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14. ABSTRACT
This Test Operations Procedure (TOP) provides specific and general procedures for testing individual Soldier equipment in a cold regions environment. The common characteristics of a cold region are cold temperatures, strong seasonality with distinct changes in insolation (solar radiation energy), frozen atmospheric moisture, frozen ground, and freeze/thaw of water. These characteristics have moderate to high-risk impacts on the survivability of the individual Soldier and are best addressed through natural environmental testing. Methods for testing individual Soldier equipment for the effect of these cold-regions characteristics are the primary goal of this TOP.

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US ARMY TEST AND EVALUATION COMMAND
TEST OPERATIONS PROCEDURE

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COLD REGIONS – ENVIRONMENTAL TEST OF INDIVIDUAL SOLDIER EQUIPMENT

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*This TOP supersedes TOP 10-2-509 Cold Regions Performance Test of Snowshoes, dated 5 May 1980; TOP 10-4-005 Arctic Environmental Test of Clothing and Sleeping Equipment, dated 26 November 1969; TOP 10-4-007 Arctic Environmental Test of Skis and Snowshoes, dated 10 July 1969; TOP 10-4-008 Arctic Environmental Test of Individual Load Carrying Equipment, dated 16 June 1969; and TOP 10-4-009 Arctic Environmental Test of Body Armor and Helmets, dated 28 November 1969.

1. SCOPE.

This Test Operations Procedure (TOP) provides specific and general required procedures for testing individual Soldier equipment in a cold regions environment. Items covered include, but are not limited to, snowshoes, skis, load carrying equipment, body armor, helmets, and rucksacks. The common characteristics of a cold region are cold temperatures, strong seasonality with distinct changes in insolation (solar radiation energy), frozen atmospheric moisture, frozen ground, and freeze/thaw of water. These characteristics have moderate to high-risk impacts on the performance of individual Soldier equipment. These effects are best addressed through natural environmental testing. Methods for testing individual Soldier equipment for the effect of these cold regions characteristics are a primary goal of this TOP. Additionally, this TOP will provide required test procedures to determine the effectiveness and suitability of individual Soldier equipment while being exposed to a cold regions environment. This TOP combines the following dated TOPs into a single test procedure:

a. TOP 10-2-509 Cold Regions Performance Test of Snowshoes.

b. TOP 10-4-005 Arctic Environmental Test of Clothing and Sleeping Equipment.

c. TOP 10-4-007 Arctic Environmental Test of Skis and Snowshoes.

d. TOP 10-4-008 Arctic Environmental Test of Individual Load Carrying Equipment.

e. TOP 10-4-009 Arctic Environmental Test of Body Armor and Helmets.

2. FACILITIES AND INSTRUMENTATION.

2.1 Facilities.

2.1.1 Test Courses.

In order to facilitate testing of different kinds of Soldier equipment, varied test courses and terrain may be required. As much as practicable, all test courses should be located in terrain that

is wide enough to allow test participants to travel in any required military or tactical formations. In general, test courses should be approximately 4 kilometers long and located within the natural environment. If possible, the test course terrain should contain slopes, snow, ice, wind, brush/vegetation, and be representative of the cold regions environment. The test area selected should replicate the cold regions conditions that the equipment will be exposed to when utilized by the end-item user. As a guide to cold regions, TOP 01-1-017[1]* provides overall cold regions information.

2.1.2 Firing Ranges.

For test items that require the use of a firing range, personnel will use a controlled access range with the following characteristics:

a. An impact area that is usable from minimum high angle to the maximum range of the weapons.

b. Test personnel should use existing firing ranges when possible as the range distances are known, automatic scoring can be provided, and thermal heat sources could be used if necessary.

c. Bomb proof shelters may be required to support some tests. Personnel should place these prior to the start of testing.

d. Support personnel must complete any ground, berm, or firing position maintenance or rework before the ground freezes and is unworkable.

2.1.3 Administrative, Maintenance, and Storage.

a. Cold Regions Test Center (CRTC) will provide office space with adequate heat, lighting, and ventilation to the test team and test participants. Test teams will use existing facilities when feasible. Telephones, computer access, office equipment, and any special requirements to support the test team must be identified and in-place prior to the start of testing. Computer and network access requires prior approval and may require additional arrangements to accommodate non-government testers, customers, contractors, or support personnel. These approvals must be coordinated with the Information Assurance (IA) section early in the test planning process.

b. On some tests, portable/mobile trailers, tents, conexes, or warm-up buildings may be used. Personnel should position these as close to the test site as possible. Briefing areas located close to the test sites will facilitate the flow of information between the test officers, test team, and test participants. When using portable/mobile facilities, gasoline generators may be required to provide power and heat. The generators must be available and able to function in temperatures as low as -46 ºCelsius (C).

*Superscript numbers correspond to Appendix E, References.

c. If testing at a remote site, latrine facilities (portable toilets) will need to be coordinated, and contracts completed, prior to the test start date.

d. Some equipment may require specific testing in unique locations that provide additional altitude, temperature, or marine environments. In this circumstance, test personnel should make consideration for temporary portable maintenance, and/or administrative facilities such as vans/expandable vans, trailers, and tents or tarps to support test operations.

2.2 Instrumentation.

A wide range of instrumentation must be available to measure and record the prevailing meteorological conditions and the performance and durability of the test items. TOP 01-1-004[2] outlines special considerations for instrumentation requirements in a cold regions environment. Table 1 highlights the instrumentation requirements and associated data elements that are most commonly measured and recorded. However, the list is not all-inclusive, and additional instrumentation may be required for specific test items or test scenarios.

TABLE 1. INSTRUMENTATION REQUIREMENTS

ITEM	DATA REQUIRED	DEVICE FOR MEASURING	PERMISSIBLE MEASUREMENT OF UNCERTAINTY[a]
Meteorological data	Ambient temperature	Digital temperature/relative humidity probe	-50 ºC to + 50 ºC, ± 0.3 ºC (-58 ºFahrenheit ((F)) to + 122 ºF,± 0.54 ºF)
	Relative humidity	Digital temperature/relative humidity probe	0-100%, ± 2% 20-25 ºC (68 to 77 ºF)
	Atmospheric pressure	Digital barometer	500-1000 hectopascal (hPa), ± 0.15 hpa
	Wind velocity	Digital anemometer	0-100 knots, ± 2 knots
	Wind direction	Digital anemometer	0-360, ± 5%
	Precipitation - winter	Observer collected	± 0.08 centimeter (cm) (0.03 inch ((in.))
	Precipitation - summer	Digital tipping bucket	± 0.05 cm (0.02 in.)
	Solar radiation	Digital pyranometer	± 14.90×10^{-6} volt (V)/watt meter^2
Snow and soil firmness	Firmness[b]	Snow kit, cone penetrometer	300 pounds per square inch (psi), ± 5%
Snow and soil strength	Compactness and strength	Snow kit, cone penetrometer	300 psi, ± 5%
Human Factors Engineering(HFE)	Test participant anthropometric data	Anthropometric measuring kit	± 0.5 cm (0.2 in.)

TABLE 1. CONTINUED

ITEM	DATA REQUIRED	DEVICE FOR MEASURING	PERMISSIBLE MEASUREMENT OF UNCERTAINTY[a]
Tape measure	Length	30 meter (m) (100 feet ((ft)) tape rule	± 1%
Scale	Weight	Scale – 115 kilogram (kg) (250 pound ((lb))	± 1%
Temperature	Temperature	Thermometer -45 ºC to 5 ºC (-50 ºF to 40 ºF)	± 1 ºC; ± 2 ºF
Thermocouple	Temperature (local)	Thermocouple -45 ºC to 5 ºC (-50 ºF to 40 ºF)	± 1 ºC; ± 2 ºF
Snow probe	Depth	Snow probe, 1 m (3 ft)	± 1%
Slope/grade	Slope/grade	Inclinometer 0 to 90 º	± 2%
Time	Time	Global Positioning System (GPS) or watch	± 1 second
Distance	Distance	GPS	± 2m[c]

Note a: The permissible measurement uncertainly is the two-standard deviation value for normally distributed instrumentation calibration data. Thus 95 percent of all instrumentation calibration data readings will fall within two standard deviations from the known calibration value.

Note b: Additional information can be found in Cold Regions Research and Engineering Laboratory (CRREL) Report 93-6[3].

Note c: Uncertainty of measurement is specific to GPS unit. It is important to verify the accuracy of the device being utilized prior to start of test.

3. REQUIRED TEST CONDITIONS.

3.1 Required Test Equipment.

a. Appropriate arctic winter uniforms and individual field equipment.

b. Vehicles, as required.

c. Meteorological support instrumentation.

d. Photographic/video equipment.

e. Weapons and ammunition, as required.

f. Thermal heat source for targets, as required.

g. Any general and/or special tools, and other ancillary items, required for repairs or maintenance on the test items.

3.2 Preparation for Test.

a. Prior to the start of test, a detailed test plan (DTP) or test plan (TP), as defined by the type of test will be staffed and approved by the US Army Test and Evaluation Command (ATEC). An evaluated program must have an approved TP prior to start of testing. The test plan will include all criteria to be measured against, as outlined by an Operational Needs Statement (ONS), Joint Urgent Operational Need Statement (JUONS), Capability Production Document (CPD), or test item performance specification.

b. Because this type of testing involves test participants and requisite surveys/interviews, test officers should approve all surveys prior to start of test. Test officers may use US Army Evaluation Center (AEC) Manpower and Personnel Integration (MANPRINT) personnel, or other test centers, to develop approved surveys/questions or provide surveys/questions used in previous testing.

c. Since natural cold weather environmental tests normally occur from October through March (6 months), test item delivery should be early enough to allow proper test item preparation to meet testing threshold temperatures.

d. If necessary, additional test center personnel may augment assigned personnel, and will be representative of the troops who will use and maintain the test items under field conditions. Contractor or program manager personnel will not act as test participants for an evaluated program.

e. Ensure that all test personnel are familiar with the required technical and operational characteristics of the item under test.

f. Review all instructional material issued with the test item by the manufacturer, contractor, or program manager; as well as reports of previous tests conducted on the same type of equipment. The test officer will ensure that all test personnel are familiar with the available references.

g. If appropriate, test personnel will ensure all test items and comparison items (if provided) are stored and maintained in an unsheltered area and exposed to ambient air temperature and prevailing weather conditions.

h. Test officers will record the grade, military occupational specialty (MOS), background, and training of all test personnel and ensure that all personnel receive new equipment training (NET) as required.

i. Data collectors will record the nomenclature, serial number, manufacturer, and specific test identification number of each test item.

j. Test personnel will prepare record forms for systematic data and test item event chronology. Additionally, and if required, test officers will ensure significant test event data are recorded and submitted via the Test Incident Report (TIR).

k. When military troops are conducting the test as test participants, the test support personnel will obtain a safety release from ATEC prior to the start of test for each unit participating and only for the duration of the test.

l. Prior to start of test, a formal Hazard Assessment Working Group (HAWG) will meet and discuss hazards and their mitigation. All test personnel will adhere to these mitigations during the conduct of the test. Adequate safety precautions to provide safety for personnel and equipment will be developed or implemented, and all applicable safety Standard Operating Procedures (SOPs) followed throughout the test.

m. Outfit test personnel in appropriate arctic winter clothing and with individual field equipment during conduct of testing.

n. Record the prevailing meteorological conditions during the storage phase, as well as during the test. Meteorological data includes, but is not limited to:

(1) Temperature.

(2) Humidity, relative.

(3) Atmospheric pressure.

(4) Precipitation, type and quantity.

(5) Solar radiation.

(6) Wind speed and direction.

(7) Frequency of readings.

(8) Source of data.

o. Perform preventative maintenance checks and services (PMCS) and prepare all equipment in accordance with applicable technical manuals (TM) or references.

p. When applicable, personnel should test items on or in conjunction with other test items of individual equipment, clothing, and rations as well as with standard items (e.g. sleeping gear with load-carrying equipment, boots with skis, etc.).

3.3 Human Resource Protection Program (HRPP) Controls.

Testing of Soldier equipment typically requires test personnel to collect personal information about participating Soldiers or civilians (e.g. weight, height, skin temperature, caloric intake, etc). Furthermore, participating individuals may be put at minor risk should the equipment (clothing, sleeping gear, etc.) not provide adequate insulation against the cold. For these reasons, equipment tests typically require HRPP review to ensure that protocols exist to protect the well-being of test participants. In most cases, test officers must forward the review document to the ATEC level HRPP committee for concurrence. Informed consent, minimization of hazards, and protection of personally identifiable information are key aspects of the HRPP.

4. TEST PROCEDURES.

4.1 Safety.

Throughout the duration of test, all personnel are responsible to monitor all safety aspects of the test. The test team will record any safety or hazard related issues associated with the test items. These issues can be narrative comments obtained from all test personnel through daily observations, interviews, and questionnaires. The following specific safety areas will be questioned:

a. Unforeseen hazards that only become apparent during testing or operation of the test item.

b. Safety hazards associated with storage, transportation, operation, and maintenance of the test item.

c. Specific safety hazards identified that might factor into the Safety Release Confirmation.

4.2 Initial Inspection and Physical Characteristics.

a. Upon receipt, carefully inspect all test and comparison items (if provided) and their shipping and/or packaging containers for completeness, damage, and general conditions. Photograph any damage or deterioration noted. Personnel will use technical manuscripts, manuals, or other publications supplied with the items as guides for the inspection.

b. Record the following:

(1) Inventory of all test items.

(2) Unique test item control number, specifically assigned to each test item.

(3) Damage or deterioration noted.

c. Measure and weigh each test item and comparison item (if applicable) and record the length, width, and height.

d. Identification photograph of each item.

e. Results of all operational checks and any discrepancies detected during the inspection. Prior to starting the test, record any discrepancies that test personnel did not correct.

4.3 Environmental Performance (Suitability/Compatibility).

This subtest shall be conducted in ambient air temperatures ranging from -18 ºC to the lowest available temperature, or in the temperature(s) required by the test item performance specification. In order to maximize the efficiency of testing multiple types of Soldier equipment, personnel should conduct tests concurrently, when possible, to effectively utilize labor and materials available.

4.3.1 Clothing.

a. If practicable, conduct this subtest with 25% of the testing performed in -18 ºC to -32 ºC temperatures; 50% in -32 ºC to -43 ºC; and 25% colder than -43 ºC. All safety hazards and risk mitigation effects must be in place, and all safety SOPs adhered to during this subtest.

b. The test participants will don and wear the applicable test items and equipment, and comparison items (if provided), with all required individual field gear and appropriate arctic winter uniform. At the direction of the test team, and as agreed upon by the test item customer, the following test events may be performed:

(1) Snowshoe; length and time appropriate to test participant size and overall test length, both which may be limited by test funding. Snowshoe should include snow-covered terrain, cross-country terrain, and areas of vegetation.

(2) Ski; length and time appropriate to test participant size and overall test length, both which may be limited by test funding.

(3) Vehicular marches:

(a) 161 kilometers over cross-country terrain in tracked vehicles.

(b) 161 kilometers on secondary roads in wheeled vehicles.

(4) Four field training exercises, lasting four days each, consisting of attack, defense, patrol, and retrograde operations. Individual Soldiers of the platoon/squad will use all tables of organization and equipment (TOE), as well as special equipment issued for use in arctic winter environmental conditions.

c. If possible, an artillery or mortar gun crew will wear the test and comparison test items during preparation and firing of indirect weapons and munitions.

d. Complete the Comparison-Compatibility Form (Appendix B) at the completion of each subtest sequence.

e. Complete the Opinion Form (Appendix C) at the completion of each subtest sequence.

f. Record the following data:

(1) Damage attributed to test items because of environmental effects.

(2) Damage attributed to wear only, discounting environmental effects.

(3) Difficulties encountered in wearing or transporting the test item during each specific mission or tasking.

(4) Test item compatibility discrepancies with other mission related gear or clothing.

(5) Water repellant qualities of the test items.

(6) Insulating qualities of the test items.

(7) Meteorological conditions at test site.

(8) Characteristic photographs of the test item during different missions and taskings.

4.3.2 Sleeping Equipment.

a. If practicable, conduct this subtest with 25% of the testing performed in -18 ºC to -32 ºC temperatures; 50% in -32 ºC to -43 ºC; and 25% colder than -43 ºC. All safety hazards and risk mitigation effects must be in place, and all safety SOPs adhered to during this subtest.

b. Inspect each test item, and comparison item (if provided), for loose, damaged, or missing parts. Personnel will correct the deficiencies prior to testing or record any uncorrected deficiencies.

c. Place the test items, and comparison items (if provided), in the prescribed carrying case or on prescribed equipment.

d. Direct test personnel to carry the test items, and comparison items (if provided), with individual field gear and dressed in appropriate arctic winter uniform during the required test events. At the direction of the test team, and as agreed upon by the test item customer, the following test events may be performed:

(1) Snowshoe; length and time appropriate to test participant size and overall test length, both which may be limited by test funding. Snowshoe should include snow-covered terrain, cross-country terrain, and areas of vegetation.

(2) Ski; length and time appropriate to test participant size and overall test length, both which may be limited by test funding.

(3) Vehicular marches:

(a) 161 kilometers over cross-country terrain in tracked vehicles.

(b) 161 kilometers on secondary roads in wheeled vehicles.

(4) Four field training exercises, lasting four days each, consisting of attack, defense, patrol, and retrograde operations. Individual Soldiers of the platoon/squad will use all TOE as well as special equipment issued for use in arctic winter environmental conditions.

e. Test personnel will direct the participants to sleep in the test items, and comparison items (if provided), in the following listed shelters. Not all of these shelters may be practicable or environmentally able to be created. The test team will direct the test participants which shelters to use from the following list:

(1) Ten-man arctic tents.

(2) Improvised shelters:

(a) Poncho.

(b) Single lean-to.

(c) Double lean-to.

(d) Tree pit.

(e) Snow well, hole, or cave as described in Field Manual (FM) 31–70[4].

f. Complete the Comparison-Compatibility Form (Appendix B) at the completion of each subtest sequence.

g. Complete the Opinion Form (Appendix C) at the completion of each subtest sequence.

h. Record the following data:

(1) Damage attributed to test items because of environmental effects.

(2) Damage attributed to use and handling only, discounting environmental effects.

(3) Difficulties encountered in entering, exiting, carrying, or transporting the test item during each specific mission or tasking.

(4) Test item compatibility discrepancies with other mission related gear or clothing.

(5) Water repellant qualities of the test items.

(6) Insulating qualities of the test items.

(7) Subjective comfort qualities of the test items.

(8) Types of shelters used during the test.

(9) Meteorological conditions at test site.

(10) Characteristic photographs of the test item during different missions and taskings.

4.3.3 Skis and Snowshoes.

a. If practicable, conduct this subtest with 25% of the testing performed in -18 ºC to -32 ºC temperatures; 50% in -32 ºC to -43 ºC; and 25% colder than -43 ºC. All safety hazards and risk mitigation effects must be in place, and all safety SOPs adhered to during this subtest.

b. Direct test personnel to inspect, don, and wear the test items in accordance with appropriate TMs. They shall be dressed in appropriate arctic winter clothing with individual field gear as required.

c. Snowshoes will:

(1) Be inspected for serviceability prior to each test event, and then inspected for snow and ice build-up and any discrepancies after each test event.

(2) Be observed to ensure they provide the proper flotation in the snow.

(3) Be inspected to ensure the harness secures the wearer's boot to the snowshoe.

d. Skis will:

(1) Be inspected for serviceability prior to each test event, and then inspected for snow and ice build-up and any discrepancies after each test event.

(2) Be inspected to ensure that the ski release bindings secure the boot and that all binding mechanisms (cable type or boot-lock) are free of snow and ice.

(3) Be inspected to ensure that a “ski brake” is present to prevent the ski from "running away" downhill.

e. Throughout the testing procedures, test personnel and test participants will ensure the ski and snowshoe bindings are adjusted properly.

f. During testing, 50 percent of the test personnel will use the test item, and the remaining 50 percent of the personnel will use a comparison item (if provided). The following missions and tasks will be accomplished at the discretion of the test team and as agreed upon by the test item customer and test center:

(1) Four field training exercises, lasting four days each, consisting of attack, defense, patrol, and retrograde operations. Individual Soldiers of the platoon/squad will use all TOE as well as special equipment issued for use in arctic winter environmental conditions.

(2) Conduct a cross-country ski march that is of sufficient length and time appropriate to test participant size and overall test length, both which may be limited by test funding.

(3) During steps (1) and (2), accomplish the following specific tasks and report the results, on a daily basis, by completing the Comparison-Compatibility Form (Appendix B).

(a) Utilizing snowshoes, conduct a march through dense, snow-covered brush.

(b) Utilizing snowshoes, conduct a march over snow covered, cross-country terrain.

(c) Ski downhill on prepared ski slopes, if available.

(d) Ski over cross-country trails.

(e) Transport snowshoes and skis 161 kilometers over cross-country terrain in a tracked vehicle.

(f) Transport snowshoes and skis 161 kilometers on secondary roads in wheeled vehicles.

(g) At the end of each field training exercise and at the end of the test, test personnel shall complete the Opinion Form (Appendix C).

(h) Record the following data:

(1) Damage attributable to environmental effects.

(2) Problems encountered (movement, discomfort, etc.).

(3) Damage due to wear and use, etc.

(4) Temperature and meteorological conditions at test site.

(5) Complete the Personal History Form (Appendix D).

4.3.4 Individual Load Carrying Equipment.

a. If practical, conduct this subtest with 25% of the testing performed in -18 ºC to -32 ºC temperatures; 50% in -32 ºC to -43 ºC; and 25% colder than -43 ºC. All safety hazards and risk mitigation effects must be in place and all safety SOPs adhered to during this subtest.

b. Inspect each test item, and comparison item (if provided), for loose, damaged, or missing parts. Personnel will correct the deficiencies prior to testing or record any uncorrected deficiencies.

c. Test participants will don and wear the test items over the following courses, as directed by the test team:

(1) Utilizing snowshoes, conduct a march through dense, snow-covered brush.

(2) Utilizing snowshoes, conduct a march over open snow-covered (cross-country) terrain.

(3) Ski over cross-country ski trails.

(4) Perform a vehicular march of 161 kilometers across cross-country in tracked vehicles.

(5) Perform a vehicular march of 161 kilometers on secondary roads in wheeled vehicles.

d. During the above tests, the test items and comparison items (if provided), should be mounted and dismounted on vehicles at least 10 times. Additionally, rotate test items and comparison items during the snowshoe and ski courses to ensure adequate exposure of the load carrying equipment to the demands of each activity.

e. Utilizing a platoon or squad, test personnel will conduct four field training exercises, lasting four days each, consisting of attack, defense, patrol, and retrograde operations. Individual Soldiers of the platoon/squad will use all TOE as well as special equipment issued for use in arctic winter environmental conditions.

f. If possible, an artillery or mortar gun crew will wear the test and comparison test items during preparation and firing of indirect weapons and munitions.

g. Each test participant shall complete the Comparison-Compatibility Form (Appendix B) at the end of each test day. After each field training exercise the Opinion Form (Appendix C) will be completed.

h. Thoroughly inspect each test item and record the following:

(1) Damage attributed to test items because of environmental effects.

(2) Damage attributed to use and handling only, discounting environmental effects.

(3) Difficulties encountered in wearing, carrying, or transporting the test item during each specific mission or tasking.

(4) Test item compatibility discrepancies with other mission related gear or clothing.

(5) Damage to the load carrying equipment due to excessive loads.

(6) Subjective comfort qualities of the test items.

(7) Meteorological conditions at test site.

(8) Characteristic photographs of the test item during different missions and taskings.

4.3.5 Body Armor and Helmets.

a. If practical, conduct this subtest with 25% of the testing performed in -18 ºC to -32 ºC temperatures; 50% in -32 ºC to -43 ºC; and 25% colder than -43 ºC. All safety hazards and risk mitigation effects must be in place and all safety SOPs adhered to during this subtest.

b. Cold-soak (outdoors for a period of at least 24 hours) all test items and comparison items (if provided) at prevailing ambient air temperatures.

c. Inspect each test item, and comparison item if required, for loose, damaged, or missing parts. Personnel will correct the deficiencies prior to testing or record any uncorrected deficiencies.

d. Test personnel dressed in the appropriate arctic winter uniform, outfitted with individual field gear, and wearing the test items as directed, will perform the following marches and exercises:

(1) Snowshoe through dense, snow-covered brush.

(2) Snowshoe over snow-covered (cross-country) terrain.

(3) Ski over cross-country ski trails.

(4) Vehicular marches:

(a) 161 kilometers cross-country in tracked vehicles

(b) 161 kilometers on secondary roads in wheeled vehicles

(5) Four field training exercises, lasting four days each, consisting of attack, defense, patrol and retrograde operations, which will require individual Soldiers of the platoon/squad to use all TOE as well as special equipment issued for use under arctic winter conditions.

e. If possible, an artillery or mortar gun crew will wear the test and comparison test items during preparation and firing of indirect weapons and munitions.

f. If possible, ensure the test participants wear the test and comparison items while entering, driving, and exiting a military tactical vehicle. Ensure the vehicle crew can perform their specific mission.

g. At the end of each day of testing, the test participants shall complete the Comparison-Compatibility Form (Appendix B).

h. Each soldier should complete the Opinion Form (Appendix C) by at the end of each field training exercise and at the end of the test.

i. Record the following data:

(1) Damage attributed to test items because of environmental effects.

(2) Damage attributed to use and handling only, discounting environmental effects.

(3) Difficulties encountered in wearing, carrying, or transporting the test item during each specific mission or tasking.

(4) Test item compatibility discrepancies with other mission related gear or clothing.

(5) Damage due to wear, use, etc.

(6) Subjective comfort qualities of the test items.

(7) Meteorological conditions at test site.

(8) Characteristic photographs of the test item being tested during different missions and taskings.

4.4 Human Factors Engineering.

a. Throughout the duration of the test, monitor and record all features and characteristics of the test items, which are incompatible with the skills, aptitudes, and limitations of the test participants who are using them. Participants will pay particular attention to the operations of the test items to insure that they can be readily donned and doffed by personnel wearing the arctic winter uniform and cold-dry hand wear.

b. Record the following data:

(1) Desirable and undesirable characteristics.

(2) Indications of acceptability or unacceptability.

(3) Compatibility problems.

(4) Problems in donning and doffing the test and comparison items.

(5) Sizing and fitting problems.

4.5 Maintenance Evaluation.

a. Throughout the duration of the test, maintain a record of date, time, and location of scheduled and unscheduled maintenance performed in accordance with prescribed publications. Whenever possible, maintenance personnel should perform tasks while exposed to existing environmental conditions.

b. Record the requirement for any additional tools and instruments, shortcomings in authorized tools and equipment, and needs for specialized tools and instruments to accomplish assigned levels of maintenance.

c. Record all replacement parts used, maintenance hours and elapsed hours required for repair, ease or difficulty of maintaining the test items, and level of maintenance skill required.

d. Beginning with the initial inspection upon receipt of the test items, maintain a detailed log of all maintenance actions. Record the date, time, test item number, and description of the failure. Additionally, data collectors will document all repair time, maintenance hours, and any used repair parts. In addition to the above items, the log shall contain the following information:

(1) Number of times the test item is assembled and installed from the field transport configuration.

(2) Number of times the test item is disassembled and repacked in the field transport configuration.

(3) Hours of operation, daily and cumulative.

(4) Equipment failures and malfunctions, including chronological data required to determine failure-free operating time, mean time between failures, maintenance downtime, and mean time for repair.

(5) Effect of failures on the operational test conduct.

e. Throughout the entire testing period, review all operations and maintenance manuals and/or any other technical manuscripts supplied with the test items for readability, completeness,

and correctness. If necessary, use the manuals for classroom instruction and as references throughout the tests.

f. Record the following data:

(1) A record of all scheduled and unscheduled maintenance of the test items and associated equipment.

(2) Favorable and unfavorable aspects of maintenance.

(3) Unsafe and inadequate aspects of maintenance operations.

(4) Human factors engineering implications.

(5) Comparison of reliability aspects for the test and control items.

(6) Any malfunction, breakage or unusual occurrence because of testing.

(7) Comments on reliability based on observations made throughout the test.

(8) Tools and equipment used for maintenance operations.

(9) Common and special tools and test equipment required, but not furnished in the maintenance package.

(10) Tools and test equipment furnished but not required.

(11) Accuracy and adequacy of maintenance publications.

(12) Unclear instructions.

(13) Inadequate TM procedures.

(14) Special training requirements.

(15) Desirable changes and comments.

(16) Errors or omissions in nomenclature.

4.6 Final Inspection.

a. Upon completion of the test, carefully inspect all test items and comparison items (if provided) for completeness, damage, and general condition. Photograph any damage or deterioration noted. Use applicable TMs or other publications supplied with the test items as guides for the inspection.

b. Record the following:

(1) Inventory of all test items

(2) Damage or deterioration noted

(3) Photographs of damage parts and/or components.

5. DATA REQUIRED.

The following data is required for each of the following subtests:

5.1 Initial Inspection and Physical Characteristics.

a. Inventory of all test items.

b. Test item unique identification number.

c. Damage or deterioration noted.

d. Dimensions (length, width, height, etc.) and weight of the test items and comparison items (if provided).

e. Identification photograph of test and comparison items.

f. Results of operational check.

g. Any discrepancies detected.

5.2 Safety.

a. Observed and recorded potential safety hazards associated with storage, transportation, operation, and maintenance of the test item.

b. Comments and assessment of test item system safety.

c. If requested, ATEC may request a Safety Confirmation Recommendation to support a Safety Confirmation.

5.3 Environmental Performance (Suitability/Compatibility).

5.3.1 Clothing.

a. Comparison-Compatibility Form (Appendix B), completed by each test participant at the completion of each subtest.

b. Opinion Form (Appendix C), completed by each test participant at the completion of each subtest.

c. Damage attributed to test items because of environmental effects.

d. Damage attributed to wear only, discounting environmental effects.

e. Difficulties encountered in wearing or transporting the test item during each specific mission or tasking.

f. Test item compatibility discrepancies with other mission related gear or clothing.

g. Water repellant qualities of the test items.

h. Insulating qualities of the test items.

i. Meteorological conditions at test site.

j. Characteristic photographs of the test item during different missions and taskings.

5.3.2 Sleeping Equipment.

a. Comparison-Compatibility Forms (Appendix B), completed by each test participant at the completion of each subtest.

b. Opinion Forms (Appendix C), completed by each test participant at the completion of each subtest.

c. Damage attributed to test items because of environmental effects.

d. Damage attributed to wear only, discounting environmental effects.

e. Difficulties encountered in entering, exiting, carrying, or transporting the test item during each specific mission or tasking.

f. Test item compatibility discrepancies with other mission related gear or clothing.

g. Subjective comfort qualities of the test items.

h. Water repellant qualities of the test items.

i. Insulating qualities of the test items.

j. Types of shelters used during the test.

k. Meteorological conditions at test site.

l. Characteristic photographs of the test item being tested during different missions and taskings.

5.3.3 Skis and Snowshoes.

a. Comparison-Compatibility Forms (Appendix B), completed by each test participant at the completion of each subtest.

b. Opinion Forms (Appendix C), completed by each test participant at the completion of each subtest.

c. Damage attributable to environmental effects.

d. Problems encountered (movement, discomfort, etc.).

e. Damage due to wear and use, etc.

f. Meteorological conditions at test site.

g. Complete Personal History Form (Appendix D).

5.3.4 Individual Load Carrying Equipment.

a. Comparison-Compatibility Forms (Appendix B), completed by each test participant at the completion of each subtest.

b. Opinion Forms (Appendix C), completed by each test participant at the completion of each subtest.

c. Damage attributed to test items because of environmental effects.

d. Damage attributed to use and handling only, discounting environmental effects.

e. Difficulties encountered in wearing, carrying, or transporting the test item during each specific mission or tasking.

f. Test item compatibility discrepancies with other mission related gear or clothing.

g. Damage to the load carrying equipment due to excessive loads.

h. Subjective comfort qualities of the test items.

i. Meteorological conditions at test site.

j. Characteristic photographs of the test item during different missions and taskings.

5.3.5 Body Armor and Helmets.

a. Comparison-Compatibility Forms (Appendix B), completed by each test participant at the completion of each subtest.

b. Opinion Forms (Appendix C), completed by each test participant at the completion of each subtest.

c. Damage attributed to test items because of environmental effects.

d. Damage attributed to use and handling only, discounting environmental effects.

e. Difficulties encountered in wearing, carrying, or transporting the test item during each specific mission or tasking.

f. Test item compatibility discrepancies with other mission related gear or clothing.

g. Damage due to wear, use, etc.

h. Subjective comfort qualities of the test items.

i. Meteorological conditions at test site.

j. Characteristic photographs of the test item being tested during different missions and taskings.

5.4 Human Factors Engineering.

a. Desirable and undesirable characteristics.

b. Indications of acceptability or unacceptability.

c. Compatibility problems.

d. Problems in donning and doffing the test and comparison items.

e. Sizing and fitting problems.

f. Appropriate anthropometric measurements and percentiles of all personnel.

5.5 Maintenance Evaluation.

a. A record of all scheduled and unscheduled maintenance of the test items and associated equipment.

b. Favorable and unfavorable aspects of maintenance.

c. Unsafe and inadequate aspects of maintenance operations.

d. HFE implications.

e. Comparison of reliability aspects for the test and control items.

f. Any malfunction, breakage or unusual occurrence because of testing.

g. Comments on reliability based on observations made throughout the test.

h. Tools and equipment used for maintenance operations.

i. Common and special tools and test equipment required, but not furnished in the maintenance package.

j. Tools and test equipment furnished but not required.

k. Accuracy and adequacy of maintenance publications.

l. Unclear instructions.

m. Inadequate TM procedures.

n. Special training requirements.

o. Desirable changes and comments.

p. Errors or omissions in nomenclature.

5.6 Final Inspection.

a. Inventory of all test items.

b. Noted damage or deterioration of test items.

c. Photographs of damage parts and/or components.

6. PRESENTATION OF DATA.

Test officers will reduce and present data in a final test report, or test event record as applicable, to the level of evaluation, or as agreed upon by the test center and customer.

6.1 Initial Inspection and Physical Characteristics.

Preoperational inspection and physical characteristics data will be reduced, organized, and presented in tabular or narrative format.

6.2 Safety.

a. Test officers will tabulate and assess hazards by category for severity and frequency in accordance with Military Standard (MIL-STD)-882D[5]. Each noted hazard should include a description, an initial Risk Assessment Code (RAC), the recommended mitigation, and a mitigated RAC in accordance with MIL-STD-882D.

b. The adequacy of safety tips, cautions, and warnings in the manuals, and the ability of those tips, cautions, and warnings to safeguard the operators and maintainers will be commented on and presented in narrative format.

6.3 Environmental Performance (Suitability/Compatibility).

6.3.1 Clothing.

a. The results of the Comparison-Compatibility Form and Opinion Form will be presented in tabular format for ease in viewing the test participant's subjective comments.

b. Clothing environmental performance data will be presented in either tabular or narrative format; whichever best details the clothing performance and provides for ease of evaluation by higher commands. If applicable, the test officer will comment on the following:

(1) If the test item has characteristics that are equal to or surpass those of the comparison items.

(2) If the test items provide environmental protection greater than the comparison items.

(3) If the test items are compatible with other items of clothing, individual equipment, and oversnow equipment.

(4) If the test items meet or exceed the appropriate specifications.

6.3.2 Sleeping Equipment.

a. The results of the Comparison-Compatibility Form and Opinion Form will be presented in tabular format for ease in viewing the test participant's subjective comments.

b. Sleeping equipment environmental performance data will be presented in either tabular or narrative format; whichever best details the sleeping equipment performance and

provides for ease of evaluation by higher commands. If applicable, the test officer will comment on the following:

(1) If the test item has characteristics that are equal to or surpass those of the comparison items.

(2) If the test items provide environmental protection greater than the comparison items.

(3) If the test items are compatible with other items of clothing, individual equipment, and oversnow equipment.

(4) If the test items meet or exceed the appropriate specifications.

6.3.3 Skis and Snowshoes.

a. The results of the Comparison-Compatibility Form and Opinion Form will be presented in tabular format for ease in viewing the test participant's subjective comments.

b. Ski and snowshoe environmental performance data will be presented in either tabular or narrative format; whichever best details the ski and snowshoe performance and provides for ease of evaluation by higher commands. If applicable, the test officer will comment on the following:

(1) If the test item has characteristics that are equal to or surpass those of the comparison items.

(2) If the test items provide environmental protection greater than the comparison items.

(3) If the test items are compatible with other items of clothing, individual equipment, and oversnow equipment.

(4) If the test items meet or exceed the appropriate specifications.

6.3.4 Individual Load Carrying Equipment.

a. The results of the Comparison-Compatibility Form and Opinion Form will be presented in tabular format for ease in viewing the test participant's subjective comments.

b. Individual load carrying equipment environmental performance data will be presented in either tabular or narrative format; whichever best details the equipment performance and provides for ease of evaluation by higher commands. If applicable, the test officer will comment on the following:

(1) If the test item has characteristics that are equal to or surpass those of the comparison items.

(2) If the test items provide environmental protection greater than the comparison items.

(3) If the test items are compatible with other items of clothing, individual equipment, and oversnow equipment.

(4) If the test items meet or exceed the appropriate specifications.

6.3.5 Body Armor and Helmets.

a. The results of the Comparison-Compatibility Form and Opinion Form will be presented in tabular format for ease in viewing the test participant's subjective comments.

b. Body armor and helmet environmental performance data will be presented in either tabular or narrative format; whichever best details the equipment performance and provides for ease of evaluation by higher commands. If applicable, the test officer will comment on the following:

(1) If the test item has characteristics that are equal to or surpass those of the comparison items.

(2) If the test items provide environmental protection greater than the comparison items.

(3) If the test items are compatible with other items of clothing, individual equipment, and oversnow equipment.

(4) If the test items meet or exceed the appropriate specifications.

6.4 Human Factors Engineering.

The data obtained and observations made during performance of this subtest shall be compared with accepted standards of human engineering. The data shall be presented in either narrative or tabular format, whichever is more practicable.

6.5 Maintenance Evaluation.

If TIR's were completed throughout the conduct of the test, then utilize the TIRs for narrative or tabular comments concerning the required maintenance. TIR summaries can provide detailed maintenance records that will aid in the calculation of any maintenance, operational, or availability numbers. For ease of readability, maintenance actions should be summarized and presented in tabular format. Instances of inadequacy of manuals and technical literature encountered during the test shall be listed in narrative or tabular format.

6.6 Final Inspection.

In narrative format, briefly describe the overall condition of the test items after the completion of all testing. Highlight any problems or discrepancies that were not considered typical wear and tear. Data collectors will annotate any discrepancies that were not repaired prior to shipping the test items.

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APPENDIX A. ABBREVIATIONS.

AEC	US Army Evaluation Center
ATEC	US Army Test and Evaluation Command
C	Celsius
cm	centimeter
CPD	Capability Production Document
CRREL	Cold Regions Research and Engineering Laboratory
CRTC	Cold Regions Test Center
DTIC	Defense Technical Information Center
DTP	detailed test plan
F	Fahrenheit
FM	field manual
ft	feet
GPS	global positioning system
HAWG	Hazard Assessment Working Group
HFE	Human Factors Engineering
hPa	hectopascal
HRPP	Human Resource Protection Program
IA	Information Assurance
in.	inch
JUONS	Joint Urgent Operational Needs Statement
kg	kilogram
lb	pound
m	meter
MANPRINT	Manpower and Personnel Integration
MIL-STD	military standard
MOS	military occupational specialty
NET	new equipment training
ONS	Operational Needs Statement
PMCS	preventative maintenance checks and services
psi	pounds per square inch

APPENDIX A. ABBREVIATIONS.

RAC	Risk Assessment Code
SOP	Standard Operating Procedure
TIR	Test Incident Report
TM	technical manual
TOE	tables of organization and equipment
TOP	Test Operations Procedure
TP	test plan
V	volt

APPENDIX B. COMPARISON-COMPATIBILITY FORM.

This Appendix is in addition to any additional questionnaires required or provided by AEC. If applicable, only use portions of this form that applies to the conducted test. This form is to be completed by each individual after each day's use of the test or control item.

COMPARISON COMPATIBILITY FORM	
Name:	Date:
Temperature Range:	

1. Type of Exercise: ☐ March ☐ Bivouac ☐ Airborne ☐ Tactical Exercise			
☐ Snowshoe	☐ Ski	☐ Defense	☐ Attack
☐ Vehicular	☐ Type Parachute:	☐ Foot Patrol	☐ Other:

2. Which did you wear/use? ☐ Test ☐ Standard

3. Which boot and binding did you wear?			
Boot:		Binding:	
☐ White, VB	☐ Black, VB	☐ All Terrain	☐ Balata
☐ Mountain and Ski	☐ Test	☐ Mountain	☐ Universal
☐ Other:		☐ Other:	

4. What problems or difficulties did you encounter while wearing/using the equipment?			
☐ Poor Stability	☐ Poor Control	☐ Snow or Ice	☐ Poor Flotation
☐ Loose	☐ Stiff	☐ Failure to Hold Binding	☐ Poor Maneuverability
☐ Other:			

5. What did you do?		
☐ Ski downhill	☐ Carry in Vehicle	☐ Climb Hills
☐ Skijor	☐ Ski/Snowshoe Cross-country	☐ Other:

6. I encountered difficulties in the following movements:		
☐ Moving Thru Woods	☐ Step Turns	☐ 1, 2, 3 Stepping
☐ Crossing Obstacles	☐ Skijoring	☐ Climbing I
☐ Downhill Control	☐ Other:	
Explain:		

7. I wore the _____ in conjunction with the following equipment:		
☐ Skis	☐ Snowshoes	☐ Loadcarrying Equipment
☐ Rucksack	☐ Other:	☐ Other:
☐ Weapon – M14, M16, M9, M60 or other _____		

Continued

APPENDIX B. COMPARISON-COMPATIBILITY FORM.

COMPARISON-COMPATIBILITY FORM (Concluded)		
8. I carried the _____ in or on:		
☐ FMTV	☐ M113	☐ Tank
☐ 2 ½ Ton	☐ ¼ Ton	☐ Aircraft
☐ Other:		

9. The _____ was or was not compatible with the following equipment:		
Equipment	Was	Was Not
Why was the test item not compatible with _____ _____ _____		

10. Did you have any problems donning or doffing the _____? ☐ Yes ☐ No		
Which hand wear did you have on?		
☐ Arctic Mitten	☐ Black/White Leather	☐ Bare Hand
☐ Anti-Contact	☐ Trigger Finger	☐ Other:

11. Which did you like best? ☐ Test ☐ Standard
Explain why:

12. The test _____ is:	
☐ More suitable than standard	☐ As suitable as standard
☐ Less suitable than standard	☐ Unknown

13. I have the following comments: _____ _____ _____ _____ _____

Signature:	Rank:

APPENDIX C. OPINION FORM.

This form will be filled out by each individual at the conclusion of each field exercise and at the completion of the test.

OPINION FORM	
Name:	Date:
Item Control Number:	

1. Which did you wear/use?	☐ Test	☐ Standard

2. Write your opinion of the _____ you used:

Test: _____
_____
_____
_____
_____

Standard: _____
_____
_____
_____
_____

3. Rank by number your order of preference:	Test:	Standard:

4. Explain why you like the _____ rated no. 1: _____
_____
_____
_____
_____
_____

Signature:	Rank:

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APPENDIX D. PERSONAL HISTORY FORM.

This form is to be completed by each individual prior to testing.

PERSONAL HISTORY FORM	
Name:	Date:
Rank	MOS/Specialty:
Applicable Specific Military Training:	

1.	Do you have any previous oversnow mobility experience?	☐ Yes	☐ No
2.	What did you wear?	☐ Snowshoes	☐ Skis
3.	Where was the experience obtained?	☐ Civilian	☐ Military
4.	If civilian indicate level of interest:	☐ Hobby	☐ Professional
5.	If military indicate MOS: _____		
6.	I wore the _____in the _____for_____.		
7.	What is your general reaction, comment and criticism regarding your previous experience: _____ _____ _____		
8.	Do you own any:	☐ Snowshoes	☐ Skis

Signature:	Rank:

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APPENDIX E. REFERENCES.

1. TOP 01–1–017, Cold Regions Environmental Considerations, 3 February 2009.

2. TOP 01–1–004, Cold Regions Instrumentation Considerations, 10 October 2007.

3. CRREL Report 93-6, Terrain Characterization for Trafficability, June 1993.

4. FM 31–70, Basic Cold Weather Manual, 17 December 1968.

5. MIL-STD-882D, Standard Practice for System Safety, 10 February 2000.

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Forward comments, recommended changes, or any pertinent data which may be of use in improving this publication to the following address: Range Infrastructure Division (CSTE-TM), US Army Test and Evaluation Command, 2202 Aberdeen Boulevard, Aberdeen Proving Ground, MD 21005-5001. Technical information may be obtained from the preparing activity: Cold Regions Test Center, P.O. Box 665, Delta Junction, AK 99737. Additional copies can be requested through the following website: http://itops.dtc.army.mil/RequestForDocuments.aspx, or through the Defense Technical Information Center, 8725 John J. Kingman Rd., STE 0944, Fort Belvoir, VA 22060–6218. This document is identified by the accession number (AD No.) printed on the first page.