REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*	**2. REPORT TYPE**	**3. DATES COVERED** *(From - To)*
17-10-2011	Final	

4. TITLE AND SUBTITLE
Test Operations Procedure (TOP) 10-2-511
Cold Regions – Environmental Testing of Individual Soldier Clothing

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHORS

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
U.S. Army Yuma Proving Ground
Cold Regions Test Center
PO Box 665
Delta Junction, AK 99737

8. PERFORMING ORGANIZATION REPORT NUMBER
TOP 10-2-511

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Range Infrastructure Division (CSTE-TM)
US Army Test and Evaluation Command
2202 Aberdeen Boulevard
Aberdeen Proving Ground, MD 21005-5001

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)
Same as item 8

12. DISTRIBUTION/AVAILABILITY STATEMENT
Distribution Statement A. Approved for public release; distribution unlimited.

13. SUPPLEMENTARY NOTES
Defense Technical Information Center (DTIC), AD No.:
This TOP supersedes TOP 10-2-510, dated 8 July 1983; TOP 10-3-512, dated 9 May 1980; and TOP 10-4-005, dated 26 November 1969

14. ABSTRACT
This Test Operations Procedure (TOP) provides testing guidelines for individual Soldier cold weather clothing and footwear in a cold regions environment. The primary goal of this TOP is to outline procedures that will determine the protective characteristics from cold, wind and snow of individual Soldier clothing, along with its safety, reliability, durability, and performance when exposed to a cold regions environment.

15. SUBJECT TERMS
Cold weather clothing test
Cold weather footwear test
Environmental clothing test
Environmental footwear test

16. SECURITY CLASSIFICATION OF:			**17. LIMITATION OF ABSTRACT**	**18. NUMBER OF PAGES**	**19a. NAME OF RESPONSIBLE PERSON**
a. REPORT	**B. ABSTRACT**	**C. THIS PAGE**			**19b. TELEPHONE NUMBER** *(include area code)*
Unclassified	Unclassified	Unclassified	SAR	48	

(This page is intentionally blank.)

US ARMY TEST AND EVALUATION COMMAND
TEST OPERATIONS PROCEDURE

*Test Operations Procedure 10-2-511 05 August 2011
DTIC AD No.

COLD REGIONS – ENVIRONMENTAL TESTING OF INDIVIDUAL SOLDIER CLOTHING

Approved for public release; distribution unlimited.

*This TOP supersedes TOP 10-2-510 Cold Regions Environmental Protection and Durability Test of Clothing, dated 8 July 1983; TOP 10-3-512 Cold Regions Environmental Test of Boot and Similar Footwear, dated 9 May 1980; and TOP 10-4-005 Arctic Environmental Test of Clothing and Sleeping Equipment, dated 26 November 1969.

1. SCOPE.

a. This Test Operating Procedure (TOP) details test procedures for determining the environmental protective capability and durability of individual Soldier cold weather clothing and footwear designed for use in a cold regions environment. Items covered include, but are not limited to; uniforms, headwear, undergarments, overgarments, clothing liners, hoods, masks, gloves, socks, and boots. Working in cold environments can not only be hazardous to your health, but also life threatening. It is critical that the body be able to preserve a minimum, steady core body temperature of 37 ºCelsius (C) (98.6 ºFahrenheit ((F)). This thermal balance must be maintained to preserve normal body functioning as well as provide energy for activity or work. The body's mechanisms for generating heat (its metabolism), has to meet the challenge presented by low temperature, wind, and moisture - the three major challenges of the cold regions environment. The human body experiences heat loss/transfer via the following three methods:

(1) Radiation: The loss of heat to the environment due to the temperature gradient.

(2) Conduction: The loss of heat through direct contact with a cooler object.

(3) Convection: The loss of heat from the body to the surrounding air as the air moves across the surface of the body.

b. In order to survive, and potentially thrive, in the cold regions environment, the constant heat loss has to be counterbalanced by the production and retention of an equal amount of heat. The common characteristics of a cold region environment are cold temperatures, strong seasonality with distinct changes in insolation, frozen atmospheric moisture, frozen ground, and freeze/thaw of water. These characteristics pose a moderate to high life threatening risk when operating in this environment. Potential hazards are best addressed through natural environmental testing. Methods for testing individual Soldier cold weather clothing against the effects of these cold regions characteristics are the primary goal of this TOP.

c. The purpose of this document is to provide a systematic approach to testing individual Soldier cold weather clothing and footwear in a cold regions environment. Ensuring that clothing performance in this environment meets, or exceeds, existing requirements. This document provides uniform procedures for testing clothing and footwear performance, in conjunction with reliability and durability, with specific emphasis placed on the moderate and high risk environmental factors found in a cold region environment.

2. FACILITIES AND INSTRUMENTATION.

2.1 Facilities.

a. Courses.

(1) A heated enclosure located adjacent to the relevant test course is required to house the test team and instrumentation, and provide a safe refuge in case of a safety issue. The heated shelter can also be used as a location to install any required test instrumentation on the test participants or test items.

(2) A 200 meter (m) long course on terrain of sufficient width to allow at least 12 participants to traverse it simultaneously will be required. This terrain should be representative of the terrain found in the cold regions environment.

(3) A natural environment test course(s) suitable for determining functional performance characteristics of the test items will be required. The course(s) will include varied subarctic terrain, vegetation, and snow/ice conditions prevalent through the temperature ranges applicable to the test item. Slopes along the course(s) will be of sufficient grade for uphill, downhill, and side hill traverses applicable to real life operational conditions.

(4) An obstacle course(s), either constructed or improvised, that provides sufficient activity and rigors to adequately determine the durability and functionality of items under test will be utilized.

b. Firing Ranges.

(1) If required, an existing firing range should be used when possible as the range distances are known, automatic scoring can be provided, and thermal heat sources could be used if necessary. This area must be in a location commensurate with the natural environment.

(2) Shelters may be required to support some tests and should be moved into place prior to the start of testing.

(3) Any ground, berm, or firing position maintenance or rework must be completed before the ground freezes and becomes unworkable.

c. Administrative.

(1) Office space with adequate heat, lighting, and ventilation must be provided to the test team and test participants. Existing facilities should be used 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 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.

(2) On some tests, portable/mobile trailers, tents, conexs, or warm-up buildings may be used and should be positioned 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 ºC (-50 ºF).

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

(4) Some clothing and footwear may require specific testing in unique locations that provide additional altitude, temperature, or marine environments. Considerations for temporary portable maintenance, and/or administrative facilities such as vans/expandable vans, trailers, and tents or tarps to support test operations should be made.

2.2 Instrumentation.

a. 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[1], Cold Regions Instrumentation Considerations, outlines special considerations for instrumentation requirements in a cold regions environment. Table 1 highlights the general 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.

b. Table 2 shows general test item instrumentation.

*Superscript numbers correspond to Appendix D, References.

TABLE 1. GENERAL 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 ºFº 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	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.)
Tape measure	Length	30 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[b]

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: 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.

TABLE 2. GENERAL TEST ITEM INSTRUMENTATION

ITEM	DATA REQUIRED	MEASURING DEVICE	MEASUREMENT OF UNCERTAINTY[a]
Clothing/boots	Time	GPS/watch	± 1.0 second
	Temperature at specific location	Thermocouple, thermistor, or digital sensor	± 2 ºC (3.6 ºF)
	Distance	GPS	± 4 m[b]
	Mass	Scale	± 1% of reading
	Tread depth	Depth micrometer	± 0.1 millimeter (mm)
	Length	Tape measure	± 1 mm

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: 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.

c. Temperature Probe Placement.

Ensure that the instrumentation listed in Tables 1 and 2 are available, in operational condition, and calibrated (if required). When required, temperature probes will be placed on the center of the instep (right side), the tip of the big toe on the left foot, the center of the throat, and at the tip of the smallest finger of the right hand of all test participants. Table 3 shows other temperature probe locations that might be required on the test participants. Placement of temperature probes can be modified as needed to conform to specific data requirements or test conditions.

TABLE 3. TEMPERATURE PROBE PLACEMENT

HEAD PROTECTIVE EQUIPMENT	UPPER TORSO	LOWER EXTREMITIES
Back of neck	Center of chest	Front of thigh (right)
Middle of forehead	Center of back (3 in. below shoulder level)	Directly behind left knee
Tip of nose	Center of stomach	
Left cheek		

3. REQUIRED TEST CONDITIONS.

3.1 Environment.

a. During testing, the ambient temperature, soil conditions, frozen ground conditions, snow and ice surface conditions, and falling snow must be recorded. These cold regions test conditions provide the critical and moderately severe environmental effects on systems required for accurate and detailed testing. All testing in the cold regions should be concerned with those factors that have moderate to critical effects on the systems under test. In order to address critical factors, clothing and footwear should be tested under conditions of cold temperature, falling snow, and surface snow and ice. Additionally, the test items should be exposed to the effects of rough terrain, slopes, rock, frozen soil, dense vegetation, and for specific associated systems, fog, ice fog, and white out conditions.

b. This TOP makes use of three cold categories (designated as C1, C2, and C3), that refer to corresponding climatic region categories defined in Army Regulation (AR) 70-38[2] These cold categories refer to the diurnal temperature variation typically experienced during the coldest day, in increasingly colder geographic areas. The C1 category represents a day in which the ambient temperature ranges from a low of -32 ºC (-25 ºF) to a high of -21 ºC (-5 ºF). C2 represents a day in which the temperature ranges from a low of -46 ºC (-50 ºF) to a high of -37 ºC (-35 ºF). C3 represents a day in which the temperature stays at the low of -52 ºC (-60 ºF) and is typically considered a storage temperature.

c. During all testing, the items under test will be operated in as wide a range of temperatures as available. However, the test effort will also be focused on ensuring tests are conducted, and data recorded, in ambient air temperatures from -21 ºC (-5 ºF) to -32 ºC (-25 ºF) and, when required, temperatures below -32 ºC (-25 ºF). If test criteria or performance specifications allow, testing will continue to the lowest ambient temperature experienced during the test. Operations below -52 ºC (-60 ºF) will not be conducted unless otherwise directed and approved by CRTC Commander.

d. Testing shall continue regardless of adverse weather conditions, except when conditions will compromise test results or endanger life or property. Preventative maintenance, checks and services (PMCS) will be conducted outdoors on all test items as required by the applicable technical manuals or operator manuals, or daily required serviceability inspection. The length of any cold-soak periods, and ambient air temperatures, will be recorded during each subtest, as appropriate. Any mission limitations or mission aborts caused by reaching a lower temperature threshold will be recorded and reported.

3.2 Test Item Configuration.

a. All test items will be inspected before the start of testing to ensure they are serviceable, clean, dry, and configured for testing. A unique test identification control number (TICN) will be permanently marked on each test item, or group of items if applicable. The locations of the TICN will be easily visible throughout the conduct of the test, and be consistently marked on all test items. If required, a cleaning schedule shall be established for

each test item that adheres to the cleaning instructions provided by the material developer or product manager. In the absence of cleaning instructions, normal procedures for cleaning like items (in accordance with the applicable technical manuals) shall be followed.

b. Upon receipt, test item shipping containers will be inspected for damage. Test items will be unpacked, inventoried, inspected for completeness, defects, and damage. Any deficiencies will be recorded and photographed. Deficiencies not corrected will be recorded. Damaged or defective test items will be disposed of in accordance with the test sponsor's directions.

c. Identification photographs will be taken of each item under test.

3.3 Test Planning.

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, all surveys need to be approved prior to start of the test. All protocols in accordance with the US Army Developmental Test Command (DTC) memorandum Human Resource Protections Program (HRPP)[3] must be adhered to. Paragraph 3.6 details certain HRPP requirements that may need to be met when using test participants and gathering certain specific data. US Army Evaluation Center (AEC) Manpower and Personnel Integration (MANPRINT) evaluation personnel can be used to develop additional approved surveys/questionnaires if required.

c. Test preparations include, but may not be limited to, preparing the test courses (if applicable), and selecting, examining, measuring, characterizing, and training the test participants. Planning may require certain preliminary activities that should be included in the test plan, such as the following:

(1) Identification and Coding. Prior to the issuance of test articles or prototypes to the test participants, test articles need to be assigned a unique TICN. The TICNs can be generated during test preparation as sequential alphanumeric numbers that correspond directly to each specific test article. The TICN database, once created, will be easily assimilated into the overall test database to permit easy access to the individual records of each test item. The TICNs will serve as the vehicle to quickly retrieve specific data corresponding to the test article, collected data, or Test Incident Reports (TIRs). The TICNs must be marked or attached to the test articles in a permanent process. The TICNs must be able to be used to track the test articles from the initial receipt from the customer through all Developmental Tests (DTs) if necessary. An overarching TICN assignment plan will often be developed to facilitate data integration when there are multiple test sites.

(2) Medical. Medical examinations or medical surveillance (such as for heat stress or cold injury) of test participants may be a requirement when testing clothing or footwear items. If a medical examination is necessary, it must be completed prior to starting the test.

(3) Training and Familiarization. Test participants must be trained on proper test item usage, mission scenarios, and test conditions. This training, or familiarization, will include the following:

(a) Description of test courses and physical activities required during actual wearing/use of the test items.

(b) Demonstration of, and training on, the test item and discussion of special characteristics and differences to comparative items, to include safety aspects and proper methods of donning, doffing, and wearing/use of the items, along with any associated items of equipment to be concurrently worn.

(c) Identification of appropriate test personnel and processes through which participants should report any safety or health related issues.

d. Demographic/Anthropometric Characterization. Prior to test initiation, demographic data including date of birth (DOB), rank, military occupational specialty (MOS), years of service, handedness, and any other pertinent data should be collected from each participant. Paragraph 3.6 details specific requirements when using test participants and recording personal data. Anthropometric measurements, which will be used to assign percentile rankings to test participants, should be taken for relevant body dimensions.

3.4 Test Controls.

a. Before testing begins, and if required by the test team, each prospective test participant will be examined by qualified medical personnel to verify they are in acceptable physical condition for performing the intended test activities. Those individuals with physical conditions that would bias the test results or endanger their health will not be used as test participants. Results of the medical examination will be a part of the privacy act release. AR 70-25[4] provides additional information on the use of volunteers as subjects of research.

b. If during testing, test participants are removed for medical reasons, they will undergo an immediate physical examination by a physician. If applicable, and required, the physician's report of the results of the examination, insofar as it reflects upon the ability of the individual to participate in the test, will be included in the test report. Results of the medical examination will be a part of the privacy act release (AR 70-25).

c. During testing, and if applicable, all test participants will be dressed with the identical type and amount of standard issue clothing. The amount of worn clothing shall be appropriate to the prevalent weather conditions and adhere to current military standards.

d. All tests will be conducted within the temperature range for which the item is designed, as determined from the requirements documents, test directive, or agreed upon by the test center and test customer. This temperature range will be divided into three equal divisions. At least one test will be conducted within the lower one-third of the lowest temperature range and one in the upper one-third of the highest temperature. If the item of clothing or footwear was designed for use in a particular temperature range, that range will be emphasized.

e. If possible, a minimum of 12 test items will be used during each test. The personnel performing the tests shall be selected for proper fit of the test items.

f. During conduct of the test when the temperature of the extremities (finger, toe) drops to 10 ºC (50 ºF), the test participant will be immediately removed from testing and allowed to warm in a heated shelter.

g. Test participants shall have a minimum rest period of 10 minutes between subtests.

h. Throughout testing, test participants will be observed for symptoms of cold injury. At the first symptoms, a test participant will be removed from testing, warmed, and if necessary, examined by medical personnel.

i. At any phase of testing, if a test participant indicates unusual discomfort, he/she will be removed from testing and the cause of the discomfort will be investigated and documented. If the item under test was responsible for the discomfort it will be appropriately documented.

j. Test procedures and quantitative limits specified in this TOP are based upon a typical test design for a broad range of cold weather clothing and footwear. Some items may require variations from these procedures to accommodate specific needs.

k. Data collected throughout testing will be of sufficient quality and quantity to support conclusions. Since acquisition of such data may be constrained by limitation in the number of test or control items, manpower restrictions, inadequate time for optimum testing, or inadequate environmental conditions; the test officer will maintain liaison with AEC to identify optimum personnel, test item sample sizes, nominal equipment sizes, or the optimum number of repetitions or replications required in a particular operation. Additional guidance may be found in TOP 3-1-002[5].

3.5 Safety.

a. A complete safety and health hazard analysis will be conducted prior to, and throughout the course of the test. Prior to start of test, a hazard assessment working group (HAWG) will meet and discuss hazards and their mitigation. Military Standard (MIL-STD)-882D[6] will be used as a guide for the classification of all hazards and their severity. A formal, agreed upon hazard assessment with risk mitigating factors will be adhered to during the conduct of the test. Prior to using any outside military personnel to conduct the test, a Safety Release must be provided by ATEC. The ATEC test manager will provide this document, when required, allowing a specific unit to participate in testing during a specific time frame at a

specific test location. During the course of testing, any potential hazard observed during operations or maintenance actions must be recorded.

b. During all weapons firing, applicable range safety procedures will be closely adhered to as required by the local range regulations. A qualified range Officer in Charge (OIC), Range Safety Officer (RSO), range safety personnel, medical personnel, and emergency equipment (depending on the caliber of the weapon or type of system) will be physically present on the firing range.

3.6 HRPP Controls.

Testing of clothing and footwear may require that test personnel 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 clothing or footwear not provide adequate insulation against the cold. For these reasons, these types of tests typically require HRPP review to ensure that protocols exist to protect the well-being of test participants. In most cases, this review must be forwarded 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.

Test procedures and quantitative limits specified in this TOP are based upon a typical test design for a broad range of cold weather protective clothing and footwear. Some items may require variations from these procedures to accommodate specific needs.

4.1 Initial Inspection.

a. Upon receipt, test item shipping containers will be inspected for damage. Test items will be unpacked and inventoried. Referencing criteria established in appropriate requirements documents, the test items will be inspected for completeness, defects, and damage. Damages will be recorded and photographed and repaired if required before the start of test. Defective test items will be disposed of in accordance with test sponsor's directions.

b. All required maintenance to correct shortcomings and deficiencies will be performed.

c. Required instrumentation will be installed. The instrumentation nomenclature (model, serial number, date of calibration, physical location, etc.) will be recorded.

d. Identification photographs will be taken of each item under test.

4.2 Physical Characteristics.

Characteristics and conditions of the test items at test start and throughout testing are a key part of the database. Dimensional measurements of combat uniforms and protective clothing will be

made to the nearest 0.3 cm (0.13 in.) unless specified differently by the requirements document. All methods for fastening apparel (hook and pile, drawstrings, buttons, etc.) and its initial serviceability will be recorded. The quantity, location and serviceability of all ventilator/filter ports will be recorded. For items undergoing laundering or other treatment, garment characteristics should be recorded before and after treatment. Special consideration should be made for characteristics such as, weight change, shrinkage, texture or color change, and expansion. Weight is measured in either ounces or grams and is usually measured for medium size garments at a minimum. If measured for multiple sizes and configurations, the measures should be reported separately. Test item inspection should also include conditions of materials, quality of construction and packaging, effects of shipment, and interfaces.

4.3 System Safety.

a. Hazards related to use and testing in the cold regions environment, as well as any other unique hazards associated with the testing location or test item, shall be recorded and reviewed for severity and frequency in accordance with MIL-STD-882D. Prior to starting the test, a HAWG will meet and discuss hazards and their mitigation. A formal hazard assessment and mitigating factors will be agreed upon and adhered to during the conduct of the test. Each hazard discussed shall include a description, an initial Risk Assessment Code (RAC), the recommended mitigation, and a mitigated RAC.

b. Safety must be considered throughout the entire conduct of the test. Any hazards or potential hazards identified during the conduct of the test will be noted, and if appropriate, the hazard risk will be classified in accordance with MIL-STD-882D. If there are specific safety and/or health issues or concerns identified in requirements documents, or considered necessary by the test team, a Safety Subtest should be incorporated in the test plan and front-loaded in the test program.

c. ATEC may ask for input from the test officer for completion of a Safety Confirmation. If asked, the test officer would supply the Safety Confirmation Recommendation to ATEC, ensuring it outlines all safety issues and appropriate mitigation factors. The Safety Confirmation indicates the system is ready for fielding, has a specific start date, and is valid indefinitely.

4.4 HFE.

4.4.1 Sizing and Fitting for Upper and Lower Torso Garments.

Combat and protective clothing components have labels attached, which indicate fitting of garment sizes by range of body measurements (anthropometrics). The following procedure is typical for clothing to determine whether the test item can be properly sized and fitted according to requirement documents. The materiel developer, or designated representative, can provide fitting procedures and fitting support, and may train the test team to perform fitting.

a. Method.

(1) Process test participants through a series of measurement and fitting stations for appropriate anthropometric measurements. These may include height, weight, chest size, arm length, waist size, hip size, and inseam length. Additional anthropometric measurements may be needed to characterize fit or adjustability problems unique to the test item.

(2) Use the measurements in conjunction with standard clothing size prediction to fit the participants with the appropriate clothing or compatible items.

(3) If an acceptable fit is not obtained with the predicted size, select alternative articles until an acceptable fit is attained; or it is determined that the individual cannot be fitted within the available sizes. Record the size initially predicted and the final best fitting size for each test participant. Document any differences in sizes needed to accommodate unique environmental clothing or other compatibility items.

(4) Subjectively rate (for example: good, fair, poor) each test participant for acceptability of fit for the final fitted size. Ratings should be done for length and breadth at torso, arms, shoulders, waist, rise, and legs. TOP 1-2-610[7] can be used as a guide for developing rating questionnaires.

(5) If required, photograph the test item(s) on a selected participant (front, side, and rear) to depict peculiar-fitting characteristics.

b. Data Required.

(1) Anthropometric body measurements.

(2) Record of clothing ensembles tried and worn with final subjective fit rating.

(3) Reasons for unacceptable fittings with narrative descriptions and photographs of improper fitting occurrences.

4.4.2 Footwear Sizing.

It is imperative that combat and protective footwear be sized and fit appropriately. The fitting of footwear is determined by foot measurements (anthropometrics). The following procedure is will be followed to determine the correct footwear size for all test participants. The materiel developer, or designated representative, can provide fitting procedures and fitting support, and may train the test team to perform fitting.

a. Method.

(1) If not done in conjunction with garment anthropometric measurements, process test participants through a footwear measurement station using a Brannock Device to determine foot length and width. Additionally, measurements for height and weight may be measured and recorded.

(2) Use the measurements in conjunction with standard footwear size prediction to fit the participants with the appropriate footwear.

(3) If an acceptable fit is not obtained with the predicted size, select alternative sizes until an acceptable fit is attained; or it is determined that the individual cannot be fitted within the available sizes. Record the size initially predicted and the final best fitting size for each test participant. Document any differences in sizes needed to accommodate unique environmental clothing or other compatibility items.

(4) Subjectively rate (for example: good, fair, poor) each test participant for acceptability of fit for the final fitted size. TOP 1-2-610 can be used as a guide for developing rating questionnaires.

(5) If required, photograph the test item(s) on a selected participant (front, side, and rear) to depict peculiar-fitting characteristics.

b. Data Required.

(1) Anthropometric foot measurements.

(2) Record of footwear sizing tried with final subjective fit rating.

(3) Reasons for unacceptable fittings with narrative descriptions and photographs of improper fitting occurrences.

4.4.3 Donning and Doffing Garments.

The objective is to evaluate the ease with which the test item can be donned and doffed, and to determine the time required to don and doff the system. Doffing shall be analyzed in terms of emergency doffing as well as doffing for body eliminations. Closures shall be analyzed with respect to the ease of opening and closing with bare hands and while wearing appropriate cold regions hand wear, both during daytime and darkness. The potential of the closures to degrade the protective characteristics of the ensemble should be considered. Multiple series of donning and doffing tests may be necessary to address multiple configurations. When testing multi-layer items, record each step of the donning and doffing process.

a. Method.

The test plan must specify the environmental clothing components to be worn and the prescribed donning and doffing sequences to be followed.

(1) A minimum of five test participants, or a sufficient sample size to support adequate statistical analysis, will be selected to perform don/doff procedures. All test participants will be trained on the proper procedures, as provided by the manufacturer or material developer, and should be given the opportunity to practice and demonstrate proficiency. At a

minimum, each test participant will don and doff the test items three times to ensure adequate proficiency is achieved.

(2) Repeat procedures as necessary to provide statistical confidence in the test results. Usually the mean don and doff times are calculated for comparison to required times. Compare don/doff times and ratings under various conditions and configurations to identify problem areas.

b. Data Required.

(1) List of all clothing systems worn.

(2) Summary of averaged timed data for donning and doffing the test items.

(3) Subjective comments by participants.

(4) Test team observer comments on ease of donning and doffing, adequacy of fit, operability/serviceability of closures, and problems encountered.

4.4.4 Donning and Doffing Footwear.

Donning and doffing exercises will be conducted at a temperature within 6 ºC of the low temperature specified as a protective limit for the footwear.

a. Method.

(1) During each exercise, a sample set of test footwear will be cold soaked for a minimum of two (2) hours.

(2) Each test participants will be observed and timed while they don the test items in low temperature conditions. The time required and any difficulties encountered will be recorded.

(3) Test participants will then wear the test footwear for one (1) hour of outside activities, after which they will be observed and timed while they doff the test footwear.

(4) Following donning, vigorous activity may be required to warm footwear interior to a nonhazardous level. Again, the time required and any observed difficulties will be recorded. The donning and doffing exercises will be performed with test participants wearing appropriate cold weather hand wear (i.e., arctic mittens, anti-contact gloves, etc). The Interview Form (Appendix C, Table C-3) will be completed by the test participants at the end of the exercise.

b. Data Required.

(1) List of footwear system worn, including configuration if applicable.

(2) Summary of averaged timed data for donning and doffing the test items.

(3) Subjective comments by participants.

(4) Test team observer comments on ease of donning and doffing, adequacy of fit, operability/serviceability of closures, and problems encountered.

4.5 Environmental Performance.

The expected life of the test item shall be obtained from the requirements documents or the test sponsor. The test item shall be worn by test participants during appropriate weather and work conditions for the specified item. The test participants shall engage in their normal duties as well as perform specific tests as described in this TOP. A daily log of the usage/wear time and subsequent activity will be maintained. At the appropriate time interval, as determined by the type of item under test, all test items shall be cleaned and reissued to the original recipient.

4.5.1 Cold Protection.

a. Clothing and Footwear.

The cold protection qualities of the test item will be evaluated during 6-hour tests blocks. Two 6-hour tests will be conducted in the lower temperature range and two 6-hour tests will be conducted in the upper temperature range for which the item was designed. Items that fail the cold protection test at the lower temperature range will be tested in the lower one-third of the mid temperature range as calculated in Section 4.4. All testing will be conducted during wind velocities of less than 5 kilometers per hour (kph) (3 mph).

b. Method.

(1) Active Test.

Test participants will spend six continuous hours outdoors performing this test. Test participants will traverse a pre-designated course for a period of six hours with a 10 minute rest period every 50 minutes. The temperature indicated by the temperature probes mounted on the test participants will be monitored and data recording will be verified every 50 minutes. Test participants who experience cold discomfort or temperature drop of their extremities to 16 ºC (60 ºF), will have their temperature probes recorded at 10-minute intervals. Further drop in extremity temperature or continued cold discomfort will result in the test participant being removed from the test. Testing will begin when the ambient air temperature reaches, and is predicted to remain, at the required test temperature. Meteorological data will be recorded continuously throughout testing.

(a) In a warm shelter, each test participant will don the test item and the additional standard issue clothing appropriate to the prevailing conditions. The initial temperature of each temperature probes shall be recorded. The day's prior food and liquid intake (e.g., breakfast) of each participant will be recorded.

(b) Test participants will traverse the designated course at 50 minute intervals, taking a 10 minute break after each interval. The rate of traverse for all movements will be as dictated by the test team and consistent with operational requirements, unless terrain or conditions dictate differently.

(c) At the conclusion of the final 10 minute break, the test participants will move back to a heated shelter. Temperature data will continue to be collected for a period of 20 minutes. Upon conclusion of the 20 minute period, test data will be downloaded and the instrumentation will be removed from the test personnel.

(d) Each test participant will then be interviewed to obtain an individual objective assessment of the test item's thermal qualities, wear characteristics, and comfort and fit.

(2) Inactive Test.

Test participants will spend two hours outside simulating "guard duty" or that type of non-physical activity. The temperature sensed by the attached thermocouples will be recorded throughout the test.

(a) In a heated shelter, each test participant will don the test item and the standard issue clothing appropriate for the prevailing weather conditions. Prior to the start of the test, the temperature of the temperature probes will be monitored to ensure they are functioning properly. Once the probes have been verified to be functioning, the test participants will exit the heated shelter and commence "inactive" testing. Temperature probe data will be recorded at a sample rate of 1 per 300 seconds (5 minutes).

(b) At the conclusion of 30 minutes, each test participant shall be scanned on four sides with a thermal imaging camera in order to locate areas of substantial heat loss. If significant heat loss is detected in specific areas, the sensitivity of the thermal camera will be adjusted to obtain maximum temperature detail on the display unit. Video or still images will be taken of the areas of significant heat loss.

(c) Repeat step (b) above at 60 and 90 minutes of testing.

(d) At the conclusion of 120 minutes, step (b) above will be performed one final time. At the conclusion of the thermal scan, each test participant will then enter the heated shelter and continue to collect data for a period of 20 minutes.

(e) At the conclusion of 20 minutes in the heated shelter the temperature probes and all other instrumentation will be removed. Each test participant will then be interviewed to obtain individual evaluation of the test item's thermal qualities.

c. Data Required.

(1) Meteorological data.

(2) Temperature and time of each measurement.

(3) Results of interview.

(4) Test participant's comments (including food and liquid intake).

(5) Discontinued test (environmental related) attributable to problems in test item.

(6) Recorded observation of the test officer.

(7) Thermal imaging photographs (if applicable).

4.5.2 Wind Protection.

a. The wind protective qualities of the test item shall be tested in two one-hour tests. The wind protection capabilities of the test item shall be tested at the lowest wind-chill temperatures for which the item is designed and/or as the natural environment and weather presents itself. If the test items are unsatisfactory at the lowest designed wind-chill temperatures, they will be re-tested at higher wind-chill temperatures and/or as the natural environment and weather presents itself. Wind-chill temperatures will be forecast and calculated by the meteorology team.

b. Clothing and Footwear.

(1) Method.

(a) Test participants will spend one continuous hour in the lowest wind-chill temperature for which the test item is designed. If the natural weather allows, the minimum wind velocities used to derive these wind-chill temperatures will be 32 kph (20 mph). Temperature probes will sample the temperatures on each test participant at a rate of 1 per 60 seconds (1 minute).

(b) In a heated shelter, each test participant will don the test item(s) and the additional standard issue clothing appropriate to the prevailing conditions.

(c) Immediately after leaving the heated shelter, test participants shall proceed to the test area, verify that all instrumentation is properly recording and begin testing. After one hour of testing, test participants shall return to the heated shelter.

(d) After returning to the heated shelter, test participants shall continue to wear the outside clothing ensemble for 20 minutes. The temperature of the thermocouples shall be recorded during this 20 minute time period.

(e) After 20 minutes, test participants may remove the test item(s). Each test participant shall then be interviewed to obtain an individual subjective assessment of the test item's wind protective characteristics.

(2) Data Required.

(a) Meteorological information.

(b) Wind-chill temperature.

(c) Test participant temperature.

(d) Number of tests discontinued because of cold and narrative description of cause.

(e) Recorded observations of the test officer.

(f) Test participant's comments.

4.5.3 Snow Protection.

a. The protective capabilities of the test item shall be evaluated from two three-hour tests. One test shall be conducted within 15 ºC of the lowest temperature at which the test item is designed to be worn and one test will be conducted at temperatures between -3.9 ºC (25 ºF) and 4.5 ºC (40 ºF). Testing shall be performed in a minimum snow depth of six inches.

b. Clothing and Footwear.

(1) Method.

(a) Prior to starting the test, all test items will be thoroughly dried and the weight of each item recorded. In a heated shelter, the test participants will don the test item and the additional standard issue clothing appropriate to the prevailing weather conditions. The temperature of each temperature probe on each test participant shall be recorded prior to leaving the warm shelter and at 20-minute intervals thereafter during the test. The test participants will be instructed to NOT brush off any loose snow during the conduct of this subtest.

(b) Test participants shall assemble in a rifle squad and move to the rifle range, or area representative of a range. The movement shall be through existing snow, a minimum of six inches deep, and across realistic operational terrain. This movement should take approximately 30 minutes.

(c) Upon arrival at the range, each test participant shall either fire or simulate the firing of 50 rounds of ammunition using the standard military rifle from the prone position. They will then low crawl 50 meters to a new firing position, and either fire or simulate the firing of 50 additional rounds from the prone position.

(d) Test participants will then low-crawl 40 meters to a new firing position and either fire or simulate firing 50 additional rounds from the prone position.

(e) After completion of the firing, test participants will assemble into a squad and conduct a 30-minute movement back to the test staging area.

(f) After reaching the staging area, test participants shall knock, or brush, off all loose snow, and then enter the heated shelter. The test items will be removed, weighed, and the weights recorded. Any additional data will be recorded.

(g) Test participants will then be interviewed to obtain an individual subjective assessment of the test item's resistance to snow penetration.

(2) Data Required.

(a) Meteorological conditions.

(b) Weight of test items, before and after the subtest.

(c) Test participant temperature.

(d) Total time.

(e) Snow classification data (Cold Regions Test Center (CRTC)) Memorandum 70-5[8]).

(f) Test participant's comments.

4.5.4 Perspiration Absorption.

a. The moisture absorption characteristics of the test item shall be assessed during four 2-hour tests. Two tests shall be conducted within 15 ºC of the lowest temperature the test item is to be worn, and two tests will be conducted between -3.9 ºC and 4.5 ºC. One test in each temperature range will be conducted with test participants moving at an average pace of 4 kilometers per hour (kph) and one test will be conducted with test participants moving at an average pace of 6 kph. The test item shall be weighed before the test begins and immediately after the conclusion of the test to determine moisture absorption. Ventilation techniques used during the test shall be consistent with current field operations and apply to all participants.

b. Clothing and Footwear.

(1) Method.

(a) All test items shall be thoroughly dried, weighed, and the weight recorded. In a heated shelter, the test participants will don the test item(s), and any additional clothing appropriate to the prevailing weather condition.

(b) The test participants shall assemble at the test site and execute the movement operations detailed above.

(c) At the conclusion of the 2-hour test period, test participants will enter the heated shelter and remove the test items. Immediately after removal, the test items will be weighed and their weight recorded. Percent absorption will be calculated as follows:

Percent Water Absorption = [(wet weight - dry weight)/ dry weight] x 100

(2) Data Required.

(a) Weight of test item (start).

(b) Weight of test item (conclusion).

(c) Test participant ventilation technique.

(d) Type test, activity, and duration of activity.

(e) Meteorological conditions.

4.6 Compatibility.

a. The compatibility of the test items with cold weather clothing, sleeping equipment, and military vehicles operating in the cold regions environment is paramount. Each test item will be tested to ensure it is compatible with existing items while performing military skills and tasks in a cold regions environment.

b. Clothing and Footwear.

(1) Method.

(a) MOS trained or equivalently qualified test participants will attempt to accomplish controlled mission oriented tasks while in, or operating, a variety of military equipment. Test participants will wear the test item and other required clothing items pertinent to the arctic environment and task being performed. Test participants and test team members will record instances where test items adversely affect the task being performed. Cases of incompatibility will be supported by photograph or video.

(b) Types of equipment to be used/operated include, but are not limited to the following:

(1) Tactical wheeled vehicles (Stryker, high-mobility multipurpose wheeled vehicle (HMMWV), family of medium tactical vehicles (FMTVs), etc.).

(2) Commercial wheeled vehicles (4-wheel drive, 15 passenger van, etc.).

(3) Tracked vehicles (M1 Abrams, Bradley Fighting Vehicle (BFV), M113 Armored Personnel Carrier (APC), etc.).

(4) Engineering construction equipment (graders, lifts, shovels, buckets, etc.).

(5) Aircraft (fixed wing and rotary wing).

(6) Snow shoes.

(7) Skis.

(c) Maneuvers and/or road/terrain conditions will be selected that require maximum dexterity and action on the part of the test participants. In tracked vehicles, test participant tasks will include crew duties through actual or simulated firing of primary and secondary (if applicable) weapons systems.

(d) Test participants will complete event (daily) usage forms and interview forms.

(2) Data Required.

(a) Daily usage and interview forms.

(b) Description of type of equipment used, clothing worn and tasks performed.

(c) Observations of supervisory personnel and difficulties encountered.

4.7 Durability.

a. A durability failure is considered to be a clothing or footwear malfunction that precludes further use of the item and is significant enough in the area of cost, safety, environmental protection, or time to restore, that the item must be replaced or completely refurbished. Durability failures will be identified as either those caused by normal wear or those caused when using obstacle or accelerated wear courses.

b. Clothing and Footwear.

(1) Method.

(a) Test item physical durability failures experienced as a result of normal wear during this test will be recorded as they occur. Failures will be identified as either those caused by normal wear or those caused by test induced activities, such as an obstacle course.

(b) Approximately 14 days after test item issue, each test participant will wear the test item(s) through an obstacle or accelerated wear course, twice. Prior to and at the conclusion of this subtest, all test items shall be inspected for physical damage and wear. This inspection shall be performed while the test item is not being worn. Damaged or worn test items shall be

photographed and a narrative description of the wear or damage recorded. All usable test items shall be returned to the test participants for completion of the test. Test items sustaining non-repairable physical damage will be disposed of in accordance with the test sponsor.

(c) At the conclusion of each additional 14 days of testing, the above procedure will be repeated.

(2) Data Required.

(a) Date of issue.

(b) Record of repairs.

(c) Photographs of damaged and unserviceable test items.

(d) Total time worn (usage time).

(e) Type of course and number of times through each course.

(f) Description of durability failures (type, size, location, time to failure, and cause if known).

4.8 Acceptability.

The objective of this subtest is to determine test participant acceptability of the items under test.

a. Method.

Throughout testing, opinion interviews will be conducted on a periodic basis. Test participants will be questioned with regard to ease of donning, doffing, comfort, fit, appearance, usability, and ability to maintain warmth and dryness.

b. Data Required.

(1) Completed interview forms.

(2) Test supervisory personnel observations on troop acceptability.

4.9 Maintainability.

a. Throughout the duration of test, maintain a record of any scheduled and unscheduled maintenance tasks. Whenever possible, maintenance shall be performed under prevailing environmental conditions. Any reasons why this is not possible shall be recorded.

b. If performing a maintenance task that requires tools or special instruments, document any shortcomings in authorized tools and equipment and any needs for specialized tools and instruments to accomplish assigned levels of maintenance.

c. Record all parts replaced, man-hours and elapsed hours required, ease or difficulty of maintaining the test item, test item accumulated hours of wear, and level of skill required.

d. Beginning with the initial inspection of the test items, maintain a complete log of all assembly, operation, disassembly, and maintenance activities for the purpose of reliability analysis. The log shall contain the following information:

(1) Hours of wear, daily and cumulative.

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

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

e. 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 as a result of testing.

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

(8) Tools and equipment used for maintenance operations.

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

(10) Accuracy and adequacy of maintenance publications.

(11) Unclear instructions.

(12) Inadequate technical manual (TM) procedures.

(13) Special training requirements.

(14) Desirable changes and comments.

(15) Errors or omissions in nomenclature.

4.10 Final Inspection.

a. Upon completion of test, carefully inspect all test items for completeness, damage, and general conditions. Photograph any damage or deterioration noted. Technical manuscripts, manuals, or other publications supplied with the items shall be used as guides for the inspection.

b. Record the following:

(1) Inventory of all test items.

(2) Damage or deterioration noted.

5. DATA REQUIRED.

The data that is required is outlined in the preceding sections of the test procedures. For those test procedures that reference other TOPs, the data to be acquired are outlined in the referenced TOPs.

6. PRESENTATION OF DATA.

Data should be presented in tabular, graphical, or narrative format. The format that presents the most simple, readable format should be used in the final test report.

6.1 Initial Inspection.

Pre-operational inspection data shall be organized and reduced and presented in tabular format.

6.2 Physical Characteristics.

Physical characteristic data shall be reduced and organized and presented in tabular format.

6.3 System Safety.

System safety observations and comments shall be presented in tabular or narrative format, whichever is more readable and understandable. In certain cases, photographs should be included to clarify safety issues.

6.4 HFE.

The data obtained and observations made during performance of this subtest shall be compared with accepted standards of human engineering. Sizing and fitting data shall be presented in tabular format with accompanying photographs, if necessary. Observations of safety aspects associated with testing of the items shall be recorded and presented in narrative format.

6.5 Environmental Performance.

In general, the clothing and footwear performance data will be presented in either tabular or narrative format; whichever best details the test item performance and provides ease of readability and evaluation by higher commands. Results of the test participant interviews and comments will be presented in tabular format for ease in viewing the subjective comments.

6.5.1 Cold Protection.

a. Data collected will be presented in tabular format. Ensure data are divided by day and event, and that all temperature values have corresponding event elapsed times. Average values from individuals for each temperature probe location can be calculated and presented.

b. Subjective comments from test participants, test supervisory personnel observations, and interview data will be summarized and presented in either tabular or narrative format.

c. Meteorology data will be presented in tabular format. To minimize the amount of data in the test report body, daily averages or mean highs and lows for all data may be presented in the test report body, but all recorded meteorology values should be included in tabular format in the test report (as a meteorology data appendix).

d. Thermal imagery photographs or temperature data will be included as necessary.

6.5.2 Wind Protection.

a. Data collected will be presented in tabular format. Ensure data are divided by day and event, and that all temperature values have corresponding event elapsed times. Average values from individuals for each temperature probe location can be calculated and presented. If necessary, temperature sensor versus time for each temperature sensor location can be plotted on a scatter plot to better visualize the wind protection of the test item.

b. Subjective comments from test participants, test supervisory personnel observations and interview data will be summarized and presented in either tabular or narrative format.

c. Meteorology data will be presented in tabular format. To minimize the amount of data in the test report body, daily averages or mean highs and lows for all data may be presented in the test report body, but all recorded meteorology values should be included in tabular format in the test report (as a meteorology data appendix).

6.5.3 Snow Protection.

a. Data collected will be presented in tabular format. Ensure data are divided by day and event, and that all temperature values have corresponding event elapsed times. Average values from individuals for each temperature probe location can be calculated and presented.

b. Subjective comments from test participants, test supervisory personnel observations and interview data will be summarized and presented in either tabular or narrative format.

c. Meteorology data will be presented in tabular format. To minimize the amount of data in the test report body, daily averages or mean highs and lows for all data may be presented in the test report body, but all recorded meteorology values should be included in tabular format in the test report (as a meteorology data appendix).

6.5.4 Perspiration Absorption.

a. Data collected will be presented in tabular format. Ensure data are divided by day and event, and that all temperature values have corresponding event elapsed times. Average values from individuals for each temperature probe location can be calculated and presented.

b. Subjective comments from test participants, test supervisory personnel observations and interview data will be summarized and presented in either tabular or narrative format.

c. Meteorology data will be presented in tabular format. To minimize the amount of data in the test report body, daily averages or mean highs and lows for all data may be presented in the test report body, but all recorded meteorology values should be included in tabular format in the test report (as a meteorology data appendix).

6.6 Compatibility.

a. Data collected will be presented in tabular format. Ensure data are divided by day and event, and that all temperature values have corresponding event elapsed times. Average values from individuals for each temperature probe location can be calculated and presented.

b. Subjective comments from test participants, test supervisory personnel observations and interview data will be summarized and presented in either tabular or narrative format.

c. Meteorology data will be presented in tabular format. To minimize the amount of data in the test report body, daily averages or mean highs and lows for all data may be presented in the test report body, but all recorded meteorology values should be included in tabular format in the test report (as a meteorology data appendix).

6.7 Durability.

a. Data collected will be presented in tabular format. Ensure data are divided by day and event, and that all temperature values have corresponding event elapsed times. Photographs of durability failures, with descriptive narratives, should be included in the final test report.

b. Repairs required will be categorized and presented in tabular format.

c. Subjective comments from test participants, test supervisory personnel observations and interview data will be summarized and presented in either tabular or narrative format.

d. Meteorology data will be presented in tabular format. To minimize the amount of data in the test report body, daily averages or mean highs and lows for all data may be presented in the test report body, but all recorded meteorology values should be included in tabular format in the test report (as a meteorology data appendix).

6.8 Acceptability.

a. Data collected will be presented in tabular format. Ensure data are divided by day and event. Photographs of any acceptability issues, with descriptive narratives, should be included in the final test report.

b. Subjective comments from test participants, test supervisory personnel observations and interview data will be summarized and presented in either tabular or narrative format.

6.9 Maintainability.

a. For ease of readability, maintenance actions should be summarized and presented in tabular format. Instances of inadequacy of manuals or repair tools/equipment encountered during the test should be listed in narrative or tabular format.

b. If TIR's were completed throughout the conduct of the test, then utilize the TIR summaries for narrative or tabular comments concerning required maintenance and maintenance man-hours. TIR summaries can provide detailed maintenance records that will aid in the calculation of maintenance, operational, and availability indices.

6.10 Final Inspection.

Briefly describe the overall condition of the test items after the completion of all testing, and highlight any problems that were not considered typical wear and tear.

APPENDIX A. ABBREVIATIONS.

ADSS	ATEC Decision Support System
AEC	US Army Evaluation Center
APC	armored personnel carrier
AR	Army Regulation
ATEC	US Army Test and Evaluation Command
BFV	Bradley Fighting Vehicle
C	Celsius
cm	centimeter
CPD	Capabilities Production Document
CRD	Capabilities Requirements Document
CRTC	Cold Regions Test Center
DOB	date of birth
DT	developmental test
DTC	US Army Developmental Test Command
DTP	detailed test plan
EA	Environmental Assessment
EIS	Environmental Impact Statement
F	Fahrenheit
FDSC	Failure Definition/Scoring Criteria
FMTV	family of medium tactical vehicles
ft	feet
GPS	Global Positioning System
HAWG	Hazard Assessment Working Group
HFE	Human Factors Engineering
HMMWV	high-mobility multipurpose wheeled vehicle
hPa	hectopascal
HRPP	Human Resource Protection Program
IA	Information Assurance
in.	inch
ITOP	International Test Operations Procedure
JUONS	Joint Urgent Operational Needs Statement
kg	kilogram
kph	kilometers per hour

APPENDIX A. ABBREVIATIONS.

lb	pound
m	meter
MANPRINT	Manpower and Personnel Integration
MIL-STD	military standard
mm	millimeter
MOS	military occupational specialty
mph	miles per hour
NEPA	National Environmental Policy Act
OIC	Officer in Charge
OMS/MP	Operational Mode Summary/Mission Profile
ONS	Operational Needs Statement
ORD	Operational Requirements Document
PHA	Preliminary Hazard Assessment
PMCS	preventative maintenance checks and services
psi	pounds per square inch
RAC	Risk Assessment Code
RAM	reliability, availability, and maintainability
REC	Record of Environmental Consideration
RSO	Range Safety Officer
SAR	Safety Assessment Report
SER	System Evaluation Report
SOP	Standard Operating Procedure
TEMP	Test and Evaluation Master Plan
TICN	test identification control number
TIR	Test Incident Report
TM	technical manual
TOP	Test Operations Procedure
TP	test plan
V	volt

.

APPENDIX B. TEST PLANNING AND SUPPORTING DOCUMENTATION.

B1. Test Planning.

a. Test planning should be initiated early in the acquisition process in order to yield the most cost effective approach to program cost, risk, and schedule.

b. Testing should be conducted so as to demonstrate an items ability to perform in a cold regions environment. Issues in the areas of compatibility, durability, maintainability, and safety must be addressed; along with human factors, and reliability, availability and maintainability (RAM).

c. Test planning should address the following:

(1) Purpose of testing.

(2) Test objectives.

(3) Test cost.

(4) Test criteria.

(5) Test method.

(6) Data required.

(7) Data analysis techniques and presentation.

(8) Report Requirements.

B2. Supporting Documents.

a. In order to properly report on the safety, performance, and reliability of individual Soldier clothing, a detailed documentation review must be conducted. This documentation review provides a more thorough understanding of the Soldier clothing characteristics, and in some instances can reduce the amount of physical testing required while also assisting in reducing the assigned RAC reported in the safety confirmation. The documentation review is required to ensure that proper safety protocols are emplaced prior to the initiation of testing. The following documents should be included in the test item data package; it is preferable that these documents be provided as early as possible prior to the start of testing. The following are required documents:

APPENDIX B. TEST PLANNING AND SUPPORTING DOCUMENTATION.

(1) Safety Assessment Report (SAR) – The SAR is a formal, comprehensive safety report that summarizes the safety data that has been collected and evaluated during the life cycle of an item. It expresses the considered judgment of the contractor or developing agency regarding the hazard potential of the item and any actions or precautions that are recommended to minimize these hazards and to reduce the exposure of personnel and equipment to them.

(2) Preliminary Hazard Assessment (PHA) – Broad hazard-screening tool that includes a review of the work that will be performed in a facility and identifies the hazards associated with the work and the facility. The results of the PHA are used to determine the need for additional, more detailed hazard analysis, serve as a precursor documenting that further analysis is deemed necessary, and serve as a baseline hazard analysis where further analysis is not indicated.

(3) Capabilities Requirements Document (CRD)/Operational Requirements Document (ORD) – Describes the overall mission area, the type of system proposed and the anticipated operational and support concepts in sufficient detail for program and logistics support planning and includes a brief summary of the mission need. If the mission need was not documented prior to the preparation of the CRD/ORD, the process that investigated alternatives for satisfying the mission need and developing the operational requirements is explained.

(4) Performance Specifications/System Specifications/Purchase Description – Communicates the user's requirements to the manufacturer. These documents translate operational requirements into more technical language that tells the manufacturer:

(a) What will be considered an acceptable product.

(b) How it will be determined if the product is acceptable.

(5) Security Classification Guide – A documentary form of classification guidance issued by an original classification authority that identified the elements of information regarding a specific subject that must be classified and establishes the level and duration of classification for each such element.

(6) Test and Evaluation Master Plan (TEMP) – This document identifies the high-level requirements and defines the objectives and overall structure of the system test and evaluation strategy.

(7) Failure Definition/Scoring Criteria (FDSC) – The FDSC are a set of rules designed to provide consistency in the interpretation of reliability test incidents. The FDSC defines the required functionality and allowable levels of degradation and establishes a framework for classifying test incidents.

APPENDIX B. TEST PLANNING AND SUPPORTING DOCUMENTATION.

(8) System Evaluation Report (SER) – Reports on effectiveness, including suitability and survivability of milestone and decision reviews.

(9) Environmental documentation must be provided in the form of a Record of Environmental Consideration (REC), an Environmental Assessment (EA), or more rarely, an Environmental Impact Statement (EIS), as required by the National Environmental Policy Act (NEPA).

(10) Test Execution Directive – Creation of ATEC Decision Support System (ADSS) project number fulfills the requirement for a directive.

(11) Prior HRPP documentation, if any, should be provided.

(12) Approved Test Plan or Event Plan (for safari efforts).

(13) Locally generated HAWG test Risk Assessment.

(14) Local directives, Standard Operating Procedures (SOPs) and policy letters applicable to testing.

b. Other documents that should be used to establish test criteria include programmatic documents that were developed for the system, or those preexisting documents that apply. These documents include documents that define the mission scenarios, climate conditions, operational, and electromagnetic environments in which the item must operate. Some of the most useful documents are listed below:

(1) Operational Mode Summary/Mission Profile (OMS/MP).

(2) Military regulations, standards and other controlling directives.

(3) Federal statutes.

(4) Test directives.

c. The final step in test planning will be to use all existing, pertinent TOPs International Test Operating Procedures (ITOPs), or any other test standards or protocols to develop the overall test plan and subsequent test procedures/scenarios. The plan and test procedures will ensure that the specific test items are tested against their required criteria.

(This page is intentionally blank.)

APPENDIX C. DATA COLLECTION SHEETS.

TABLE C-1. SAMPLE DATA SHEET

Test Date _____ Time Started _____

Test Item (Name) _____ Test Item (Name) _____

Test Participant (Name) _____

Test Time	Temperature (°C)								Wind Speed
	Ambient	Thermocouple Temperature							
Minutes	Outside	1	2	3	4	5	6	7	
0									
60									
120									
180									
240									
300									

Thermocouple Location

Position

1._____

2. _____

3. _____

4._____

5._____

6._____

7._____

APPENDIX C. DATA COLLECTION SHEETS.

TABLE C-2. DAILY/EVENT USAGE FORM

Instructions: Complete daily usage of the test item at the conclusion of each day and return completed forms to the test officer at the beginning of each test week.

Name: _____ Test Item Control No. _____

Condition	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Test item worn							
Duration (minutes)							
Activities							
Terrain							
Temperature (ºC)							
Precipitation							
Additional Items Worn							
Cold (If yes, explain below)	Yes __ No __	Yes __ No __	Yes __ No __	Yes __ No __	Yes __ No __	Yes __ No __	Yes __ No __
Wet (If yes, explain below)	Yes __ No __	Yes __ No __	Yes __ No __	Yes __ No __	Yes __ No __	Yes __ No __	Yes __ No __
Test item damaged (If yes, explain below)	Yes __ No __	Yes __ No __	Yes __ No __	Yes __ No __	Yes __ No __	Yes __ No __	Yes __ No __

Test participant comments:

_____

_____

_____

_____

_____

_____

APPENDIX C. DATA COLLECTION SHEETS.

TABLE C-3. TEST PARTICIPANT INTERVIEW FORM

1. a. How do you rate the fit if the test item that you have worn?

   1. ____ Excellent
   2. ____ Very Good
   3. ____ Adequate
   4. ____ Not Quite Adequate
   5. ____ Poor
   6. ____ Extremely Poor

   b. Comments: _____
   _____
   _____
   _____
   _____
   _____
   _____
   _____

2. a. How do you rate the freedom of movement afforded by the test item?

   1. ____ Excellent
   2. ____ Very Good
   3. ____ Adequate
   4. ____ Not Quite Adequate
   5. ____ Poor
   6. ____ Extremely Poor

   b. Comments: _____
   _____
   _____
   _____
   _____
   _____
   _____
   _____

APPENDIX C. DATA COLLECTION SHEETS.

TABLE C-3. CONTINUED

3. a. How do you rate the ability of the test item you have worn to keep you warm on a windy day?

   1. ____ Excellent
   2. ____ Very Good
   3. ____ Adequate
   4. ____ Not Quite Adequate
   5. ____ Poor
   6. ____ Extremely Poor

   b. Comments: _____
   _____
   _____
   _____
   _____
   _____
   _____
   _____

4. a. How do you rate the ability of the test item you have worn to keep you warm on a calm day?

   1. ____ Excellent
   2. ____ Very Good
   3. ____ Adequate
   4. ____ Not Quite Adequate
   5. ____ Poor
   6. ____ Extremely Poor

   b. Comments: _____
   _____
   _____
   _____
   _____
   _____
   _____
   _____

APPENDIX C. DATA COLLECTION SHEETS.

TABLE C-3. CONTINUED

5. a. How do you rate the ventilation characteristics of the test item that you have worn?

   1. ____ Excellent
   2. ____ Very Good
   3. ____ Adequate
   4. ____ Not Quite Adequate
   5. ____ Poor
   6. ____ Extremely Poor

   b. Comments: _____
   _____
   _____
   _____
   _____
   _____
   _____
   _____

6. a. How do you rate the test item you have worn for use by the Army?

   1. ____ Excellent
   2. ____ Very Good
   3. ____ Adequate
   4. ____ Not Quite Adequate
   5. ____ Poor
   6. ____ Extremely Poor

   b. Comments: _____
   _____
   _____
   _____
   _____
   _____
   _____
   _____

APPENDIX C. DATA COLLECTION SHEETS.

TABLE C-3. CONTINUED

7. a. How do you rate the fasteners, snaps and zippers provided on the test item that you have worn?

   1. ____ Excellent
   2. ____ Very Good
   3. ____ Adequate
   4. ____ Not Quite Adequate
   5. ____ Poor
   6. ____ Extremely Poor

   b. Comments: _____
   _____
   _____
   _____
   _____
   _____
   _____
   _____

8. a. How do you rate the ease with which you were able to don the test item?

   1. ____ Excellent
   2. ____ Very Good
   3. ____ Adequate
   4. ____ Not Quite Adequate
   5. ____ Poor
   6. ____ Extremely Poor

   b. Comments: _____
   _____
   _____
   _____
   _____
   _____
   _____
   _____

APPENDIX C. DATA COLLECTION SHEETS.

TABLE C-3. CONTINUED

9. a. How do you rate the ease with which you were able to doff the test item?

1. ____ Excellent
2. ____ Very Good
3. ____ Adequate
4. ____ Not Quite Adequate
5. ____ Poor
6. ____ Extremely Poor

b. Comments: _____
_____
_____
_____
_____
_____
_____
_____

10. a. Did you sweat excessively while wearing the test item during outdoor activity?

Yes__ No __

b. If yes, explain: _____
_____
_____
_____
_____
_____
_____
_____

APPENDIX C. DATA COLLECTION SHEETS.

TABLE C-3. CONTINUED

11. a. Did you experience any cold spots, numbness or shivering while wearing the test item during outdoor activities?

    Yes__ No __

    b. If yes, explain: _____
    _____
    _____
    _____
    _____
    _____
    _____

12. a. While you were wearing the test item, did snow or other foreign material get inside the test item?

    Yes__ No __

    b. If yes, explain: _____
    _____
    _____
    _____
    _____
    _____
    _____

APPENDIX C. DATA COLLECTION SHEETS.

TABLE C-3. CONTINUED

13. a. Were you bothered by any of the following while you were wearing the test item?

Yes	No	
___	___	Fabric Noise
___	___	Static Electricity
___	___	Loose Flaps
___	___	Loose Cords

b. If yes, explain: _____
_____
_____
_____
_____
_____
_____
_____

(This page is intentionally blank.)

APPENDIX D. REFERENCES.

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

2. AR 70-38, Research, Development, Test and Evaluation of Materiel for Extreme Climatic Conditions (with change 1), 15 September, 1979.

3. DTC Memorandum, Subject: Human Research Protections Program (HRPP), 22 April 2010.

4. AR 70-25, Use of Volunteers as Subjects of Research (with change 1), 25 January 1990.

5. TOP 03-1-002, Confidence Intervals and Sample Size, 25 January 1967.

6. MIL-STD-882D, Department of Defense Standard Practice for System Safety, 10 February 2000.

7. TOP 01-2-610, Human Factors Engineering Part I, 15 May 1990.

8. CRTC Memorandum 70-5, Subject: Snow Classification.

(This page is intentionally blank.)

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.