

AD 717 385

29 May 1969

Materiel Test Procedure 3-4-004
U. S. Army Arctic Test Center

U. S. ARMY TEST AND EVALUATION COMMAND
ENVIRONMENTAL TEST PROCEDURE

ARCTIC ENVIRONMENTAL TEST OF INDIVIDUAL WEAPONS
RIFLES (SEMI-AUTOMATIC AND AUTOMATIC) AND PISTOLS

1. OBJECTIVE

The objective of the procedures outlined in this MTP is to provide a means of evaluating the performance of individual weapons (rifles and pistols) under arctic winter environmental conditions.

2. BACKGROUND

Engineering tests of weapons are conducted to determine the characteristics and performance of the weapons under various conditions of operation, and to ensure their compliance with specified requirements. Testing in a natural arctic winter environment is used to substantiate or supplement data obtained from simulated tests conducted during the Engineer Design and Engineering Test Phase. Testing in the arctic winter environment generally is not authorized until data from simulated environmental tests provides reasonable assurance that the test item will function satisfactorily when subjected to the conditions that would be encountered in the arctic.

3. REQUIRED EQUIPMENT

- a. Appropriate arctic winter uniform.
- b. Weapons as required.
- c. Ammunition as required.
- d. Standard American Targets.
- e. Vehicles as required.
- f. Support aircraft.
- g. Drop zone.
- h. M1950 Parachutist's individual weapons case (or latest standard containers).
- i. All general and special Tools and ancillary items required to perform maintenance on the test item.
- j. Test equipment as required.
- k. Photographic equipment (black and white or color).
- l. Meteorological support instrumentation.
- m. Suitable Timing Device.

4. REFERENCES

- A. AR 705-15, Operations of Materiel Under Extreme Conditions of Environments.
- B. AR 705-5, Army Research and Development.
- C. AR 70-8, Human Factors and Social Sciences Research.
- D. AR 70-10, Army Materiel Testing.
- E. AR 750-6, Maintenance Support Planning.
- F. USATECOM Regulation 705-2, Documenting, Test Plans and Reports.

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- G. USATECOM Regulation 350-6, Training in New or Modified Equipment and Training Devices.
- H. MTP 3-4-005, Arctic Environmental Test of Grenade Launchers.
- I. MTP 10-4-500, Arctic Pre-Operational Inspection, Physical Characteristics, Human Factors, Safety and Maintenance.
- J. MTP 3-2-504, Safety Evaluation - Small Arms.

5. SCOPE

5.1 SUMMARY

The procedures outlined in this MTP are designed to determine and evaluate the functioning characteristics of rifles and pistols under arctic winter environmental conditions.

The specific tests to be performed, along with their intended objectives, are listed below:

a. Pre-Operational Inspection and Physical Characteristics - This test provides for an inspection of the test item to:

- 1) Identify damage received during shipping and handling.
- 2) Determine its physical condition.
- 3) Determine if the test item dimensions, weight and characteristics conform to applicable criteria.
- 4) Locate any defects.

b. Firing Tests - The objective of this test is to determine the firing accuracy of hand and shoulder fired individual weapons under arctic winter conditions.

c. Position Disclosing Effect - The objective of this subtest is to determine and measure the position disclosing effects created by the cumulative smoke and muzzle flash and sound of the test weapons operated under arctic environmental conditions.

d. Functional and Operability/Portability - The objective of this subtest is to determine the ease of carrying and transporting the test weapons cross-country and over ski trails wearing snow shoes and skis.

e. Aerial Delivery - The objective of this subtest is to determine the suitability of the test weapons for Phase I airborne operation under arctic environmental conditions.

f. Human Factors Evaluation and Safety - The objective of this subtest is to determine if all accessories and components of the test weapons enable easy operation by test crews wearing the appropriate arctic winter uniforms.

g. Maintenance Evaluation - The objective of this subtest is to determine if the test weapons meet maintenance and maintainability requirements as defined by QMR, TC, MC or other established criteria under arctic winter environmental conditions.

5.2 LIMITATIONS

The procedures described in this MTP are limited to the testing of

pistols and rifles (automatic and semiautomatic) under arctic winter environmental conditions. Specific tests on similar types of weapons may be performed using this MTP as a guide with variations applicable to the weapon to be tested.

6. PROCEDURES

6.1 PREPARATION FOR TEST

a. Since arctic winter environmental tests are normally scheduled from October through March (6 months), ensure that test item, test comparison, and support weapons are delivered to the Arctic Test Center prior to 1 October.

b. TDY Personnel shall be used to augment assigned personnel and shall be trained to the degree that they are as proficient on the individual weapons as the troops who will use the weapon.

c. Ensure that all test personnel are familiar with the required technical and operational characteristics of the item under test, such as stipulated in Qualitative Materiel Requirements (QMR), Small Development Requirements (SDR), and Technical Characteristics (TC), and record this criteria in the test plan.

d. Review all instructional material issued with the test item by the manufacturer, contractor, or government, as well as reports of previous tests conducted on the same type of equipment, and familiarize all test personnel available for reference.

e. Record the grade, MOS, background, and training of all test personnel and ensure that all personnel receive new equipment training (NET) as required.

f. Record the following information:

- 1) Nomenclature, serial number(s), and manufacturer's name of the test items.
- 2) Nomenclature, serial number(s), accuracy tolerances, calibration requirements, and last date calibrated of the test equipment selected for the tests.

g. Select test equipment ideally having an accuracy 10 times greater than that of the function to be measured.

h. Prepare record forms for systematic entry of data, chronology of test, and analysis in final evaluation.

i. Prepare adequate safety precautions to provide safety for personnel and equipment, and ensure that all safety SOP's are observed throughout the test. MTP 3-2-504, Safety Evaluation-Small Arms must be completed.

j. Outfit grenadiers in appropriate arctic winter clothing as described in MTP 10-4-500 and with individual combat equipment, during all weapon testing.

k. Ensure that when not in use, all test weapons, control weapons, and ammunition are stored and maintained in an unsheltered area and exposed to ambient air temperature and prevailing weather conditions.

l. Record the prevailing meteorological conditions during the storage phase, as well as test conduct, to include:

- 1) Temperature
- 2) Humidity, relative or absolute

- 3) Temperature gradient
- 4) Atmospheric pressure
- 5) Precipitation
- 6) Solar radiation
- 7) Wind speed and direction
- 8) Frequency of readings
- 9) Source of data

6.2 TEST CONDUCT

NOTE: When conducting individual weapon test involving several subjects, samples and conditions i.e., range, temperature, position, etc., a "Latin Square" or comparable test design procedure will be imposed to assure a representative distribution of variables and minimum biasing.

6.2.1 Pre-Operational Inspection and Physical Characteristics

a. Upon receipt, carefully inspect all test items and comparison weapons and their shipping or packaging containers for completeness, damage and general conditions in accordance with the applicable sections of MTP 10-4-500.

6.2.2 Firing Tests

6.2.2.1 Accuracy and Cyclic Rate of Fire

6.2.2.1.1 Hand Fired Weapons

- a. Cold soak all test and comparison weapons for at least 24 hours.
- b. Install Standard American 25 meter pistol targets at ranges of 10 meters, 15 meters, and 25 meters, and zero all test and comparison weapons at the appropriate range. Record any difficulties encountered.

NOTE: Conduct this subtest at ambient air temperatures ranging from 0°F to -25°F to the lowest available temperature.

- c. Order soldiers with test weapons to fire three (3) 10-round groups at each of the targets in accordance with Table I.

TABLE I. ACCURACY FIRING

Range-to-Target	Shots	Times Conducted	Position	Time
25 meters	10	3	Bench Rest	No limit
15 meters	10	3	Bench Rest	No limit
10 meters	10	3	Bench Rest	No limit
25 meters	10	3	Prone Support	No limit
15 meters	10	3	Prone support	No limit
10 meters	10	3	Prone support	No limit

- d. Repeat step c above, utilizing comparison weapons.
- e. Record the following data:

- 1) Center of impact, mean radius, maximum vertical spread, maximum horizontal spread, and maximum spread at each range.
- 2) Number of rounds fired and percentage of hits within a 19-inch circle at each range and position.
- 3) Ambient air temperature at test sight.
- 4) Type ammunition fired.
- 5) Lot number of ammunition fired.
- 6) Rate of fire for each test and comparison weapon at the start of accuracy phase.
- 7) Rate of fire for each test and comparison weapon at the midway point of accuracy phase.
- 8) Malfunctions of test or comparison weapons which affect the rate of fire.

f. Repeat steps c through e above, at an ambient air temperature range of from -25°F to -45°F, and again at a temperature range from -45°F to the lowest available temperature.

6.2.2.1.2 Shoulder Fired Weapons

NOTE: Conduct this subtest at ambient air temperatures ranging from 0°F to the lowest available temperature.

- a. Cold soak all test and comparison weapons for at least 24 hours.
- b. Install Type A and B rifle targets at ranges of 200, 300 and 500 meters for the semiautomatic firing, and zero all test and comparison weapons at the appropriate range. Record any difficulties encountered.
- c. Determine the cyclic rate of fire for each test and comparison weapon having semiautomatic capability by firing, semiautomatically. A rate of fire recorder or stop watch shall be used to record the rate of fire.
- d. Position soldiers with test weapons in the prone position and semiautomatically fire three (3) 10-round shot groups at each Type A and B target.

- NOTES:
- 1. No support other than that provided by the rifleman (elbow) and weapon bipod (if it is a component of the weapon) shall be utilized for semiautomatic fire.
 - 2. Cyclic rate of fire shall be determined as outlined in step d above, at the start of each firing subtest, at the midway point and at the end of the subtest.

- e. Repeat step d above, utilizing comparison weapons.
- f. Record the following data:

- 1) Mean radius, maximum vertical spread, maximum horizontal spread, and maximum spread at each range.
- 2) Number of rounds fired and percentage of hits within a 40-inch circle on each Type A and B target, semiautomatic fire - B

- target, automatic fire.
- 3) Ambient air temperature at test site.
 - 4) Type ammunition fired.
 - 5) Lot number of ammunition fired.
 - 6) Rate of fire for each test and comparison weapon at the start of accuracy phase.
 - 7) Rate of fire for each test and comparison weapon at the midway point of accuracy phase.
 - 8) Rate of fire for each test and comparison weapon at the end of accuracy phase.
 - 9) Malfunctions of test or comparison weapons which affect the rate of fire.

g. Repeat steps c through f above, at an ambient air temperature range of from -25°F to -45°F, and again at a temperature range from -45°F to the lowest available temperature.

h. Install Type B rifle targets only at a range of 200 meters for the automatic firing and zero all test and comparison weapons. Record any difficulties encountered.

i. Determine the cyclic rate of fire for each test and comparison weapon having an automatic fire capability by firing automatically; a rate of fire recorder or stopwatch shall be used to record the rate of fire.

j. Utilizing test weapons and test soldiers in the prone position, automatically fire three (3) 20-round groups, in 3 to 5 round bursts, at Type B targets installed in step h above.

- NOTES:
1. No support other than that provided by the rifleman (elbows) and weapon bipod (if it is a component part of the weapon) shall be utilized for automatic fire.
 2. Cyclic rate of fire shall be determined as outlined in step j above, at the start of each firing subtest, at the midway point and at the end of the subtest.

k. Repeat step j above, utilizing comparison weapons.

l. Record data as outlined in step f above.

m. Repeat steps i through j above, at an ambient air temperature range of from -25°F to -45°F, and again at a temperature range from -45°F to the lowest available temperature.

6.2.3 Position Disclosing Effect

a. Cold soak all test and comparison weapons for at least 24 hours.

b. Mount cameras perpendicular to the muzzles of the test weapons at a sufficient distance to photograph all the flash.

c. Position an observer behind each weapon and down range at distances of 100, 200, 300, 400, 500 and 600 meters.

d. Order soldiers to fire the test and comparison weapons at a range of 600 meters.

e. Fire the test and comparison weapons under both nighttime and daytime conditions, without photographing the flash.

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NOTE: This subtest shall be conducted in temperatures ranging from 0°F to the lowest available temperature.

g. Record the following:

- 1) Smoke and flash effects at fire positions.
- 2) Smoke and flash effects visible to the observers at indicated range.
- 3) Annotations to the photographs of cumulative flash with regard to variations of flash during the firing.
- 4) Ambient air temperature at test site.
- 5) Light conditions.

6.2.4 Functional and Operational Suitability - Portability

6.2.4.1 Hand-Held Weapons

- a. Cold soak all test and comparison weapons for at least 24 hours.
- b. Inspect each weapon for loose, damaged or missing parts, and place in the best possible serviceable condition with an empty magazine installed in each weapon.
- c. Place each weapon in its prescribed carrying case.
- d. Carry the weapon over the following courses:
 - 1) Snowshoe three miles through dense, snow-covered brush.
 - 2) Snowshoe five miles over open snow-covered (cross-country) terrain.
 - 3) Ski ten miles over cross-country ski trails.
- e. Dry-fire each weapon a minimum of five times during each of the above courses.
- f. Thoroughly inspect each weapon and record the following:
 - 1) Damage attributed to environmental effects
 - 2) Problems encountered while transporting weapons
 - 3) Damage to weapons due to handline
 - 4) Temperature at test site

NOTE: Conduct this subtest at ambient air temperatures ranging from 0°F to the lowest available temperature.

6.2.4.2 Shoulder Weapons

- a. Conduct functional and operational suitability tests on shoulder weapons as outlined in paragraph 6.2.4.1. above, except each weapon shall be hand carried over one-half of each course, and carried by their slings over the right shoulder for the remaining distance. The weapons shall not be carried in their cases.
- b. Record data as prescribed in paragraph 6.2.4.1.f.

6.2.5 Aerial Delivery

- a. Cold soak all test and comparison weapons for at least 24 hours.
- b. Inspect each weapon for loose, damaged or missing parts, and proper functioning and place in the best possible serviceable condition with an empty magazine installed in each weapon.
- c. Subject each test and comparison weapon to a minimum of three parachute jumps under the following conditions:
 - 1) Each parachutist will be equipped with standard equipment and will jump in accordance with latest TM's.
 - 2) Each test rifle will be packed in an M 1950, Parachutists Adjustable Individual Container (or latest standard container) and attached to the parachutist's person as prescribed in appropriate TM's. Hand-held weapons shall be carried in appropriate holsters by the parachutists.
- d. Inspect all weapons after each jump for damage and proper operation.
- e. Record the following data for each jump:
 - 1) Altitude and speed of delivery aircraft
 - 2) Ambient air temperature
 - 3) Results of inspections
 - 4) Malfunctions of test and comparison weapons
 - 5) Method used for attachment of weapons to parachutists
 - 6) Compatibility with parachute equipment

6.2.6 Human Factors Evaluation and Safety

- a. Conduct all Human Factors and Safety Tests in accordance with the applicable sections of MTP 10-4-500.
- b. Conduct these tests concurrently with the operational tests (Firing, Position Disclosure, Functional and Operational Suitability and Aerial Delivery), described in this MTP.

6.2.7 Maintenance Evaluation

- a. Conduct all maintenance evaluation tests (maintenance and reliability) in accordance with applicable sections of MTP 10-4-500.
- b. Conduct these tests concurrently with the operational tests (Firing, Position Disclosure, Functional and Operational Suitability and Aerial Delivery), described in this MTP.

6.3 TEST DATA

All test data to be recorded will be as specified in the individual subtests of this MTP.

6.4 DATA REDUCTION AND PRESENTATION

Processing of raw test data shall, in general, consist of organizing,

marking for identification and correlation, and grouping the test data according to test title.

Specific instructions for the reduction and presentation of individual test data are outlined in succeeding paragraphs.

6.4.1 Pre-Operational Inspection and Physical Characteristics

Pre-operational inspection and physical characteristics data shall be reduced and presented in accordance with MTP 10-4-500.

6.4.2 Firing Tests

Compare mean radius, hit percentage, and cyclic rate of fire to weapon specifications for possible deviations due to arctic winter environmental conditions.

6.4.3 Position Disclosing Effect

The data obtained from the test item shall be evaluated in accordance with data from comparison weapons and accepted military standards.

6.4.4 Functional and Operational Suitability - Portability

The adequacy with which the weapon under test feeds, extracts and ejects under extreme arctic winter conditions shall be determined by comparison with previously accepted items of like nature and specifications. The damage to the weapons attributed to environmental effects or handling shall be compared with weapon specifications contained in appropriate QMR and TC.

6.4.5 Aerial Delivery

The suitability of the weapon under test for airborne operations under arctic winter environmental conditions shall be determined by comparison with previously accepted items of like nature and specifications. The damage to and/or malfunctions of the weapons attributed to parachute jumps or environmental effects shall be compared with weapon specifications contained in appropriate QMR and TC.

6.4.6 Human Factors Evaluation and Safety

Human Factors and Safety data shall be reduced and presented in accordance with MTP 10-4-500.

6.4.7 Maintenance Evaluation

Maintenance data shall be reduced and presented in accordance with MTP 10-4-500.

GLOSSARY

1. Maximum Vertical: Vertical distance between the center of the hole made by the uppermost shot and the center of the hole made by the lowermost shot.
2. Maximum Horizontal: Horizontal distance between the center of the hole made by the shot farthest to the right and the center of the hole made by the shot farthest to the left.
3. Maximum Spread: Distance between centers of the shot holes farthest apart.
4. Mean Radius: Arithmetic mean of the distances between the centers of all shot holes and a point of the target called Center of Impact.
5. Center of Impact: Defined as the point at which the algebraic sum of the components of the distances to the center of each shot hole is zero.