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FIELD BOOTS

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13. ABSTRACT
Describes a method for evaluation of field boots for suitability for U.S. Army use. Provides procedures for preoperational inspection and physical characteristics, safety, personnel training, sizing and fitting, compatibility with tasks, durability, maintenance evaluation, human factors engineering, and value analysis.

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U. S. ARMY TEST AND EVALUATION COMMAND
EXPANDED SERVICE TEST - SYSTEM TEST OPERATIONS PROCEDURES

AMSTE-RP-702-109
Test Operations Procedure 10-3-026 28 June 1972

FIELD BOOTS

SECTION I
GENERAL

1. Purpose and Scope.

a. This Test Operations Procedure (TOP) is published as a guide to be used in preparing the test plan to support an Expanded Service Test (EST) of type field boot. The guidance presented is adaptable to any environmental condition, although it is recognized that extremes of weather may require additional specifiized footwear.

b. In scope, these procedures span preoperational requirements, safety consideration, training of test personnel, and a suitability evaluation of the test item. A series of subtests is presented, each designed to produce data to support a judgment as to the suitability of the test item in a major area of test interest.

2. Background.

Although troop activities often require a specialized foot gear to be worn in areas of extreme temperature or climate, a need still exists for a field boot suitable for general wear over a wide range of environmental conditions. The constant search for improved articles of clothing and equipment, to include boots, requires frequent field testing of new ideas. The EST phase of the testing process will be described in these procedures.

3. Equipment and Facilities.

a. Equipment.

(1) Test boots, assorted tariff of sizes. (Preferably, a tariff which spans the 5th and 95th percentile in accordance with MIL-standard 1472A).

(2) Control boots should be the current standard field boot, tariff of sizes identical to test tariff.

(3) Test personnel.

(4) Weighing equipment.

(5) Photographic equipment.

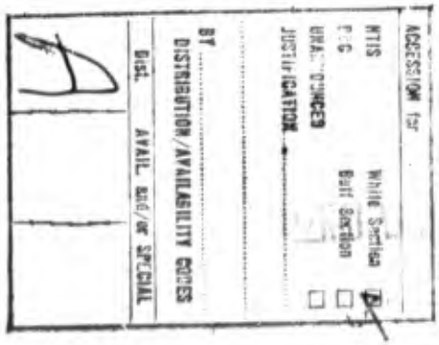
(6) Foot size-measuring device.

(7) Safety and first aid equipment.

(8) Marking equipment (for identification of test/control items).

(9) Tactical vehicles - air and ground.

(10) Socks-standard issue, in tariff of sizes, compatible with boots.



(11) Duplicating means for questionnaires.

b. Facilities.

(1) Classroom or instructional area.

(2) Suitable facility for fitting boots.

(3) Receiving and storage area.

(4) Office space.

(5) Ranges.

(6) Confidence course.

(7) Bayonet and grenade courses.

(8) Parachute Jump Tower, if available.

SECTION II
TEST PROCEDURES

4. Supporting Tests.

a. The testing procedures are described in successive paragraphs following these introductory comments. There is no requirement that the tests be conducted in the order in which they appear. Many will be performed simultaneously with, or overlap the procedures of other subtests. Specific and detailed procedures should be developed by the test officer. The test plan should reflect the state of the art at the time and place of the testing, as influenced by directives and the guidance available in local command and advisory channels.

b. The data collected should be of sufficient quality and quantity to support reliable conclusions. This objective may be constrained by a limited number of test or control items, an inadequate period of time for optimum testing, or restrictions of manpower, funds, and/or support facilities. The test officer should consult a statistician to establish the experimental pattern and to identify the best means of securing the most meaningful data within the limitations imposed. The consultation should fix requirements such as the number of test personnel needed, the number of test and control

items required by phase, and the optimum number of repetitions or replications required of a particular operation to produce statistically sound conclusions. Additional guidance will be found in MTP/TOP 3-1-002, Confidence Intervals and Sample Size.

c. The maintenance of a log book for entering pertinent remarks and observations, meteorological data, times, comparisons, and other specific and applicable information will aid in the collection of test data to support findings. The use of photographs and motion pictures is recommended.

d. Valuable data will be accumulated throughout testing by comparing the test boots with a standard or control item. To equalize the normal breaking-in type problems associated with new footwear, both test and control boots must be new, Both will be issued at the same time, using identical fitting procedures, and recipients should receive the same instructions related to wearing and caring for their boots. Standard issue socks should be worn throughout the tests.

e. Questionnaires are used extensively in this document to collect data and analyze performance. Pending publication of appropriate documents on the preparation of questionaires, assistance may be obtained from the Human Factors Engineering Directorate of this headquarters.

f. Common Service MTP/TOP, the tests defined in Section III, and other published documents to be considered in formulating an EST plan are as follows: (Additional reference material will be found in the reference appendix).

TEST SUBJECT TITLE	PUBLICATION NO.
(1) Preoperational Inspection and Physical Characteristics (Refer to paragraph 5)	10-3-500
(2) Safety (Refer to paragraph 6)	10-3-507
(3) Personnel Training (Refer to paragraph 7)	10-3-501
(4) Sizing and Fitting (Refer to paragraph 8)	
(5) Compatibility With Tasks (Refer to paragraph 9)	
(6) Durability (Refer to paragraph 10)	10-3-502

TEST SUBJECT TITLE	PUBLICATION NO.
(7) Maintenance Evaluation (para 11, this TOP)	10-3-504
(8) Human Factors Engineering (para 12, this TOP)	10-3-505
(9) Value Analysis (para 13, this TOP)	

SECTION III
SUPPLEMENTARY INSTRUCTIONS

5. Preoperational Inspection and Physical Characteristics.

a. The objectives of this testing phase is to verify the completeness of the candidate field boot received for the test and to compare the test items' physical characteristics with criteria established in appropriate materiel needs documents. A further objective is to determine that each item made available for testing is in a serviceable condition and suitable for testing. Common MTP/TOP 10-3-500, Preoperational Inspection and Physical Characteristics, describes a series of tests to be conducted on newly arrived general supplies and equipment prior to expanded service testing. The objectives of this subtest will be met by accomplishing the applicable procedures of that MTP/TOP.

b. In the collection of data to support test findings, it is important to identify the when, where, and why of events in addition to the final judgment of what happened. It is possible that a failure attributed to expanded service testing may have been a by-product of poor shipping practices or improper handling prior to being received at the test site. This type of damage or deficiency must be found prior to the conduct of the various other subtests in order to identify valid test-faults as failures of testing - and not the results of a pretest condition.

c. The physical characteristics of the test field boot, described in requirements documents, should be verified in a preoperational inspection. Some examples of characteristics normally applicable to boots are:

(1) The weight and height of the boot.

(2) The physical properties of materials used, i.e., rigidity, pliancy, elasticity, fragility, texture, and other specific limitations.

(3) The color, or colormetric quality desired. This characteristic should express features related to compatibility with other clothing and equipment, reflectiveness, etc.

(4) Design features required.

6. Safety.

a. Perform the appropriate procedures of MTP/TOP 10-3-507, Safety, to determine the effectiveness of the boots' safety features, and to confirm the safety of each item received for the test.

b. During this phase the tester should identify any restrictions imposed by the safety release, directives, or local ground rules which might influence the test results. An evaluation reflecting the judgment of the tester as to the degree safety restrictions may have influenced test conclusions should be included in post-test reports.

7. Personnel Training.

a. Conduct training as prescribed in applicable parts of MTP/TOP 10-3-501, Personnel Training, to evaluate the training package (if furnished) which accompanied the test item. The program of instruction should familiarize participants with the candidate test item, the conduct of the test, and individual responsibilities in support of operational proficiency.

b. Test participants must receive sufficient orientation and indoctrination to minimize potential opposition to, or degradation of, the test boot because of its newness or different appearance, when compared with the more familiar standard or control item. A clear understanding of expanded service test objectives and procedures, individual responsibilities, and the test soldiers' important role in inevitable and desirable progress will assist in eliminating bias.

c. In the event instructional material or a test training package is furnished it should be evaluated for adequacy. Information

and data related to the time required for acceptable orientation, completeness of the program of instruction, and recommendations for change or improvement in the training package should be recorded for inclusion in the report of findings upon completion of the test.

8. Adequacy of Sizing and Fitting.

a. Objectives - This subtest is designed to evaluate the sizing and fitting characteristics of the test boot and to determine if representative troops can be properly fitted using standard fitting procedures, publications, and equipment.

b. Method.

(1) TM 10-228, Fitting of Footwear, contains detailed instructions directing the proper sizing and fitting of military footwear. Included in the manual are instructions for recalibrating and operating the foot measuring device, procedures for fitting individuals, a size correlation table of standard footwear now in the system, and a lesson plan designed to be used for training personnel in sizing and fitting operations. (Although the lesson plan is designed for wholesale fittings at clothing issue points or clothing sales stores, the principles apply to the objectives of this test as well.) The three general principles of good boot fitting; foot construction, concept of fit, and misfitted footwear, are addressed in depth. The objectives of this subtest will be accomplished by following the procedures of the TM.

(2) Throughout the conduct of all phases of testing, personnel will be alerted to observe, comment, and record evidence related to sizing and fitting.

(3) A portion of any questionnaire used should address sizing and fitting.

c. Data Required.

(1) The amount, type, completeness, and clarity of written instructions received with test boots should be noted. The reaction of soldiers to these instructions as obtained through questionnaire and/or comments and observations will assist in the collation of information.

(2) Method used to fit soldiers and size issued to each.

(3) Observations and comments related to fit and comfort of wearing the test boots.

(4) Record of any difficulty encountered, or inability to fit any test soldier because of the confines of sample sizes provided.

(5) Comparison impressions - test boots versus standard item.

d. Analytical Plan.

Perform a subjective analysis on data assembled from observations, comments, and opinions expressed through questionnaire and/or interviews. Support narrative with pictures, charts, and graphs as appropriate.

9. Compatibility With Tasks.

a. Objectives.

This test should determine the extent of influence the test item has on tasks associated with the normal duty of service personnel, and provide clinical data to indicate whether the test boot contributes to, or is detrimental to healthy feet.

b. Method.

(1) A TOE unit, equipped with combat load, organic weapons, and a representative proportion of test and/or control boots should engage in a series of diversified activities which might include but is not limited to the following:

(a) Tactical field exercises conducted under varying conditions of terrain, weather, and foot movement situations.

(b) Field and range exercises requiring the firing of individual and crew served weapons.

(c) Road and cross country marches of varying lengths and speed.

(d) Parachute activities to include tower and actual jumps.

(e) Garrison type activities to include formations, parades, and ceremonial movement.

(f) Confidence, bayonet, and grenade courses.

(2) Prior to participating in the above activities a medical support and evaluation plan should be prepared in accordance with the professional advice and guidance of a medical officer. The plan should include a pretest examination to establish each test soldier's leg and feet conditions and his medical suitability for test participation. A medical check at intervals throughout the test cycle should complete the evaluation.

(3) A questionnaire is suggested as a means of collecting individual reaction to the boots performance in the above situations. Answers to the questionnaire should be recorded in a controlled interview following each phase of testing to assure accurate and timely recording of opinions.

(4) A Clothing and Equipment Test Facility (CETF), located at Fort Benning, facilitates the collection of performance data. The procedures as described in MTP/TOP 10-2-509, Combat Effectiveness Test Facility, are adaptable to other test sites if access to the CETF is impractical.

c. Data Required.

(1) Comments, observations, and other evidence describing the influence of the test boots on the actions and activities of the test participants.

(2) Evidence of statistical comparison value - test versus control item, and test item against the criteria established in materiel needs documents.

(3) Records of the medical evaluation of each test soldier obtained during pretest examination and check-ups throughout the test period.

d. Analytical Plan.

(1) Prepare a subjective analysis of data assembled as a result of comments, observations, interviews, and/or answers to questionnaire.

(2) Conduct an appropriate statistical analysis of the measures of effectiveness examined to determine any significant difference between test and control items, or test item and criteria. This might include:

(a) Mean times to complete confidence, bayonet, grenade courses, and those exercises conducted on the CETF.

(b) Mean times to complete road and cross country marches.

(c) Relative support afforded - Test vs control item.

(d) Relative comfort afforded - Test vs control item.

(e) Relative protection afforded - Test vs control item.

(3) Where comparison is used to test a measure of effectiveness the results should indicate whether the test boot shows evidence of support, comfort, and/or protection less than, equal to, or greater than those same qualities found in the control item, and/or expressed as criteria in requirements documents.

10. Durability and Reliability.

a. Perform applicable procedures of MTP/TOP 10-3-502, Durability, to determine the degree to which the test item will survive a projected service life in serviceable condition, while performing its intended functions.

b. MTP/TOP 10-3-502 has been prepared as a guide to assist in examining durability during general equipment tests. The broad contents are adaptable, in part, to any item under test. A careful review of all requirements documents, test directives, and pretest command guidance should be made to insure close examination of specific durability requirements for the test item.

c. Upon completion of all tests, the test boots should be examined for serviceability. The number of serviceable items, compared to the total items tested, will furnish data to support a reliability judgment. Figures should be calculated at 90 percent confidence level. The overall durability and reliability of the candidate test item may be determined by an evaluation of critical

failures - where failure is defined as any weakness or discrepancy which renders the boot unserviceable or less than fully functional.

11. Maintainability.

a. Apply pertinent procedures described in MTP/TOP 10-3-504, Maintenance Evaluation, to determine if the instructions for use are adequate, and to compare maintenance requirements of the test item against the control item and criteria expressed in materiel needs documents.

b. The maintenance evaluation of the test item should be conducted concurrently with other testing. The usual care, cleaning, drying, and polishing required of test soldiers undergoing the varied training required in other subtests will provide information and data comparable to that equated to a normal user environment.

12. Human Factors Engineering.

a. Accomplish the applicable procedures of MTP/TOP 10-3-505, Human Factors Evaluation, to determine if the test item meets human factors requirements expressed in materiel needs documents, is suited for service in accordance with basic human factors principles, and to what degree the candidate field boot meets with troop approval.

b. Throughout the conduct of all testing, data related to soldier acceptance, degradation of performance, and compatibility of the test item with soldier skills, aptitudes, and limitations will be collected. The use of questionnaires, interviews, and the observations of data oriented supervisory personnel are means of assembling such information.

13. Value Analysis.

a. Objective.

To determine if the test item has any nonessential features which might be eliminated without compromising the primary function of supporting and protecting the feet and lower legs.

b. Method.

Concurrent with all testing, participating personnel will be alerted to the requirement for reporting any nice-to-have but superfluous features of the test item.

c. Data Required.

The comments and observations of test personnel.

d. Analytical Plan.

Prepare a subjective analysis of data collection and support narrative with charts, pictures, tables or graphs as required.

Recommended changes to this publication should be forwarded to Commanding General, U.S. Army Test and Evaluation Command, ATTN: AMSTE-ME Aberdeen Proving Ground, Maryland 21005. Technical information related to this publication may be obtained from US Army Infantry Board, ATTN: STEBC-MO-M, Fort Benning, Georgia 31905. Additional copies of this document are available from the Defense Documentation Center, Cameron Station, Alexandria, Virginia 22314. This document is identified by the accession number (AD No) printed on the first page.

APPENDIX
REFERENCES

1. A Study to Conserve the Energy of the Combat Infantryman U.S. Army Combat Developments Command, 5 Feb 64.

2. Department of Army Approved Qualitative Materiel Requirements for a System of Lightweight Individual Clothing and Equipment (LINCLOE) 1 Sep 65.

3. FM 21-15, Care and Use of Individual Clothing and Equipment.

4. TECOM Reg 385-6, Verification of Safety of Materiel During Testing.

5. TECOM Reg 750-15, Maintenance Portion of the Service Test.

6. TECOM Reg 70-24, Documenting Test Plan and Reports.

7. TECOM Reg 70-34, Risk Analysis for Suitability Tests.

8. AR 70-10, Research and Development, Test and Evaluation During Development and Acquisition of Materiel.

9. TM 10-228, Fitting of Footwear.

10. MTP/TOP 3-1-002, Confidence Intervals and Sample Size.

11. MTP/TOP 10-2-509, Combat Effectiveness Test Facility.

12. MIL-STD-1472A.