through the surf to the shore.

ab. Maintenance Evaluation

- 1) Maintainability. A determination of the maintenance requirements, both scheduled and unscheduled, of the test item, and the ease of performing the required maintenance action.

- 2) Tools and Test Equipment. An evaluation to determine whether common and special tools and test equipment furnished for the test item are suitable for the intended purpose and maintenance level.
- 3) Technical Manuscripts and Manuals. An evaluation to determine the adequacy of technical publications provided.

ac. Reliability. An evaluation of the test item's reliability to include information regarding expected service life.

5.2 LIMITATIONS

None.

6. PROCEDURES

6.1 PREPARATION FOR TEST

6.1.1 Personnel

Ensure that all test personnel are properly licensed to operate the item being tested.

6.1.2 Equipment and Facilities

Ensure that equipment and facilities listed in paragraph 3 and in Materiel Test Procedures referenced in paragraph 4 above are available.

6.1.3 Safety Release

The project officer shall ensure that a safety release (ref 4A), which includes information pertaining to operational limitations and specific hazards peculiar to the test item, has been received from HQ USATECOM, is understood, and complied with during testing.

6.2 TEST CONDUCT

NOTE: The subtests listed below are those that would be applicable to a complete mechanized flamethrower to include all on-vehicle automatic weapons with their respective ammunitions and related fire control system(s). The subtests to be used for any one specific project will depend upon the requirements and criteria contained in the test directive or other appropriate documents.

6.2.1 Operator Training and Familiarization

Conduct tests as described in MTP 10-3-501 (ref 4B).

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NOTE: Mechanized flamethrowers are manned by specially trained personnel as a primary duty. These personnel must be capable of firing the flame gun and machine gun(s) as well as driving the vehicle.

6.2.2 Safety Hazards

Conduct a continuing evaluation of all safety aspects of the test item as described in MTP 2-3-501 (ref 4C).

NOTE: Instructions on safety for mechanized flamethrowers are contained in AR 385-63 (ref 4D).

6.2.3 Preoperational Inspection and Physical Characteristics

a. Perform inspections, checks, inventories, measurements, weighing, and photographing of:

- 1) The test vehicles and vehicular related equipment as described in MTP 2-3-500 (ref 4E).
- 2) Radios and related items as described in MTP 6-3-500 (ref 4F) and MTP 6-3-501 (ref 4G).

b. Perform break-in operations of test vehicle and related vehicular equipment as described in MTP 2-3-500 (ref 4E).

6.2.4 Human Factors Engineering

Determine the effectiveness of the man-machine relationship during use of the test item as described in MTP 2-3-516 (ref 4H).

6.2.5 Kit Installation and Evaluation

Conduct applicable portions of tests described in MTP 2-3-514 (ref 4I).

6.2.6 Stowage

Conduct applicable tests as described in MTP 2-3-508 (ref 4J).

6.2.7 Communication Equipment

Conduct applicable tests as described in MTP 6-3-503 (ref 4AJ).

6.2.8 Compatibility with Fire Control

Conduct applicable tests as described in MTP 4-3-519 (ref 4K).

6.2.9 Speed and Precision of Lay

Conduct applicable tests as described in MTP 3-3-505 (ref 4L).

6.2.10 Close-In-Fields of View and Fire

Conduct applicable tests as described in MTP 3-3-504 (ref 4M).

6.2.11 Obscuration

Conduct applicable portions of tests as described in MTP 3-3-516 (ref 4N).

6.2.12 Road Mobility

- NOTE: 1. Since flamethrowers are installed in vehicles that have been type classified, the primary purpose of mobility testing of the vehicle is to determine the effects, if any, which vehicle operation will have on flamethrower components.
2. When traveling in convoy with the flamethrower fueled and pressurized, the interval between vehicles will be at least 250 meters.

Conduct road mobility testing as described in MTP 2-3-505 (ref 4O) and below unless otherwise specified in the test directive or other approved document.

a. During the initial paved and gravel road convoy operations with associated vehicles and other special tests such as maximum and minimum speeds, acceleration and braking tests, all test vehicles, comparison vehicles, and associated items, with trailed load, as applicable, should carry maximum rated or full combat loads.

b. As a minimum, special tests should be conducted near the beginning, midway point and end of testing.

6.2.13 Cross-Country Mobility

NOTE: The NOTE under paragraph 6.2.12 is applicable here also. Conduct cross-country mobility testing as described in MTP 2-3-504 (ref 4P) and below unless otherwise specified in the test directive or other approved document.

a. During the initial cross-country operations with associated vehicles and other special tests such as maximum grade, side slope, obstacle crossing, etc., all test and comparison vehicles and associated items, with trailed load, when applicable, should carry maximum rated or full combat loads.

b. As a minimum, these special tests should be conducted near the beginning, midway point and end of test.

6.2.14 Fuel and Oil Consumption

Conduct cruising range and vehicle refueling tests and maintain records of all fuel and oil consumed as described in MTP 2-3-513 (ref 4Q).

6.2.15 Boresight and Zero

Boresight and zero vehicular-mounted machine guns as described in MTP 3-3-503 (ref 4R) and/or as described in the technical publication for the particular system being tested.

NOTE: Since the flame gun is unlike a conventional gun, in the there is no bore to be used as a reference for bore-sighting, it cannot be boresighted. The flame gun can only be zeroed. Zeroing is covered under the subtest entitled, Functional Suitability.

6.2.16 Vehicular-Mounted Automatic Weapons Dispersion

Conduct applicable portions of testing as described in MTP 3-3-525 (ref 4S).

6.2.17 Weapons Functioning

Conduct applicable portions of testing as described in MTP 3-3-510 (ref 4T) for vehicular-mounted machine gun(s).

6.2.18 Ammunition Functioning

Conduct applicable portions of testing as described in MTP 4-3-522 (ref 4U) for machine gun ammunition.

6.2.19 Compatibility with Related Equipment

Conduct tests as described in MTP 2-3-512 ((ref 4V).

6.2.20 Functional Suitability of Flamethrower

- NOTE: 1. All mechanized flamethrowers operate on the same basic principles; however, the nomenclature of controls and components and the sequence of specific procedures prior to firing will vary with the type of vehicle in which the flame gun and related components are installed. Therefore, the procedures outlined in this subtest are of a general nature. The specific procedures and the sequence to be followed should be as described in the appropriate technical publication for the item being tested.
2. The definition of terms peculiar to flamethrower operation are in the Glossary on the last page of the MTP.

6.2.20.1 Objective

The objectives of this subtest are to determine:

- a. The compatibility of the flamethrower with the service unit.
- b. The time required to service the flamethrower and pressurize its air tanks.
- c. The adequacy of zeroing procedures for the flame gun.
- d. The compatibility of sight reticles with flame gun-rod combinations.
- e. Hitting capability of a stationary flame gun against:
 - 1) Known range stationary targets.
 - 2) Unknown range stationary targets.
- f. Hitting capability of a moving flamethrower using the flame gun and machine gun(s) against stationary targets.
- g. The time required to accomplish the following under simulated combat conditions:
 - 1) Expend flame gun fuel load.
 - 2) Return to service point.
 - 3) Reservice flamethrower.
 - 4) Return to firing site.

6.2.20.2 Preparation for Test

- a. Ensure that a flamethrower service unit is available to provide:
 - 1) Properly mixed fuel for the flamethrower.
 - 2) An air compressor for pressurizing the system.
- b. Obtain a firing range area devoid of inflammable material such as grass, brush, etc., so as to avoid starting fires.
- c. Prepare a plot of the firing range.
- d. Arrange for fire fighting equipment when deemed necessary.

NOTE: As a minimum, wet blankets or fireproof material should be available for extinguishing fires on personnel.

- e. Prepare targets of various sized to represent openings in gun emplacement, caves, windows, etc.

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NOTE: Targets consisting of only metal frames are preferred to prevent burning and to permit wet shots being fired through them.

f. Perform the organizational preventive maintenance described in the pertinent technical publication to the extent required to ensure that the flamethrower and all related components are in proper condition for testing.

g. If practicable, personnel should be given the necessary pre-test training in the use of portable flamethrowers as described in MTP 3-3-501 (ref 4W) and some firing practice with these weapons prior to training and use of mechanized flamethrowers.

h. Position photographic and meteorological equipment near the firing position.

6.2.20.3 Method

NOTE: The area selected for servicing the flamethrower should be reasonably flat and free of foliage, rubbish, or debris.

6.2.20.3.1 Compatibility with Service Equipment. Perform the following task, if applicable, as outlined in pertinent technical publications and/or as described on the Instruction Plate attached within the vehicle for the various components.

- a. Pressurize the hydraulic accumulator.
- b. Fill ignition gasoline tank.
- c. Before servicing, inspection to include:
 - 1) Instrument and fire control system lights.
 - 2) Traversing and elevating system.
 - 3) Couplings and connectors.
 - 4) Testing of the ignition spark.
- d. Service the flamethrower

NOTE: A vehicle-mounted service unit is used for this task. Operation of the flamethrower service unit will be covered under a separate MTP.

- 1) Position the service unit alongside the flamethrower so that the fuel delivery hose will reach the fuel inlet and the air service hose will reach the air filling line connector on the pressure control unit.
- 2) To fill flame fuel tanks, proceed as follows:
 - a) Turn vehicle master switch to OFF position.

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- b) Place circuit breaker switch in OFF position.
- c) Assure that each pressure control unit valve is in the position specified by the pertinent technical publication.
- d) Open the fuel filling inlet cover and/or remove the fuel filling inlet cap.
- e) Connect the fuel delivery hose from the service unit to the fuel filling inlet on the flamethrower.
- f) Pump the thickened fuel into the flamethrower tanks in accordance with instructions contained in the technical publication(s) for the service unit and the flamethrower.
- g) Observe flamethrower fuel gage for proper functioning while filling the fuel tank(s).
- h) Disconnect the fuel delivery hose, replace the fuel filling inlet cover, if applicable.
- i) Measure the time to fill tank(s) (clock hours and manhours to nearest tenth).

e. To pressure the air tanks, proceed as follows:

- 1) Connect the high pressure air service hose from the service unit to the air filling line connector on the pressure control unit of the flamethrower.
- 2) Start the service unit compressor.
- 3) Open the high pressure line valve on the service unit.
- 4) Pressurize the air tanks in accordance with the instructions contained in the technical publication(s) for the service unit and the flamethrower.
- 5) Close the high pressure valve on the service unit.
- 6) Stop the service unit compressor.
- 7) Bleed the service unit pressure hose.
- 8) Disconnect the service unit pressure hose from the air filling hose connector on the pressure control unit of the flamethrower.

NOTE: Pressurizing the flamethrower can be done concurrently with fuel filling. The operator and driver of the flamethrower should be present to assist the crew of the service unit during fuel filling and pressurizing.

f. Measure the time (clock hours and manhours to nearest tenth) required to service and pressurize the flamethrower.

NOTE: Since the flamethrower fuel load can be expended so quickly in combat, speed in refueling and pressurizing should be emphasized to the greatest extent practicable without creating undue safety hazards.

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g. Record the reading of:

- 1) Fuel tank gages.
- 2) Pressure tank gages for both primary and secondary fuel systems.
- 3) Firing time indicator.

h. Compare readings recorded in paragraph g above with those prescribed in the pertinent technical publication.

i. Check the following in the fuel and pressure systems for any indication of leaking:

- 1) Tanks.
- 2) Hoses.
- 3) Connections.
- 4) Fittings.
- 5) Gages.
- 6) Firing time indicators.

j. Wait one hour and recheck readings in paragraph g above for possible leaks.

6.2.20.3.2 Zeroing the Flame Gun. To zero the flame gun:

a. Position test vehicle at selected range site.

b. Unless otherwise specified, the zeroing target will be 100 meters from the flamethrower.

- NOTE:
1. Zeroing should be performed when there is little or no wind. If there is any wind, the vehicle should be positioned so as to have a following or tail wind.
 2. Effects of Weather on Flame Gun Operation.
 - a. Head winds shorten the effective range of the flame gun and tend to blow the flame rod apart and back toward the firing vehicle. Firing must not be done into headwinds of greater than five miles per hour during testing. The test vehicle will be completely buttoned up when firing into any headwind. (See the last page of this MTP for the Glossary of technical terms.)
 - b. Tail or following winds will increase the range of the flame gun and are the safest and best wind conditions for firing.
 - c. Crosswinds tend to blow the flame rod off the gun-target line and if greater than five miles per hour may break up the flame rod as it reaches the target. The operator must aim off the target to

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compensate for the drift of the flame rod and either increase the range setting on the sight or move the vehicle into closer range to engage under these conditions.

- d. Quartering winds from the rear of the vehicle increase the maximum range of the flame gun and tend to blow the flame rod off the gun-target line.
- e. Quartering winds blowing towards the front of the vehicle will shorten the maximum range of the flame gun and tend to blow the flame rod off the gun target line.
- f. Light rain will have no appreciable effect on the flame rod.
- g. Heavy rains will extinguish a long flame rod before it hits the target.
- h. Cold and snow or hot dry dusty conditions will not affect the operation of a flamethrower.

c. Determine the size of the flame fuel nozzle in the flame gun. If more than one size nozzle is provided, begin firing with the smallest.

NOTE: Some flame guns have two different size fuel nozzles. The larger size nozzle gives greater range than the smaller but has a higher rate of discharge. It should be used where range rather than firing time is the prime consideration.

d. Perform all prefiring checks as described in the pertinent technical publication for the test item.

e. Point the flame gun at the zeroing target and:

- 1) Fire a short burst by first actuating the ignition trigger (switch) and then immediately actuating the flame fuel trigger, then releasing both triggers.

NOTE: The length of a burst is determined by the time the triggers remain actuated. A short burst is one of approximately one second duration.

- 2) If flame continues after both triggers are released, press snuffer (muzzle fire extinguisher) trigger for approximately one second, when applicable to the system.
- 3) Photograph each flame rod to the extent practicable.
- 4) Measure the length (time in seconds) for each burst.
- 5) Plot the approximate position of the impact of each burst in relation to the target.
- 6) Record the primary fuel pressure reading after each burst fired.
- 7) If target is not hit, adjust the flame gun in elevation and/or deflection as required and fire another short burst as described in paragraph 1) above.

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- 8) Repeat procedures described in paragraph 7) above until the flame rod strikes near the center of the zeroing target.
- 9) Without moving the flame gun, adjust the optical sight until the 100 meter aiming point is on the center of the target.
- 10) Fire another short burst. If the flame rod hits near the center of the target, the flame gun is zeroed; if it does not, repeat procedures until gun is zeroed.
- 11) Measure the amount of sight adjustment movement remaining, if practicable.
- 12) Reboresight and/or zero coaxial machine gun, if required.

f. If two different size nozzles are provided:

- 1) Insert the larger nozzle.
- 2) Fire at least three short bursts using the same sight setting used with the smaller nozzle.
- 3) Compare the location of burst impacts obtained with the different nozzles.

- NOTE:
1. A mechanized flamethrower must be emptied of all flame fuel and pressure before leaving the firing range. Test plans should be flexible enough to permit doing this by continuing the same subtest or beginning another.
 2. A billowing mass of flame followed by a rush of air at the flame gun nozzle indicates that the fuel tank(s) are empty.
 3. To assure that no fuel or air is left in the in the flamethrower, vent the system in accordance with instructions in the technical publication for the test item.

6.2.20.3.3 Known Range Firing. Proceed as follows:

a. Erect a target at the ranges equivalent to each clearly defined aiming point on the sight reticle for the flame gun from 50 meters out to the maximum effective range of the flame gun as shown in the QMR, SDR, or other appropriate document.

b. Prepare a plot of target layout showing range to each target.

c. Using the proper point on the sight reticle:

- 1) Lay the sight precisely on the nearest target using manual controls.
- 2) Using the small nozzle, when applicable, fire a short burst.
- 3) Measure the length of each burst in seconds.

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- 4) If a hit was obtained, fire two additional bursts.
 - 5) If the flame rod missed the target:
 - a) Make necessary correction in elevation and/or deflection.
 - b) Fire another short burst.
 - c) Repeat procedures in a) and b) above until a target hit is obtained.
 - d) Record primary fuel pressure reading after each burst.
 - e) Fire two additional bursts with the same sight setting.
 - 6) Photograph flame rods to the extent practicable.
- d. Repeat procedures outlined in paragraph c above, as applicable, for each range established by paragraph a above.
- e. Repeat the firing on at least three representative range targets except that the length of bursts should be increased:
- 1) Twenty-five percent.
 - 2) Fifty percent.
- f. Compare the accuracy and range obtained with bursts of different lengths.
- g. Extend the range to the target, if necessary, and continue firing until the following are determined:
- 1) Maximum effective range.
 - 2) Maximum range.
- h. Install the larger nozzle, when applicable, and repeat procedures described in paragraph c through g above.
- i. Repeat representative portions of firing described in paragraphs c and d above using power controls, when applicable.
- j. Compare results obtained with:
- 1) Manual controls.
 - 2) Power controls.
- k. Using metal frames as targets, repeat firing as described in paragraphs c and d above at representative ranges using the wet shot (see item 10 of Glossary) procedures as follows:
- 1) Lay the sight precisely on the selected target.
 - 2) Fire a short wet shot.
 - 3) Ignite the wet shot fuel with a short burst (flame rod).

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- 4) If wet shot did not go through the target, make the necessary sight corrections and fire another wet shot; then ignite it.
- 5) Repeat the procedures described in paragraph 4) above until a wet shot is placed through the target frame.
- 6) If the first wet shot goes through the target frame, ignite it and fire at the next selected target.

6.2.20.3.4 Unknown Range Firing. Proceed as follows:

a. Erect targets of various sizes at staggered intervals beginning approximately 35 meters from the firing point and extending out to the maximum effective range established in the Known Range Firing subtest (paragraph 6.2.20.3.3 above).

NOTE: Targets for the flame gun, other than those at maximum effective range, should be at slightly different range than those used in the Known Range Firing subtest.

b. Repeat applicable portions of firing described in paragraph 6.2.20.3.3 above except that the range will be estimated.

c. Repeat unknown range firing at near the beginning, midway point and end of the service test.

6.2.20.3.5 Moving Gun Mount-Stationary Target Firing. Proceed as follows:

NOTE: Since the vehicular-mounted machine guns are to be used in conjunction with the flame gun, this subtest should include the firing of both type weapons. The initial testing may be done with only one type weapon, but the final phases will include the firing of both types.

a. Erect targets of selected sizes for the ranges to be fired with the flame gun and groupings of silhouette targets appropriate for the vehicular-mounted machine gun(s). See sample target layout at Appendix A.

NOTE: The plan for this subtest should require sufficient firing of the flame gun to necessitate refueling. The service unit must be located as far from the firing range as it would be from the final assault line in actual combat in order to generate realistic turn-around time.

b. Locate the service unit as would be done in a combat assault situation.

c. Service the flamethrower as described in paragraph 6.2.20.3.1 above.

- d. Move the flamethrower to the firing site.
- e. Measure the time required to service the flamethrower.
- f. Prepare a plot of:
 - 1) The firing range showing each target size, assigned number and the approximate distance from its related firing position.
 - 2) The overall test area showing the position of the service unit in relation to the firing site.
- g. Proceed as follows:
 - 1) Move vehicle along the course firing the flame gun or machine gun, when applicable, at the first targets until:
 - a) A hit is obtained with the flame gun, or
 - b) The test officer signals that target is destroyed.
 - c) Measure the time consumed in hitting or destroying the target.
 - 2) Repeat procedures described in paragraph 1) above on each succeeding target until the flame fuel tank(s) are empty.
 - 3) Return the flamethrower to the service unit.

NOTE: In the interest of training and tactical realism, the target area should be kept under machine gun fire as the test item is turned around and started toward the refueling area.

- 4) Measure the time required to:
 - a) Reach the service unit.
 - b) Service the flamethrower.
 - c) Return to the firing site.
- 5) Repeat the procedures described in paragraphs 1) through 4) above until all targets are hit or considered to be destroyed.

h. This test should be of sufficient length to require at least three refuelings of the flamethrower.

i. As a minimum, testing described in paragraphs a through h above should be conducted near the beginning, midway point and end of the service test.

6.2.21 Security (Susceptibility to Detection)

Conduct tests as described in MTP 2-3-511 (ref 4X).

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6.2.22 Fording

Conduct applicable portions of tests as described in MTP 2-3-509 (ref 4Y).

6.2.23 Inland Waterway Operations

Conduct swimming and floating tests as described in MTP 2-3-510 (ref 4Z).

6.2.24 Simulated Tactical Operation

Conduct tests as described in MTP 2-3-506 (ref 4AA).

6.2.25 Transportability

a. Surface Transportability (Vehicles). Conduct tests as described in MTP 2-3-519 (ref 4AB).

b. Air Portability, Internal - Suitability of Supplies and Equipment for. Conduct tests as described in MTP 7-3-515 (ref 4AC), if applicable.

c. Air Portability, External - Suitability of Supplies and Equipment for. Conduct tests as described in MTP 7-3-516 (ref 4AD), if applicable.

6.2.26 Logistics Over-the-Shore (LOTS)

Conduct tests as described in MTP 2-3-520 (ref 4AE).

6.2.27 Maintenance Evaluation

a. Maintainability. Conduct the maintainability evaluation and make required computations for the test item as described in MTP 2-3-502 (ref 4AF) or other appropriate documents.

b. Tools and Test Equipment. Throughout the performance of all daily maintenance services and all maintenance tasks, a record of tools and test equipment used should be maintained as described in MTP 2-3-527 (ref 4AG) to determine whether the common and special tools and test equipment are suitable for the intended purpose and prescribed level of maintenance.

c. Technical Manuscripts and Manuals. All equipment publications provided with or furnished as guidance for the use and maintenance of the test item should be continuously evaluated with respect to availability, adequacy, accuracy and currency and required changes forwarded as described in MTP 2-3-528 (ref 4AH).

6.2.28 Reliability

Conduct reliability testing and make required computations for the test item as described in MTP 2-3-507 (ref 4AI) or other appropriate documents.

NOTE: Test cycling should be designed to distribute operation with the flame fuel tank(s) full and empty, evenly throughout the entire test and where possible each season of the year. Figure 1 shows an example mileage cycle for use when none is specified in the QMR or other criteria. The percentages shown in Figure 1 are percentages of the mileage breakdown. It is emphasized that the number of miles specified for each type of operation in cycle are not to be run continuously until a full quota of a type is completed. On the contrary, in an attempt to duplicate troop used of the vehicle, every effort will be made to develop a proper proportion of each type mileage with the flame fuel tank(s) full and empty as it would be accumulated in user organizations.

<u>Type Vehicle</u>	<u>Total</u>	<u>Highway*</u>	<u>Secondary**</u>	<u>Cross-Country</u>
Carrier	750	225 (30%)	255 (34%)	270 (36%)
Tank	750	210 (28%)	270 (36%)	270 (36%)

* Paved roads

** Gravel roads

Figure 1. Sample Mileage Cycles for Mechanized Flamethrowers.

6.3 TEST DATA

6.3.1 Operator Training and Familiarization

Record data for each test participant as described in MTP 10-3-501 (ref 4B).

6.3.2 Safety Hazards

Record data as described in MTP 2-3-501 (ref 4C).

6.3.3 Preoperational Inspection and Physical Characteristics

Record data as described in:

a. MTP 2-3-500 (ref 4E).

b. MTP 6-3-500 (ref 4F).

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c. MTP 6-3-501 (ref 4G).

6.3.4 Human Factors Engineering

Record data as described in MTP 2-3-516 (ref 4H).

6.3.5 Kit Installation and Evaluation

Record data as described in MTP 2-3-514 (ref 4I).

6.3.6 Stowage

Record data as described in MTP 2-3-508 (ref 4J).

6.3.7 Communication Equipment

Record data as described in MTP 6-3-503 (ref 4AJ).

6.3.8 Compatibility with Fire Control Equipment

Record applicable data as described in MTP 4-3-519 (ref 4K).

6.3.9 Speed and Precision of Lay

Record applicable data as described in MTP 3-3-505 (ref 4L)

6.3.10 Close-In Fields of View and Fire

Record applicable data as described in MTP 3-3-504 (ref 4M).

6.3.11 Obscuration

Record applicable data as described in MTP 3-3-516 (ref 4N).

6.3.12 Road Mobility

Record data as described in MTP 2-3-505 (ref 4O).

6.3.13 Cross-Country Mobility

Record data as described in MTP 2-3-504 (ref 4P).

6.3.14 Fuel and Oil Consumption

Record data as described in MTP 2-3-513 (ref 4Q).

6.3.15 Boresight and Zero

Record applicable data for vehicular-mounted machine guns as described in MTP 3-3-503 (ref 4R).

6.3.16 Vehicular-Mounted Automatic Weapons Dispersion

Record applicable data as described in MTP 3-3-525 (ref 4S).

6.3.17 Weapons Functioning

Record applicable data as described in MTP 3-3-510 (ref 4T).

6.3.18 Ammunition Functioning

Record applicable data as described in MTP 4-3-522 (ref 4U).

6.3.19 Compatibility with Related Equipment

Record data as described in MTP 2-3-512 (ref 4V).

6.3.20 Functional Suitability of Flamethrower

6.3.20.1 Preparation for Test

Record or retain the following:

- a. Nomenclature and serial number of the service unit.
- b. Plot of firing range(s).
- c. Type of fire fighting equipment for on-site use.
- d. Description of targets.
- e. Repairs, adjustments, or servicing done, if any.

NOTE: Any repairs or adjustments made should be recorded here and in the Maintenance Evaluation Maintainability subtest also.

f. Name and rank or grade of test personnel trained in the use of portable flamethrowers, if any, and the amount of such training received.

6.3.20.2 Method

6.3.20.2.1 Compatibility with Service Equipment. Record the following:

- a. Problems, if any, in:
 - 1) Pressurizing the accumulator.
 - 2) Filling the ignition gasoline tank.
 - 3) Performing the before-servicing inspection.

b. On servicing the flamethrower:

- 1) Length of:
 - a) Fuel hose.
 - b) Air hose.
- 2) Whether the above hoses were long enough to permit servicing the vehicle from either side.
- 3) Difficulty, if any, in:
 - a) Removing the fuel filling inlet cap and cover, when applicable.
 - b) Determining the proper position for the pressure control unit valve.
 - c) Connecting the fuel delivery hose.
 - d) Pumping thickened fuel into the flamethrower tank(s).
- 4) The amount of fuel required to fill the flamethrower tank(s).
- 5) Malfunctioning, if any, of the flamethrower fuel tank gage.
- 6) Difficulty, if any, in disconnecting the fuel delivery hose.
- 7) Time (in clock-hours and man-hours) to fuel the flamethrower.
- 8) Leaks, if any, in fuel system.

c. On pressurizing the air tanks:

- 1) Difficulty, if any, in:
 - a) Connecting the high pressure air service hose.
 - b) Opening the air pressure valve on the service unit.
 - c) Pressurizing the air tanks.
- 2) The amount of pressure:
 - a) Specified in pertinent technical publication.
 - b) Pumped into the pressure tank(s).
- 3) Malfunctioning, if any, of the pressure gage(s).
- 4) Difficulty, if any, in:
 - a) Closing the high pressure valve on the service unit.
 - b) Bleeding the service unit pressure hose.
 - c) Disconnecting the pressure hose from the flamethrower.

d. Time (in clock-hours and man-hours) to pressurize the air tank(s).

e. Leaks, if any, in pressure system.

f. Total time (in clock-hours and man-hours) to service the fuel tank(s).

g. Nomenclature and serial number of service unit.

h. Whether air tank(s) were pressurized concurrently with fueling operation.

6.3.20.2.2 Zeroing the Flame Gun. Record or retain the following:

- a. Name and rank or grade of operator (gunner).
- b. Date and time.
- c. Nomenclature and serial number of:
 - 1) Flame gun.
 - 2) Flamethrower vehicle.
- d. Technical document containing zeroing instructions.
- e. Type controls used (manual or power).
- f. Nomenclature and serial number of sight used.
- g. Total number of bursts required for zeroing.
- h. Length (time in seconds) for each burst.
- i. Primary fuel pressure reading after each burst and the effect, if any, lower pressure has on accuracy and range capabilities.
- j. Plot showing approximate impact of each burst in relation to the target.
- k. For weather:
 - 1) Wind speed and direction.
 - 2) Ambient temperature.
 - 3) Relative humidity.
- l. Amount of sight adjustment remaining.
- m. All still negatives and movie film.
- n. Range to zeroing target.
- o. Difference, if any, in the location of burst impacts obtained with the different size nozzles.

6.3.20.2.3 Known Range Firing. Record or retain the following:

- a. Name and rank or grade of operator (gunner).
- b. Date and time.

- c. Nomenclature and serial number of:
 - 1) Flame gun.
 - 2) Flamethrower vehicle.
 - 3) Optical sight used.
- d. Type controls used (manual or power).
- e. Number of targets erected.
- f. For weather:
 - 1) Wind speed and direction.
 - 2) Ambient temperature.
 - 3) Relative humidity.
- g. Plot of target layout.
- h. For each target engaged:
 - 1) Type and size of target.
 - 2) Range to target.
 - 3) Number of bursts required to obtain a hit.
 - 4) Sight corrections made, if any.
 - 5) Approximate point of impact in relation to target of flame rods which were misses.
 - 6) Length of each burst in seconds.
 - 7) Number of:
 - a) Bursts fired after initial hit was obtained.
 - b) Hits obtained after the initial hit.
- i. Maximum effective range of the system.
- j. Difference, if any, in the range and accuracy achieved with bursts of different length.
- k. Maximum effective range achieved.
- l. Maximum range achieved.
- m. Data as described in paragraph h through l above for firing conducted with the larger nozzle, when applicable.
- n. Results of comparison between the use of manual and power controls.
- o. Data described in paragraph h above for each wet shot fired and:

- 1) Differences, if any, between sight setting required to obtain a hit at each different range with:
 - a) Wet shot
 - b) Burst (flame rod)
- 2) Difficulty, if any, in igniting each wet shot.

6.3.20.2.4 Unknown Range Firing. Record or retain applicable data as described in paragraph 6.3.20.2.3 above.

6.3.20.2.5 Moving Gun Mount-Stationary Target Firing. Record or retain data as described in paragraph 6.3.20.2.3a through h above and the following:

- a. Scaled plot showing flamethrower servicing, and range sites.
- b. Time required for:
 - 1) Initial servicing of flamethrower and amount of fuel used.
 - 2) Initial filling of machine gun ammunition ready racks and number of rounds required.
 - 3) Stowing other machine gun ammunition in on-vehicle racks and the number of rounds or boxes accommodated.
 - 4) Initial movement of flamethrower from service site to range site.
 - 5) Firing all fuel out of the flamethrower and:
- c. Record the:
 - 1) Number of:
 - a) Targets engaged.
 - b) Bursts fired.
 - c) Wet shots fired, when applicable.
 - d) Total number of hits obtained with
 1. First bursts.
 2. Second bursts.
 3. Subsequent bursts by number, if applicable.
 - 2) The range (distance) at which:
 - a) Hits were obtained.
 - b) Targets were missed.
- d. Number of machine gun rounds fired concurrently with the flame gun, if applicable.
- e. Number of machine gun rounds fired during the turn around of the flamethrower for reservicing.
- f. Number of hits obtained with machine gun(s).
- g. Time required to:
 - 1) Return to service point.

- 2) Reservice flamethrower.
- 3) Resupply machine gun ammunition.
- 4) Return to firing site.

h. Amount of fuel used in reservicing.

i. Number of rounds by type required to replenish ammunition load.

6.3.21 Security (Susceptibility to Detection)

Record data as described in MTP 2-3-511 (ref 4X).

6.3.22 Fording

Record data as described in MTP 2-3-509 (ref 4Y).

6.3.23 Inland Waterway Operations

Record data as described in MTP 2-3-510 (ref 4Z).

6.3.24 Simulated Tactical Operation

Record data as described in MTP 2-3-506 (ref 4AA).

6.3.25 Transportability

a. Surface Transportability (Vehicles). Record data for transport by rail and ship as described in MTP 2-3-519 (ref 4AB).

b. Air Portability, Internal - Suitability of Supplies and Equipment for. Record data as described in MTP 7-3-515 (ref 4AC).

c. Air Portability, External - Suitability of Supplies and Equipment for. Record data as described in MTP 7-3-516 (ref 4AD).

6.3.26 Logistics Over-the-Shore (LOTS)

Record data as described in MTP 2-3-520 (ref 4AE).

6.3.27 Maintenance Evaluation

a. Maintainability. Record data as described in MTP 2-3-502 (ref 4AF).

b. Tools and Test Equipment. Record data as described in MTP 2-3-527 (ref 4AG).

c. Technical Manuscripts and Manuals. Record data as described in MTP 2-3-528 (ref 4AH).

6.3.28 Reliability

Record data as described in MTP 2-3-507 (ref 4AI).

6.4 DATA REDUCTION AND PRESENTATION

a. All data obtained by inspection, observation, questionnaires and testing, including photographs, shall be analyzed and presented in a manner to indicate whether the test item meets the established criteria.

b. A Safety Confirmation shall be presented in accordance with USATECOM REG 385-6.

GLOSSARY

1. Flamethrower. A weapon that projects and ignites flame fuel in a steady stream for the purpose of producing casualties or destroying materiel.
2. Flame Rod. The stream of burning flame fuel projected by a flamethrower.
3. Burst(s). A rod of burning flame fuel fired from a flamethrower by a single pressure on the valve lever or trigger.
4. Igniter. A device for igniting the secondary flame fuel (atomized gasoline) such as the spark plugs (spark igniter) in a mechanized flame-thrower.
5. Peptizer. A substance used to accelerate the mixing and gelling action of thickened fuel at temperatures below 60°F.
6. Flame Fuel. (Incendiary Fuel). Either thickened or unthickened fuel used in flame weapons.
7. Thickened Fuel. Gasoline with a thickener (gelling agent) added for use in flamethrowers. (It is not fuel made more viscous by the addition of heavy fuel oil or coal tar.)
8. Thickener. Granular or powdered material which, when mixed with gasoline, produces a gel. (M1 and M4 thickeners are current types.)
9. Unthickened Fuel. A blend of gasoline and either light fuel oils or lubricating oils used as a flame fuel in portable flamethrowers.
10. Wet Shot. A burst of flamethrower fuel delivered without ignition. (Subsequent ignition produces an intense ball of flame with high heat effect.)
11. Ignition Exciter. A step-by transformer that converts the 24 volt d.c. from the vehicle's power supply to 2,000 volts d.c.
12. Flame Snuffer. A carbon dioxide (CO₂) fire extinguisher with a line connected to the flame gun to snuff out or extinguish residual fire which may remain at the flame gun nozzle after the firing switch has been released or turned off.
13. Maximum Effective Range. This is the distance from the flame gun nozzle to the center of the main bulk of burning fuel on the ground when the flame gun is fired at optimum elevation. Note: The maximum effective range is not always obtained at the higher elevations. This is due to the effect of air resistance on the flame rod, which will eventually break it up and result in a raining effect on the target. A wet shot will normally achieve about one-third greater range than a flame rod. The maximum effective range may increase by increasing the diameter of the flame gun nozzle, when the gun is so designed, and by increasing the propellant pressure. There

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is, however, a maximum pressure for every fuel and an increase in pressure beyond this maximum will shatter the flame rod in flight.

14. Maximum Range. This is the distance from the flame gun nozzle to the farthest fuel deposit on the ground when the flame gun is fired at optimum elevation. Maximum range, like the maximum effective range, is not always achieved at the higher elevations. See the explanation in item 13 above.

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