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Materiel Test Procedure 4-3-059
U. S. Army Infantry Board

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

FUZES, HAND GRENADE

1. OBJECTIVE

The objective of this document is to establish test methods and techniques to be used in determining whether (a) a test hand grenade fuze meets the criteria described in applicable materiel requirements documents (Materiel Need), and (b) the test fuze is suitable for use by the U. S. Army.

2. BACKGROUND

Most types of hand grenades are furnished with fuzes installed. The service test of these hand grenades will include tests of the integral fuze under applicable procedures of this MTP. When fuzes are supplied for service test as a separate item, they will be installed in appropriate practice and/or live grenades and tested under these procedures in accordance with Criteria of the applicable requirements documents and the basic MTP for the particular type hand grenade undergoing test. Fuzes may be categorized as either detonating or igniting types.

The service test will determine the suitability of a test fuze-grenade combination when used by troops representative of those who will use the item in the field. Results of the test provide a basis for recommendations on type classification.

3. REQUIRED EQUIPMENT

- a. Hand grenade ranges and suitable targets.
- b. Safety and first aid equipment.
- c. Photographic equipment.
- d. Communication equipment.
- e. Tactical ground vehicles.
- f. Time measuring equipment (to measure time between fuze arming and detonation).
- g. Hand grenades - appropriate types of practice, inert, and live.

4. REFERENCES

The following is a list of references which should be considered when preparing a plan of test:

- A. FM 23-30, Grenades and Pyrotechnics.
- B. TM 9-1330-200, Grenades, Hand and Rifle.
- C. USATECOM Regulation 385-6, Verification of Safety of Materiel During Testing.
- D. MTP 3-1-002, Confidence Intervals and Sample Size.

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- E. MTP 3-3-030, Grenades, Hand, H.E.
- F. MTP 3-3-500, Preoperational Inspection and Physical Characteristics.
- G. MTP 3-3-517, Safety
- H. MTP 3-3-521, Human Factors Engineering.
- I. MTP 3-3-524, Adverse Conditions.
- J. MTP 8-3-091, Grenades, Hand or Weapon Launched, Smoke/ Incendiary.
- K. MTP 8-3-092, Grenades, Hand or Weapon Launched, Smoke, Colored Marking.
- L. MTP 10-1-002, Field Combat Test Exercises.

5. SCOPE

5.1 SUMMARY

The procedures outlined in this MTP provide general guidance to the test officer for the service testing of hand grenade fuzes, whether supplied as a separate item or preinstalled as an integral part of grenades furnished for service test. Appropriate procedures of this MTP are applicable to the testing of hand grenade fuzes under the following related materiel test procedures:

- a. MTP 3-3-030, Grenades, Hand, H.E.
- b. MTP 8-3-091, Grenades, Hand or Weapon Launched, Smoke/ Incendiary.
- c. MTP 8-3-092, Grenades, Hand or Weapon Launched, Smoke, Colored Marking.

The tests will be applied selectively according to the mission of, and criteria for, the test item and the type grenade with which it is used. Specific procedures will depend on characteristics of the test fuze and the stated requirements of the applicable materiel requirements document. Those reflecting greatest risk will be considered first, when feasible.

Although the tests are described in successive paragraphs, they need not be conducted in the order presented, some may overlap or be performed simultaneously.

a. Preoperational Inspection and Physical Characteristics - The objectives of this subtest are to: (1) determine the receipt condition of the test fuze and packaging, (2) verify the completeness of the shipment, and (3) compare the physical characteristics of the test fuze with those stated in the materiel requirements documents.

b. Safety - The objectives of this subtest are to: (1) determine effectiveness of the safety features, and (2) confirm the safety of the test fuze. Special attention will be given to the safety aspects of impact-type fuzes.

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c. Fuzing the Grenade - The objective of this subtest is to determine ease of installing the test fuze.

d. Arming - The objective of this subtest is to determine the mechanical and human factors aspects of arming the test fuze preparatory to throwing the grenade.

e. Time Delay Functioning - The objective of this subtest is to determine minimum, maximum, and average time between arming and detonation.

f. Impact Functioning - The objective of this subtest is to determine the effectiveness of the impact functioning feature of the test fuze-grenade.

g. Arming Delay - The objective of this subtest is to verify the arming delay feature of the test fuze. Special note will be made of this feature in the case of impact-type fuzes.

h. Overriding Time Functioning - The objective of this subtest is to determine the effectiveness of the overriding time functioning element of the test fuze when impact functioning does not occur.

i. Adverse Conditions - The objective of this subtest is to determine performance of the test fuze under adverse environmental conditions encountered or simulated during service testing.

j. Durability and Reliability - The objective of this subtest is to determine the durability and reliability of the test fuze.

k. Human Factors Engineering - The objective of this subtest is to determine suitability of the test fuze with respect to the capabilities and limitations of the human operator.

l. Value Analysis - The objective of this subtest is to determine if the test fuze has any unnecessary, costly, or "nice-to-have" features which might be eliminated without adversely affecting its performance, reliability, durability, or safety.

5.2 LIMITATIONS

None.

6. PROCEDURES

6.1 PREPARATION FOR TEST

6.1.1 Administration

a. Reports of materiel received for the test will be prepared and submitted to the appropriate USATECOM Materiel Testing Directorate.

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b. Arrangements will be made to obtain the necessary test and support personnel.

c. Preparation will be made to record direct labor manhours and cost data throughout the conduct of the test.

d. Necessary data recording forms will be prepared.

6.1.2 Selection and Training of Test Soldiers

a. Soldiers used in the test must be representative of those expected to use the test fuze in the field, and some must be left-handed.

b. Test soldiers will be informed of the objectives and purpose of the tests in which they participate as well as the safety aspects of the test. Sufficient training will be given the test soldiers to ensure their familiarity with procedures for handling and detonating fuzed grenades. Precautions regarding use of impact-fuzed grenades will be emphasized.

6.1.3 Statistical Considerations

To identify the best means to collect the most meaningful data available, the test officer shall consult with a statistician when planning the test to insure sufficient data will be acquired to permit a statistically valid evaluation of the test item. This objective may be constrained by: (a) limited numbers of test items, (b) limited time to accomplish the test, (c) limited manpower and/or funds available, and (d) limited support and/or control equipment available. Such data as the number of test soldiers required, the number of test items to be tested, and the number of replications required for a specific operation shall be determined. Statistical guidance is found in MTP 3-1-002, Confidence Intervals and Sample Size.

6.1.4 Security

When the test fuze or any aspect of the service test bears a security classification, test personnel will comply with all pertinent security regulations.

6.1.5 Logistical Requirements

Coordination for required logistical support shall be made during the planning phase and in advance of actual service testing.

6.1.6 Control Fuzes

When required for comparative data, control fuzes used in the tests shall be the current standard issue most comparable in mission to the intended mission of the test fuze.

6.2 TEST CONDUCT

6.2.1 Field Combat Test Exercises

In order to provide as realistic a combat environment as possible, and to insure adequate preconditioning (stressing) of the test soldiers, whenever practicable field testing will be integrated into appropriate combat exercises described in MTP 10-1-002.

6.2.2 Preoperational Inspection and Physical Characteristics

- a. Examine packing boxes, inner packaging, and the test fuzes to determine receipt condition.
- b. Count the test fuzes and compare quantity and lot number with information listed in the shipping document.
- c. Weigh, measure, and photograph samples of the test fuzes.
- d. Compare the physical characteristics with criteria stated in the materiel requirement document.

NOTE: Fuzes preinstalled in grenades will not be removed from the grenade. In such cases, utilize drawings and technical data furnished by the developer and/or supplied with other instructional material.

6.2.3 Safety

- a. This subtest will be conducted under applicable procedures of common MTP 3-3-517.
- b. Particular emphasis will be placed on determining whether the test fuze is safe for troop use. Special attention will be given to impact functioning fuzes and procedures required for their use.
- c. The Safety Release will be evaluated to determine any features unduly restrictive or which limit tactical use of the test fuze.
- d. Safety data pertinent to the Safety Confirmation required by USATECOM Regulation 385-6 will be compiled.
- e. Particular attention will be given adequacy of features intended to prevent accidental arming of the fuze/grenade. Use data from subtest 6.2.5 in the evaluation.

6.2.4 Fuzing the Grenade

NOTE: This test is applicable only when the test fuze is furnished as a separate item.

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a. A quantity of test fuzes will be installed in practice grenades and/or inert grenades of suitable type by qualified representative test soldiers. Note will be made of procedures required and ease or difficulty of installation.

b. A quantity of test fuzes will be installed in live grenades of suitable type by qualified representative test soldiers. Note will be made of procedures required and ease or difficulty of installation.

c. The fuzed grenades prepared in subtest 6.2.4.a and b will be used as test items in appropriate functional tests, paragraphs 6.2.5 through 6.2.8. The fuzed practice and/or inert grenades will be used in these tests to confirm safety and functioning characteristics before using the live grenades.

6.2.5 Arming

During all functional tests, supervisors and test soldiers will note arming characteristics of the fuze/grenade. This will include manner of holding the grenade in the throwing hand, ease or difficulty of moving the safety clip, pulling the safety pin and/or other safety devices, and ease or difficulty of maintaining proper pressure on the safety lever, or arming sleeve until the grenade is thrown.

NOTE: For this subtest, the fuze/grenade is considered armed when the safety pin is pulled, unless there is an auxiliary safety clip or similar device.

6.2.6 Time Delay Functioning

a. Test soldiers will throw a series of armed grenades a medium distance at typical targets. The time from the moment the grenade leaves the thrower's hand until detonation will be measured. Minimum, maximum, and average time delay will be determined.

b. If the fuze is an impact one with overriding time delay feature, special procedures, not involving impact, must be employed to conduct this subtest.

6.2.7 Impact Functioning

a. A series of grenades equipped with test fuzes will be thrown against various surfaces such as hard ground, grassy sod, sand, mud, water, concrete, steel, foliage, high grass, window glass, etc. The height/distance of throw will be such as to ensure that impact does not occur before maximum time of arming delay has elapsed. Special precautions may have to be exercised in conduct of this subtest.

b. Observers will make note of any malfunctions.

6.2.8 Arming Delay

a. A series of grenades equipped with test fuzes will be thrown and/or dropped to impact on a firm surface. The height/distance of throw or drop shall be such as to cause a number of impacts to occur under each of the following conditions:

- 1) In slightly less time than the specified minimum arming time delay.
- 2) During the time interval between minimum and maximum specified arming time delay.

b. The arming delay time range (minimum, maximum, and average) will be determined.

6.2.9 Overriding Delay Functioning

a. A series of grenades equipped with test fuzes will be thrown and/or dropped to impact on a firm surface. The height/distance of throw or drop shall be such as to cause impact to occur before elapse of the minimum arming delay time as determined in subtest 6.2.8. Under these conditions detonation should not occur upon impact.

b. The interval from throw or drop to impact, and the interval from impact to detonation, will be measured.

c. Note will also be made of any grenades which detonate upon secondary impact (bounce).

6.2.10 Adverse Conditions

This subtest will be conducted under applicable procedures of common MTP 3-3-524. Consideration shall be given to results of environmental chamber tests made during engineering testing in order to avoid unnecessary duplication.

6.2.11 Durability and Reliability

a. Throughout the course of other subtests, note shall be made of all malfunctions and occurrences having a bearing on durability and reliability.

6.2.12 Human Factors Engineering

This subtest will be conducted under applicable procedures of common MTP 3-3-521. Particular note will be made of simplicity and ease of arming (pulling the safety pin) and retention of safety lever and safety clips or arming sleeve until the grenade is thrown. The ease, or difficulty, experienced by left-handed test soldiers in handling and throwing the grenade and fuze will be a matter of special note.

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6.2.13 Value Analysis

During conduct of other subtests, note will be made of any non-essential or "nice-to-have" features which might be modified or eliminated without compromising the effectiveness or safety of the test fuze.

6.3 TEST DATA

6.3.1 Data Common to All Subtests

a. A log book shall be maintained for entries in chronological order of pertinent remarks and observations, such as weather, test soldier uniform and equipment, and time of day, which will aid in subsequent analysis of test data.

b. Extensive use shall be made of photographs, motion pictures, and/or video tape to support test findings. Fast frame photography, when available, should be used to evaluate human engineering aspects of the test.

6.3.2 Pretest Data

The following shall be recorded, as appropriate:

a. Personnel Data.

- 1) Name, rank, and SSAN of each test soldier.
- 2) MOS.
- 3) Length of service (and combat experience, if any).
- 4) Length of time in MOS.
- 5) Qualification in arms.
- 6) Physical characteristics.

b. Test and Control Fuzes/Grenades.

- 1) Nomenclature.
- 2) Manufacturer.
- 3) Lot numbers.

6.3.3 Preoperational Inspection and Physical Characteristics

The following shall be recorded:

- a. A description of the test fuze, components, and packaging.
- b. Receipt condition and completeness of shipment.
- c. The weight and dimensions of the test fuze.

d. A comparison of the physical characteristics of the test fuze with those stated in the criteria.

- e. Photographs and/or drawings of the test fuze.

6.3.4 Safety

The following shall be recorded:

- a. The results of studying the Safety Release and any safety limitations which may place undue restrictions on the tactical use of the test fuze.
- b. A comparison of the safety features of the test fuze with those stated in the criteria.
- c. Any safety hazard reported or observed during conduct of the test.
- d. Any additional data required by MTP 3-3-517 which will serve as a basis for the Safety Confirmation required by USATECOM Regulation 385-6.

6.3.5 Fuzing the Grenade

Record the following:

- a. Number of test soldiers participating.
- b. Number of test fuzes installed in grenades, by type of grenade.
- c. Simplicity, ease, or difficulty of installation.

6.3.6 Arming

Record comments of supervisors and test soldiers regarding simplicity, ease, or difficulty of arming the fuze/grenade and maintaining the safety condition until the grenade is thrown.

6.3.7 Time Delay Functioning

Record the following:

- a. Grenade type.
- b. Number of grenades thrown.
- c. Time from throw to detonation of each grenade.

6.3.8 Impact Functioning

Record the following:

- a. Grenade type.

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- b. Number of grenades thrown, and type of impact surfaces.
- c. For each grenade, as applicable.
 - 1) Detonation or nondetonation upon impact.
 - 2) Detonation upon secondary impact (bounce).
 - 3) Overriding delay detonation.
 - 4) Duds.
- d. Description of range layout, safety procedures followed, and special procedures required for impact functioning grenades.

6.3.9 Arming Delay

Record the following:

- a. Grenade type.
- b. Time to impact, each grenade.
- c. Detonation or nondetonation upon impact, each grenade.
- d. Duds.

6.3.10 Overriding Delay Functioning

Record the following:

- a. Grenade type.
- b. Number of grenades tested.
- c. For each grenade, time from throw or drop to impact, and time from impact to detonation.
- d. Grenades which detonate upon impact, if any.
- e. Secondary impact detonations.
- f. Duds.

6.3.11 Adverse Conditions

The test data shall be as indicated in common MTP 3-3-524.

6.3.12 Durability and Reliability

The test data shall be the record of duds and other malfunctions and occurrences having a bearing on durability and reliability noted during other subtests.

6.3.13 Human Factors Engineering

The test data shall be as indicated in common MTP 3-3-521

6.3.14 Value Analysis

The test data shall be the value analysis observations regarding nonessential features of the test fuze noted by test personnel throughout the conduct of other tests.

6.4 DATA REDUCTION AND PRESENTATION

a. Statisticians will be present to observe or participate in operational tests to the extent necessary to become familiar with the actual data collection methods, and to advise on the validity of data being collected.

b. All data collected during the test shall be collated and reduced to a concise, workable form. These data will be analyzed to identify deficiencies and shortcomings and determine whether; (1) the test objectives were met, and (2) the test fuze meets the established criteria.

c. The results of testing will be presented in narrative form supplemented with tables, charts, graphs, photographs, motion pictures, video tapes and other instrumentation, as required. The results of questionnaires will be tabulated and presented. Where opinions are presented, they will be identified as such, and separated from factual data.

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